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Using mHealth to support weight management among women with history of gestational diabetes: a mixed methods study

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University of Plymouth

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**UNIVERSITY OF
PLYMOUTH**

Using mHealth to support weight management
among women with history of gestational diabetes:
a mixed methods study

By

KATIE JANE EDWARDS

A Thesis Submitted to the University of Plymouth in partial fulfilment for the Degree of:

DOCTOR OF PHILOSOPHY

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AUTHOR'S DECLARATION

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Doctoral College Quality Sub-Committee. Work submitted for this research degree at the University of Plymouth has not formed part of any other degree either at the University of Plymouth or at another establishment.

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Abstract

Using mHealth to support weight management among women with history of gestational diabetes: a mixed methods study

Katie Jane Edwards

Background: Women who experience gestational diabetes mellitus (GDM) are at significant risk of developing type 2 diabetes and recurrent GDM in subsequent pregnancies, particularly if they are overweight (body mass index (BMI)>25) or obese (BMI >30). Prevention of chronic disease in this population is of major public health concern, but formalised support in the UK is disjointed and limited. Women face considerable barriers to maintain motivation when undertaking and sustaining weight management, despite desires to improve their health. Motivation is a predictor of long-term weight loss; however, few interventions focus on providing women with prior GDM motivational support. A newly developed intervention, Functional Imagery Training (FIT), aims to strengthen motivation using goal-related mental imagery. Evidence suggests FIT holds promise as an effective weight management intervention and it has been translated into an app, FITZ. However, the effectiveness of delivering FIT via mobile app remains unclear, as do the intricacies of implementation among women with history of GDM.

Research question: Could a motivational mHealth app (FITZ) be a needed, acceptable, and feasible weight management intervention for women with history of GDM?

Aim: Motivated by identified gaps in knowledge, the aims of this project were twofold: 1) to better understand the need for, and the role of, mHealth to support

women with a history of GDM following birth and 2) to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM.

Methods: This project was underpinned by the pragmatist paradigm and incorporated mixed methods over two phases. Seven individual studies were undertaken using a scoping review, surveys, semi-structured interviews, feasibility assessments and a co-production workshop.

Results: Few mHealth interventions exist for supporting women to manage their health following a pregnancy complicated by GDM. Few interventions were guided by behavioural theory and only a limited range of behaviour change techniques were incorporated. Women highly valued the use of social media, but health care professionals (HCPs) were reluctant to recommend this as a source of credible information due to lack of governance and fear of misinformation spread. Women found existing behaviour change apps did not meet their needs and few mHealth resources were recommended by professionals. Women and their HCPs expressed desire for motivational support to achieve a healthy next pregnancy and beyond. The concept of FITZ aligned with women's goals and the barriers they experienced in achieving them. The app was perceived as useful by some women who tried it and most HCPs answering a survey. Nevertheless, women and HCPs recognised significant limitations that would impact engagement and implementation. Suggestions for adaptations to FITZ to maximise impact included adapting and tailoring content, integrating FITZ with other programmes, and incorporating peer support.

Conclusion: The findings from this project suggest current mHealth interventions require a broader focus to meet women’s motivational and peer support needs. mHealth interventions underpinned by behaviour change techniques, such as FITZ, hold potential to provide women with history of GDM a highly scalable weight management intervention that aligns with their goals and addresses their unique barriers, following birth. To optimise penetration, implementation and participation among this population, adaption is required to include tailored content and peer support. Future iterative development should involve co-production with key stakeholders and taking advantage of the online spaces women already use and value, such as social media.

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Abbreviations

BCT	Behaviour change technique
BGC	Blood glucose control
BGL	Blood glucose level
BMI	Body mass index
DPP	Diabetes Prevention Programme
FIT	Functional Imagery Training
GDM	Gestational diabetes mellitus
GP	General Practice/Practitioner
HCP	Health care professional
HRA	Health Research Authority
JBI	Joanna Briggs Institute
MI	Motivational interviewing
MMR	Mixed methods research
NHS	National Health Service
NICE	National Institute for Care Excellence
NIHR	National Institute for Health Research
NPT	Normalisation Process Theory
OGTT	Oral glucose tolerance test
PIS	Participant information sheet
PPI	Public and patient involvement
RCH	Royal Cornwall Hospital

RCT	Randomised controlled trial
TA	Thematic Analysis
WHO	World Health Organisation

Chapter 1: Gestational diabetes mellitus and its long-term implications

1.1 Overview

Current trends in changes of maternal demographics such as older age and increasing body mass index (BMI) means gestational diabetes mellitus (GDM) is becoming increasingly common worldwide. For example, in England and Wales, the average age of first pregnancy has steadily increased from the mid-1970's from 26.4 years to 29.5 years in 2010 (ONS, 2011). The proportion of pregnant women with obesity has doubled in the past decade from 22% in 2010 to 44% in 2018 (PHE, 2019). GDM is associated with several adverse outcomes during pregnancy and birth. Longer-term consequences include infants with increased risk of obesity and type 2 diabetes mellitus (T2DM), implicating GDM as transgenerational in nature. Women with prior GDM are also at increased risk of GDM reoccurrence in future pregnancies, T2DM, cardiovascular disease and metabolic syndrome. Prevention of chronic disease among this group of women is therefore a major public health concern. There is now a substantial body of evidence suggesting BMI is a significant, modifiable, factor associated with increased risk of T2DM and GDM recurrence. However, postpartum and interconception support for women is currently disjointed and limited.

This chapter will provide an overview of the clinical presentation of GDM, how it is diagnosed and treated and present evidence demonstrating the long-term impacts of GDM. Current postpartum and interconception care will be explored along with

evidence detailing the impact of weight management interventions designed to help stem the development of T2DM and recurrent GDM among women with GDM history.

1.2 Gestational Diabetes Mellitus

1.2.1 Classification and prevalence of GDM

Gestational diabetes mellitus (GDM) is defined by the WHO (1999) as carbohydrate intolerance that begins or is first recognised during pregnancy. This definition includes women who first present with type 1 (T1DM) or type 2 (T2DM) diabetes during pregnancy, or where diabetes was previously undetected. Unlike T1DM where there is a lack of insulin, GDM is likely caused by hormones produced during pregnancy that make insulin less effective, a condition known as insulin resistance. Unlike T2DM, GDM symptoms usually resolve following delivery. While there is evidence that GDM can occur as a result of T1DM, T2DM and other causes such as drug or chemical-induced diabetes (American Diabetes Association, 2018), most GDM cases fall into the category of chronic insulin resistance, where affected women have greater insulin resistance than healthy pregnant women (Buchanan & Xiang, 2005). As this form of GDM is the most common, it will be the focus of this thesis.

The prevalence of GDM worldwide varies and global estimates are difficult due to inconsistencies in the screening methods and diagnostic criteria (Ben-Haroush, Yogev & Hod, 2003). A recent systematic review and meta-analysis estimates globally, 10% of pregnancies are affected by GDM, but prevalence varies from 2-38% depending on geographical location and screening and diagnostic practices (Gyasi-Antwi *et al.*, 2020). In the UK, the current prevalence is estimated to be 16 in 100 women (Diabetes UK, 2019).

1.2.2 Risk factors for GDM development

Risk factors for the incidence of GDM can be both modifiable and unmodifiable (Table 1). Evidence demonstrates that the development of GDM is likely due to genetic, epigenetic and environmental factors and accordingly the mechanisms involved are complex and progress over a considerable period of time (Plows *et al.*, 2018). Each of the risk factors presented in Table 1 is either directly or indirectly connected with insulin sensitivity and/or impaired b-cell function.

Table 1. Modifiable and non-modifiable risk factors associated with the incidence of GDM.

Modifiable risk factors for GDM onset	Non-modifiable risk factors for GDM onset
Maternal overweight or obesity (BMI >25kg/m ² or 30 kg/m ² , respectively (Torloni <i>et al.</i> , 2009)	Ethnicity (African, Hispanic, South or East Asian, Native American, Pacific Islander) (Petry, 2010)
	Advanced maternal age (Petry, 2010)
	Polycystic ovarian syndrome (Toulis <i>et al.</i> , 2009)
	Family history of First-degree relatives with GDM or T2DM (Petry, 2010)
	Maternal high or low birth weight (Petry, 2010)
	History of GDM or glucose intolerance (Kim, Berger & Chamany, 2007)
	High Parity (Petry, 2010)
	Twin pregnancies (Rauh-Hain <i>et al.</i> , 2009)

The central role of b-cells is to secrete and store in response to the presence of glucose. These b-cells become dysfunctional when they lack the ability to effectively sense blood glucose concentration and release insulin in response. This dysfunction is

thought to originate from chronic fuel excess which produces prolonged and excessive insulin production (Weir *et al.*, 2001). However, the exact mechanisms behind GDM development are varied and complex, and evidence suggest that chronic insulin resistance, neurohormonal networks, adipose tissue, liver function, skeletal and cardiac muscle, gut microbiome, oxidative stress, and placental transport could also be involved (Plows *et al.*, 2018). A summary diagram of the various processes involved in the pathophysiology of GDM is presented in Figure 1.

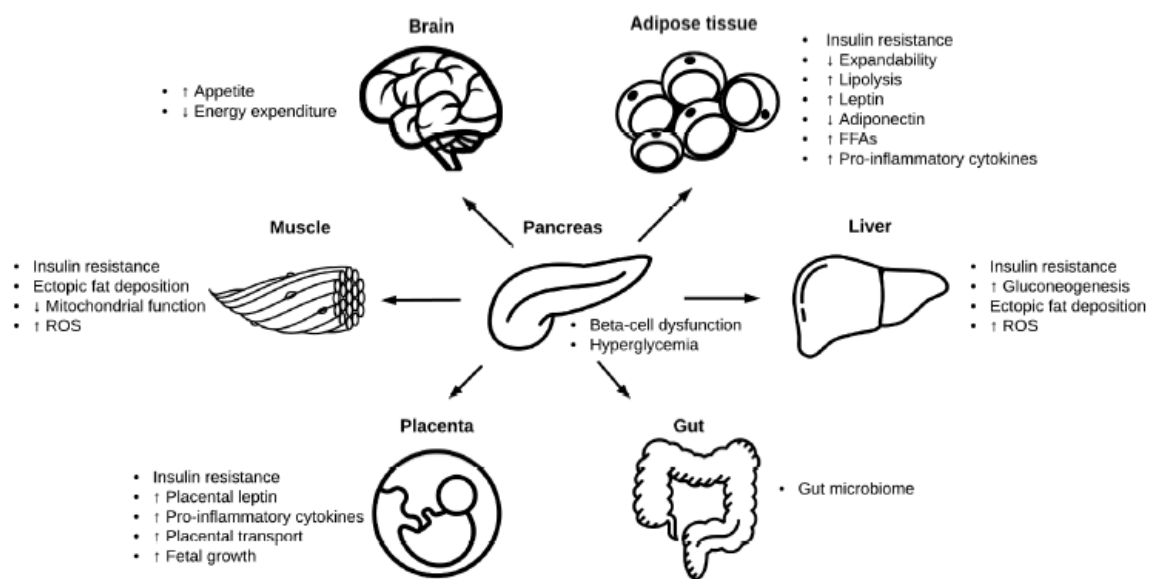


Figure 1. Organs involved in the pathophysiology of GDM (Images in this figure were obtained from The Noun Project under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>). Brain and Gut by Hunotika; Liver by Lavmik; Pancreas by Arif Fajar Vulianto; Placenta by Charameleon Design; Muscle by Misha Petrishchev)

1.2.3 Screening and Diagnosis

There is little consensus to the most appropriate way of screening and diagnosing GDM (Agarwal, 2018). Screening methods include selective, risk factor or universal screening. Testing commonly involves a 75g or 100g oral glucose tolerance test (OGGT)

with various diagnostic cut-offs. The OGTT is typically performed between 24- and 28-weeks' gestation. The different criteria for GDM diagnosis using OGTT are detailed in Table 2.

Table 2. Various criteria for GDM diagnosis using oral glucose tolerance test (OGTT)

Criteria	Pregnancies	Timing of OGTT	Glucose Load (g)	Glucose threshold (mmol/L)			
				Fasting	1h	2h	3h
American Diabetes Association (ADA), 2004	High and medium risk	14-18 weeks (high risk) 28-34 weeks (medium risk)	100	5.3	10.0	8.6	7.8
ADA, 2016	All	24-28 weeks	75	5.1	10.0	8.5	-
WHO, 2013							
IADPSG, 2010							
NICE, 2015a	High risk	24-28 weeks, or as early as possible if GDM in previous pregnancy	75	5.6	-	7.8	-
O'Sullivan, 1964	All	24-28 weeks	100	5.0	9.2	8.1	6.9
WHO, 1999	All	24-28 weeks	75	7.0	-	7.8	-

In the UK the current screening approach is risk factor driven and midwives are expected to test women demonstrating the following risk factors: Twin pregnancy, prior GDM, family history of diabetes, BMI (>30kg/m²), previous baby weight of 4.5kg or more, and/or minority ethnic family origin with high prevalence of diabetes (NICE, 2015a).

The research reported in this thesis took place over a period that included the outbreak of COVID-19, which began in March 2020. During this time, screening for GDM changed globally to reduce the risk of viral transmission. Across the UK, Canada, United States of America, Australia and New Zealand a consensus was reached that alternative tests to the 2-hour OGTT at 24-28 weeks of gestation would be used to avoid long waits in hospitals (Nouhjah, Jahanfar & Shahbazian, 2020). The impact of this practice on ability to detect GDM and provide appropriate care and treatment is yet to be fully determined. However, an initial study has found across the UK, Canada and Australia, that all post COVID-19 modified diagnostic processes reduced GDM frequency. In the UK an 82% reduction in diagnosis was seen where detection rates dropped from 12.9% to 2.5% of all pregnancies, suggesting many missed opportunities to influence pregnancy and postpartum outcomes (McIntyre *et al.*, 2020).

1.2.4 Maternal and infant clinical features of GDM

Maternal

Women generally do not develop symptoms before diagnosis, however, some women can experience polyuria, polydipsia and/or fatigue. GDM is associated with increased rate of caesarean births and pre-eclampsia (Dodd *et al.*, 2007). Some evidence also suggests receiving a GDM diagnosis can have a negative impact on maternal mental health. Compared to women with normal glucose tolerance, women with a new GDM diagnosis were more likely to have higher levels of state anxiety at the time of first assessment (Daniells *et al.*, 2003).

Infant

The primary perinatal concern associated with a GDM diagnosis is macrosomia, defined as a birthweight greater than 4000g. The presence of macrosomia can lead to birth trauma such as nerve palsies, fractures, and shoulder dystocia (Reece, 2010). GDM is also associated with other negative infant outcomes including hypocalcaemia (low calcium), respiratory distress syndrome, polycythaemia (excess red blood cells), neonatal hypoglycaemia (low blood glucose) and hyperbilirubinemia (Reece, 2010).

1.1.5 GDM management and treatment

Successful treatments for GDM have potential to improve health outcomes for women and their babies and are typically focused on achieving within range blood glucose levels (BGL) during pregnancy. UK guidelines state that: *'good blood glucose control throughout pregnancy will reduce the risk of macrosomia, trauma during birth, induction, C-section. Women should also be advised to eat a healthy diet and replace high glycaemic index foods with low glycaemic foods. All women should be referred to a dietician'* (NICE, 2015b).

As a first step towards the management of GDM, women in the UK are guided to self-manage their blood glucose levels (BGL). Women whose fasting plasma glucose levels are below 7mmol/litre at diagnosis are encouraged to change their diet and exercise. For those with higher levels, Metformin an oral therapy, can be offered. For women who are unable to meet the blood glucose targets by changes in diet and exercise within 1-2 weeks are recommended to start Metformin. If Metformin is contraindicated, unacceptable or non-effective, insulin can be offered.

There is currently a lack of high-quality evidence about the effects (harms and benefits) of different treatment interventions and their impact on health outcomes for women and their babies (Martis *et al.*, 2018). However, a Cochrane overview of reviews suggests lifestyle interventions (defined as; self-monitoring of blood sugar levels, physical activity and minimum healthy eating) were the only treatment that showed reduction in the number of babies born large for gestational age (Martis *et al.*, 2018).

1.3 Long-term Implications of GDM

1.3.1 Infant Consequences

Exposure to hyperglycaemia in utero has demonstrated some long-lasting effects on infants including obesity, T2DM, cardiovascular disease and associated metabolic diseases (Plows *et al.*, 2018). Children born to mothers who experienced GDM are found to be nearly at double the risk of developing childhood obesity compared to those born to mother without diabetes, even after adjusting for maternal BMI and other variables (Vohr & Boney, 2008). Impaired glucose tolerance has also been detected in children as young as five years (Malcolm *et al.*, 2006). Female children are therefore also more likely to experience GDM in their own pregnancies, demonstrating the intergenerational nature of GDM.

1.3.2 Maternal Consequences

The long-term maternal consequences for women are extensive and include significantly higher risk of cardiovascular disease (Kramer, Campbell & Retnakaran,

2019), postnatal depression (Azami *et al.*, 2019), and metabolic syndrome (Pathirana *et al.*, 2021). Two of the most prominent and researched long-term impacts are T2DM and recurrence of GDM in subsequent pregnancies.

Type 2 diabetes

In 2002 a systematic review found a 2.6-70% cumulative incidence of T2DM among women with prior GDM, ranging from 6 weeks to 28 years. This incidence was highest in the first five years postpartum (Kim, Newton & Knopp, 2002). However, in recent years the demography of pregnant women has changed with increasing maternal age and rates of obesity (Ferrera, 2007). In a recent systematic review, authors suggest the risk of T2DM development could be 10-fold higher in women with a history of GDM compared to those with normoglycaemic pregnancy (Vounzoulaki *et al.*, 2020). T2DM is a global public health challenge. For the individual, the impact of a T2DM diagnosis is pervasive and includes life-time monitoring of BGL, significant dietary change and pharmacological input (WHO, 2021). T2DM is also associated with increased risk of heart-attacks, stroke, lower limb amputation, diabetic retinopathy and kidney failure (WHO, 2021). At organisational levels, people with diabetes are more than twice as costly to manage as those who are non-diabetic, due to management of diabetes related complications (Janssen *et al.*, 2020). Indeed, diabetes care already accounted for 2-7% of western European countries total national health care budgets in 2013 (Zimmet, 2003), a figure likely to grow with increasing global prevalence.

Recurrent GDM

Another major concern following a GDM pregnancy is the risk of recurrence in subsequent pregnancies. Much like the prevalence of GDM, understanding the rate of GDM recurrence is highly variable and influenced by diagnostic criteria and baseline population characteristics (Table 3) (Egan *et al.*, 2021). A meta-analysis conducted in 2007 estimates that GDM recurs in 30-84% of subsequent pregnancies (Kim *et al.*, 2007). As well as the already described adverse impact of a pregnancy complicated by GDM for both mother and infant, the recurrence of GDM further promotes the intergenerational cycle of both T2DM and obesity among offspring. Evidence is now emerging that repeated GDM pregnancies may put extra pressure on maternal physiological systems that further increase the risk of maternal progression to T2DM (Diaz-Santana *et al.*, 2022). With increasing rates of GDM, T2DM and obesity, the prevention of both T2DM development and GDM occurrence among women with history of GDM is of high public health importance.

Table 3. Evidence detailing the epidemiology of GDM recurrence with identified clinical risk factors (in index pregnancy unless otherwise specified) (Egan et al., 2021)

Meta-Analyses	N (with GDM in Index Pregnancy)	GDM recurrence rate (%)	Risk factors associated with recurrence
Kim <i>et al.</i> 2007	13 studies—11 retrospective cohorts, 2 case-control studies; 3790 women	30–84% in retrospective cohorts; OR 15–23 for case control studies	Minority populations: African American, Latina, Asian
Schwartz, Nachum & Green, 2016	14 cross-sectional cohort studies; 9211 women	30–80%	Maternal age Maternal BMI Inter-pregnancy weight gain

Individual Studies not included in meta-analyses	N (with GDM in Index Pregnancy), Location of Study	GDM recurrence rate (%)	Risk factors associated with recurrence
			OGTT glucose concentrations Use of insulin Multiparity Fetal macrosomia
Ehrlich <i>et al.</i> 2011	1028, USA	38%	Inter-pregnancy weight gain
England <i>et al.</i> 2015	4102, USA	34–48%	Maternal age Born outside of United States
Getahun, Fassett & Jacobsen, 2010	2351, USA	52%	Ethnicity: Hispanic & Asian/Pacific Islanders
Wang <i>et al.</i> 2019	143, China	55%	OGTT glucose concentrations First trimester triglycerides
Wong <i>et al.</i> 2019	3587, Australia	73%	Maternal BMI OGTT glucose concentrations Inter-pregnancy weight gain

1.3.3 Risk Factors associated with development of T2DM and recurrent GDM

In addition to understanding the prevalence of T2DM development and GDM recurrence, understanding which women are at highest risk of these adverse outcomes is of significant clinical importance, especially when designing preventative

interventions. The risk factors associated with the development of T2DM and recurrent GDM comprise of both modifiable and non-modifiable factors (Table 3).

While some factors are clearly unmodifiable, pre-pregnancy BMI (Kim, Newton & Knopp, 2002), obesity and weight gain between pregnancies are associated with higher risk of both T2DM and GDM recurrence (Ehrlich *et al.*, 2011; Schwartz, Nachum & Green, 2016; Wong *et al.*, 2019).

The role of weight and BMI

Excess weight gain is a well-documented risk factor for the development of T2DM in the general population (Colditz *et al.*, 1995). Compared to the general population, women who go on to develop GDM are more likely to be overweight or obese at diagnosis and are more likely to become overweight or obese in later life (Ratner, 2007). It is common for women with prior GDM to gain weight following their index pregnancy and throughout their lifetime (Ratner, 2007; Ferrara *et al.*, 2011).

This is problematic as higher pre-pregnancy BMI and weight gain after and/or between pregnancies is a well demonstrated risk factor for T2DM development and recurrent GDM. A longitudinal prospective cohort study of 1,695 women found each 5kg of weight gain after GDM diagnosis was associated with a 27% higher risk of T2DM development (Bao *et al.*, 2015). In a study of 2763 women with GDM in their first pregnancy found weight loss (by 1-2 BMI units) reduced the risk of recurrent GDM in subsequent pregnancy (Sorbye *et al.*, 2020). The risk of recurrent GDM increased if BMI increased by \rightarrow 4 units, in comparison to stable BMI (-1-1 units). Even in women with normal weight, the risk of GDM recurrence rose with an increase of BMI by 2-4

units, compared to a stable BMI. The mechanisms behind weight management as a protective factor likely relate to b-cell function and insulin sensitivity (Sorbye *et al.*, 2020). Interpregnancy weight loss may improve insulin sensitivity and reduce impairment of b-cell function, resulting in better ability to cope with physiological demands of increased insulin sensitivity in the subsequent pregnancy (Forsythe, Wallace & Livingstone, 2008). These results suggest that weight loss may hold a specific benefit to reducing the risk of T2DM and recurrent GDM. This highlights the importance of controlling both pre-pregnancy weight and weight gain in the postpartum and interconception periods.

1.4 Postpartum and Interconception Care for women with history of GDM

With significant risk of long-term health implications for women and cost to public health, it is important to understand what support is currently provided for women in the postpartum and interconception periods to help mitigate the risk of T2DM and recurrent GDM.

1.4.1 NICE guidance on Postpartum Care

Follow-up of women with a history of GDM can provide opportunities for chronic disease prevention and potential for early diagnosis and treatment, particularly of diabetes and pre-diabetes. The postpartum period is typically defined as the first 6-8 weeks following delivery (NICE, 2015a).

In the UK, NICE (2015b) recommend that women have their blood glucose tested at delivery, 6-13 weeks postpartum and annually thereafter to check for the presence of

T2DM. Women who have blood glucose levels in the normal range should be reminded of the symptoms of hyperglycaemia, the risk of recurrence of GDM in future pregnancies, and offered testing for diabetes if planning future pregnancies. Women should also be offered lifestyle advice focused on diet, exercise and weight control. For women who return a test outside of the normal range, they are advised that they are at high risk of T2DM development and should adhere to guidance on prevention and treatment. Women who return results above the diagnostic thresholds for T2DM should be referred for further care.

Despite these guidelines it is widely common for the opportunity of postpartum screening for T2DM to be missed among women with a recent GDM pregnancy (Ward *et al.*, 2020). Reported rates of testing vary from 5% to 60%, with around only 20 – 40% of women receiving some sort of glucose testing (Clark *et al.*, 2009). The proportion of women tested in any given year in the UK averaged 34.2% over a 17-year period (Ward *et al.*, 2020). Barriers to uptake of postpartum screening by mothers with a history of GDM have been widely researched and include lack of time, inadequate childcare, a need to focus on health of the child (Van Ryswyk *et al.*, 2016), lack of perception of risk (Kim *et al.*, 2007), and fear of diabetes diagnosis (Bennett *et al.*, 2011). Facilitators include increase maternal age, higher education level (Jones *et al.*, 2018), and having a shorter testing time (Van Ryswyk *et al.*, 2016).

1.4.2 Transition from maternity care to general practice

The provision of postpartum care is also significantly impacted by current organisational and professional barriers. In the UK and Australia, after delivery, women's ongoing healthcare is typically monitored, managed and delivery by a general

practitioner (GP). However, in a survey of 106 healthcare professionals (HCPs) in the UK, including obstetricians, diabetologists, and GPs found a lack of consensus on responsibility for immediate postpartum screening for T2DM (Rayanagoudar *et al.*, 2015). In the same survey, nearly all respondents offered advice on diet and exercise, however, midwives and obstetricians underestimated, or were unsure of, the future risk of T2DM. Inconsistencies have also been observed in the dietary and weight management advice being offered by GPs and authors recommend that GPs better tailor their advice based on women's health literacy and their experienced barriers (Pennington *et al.*, 2017). A study in the USA exploring women and HCPs perspectives of postpartum care following a pregnancy complicated by GDM found women felt anxiety about the burdensome effect of T2DM and providers chose reassurance over risk communication and both had primary focus on the health of the baby (McCloskey *et al.*, 2019). Because of a lack of consensus on the process of T2DM screening and prevention for women with history of GDM, GPs are often left with uncertainty about which guidelines to follow and subsequent inertia (Pierce *et al.*, 2011).

This lack of consistent support for women with history of GDM is further compounded by an absence of coordination between clinical teams making communication of consistent advice, and tracking women's data, difficult. Some have described this situation as a '*perfect storm*' whereby women must navigate several systems all while dealing with new motherhood (McCloskey *et al.*, 2019).

Indeed, the transition from maternity to primary care is consistently experienced by women as fragmented and lacking. In a demographically diverse group of women with GDM history in the UK, authors found that women felt abandoned and forgotten

postpartum, which they felt surprised by, considering they had been told they were at risk of T2DM (Parsons *et al.*, 2018). This is further confirmed in a study exploring women's postpartum experiences where one participant said: "*you feel kind of abandoned, you have this horrendous situation where everything you eat has to be checked and then suddenly they kind of go, 'well off you go then'*" (McMillan *et al.*, 2016).

This sense of abandonment is perhaps exacerbated by the fact that women with GDM experience frequent and often highly intensive monitoring during pregnancy that ends abruptly after delivery (Walker, Murphy & Nichols, 2015). This discontinuation in care may also contribute to a sense among women and some HCPS that GDM 'disappears' after delivery (Parsons *et al.*, 2018).

1.4.3 Interconception Care

The interconception period is defined as the time directly following birth and a subsequent conception (Hubertly *et al.*, 2013) and includes the postpartum period (Antheumis, Tates & Nieboer, 2013). This time period represents a significant window of opportunity to influence future pregnancy and family health outcomes by managing, monitoring and providing preventative interventions (Phelan, 2017). Although some adverse pregnancy outcomes cannot be prevented, optimising women's health in-between pregnancies by tackling modifiable risks, can eliminate or reduce the possibility of adverse outcomes in future pregnancies (ACOG, 2005). Interconception care has been defined as the care provided to a woman between the birth of one child and the conception of the next (Tieu *et al.*, 2017). This definition has now been expanded as experts argued that the definition of interconception care should be in

line with preconception care and that the target group should be “all women who have been pregnant and could be pregnant in the future and their (possible) partners”. As a result, interconception care can now be defined as preconception care between pregnancies and includes those seeking assisted fertility, miscarriages, stillbirths and live births (Sijpkens *et al.*, 2019). The American College of Obstetricians and Gynaecologists have developed a set of general interconception care recommendations for pregnant women, that includes addressing weight and BMI before next pregnancy (ACOG, 2005). However, while interconception care is often recommended, no specific interconception care guidelines for women with prior GDM currently exist. It is suggested that women with prior GDM require a defined strategy in the interconception period that incorporates key elements of care (Table 4). Authors suggest that one of the key challenges will be to instil life-long healthy habits that are necessary to interrupt or delay the development of T2DM, recurrent GDM (Mielke, Kaiser & Centuolo, 2013).

In the UK, NICE (2015b) suggest that women with a history of GDM should be reminded of their risk of recurrent GDM and offered testing for diabetes if planning future pregnancies to prevent further risk to their health. The guidelines also suggest early self-monitoring of blood glucose or an early OGTT, once pregnant (NICE, 2015b). However, with limited clarity on the responsibility of post-delivery care (Rayanagoudar *et al.*, 2015), and increased pressure on GP services (Baird *et al.*, 2016), the likelihood of interconception care implementation for women in the UK with history of GDM is slim.

Table 4. Principles of Interconception Care for Women with prior GDM (Mielke, Kaiser & Centuolo, 2013)

Principles of Interconception Care for Women with prior GDM
Identification of women with prior GDM and subsequent interconception screening is optimized with multiple patient and clinician reminders starting in pregnancy and throughout the postpartum and interconception periods.
Postpartum screening (75-g 2-hour OGTT) is essential, as a substantial number of women demonstrate persistent glucose intolerance 6 to 12 weeks postpartum.
As women with prior GDM are at risk for DM and cardiovascular disease, concurrent screening for glucose intolerance (75-g 2-hour OGTT, A1C, or FPG) and dyslipidemia (FLP) should be done by the first year postpartum and then at least every 3 years. If additional risk factors are present (eg, insulin use during pregnancy, earlier pregnancy diagnosis of GDM, obesity, prediabetes), then screening should be done annually.
As women with prior GDM are at higher risk for glucose intolerance, the 75-g 2-hour OGTT is the preferred screening test.
When glucose intolerance is observed, use of the term prediabetes is preferred, as it reinforces the risk for progression to DM.
Benefits of breastfeeding in general (eg, improved glucose tolerance, postpartum weight loss, and reduction of childhood overweight) should be reinforced, along with the potential health benefits of longer duration of breastfeeding. Women with GDM are less likely to breastfeed and therefore need individualized and focused lactation support.
Contraception and birth planning should be included at each interconception visit. Long-term methods that involve a clinician for removal, such as the implant and IUD, should be encouraged to diminish the risk of hyperglycaemia in early pregnancy.
Modest weight loss (7%) from dietary modification (dietary fat 7% and increase in dietary fiber) with 150 minutes/week of regular exercise delays or prevents both GDM and DM. In women with prediabetes, drug therapy may also help.

1.4.4 Weight Management Interventions for Prevention of T2DM and Recurrent GDM

T2DM prevention

Health behaviour change interventions to promote weight management remain the backbone of research regarding the prevention of adverse long-term maternal health outcomes following a pregnancy complicated by GDM. So called 'lifestyle interventions' typically offer information and support to increase physical activity, breastfeeding and improve dietary intake in-line with national healthy eating guidelines, via health education, goal setting and monitoring (Pedersen, Terkildsen Maindal & Juul, 2017). Many interventions have been developed and evaluated and as a result, several systematic reviews, meta-analyses and overview of reviews have been undertaken to understand their effectiveness at delaying and/or preventing T2DM development.

A systematic review conducted in 2017 found that overall, provision of interventions addressing health behaviour in women with prior GDM, starting before one year postpartum, were superior to no intervention at all. However, even when significant, intervention impact on incidence of T2DM and reduction of weight and waist circumference are often modest (Goveia *et al.*, 2018; Hedeager Momsen *et al.*, 2020; Ferrara *et al.*, 2016)

The quality of evidence regarding the impact of lifestyle interventions on T2DM incidence, insulin resistance and body weight is low (Pedersen, Terkildsen Maindal & Juul, 2017). Study results are often based on small sample sizes, with no power to show statistically significant effects. Small sample sizes and lack of statistical power may be reflective of limitations around intervention penetration, where reaching and engaging a diverse proportion of the target population has proved difficult, as has retaining women over prolonged participation periods (Lim *et al.*, 2020a). Low quality

evidence is also impacted by a lack of heterogeneity in intervention components, duration, timing and outcome measures, meaning currently, no one intervention component can be recommended for the prevention of T2DM in women with a history of GDM (Pedersen, Terkildsen Maindal & Juul, 2017; Hedeager Momsen *et al.*, 2020).

However, Goveia *et al.* (2018) found trials offering interventions soon after delivery (<6 months) were more effective at reducing T2DM incidence than those starting later, as did Hedeager Momsen *et al.* (2020) who saw greater effect if the intervention began earlier after birth and lasted longer. However, other reviews suggest that intervention frequency, timing, delivery mode, or setting had little impact on effectiveness, but those that were delivered by HCPs and included behaviour change techniques (BCTs) were more effective (Lim *et al.*, 2019; Lim *et al.*, 2020b). Others suggest the inclusion of professional and social support significantly increases the chance of effectiveness (Hedeager Momsen *et al.*, 2020).

It is clear from multiple evidence syntheses, that a lack of intervention fidelity is a significant implementation challenge and further confirmation is required as to which core components are most effective at creating and sustaining weight management among women with prior GDM. Real-world trials are needed to monitor the consistency of delivered components as well as understand the potential reach among targeted populations (Lim *et al.*, 2020a). Indeed, very few trials to-date have been conducted under real-world conditions, using pragmatic trial designs, thus understanding how interventions can translate and be sustained in real-world settings is currently limited.

Further evidence regarding T2DM prevention comes from studies conducted on the internationally developed and implemented, Diabetes Prevention Programme (DPP). The DPP is a lifestyle intervention aimed at preventing or delaying the onset of T2DM among those with impaired glucose tolerance. Key features include goal-based behavioural intervention delivered by a lifestyle coach with frequent contact and ongoing support to achieve and maintain weight and physical activity goals (DPP Research Group, 2002). A meta-analysis of eight DPP intervention studies demonstrated a small but significant reduction in T2DM incidence among women with previous GDM (Goveia *et al.*, 2018). Modest weight loss among women with prior GDM were also reported by DPP's (Peacock *et al.*, 2015; Hu *et al.*, 2021; Shyam *et al.*, 2013; Reinhardt *et al.*, 2012; Nicklas *et al.*, 2014) with a weighted mean change of 1.8 kg (95% CI:-2.9, -0.6) based on 11 randomised controlled trials (RCTs) in a systematic review (Hewage *et al.*, 2020). However, women with GDM have greater risk of weight regain compared to women without GDM (Ratner *et al.*, 2008) and long-term follow-up has not been conducted.

Despite 10 years passing since the US and Finnish DPP studies (Tuomilehto *et al.*, 2001; Knowler *et al.*, 2002) very few people at risk of diabetes have been referred to or participated in the DPP in the US (Ali *et al.*, 2019). In the UK, the implementation of the DPP has been ongoing since 2016. The national intervention, known as 'Healthier You' is an intensive behavioural programme targeting weight loss, diet and physical activity goals and includes 13 face-to-face group sessions delivered over 9 months to 15-20 adults with non-diabetic hyperglycaemia. To date over 400,000 people have been referred to the NHS DPP, and the NHS Long Term Plan commits to doubling capacity from 100,000 places per year to 200,000 by 2023/24 (NHS, 2019). However, a recent

impact analysis of 'Healthier You' does not identify if, or how many, women with prior GDM have accessed the programme (Penn *et al.*, 2018) and thus it is unclear how the programme may have impacted outcomes for women. Because referral to the programme relies on screening/identification of 'pre-diabetes', a process known to be poorly attended by women (Ward *et al.*, 2020), the number of referrals is likely limited in this population. Indeed, women with history of GDM still in the normoglycemic range were originally excluded from inclusion into the programme because of previously seen low rates of engagements in other face-to-face T2DM prevention strategies (Valabhji, 2021). However, with the addition of a digitally delivered programme, the DPP in the UK opened to women with history of GDM, regardless of Hba1c levels, in early 2021. Between February and August 2021 there were 246 referrals made for women with GDM, of those referred 115 attended at least one session (Valabhji, 2021). The digital stream of the DPP is only currently available in eight UK pilot sites. There is currently no published evidence demonstrating the impact of the digital stream on women with history of GDM.

Recurrent GDM

While evidence suggests some ability for weight management interventions to reduce or delay the risk of T2DM development, the effects of preconception, postpartum and interconception interventions on the recurrence of GDM in subsequent pregnancies has been given limited attention in the research literature.

Preliminary data from bariatric surgery and epidemiologic studies (Villamor & Cnattingius, 2006; Johansson *et al.*, 2015; Caughey, 2015) suggest reducing body weight in the prenatal setting, before pregnancy, can prevent the development of

GDM, but these trials typically include women with risk factors for GDM, rather than being specifically targeted for those with prior GDM. Indeed, to date, there is limited published data on the effects of lifestyle intervention to reduce body weight before pregnancy to prevent GDM recurrence. A Cochrane review published in 2017 (Tieu *et al.*, 2017) found no published protocols or trials evaluating the impact of interconception care for women with a history of GDM on maternal or infant health outcomes. Since this review, two RCT protocols and one set of preliminary postpartum data have been published.

Bogaerts *et al.* (2017) developed the INTER-ACT interconception weight management intervention, implemented between pregnancies, aimed at women with increased gestational weight gain during index pregnancy, including those with GDM. Behaviour change techniques are central to the intervention which comprises of face-to-face coaching and an app linked to a scale and activity tracker. Women were recruited into the study at day 2 or 3 after delivery and randomised at 6 weeks postpartum. The primary outcome of the study is rate of pregnancy-induced hypertension, GDM, C-section and large for gestational age infant in subsequent pregnancy. The effect of the intervention on these primary outcomes is yet to be published, however, preliminary data from the postpartum phase of the study found the intervention was effective in improving nutrition related outcomes, but these effects were not sustained at 12-month follow-up. No effects were found on physical activity or sedentary behaviour (Bijlholt *et al.*, 2021).

More recently, Phelan *et al.* (2020) have published a protocol detailing the planned evaluation of weight management intervention based on the DPP and Social Cognitive

Theory. The intervention aims to initiate and sustain weight management via education, behavioural self-regulatory strategies, feedback on progress, contact with a lifestyle coach and social support. For the first 16 weeks of the intervention participants will meet weekly with a weight loss advisor. These visits will become bi-weekly up until conception. Participants will be given weight loss, dietary and physical activity goals to achieve. Primary outcome is GDM recurrence at next pregnancy and secondary outcomes include, physical activity, diet, weight changes over time and psychosocial factors.

1.5 Chapter Summary

This chapter has focused on the clinical aspects of GDM, including presentation, implication during pregnancy and risk factors associated with onset. A mounting evidence base is presented demonstrating the long-term adverse maternal impacts of GDM development including progression to T2DM and recurrent GDM in future pregnancies. While many risk factors for these long-term adverse outcomes are non-modifiable, weight and BMI appear to play a critical role in the development of both T2DM and GDM recurrence. The transgenerational nature of GDM suggests there is significant need to provide women with opportunities and support to reduce their risk of adverse outcomes, not only for themselves but also their families. Postpartum and interconception periods present as a window of opportunity to promote and implement strategies for weight management and potentially break the cyclical nature of GDM. Lifestyle interventions for women with prior GDM have been evaluated and show some promise for reducing risk factor associated with the development of T2DM.

However, questions remain on which are the most effective components that impact intervention effectiveness. In addition, challenges related to implementation mean translation to real-world settings is limited. In addition, very limited evidence exists regarding the ability of interconception weight management interventions to impact the incidence of recurrent GDM. The following chapter will examine how the inclusion of relevant behaviour change theory and techniques could optimise weight management interventions for women with history of GDM, particularly when they consider factors that help or hinder women's efforts. The role of motivation in weight management is discussed, as are the possible advantages of offering women motivational support. Existing motivational interventions are critiqued and a newly developed motivational intervention, Functional Imagery Training (FIT) (Andrade *et al.*, 2016), is introduced including its potential as a digitally delivered weight management intervention for women with history of GDM.

Chapter 2: The optimisation of weight management interventions for women with history of GDM

2.1 Overview

Chapter 1 provided an overview of GDM, its clinical presentation, prevalence, and long-term implications. Evidence suggests weight and BMI play a critical role in the development of T2DM and recurrent GDM and thus effective weight management interventions are needed. However, existing evaluations demonstrate limited effectiveness and implementation issues such as lack of fidelity and reach. Currently, no single component or approach can be recommended as optimal for supporting women to manage their weight following their pregnancy complicated by GDM.

This chapter examines how weight management interventions for women with history of GDM could be optimised through inclusion of relevant behaviour change theory and techniques, and consideration of factors that impact women's ability to undertake behaviour change following birth. The role of motivation in women's weight management efforts is discussed and rationale is provided for why offering women motivational support could be advantageous. Existing motivational interventions are critiqued and a newly developed motivational intervention, Functional Imagery Training (FIT) and its accompanying app, FITZ, are introduced. Evidence of the impact on FIT for weight loss among the general population is presented, and gaps in knowledge around the efficacy of delivering FIT via mobile app are highlighted. Finally, the potential of delivering digital weight management interventions for women with

history of GDM is explored along with outstanding questions regarding the implementation of digital solutions among this population.

2.2 The importance of behaviour change theory and techniques

Interventions to change behaviour are essential to the prevention of mortality and morbidity as human behaviour is one of the biggest contributors to ill health (Mokdad *et al.*, 2000; Parkin, Boyd & Walker, 2011). A multidisciplinary consensus study of theories of behaviour change defines behaviour as *'Anything a person does in response to internal or external events. Actions may be overt (motor or verbal) and directly measurable, or covert (e.g. physiological responses) and only indirectly measurable; behaviours are physical events that occur in the body and are controlled by the brain'* (Hobbs *et al.*, 2011).

In the context of health, 'behaviour' could be a simple action, such as swallowing a pill or a more complex series of actions that occur over time. Weight loss and maintenance of weight loss involves a multi-layered set of behaviours which make it difficult to sustain. Behaviours include high levels of physical activity, eating a low-calorie diet, self-monitoring weight, and consistency in eating patterns across weekdays and weekends (Thomas *et al.*, 2014; Wing & Phelan, 2005). There is now a broad consensus that weight management interventions that are informed by behaviour change theories are most optimized (Michie *et al.*, 2005). This is because behaviour change theories attempt to explain and predict behaviour by identifying and conceptualising constructs that operate as predictors and mechanisms underlying human behaviour (Teixeria *et al.*, 2017). The updated Framework for Developing and Evaluating Complex Interventions suggests drawing on existing evidence and theory is

critical when developing a complex intervention, as it is the optimum way to understand likely processes of change (Skivington *et al.*, 2021; Craig *et al.*, 2008). NICE recommends the planning, delivery and evaluation of any behaviour change or public health intervention should consider relevant behaviour change theory in order to maximise effectiveness (NICE, 2007). Nevertheless, a scoping review (Chen & Carbone, 2017) and a systematic review (Pedersen, Terkildsen & Juul, 2017) both found that few lifestyle interventions for women with history of GDM, were developed using behaviour change theory.

2.2.1 Behaviour change techniques

As well as theory, a key aspect of the development, implementation and evaluation of behaviour change interventions is the inclusion and categorisation of the techniques used within interventions that help change behaviour. So called behaviour change techniques (BCTs) are defined as the ‘active ingredients’ or ‘mechanisms of change’ and can be used alone or in combination (Michie *et al.*, 2011a). The consistent and reliable use of BCTs is helpful in a number of ways; it can help interventions be described more clearly, be more rigorously tested, and enable the identification of BCTs which might be most effective for producing different desired behaviours and outcomes (Teixeira & Marques, 2017).

Work led by Michie *et al.* (2008) has resulted in the formation of a BCT taxonomy (Table 5). Since the publication of the taxonomy many studies have attempted to identify associations between BCTs and different behavioural outcomes (Michie *et al.*, 2011a; Michie *et al.*, 2011b). Review findings suggest combining BCTs that focus on self-regulation and monitoring were more effective in promoting changes in healthy

eating and physical activity in the general population, than interventions that did not incorporate these techniques (Michie *et al.*, 2009). Similar effects have been found in other meta-analyses of interventions focused on weight loss and maintenance in overweight and obese participants (Dombrowski *et al.*, 2021).

Table 5. Definitions of 26 behaviour change techniques and their corresponding theoretical frameworks (Abraham & Michie, 2008). IMB = information-motivation-behavioural skills model; TRA = theory of reasoned action; TPB = theory of planned behaviour; SCogT = social-cognitive theory; CT = control theory; OC = operant conditioning.

Technique (theoretical framework)	Definition
1. Provide information about behaviour health link (IMB)	General information about behavioural risk, for example, susceptibility to poor health outcomes or mortality risk in relation to the behaviour.
2. Provide information on consequences (TRA, TPB, SCogT, IMB)	Information about the benefits and costs of action or inaction, focusing on what will happen if the person does or does not perform the behaviour.
3. Provide information about others approval (TRA, TPB, IMB)	Information about what others think about the person's behaviour and whether others will approve or disapprove of any proposed behaviour change.
4. Prompt intention formation (TRA, TPB, SCogT, IMB)	Encouraging the person to decide to act or set a general goal, for example, to make a behavioural resolution such as 'I will take more exercise next week'.
5. Prompt barrier identification (SCogT)	Identify barriers to performing the behaviour and plan ways of overcoming them
6. Provide general encouragement (SCogT)	Praising or rewarding the person for effort or performance without this being contingent on specified behaviours or standards of performance.
7. Set graded tasks (SCogT)	Set easy tasks, and increase difficulty until target behaviour is performed.
8. Provide instruction (SCogT)	Telling the person how to perform a behaviour and/or preparatory behaviours.

9. Model or demonstrate the behaviour (SCogT)	An expert shows the person how to correctly perform a behaviour, for example, in class or on video.
10. Prompt Specific goal setting (CT)	Involves detailed planning of what the person will do, including a definition of the behaviour specifying frequency, intensity, or duration and specification of at least one context, that is, where, when, how, or with whom.
11. Prompt review of behavioural goals (CT)	Review and/or reconsideration of previously set goals or intentions.
12. Prompt self-monitoring of behaviour (CT)	The person is asked to keep a record of specified behaviour(s) (e.g., in a diary).
13. Provide feedback on performance (CT)	Providing data about recorded behaviour or evaluating performance in relation to a set standard or others' performance, i.e., the person received feedback on their behaviour.
14. Provide contingent rewards (OC)	Praise, encouragement, or material rewards that are explicitly linked to the achievement of specified behaviours.
15. Teach to use prompts or clues (OC)	Teach the person to identify environmental cues that can be used to remind them to perform a behaviour, including times of day or elements of contexts.
16. Agree on behavioural contract (OC)	Agreement (e.g., signing) of a contract specifying behaviour to be performed so that there is a written record of the person's resolution witnessed by another.
17. Prompt practice (OC)	Prompt the person to rehearse and repeat the behaviour or preparatory behaviours.
18. Use follow-up prompts	Contacting the person again after the main part of the intervention is complete.
19. Provide opportunities for social comparison (SCompT)	Facilitate observation of nonexpert others' performance for example, in a group class or using video or case study.
20. Plan social support or social change (social support theories)	Prompting consideration of how others could change their behaviour to offer the person help or (instrumental) social support, including "buddy" systems and/or providing social support.

21. Prompt identification as a role model	Indicating how the person may be an example to others and influence their behaviour or provide an opportunity for the person to set a good example.
22. Prompt self-talk	Encourage use of self-instruction and self-encouragement (aloud or silently) to support action.
23. Relapse prevention (relapse prevention therapy)	Following initial change, help identify situations likely to result in readopting risk behaviours or failure to maintain new behaviours and help the person plan to avoid or manage these situations.
24. Stress management (stress theories)	May involve a variety of specific techniques (e.g., progressive relaxation) that do not target the behaviour but seek to reduce anxiety and stress.
25. Motivational interviewing	Prompting the person to provide self-motivating statements and evaluations of their own behaviour to minimize resistance to change.
26. Time management	Helping the person make time for the behaviour (e.g., to fit it into a daily schedule).

2.2.2 Which behaviour change techniques are optimal for postpartum weight management interventions?

While the application of specific BCTs might be effective across population groups (e.g. self-monitoring) (Michie *et al.*, 2009), some findings suggest particular approaches may apply to certain subgroups (Golley *et al.*, 2011; Lara *et al.*, 2014). Makama *et al.* (2021) found that inclusion of more BCTs as well as ‘self-monitoring’ and ‘goal setting’ were correlated with greater reduction in food intake and improvement of physical activity among postpartum women without history of GDM. A systematic review and meta-analysis aiming to understand which BCTs were effective for changing physical activity and healthy eating behaviours among postpartum women with and without GDM, found no specific strategy was significantly associated with physical activity or weight related outcomes (Lim *et al.*, 2020b). Nevertheless, and similarly to Makama *et al.*

(2021), on meta-regression, strategies relating to self-regulation were associated with greater reduction in energy intake (Lim *et al.* 2020b). This evidence combined implies future interventions aimed at women with history of GDM should concentrate on the application of effective BCTs, particularly those identified for postpartum women. However, it is possible that there may be techniques that are not currently coded in the taxonomies used (Gillison *et al.*, 2019). For example, motivational interviewing interventions are known to include techniques additional to those defined within existing taxonomies (Hardcastle *et al.*, 2017).

Moreover, although the review by Lim *et al.* (2020b) included some studies that focused on women with prior GDM, it remains unclear if these strategies are optimal or effective specifically for this population. Women with history of GDM are more likely to be managing problems such as depressive symptoms, lactation issues, and feeling frustration with healthcare provision (Nicklas *et al.*, 2011; Dalfrà *et al.*, 2012). A study found that while women typically engaged in healthy behaviours during their GDM pregnancy, these behaviours were difficult to maintain postpartum (Tierney *et al.*, 2015). Crucial questions therefore remain when designing behaviour change interventions for women with GDM history, including which techniques or combinations of techniques may or may not enhance effectiveness over long-term?

2.3 What hinders women's weight management efforts following birth?

Understanding women's experiences with weight management is important as this can contribute to successful intervention development by identifying factors that may help or hinder weight-loss efforts and adherence to behaviour change programs (Delahanty *et al.*, 2012). A wealth of public health evidence demonstrates the role of societal

disadvantage that impacts health and obesity (Marmot *et al.*, 2020; Lee, Cardel & Donahoo, 2015). Indeed, there is a strong relationship between obesity and low socioeconomic status, especially for women (WHO, 2014). A person's ability and opportunity to engage in behaviour change are highly influenced by factors outcomes of individual control such as environmental and social planning, marketing, legislation, service provision, regulation and fiscal measures (Michie, van Stralen & West, 2011). For example, a woman living in poverty is less likely to have access to healthy foods and the ability to exercise freely without the constraints of childcare. With those who are overweight at higher risk of GDM development (Torloni *et al.*, 2009) and subsequent progression to T2DM (Bao *et al.*, 2015; Sorbye *et al.*, 2020), it is likely that at least a proportion of women will experience barriers to weight management, that are outside of their control. These factors cannot be ignored when thinking about interventions to support women to manage their weight following a pregnancy complicated by GDM. Nevertheless, even when both opportunity and capability are abundant, motivation is still required (Solbrig *et al.*, 2017).

The barriers postpartum women face when making healthy lifestyle choices following birth are well documented. Stressors following birth include, worries about baby's health, adjusting to changes in life with a new born, pressure to breastfeed, loneliness and changes to relationships with partners and others (Parsons *et al.*, 2004). In addition to these early postpartum barriers, general barriers exist for postpartum women including, struggles to change eating habits, lack of confidence to engage in exercise and not enjoying physical activity such as not enjoying exercise (Nuss *et al.*, 2006; Lambert *et al.*, 2005; Carter-Edwards *et al.*, 2009). Women may also feel guilty for taking the time for self-care due to societal and personal expectations and

pressures they feel (Cheung *et al.*, 2019; Buelo *et al.*, 2019). Sleep deprivation is also a significant barrier to achieving weight management for postpartum women (Gunderson *et al.*, 2008), particularly considering the links between reduced sleep duration, poor sleep quality and increased snacking on high fat and carbohydrate foods (Papatriantafyllou *et al.*, 2022).

Research focused on barriers faced specifically by women with history of GDM, has identified multifaceted barriers to achieving weight-loss, including lack of time, infant health issues, fatigue and family responsibilities, all of which result in low levels of motivation (Gilinsky *et al.*, 2015; Ratner *et al.*, 2007; Nicklas *et al.*, 2011; Christiansen *et al.*, 2021; Ryswyk *et al.*, 2015). Indeed, women with history of GDM frequently report low levels of motivation as a key barrier to making healthy lifestyle changes following the birth of their baby (Lim *et al.*, 2020a). Tierney *et al.* (2015) suggest motivation may be particularly low postpartum for women with prior GDM, as extrinsic motivators that drove healthy choices during pregnancy, such as the health of the unborn child and monitoring from HCPs, are no longer present or prominent. Indeed, following childbirth women's focus shifts from managing her own health, to that of the child's (Lie *et al.*, 2013; Sundarapperuma *et al.*, 2018).

However, evidence suggests that some women with history of GDM have good levels of knowledge regarding strategies to manage weight including healthy eating and physical activity (Ratner *et al.*, 2008; Lambert *et al.*, 2005). Postpartum women with prior GDM also desire to contribute to their family's health by providing healthy food and model healthy behaviours to their children (Nielsen *et al.*, 2018; Buelo *et al.*, 2019). This evidence suggests that following birth, women with history of GDM

experience high levels of goal conflict, meaning they know they 'should' and even 'want' to make changes to reduce their future risks, and they know how to make these changes, but struggle to do so because of competing factors. Presence of such high goal conflict following birth, can create lower levels of motivation to start, undertake and maintain the behaviour changed needed for healthy lifestyle (Boudreaux & Ozer, 2013). A person must have the capability and opportunity, as well as motivation, to engage in healthy behaviour (Michie, van Stralen & West, 2011).

Presence of high levels of goal conflict and multiple barriers leading to low levels of motivation suggests interventions that support women to build and sustain motivation might be needed. Alongside factors such as depression, food cravings, stress and lack of time (Sharifi, Mahdavi & Ebrahimi-Mameghani, 2013; Welsh *et al.*, 2013), motivation is one of the most commonly reported issues impacting successful weight management among treatment-seeking overweight and obese adults (Solbrig *et al.*, 2017). Evidence also suggests that this type of support is desired by both overweight and obese adults in the general population (Solbrig *et al.*, 2017) as well as among postpartum women without history of GDM (Christiansen *et al.*, 2021). Despite this, it remains unknown if women with history of GDM desire this type of support.

2.4 Taking a motivational approach to weight management

Motivation has been found to be a good predictor of long-term weight loss and is a fundamental element of behaviour change and maintenance of functional behaviours (Elfhag *et al.*, 2005; Teixeira *et al.*, 2004; Silva *et al.*, 2011). Recent evidence suggests approaches that support autonomous motivation are more effective generating long-term behaviour change (Samdal *et al.*, 2017; Rutten *et al.*, 2014). Autonomous

motivation has been defined as motivation that is self-determined or emanates from the self, and drives behaviour that is consistent with goals and outcomes (Hagger *et al.*, 2014). This is consistent with findings from other studies that suggest provision of information alone is not effective for weight loss (Samdal *et al.*, 2017; Pesseau *et al.*, 2015; Dombrowski *et al.*, 2021; Lim *et al.*, 2020b). However, it has been found that those in the general population who seek weight management support in primary care generally receive diet and lifestyle advice only (Booth, Prevost & Gulliford, 2015). Current weight-loss programmes on tier 2 of the UK obesity pathway, (for people with BMI >30) typically focus on lifestyle education, advice and some behavioural skills (e.g., provide feedback, prompt self-monitoring and goal-setting,) an approach currently recommended by Public Health England, and NICE (PHE, 2017; NICE 2017b) (Figure 2). However, most people who complete these tier 1 or tier 2 interventions do not maintain meaningful levels of weight loss, on average a third of initial weight lost, is regained within 12 months and the rest over 3-5 years (Wadden *et al.*, 2015; Dombrowski *et al.*, 2014; Dansinger *et al.*, 20017). Indeed, a key issue related to maintaining the benefits of weight loss interventions is that people struggle to stay motivated to continue making changes, particularly once interventions end (Solbrig *et al.*, 2017). This evidence suggests that motivational intervention may be an important addition to skills based and educational weight management approaches. Regardless, in the UK, it is not until a person has reached tier 3 weight management support that they can access treatments that aim to elicit and increase motivation, such as Motivational Interviewing (MI) (Figure 2).

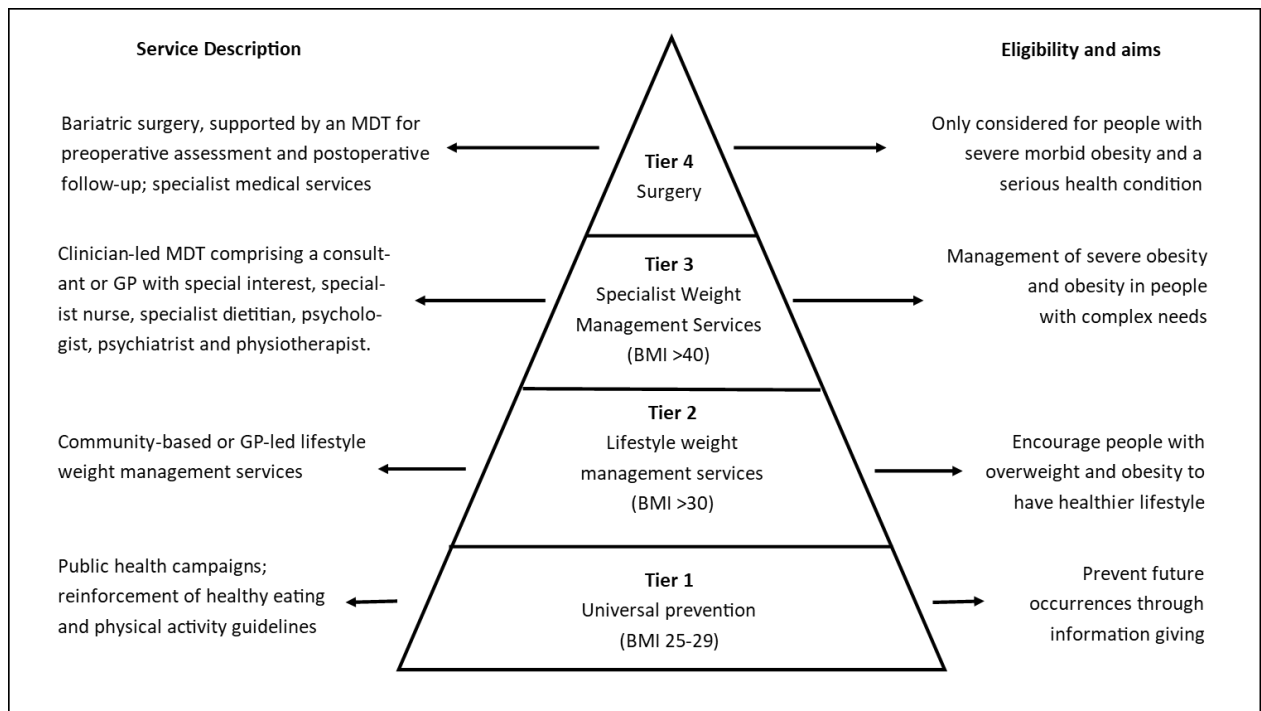


Figure 2. UK obesity care pathway (MDT = multidisciplinary team)

2.4.1 Motivational interviewing

Motivational interviewing (MI) is one of the most established standalone motivational interventions for behaviour change. The main focus of MI is to elicit and build internal motivation for functional behaviour change. MI combines a distinct combination of BCTs including, action planning, goal setting, overcoming barriers, building self-efficacy, and eliciting motivation (Miller & Rollnick, 2012). MI emphasises autonomy by being client-centred and involving non-confrontational collaborative decision making (Miler & Rollnick, 2012). The process of MI involves clients recognising any discrepancy between personal goals and current health behaviours. Clients are directed to focus on their own incentives and related desires for change, and therefore creating less ambivalence. Self-efficacy, or the belief a person has in their ability to achieve something, is built through reviewing past successful attempts at behaviour change. 'Change talk' is encourage whereby clients create confidence as they are inclined to

believe what they hear themselves say and trust their own opinions more than that of others. Clients are further supported to create action plans and speak about solutions to immediate barriers to change, further boosting self-efficacy (Miller & Rollnick, 2012).

MI interventions have consistently demonstrated as superior to advice and information-based treatments for changing health related behaviours such as, adherence to medication (Zomahoun *et al.*, 2016), smoking cessation (Rubak *et al.*, 2005), increasing physical activity (O'Halloran *et al.*, 2014), improving cardiovascular health (Thompson *et al.*, 2011) and reducing blood pressure (Vanbuskirk & Wetherell, 2014). However, studies investigating MI for weight loss have, to-date, demonstrated only modest to medium effects (Barnes & Ivezaj, 2015; Hardcastle *et al.*, 2013; Vansuskirk & Wetherell, 2014). For example, in a meta-analysis of 11 RCT's comparing MI to control interventions among overweight or obese adults, authors conclude that although MI did produce significant changes in body weight compared to controls, these effects were small to moderate, at best (Armstrong *et al.*, 2011).

2.4.2 Motivational Interviewing interventions for women with history of GDM

Some evidence suggests that MI interventions delivered during a pregnancy complicated by GDM can increase physical activity levels among women, particularly in the short term (Smith *et al.*, 2021). Evidence also demonstrates that MI tended to reduce foetal overgrowth but not significantly and does not impact gestational weight gain (Ásbjörnsdóttir *et al.*, 2019).

Only two studies to-date have focused on the provision of MI for weight management among women with history of GDM, following birth. Reinhardt *et al.* (2012) investigated if telephone delivered lifestyle education using motivational interviewing could result in positive lifestyle change for women with prior GDM living in a large rural location. The intervention group received telephone-based MI intervention lasting for 6 months. At follow-up (6 months) the intervention group, compared to the control group receiving standard care, had significantly reduced total fat and carbohydrate intake, and reduced glycaemic load. The intervention group also reduced their BMI by -1.5 kg/m^2 but this result was not significant. However, this study was a pilot, and no longer-term follow-up was conducted meaning it is difficult to understand if these effects could be sustained.

Ferrara *et al.* (2016) investigated the effectiveness of a mail and telephone version of the diabetes prevention program (DPP) which incorporated motivational interviewing. Behaviour change techniques were tailored to women's resources and cultural preferences. The intervention period lasted 6 months, with a maintenance period from 6-12 months. The primary outcomes were proportion of women reaching pre-gravid weight (if pre-gravid weight $\leq 25 \text{ kg/m}^2$), or losing 5% of pre-gravid weight (if BMI $>25 \text{ kg/m}^2$) and pre-gravid to postpartum weight change. Findings showed those receiving the intervention had significantly higher odds of meeting weight related goals than women receiving standard care (educational materials) at 6 weeks and 6 months follow-up. However, these differences were reduced at 12 month follow up, suggesting a lack of ability for MI to impact longer-term maintenance of behaviours.

Indeed, there is only limited evidence to support the long-term effects of MI, making it difficult to understand if and how fast, any effects may decay after the intervention is over. Available evidence suggests that weight re-gain occurs rapidly after 12-18 months of MI withdrawal in the general population (West *et al.*, 2007; West *et al.*, 2011; Dombrowski *et al.*, 2014). Overall, this evidence suggests that motivational support such as MI could be more effective than skills-based or educational approaches, for creating moderate weight loss among women with history of GDM, but there is room for improving its effectiveness, especially long-term, making in an important area for further development.

2.5 Functional Imagery Training (FIT)

Functional Imagery Training (FIT) developed by Kavanagh, Andrade and May is a motivational intervention that is based on the well-evidenced benefits of MI but additionally incorporates mental imagery and training in self-motivation (Kavanagh *et al.*, 2014). Mental imagery is often described as “seeing with the mind’s eye” or “hearing with the mind’s ear” (Kosslyn, Ganis & Thompson, 2001). As humans we have the ability, using all our senses, to experience, through our imagination, objects, people, activities, and events. This ability has been likened to a weak form of perception, whereby mental imagery creates a depictive internal representation of ‘things’ (Pearson *et al.*, 2015).

Evidence suggests that the application of mental imagery could be advantageous to increasing motivation for behaviour change, through several avenues including, building self-efficacy (Knäuper *et al.*, 2011), increasing emotional impact (Holmes & Mathews, 2005), and reducing ‘delay discounting’ (Daniel, Stanton & Epstein, 2013) a

concept whereby humans tend to choose short term pleasure rather than attend to longer-term goals (Bickel & Marsch, 2001). However, mental imagery is currently not systematically or routinely elicited during MI, potentially limiting its impact.

FIT is a direct translation of Elaborated Intrusion theory which posits that practicing imagery associated with healthy behavioural goals, helps to strengthen desire for those goals and increases the belief that they are achievable (Kavanagh, Andrade & May, 2005). Elaborated Intrusion theory also suggests that practising imagery can weaken craving as mental imagery relies on limited capacity working memory and can therefore interfere with competing imagery related to temptations (Baddeley & Andrade, 2000; May et al., 2010; Kemps & Tiggemann, 2007).

Often behaviour change interventions tend to build motivation through specific techniques such as goal setting and monitoring, reminders and feedback, whereas FIT aims directly to strengthen desire for behaviour change and self-efficacy for achieving it. FIT is delivered in a very similar way to MI but differs in two important ways: 1) it develops emotionally charged mental imagery during interview sessions to elicit and strengthen motivation and 2) promotes the maintenance of motivation by training individuals to practice goal-related imagery regularly, particularly when setting new goals. By practicing imagery, it should become easier to bring vivid images of goal-achievement to mind, particularly when faced with conflict or temptation, boosting motivation, and weakening cravings.

FIT uses short interview sessions, to build and support desire for specific goals and sub-goals that are self-set and achievable (Andrade *et al.*, 2016) (Figure 3). FIT covers similar topic areas to MI (Miller & Rollnick, 2012), including incentives to change,

exploring discrepancies between values and current behaviour, boosting self-efficacy, and developing specific action plans. Crucially it also invites and trains individuals to develop personalised multisensory imagery related to their goals so that each step toward their goal is explored via their own imagination (Andrade *et al.*, 2016). This is important as because imagery is more emotionally charged, it should create stronger commitment and pursuit toward goals.

The intervention promotes autonomy and the ability for participants to respond to challenges that occur in their natural environment by training them to become their own FIT therapist. Clients are guided through a series of mental imagery exercises and trained to practice imagery at home. Practice of imagery outside of ‘therapy sessions’ is a key part of FIT and is often paired with another regular behaviour such as brushing teeth or making a cup of tea. This helps to consolidate imagery practice into a cognitive habit, meaning a person can deliberately draw upon emotive goal-related multisensory imagery whenever motivation needs to be strengthened or renewed.

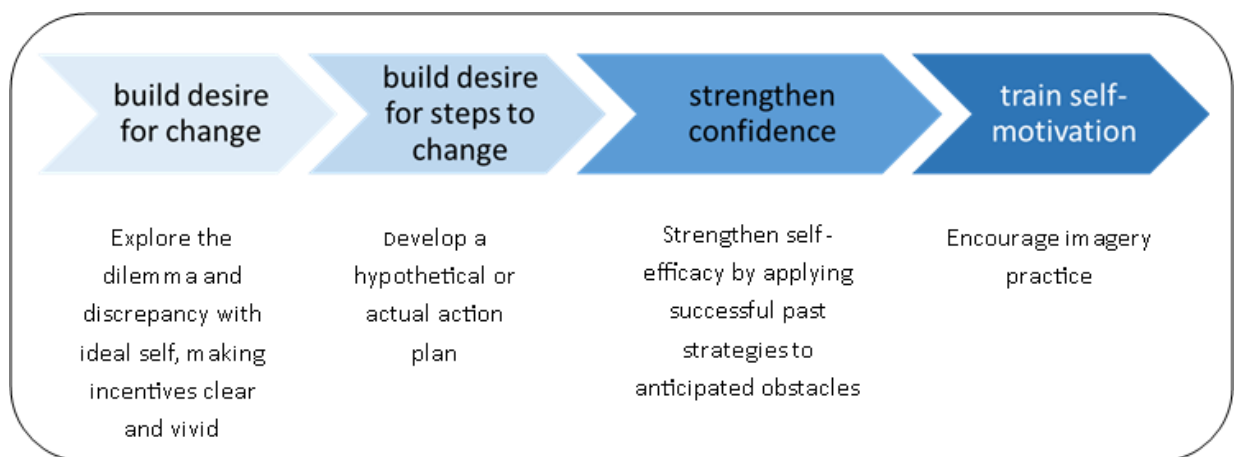


Figure 3. Components of FIT

Imagery practice is also focused on the specific actions individuals will need to take to achieve goals and sub-goals, particularly the visualisation of overcoming barriers and imagining strategies that have worked in the past (Andrade *et al.*, 2016). This allows a person to anticipate challenging situations, and plan and rehearse responses before they may occur, a process called 'symbolic practice' (Bandura, 1982). The premise behind this is that the end goal becomes more proximal, with clear visible and realisable steps (Trope & Liberman, 2010). Vividly imagining past successes also helps to boost self-efficacy, a known vital component of sustained behaviour change (Bandura, 1989; Miller & Rollnick, 2012).

2.5.1 The impact of FIT on behaviour change and weight management

FIT has been investigated as an intervention across a range of behaviours including, physical activity (Rhodes *et al.*, 2021), alcohol consumption (Kavanagh *et al.*, 2018), adherence to physical therapy (Nedza & May, 2021) and success in professional sport (Rhodes, May & Booth, 2020).

One of the first investigations of the impact of FIT on weight management focused on the behaviour of snacking, defined as in-between meal food and drink consumption (Andrade *et al.*, 2016). Using a step-wedged design, adults aged 18-67 wishing to lose weight received one session of FIT plus one booster call over a 4-week period.

Participants reported all snacking and were assessed on the frequency of their motivational thoughts regarding the reduction of snacking. Results demonstrated frequency of motivational thoughts regarding the reduction of snacking rose following FIT. This finding correlated with reduction in high calorie snacking and modest weight loss, and for the group that received the intervention at baseline this effect persisted

for four weeks. However, because FIT includes elements of MI, such as goal setting, it is possible that this may have served as an additional prompt to reduce snacking, therefore, further work was needed to compare FIT with MI, to understand whether the effects of FIT are related to imagery specific components, as predicted by EI theory. This study used a short session of FIT, and thus questions remained if longer term implementation could be advantageous for supporting weight loss over time and sustaining motivation across different challenges over time.

In response to these questions Solbrig *et al.* (2019) conducted a single centre RCT to compare the impact of FIT with MI on weight-loss in the general population. The participant sample consisted of 121 participants, 82 were female and 31 were male. The age range of participants was 19-72 years with a median age of 45. FIT was delivered in two sessions, the first being face-to-face and the second over telephone. Following these initial two sessions, booster phone calls (lasting 15 mins) were provided every 2 weeks for 3 months, then once-monthly up until 6 months. The control group received time and contact-matched motivational interviewing. Results demonstrated clinically meaningful weight-loss at 6 months (4.11kg) which continued to 12 months (6.44kg) among the group receiving face-to-face FIT intervention. This was compared to the MI group who experienced minimal weight loss at 6 months (0.74kg), which stabilised at 12 months (0.67kg) (Solbrig *et al.*, 2019). In qualitative evaluation of the experience of MI and FIT participants, those who experienced FIT described a mind-set change and were confident they could maintain changes and overcome challenges using imagery techniques. Participants receiving MI, wished for continued therapist support and feared relapse (Solbrig, 2018). One of the main limitations of this study was the use of one practitioner to deliver FIT and thus findings

require replication in larger multi-centre studies which could assess if FIT can be delivered effectively at-scale. However, given the demonstrated benefit of mental imagery in weight-control, FIT should be considered and further tested as an intervention for weight management among other populations. Indeed, the efficacy of delivering FIT to women with history of GDM is unknown, however, the predominantly female sample used in this RCT, suggests potential for this population, although not all were of childbearing age.

2.5.2 FITZ – an app version of FIT

One of the key aspects linked to the effectiveness of FIT is the importance of maintaining imagery practice overtime to help minimise the discrepancy between short term gains and conflicts. To assist with this, as well as make FIT as accessible as possible, the developers of FIT translated the intervention into an app called FITZ. This was prompted by evidence suggesting a desire among the general population for motivational support delivered via an app to help overcome waning motivation during weight management attempts (Solbrig *et al.*, 2017).

The FITZ app was developed by Professors David Kavanagh and Jackie Andrade, two of the originators of FIT. It is designed to lead the user through a structured dialogue with guided imagery exercises, as human-delivered FIT does. The app asks the user questions about why their goal is important to them and how they will set about achieving it. Using a recording feature within the app, the user responds to these questions, out loud, to capture the benefit of hearing themselves talking about their values and goals (Figure 4). The app records what they say and they can play it back as a reminder of the importance of the goal. The app talks the user through multisensory

imagery exercises about their goal, their plans for achieving it, past successes and strategies for overcoming anticipated obstacles. It encourages the user to practice this imagery regularly, and they can do so by replaying the different imagery exercises in the app. The app also allows the user to record their goals and sub goals, track their imagery practice, and view their progress. Users can upload their own photos and select a photo to focus on while listening to guided imagery practice.

The app therefore approximates a human-delivered FIT session as closely as possible, both in the structure of the intervention and the content. It provides additional imagery practice exercises and uses mobile phone functions such as reminders and progress charts that would be lacking in face-to-face FIT. It of course lacks the ability to respond reflectively to what the user says in the way a trained practitioner would. Exploration of the impact of FITZ on weight loss is yet to be undertaken and thus its efficacy as weight management tool it yet to be understood.

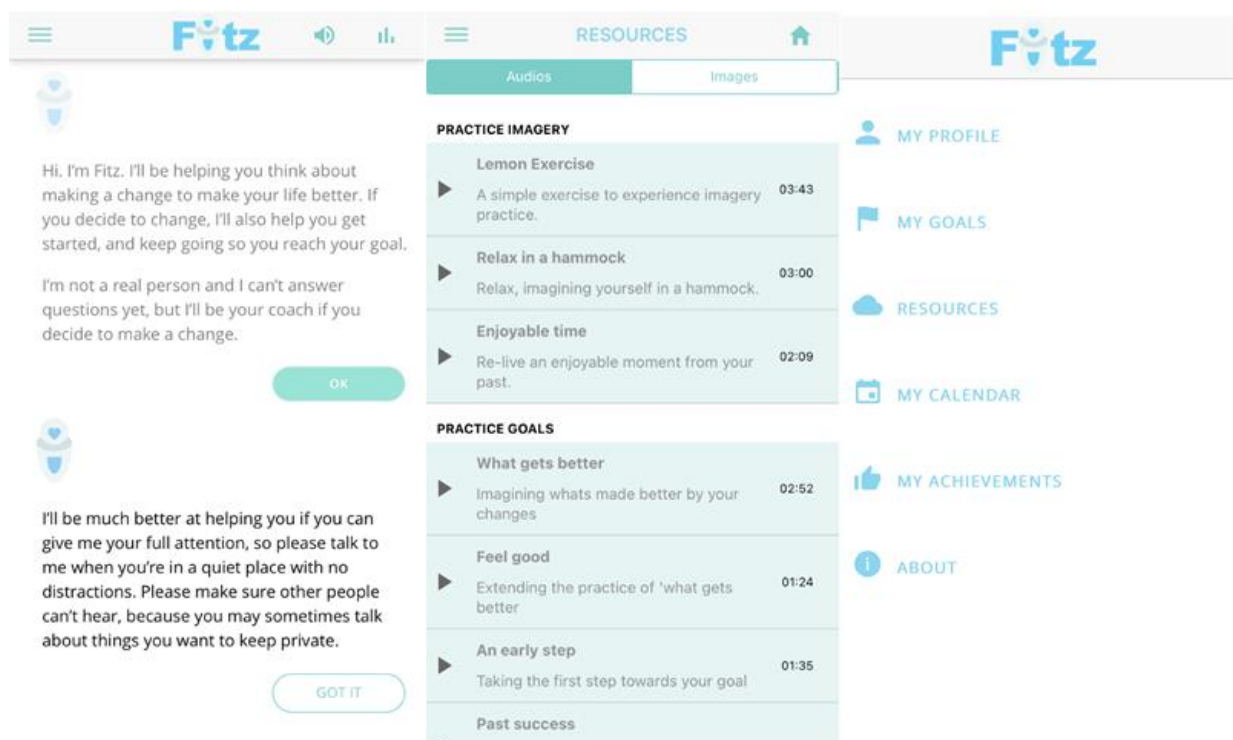


Figure 4. Key features of the FITZ app

2.6 Digital delivery of weight management interventions for GDM

The potential for delivering interventions, such as FIT, via mobile app means it is important to understand the advantages, issues and impact of implementing digitally delivered weight management interventions for women with a history of GDM. Rapid development of technology has led to a quickly growing market for mobile health (mHealth), defined as "*use of mobile and wireless technologies, such as mobile phones and personal digital assistants (PDAs), to support the achievement of health objectives*" (WHO, 2011).

Globally, smartphone ownership is estimated to be 78% in 2020 (Statista, 2021). An mHealth economics report found that apps for diabetes were one of the strongest markets within digital health innovation (Research2Guidance, 2017). In recent years there has also been in a large increase in the use of digitally delivered weight management interventions. Several advantages of digital delivery include wide reach at a low cost, with the ability to implement at scale. Digital solutions also have the ability to tailor content to individual needs with a higher degree of fidelity to intervention content (Griffits *et al.*, 2016; Michie & West, 2016). For weight management in particular, digital solutions offer the possibility to deliver intervention content in the longer-term, something required for maintenance of weight reduction. Lack of intervention 'reach', 'participation' and 'fidelity' are all implementation issues noted with interventions aimed to prevent T2DM development in women with history of GDM (Lim *et al.*, 2020a). Indeed, Lim *et al.* (2020a) suggest mHealth technology may offer a solution to partly overcome some common 'opportunity-related' barriers such as time, cost, travel that women with prior GDM experience when undertaking lifestyle

change following birth. Nevertheless, it must be recognised that mHealth interventions also have potential to widen health inequalities, where some may not have access to mobile devices and mobile data, especially during cost-of-living crises (Ibrahim *et al.*, 2021). This is particularly salient considering associations between socioeconomic status and ill-health (Marmot *et al.*, 2020).

Despite potential, the optimal design of mHealth weight management intervention for women with history of GDM remains unknown (Lim *et al.*, 2020a). Studies have found pregnant women commonly use their smartphones to access information to help them prepare for birth, (Sanders & Crozier, 2018), share experiences and seek support with others via social media (Sparud-lundin *et al.*, 2011; Naveh & Bronstein, 2019). In one study a third of women experiencing GDM said they expected information about their pregnancy to come from the internet and for those aged 30 or more, the internet was perceived as the best source of information, offering more privacy and greater accessibility (Sayakhot *et al.*, 2016).

Nevertheless, much less is known about how women with history of GDM access the internet for health, particularly via mobile phone, what they use it for and how it may facilitate their ability to manage GDM and its longer-term health consequences. A qualitative study examining how primary care services could better support postnatal women with history of GDM, found women thought technology could support flexible and personalised self-management, as well as providing information and facilitate social support (McMillan *et al.*, 2018). Existing weight management apps may represent highly scalable solutions to this situation, however, relatively little is known about women's views and experiences of using such apps during this time, or which

features they particularly value to support them achieve their health behaviour change goals.

One review of mHealth applications for use during pregnancy suggests that currently, very few interventions are informed by behaviour change theory (Chen & Carbone, 2017). It also remains unknown if interventions include relative/appropriate behaviour change techniques. This is despite the NICE digital evidence framework standards recommending that any digital health intervention that wishes to create preventative behaviour change or disease self-management should incorporate recognised behaviour change techniques that are targeted to the population in question (NICE, 2021).

2.7 Chapter Summary

The evidence presented in this chapter suggests that few weight management interventions for women with history of GDM are currently informed by behaviour change theory and it remains unknown what BCTs might be most effective for this population. Exploration of the factors that hinder women's efforts to manage their weight following birth, suggest offering women motivational support could be advantageous. Nevertheless, it remains unknown if women desire this type of support, despite reported low levels of motivation following birth. Critique of existing motivational interventions suggests they could be more effective than skills-based or educational approaches for creating moderate weight loss among women with GDM, but there is room for improving its effectiveness, particularly in the long-term. Current theorising suggests the application of mental imagery could be advantageous to increasing motivation and self-efficacy for behaviour change.

A newly developed intervention, FIT, incorporates mental imagery and directly aims to strengthen desire for behaviour change and self-efficacy for achieving it. Evidence suggests that FIT holds promise as an effective weight management intervention, however, the efficacy of delivering FIT via mobile app remains unclear as do the intricacies of implementing such an intervention among a population of women with history of GDM. Digitally delivered weight management support could be advantageous in overcoming some of the barriers women face following birth. Despite potential, the optimal design of mHealth weight management interventions for women with history of GDM remains unknown. The following chapter, provides a summary of the gaps in knowledge identified so far in this thesis and presents rationale for the project research question, aims and objectives. An overview of the thesis and project structure are presented.

Chapter 3: Project Outline

3.1 Overview

This chapter presents an overview of this PhD project including the research question, aims, objects and thesis structure. The literature explored in chapters one and two demonstrated several clear gaps in knowledge regarding the development and implementation of weight management interventions for women with prior GDM. To establish population impact, the success of broader implementation of weight management interventions for women with prior GDM will be key. To support this, interventions will need to address the unique barriers and facilitators to health behaviour change that are faced by women in order to enhance penetration, implementation, participation. Although evidence suggested women might benefit from enhanced motivational support following the birth of their baby, it was unclear if women desired this type of support. Interventions delivered digitally via mHealth might help to overcome some of the situational barriers women face when making lifestyle changes, following birth. The use and evaluation of mHealth was timely, as the recent outbreak of COVID-19 pushed forward the need and possibility of digitally delivered diabetes in pregnancy services (Murphy, 2020). However, it was unclear if and what mHealth was already available for women and if it incorporated relevant behaviour change techniques. In addition, relatively little was known about women's views and experiences of using mHealth or which features they particularly valued to support them achieve their health behaviour change goals following a pregnancy complicated by GDM. Evidence suggested that the FIT intervention held promise as an effective weight management tool, that takes a different approach to standard provision of information and advice. However, the efficacy of delivering the

intervention via mobile app remained unclear as did the intricacies of implementing such an intervention among a population of women with history of GDM. Among the top 10 research priorities in diabetes and pregnancy according to women, support networks and HCPs were technologies for the prevention of other types of diabetes in women with gestational diabetes (Ayman *et al.*, 2021).

This PhD project therefore aimed to explore the concept of using mHealth to support weight management following a pregnancy complicated by GDM including the acceptability and feasibility of the FITZ app as a potential weight management intervention for women with history of GDM.

3.2 Research Question, Aims and Objectives

3.2.1 Research question

Could a motivational mHealth app (FITZ) be a needed, acceptable, and feasible weight management intervention for women with history of GDM?

3.2.2 Aims of the project

Motivated by the evidence presented in chapters one and two, the aims of this project were twofold:

The first aim of this project was to better understand the need for, and the role of, mHealth to support women with a history of GDM following birth

The second aim of the project was to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM.

3.2.3 Objectives

To achieve these aims, the project objectives were to:

1. To systematically map the extent of knowledge related to the use of mHealth interventions for the prevention and management of GDM and its long-term implications among women at risk of or diagnosed with GDM in order to identify gaps in knowledge (Chapter 5, study 1)
2. To systematically examine existing literature to understand if mHealth interventions for women at risk of or diagnosed with GDM incorporate relevant behaviour change theory and techniques (Chapter 5, study 1)
3. To understand key stakeholder experiences and preferences regarding the use of mHealth following a pregnancy complicated by GDM and to assess if the use of a live webinar was a useful way to recruit, collect data and retain these stakeholders into follow-up research activities (Chapter 6, studies 2a and 2b)
4. To explore the views and experiences of women and HCPs of using mHealth before, during and after pregnancy to help prevent and manage GDM and its associated long-term health outcomes (Chapter 7, studies 3a and 3b)
5. To explore the acceptability of FITZ among recently postpartum women with history of GDM including their willingness to use the app 8-12 weeks following birth (Chapter 8, study 4)
6. To assess the feasibility of recruiting and retaining women with recent history of GDM from a diabetes in pregnancy service (Chapter 8, study 4)
7. To explore what weight management support HCPs currently offer to women with history of GDM and to assess the acceptability and perceived usefulness of FITZ among HCPs (Chapter 9, study 5)

8. To explore ways in which HCPS thought FITZ could be improved or adapted for use in practice (Chapter 9, study 5)

3.3 Thesis structure

An overview of the project structure is provided in Figure 5. A description of what is included in each chapter of this thesis is provided below.

Chapter 1 presented an overview of the clinical presentation of GDM including long-term implications for both mother and baby. This chapter discussed the critical role of weight and BMI in the development of T2DM and recurrent GDM and the significant need to provide women with opportunities to effectively manage their weight to help reduce their risk of adverse outcomes following birth. This chapter highlighted several, critical gaps in knowledge regarding what components make lifestyle interventions for women with prior GDM effective and how they might be best designed to overcome implementation challenges in real-world settings. This chapter additionally highlighted a significant lack of evidence focused on the development and evaluation of interconception weight management interventions for the prevention of recurrent GDM.

Chapter 2 considered how the inclusion of relevant behaviour change theory and techniques could optimise weight management interventions for women with history of GDM, particularly when they consider factors that help or hinder women's efforts. The role of motivation in weight management was discussed and rationale was provided for why offering women motivational support could be advantageous. Existing motivational interventions were critiqued and a newly developed motivational intervention, Functional Imagery Training (FIT), was introduced including its potential

as a digitally delivered weight management intervention for women with history of GDM.

Chapter 3, this chapter, outlines the rationale for the PhD project, it's aims and objectives and provides details of how this thesis and project is structured.

Chapter 4 provides a discussion of the methodology used to address the project question, aims and objectives including an overview of the philosophical underpinnings and how a research paradigm and specific methods were chosen. This chapter also presents the theoretical frameworks used to the guide the project design and discusses ethical considerations and the practical issues faced during development and conduct.

Chapter 5 presents a systematic scoping review of the literature and provides an overview of what is currently known about the use of mHealth interventions for the prevention and management of GDM and its long-term implications. The review also provides exploration of if these mHealth interventions incorporate relevant behaviour change techniques. The review identifies gaps in the current knowledge and highlights how the review findings influenced the development of this projects aims and objectives. Recommendations for future research are also made.

Chapter 6 describes the conduct of two studies (2a and 2b) that focus on a webinar held during April 2019. The purpose of the webinar was twofold; 1) to understand if hosting a webinar was an effective method of engaging stakeholders, particularly postpartum women, into research activities and 2) to use an embedded survey within the webinar collect data regarding stakeholder experiences and preferences of the use of mHealth following a pregnancy complicated by GDM. The process of undertaking the webinar and the findings regarding its ability to engage and retain stakeholders is

presented in the first half of this chapter. The methods and findings associated with the embedded survey exploring stakeholder experiences and preferences regarding mHealth use following birth, are provided in the second half, with a preliminary discussion, followed by an overall summary of the two studies.

Chapter 7 presents two published studies (3a and 3b) that were undertaken as part of phase one of this project. Both studies provide qualitative findings regarding women's and HCPs experiences and views of on the use of mHealth before, during and after a pregnancy complicated by GDM. An overall reflection of phase one of the project is presented and serves to triangulate the findings from all the studies conducted as part of phase one of this project. The continued rationale for the investigation of FITZ among women with history of GDM, based on the overall findings of phase one, is provided.

Chapter 8 describes the methods, findings, and preliminary discussion of study 4, the first study undertaken as part of phase two of the project. This study took a mixed methods approach to understanding what women thought of the idea behind FITZ, if they would be willing to invest time into using it following birth and which bits of the app, if any, they liked or disliked. This study had the additional aim of assessing the feasibility of recruiting and retaining women from a local diabetes in pregnancy service. The findings from this study served to inform both the usefulness of continuing to investigate FITZ among this population and the design of any future evaluations. The strengths and limitations of this study are presented along with implication for future research.

Chapter 9 presents the methods, findings and preliminary discussion of study 5, the second and final study undertaken as part of phase two of the project. The purpose of

this study was to explore the acceptability and perceived usefulness of FITZ among HCPs, including any challenges they foresaw regarding implementation in practice. This study then went on to explore ways in which HCPs thought these challenges could be overcome by making changes to FITZ. The findings of an online survey and co-production workshop are presented with a summary of suggested improvements to FITZ made by HCPs. The strengths, limitations and implications of the study are discussed.

Chapter 10 provides an overall discussion of the project including exploration of the original research question and aims. The overall findings are summarised and compared with existing literature. The implications of these findings for policy, practice and research are highlighted and the overall strengths and limitations of the project are discussed. Finally, opportunities for future research are presented and an overall conclusion is provided.

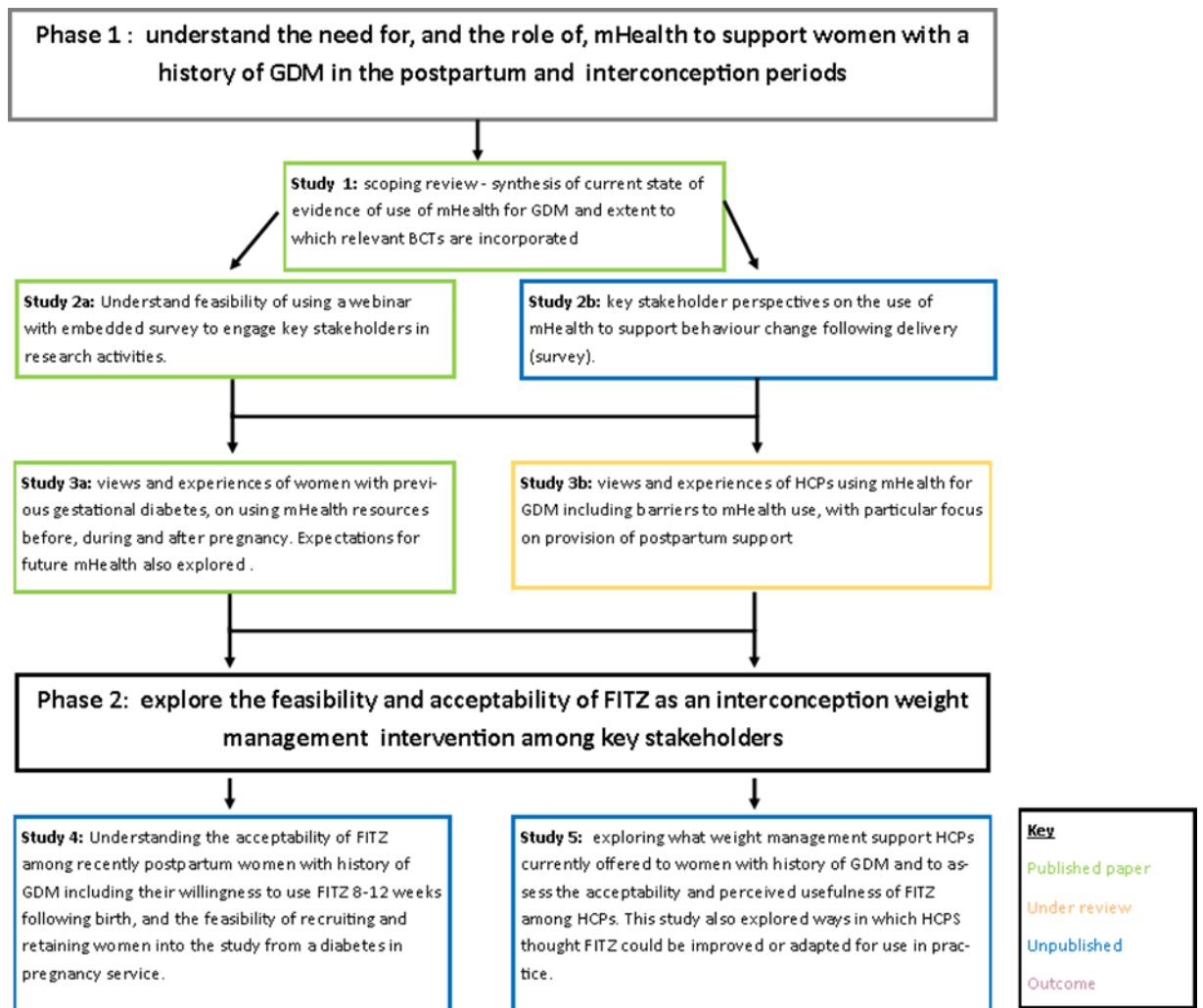


Figure 5. Overview of PhD project structure

3.4 Chapter Summary

This chapter has presented the project research question, aims and objectives, along with a breakdown of how this thesis is structured. The following chapter, chapter 4, describes the methodology used to address the project aims and objectives including an overview of the philosophical underpinnings and how a research paradigm and specific methods were chosen. Chapter 4 also presents the theoretical frameworks used to guide the project design and discusses ethical considerations and practical issues faced during the development and conduct of the project.

Chapter 4: Methodology

4.1 Overview

This chapter firstly explores the philosophical underpinnings of the methodological approach taken in this project including how a research paradigm was chosen along with its guiding ontology and epistemology. The chapter then explores how the design and conduct of the project has been influenced by two relevant theoretical frameworks. Rationale for why a mixed methods approach was chosen as the most appropriate methodology to answer the project research question is detailed. The data collection and analysis methods are described alongside as description of how rigour and trustworthiness were maintained. Finally, ethical considerations are discussed along with practical issues faced during this project.

4.2 Philosophical approach

As a researcher it is important to acknowledge that there are different ways of viewing the world and that any selected approach to knowledge is one of many. Understanding the philosophical approach from which any research is derived is essential to critically appraising the approach taken to gain that knowledge, as well as interpret findings and their impact on scientific knowledge. This section on 'philosophical approach' will provide an overview of how the methods chosen to address the research question, aims and objectives were derived from an overarching philosophical position.

4.2.1 Research Paradigms

A research paradigm has been defined as *"The set of common beliefs and agreements shared between scientists about how problems should be understood and addressed"*

(Kuhn, 1970). When applied in a research setting it is the assumptive base from which knowledge is produced (Rehman & Alharthi, 2016). There are five main research paradigms: critical, subjectivism, pragmatism, positivism, and constructivism (Guba & Lincoln, 1998). Each of these paradigms is characterised by a matrix of ontology, epistemology, theoretical perspectives, methodologies and methods (Table 6). In philosophy of science, ontology focuses on entities that are both observable and non-observable (Creswell & Plano Clark, 2007). Epistemology on the other hand, is the study of knowledge; what can we know, and how can we know it (Creswell & Plano Clark, 2007).

4.2.2 Ontology and Epistemology

Various ontological and epistemological perspectives exist, and their differences have important influence on research design, including the methods used to collect relevant data, and thus the type of knowledge derived from any given research question.

Understanding the ontological and epistemological paradigm used by any given researcher is deemed essential to understanding his or her results and their impact on scientific knowledge (Bishop, 2015). A realist ontology (associated with positivist paradigm) posits that a real-world exists independently of people's constructs, theories, and perceptions. Alternatively, an idealist ontology (associated with constructivist paradigm) stresses a central role on the interpretation of experience and that reality is fluid and the objects of knowledge are held to be in some way dependent on the activity of the mind (Guba & Lincoln, 1998). These competing ontologies are important because they influence assumptions about 'what can be known' and how a researcher can 'know' reality – or their epistemological viewpoint.

Table 6. Research paradigms, their ontology, epistemology, methodology and methods (Adapted from Crotty, M., 1998).

Paradigm	Ontology (What is reality?)	Epistemology (How can I know reality?)	Theoretical perspective (Which approach do you use to know something?)	Methodology (How do you go about finding it out?)	Method (What techniques do you use to find out?)
Positivism	There is a single reality or truth	Reality can be measured hence the focus is on valid tools	Positivism Post-positivism	Experimental research Survey research correlational & value neutral studies	Quantitative sampling, statistical analysis, randomised controlled trials, standardised tests
Constructivism	There is no single reality or truth	Reality needs to be interpreted	Interpretivism	Ethnography, Grounded Theory, Phenomenology	Qualitative interviews, focus groups, open ended questionnaires
Pragmatism	Reality is constantly renegotiated & debated	The best method is one that solves problems	Research through design	Mixed methods designs	Combination of qualitative and quantitative methods
Subjectivism	Reality is what we perceive it to be	All knowledge is purely a matter of perspective	Postmodernism Structuralism Post-structuralism	Discourse theory, archaeology, deconstruction	Auto-ethnography

Critical	Realities are socially constructed entities that are under constant internal influence	Reality and knowledge are both socially constructed and influenced by power relations from within society	Marxism Queer Theory Feminism	Critical discourse analysis, critical ethnography, action research	Ideological review, civil action, open-ended interviews, observations
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Quantitative approaches to data collection are conventionally associated with positivist or post-positivist epistemologies (Bishop, 2015) (Table 6). Taking on a realist ontology, post-positivist epistemology typically entails deriving knowledge from bias-free, objective measurements to reach the goal of discovering a reality that is knowable (e.g. universal laws such as the universal law of gravitation) (Creswell, 2003). Qualitative approaches to data collection are traditionally associated with constructionist or interpretive epistemologies (Bishop, 2015). Constructionist or interpretive epistemologies typically entail taking on an idealist ontology, where it is assumed that we can only know the world through different conceptual frameworks that vary between individuals and cultures (Guba & Lincoln, 1998). From this perspective, knowledge and the research process itself is inescapably rooted in values and cultures. Taking this viewpoint typically involves collecting locally situated and contextualised data that is pursued through inherently subjective means.

This brief description of two seemingly competing epistemologies demonstrates the competing philosophical underpinning of qualitative and quantitative methods and shows how differing epistemological standpoints can ultimately influence the methodology and methodological tools the researcher chooses to use to gather their data and ultimately answer their research question. This throws up a contentious issue when using a mixture of qualitative and quantitative methods to address a research question at hand. However, within several research paradigms lies the opportunity for knowledge to be best understood using a combination of methods. Like all research, taking a mixed methods approach necessitates both philosophical beliefs and practical methods, and can therefore be conceptualised as a research methodology in its own right (Creswell & Plano Clark, 2007). It

was important for me to gain an understanding of different paradigm perspectives before deciding which research paradigm would guide the development of this project.

4.2.3 Critical realism

Critical Realism is a relatively new research paradigm which incorporates both realist ontology and constructivist epistemology. Realism is different to positivism in that it accepts differences in social realities and places importance on them to explain causality. The critical realist viewpoint is concerned with both patterns of causality, produced by quantitative research (positivist) as well as how this causality can differ depending on different situations (constructivist). Both these perspectives are granted equal weight and thus it is an appropriate standpoint from which to conduct mixed methods research (Maxwell & Mittapalli, 2010). Critical realism may sidestep issues associated with paradigm switching, particularly in health care research (Mcevoy & Richards, 2006). However, critics of the approach suggest switching between alternate paradigms which are so radically different from one another leaves no room for reconciliation (Ford-Gilboe, Campbell & Berman, 1995). Taking such a principled approach to combining methods from common ontological and epistemological positions, leaves the critical realist paradigm wrestling with competing ideologies (Perlesz & Linsay, 2003).

4.2.4 Pragmatism

However, pragmatism affords the possibility of mixing methods without attending to the importance of competing epistemology and ontology. Rather, the paradigm is concerned with using methods which produce the most valuable external consequences.

Pragmatism offers a competing paradigm from which to approach research using mixed methods to share meaning and pursue joint action (Morgan, 2007). Peirce (1878) coined what is termed the pragmatist maxim that posits that any difference we employ in terms, concepts and theories must make a practical difference to us as humans and it must be known by its consequences (Peirce, 1878). For example, the concept of 'sweet' is known by its consequences to humans as tasters. The purpose of this maxim is to essentially free philosophy and science of pointless activity that has no effect on humans (Allmark & Machaczek, 2018). Thus, a pragmatist believes that questions about the laws of nature and reality (ontology) and theory of knowledge (epistemology) should be de-prioritised and instead focus should be applied to the concept of 'what works' (Patton, 2002). With this in mind, the pragmatist perspective is not concerned with whether research produces an accurate representation of 'reality' or 'knowledge', but rather does it achieve its own desired external consequence and hold value for those who the research is addressing (e.g., improved quality of life for patients or more effective interventions targeting specific health behaviours). The pragmatic approach therefore allows richness to be obtained from both quantitative and qualitative methods, depending on the research question.

4.2.5 Choosing a paradigm

Using ontology and epistemology as a guide to choosing a research paradigm can be a top down or bottom-up process. The choice of paradigm for this project was guided by our research questions and two project aims (Chapter 3 section 3.2). During methodological exploration, both the two extremes of Positivist and Constructivist paradigms (realist vs idealist ontologies) were considered to not serve the purpose of answering the research

question and achieving project objectives. Rather a pragmatist set of beliefs would allow for the aims and objectives of this project to be addressed using the methods deemed most applicable to retrieving real-world value. An overview of how component project studies map to the pragmatist research paradigm are outlined in table 7.

Table 7. Overview of project methodological approach. JBI = Joanna Briggs Institute.

Research Objectives	Paradigm	Guiding Ontology/ Epistemology	Theoretical perspective/ frameworks	Methodology	Method	Data Analysis Methods	Triangulation of data
<p>Study 1: Synthesis of current evidence related to mHealth for GDM</p> <p>Study 2a and 2b: Ability for live webinar to engage key stakeholders in research, and preliminary exploration of key stakeholder views & experiences of mHealth for GDM</p> <p>Study 3a and 3b: views and experiences of women and their HCPs regarding use</p>	Pragmatism	Reality is constantly renegotiated and debated. The best method is one that	<p>The updated Framework for Developing and Evaluating Complex Interventions (Skivington <i>et al.</i>, 2021; Craig <i>et al.</i>, 2008)</p> <p>+</p>	Mixed Methods (multiphase)	<p>JBI method for conducting scoping reviews</p> <p>Feasibility assessment + Online survey embedded in a live webinar</p> <p>Semi structured interviews</p>	<p>Mapping scope of existing literature</p> <p>Descriptive analysis</p> <p>Thematic analysis</p>	<p>Phase one: Triangulation of findings from studies 1, 2a, 2b, 3a and 3b was methodological (evidence synthesis, survey, interviews), participant based (women and HCPs across different participant pools and time points)</p>

and desires for mHealth	solves the problem	Normalisation Process Theory (Murray <i>et al.</i> , 2010)	Feasibility of recruitment measures + Semi structured interviews	Descriptive analysis + Content analysis	Phase 2: Triangulation of studies 4 and 5 was participant based (women and HCPs)
Study 4: Acceptability of FITZ among recently postpartum women and feasibility of recruiting and retaining women from a diabetes in pregnancy service			Online Survey + co- production workshop	Descriptive analysis + content analysis	
Study 5: Acceptability and perceived usefulness of FITZ among HCPs and ideas for improvement					

4.3 Theoretical Frameworks

Two different theoretical frameworks have guided the methodology and methods used in this project; The updated Framework for Developing and Evaluating Complex Interventions commissioned by the Medical Research Council and the National Institute of Health Research (Skivington *et al.*, 2021) and Normalisation Process Theory (Murry *et al.*, 2010). This section describes both frameworks and discusses how they have been applied to the design and development of this project.

4.3.1 The updated Framework for Developing and Evaluating Complex Interventions

To support the rigorous planning, conduct and reporting of complex health intervention development and evaluation, the Medical Research Council (MRC) published a set of guidelines in 2000 and 2006 to encourage gold standard practice. Although these guidelines continue to be used, the NIHR and MRC commissioned an updated framework in 2021, to incorporate important conceptual, methodological, and theoretical developments that have taken place since 2006 (Skivington *et al.*, 2021). For intervention research, particularly in healthcare settings, the guidance suggests greater priority should be given to mixed methods, theory-based evaluations that are sensitive to complexity and emphasise implementation and context. The framework also highlights how implementation should be considered at an early stage, asking questions such as ‘would it be possible to use this?’ ‘by whom?’ and in ‘what setting?’.

The updated Framework for Developing and Evaluating Complex Interventions divides complex intervention research into four phases: development or identification of the intervention, feasibility, evaluation, and implementation (Figure 6). Research can begin at any phase and does not have to occur in a linear fashion but can be fluidly actioned and often repeated if uncertainties remain unresolved. Each of these phases has a common set of core elements (Figure 6) that should be considered continually and particularly when transitioning between phases. How this framework has guided the development and design of this project is outlined in figure 7 and described below.

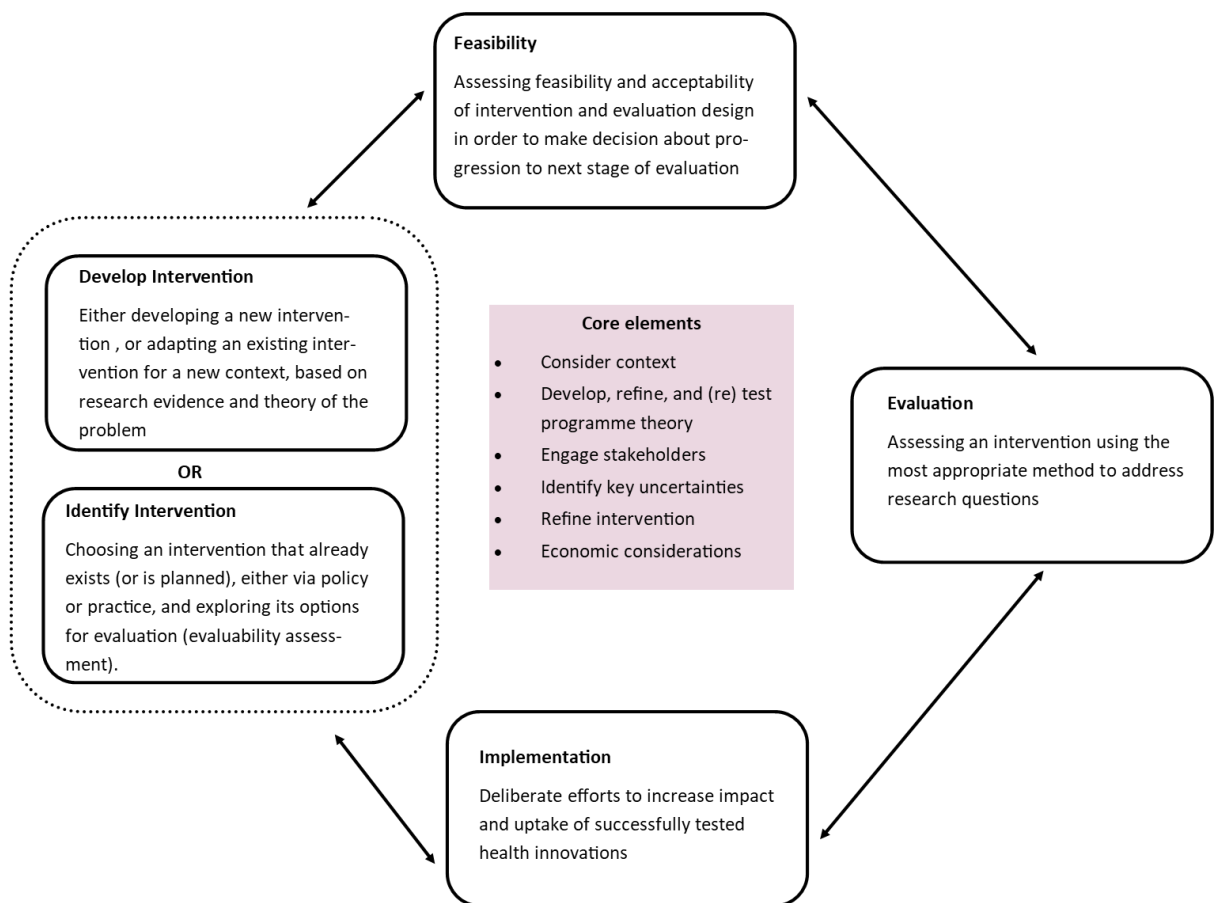


Figure 6. Updated framework for developing and evaluating complex interventions core elements and phases (Skivington et al., 2021)

This project focused on two phases, 'Develop Intervention' and 'Feasibility' and considered the core elements throughout. Figure 7 depicts how each of these phases

maps to different studies undertaken in this project. During the 'develop intervention' phase it is highlighted that complex intervention research does not always begin with new interventions and that interventions already developed have the possibility of being adapted to a new context. Adaptation could involve adapting to a new population, or a new setting or to new target outcomes. In this project, the existing intervention, FITZ, is considered in terms of its potential to be a needed, acceptable, and feasible intervention among a population where it has previously not been studied. Studies 2a, 2b, 3a and 3b all were undertaken as part of the 'develop/identify intervention' phase (Figure 7) where new primary research aimed to gain greater insight into the target population, including their existing experiences and future desires for mHealth interventions. These studies served to explore if FITZ could be an appropriate and needed intervention for further exploration. Guidance was also taken from the original framework for developing and evaluating complex interventions (Craig *et al.*, 2008) where this phase also includes identifying relevant existing knowledge surrounding the intervention, this took place as part of an evidence synthesis undertaken in study 1 (Chapter 5).

The 'feasibility' phase of the framework includes assessing the feasibility of and acceptability of an intervention and proposed evaluation design. This phase was the focus of studies 4 and 5, where the acceptability of the intervention was assessed among women and HCPs as was the feasibility of recruiting and retaining recently postpartum women to a study involving app usage from an NHS diabetes in pregnancy service (Figure 7). The core element of 'refine intervention' was of particular focus during this phase as it became clear that FITZ would need to incorporate changes to

make it optimal for women and integrate better into practice.

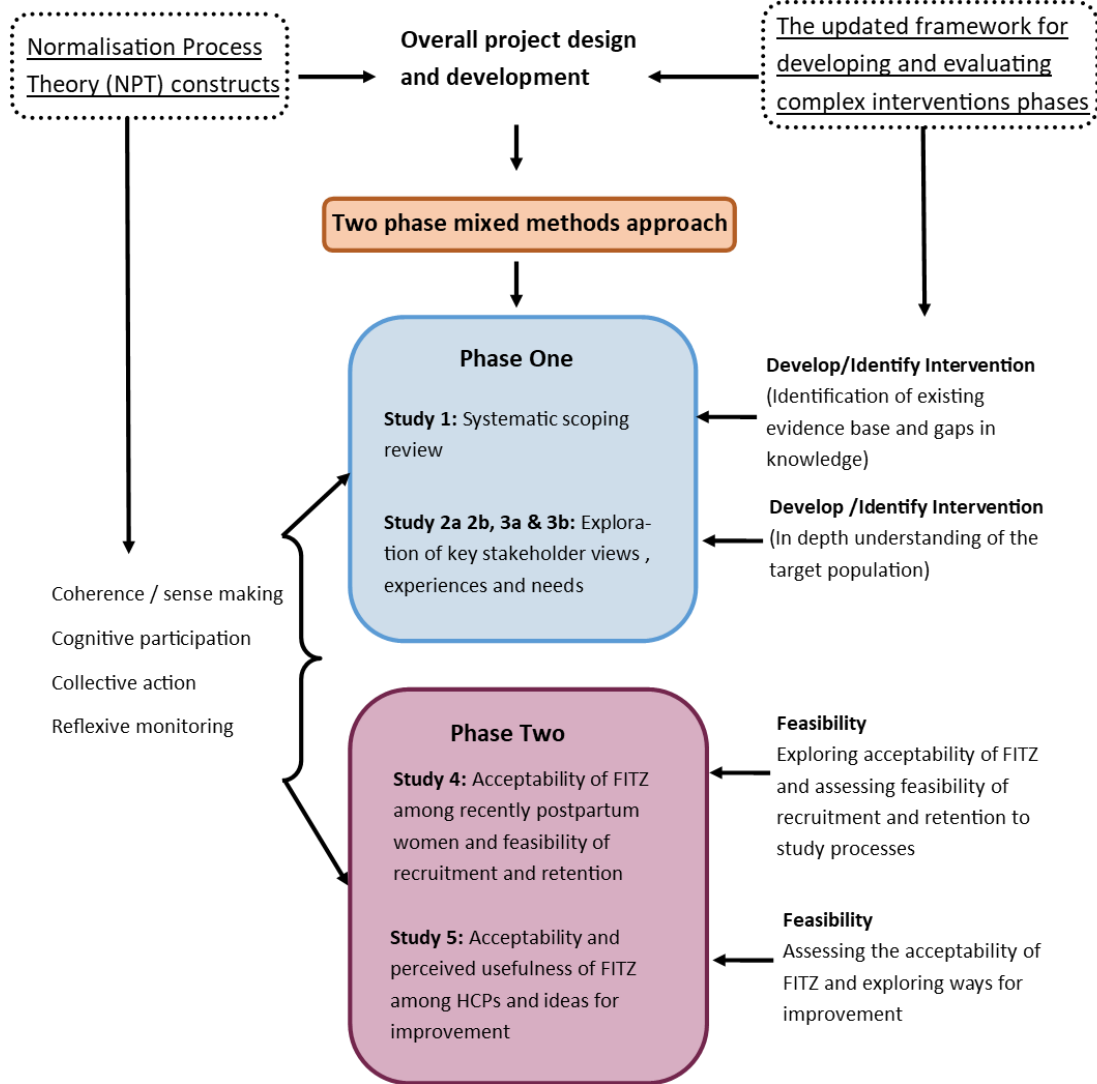


Figure 7. How two theoretical frameworks have been used to guide the design and development of this project

The guidelines emphasise the importance of combining mixed methods to evaluate and interpret feasibility study findings and combining information from different data sources can better inform future full-scale evaluation designs, and recognise why and how interventions may or may not be effective (Skivington *et al.*, 2021; Craig *et al.*, 2008).

The updated Framework for Developing and Evaluating Complex Interventions also suggests making additional use of other formal frameworks for developing, testing and implementing complex interventions in order to guide process and outcome modelling as well as feasibility testing, hence this project also took guidance from another framework called Normalisation Process Theory.

4.3.2 Normalisation Process Theory

New technological interventions aimed at implementation in healthcare settings are often faced with challenges, including non-adoption and abandonment (Greenhalgh *et al.*, 2017), resulting in a gap between technological advances and their availability to end-users within healthcare settings (Grol & Grimshaw, 2003; Woolf, 2008). It has been argued that efforts to implement technologies into healthcare contexts are unsuccessful due to insufficient consideration of wider contextual issues (Mair *et al.*, 2012). Several theories and frameworks that map onto the field of implementation science were developed in response to the acknowledgement that implementation failure of new interventions were due to a lack of theoretical foundation during planning and evaluation (May *et al.*, 2000; Eccles & Mittman, 2006).

Normalisation Process Theory (NPT) is one such theory that seeks to identify factors that may enable or inhibit an intervention becoming ingrained into everyday practice (embedded) as well as sustained (integrated) (Murray *et al.*, 2010). NPT was developed because of the observed difficulty of integrating and implementing new models of care into healthcare settings (May *et al.*, 2009). One prominent example is the failure of widely adopted and diffused tele-medical systems, despite significant clinical and political backing (May *et al.*, 2000). The developers of NPT suggest that new

innovations are more likely to be successfully adopted into practice if their use becomes normalised to a point where it disappears into everyday activities (Murray *et al.*, 2010).

The four constructs of NPT

NPT is built around a set of constructs that help to organise the ideas that represent real-world human process that occur during implementation, embedding and integration. The theory posits that implementation is operationalised through the four different mechanisms of coherence, cognitive participation, collective action, and reflexive monitoring (Table 8). Each mechanism is not linear, but rather they are dynamically connected with one another and with the wider contexts such as social norms, group conventions and organisational contexts.

Crucial considerations prior to developing or evaluating a new technology are guided by each construct to ensure that i) the new technology would be meaningful, beneficial and easily understood by stakeholders and organisations (coherence/ sense making) ii) stakeholders would perceive the intervention to be a good idea, be prepared to invest time and energy into its implementation (cognitive participation / relational work) iii) understand ability to fit with existing practices, skills and that potential end users will be prepared to take the actions needed for the new technology to become a part of routine practice (collective action / operationalisation) iv) stakeholders can assess/review interventions and provide feedback, used to improve the technology (reflexive monitoring / appraisal).

Using Normalisation Process Theory to guide project design

NPT is a well-established theory and has been noted as a particularly useful framework for the evaluation and implementation of behaviour change interventions as well as new technologies and complex interventions (May *et al.*, 2015; May *et al.*, 2018).

Other theory-based implementation frameworks were considered at the outset of this project, including RE-AIM (Glasgow, Vogt & Boles, 1999), Proctor's taxonomy of implementation outcomes (Proctor *et al.*, 2011), and the Non adoption, abandonment, scale-up, spread and sustainability (NAAS) framework (Greenhalgh *et al.*, 2017).

However, on reflection these frameworks were considered a better fit for later stage evaluation work, which out of scope of this project.

Despite this project being predominately focused on the early stages of development and evaluation, eventual implementation was considered from the very beginning.

Both the updated framework for developing and evaluating complex intervention (Skivington *et al.*, 2021) and the developers of NPT suggest implementation is an important concept to consider throughout the lifecycle of a new intervention or technology. Indeed, the NPT website states, "*identifying and adopting an innovative health technology, or new way of organising professional work, is the beginning of the story, not the end*". Hence, NPT was considered the most useful framework to guide the design and development of the exploratory nature of this project.

To answer the research question (*Could a motivational mHealth app (FITZ) be a needed, acceptable, and feasible weight management intervention for women with history of GDM?*) and meet aims and objectives, this project considered and explored each of the four NPT constructs (Table 8). This was achieved by using NPT to guide relevant aspects of study designs including interview topic guides and survey questions

(Table 8). Where each of the constructs has been considered as part of a study is illustrated in table eight and detail of how these constructs influenced individual study are described in their respective chapters.

Table 8. The four constructs and corresponding component of NPT and how they have been explored and considered in this study

NPT constructs and components	Areas considered and explored within this study
<i>Coherence:</i> sense making when faced with a new problem or practice	
Differentiation: understanding how a set of practices and their objects are different from each other e.g. virtual consultations vs face-to-face consultations	Is the FITZ app easy to understand and describe? (study 4 & 5)
Communal Specification: people working together to build a shared understanding of the aims, objectives and expected benefits of a new intervention or practice	Is the FITZ app different from other mHealth interventions for behaviour change? (study 4 & 5)
Individual specification: understanding the specific tasks and responsibilities around a new intervention or practice	Are the benefits of FITZ likely to be valued by women with history of GDM and their HCPs? (study 1, 2b, 3a, & 3b)
Internalisation: understanding the value, benefits and importance of an intervention or practice	
<i>Cognitive Participation:</i> the relational work to build and sustain a community of practice around a new technology or intervention	

Initiation: do people work to drive forward new practices in order to drive them forward

Will women with history of GDM and their HCPs see the point of FITZ and think the app is a good idea? (study 4 & 5)

Enrolment: organisation or reorganisation of self and others that may involve rethinking relationship between people and things

What kind of skills and experience do women and their HCPs have with using mHealth (study 2a, 2b, 3a, 3b)

Legitimation: Ensuring that people believe it is right for them to be involved and that can make a valid contribution

Will women and their HCPs be prepared to invest energy, time and work into using and/or implementing FITZ? (study 4 & 5)

Activation: collective definition of actions and procedures need to sustain a new intervention

Collective Action: the operational work people do to enact a set of practices

Interactional workability: the work people do with each other, objects, and other elements when they seek to operationalise new practices in everyday settings.

What weight management support do HCPs currently offer and how would providing the FITZ app promote or impede their work? (study 2b, 3b & 5)

Relational Integration: the knowledge work that people do to build confidence and accountability

How might FITZ be implemented into HCPs current workflows (study 5)

Skill set Workability: allocation of labour and division of work around a new set of practices

How would an intervention impact on HCP workload and other resources, such as time? (study 3b & 5)

How would an intervention impact on women's workload and other resources, such as time? (study 3a & 4)

Contextual Integration: the allocation of resources, protocols, policies and procedures	
<hr/>	
<i>Reflexive Monitoring: the appraisal work needed to assess and understand the effect of a new technology on themselves and others</i>	How do women perceive the use of the intervention, do they think it will be advantageous for other women? (study 3a & 4)
Systematisation: determining how effective and useful it is for self and others	What could be improved, adapted or added to make FITZ more engaging and/or usable to women? (study 4 & 5)
Communal appraisal: formal and informal collaborative evaluation of worth	What could be improved or adapted to make FITZ work better in practice? (study 4 & 5)
Individual appraisal: individual appraisal of effects within individual context	
Reconfiguration: appraisal work by individuals and groups may lead to attempts to redefine and modify practice or change the shape of a new technology	

4.4 Methodology

Often referred to as a new methodology, mixed methods research (MMR) dates back to the late 1980's, where its use in medicine and epidemiology were prominent (Maxwell, 2016). In mixed methods research (MMR), qualitative and quantitative approaches are combined in a single study or across a programme of related work. The origins of MMR are often traced back to the work of Denzin (1978) who promoted the use of multiple data sources to conduct scholarly studies and that of Campbell and

Fiske (1959) who applied multiple forms of quantitative data to examine behavioural characteristics. Both the growing complexity of research and the need for evidence-based research in applied settings has sparked the growth of MMR (Creswell, 2014). It is suggested that taking an MMR approach is particularly beneficial to mHealth feasibility and development studies, where a combination of two or more methods can best answer the research question (Mummah *et al.*, 2016).

Taking a MMR approach was considered the most appropriate way to address the research question, aims and objectives of this project. The decision to take a MMR approach was guided by a number of factors including taking note of relevant literature related to behaviour change, mHealth development and evaluation and from reflection of theoretical frameworks related to the implementation of digital technologies in healthcare settings. The theoretical frameworks chosen to guide the design of this project that are discussed in section 4.3 of this chapter further reflect the justification of taking a MMR approach.

4.4.1 Choosing a mixed methods typology

Combining qualitative and quantitative methods in an ad-hoc way, does not attend to how findings may be interpreted. Questions remain about when and how to combine qualitative and quantitative methods. To address this, typologies of mixed methods designs have been developed (Bishop, 2015).

Creswell and Plano Clark (2003) describe four major typologies: Triangulation, Embedded, Explanatory and Exploratory (Table 9). These typologies tend to differ across dimensions of timing and emphasis. When choosing an appropriate typology

several factors should be considered including i) aims and goals of each section of the project ii) data collection methods iii) the timing of data collection and iv) how it will be integrated.

Table 9. The four main mixed method typologies Creswell and Plano Clark (2003). QUAN = quantitative, QUAL = qualitative. Capitalisation denotes higher importance than lowercase

Mixed methods	Variants	Timing	Weighting	Mixing	Notation
Triangulation	<ul style="list-style-type: none"> • Convergence data • Transformation • Validating quantitative data • Multilevel analysis 	Concurrent: quantitative and qualitative at the same time	Typically equal	Merged during the interpretation or analysis	QUAN + QUAL
Embedded	<ul style="list-style-type: none"> • Embedded experimental • Embedded correlational 	Concurrent or sequential	Unequal	Embed one type of data within a larger design using the other type of data	QUAN (qual) Or QUAL (quan)
Explanatory	<ul style="list-style-type: none"> • Follow-up explanations • Participant selection 	Sequential: Quantitative followed by qualitative	Typically quantitative	Data connected between the two phases	QUAN + qual
Exploratory	<ul style="list-style-type: none"> • Instrument development • Taxonomy development 	Sequential: qualitative followed by quantitative	Typically qualitative	Data connected between the two phases	QUAL + quan

However, at least 15 different mixed methods designs are known to have been published (Creswell & Plano Clark, 2011) and while their development may facilitate consistent application of approaches, some suggest that choosing one approach alone

may be unnecessarily constraining for those working on complex multidisciplinary projects that span different phases (Guest, 2013). When designing a mixed methods project, some suggest that the design must be driven by the research question (Tashakkori & Teddlie, 2010). In relation to this issue, Creswell and Plano Clark (2011) added two further typologies to their taxonomy. The 'transformative' and 'multiphase' typologies extend the versatility of embedded designs that can be undertaken in concurrent or sequential fashion. The transformative typology incorporates any combination of methods conducted with a central framework. The multiphase typology (Figure 8) comprises any combination of methods conducted within a comprehensive programme of work. Both these approaches take a less prescribed approach and take into account complex research designs and questions, allowing different methods to collaborate iteratively over time. Because this project incorporated methods and results over various sub studies, a multiphase design was chosen to be most appropriate typology for this project where mixed methods were used in multiple studies concurrently and sequentially in the service of an overall project objectives. Equal emphasis was applied to each method, with consideration given to the limitations experienced in individual studies.

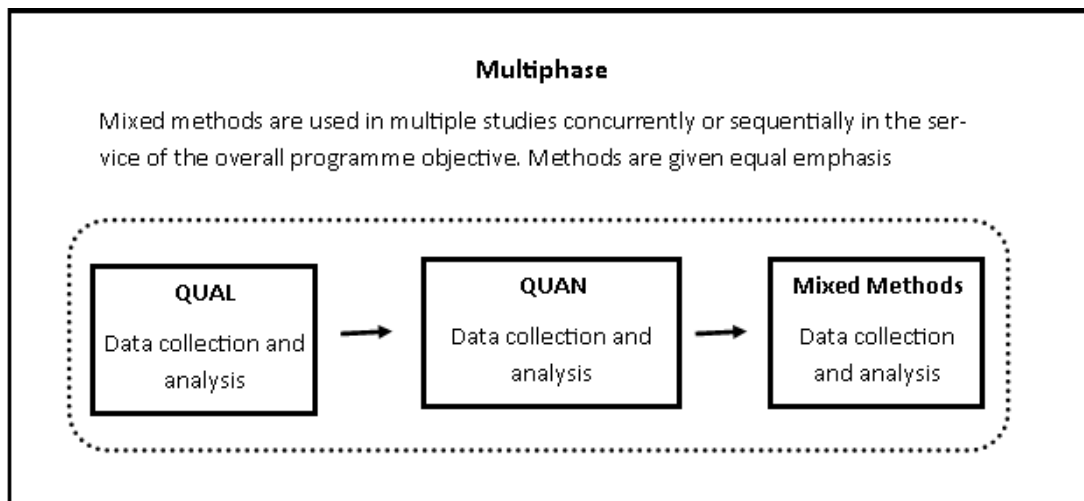


Figure 8. Multiphase mixed method design (Creswell & Plano Clark, 2011 – adapted from Bishop, 2014)

4.5 Methods

Linked to the information above, this project uses both qualitative and quantitative data collection methods including, surveys, semi-structured interviews, feasibility assessments and a co-production workshop. Further justification for the methods chosen, along with their strengths and limitations and their relevance for the individual studies undertaken in this project is provided in their relative chapters.

4.5.1 Analysis methods

Because of the mixed methods nature of this project, data analysis involved both quantitative and qualitative approaches. Qualitative approaches used thematic analysis (TA) and content analysis. TA facilitates effective and rigorous abstraction of salient themes and sub-themes from a complex and detailed textual dataset (Braun & Clark, 2006). Some line of thought implies that TA is not as rigorous as other analysis

methods such as interpretive phenomenology, ethnography and grounded theory (Nowell *et al.*, 2017). However, it is now recognised as an appropriate analysis method in its own right and is commonly used in health and social sciences (Braun *et al.*, 2019). TA is theoretically flexible and can be guided by concepts from a variety of fields, as well as being used in a variety of research approaches. Indeed, TA is not a single analytic approach but is an umbrella term encompassing three broad approaches: 'coding reliability' 'codebook' and 'reflexive'. Where TA was used in this project, a reflexive approach was taken whereby codes were generated from explicit content which evolved and were adapted through analytic work, to produce themes and subthemes that represented meaning across the dataset. An inductive approach to analysis was taken whereby themes were generated from the data at hand rather than predetermined.

Sharing a history with TA, content analysis follows a similar process involving coding and categorising datasets, but the frequency of occurrence is deemed of additional importance (Vaismoradi *et al.*, 2013; Elo & Kyngäs, 2008). Content analysis was selected for studies where it was seen as advantageous to have a numerical insight of the thematic patterns, in addition to qualitative themes, particularly where changes were being suggested and likes and dislikes related to FITZ were captured. This was to ensure the most generalisable representation of views.

Descriptive analysis was employed on quantitative data. Descriptive analysis on survey data allowed for insight into stakeholder experiences and desires for mHealth as well as their views on FITZ. This project did not include any inferential statistical analysis as

sample sizes were too small to show meaningful effects. This issue is described in detail, where appropriate, in the individual study chapters.

4.5.2 Rigour and Trustworthiness

As described above, mixed methods researchers must be cautious when negotiating between different approaches, however, it is well noted that mixing methods can provide deeper understanding of a research question, which might not be captured using a single approach (Venkatesh, Brown & Bala, 2013). There is agreement that mixed methods designs require vigilance if rigor is to be achieved. However, there is no standard for evaluating the rigour of mixed methods research (Eckhardt & Devon, 2017). O'Cathain, Murphy and Nicholl (2008) and Creswell et al. (2011) promote several guidelines for increasing the quality of mixed methods research including justification of the use of mixed methods, description of the purpose, priority and sequence of methods used; identification sampling, data collection and analysis methods; detail of the integration, limitation and insights from the chosen methods.

With regards to the quantitative data collected in this study, methodological rigor has been described in individual chapters with reference to the precision of planning, data collection, analysis and reporting (Marquart, 2017). The use of reliable and valid measures is a key part of maintaining rigour in quantitative studies. Because of the nature of concepts explored in this project, it wasn't always possible to use existing, validated measures, however, justification for the measures used and how they were developed is described in individual study chapters, as are the limitations associated with their use.

Qualitative research is often criticised of failing to demonstrate sufficient rigor or integrity compared to quantitative methods associated with the positive paradigm (Noble & Smith, 2015; Mays & Pope, 2000). As a result, Lincoln and Guba (1989) provide an approach to establishing trustworthiness in qualitative research through four key principals, that parallel those establishing rigour in the positivist paradigm (Guba & Lincoln, 1989). Credibility is the degree a description could be recognised by those who have experienced it and understood by those who have not. Transferability refers to if finding could fit into contexts outside of the study situation. Dependability refers to the consistency of the findings. Confirmability refers to how the researcher influences data interpretation. Table 10 outlines how this project has taken steps to ensure trustworthiness of qualitative research, relative to this criterion.

Table 10. Techniques taken to ensure qualitative rigour and trustworthiness as outlined by Guba and Lincoln (1989)

Trustworthiness criteria	Criteria met in this project	
Credibility	Triangulation	<ul style="list-style-type: none"> - Method triangulation through interviews, online surveys and focus groups - Method triangulation with quantitative measures - Source triangulation via multiple stakeholder groups - Analyst triangulation through two independent researchers
	Transcripts	<ul style="list-style-type: none"> - Transcripts of interviews are provided in appendices
	Use of quotes	<ul style="list-style-type: none"> - Verbatim quotes are provided in every qualitative study
	Peer debriefing	<ul style="list-style-type: none"> - Review of data collection, analysis and reporting through supervision and peer review of published papers

	Member checking	- Clarifying questions and probes asked - Sharing findings with participants and those involved in PPI
	Negative case analysis	- Identification and sharing of experiences that contrasted against majority views
Transferability	Thick description	- Dense description of research processes, context and analysis provided
Dependability	Audit trail of process	- Maintained accurate records of data management and collection
Confirmability	Audit of product	- Acknowledgement of studies limitations - Provision of full tables of evidence of original codes and themes are provided in appendices

4.5.3 Project Structure

The project took on two distinct phases that incorporated two distinct two aims. Phase one aimed to better understand the need for, and the role of, mHealth to support women with a history of GDM following birth. Phase two aimed to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM. Studies 1, 2a, 2b, 3a and 3b make up phase one. Studies 4 and 5 make up phase two (Figure 9).

Phase one commenced with a systematic scoping review of literature (Chapter 5, study 1) to identify any gaps in knowledge regarding the use of mHealth interventions for women with experience of GDM. Further studies (2a, 2b, 3a and 3b) aimed to gain an in-depth understanding of the target population (women and HCPS) to understand

barriers to mHealth use, previous experiences and desires for future interventions (Chapters 6 and 7). It was important to carry out this work first, as there was limited understanding of women and HCPs current use of mHealth, as well as their barriers and desires for future support. This knowledge was essential before carrying out any extensive, timely and costly feasibility or evaluation work on FITZ among this population of women. For example, although evidence outlined in chapter 2 suggests that women with prior GDM might benefit from motivational support, this kind of support would only be accessed if women actually wanted help with sustaining motivation and healthcare providers saw benefit in offering this type of support. The studies conducted in Chapters 6 and 7 aimed to understand what desires both women and HCPs wanted from mHealth interventions.

Triangulation of findings from phase one suggested potential for FITZ as a needed intervention for women following birth and thus phase two of the project focused on the acceptability and feasibility of FITZ among women with prior GDM (Chapter 8) and their HCPs (Chapter 9). Work was also undertaken in this phase with HCPs to explore how challenges that they identified could be overcome by making improvements to FITZ, resulting in a summary of identified changes (Chapter 9).



Figure 9. Project structure

4.6 Ethical considerations and project practicalities

In June 1964 the World Medical Association, developed the Declaration of Helsinki (WMA, 2013) as a statement of ethical principles for the conduct of medical research involving humans. The 32 principals place importance on informed consent, confidentiality, vulnerable populations and protocol review by ethics committee. These principles served to prevent malpractice, improve safety of research participants, and encourage best research practice. Beauchap and Childress (2001) developed four cardinal principals of ethics in research; autonomy, non-maleficence, beneficence and justice and are fundamental for understanding the current ethical approach to assessment of healthcare. Autonomy refers to the ability for potential participants to being given sufficient information and time to understand the information and act upon such information with intention. Beneficence references the promotion of participants and society's wellbeing. Justice refers to the equitable distribution of social benefits and non-maleficence implies do no harm by undertaking effective decision making and adequate training. These principals were adhered to throughout the conduct of this study and the actions associated with them will be discussed in the following sections.

4.6.1 Ethical approval

Ethical approval was not required for the conduct of the scoping review described in Chapter 5, as it involved synthesis of already available data. Ethical approval for the work carried out in studies 2a, 2b (Chapter 6), 3a, 3b (Chapter 7) and study 5 (Chapter 9) was obtained from the Faculty of Human Health Sciences, University of Plymouth.

Approval letters for each of these ethical applications can be found in Appendix A.

Health Research Authority ethical approval was required for the work carried out in study 4 (Chapter 8) as this involved the recruitment of women receiving care from an NHS hospital. The London-Bromley Research Ethics Committee granted approval for the study on 30.03.2020 (IRAS ID: 252946) (Appendix A) .

4.6.2 Informed consent

Informed consent was always obtained prior to study participants undergoing any activities specifically for the purposes of this project. Only participants who had the capacity to consent were recruited into research activities related to this project.

Before potential participants decided to take part in any research activity associated with this project, they were provided with a participant information sheet (PIS) that explained in lay terms the purpose of the study, why the participant was asked to take part, their right to withdraw and any associated benefits and risks. Potential participants had the opportunity to take the PIS and consent forms away with them before making a decision to take part. Participants were always informed that taking part was entirely voluntary and that they may withdraw from the study at any time, without prejudice to their ongoing healthcare. All participant facing documentation used in this project was reviewed by my supervisory team and, where applicable, those involved in the PPI engagement processes.

4.6.3 Confidentiality and data protection

The following measures were taken to protect participants confidentially throughout this project. All involved in this project complied with the requirement of the Data Protection Act 1998 with reference to the collection, storage, processing and disclosure of personal information and upheld the Act's core principles. All personnel involved in any research activities associated with this project were aware of the importance of maintaining confidentiality and adhering to the General Data Protection Regulations, 2018.

All project files were encrypted and stored on a password protected university computer. All hard copies of data and audio equipment were locked inside a cabinet in a secure office, located on University of Plymouth property. The researcher was the sole custodian of the study data. Identifiable data was only accessible to me, and any data transferred to academic supervisors was always anonymised. Study data will be kept for a minimum period of 10 years after the publication or public release of the work in accordance with the Plymouth University Research Data Management Policy. Specific data management and confidentiality procedures were described in detail in the relevant ethics applications associated with each study.

4.6.4 Confidentiality and internet-mediated research

As described above, the onset of COVID-19, necessitated for most research procedures to be conducted online. Data collected for the work outlined in Chapters 6 and 7 was predominately collected before the onset of the pandemic, although some interviews with HCPs were conducted afterwards (study 3b, Chapter 7). Zoom calls, using a

verified University of Plymouth account were used to conduct interviews (study 3b and 4) and a coproduction workshop (study 5). Zoom was used as it provided end-to-end encrypted video calling functionality, meaning discussions were private and secure. Participants were made aware that video calling would be part of participating and were given full instructions on how to use the software.

Where participants were recruited via social media (studies 2a, 2b, 3a, 3b and 5) their participation remained entirely anonymous. All adverts that were placed in relevant social media groups were always done so by a group administrator, as a result any contact between potential participants and me was always via email or telephone, not via social media. The limitations and ethical consideration of using social media to recruit participants to research is discussed in more detail throughout this thesis.

Where the FITZ app was used by participants (Studies 4 & 5), participants were made aware on the participant information sheet that the app was not owned or controlled by the University of Plymouth and thus downloading and using it was done so at their own risk. A guide to downloading and using the app was provided to participants. Participants were reassured that none of their personal information or data could be viewed or downloaded by the research team.

4.6.5 Patient and Public involvement

Following the UK Standards for Public Involvement (NIHR, 2019) patient and public involvement was used to understand if our research questions, procedures, and outcomes were appropriate and realistic. According to the HRA Public involvement in research means: *“patients or other people with relevant experience contribute to how*

research is designed, conducted and disseminated” (NIHR, 2022). Undertaking public involvement and listening to people with relevant lived experience, can improve both research quality and relevance (NIHR, 2019).

During the development of study 4 (Chapter 8) a patient and public engagement session was held on 3.4.2019 and included three women with experience of GDM. The session was held in a seminar room at the local NHS Trust Hospital. The aim of this session was to give women the opportunity to contribute their views and opinions on the design of the study, to ensure that the research process could be acceptable and applicable to future participants. Women with experience of GDM were recruited to the engagement session by the local NHS Trust Research, Development and Innovation department as part of their PPI initiative work. Adverts were placed on the departments social media pages and physical adverts were placed in relevant clinics. It was hoped that around six women would be able to attend but due to childcare pressures only three were able to attend the session. Details of the feedback from this session and how it impacted the research design and conduct is described in chapter 8 (section 8.3.2). I am extremely grateful to all the women who took part in this engagement session for giving their valued opinions and feedback. The Research, Development and Innovation department at the local NHS trust were also involved in the development of this protocol and reviewed all study processes and procedures.

Two diabetes midwives working at the local NHS Trust Hospital were also consulted during the development of study 2b and study 5 to ensure that the various aims and objective were needed, viable and relatable, particularly from the point of view of healthcare providers. They also provided valuable feedback regarding the viability of

HCPs taking part in the study processes, and suggestions for improving practicalities.

Details of how this feedback impacted the design and conduct of each of these studies are provided in their respective chapters (Chapter 6 and 9).

4.6.6 Access to NHS study site

Before the commencement of data collection for study 4 (chapter 8) it was important to build relationships within the NHS site to enable eventual running of the study, gain permission to enter the setting and access participants. Gaining access ensures that research process can be put in place including necessary dissemination of information and documents, observation of any practical issues and that potential participants can be approached with relative ease (Holloway & Wheeler, 2010; Harding, 2013).

Pre-existing relationships with some members of the Research Development and Innovation team at RCH, having worked in the department from 2010-2015, helped me to gain information about the processes involved in obtaining HRA ethical approval as well as study set-up and site access. Multiple meetings were organised between Research site staff, and others including the senior diabetes research nurses and myself to ensure the practicalities of the study, the study design and data collection methods were acceptable. Ongoing communication with two diabetes midwives located at the site, who eventually went on to recruit women to study 4, was continual throughout all stages of the project. My relationship with these two midwives was pivotal to many successful aspects of this project including the recruitment of women to study 4, provision of contextualisation of women's experiences within the GDM care

pathway, and also clinical expertise in activities such as the webinar, presented in chapter 6.

4.6.7 The impact of COVID-19 on the conduct of this project

During the conduct of this PhD project a global pandemic was declared by the WHO on 11 March 2020 following the outbreak of the novel COVID-19 virus. On 30th of March 2020 the London Bromley Research Ethics Committee granted HRA approval for study 4 (Chapter 8) to go ahead. The study involved recruiting women receiving care at a UK diabetes in pregnancy service. Following government guidance the Research Development and Innovation department at the study site halted all non-essential research and diabetes in pregnancy services dramatically adapted their clinical provision to limit the spread of the virus (Murphy, 2020; Bailey & Nightingale, 2020). In response to this, and ongoing uncertainty on the viability of recruiting, informing, and consenting, and conducting research in face-to-face settings, an amendment for study 4 was submitted to the HRA on 11.09.2020. The decision to submit this amendment took some time from the initial outbreak as government guidance was continually changing and the level of uncertainty remained high with regards to how research might go head. Because women were no longer being seen in clinics, the amendment focused on changing recruitment to be conducted by midwifery support workers who were still visiting women in their homes to supply glucose meters. The amendment also replaced any face-to-face interaction with video or telephone calls. This amendment was approved on 13.10.2020. Confirmation of capacity and capability at the NHS site to run the study was granted on 06.01.2021. This process took an unusually long time as priority was understandably given to COVID-19 vaccine trials.

This period involved a great deal of uncertainty and change regarding government guidance on how clinical and research services could be run. Following a further amendment (approved on 26.01.2020) women were eventually recruited at clinic by diabetes midwives following change in guidance and practice.

From this point forward, the decision was taken to plan and conduct any further research activities with a view that they could remain robust despite further lockdowns or changes in government guidance. This was ultimately to protect future participants and the researcher from exposure to the virus, but also to ensure the project could be delivered within allocated timeframes. Further reflection of the impact of COVID with regards to technology adoption and how that has impacted the findings of this project is discussed throughout this thesis.

4.7 Chapter Summary

This chapter has provided rationale to the reasoning behind the methodology chosen for this project. The philosophical underpinnings of the research have been considered and discussion demonstrated how the methodological approach of this project has been guided by the Pragmatist research paradigm. The processes that took place to reach the final project design were outlined, including the theoretical frameworks used for guidance, ethical conduct, and research practices. The following chapter presents the first study undertaken as part of phase one of the project, a systematic scoping review of the literature regarding the use of mHealth interventions for the prevention and management of GDM and its long-term implications.

Chapter 5 (Phase 1) Mobile health as a primary mode of intervention for women at risk of, or diagnosed with, gestational diabetes mellitus: a scoping review

5.1 Overview

The majority of data collected as part of phase one of the project has resulted in published material. Studies 1 (this chapter), 2a (Chapter 6, section 6.1), 3a and 3b (Chapter 7) are presented as complete papers or abstracts. All studies were first authored by KE, with additional authors providing i) supervision, ii) second researcher validity and iii) specific expertise. Where there is use of the pronoun 'we' and 'our' within included published manuscripts, this refers to myself as the Principal Investigator and PhD candidate together with my supervisors and other colleagues.

This chapter presents a scoping review undertaken to map the extent of knowledge related to the use of mHealth for GDM and identify gaps in knowledge. The scoping review is presented in its published format below. A protocol for the conduct of the scoping review was also published prior to its conduct and is available in Appendix B.

5.2 Study 1: Mobile health as a primary mode of intervention for women at risk of, or diagnosed with, gestational diabetes mellitus: a scoping review

(Published in JBI Evidence Synthesis: doi: 10.11124/JBIES-21-00294)

Authors

5.2.1 Abstract

Objective

To map the extent of knowledge related to the use of mHealth as primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of or diagnosed with GDM. We also sought to understand if mHealth for women at risk of or diagnosed with GDM incorporated relevant behaviour change theory and techniques.

Introduction

Prevention and management of GDM and its associated adverse outcomes are important to maternal and infant health. Women with GDM report high burden of disease management and barriers to lifestyle change post-delivery which mHealth interventions may help to overcome. Evidence suggests apps could help GDM prevention and management, however, less is known about broader applications of mHealth from preconception to interconception and whether relevant behaviour change techniques (BCT) are incorporated.

Inclusion criteria

Studies, published in English, considered for inclusion focused on mHealth use as primary mode of intervention for the prevention and management of GDM and its long-term implications. Telehealth or telemedicine were excluded as these have been reviewed elsewhere.

Methods

Six databases were searched during March 2021; MEDLINE (Ovid), CINAHL (EBSCO), EMBASE (Ovid), Cochrane Database (Wiley), Scopus, and TRIP. No limits were applied to database exploration periods to ensure retrieval of all relevant studies. Also, gray literature; Open Grey, ISRCTN Registry, ClinicalTrials.gov, EU Clinical Trials register, and ANZCTR. Two reviewers independently screened abstracts and assessed full texts against the inclusion criteria. Data were extracted using an adapted version of the JBI results extraction instrument. Data are presented in narrative form accompanied by tables and figures.

Results

This review identified 2166 sources, of which 96 full texts were screened. Thirty eligible reports were included, covering 25 different mHealth interventions. Over half (14/25) were for self-managing blood glucose during pregnancy. Common features included tracking blood glucose levels, real-time feedback, communication with professionals and educational information. Few (6/25) mHealth were designed for postpartum use and none for interconception use. Five for postpartum use supported behaviour change to reduce risk of type 2 diabetes and included additional features such as social support functions and integrated rewards. Early development and feasibility studies used mixed methods to assess usability and acceptability. Later stage evaluations of effectiveness typically used randomized controlled trial designs to measure clinical outcomes such as glycemic control and reduced body weight. Three mHealth interventions were developed using behaviour change theory. Most mHealth incorporated two BCTs shown to be optimal when combined and those delivering

behaviour change interventions included a wider range. Nevertheless, only half of the 26 techniques listed in a published behaviour change taxonomy were tried.

Conclusion

mHealth for GDM focusses on apps to improve clinical outcomes. This focus could be broadened by incorporating existing resources that women value, such as social media, to address needs such as peer support. Although nearly all mHealth interventions incorporated BCTs, findings suggest future development should consider selecting techniques that target women's needs and barriers. Lack of mHealth intervention for prevention of GDM recurrence and T2DM suggests further development and evaluation is required.

Keywords: diabetes, gestational; mHealth; postpartum period; interconception; behaviour change techniques

5.2.2 Introduction

Rapid development of technology has led to a quickly growing market for mobile health (mHealth), defined as "use of mobile and wireless technologies, such as mobile phones and personal digital assistants (PDAs), to support the achievement of health objectives" (WHO, 2011). Globally, smartphone ownership is estimated to be 78% in 2020 (Statista, 2021). An mHealth economics report found that apps for diabetes were one of the strongest markets within digital health innovation (Research2Guidance, 2017), however, there are comparatively few apps targeting the prevention and management of Gestational Diabetes Mellitus (GDM) (Hoppe *et al.*, 2017). GDM defined as "carbohydrate intolerance resulting in hyperglycemia of variable severity with onset or first recognition during pregnancy" (WHO, 1999) presents as a significant

pregnancy complication, and if not managed well, can result in adverse maternal, fetal and neonatal outcomes (Reece, 2010; Landon *et al.*, 2011). Longer-term implications for maternal health include reoccurrence of GDM in future pregnancies, and development of type 2 diabetes; two outcomes found to be independently associated with higher body mass index (BMI) ($\geq 25\text{kg/m}^2$) (Kim, Berger & Chamany, 2007; Bellamy *et al.*, 2009). The prevalence of GDM is increasing worldwide (Chen, Magliano & Zimmet, 2021) and in the UK, is expected to develop in 16 out of every 100 women (Diabetes UK, 2019).

Effectively managing GDM following diagnosis is key to reducing the likelihood of adverse outcomes. Combinations of intervention such as dietary modification, exercise, blood glucose self-monitoring and/or pharmacological treatment are found to reduce most adverse perinatal outcomes compared to standard care (Farrar *et al.*, 2017). mHealth interventions can offer highly scalable solutions to support disease management and prevention and have the advantage of being low cost, tailored to individual needs and have the ability to relay data to HCPs. Commonly used mHealth technologies include apps, wearable sensors, social media, websites, and videoconferencing. In a recent survey of 63 women in the UK, most of whom had GDM, 43/63 (73%) used smartphones to obtain health or pregnancy related information, and only 16/63 (25%) expressed concerns about using an app to monitor diabetes, suggesting an appetite among women with GDM for digitally supported services (Alqudah *et al.*, 2019).

A recent literature review by Nikolopoulos *et al.* (2019) aimed to identify and appraise apps implemented by healthcare providers for GDM care. Three apps for supporting

blood glucose monitoring were included. The review concluded that apps were a useful and practical way of reducing the burden of GDM. A scoping review, conducted in 2017, consolidated knowledge around the implementation, functionality, impact, and role of health literacy of mobile apps for GDM (Chen & Carbone, 2017). Seven different apps described across 12 articles were included and authors concluded that mobile apps have the potential to support prevention and management of GDM. However, consideration of health literacy may enhance usability and engagement and larger scale trials are required to evaluate app impact on health outcomes. While both these reviews show encouraging support for mobile apps for use in GDM care, particularly during pregnancy, we aimed to broaden the scope of this knowledge in a number of ways.

Firstly, we sought to explore the development, implementation and evaluation of all types of mHealth (rather than just apps) including, wearable sensors, websites and social media. Secondly, while the reviews by Nikolopoulos *et al.* (2019) and Chen and Carbone. (2017) focus on app use prior to and during pregnancy, this review aimed to also include studies looking at the development, implementation or evaluation of mHealth to support women in the postpartum and interconception periods. Risk of progression to T2DM is estimated to be 10 fold higher in women with GDM compared to their normoglycaemic counterparts (Vounzoulaki *et al.*, 2020) and reoccurrence of GDM is thought to arise in 30% to 84% of subsequent pregnancies (Reece, 2010). Consequently, the interconception and postpartum periods provide key windows of opportunity to reduce the likelihood of future GDM pregnancies, as well as onset of T2DM (Tieu *et al.*, 2017). However, women with previous diagnosis of GDM encounter several barriers to engaging in face-to-face interventions, including time and financial

constraints, childcare duties, fatigue and lack of motivation (Nicklas *et al.*, 2011). Thus, delivery of care via telephone or internet has been suggested as an optimal way of supporting this population during this time (Phelan, 2017).

In addition, following delivery, the transition from maternity to primary care is often complex and women report feelings of abandonment (McMillan *et al.*, 2018). Studies report a lack of consensus on responsibility for follow-up care among professionals (Rayanagoudar *et al.*, 2015) and inconsistencies in information provided to women (Pennington *et al.*, 2017). With this in mind, this review also sought to understand, how, when and where mHealth were implemented across preconception, pregnancy, postpartum and interconception periods.

Consequently, we developed and published a protocol for a scoping review aiming to provide an overview of the extent of the knowledge related to the use of mHealth as a primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of or diagnosed with GDM (Chapter 7, study 3a). The objectives of the proposed review were to identify gaps in knowledge by mapping the characteristics of all types of mHealth, their implementation contexts, and how they were evaluated. The proposed review also sought to understand if mHealth were developed using relevant behaviour change theory. These objectives remain. However, during data extraction we discovered limited acknowledgement of behaviour change theory among mHealth development, a finding congruent with the findings of Chen and Carbone (2017). Behaviour change is an important concept throughout GDM prevention and management. Women must enact significant changes to their lifestyle in order to control and monitor their blood glucose levels

(BGL), and to reduce risk of T2DM or recurrent GDM in future pregnancies. In order to further understand if mHealth of GDM included theory-based components we additionally extracted data on inclusion of behaviour change techniques (BCTs). BCTs were identified using the 26-item taxonomy developed by Abraham and Michie (2008). This taxonomy was developed using variety of theoretical accounts of behaviour change and each BCT can be mapped to various theoretical frameworks and therefore serves as a 'proxy' measure of theory-based development. An evaluation of diabetes apps found few included relevant BCTs (Hoppe, Cade & Carter, 2017). One commercially available app for GDM was included in the review by Hoppe *et al.* (2017), however, to-date no review has examined the use of BCTs across mHealth interventions developed specifically for GDM.

The objectives of this scoping review were, therefore, twofold: 1) to provide an overview of the extent of knowledge related to the use of mHealth as primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of or diagnosed with GDM and 2) to understand if mHealth for GDM incorporated relevant behaviour change theory and techniques.

A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews, JBI Evidence Synthesis and the JBI Database of Systematic Reviews and Implementation Reports was conducted and no current or underway systematic or scoping reviews on the topic were identified. To the best of our knowledge, this scoping review is the first to address the objectives stated above. This review was conducted in accordance with an *a priori* protocol (Edwards *et al.*, 2020) but with the addition of extracting data regarding BCTs.

5.2.3 Review questions

- 1) What is known about using mHealth as a primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of and diagnosed with GDM?
- 2) Do mHealth interventions for women at risk of and diagnosed with GDM, incorporate relevant behaviour change theory and techniques, where appropriate?

5.2.4 Inclusion criteria

Participants

This review considered studies that included women who are at risk of GDM, currently have or have previously had a diagnosis of GDM. We acknowledge that women who have pre-existing diabetes (type 1 or type 2) will continue to experience diabetes during pregnancy; however, because the focus of this review was on GDM, we excluded studies primarily focused on, or including, women with pre-existing Type 1 or Type 2 diabetes. Because we wanted to understand use of mHealth among women with a previous diagnosis of GDM (interconception and postpartum periods) no limit was placed on time since pregnancy occurred. No limits were placed on the inclusion of women with regards to their age, body weight, other comorbidities, mode of conception (e.g. physiological, assisted), or pregnancy status (e.g. single, multiple).

Concept

This review considered studies examining mHealth for GDM. mHealth has been defined as the use of mobile and wireless technologies to support the achievement of health objectives (WHO, 2011). We included studies examining all types of mHealth

technologies such as smartphone apps, wearable sensors, and social media use. Other types of mHealth were considered for inclusion but did not feature in the studies selected for inclusion in this review. Studies focused on telehealth or telemedicine for GDM care, were excluded as these have been systematically reviewed elsewhere (Rasekaba *et al.*, 2018). In cases where studies included mHealth as one component of a broader interventional approach, mHealth must have been the primary mode of intervention delivery to be considered for inclusion in this review.

Context

This review considered studies that were conducted in any geographical location and any setting (such as diabetes clinics, other hospital settings, primary care, community care and at home). With no commonly established implementation route, we aimed to include all settings within this review. With reference to our aim of understanding mHealth use for GDM before, during and after pregnancy we considered studies that examined mHealth during preconception, pregnancy, interconception and postpartum periods. We posed no limit to the timeframe of these periods as definitions can vary across different contexts. We posed no limit on study date as mHealth is a relatively new concept and we aimed to ensure the retrieval of all relevant studies.

Types of sources

This scoping review considered both experimental and quasi-experimental study designs including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. Study protocols were also considered for inclusion. Any systematic reviews that met the inclusion criteria were retrieved and their original source papers were searched for eligibility for inclusion.

In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies were considered for inclusion. We also considered descriptive observational study designs including case series, individual case reports and descriptive cross-sectional studies for inclusion. Qualitative studies were also considered that focus on qualitative data including, but not limited to, designs such as phenomenology, grounded theory, ethnography, qualitative description, action research and feminist research. Only studies published in English were included.

During the pilot search conducted during protocol development and prior to the full search strategy being developed, a google search of key words was undertaken and the first 5 pages reviewed. Only published literature was retrieved from this search and therefore this review focused on empirical studies only.

5.2.5 Methods

This scoping review was conducted in accordance with the Joanna Briggs Institute methodology for scoping reviews (Peters *et al.*, 2015; Peters *et al.*, 2017).

Search strategy

The search strategy aimed to locate published studies. An initial limited search of Scopus and MEDLINE was undertaken to identify articles on the topic. The text words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles were used to develop a full search strategy. The search strategy, including all identified keywords and index terms, was adapted for each included information source and a second search was undertaken on 22 March 2021. The full

search strategies for each database are provided in Appendix C. The reference lists of all studies selected for inclusion were hand searched for additional studies.

Information sources

The databases searched were MEDLINE (via Ovid), CINAHL (via EBSCOhost, USA), EMBASE (via Ovid), Cochrane Database (via Wiley, USA) Scopus, and TRIP. Sources of unpublished studies and grey literature were searched using Open Grey, ISRCTN Registry, ClinicalTrials.gov, EU Clinical Trials register and ANZCTR.

Study selection

Following the search, all identified citations were collated and uploaded into Endnote X8, 2018 (Clarivate Analytics, PA, USA) and duplicates removed. Titles and abstracts were screened by two independent reviewers (KE, KM) for assessment against the review inclusion criteria. Potentially relevant studies were retrieved in full and their citation details imported into the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (Munn *et al.*, 2019). The full text of selected citations were assessed in detail against the inclusion criteria by two independent reviewers (KE, KM). Full text papers that did not meet the inclusion criteria were excluded and reasons for the exclusion are provided in Appendix C. Any disagreements that arose between the reviewers at each stage of the study selection process were resolved through discussion, or with a third reviewer (JS).

Data extraction

Data was extracted from papers included in the scoping review by two independent reviewers (KE, KM) using a data extraction tool developed by the reviewers and

adapted from the JBI results extraction instrument (Appendix C). During the extraction we discovered limited acknowledgement of behaviour change theory in full text articles. In order to gain a full understanding of the inclusion of theory-based behaviour change components the decision was taken to additionally extract data regarding BCTs. We therefore adapted the data extraction tool to include both behaviour change theory and BCTs. BCTs identified from included full text articles were categorized based on the 26-item taxonomy developed by Abraham and Michie (2008). This taxonomy has been used previously to identify BCTs within diabetes apps (Hoppe, Cade & Carter, 2017). The data extracted was tabulated and included: author, year of publication, origin, study design, mHealth objective, population, outcome measures, intervention type and purpose (e.g. app), setting, timing, technology features, behaviour change theory, BCTs and key findings related to review objectives. Any disagreements that arose between reviewers were resolved through discussion, and with a third reviewer (JS). Authors of papers were contacted to request missing or additional data, where required.

Data presentation

The data extracted from full text articles are presented in tabular and diagrammatic form according to scoping review guidelines. An overview of our key review findings are presented in graphic form and are accompanied by a narrative summary that describes how the results related to the review questions and objectives.

5.2.6 Results

Study inclusion

Database searches retrieved 2166 records (Figure 10) (Page *et al.*, 2021). Grey literature searches identified 511 records. After duplicates were removed, the remaining 1593 records were screened by title and abstract, and 1495 were excluded. The full text of 96 reports were assessed for eligibility, and another 66 were excluded with reasons documented (Appendix C). Most reports were excluded due to ineligible intervention type (n=25) (e.g. mHealth was not the primary component of the intervention under investigation). Thirty reports were included (Borgen *et al.*, 2019; Castorino *et al.*, 2018; Crimmins *et al.*, 2019; Dyson *et al.*, 2018; Garnweidner-Holme *et al.*, 2015; Ghaderi *et al.*, 2019; Guo *et al.*, 2019; Hasmi, 2019; Hirst *et al.*, 2015; Jo & Park, 2016; Kim, Kim & Shin, 2021; Lechner, 2017; Lim *et al.*, 2021; Loerup *et al.*, 2013; Mackillopp, 2020; Mackillop *et al.*, 2018; Mackillop *et al.*, 2014; Miremberg *et al.*, 2018; O'Reilly & Laws, 2019; Pais *et al.*, 2017; Poulter, 2019; Pustozarov *et al.*, 2017; Rawal & Peters 2019; Rigla *et al.*, 2018. Seely *et al.*, 2020; Skar *et al.*, 2018; Sung *et al.*, 2019; Varnfield *et al.*, 2021; Wickramasinghe *et al.*, 2019 Yew *et al.*, 2021).

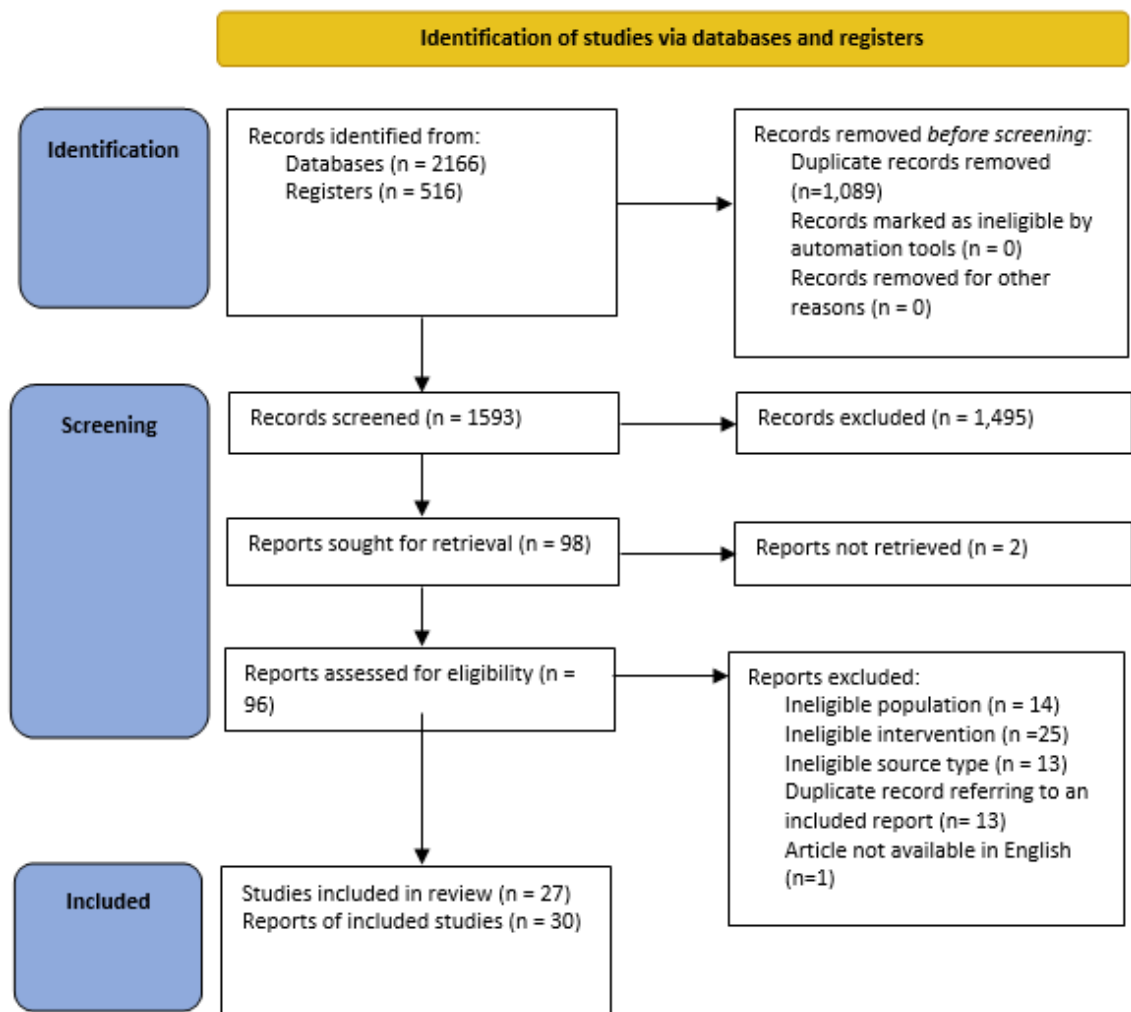


Figure 10. Search results and study selection and inclusion process (Page et al., 2021)

Characteristics of included studies

The 30 reports originated from 15 countries: Norway (Borgen et al., 2019; Garnweidner-Holme et al., 2015; Skar et al., 2018), Iran (Ghaderi et al., 2019), Israel (Miremberg et al., 2018), Spain (Rigla et al., 2018), Oman (Hashmi, 2019), Germany (Lechner, 2017), New Zealand (Pais et al., 2017), China (Guo et al., 2019), Nepal (Rawal & Peters, 2019), USA (Castorino et al., 2018; Crimmins et al., 2019; Seely et al., 2020), Russia (Pustozarov et al., 2017), Australia (O'Reilly & Laws, 2018; Poulter, 2019; Varnfield et al., 2021; Wickramasinghe et al., 2019), South Korea (Jo & Park, 2016; Kim, Kim, & Shin, 2021; Sung et al., 2019), Singapore (Lim et al., 2021; Yew et al., 2021), and

the UK (Dyson *et al.*, 2018; Hirst *et al.*, 2015; Loerup *et al.*, 2013; Mackillop, 2020; Mackillop *et al.*, 2018; Mackillop *et al.*, 2014). Twenty five different mHealth interventions were described across the 30 reports. Around half (14/30) of the studies were early development of the technology and/or pilot studies, the other half (16/30) were later large studies such as RCTs (Table 11).

Of the 25 studies that reported results, 1303 participants were included (range 5-170). These 1303 includes some 'double counting' (for example, participants reported in a qualitative sub study (Skar *et al.*, 2018) and different studies reporting results from the same service development project (Hirst *et al.*, 2015; Loerup *et al.*, 2013; Mackillop *et al.*, 2014). Six studies focused on postpartum women, the remaining 24 included, or aimed to include, women currently pregnant with GDM diagnosis (Table 11).

Review findings

Appendix C describes the relevant data from the included sources related to the review objectives including; mHealth purpose and features, study design, population, outcome measures, implementation and duration of use, behaviour change theory and techniques and key study findings. A summary of this scoping review's main findings is provided in Figure 11.

Table 11. Characteristics of mHealth for use during and after pregnancy. PA = physical activity

Timing and Purpose	mHealth name, type and country	mHealth intervention features	Evaluation method(s)	Implementation setting	Behaviour Change Theory and No. of BCTS
During pregnancy					
Self-management for BGC	Pregnant + App (Norway)	<ul style="list-style-type: none"> - Auto upload of BGL readings - Real-time visualization of BGL levels - Information on healthy diet, PA and diabetes 	Development and usability (Garnweidner-Holm <i>et al.</i> , 2015) Evaluation (RCT) (Borgen <i>et al.</i> , 2019) Evaluation (qualitative) (Skar <i>et al.</i> , 2018)	Hospital setting (at diagnosis)	Health Belief Model 5
	GDmHealth App (UK)	<ul style="list-style-type: none"> - Auto upload of BGL readings - Real-time feedback on BGL levels - Two-way communication with HCP 	Development and usability (Mackillop <i>et al.</i> , 2018) Pilot study (Loerup <i>et al.</i> , 2013) Pilot study (Hirst <i>et al.</i> , 2015) Evaluation (RCT) (Mackillop <i>et al.</i> , 2018)	Hospital setting (at diagnosis)	3
	Glucose Buddy App (Israel)	<ul style="list-style-type: none"> - Manual BGL level upload - BGL reports emailed direct to HCP via app - Feedback on BGL levels, diet, treatment and appointments emailed to women - Two way interaction with HCP 	Evaluation (RCT) (Miremberg <i>et al.</i> , 2018)	Hospital setting (at diagnosis)	3

dNurse App (China)	<ul style="list-style-type: none"> - Manual BGL upload - Real-time feedback on BG levels - Two way connections with HCP - Information on diet, exercise and treatment 	Evaluation (RCT) (Guo <i>et al.</i> , 2019)	Hospital setting (at diagnosis)	4
DiaMOnd App (Australia)	<ul style="list-style-type: none"> - Manual upload of BGL readings - Real-time feedback from HCP on BGL, diet, exercise and insulin titration. - Logs diet, PA and insulin use 	Evaluation (cross over trial) (Wickramasinghe <i>et al.</i> , 2019)	Private Hospital setting (at diagnosis)	3
GlucoseMamma App (USA)	<ul style="list-style-type: none"> - Manual upload of BGL readings - Real-time feedback on BGL levels - Positive text messaging - Information on healthy eating, recipes and meal plans 	Evaluation (prospective RCT) (Crimmins <i>et al.</i> , 2019)	Hospital setting (at diagnosis)	2
GEM App (Russia)	<ul style="list-style-type: none"> - Auto upload of BGL readings - Logs dietary intake - Personalized advice on upcoming meals based on BGL readings 	Pilot study (mixed methods) (Pustozarov <i>et al.</i> , 2017)	N/A	2
Mother App (Australia)	<ul style="list-style-type: none"> - Manual BGL level upload - BGL levels viewed by HCP via online portal 	Pilot study (Varnfield <i>et al.</i> , 2021)	Hospital setting (at diagnosis)	2
Net Health App (Australia)	<ul style="list-style-type: none"> - Auto upload of BGL readings - Two way interaction with HCP - Auto alert to HCPs if BGL levels are out of range 	Trial registration (pilot Non-RCT) (Poulter, 2019)	Hospital setting (at diagnosis)	3

	App (Korea)	<ul style="list-style-type: none"> - Auto upload of BGL readings - Two way communication with HCP - Records dietary intake - Tailored in-app messaging 	Pilot study (Pilot RCT) (Sung <i>et al.</i> , 2019)	Hospital setting (at diagnosis)	3
	App ecosystem (New Zealand)	<ul style="list-style-type: none"> - Food diaries, exercise tracking, glucose monitoring - Ability to export data to HCP 	Pilot study (qualitative) (Pais <i>et al.</i> , 2017)	N/A	1
	App (Oman)	<ul style="list-style-type: none"> - Health education and videos on PA, BG monitoring and diet - Tracks PA, diet and BGL - Provides feedback charts - Daily reminders to monitor BGL 	Trial registration (feasibility RCT) (SESSPA) (Hasmi, 2019)	Hospital setting (at diagnosis)	7
	MobiGuide App (Spain)	<ul style="list-style-type: none"> - Auto upload of BGL readings - Two way interaction with HCP via messaging - tracks PA via embedded accelerometer 	Pilot study (observational, prospective) (Rigla <i>et al.</i> , 2018)	Hospital setting (at diagnosis)	2
	App (South Korea)	<ul style="list-style-type: none"> - Generates generic and tailored recommendations on BGL management, PA, bodyweight and diet based on patient data and clinical guidelines 	Development and usability (mixed methods) (Jo & Park, 2016)	Online diabetes group (at home)	2
Education	Educational App (Iran)	<ul style="list-style-type: none"> - Reminders for tests and medication - Educational material in video photo and text format 	Evaluation (quasi-experimental with control) (Ghaderi <i>et al.</i> , 2019)	Hospital setting (at diagnosis)	4

Behaviour change for healthy lifestyle	GDMHealth Plus app (UK)	<ul style="list-style-type: none"> - Weekly self-weighing - Carbohydrate counting - PA monitoring - Real-time feedback via HCP 	Pilot study (mixed methods) (Dyson <i>et al.</i> , 2018)	Hospital setting (at diagnosis)	3
	Habits-GDM app (Singapore)	<ul style="list-style-type: none"> - Tracks diet and PA - Interactive educational content -Lifestyle coaching via in-app messaging 	Evaluation (RCT) (Yew <i>et al.</i> , 2021)	Hospital setting (at diagnosis)	4
	mGDM app (Nepal)	<ul style="list-style-type: none"> - Health education - Identification and setting of health goals - Facilitates support from family members 	Trial registration (RCT) (Rawal & Peters, 2019)	Hospital setting (at diagnosis)	Social Cognitive Theory 3
	Stay Active App + (Mackillop) (UK)	<ul style="list-style-type: none"> - Two way interaction with HCP - Remote motivational interviewing - PA goals can be reviewed - feedback via messaging 	Trial registration (feasibility) (Mackillop, 2020)	Hospital setting (at diagnosis)	4
Postpartum					
Education	Tu Puedes app (USA)	<ul style="list-style-type: none"> - 4 'lessons' about T2DM prevention - Culturally applicable information 	Pilot study (quasi-experimental with control) (Castorino <i>et al.</i> , 2018)	N/A	1
Behaviour change for T2DM prevention	nBuddy App (Singapore)	<ul style="list-style-type: none"> - Tracks diet and exercise with visual feedback - Personalized education - Two way communication with health and lifestyle coach 	Evaluation (RCT) (Lim <i>et al.</i> , 2021)	Hospital setting (at delivery)	5
	Triangle App	N/A	Trial registration (RCT) (Lechner, 2017)	N/A (3-8 months postpartum)	N/A

(Germany)				
Health-e mums app + social media	<ul style="list-style-type: none"> - Tracks weight, exercise and dietary intake - Feedback via push notifications 	Pilot Study (qualitative) (O'Reilly & Laws, 2018)	N/A	7
(Australia)	<ul style="list-style-type: none"> - Virtual health coach guides through 7 educational modules 			
Virtual Reality program	<ul style="list-style-type: none"> - 123 exercise options - Nutrition program - Ability to track diet with visual feedback - Stress relief exercises - neonatal first aid program 	Evaluation (quasi-experimental with control) (Kim, Kim & Shin, 2021)	Hospital setting (at delivery)	5
(South Korea)				
Hola Bebe, Adios Diabetes App	<ul style="list-style-type: none"> - Educational videos on PA and diet - Personalized action plans - Educational and motivational messages - Weight tracking - Recipes - Badge based reward system 	Pilot study (Seely <i>et al.</i> , 2020)	Community Health Centre (up to 5 years postpartum)	Social Cognitive Theory 7
(USA)				



Figure 11. Summary of scoping review main findings

mHealth purpose

All (25/25) mHealth required women to use an app, one of which enabled a mobile-based VR program with use alongside a VR headset (Kim, Kim & Shin, 2021) and one incorporated social media (O'Reilly & Laws, 2019) (Table 11). Nearly all (24/25) mHealth were specifically developed for women experiencing GDM. One study described curating an ecosystem of five commercially available health and wellness apps to meet various self-management needs (Pais *et al.*, 2017).

For mHealth used during pregnancy there were three main purposes: 1) to support self-management for blood glucose control (BGC) 2) provide education and 3) to support behaviour change for healthy lifestyle (Table 11). For mHealth used postpartum (6/25) there were two main purposes: 1) behaviour change interventions for the prevention of T2DM and 2) providing education for lifestyle change.

mHealth features and key findings

Self-management for BGC: All GDM self-management apps included features that enabled BGL monitoring and management (Borgen *et al.*, 2019; Crimmins *et al.*, 2019; Guo *et al.*, 2019; Hasmi, 2019; Jo & Park, 2016; Mackillop *et al.*, 2018; Miremberg *et al.*, 2018; Pais *et al.*, 2017; Poulter, 2019; Pustozarov *et al.*, 2017; Rigla *et al.*, 2018; Sung *et al.*, 2019; Varnfield *et al.*, 2021; Wickramasinghe *et al.*, 2019). Many apps enabled interaction with HCPs (Poulter, 2019; Rigla *et al.*, 2018; Sung *et al.*, 2019; Varnfield *et al.*, 2021; Wickramasinghe *et al.*, 2019). This interaction predominantly served to transmit BGL readings to HCPs who could provide feedback on BGL, diet and therapy adjustment where required. Some also enabled appointment booking (Miremberg *et al.*, 2018), a call back service (Mackillop *et al.*, 2018) and ability to ask questions (Guo *et al.*, 2019; Miremberg *et al.*, 2018). One app included a system to

remind women to monitor their BGL twice per day (Hashmi, 2019). One study described an in-app algorithm to predict BGLs and provide tailored feedback, based on data input by women and clinical guidelines (Jo & Park, 2016).

Some apps also enabled tracking of dietary intake and physical activity (Pais *et al.*, 2017; Pustozarov *et al.*, 2017; Sung *et al.*, 2019; Wickramasinghe *et al.*, 2019), one included an embedded accelerometer (Rigla *et al.*, 2018). Some apps also included educational materials regarding diet, physical activity and general information on GDM (Borgen *et al.*, 2019; Crimmins *et al.*, 2019; Guo *et al.*, 2019; Hashmi, 2019). Studies exploring apps for self-management of BGC suggest they were used, easy to navigate and were generally satisfactory for women (Hirst *et al.*, 2015; Jo & Park, 2016; Loerup *et al.*, 2013; Mackillop *et al.*, 2018; Mackillop *et al.*, 2014; Pais *et al.*, 2017; Pustozarove *et al.*, 2017; Wickramasinghe *et al.*, 2019).

Education: Two apps focused on delivery of education. One for use during pregnancy aimed to increase risk perception of T2DM (Ghaderi *et al.*, 2019) and one for use postpartum provided health education to Spanish-speaking Latina women (Casterino *et al.*, 2018) (Table 11). One app (Ghaderi *et al.*, 2019) included video, photo and text based educational materials as well as reminders for tests and medications and an FAQ section regarding GDM and T2DM. The Tu Puedes app included lessons about T2DM prevention that included culturally applicable information (Casterino *et al.*, 2018).

Behaviour change: Nine mHealth interventions were developed to provide behaviour change support (Table 11) (Dyson *et al.*, 2018; Kim, Kim & Shin, 2021; Lechner, 2017; Lim *et al.*, 2021; Mackillop, 2020; O'Reilly & Laws, 2019; Rawal & Peters, 2019; Seely *et al.*, 2020; Yew *et al.*, 2021). Of the four apps for use during pregnancy two (Dyson *et*

al., 2018; Yew *et al.*, 2021) aimed to address weight management, one to increase self-efficacy to adhere to physical activity and dietary regimens (Rawal & Peters, 2019) and one to motivate women to increase physical activity levels (Mackillop, 2020). Five mHealth were developed for the purpose of creating and sustaining health behaviour change to prevent onset of T2DM after pregnancy (Kim, Kim & Shin, 2021; Lechner, 2017; Lim *et al.*, 2021; O'Reilly & Laws, 2019; Seely *et al.*, 2020).

Most apps included features to track physical activity, dietary intake and weight, track progress and receive feedback (Dyson *et al.*, 2018; Kim, Kim & Shin, 2021; Lim *et al.*, 2021; O'Reilly & Laws, 2018; Seely *et al.*, 2020; Yew *et al.*, 2020). One app also included motivational messages and interaction with HCPs to provide feedback on progress (Mackillop *et al.*, 2018). mHealth for postpartum use included additional features of social support via use of Facebook and provision of rewards (O'Reilly & Laws, 2019; Seely *et al.*, 2020). Studies exploring apps for behaviour change suggest women's feedback at an early stage of design and development is important as some features and functions were valued more than others (Dyson *et al.*, 2018; Lim *et al.*, 2021; O'Reilly & Laws; Seely *et al.*, 2020).

mHealth implementation

When: During pregnancy app use usually started at time of diagnosis (typically 24-28 weeks gestation) and ceased on delivery (Appendix C). Twelve of 19 mHealth required women to start using them at specified gestation periods that ranged from 12-35 weeks gestation (Borgen *et al.*, 2019; Crimmins *et al.*, 2019; Guo *et al.*, 2019; Hasmi, 2019; Mackillop, 2020; Mackillop *et al.*, 2018; Miremberg *et al.*, 2018; Poulter, 2019; Rawal & Peters, 2019; Rigla *et al.*, 2018; Sung *et al.*, 2019; Varnfield *et al.*, 2021; Yew *et*

al., 2021). One app implemented during pregnancy could be used up to three months after delivery (Borgen *et al.*, 2019). Timing of postpartum mHealth delivery varied from soon after delivery (Kim, Kim & Shin, 2021; Lim *et al.*, 2021), three to eight months (Lechner, 2017) post-delivery, and up to five years postpartum (Seely *et al.*, 2020).

Where: mHealth for use during pregnancy were typically introduced to women in hospital settings (11/19), usually diabetes in pregnancy outpatient clinics (Table 11). One study describes recruiting women online for app use at home (Jo & Park, 2016). Two mHealth for use postpartum were introduced to women at their delivery location (Kim, Kim & Shin, 2021; Lim *et al.*, 2021) and one from a community healthcare centre (Seely *et al.*, 2020).

How: Six studies detailing mHealth for use during pregnancy and two for use postpartum reported that women received training on how to use the technology, including face to face sessions (Kim, Kim & Shin 2021; Mackillop, 2020; Mackillop *et al.*, 2018; Miremberg *et al.*, 2018; Seely *et al.*, 2020; Sung *et al.*, 2019; Wickramasinghe *et al.*, 2019) and a booklet (Ghaderi *et al.*, 2019). Two studies relied on women's own capability to download and start using apps (Borgen *et al.*, 2019; Guo *et al.*, 2019). Two apps included 'how-to' instructions (Poulter, 2019; Seely *et al.*, 2020). Two studies report the app being set-up for women by researchers (Ghaderi *et al.*, 2019; Rawal & Peters, 2019).

Behaviour change theory and techniques

Three studies described using behaviour change theory to guide the development of mHealth interventions (Borgen *et al.*, 2019; Rawal & Peters, 2019; Seely *et al.*, 2020).

Borgen et al., (2019) based their app for self-management of BGC on Social Cognitive Theory (Borgen *et al.*, 2019). Two apps designed to support behaviour change, one during pregnancy (Rawal & Peters, 2019) and one postpartum (Seely *et al.*, 2020), used the Health Belief Model to guide intervention development.

However, nearly all (22/25) mHealth interventions incorporated at least two BCTs. Of the 26 BCTs on the Michie and Abraham (2008) taxonomy, 13 were identified as present across mHealth included in this review (Figure 12). The most common number of BCTs across all mHealth was 3 (Table 11).

mHealth developed specifically to deliver behaviour change interventions typically included a broader range of BCTs (3-7) than those designed for education (1-4) or self-management of BGC (1-5).

All but one (Pais *et al.*, 2017) mHealth intervention for supporting self-management of BGC, included both 'prompt self-monitoring behaviour' and 'provision of feedback on performance'. These techniques mapped to functions that allowed women to monitor their blood glucose, physical activity, diet and weight and receive feedback on their performance, often in real-time.

mHealth for behaviour change intervention during pregnancy included similar features to that included for self-management of BGC but additionally included identification of goals, information on health-behaviour link and opportunity for social support. One also included motivational interviewing facilitated remotely within the app (Mackillop *et al.*, 2018).

mHealth to support behaviour change postpartum included the widest range of BCTs per technology (5-7) (Table 11) and included self-monitoring features that tracked physical activity, dietary intake and monitored weight (Table 11). One technology (Kim, Kim & Shin, 2021) included techniques for stress management, one provided women with contingent rewards (Seely *et al.*, 2020) and one provided opportunities for social support via social media (O'Reilly & Laws, 2019).

mHealth aimed at providing education for T2DM prevention included one (Castorino *et al.*, 2018) and four (Ghaderi *et al.*, 2019) techniques including 'prompt practice', 'information about behaviour-health link' and 'information about consequence'. Although it could be argued that provision of education does not require behaviour change, the evaluation of one educational app (Castorino *et al.*, 2018) included outcomes such as BMI, blood pressure and waist measurement suggesting the intended impact of the app was for women to make relevant lifestyle changes.

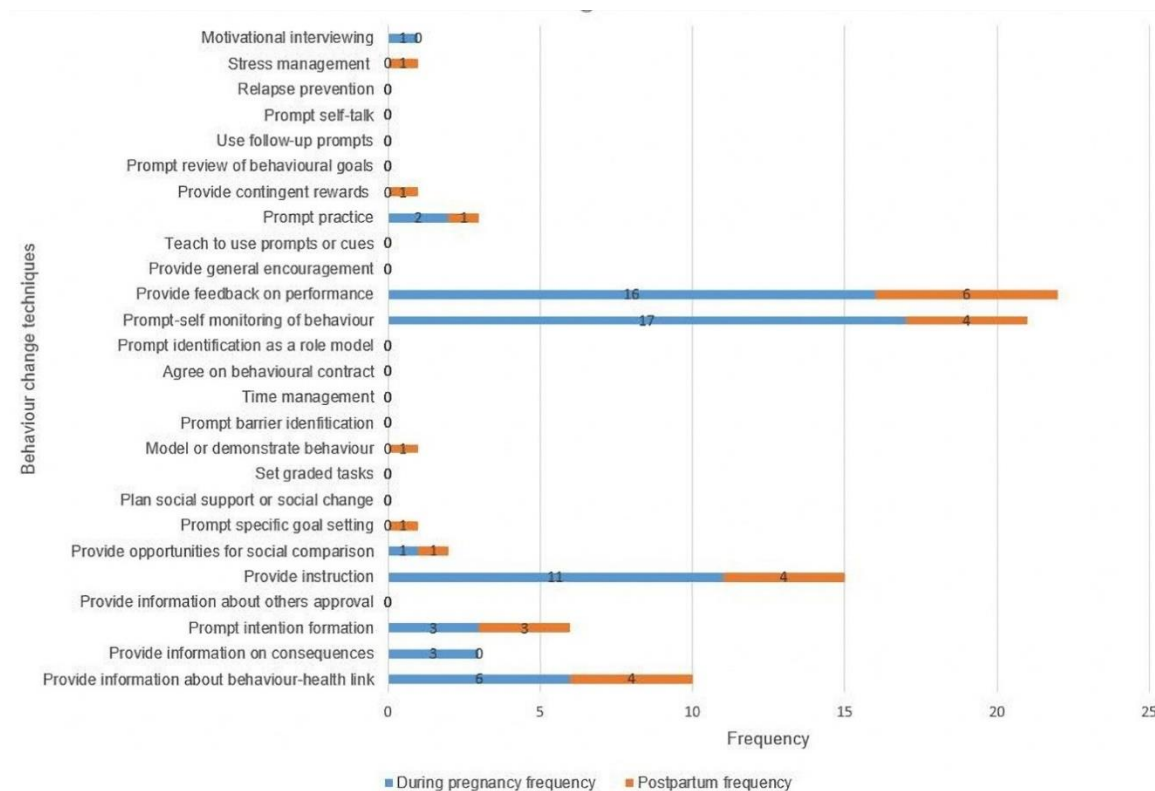


Figure 12. Frequency of behaviour change techniques identified in mHealth technologies for GDM using the Michie and Abraham 26 item taxonomy (Abraham & Michie, 2008)

mHealth Study Design

Development: Of the two studies describing the mHealth development process, one used an iterative user-centered process with think-aloud interviews to assess usability (Garnweidner-Holme *et al.*, 2015), the other drew on clinical guidelines and evaluated usability and acceptability using online surveys (Jo & Park, 2016).

Pilot studies: For mHealth used during pregnancy, pilot studies typically used surveys to capture data on usability, usage and patient satisfaction after women had used the app from diagnosis to delivery (Dyson *et al.*, 2018; Garnweidner-Holem *et al.*, 2015; Hirst *et al.*, 2015; Jo & Park, 2016; Loerup *et al.*, 2013; Mackillop *et al.*, 2014; Pustozarov *et al.*, 2017; Varnfield *et al.*, 2021). One study used an observational prospective study to understand compliance with BGL monitoring compared to a historical cohort who used standard monitoring methods (Rigla *et al.*, 2018). A further pilot study used a single center RCT design to capture preliminary effectiveness of app use vs standard care via obstetric outcomes and OGTT results at 5-12 weeks postpartum (Sung *et al.*, 2019).

For postpartum mHealth, two pilot studies used quasi-experimental designs (Castorino *et al.*, 2018; Kim, Kim & Shin, 2021) to determine impact of mHealth use on various weight parameters and self-reported lifestyle behaviours. A further pilot study used qualitative methods to gather feedback from women on a prototype of a postpartum mHealth program (O'Reilly & Laws, 2019). Seely *et al.* (2020) describe the

development, feasibility and preliminary effectiveness of their app using a series of studies involving qualitative feedback, usability testing and a single arm pilot trial.

Efficacy evaluations: The majority of studies evaluating clinical efficacy of mHealth for use during pregnancy typically used non-blinded randomized control trials, either single or multi-center (Table 11) (Borgen *et al.*, 2019; Crimmins *et al.*, 2019; Guo *et al.*, 2019; Hashmi, 2019; Mackillop, 2020; Mackillop *et al.*, 2018; Miremberg *et al.*, 2018; Rawal & Peters, 2019; Sung *et al.*, 2019; Wickramasinge *et al.*, 2019; Yew *et al.*, 2021). Apps were used from diagnosis to delivery, and outcome measures focused on glycemic control (during pregnancy and at delivery), as well as various maternal, delivery and neonatal outcomes. Compliance with BGL monitoring and satisfaction with the app were also measured. Postpartum (3 month) BGLs were measure as primary outcome in one trial however, significant loss to follow-up meant results could not be relied upon (Borgen *et al.*, 2019).

For evaluations of postpartum mHealth, Lim *et al.* (2021) used a non-blinded single center RCT design to understand the impact of app use among 200 postpartum women on ability to restore booking weight at four months postpartum. A parallel multi-center RCT with 64 postpartum women is planned to evaluate the Triangle app (Lechner, 2017). Primary outcome will be proportion of women reaching three or more of the five Diabetes Prevention Program lifestyle milestones. Secondary outcomes included physical activity, dietary intake, weight and BMI after six months of use (Lechner, 2017).

5.2.7 Discussion

This scoping review aimed to synthesize current knowledge on the use of mHealth as primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of or diagnosed with GDM. We also aimed to understand if, where appropriate, mHealth for GDM incorporated relevant behaviour change theory and techniques.

This review identified 30 sources of evidence that used mHealth as a primary mode of intervention to support women at risk of, and diagnosed with GDM. Despite broadening our search to include all types of mHealth (rather than just apps), all (25/25) required women to use an app. One study used an app to enable a mobile-based VR program with use of a headset, and only one included social media use. It is possible that other types of mHealth, such as websites, wearables and social media are not suited to address the clinical purpose of the mHealth described in this review. However, a recent study found women with experience of GDM frequently used and highly valued social media for meeting their informational and peer support needs (Chapter 7, study 3a). These findings suggest future mHealth development should consider inclusion of existing online spaces women value in order to meet needs such as peer support, which have been found to impact women's ability to self-manage (Craig *et al.*, 2020) and support behaviour change (Ingstrup *et al.*, 2019).

Building on the findings of Chen and Carbone (2017), this review included six studies evaluating the effectiveness of mHealth systems for self-management of BGC. In accordance with NICE guidelines (2019) evaluations typically adopted RCT designs to measure the ability of mHealth to improve glycemic control in comparison to standard care. Women appeared satisfied with apps, however, the burden of managing GDM

has been linked to feelings of depression and isolation among women (Parsons *et al.*, 2018) thus we suggest future evaluation of mHealth should consider wider reaching outcomes such as quality of life and wellbeing, in order to capture other important possible benefits for women. In addition, as recommended by Craig *et al.* (2008) further qualitative exploration of women's experiences of app use could help to tease out barriers and facilitators that may enhance future adoption and efficacy (Maar *et al.*, 2017).

Only six of twenty five mHealth interventions were designed for postpartum use and none were developed for the purpose of preventing GDM reoccurrence, despite high prevalence, particularly for those with high BMI (MacNeil *et al.*, 2001). mHealth for use after delivery typically focused on preventing progression to T2DM by creating behaviour change for weight management, however, there is currently limited evidence examining their effectiveness. Weight increase during postpartum and interconception periods is an important modifiable factor known to increase the risk of progression to T2DM (Bao *et al.*, 2015) and also recurrence of GDM in both normal and overweight/obese women (Sorbye *et al.*, 2020). Thus, finding effective, engaging and acceptable interventions is of key public health importance.

Because of a lack of published evidence, it was difficult to gain a thorough understanding of how, when and where postpartum mHealth was implemented. Both Lim and Kim demonstrated good engagement with intervention delivered soon after delivery. However, learning from evaluation of mHealth for use during pregnancy (Borgen *et al.*, 2019), large loss to follow-up postpartum means that this relatively early timing needs to be balanced with women's barriers to engagement, including the

pressures of new motherhood (Nicklas *et al.*, 2018). In addition, it is well documented that the transition from maternity to primary care, following delivery, can be fragmented (McCloskey *et al.*, 2019). Thus, early consideration of future implementation strategies will be essential for mHealth to function effectively within wider healthcare systems.

In line with findings from Chen and Carbone (2017) only one app for self-management and two apps for behaviour change intervention were developed using behaviour change theory. Although not all apps were designed to deliver a behaviour change intervention, self-management of BGC and education for T2DM prevention require women to make changes to their lifestyle, suggesting a need for theory-developed behaviour change components. This is reflected in the finding that nearly all apps (24/25) included at least two BCTs and those designed to support self-management of BGC nearly always included two techniques seen as 'optimum' when combined (Miche *et al.*, 2009). mHealth for behaviour change intervention included a wider range of BCTs, nevertheless, of the twenty-six theory linked BCTs that have been described and tested (Abraham & Michie, 2008), 13 were still not included within any mHealth reviewed. Clearly the inclusion of all techniques is not realistic for all mHealth interventions, however, referring to the 26-item taxonomy when developing mHealth for GDM could be advantageous for selecting specific BCTs that might support women with particular needs. For example, evidence has shown women experience a significant drop in motivation after delivery (Nicklas *et al.*, 2011) and face-to-face motivational interviewing has shown some promise for creating behaviour change among postpartum women (Reinhardt *et al.*, 2021). Despite this, none of the mHealth interventions for postpartum behaviour change included 'motivational interviewing'

techniques suggesting potential disparity between the BCTs included in postpartum mHealth interventions and the barriers and needs women experience at this time.

Limitations

Our objective was to synthesize current knowledge and identify research gaps for future study, however scoping methodology does not include quality assessment and consequently this review is unable to identify the quality of included studies. In addition, due to lack of resource, only evidence published in English were included and thus our findings may have omitted evidence in other languages.

A further limitation was that BCTs were extracted using descriptions of mHealth provided in studies, rather than by direct examination and thus some features/techniques may have been missed. Direct examination of mHealth was beyond the scope of this review but is something that could be undertaken in future work.

The lack of studies focused on postpartum mHealth interventions may be reflected in our decision to include mHealth as the primary component of the intervention. For example, several studies were excluded where mHealth was used for postpartum intervention but was not the main component (Appendix C). Postpartum interventions are typically more complex and may therefore require a broader approach.

Nevertheless, of the 98 studies taken to full text screening, only 23 focused on postpartum usage and one for interconception care (Appendix C).

Conclusions

This scoping review has identified the majority of mHealth interventions for GDM are apps that aim to improve clinical outcomes during pregnancy. Further consideration of broader outcomes related to women's wellbeing and qualitative experiences is required to further inform improvement of these systems. In addition, consideration should be given to the inclusion of other existing resources such as social media that could help address needs such as peer support that impact on women's ability to self-manage.

It was previously unknown if BCTs were included within mHealth for GDM where appropriate. Our findings suggest most mHealth included BCTs. However, coming from a pragmatist position we suggest that in order for mHealth interventions to have maximum impact, intervention developers should consider referring to the 26-item taxonomy in order to select techniques that map to women's reported behaviour change barriers. Overall, a lack of published studies examining mHealth for postpartum and interconception use indicates that further high-quality primary research is needed to better understand and identify effective ways of using mHealth to reduce risks associated with GDM recurrence and progression to T2DM. We suggest that once evidence is available regarding the impact of postpartum and interconception mHealth interventions, a systematic review is warranted to understand how specific features, BCTs and aspects of implementation may impact their efficacy.

5.3 Chapter Summary

This chapter has presented a systematic search and mapping of the current evidence of using mHealth to support women with GDM. The review identified several gaps in knowledge including a lack of mHealth interventions for the prevention of GDM

recurrence and T2DM suggesting a need for further development and evaluation. The review also identified an absence of BCTs that target women's postpartum and interconception needs and barriers, such as lack of motivation.

The following two chapters (Chapter 6 & 7) continue to contribute toward phase one of the project, by conducting new primary research to gain an in-depth understanding of both women's and HCPs experiences of using mHealth as well as their views on the provision of future mHealth interventions to support weight management following a pregnancy complicated by GDM.

Chapter 6 (Phase 1) Using a webinar with embedded survey to engage with, and collect preliminary data from, key stakeholders involved in GDM

6.1 Overview

This chapter, and chapter 7, present four studies exploring key stakeholder views and experiences of using mHealth for GDM. The work in this chapter, alongside that undertaken in chapter 5 (study 1) contributed toward achieving the overall aim of phase one of the project; to better understand the need for, and the role of, mHealth to support women with a history of GDM following birth. The hope was, at this stage, to learn what existing experience women and their HCPs had with mHealth and to understand what the key barriers and facilitators were for mHealth adoption and implementation. Desires for future mHealth interventions were also explored, particularly during the postpartum and interconception periods where support is currently lacking. This was important to understand before embarking on any further development or evaluation of FITZ.

The work described in this chapter focuses on the conduct of a webinar held on 31.4.2019. The purpose of the webinar was twofold; 1) to understand if hosting a webinar was an effective method of engaging stakeholders, particularly postpartum women, into research activities and 2) to use an embedded survey within the webinar to collect data regarding stakeholder experiences and preferences of the use of mHealth following a pregnancy complicated by GDM.

The process of undertaking the webinar and the findings regarding its ability to engage and retain stakeholders is presented in the first section of this chapter in the form of a published abstract presented at the Health Services Research conference 2021 (study 2a, section 6.2). The methods and findings associated with the embedded survey exploring stakeholder experiences and preferences are provided in the second section of this chapter (study 2b, section 6.3) (not published work), with a discussion followed by an overall summary of this chapter.

6.2 Using a webinar to recruit postpartum women with experience of gestational diabetes to research (study 2a)

(accepted for presentation at Health Services Research conference 2021)

Authors

Katie J. Edwards, Helen Probert, Wendy Preen, Jackie Andrade, Ray B. Jones, and Jill Shawe

6.2.1 Background

Recruitment to research of postpartum women, particularly those experiencing complications, has historically been difficult (Peindl *et al.*, 2003). Women with Gestational Diabetes Mellitus (GDM) experience barriers engaging with face-to-face interventions after delivery. While digital interventions are commonplace, less is known about how technologies could enhance research processes. We assessed the

use of a live webinar to recruit, collect data, and subsequently follow-up women with experience of GDM.

6.2.2 Method

Recruitment to the webinar took place over three months in 2019 using social media and email contacts. Advertisements included a link to register for the 'GoToWebinar' focused on GDM and mHealth. The webinar lasted 65 minutes and included 12 questions, one of which sought consent. All registrants were invited, via email, to follow-up interview. We aimed to recruit at least six participants for follow-up. Data regarding recruitment and engagement, were descriptively analysed. A detailed research diary assessed recruitment effort.

Ethical approval (ref.UoPFoH18/19-1088).

6.2.3 Results

Eighty-six people registered, of which, 29 (35%) attended (Figure 13). Attendees comprised HCPs (7), healthcare students (8), women with experience of GDM (8) and 'other' (2). Four women experienced GDM <12 months ago and three experienced GDM >12 months ago. One did not answer. Recruitment amounted to four hours of research assistant time. Recruitment of women was achieved using advertisements in GDM Facebook groups.

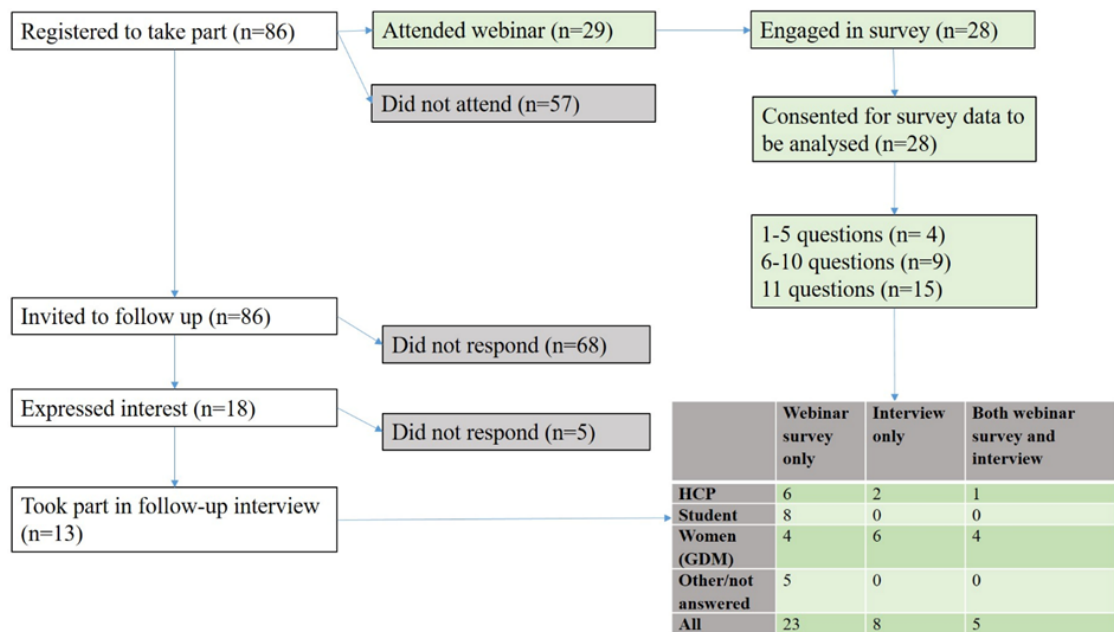


Figure 13. Flowchart of recruitment, webinar engagement, and follow-up

Of the 86 invited to follow-up interviews, 18 (20%) expressed interest, and 13 (15%) took part. Ten of the 13 follow-up participants were women with experience of GDM, three were professionals. Time spent in the webinar ranged from 12 to 65 (mean 50) minutes.

Of the 29 people who attended, 28 actively engaged with the embedded survey and consented for their responses included for analysis. Fifteen out of 28 participants (52%) answered all 11 questions. Four (17%) answered between one and five questions, nine (31%) answered between six and 10 questions.

6.2.4 Implications

Our findings demonstrate the webinar attracted and retained participants into follow-up activities. Effort to recruit was minimal in comparison to other eHealth intervention studies (Jones *et al.*, 2020). Hosting online events has increased in popularity since

COVID-19, thus increased concept familiarity may enhance these findings further, however, it is possible recruitment could become more difficult in a saturated 'market'. Understanding accessibility of online platforms remains important; factors such as ease of use and reliability are critical (Wherton *et al.*, 2020).

Our aim to retain six participants was exceeded with 13 taking part in follow-up interviews. Interestingly, more women with experience of GDM who registered, but did not attend the webinar, took part in follow-up interviews, than those who did attend, suggesting the offer of the webinar rather than its content had more influence on women's willingness to participate in further activities.

This study included women with experience of GDM already engaged in online activities (Facebook) therefore findings are not generalizable to wider populations. Future studies should aim to understand participant perspectives and cost effectiveness.

We demonstrated similar rates of recruitment and response (Jo & Park, 2016) to an online survey for postpartum women with history of GDM. Webinars with embedded data collection and follow-up provide an alternative way of engage women with prior GDM in research.

6.3 mHealth for postpartum and interconception care following a pregnancy complicated by gestational diabetes: a survey of key stakeholder experiences and preferences (study 2b)

As well as understanding the ability for the webinar to engage stakeholders, including postpartum women (study 2a, section 6.2), the webinar also served the purpose of collecting data via an embedded survey. The survey data aimed to gain a preliminary understanding of stakeholder experiences and preferences regarding the use of mHealth following a pregnancy complicated by GDM.

Gaining a preliminary understanding of stakeholder's experiences of mHealth for GDM was important as little is currently known regarding what mHealth resources women and HCPs currently use, what they use it for and what their desires are for mHealth interventions to support women following birth. Although the acceptability and usability of specific postpartum T2DM prevention app prototypes have been qualitatively explored (O'Reilly & Laws, 2019; Seely *et al.*, 2020; Nicklas *et al.*, 2019), findings demonstrate different features and functions are valued by women across different studies and technologies. For example, women lacked satisfaction and engagement with weight tracking functions for an app during pregnancy (Dyson *et al.*, 2018), found dietary intake tracking burdensome after pregnancy (Nicklas *et al.*, 2019) but valued tracking features that offered social support (O'Reilly & Laws, 2019). It is also possible that key features and functions are missing from existing interventions (Chapter 5, study 1), leaving a broader knowledge gap surrounding purpose, functionality and implementation.

6.3.1 Aim and objectives

Aim

The aim of the survey was to gain a preliminary understanding of key stakeholders existing experiences of mHealth use, and their desires regarding the purpose, functionality, and implementation of future mHealth for supporting women following a pregnancy complicated by GDM.

Objectives

1.1 To understand if and how stakeholders currently use or recommend the use of mHealth to support women with experience of GDM

1.2 To explore the barriers of using or recommending the use of mHealth to support women following a pregnancy complicated by GDM

1.3 To understand which features of mHealth interventions stakeholders deem most important for supporting women following a pregnancy complicated by GMD

1.4 To understand stakeholder preferences regarding the type of support delivered by an mHealth intervention to support women following a pregnancy complicated by GDM.

1.5 To understand stakeholder preferences regarding the implementation context of mHealth intervention aimed to support women following a pregnancy complicated by GDM

6.3.2 Methods

Study design

For this part of the study, a cross sectional survey design was used (Morris, 2004). The questionnaire was designed to elicit the views and experiences of key stakeholders.

The overarching objective of the questionnaire was to assess stakeholders existing experiences of using mHealth, as well as their preferences and desires for future mHealth to support women following a pregnancy complicated by GDM. A key area of interest was, what stakeholders would prioritise in terms of what they wanted an mHealth intervention to support women with after pregnancy, what features they valued to do this, and in what context they thought an intervention should be delivered. The survey also aimed to understand any barriers or concerns stakeholders had regarding the adoption of mHealth following pregnancy.

Understanding possible differences in experiences and views between women and their HCPs, particularly around the kind of support desired and the features preferred was important at this stage of the project. For example, social media use among UK women is high, with 93% of 16–24-year-olds and 88% of 24–34-year-olds classing themselves as active users (ONS, 2020). Literature suggests that pregnant women use and value social media to gather information and seek peer support regarding their pregnancy (Naveh & Bronstein, 2019; Oviatt & Reich, 2019). However, midwives have expressed concerns about the accuracy and misinformation shared online (Dalton *et al.*, 2014). In addition, prior research also shows discrepancies between the features included in weight management interventions and those desired by the general population wishing to lose weight (Solbrig *et al.*, 2017).

No existing validated questionnaire enabled the collection of data to answer the research aim and objectives. Therefore, the 12-item questionnaire (Appendix D) was developed by myself and reviewed by my supervisory team specifically for this study to help develop an understanding of key stakeholder's views on the use of mHealth to support women following a pregnancy complicated by GDM. No attempt was made to assess internal consistency or construct validity of the questions prior to data collection. The concepts of NPT (Murray et al., 2010) were used to help guide the questionnaire content. In particular, NPT was used to include questions aiming to understand what experience women and their HCPs had already with using mHealth (cognitive participation), and what desires stakeholders had for future support delivered via mHealth (coherence). The decision on the number of questions to include in the survey was a compromise between gaining enough relevant data and overloading participants within a one hour time period. The phrasing of the questions and multiple choice answers was, in part, determined by the character limit imposed by the GoToWebinar polling functionality used to deliver the survey.

The survey was embedded in a webinar. A webinar is an online communication system that is used to facilitate video conference in a real-time and interactive format (Wang, 2008). Webinars were commonly used for training and learning through a virtual classroom style environment (Jones *et al.*, 2009). According to Wang (2008), a webinar *"provides a nearly face-to-face environment that increases participant's social presence and facilitates multi-level interaction"*.

A study in Canada found webinars were a good alternative to face-to-face focus groups, facilitating data collection with participants dispersed across a wide

geographical area, within a short time frame (Chong *et al.*, 2015). Authors report that the webinar supported interaction among participants and enabled the ability to capture non-verbal interactions between them. In addition, Jones *et al.* (2017) found good engagement from student nurses who were asked to respond to multiple choice questions during a webinar focused on the inclusion of digital patient feedback in the nursing curriculum. Since the onset of the COVID-19 pandemic, the use of video calling platforms, such as Zoom, for qualitative data collection has become more common place (Lobe, Morgan & Hoffman, 2020). However, using video calling technology, including webinars, to augment quantitative data collection (such as a survey) is still relatively limited.

Expert Involvement

Two diabetes midwives working at the local NHS Turst Hospital were involved in the design development and conduct of this study. These experts were involved in making sure the content of webinar presentation and the questions in the survey were acceptable and applicable to both women and HCPs. Midwives also provided expert clinical support and panel discussion during the webinar.

Participants

Key stakeholders in gestational diabetes were defined as the following:

- Health care professional involved in the care of women experiencing GDM this includes but is not limited to; midwife, dietician, health visitor, nurse, diabetologist, obstetrician, endocrinologist

- Student in the healthcare professions
- Women with self-declared diagnosis or past diagnosis of GDM

Inclusion criteria for webinar survey participation

- Self-declared as fitting into one of the key stake holder categories (as above)
- 18 years or older.

Recruitment

Participants were convenience sampled and were recruited to join the webinar using a mixture of social media, existing project contact database, personal contacts and snowballing. Emails advertising the webinar, including a registration link were sent to HCPs that were part of an existing project contact database (Jones *et al.*, 2019) and personal contacts of the research team. Twitter was used to target stakeholders through other professional accounts such as Diabetes UK. Tweets included the webinar time and date as well as a link to register. The online platform 'Mumsnet' was used to post adverts for the webinar in threads focused on GDM. Similar adverts were posted onto Facebook, targeting local mums and baby groups and groups for GDM. On searching Facebook for relevant 'groups' a group for women experiencing GDM in the UK was found, that included 16,000 members. This group, and some others, were private, meaning only people experiencing GDM were allowed to join. Where this was the case, the administrator or owner was emailed, or sent a Facebook message to explain the purpose behind the webinar and ask for an advert to be posted on my behalf. Group owners were generally receptive to my messages and were happy to post adverts into their groups. Recruitment to the webinar took place between 15th Feb 2019 and April 29th, 2019.

Sample Size

The target sample size for the survey was based on feasibility and experience of past webinars where 60-70 people was thought to have been a successful webinar.

Answers from 70 participants would have allowed the estimation of the question 'Which of the following would you be most likely to use, or as a HCP recommend using, to help you live a healthy lifestyle after having a baby?' with a confidence interval of $\pm 9.4\%$ if the estimate was 80%. This would have been of sufficient precision for this stage of the overall study. A larger sample would increase confidence levels, however recruiting larger numbers was not feasible for this study.

The final sample size for webinar attendance was 29 participants, and 28 took part in the survey. This meant that no statistical analyses were performed on data as the sample size was too small to generate sufficient confidence. The retention rate from registration to participation (35%) is discussed in the above section (5.2), however, engagement in the survey and possible solutions and described in more detail in the discussion section below (section 6.3.4).

Data collection

Data were collected through completion of the survey questionnaire, online, during the live webinar. Nominal categorical data were collected using 12 multiple choice questions.

Procedure

Participants were able to register to take part in the webinar using a link provided to them on their invitation advertised to them using one of the recruitment methods described above (Appendix D). After the participant registered they were sent an email including information, written in lay terms, regarding the purpose of the study, why they have been asked to take part, what their participation will involve, details of their right to withdraw and contact details of the research team. Accessing the webinar required participants to download the GoTo Webinar software. This software is free of charge to download and full instructions are provided during registration process.

The webinar was presented by me and two diabetes midwives who provided expert clinical support and panel discussion. I developed the content of the webinar in collaboration with my supervisory team and the two diabetes midwives who provided feedback and suggestions (presentation available in Appendix D). The content of the webinar was designed to introduce stakeholders to the topic of mHealth for GDM and present some existing resources and ideas for postpartum support. The content was carefully scheduled around the 12 questions so that any information provided in the presentation and discussion so that it did not, as much as possible, bias participant responses.

The 12-item survey, embedded within the webinar was administered to participants via the 'polling' functionality available on the webinar software platform, Go To Webinar (www.goto.com/webinar). The questions and multiple choice answers were pre-uploaded before the webinar began. Webinar participants were asked to respond to the 12 multiple choice questions at various points during the webinar. The final question in the survey sought to gain consent to use responses for research purposes.

The rationale of gaining consent at the end of the webinar was to allow participants to engage with the content and survey before deciding. All 28 webinar participants who engaged with the survey provided consent.

Data Analysis

Data were descriptively analysed using IBM SPSS Statistics for Windows, version 12 (IBM Corp., Armonk, N.Y., USA). No further statistical analysis was performed due to the small sample size.

6.3.3 Findings

Participant Characteristics

Eighty-six people registered, of which, 29 (35%) attended the webinar on April 30th, 2019. Attendees comprised HCPs (7), healthcare students (8), women with experience of GDM (8) or 'other' (6) (Table 12). Of the seven HCPs, two were diabetes specialists located in secondary care, three were midwives, four classified as 'other'. Of the students, five were from the midwifery discipline, two classified as 'other' and one did not answer. None of the women with experience of GDM were currently pregnant, four had experience of a pregnancy complicated by GDM in the last twelve months and three had experienced GDM more than 12 months ago. One did not answer the question.

Participants were located in Cornwall (3/29), South West UK (7/29), elsewhere in the UK (8/29) and elsewhere in the world (2/29). Nine stakeholders did not answer the question regarding their location.

Table 12. Survey participants stakeholder group

Stakeholder Group	N
Health care professional	7
Students	8
Women with history of GDM	8
Other	6

Survey Findings

When asked what mHealth they currently use or recommend, overall, stakeholders most frequently reported use for healthy lifestyle during pregnancy (Figure 14). This was followed by prevention of GDM and healthy lifestyle after pregnancy. Managing blood glucose levels during pregnancy was the least frequently reported use. Two women with experience of GDM, two HCPs and two students currently did not use or recommend any mHealth.

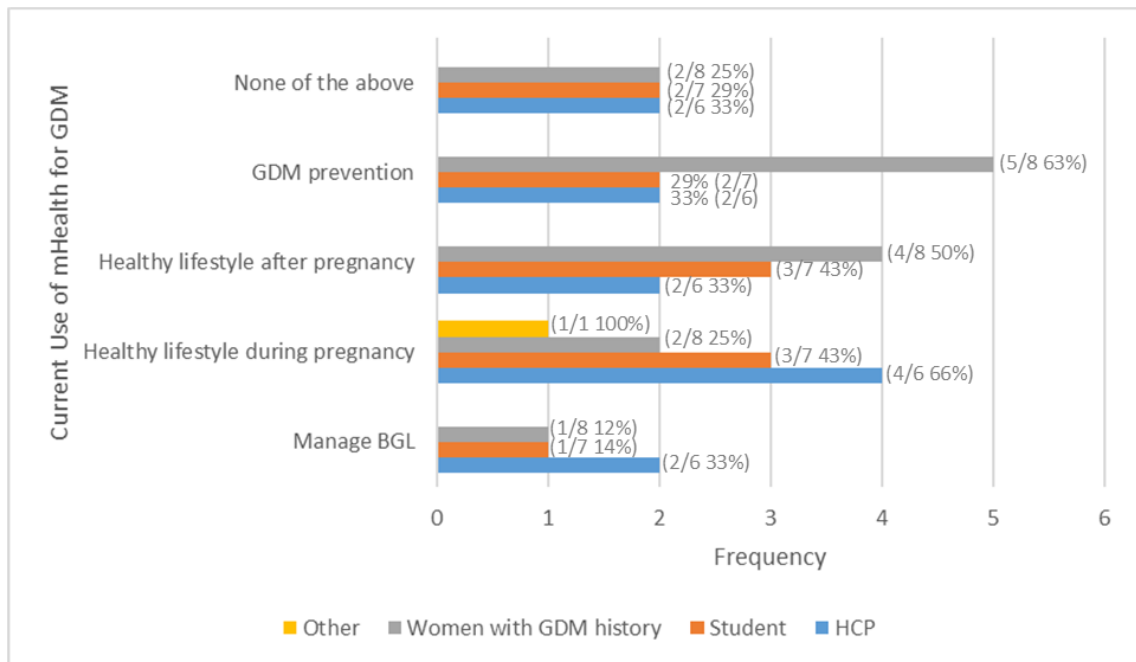


Figure 14. Stakeholders current use of mHealth including number of responses, per stakeholder category, to different uses of mHealth for GDM support. Participants were able to select multiple responses applicable to them. 8/8 Women with history of GDM answered the question. 6/7 HCPs answered the question. 7/8 Students answered the question. 1/6 'Other' answered the question.

When asked about their preferences for accessing mHealth following a pregnancy complicated by GDM, women with experience of GDM (5/7 71%), HCPs (4/5 80%) and students (4/6 66%) reported their preferred method of mHealth access as via an app and website combined, rather than an app alone, or website alone. Those identifying as 'other' (2/6 33%) also reported their preferred method of access as via both apps and websites.

When asked what type of support stakeholders would prefer to receive via mHealth following a pregnancy complicated by GDM, women with experience of GDM (5/7 71%) said they would most like mHealth to help support them to stay motivated to live a healthy lifestyle (Figure 15). Two women (2/7 29%) reported weight management as

their preferred type of support. HCPs (3/6 50%) reported weight management as their preferred type of support, followed by maintaining motivation to live a healthy lifestyle (2/6 33%). Students (3/4 75%) reported maintaining motivation to live a healthy lifestyle as their preferred type of support.

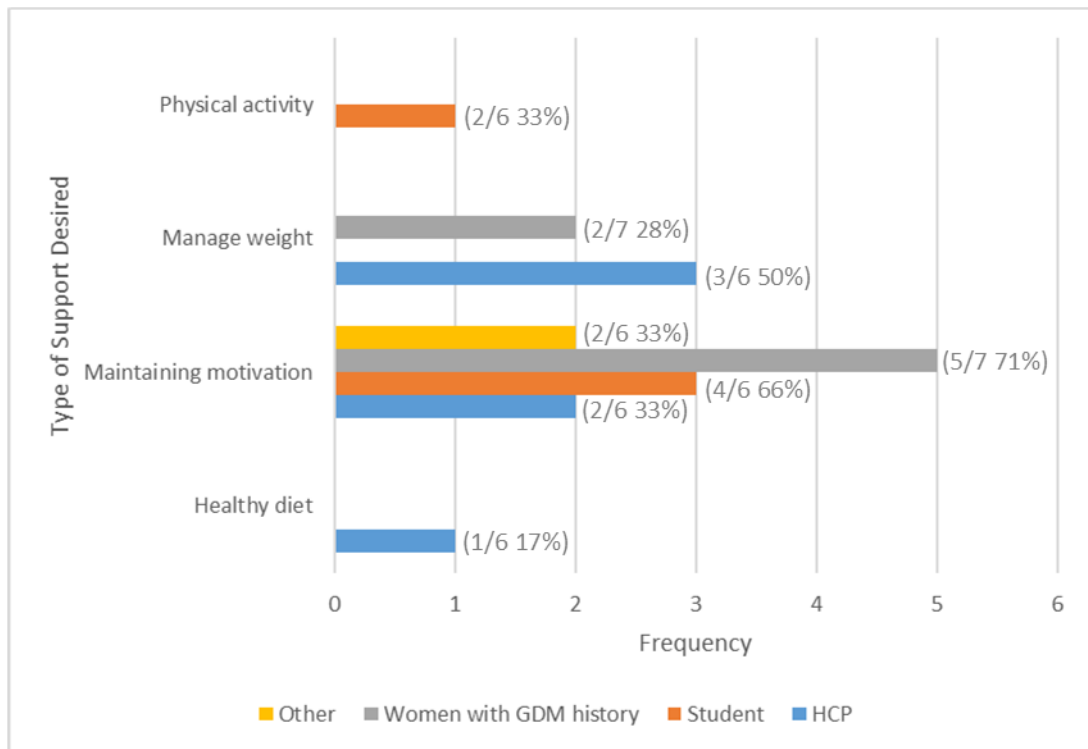


Figure 15. Stakeholder preferences for the type of support delivered by mHealth following a pregnancy complicated by GDM including number of responses per stakeholder category for preferred type of mHealth support. Participants could only select one answer. 7/8 Women with GDM history answered the question. 6/7 HCPs answered the question. 6/8 Students answered the question. 2/6 'others' answered the question.

When asked which feature stakeholders most preferred for inclusion in mHealth for use following a pregnancy complicated by GDM, women with experience of GDM (4/6 67%) reported preference for information about healthy lifestyle, followed by peer support (2/6 33%) (Figure 16). Half of HCPs (2/4 50%) reported that information about

healthy lifestyle was their preferred feature. HCPs were the only stakeholder group to report calorie counting (1/4 25%) and step tracking (1/4 25%) as a preferred feature.

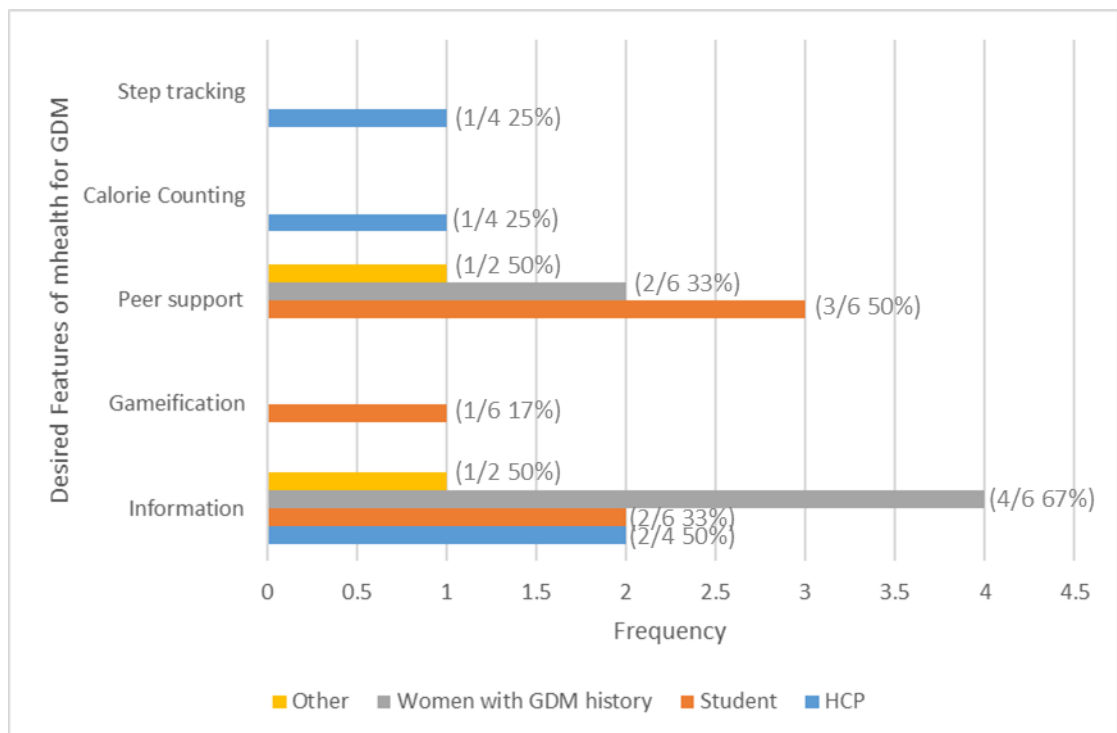


Figure 16. Stakeholders preferred features to include in mHealth following a pregnancy complicated by GDM including number of responses per stakeholder category for preferred feature to include in mHealth. 6/8 Women with GDM history answered the question. 5/7 HCPs answered the question. 6/8 Students answered the question. 0/6 'Others' answered the question.

When asked about their preferences regarding the implementation context of mHealth support, women with history of GDM (5/7 71%) felt that mHealth should be delivered in a community care setting, (1/7 14%) primary care and (1/7 14%) secondary care. Similarly, students (4/5, 80%) selected community care as their preferred implementation setting. HCPs were split in their preference between community care (2/6 33%) and secondary care (2/6 33%).

When asked what concerns stakeholders held when thinking about the use of mHealth following a pregnancy complicated by GDM, women with experience of GDM (6/7 (86%)) said they had no concerns when thinking about using mHealth and none of the students had concerns. Half of HCPS (4/5 (50%)) had no concerns but just over a third (3/8 (38%)) said a lack of credibility concerned them, with one concerned about a lack of knowledge.

6.3.4 Discussion

The purpose of this survey was to gain a preliminary understanding of key stakeholders existing experiences of mHealth use, and their desires regarding the purpose, functionality, and implementation of future mHealth for supporting women following a pregnancy complicated by GDM.

Women reported that they currently used mHealth to prevent GDM and promote healthy lifestyle after pregnancy. The women taking part were not currently pregnant suggesting their prevention activities were focused on their next pregnancy. With limited implementation of postpartum or interconception interventions in practice (Chapter 7, study 3b), these findings suggest women may be using existing or commercially available mHealth solutions. The ability for existing diabetes self-management apps to meet the needs of women diagnosed with GDM, has been assessed (Tassone *et al.*, 2020). Authors found very few apps contained evidence based educational content or tracking tools, nor did they integrate with electronic health records, suggesting a need for more tailored solutions (Tassone *et al.*, 2020). In addition, studies evaluating apps for diabetes (Hoppe, Cade & Carter, 2017) and pregnancy (Brown *et al.*, 2018) suggest poor quality and lack of appropriate BCTs.

Thus, questions remain regarding what mHealth interventions women are using and if they meet their needs. HCPs reported that they currently recommended mHealth for promoting healthy lifestyle during pregnancy. Interestingly, few said they currently offer mHealth for blood glucose management, a key area of interest for much of the literature related to mHealth for GDM (Chapter 5, study 1).

In line with research demonstrating weight and BMI as a risk factor for progression to T2DM and recurrent GDM (Bao *et al.*, 2015; Sorbye *et al.*, 2020), both women and HCPs reported wanting interventions to support weight management, following a pregnancy complicated by GDM. Over half of women also reported wanting help to maintain motivation. In line with this finding, a group of adults in the general population wanting to lose weight, all freely stated desire for motivational support for increasing physical activity and losing weight activity (Solbrig *et al.*, 2017). However, few mHealth interventions, for both during and after pregnancy complicated by GDM, were found to incorporate BCTs related to motivation (Chapter 5, study 1). Only two face-to-face interventions for diabetes prevention have significantly incorporated motivational interviewing (Reinhardt *et al.*, 2021; Ferrara *et al.*, 2016).

With regards to preferences on the type of features to be included in mHealth to support women after a pregnancy complicated by GDM, some differences (although not statistically demonstrated) between women and HCPs were observed. HCPs were the only stakeholder group to report preference for calorie counting and step tracking, while women thought information and peer support were more important. It has been observed that those in the general population disliked features that supported calorie counting and were looking for support that enabled them to autonomously manage

their weight, meaning they wanted something to keep themselves motivated to do the required behaviours, rather than help with the behaviours themselves (Solbrig *et al.*, 2017). Interestingly, peer support was not a feature commonly found in existing mHealth for GDM (Chapter 5, study 1), suggesting current mHealth solutions may require a broader focus to meet motivational and peer support needs.

Responses to the survey suggest that stakeholders had preference for the delivery of mHealth for support following a pregnancy complicated by GDM, to take place in community-based services. A current lack of published evidence, including real-world evaluations, means it is difficult to gain a thorough understanding of how, when, and where postpartum and interconception support is currently implemented (Chapter 5, study 1). Several studies have demonstrated good engagement with interventions soon after delivery (Kim, Kim & Shin, 2021; Lim *et al.*, 2021). However, learning from evaluation of mHealth for use during pregnancy (Borgen *et al.*, 2019), large loss to follow-up postpartum means that this relatively early timing needs to be balanced with women's barriers to engagement, including the pressures of new motherhood (Nicklas *et al.*, 2011). The survey implemented in this study did not give an option for implementation during pregnancy, a shortcoming considering evidence suggests earlier delivery of interventions for T2DM prevention is linked to greater efficacy (Momsen *et al.*, 2020). In addition, the transition from maternity to primary care is consistently reported as fragmented for women (Parsons *et al.*, 2018) and HCPs (Rayanagoudar *et al.*, 2015), thus, further in-depth investigation of barriers and facilitators to mHealth adoption, following birth, is warranted among both professionals and women.

Most participants had no concerns regarding the use of mHealth for women following a pregnancy complicated by GDM. Those that did, cited lack of credibility as a concern. Concerns about misinformation spread, particularly via social media platforms, have been reported in the midwifery community (Dalton *et al.*, 2014) and having a 'validated' app has also been seen as a facilitating factor for the adoption of nutrition and diet apps among professionals (Vasiloglou *et al.*, 2020). Indeed, in a systematic review of factors affecting the adoption of mHealth among health professionals found completeness, relevance and accuracy were influential (Gagnon *et al.*, 2016). Evidence also suggests engagement with postpartum T2DM prevention interventions is higher when delivered by a HCP, possibly because of increased trust and perceived credibility (Lim *et al.*, 2021). Indeed, a recent study found first-time mothers receiving app delivered support and guidance through pregnancy and 6 months following birth, felt the app and included information was reliable as it was provided by professionals (Bailey *et al.*, 2022). However, in line with our finding that few women had concerns, evidence suggests that pregnant women in general are not actively assessing the validity of the content of pregnancy apps, or considering issues related to security and privacy of personal information that apps collect (Lupton & Pedersen, 2016).

Strengths and Limitations

A strength of this study was the use of a novel data collection method as a way of engaging stakeholders, including hard-to-reach postpartum women, in research activities. The webinar was conducted before the outbreak of COVID-19 in a time where there was little insight into the application of webinar or video calling technology to augment data collection for research or evaluation purposes. Since the

onset of the COVID-19 pandemic, the use of video calling platforms for qualitative data collection has become more common place (Lobe, Morgan & Hoffman, 2020).

However, its use for quantitative data collection (such as a survey) is still relatively limited. The output from this study has enabled us to gain a preliminary understanding of understanding of stakeholder desires for mHealth to support women following a pregnancy complicated by GDM. These findings are open to triangulation with further data collected across different stakeholders using different methods (Chapter 7).

A significant limitation of this study was the small sample size. It was estimated that responses from 70 participants would have given sufficient power for this stage in the project. However, despite 89 registrations, only 29 people attended the webinar and consented to have their survey responses analysed. Limited translation from registration to attendance could be reflective of a number of factors including forgetting (although email reminders were sent) and competing priorities. Those who registered were able to playback the webinar using a link provided in a follow-up email but were not able to take part in the survey as this functionality was only available on the live version. However, for this stage of the research, only a preliminary understanding was desired and although the sample size was much smaller than hoped, the findings from this survey will be triangulated with further qualitative data (Chapter 7).

Although all 29 attending the webinar gave consent for their data to be used, engagement in the survey was limited. Compared to a standard online survey, the webinar required participants to be online for longer, perhaps accounting for our low completion rates (52%). In addition, the GoToWebinar platform restricted question

characters, number of response options and did not facilitate free text answers, limiting the survey set-up.

Using predominantly online recruitment methods, may mean that our participants were already using technology and thus our findings are not representative of the views of those who are not technological enabled. For example, the Go To Webinar platform required participants to download software before gaining access, which may have prohibited some from joining. Although for a different purpose, research regarding the use of online video consultations for healthcare appointments found one-click access was key to increasing participation and satisfaction (Wherton *et al.*, 2020).

Implications

With the limitations of this study in mind, there are several implications of the findings from the survey. Firstly, both HCPs and women currently use mHealth for various purposes, but with lack of formally developed and implemented interventions (for both during and after pregnancy) it remains unclear what resources are being used and in what contexts. Evidence suggests commercially available apps for both pregnancy and diabetes are often low in quality and may not be tailored (Tassone *et al.*, 2020; Hoppe, Cade & Carter, 2017; Brown *et al.*, 2018). Thus, questions remain if existing mHealth resources meet women's and HCP needs.

Although both women and HCPs suggested mHealth for postpartum support might be best delivered in a community care setting, with limited detail enabled by the survey, further exploration of existing working practices around mHealth implementation and

the barriers and facilitators to mHealth adoption in practice is warranted. This is particularly important as previous evidence suggests interventions for T2DM prevention among women with prior GDM that are delivered by a HCP could be more effective (Momsen *et al.*, 2020; Lim *et al.*, 2019). Furthermore, concerns regarding credibility were noted by both women and HCPs in this survey, suggesting any future mHealth intervention would need to be recommended by a credible source, such as a HCP.

Understanding accessibility of online platforms remains an important question as conducting research online holds potential to exclude those not digitally enabled. For example, during the pandemic, uptake of online GP consultations has rapidly increased, however, the importance of ease of use and reliability are key factors for effective implementation and adoption (Wherton *et al.*, 2020). As the use of internet research methods becomes more widespread, in part due to the COVID-19 pandemic, continuing to evaluate their implementation will be important for understanding any impact on recruitment and retention and for whom they make research opportunities most accessible to.

6.4 Chapter Summary

The first section of this chapter focused on understanding if engagement, recruitment, data collection, and retention of key stakeholders, were feasible through a webinar. The webinar attracted and retained women with history of GDM into a follow-up study, but the embedded survey was less successful at capturing quantitative data. Questions remain if synchronous online technologies provide increased value and engagement over other methods. Findings from the embedded survey, although from

a small sample, suggest women and their HCPs desire mHealth to support weight management following pregnancy, that provide support to maintain motivation. Triangulation with in-depth qualitative data is needed to further understand what existing resources are being used, if they meet women's and HCPs needs, and what barriers both stakeholders face during adoption and implementation.

The following chapter (Chapter 7) goes on to describe in-depth qualitative enquiry into women's and HCPS's experiences and views of using mHealth before, during and after a pregnancy complicated by GDM. Triangulation of the findings from studies conducted during phase one of the project (studies 1, 2a, 2b, 3a, 3b) are presented at the end of chapter 7 along with their implications for phase two of the project.

Chapter 7 (Phase 1) Qualitative exploration of key stakeholder views and experiences of using mHealth for GDM (study 3a & 3b)

7.1 Overview

This chapter presents two studies (3a and 3b) that sought to qualitatively explore the experiences and views of women and their HCPs on the use of mHealth before, during and after a pregnancy complicated by GDM. The findings from the survey, discussed in chapter 6, suggested that both women and HCPs desired a postpartum weight management intervention that supported women to remain motivated. However, with a limited sample size it was important to triangulate these findings with further in-depth enquiry using qualitative methods.

Women's experiences are presented first in the form of a published manuscript (study 3a), followed by HCPs experiences presents as a manuscript currently under review (study 3b). An overall summary of phase one of the project is provided at the end of this chapter followed by a chapter summary.

7.2 How do women with a history of gestational diabetes mellitus use mHealth during and after pregnancy? Qualitative exploration of women's views and experiences (study 3a)

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7.2.1 Abstract

Background

Women experiencing gestational diabetes face challenges during and after pregnancy that could be supported with mobile health. Mobile health isn't routinely implemented, and little is known regarding its use to aid information seeking, peer support and behaviour change. Understanding women's experiences of mHealth is critical to ensuring acceptance and use, particularly with relation to postpartum and interconception periods, where support is currently lacking. This study therefore aimed to explore the views and experiences of women with previous gestational diabetes, on using mHealth resources before, during and after pregnancy. Women's expectations for future mHealth were also explored.

Setting

Ten female participants from across the United Kingdom, experiencing GDM within the past five years, were convenience sampled from a group of individuals participating in

a webinar. The webinar about technology to support GDM management was advertised online and all of those who registered were invited, via email, to take part.

Design

Women's views and experiences were explored using semi-structured telephone interviews. Audio recorded data were transcribed, coded and analysed using NVivo 12. Thematic analysis was used to analyse data, creating main and sub-themes. Data are presented in narrative form.

Participants

Ten women living across the United Kingdom who had experienced gestational diabetes within the past five years, participated.

Findings

All ten women used mHealth, valuing social media for dietary information and peer support. Few mHealth resources were recommended by professionals and women discussed discontentment with the information they provided. Information found online was often valued over that provided by professionals. Some women used apps for behaviour change, but disliked certain features and poor engagement hindered their use. Women desired an app to overcome lack of motivation and prepare them for future healthy pregnancies.

Key Conclusions

Information provided to women by professionals was viewed as 'limited' and mHealth resources were rarely recommended. In response, women used social media to meet informational and emotional needs. Postpartum behaviour change is important to women and could be facilitated with tailored mHealth focused on increasing motivation. To maximise adoption and engagement future mHealth should be integrated with existing resources women value and be co-produced with professionals.

Implications for practice

Current lack of engagement in mHealth for GDM by HCPs means opportunities to influence or contest poor information are missed. We recommend increased participation by professionals to reduce opportunities for information miss-spread and reliance on peer driven information. Increasing digital confidence among professionals to support women navigate online spaces and take part in co-design is recommended.

Keywords: Gestational diabetes mellitus; mHealth; Social media; Qualitative research; Interviews; Women's health

7.2.2 Introduction

Gestational Diabetes Mellitus (GDM), carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy (WHO, 1999), will be experienced by 16% of women in the United Kingdom (UK) (Diabetes UK, 2019). GDM is a significant predictor of pregnancy complications and lifetime risk of Type 2 Diabetes and metabolic syndrome (Kaaja & Rönnemaa, 2008).

Effectively managing blood glucose levels during pregnancy is central to improving maternal and neonatal outcomes (Kelley *et al.*, 2015), but requires intensive clinical input and puts significant demand on women (Parsons *et al.*, 2018). As well as managing blood glucose levels women must navigate a plethora of new information and enact significant changes to their diet, making diagnosis a stressful time (Draffin *et al.*, 2016). As well as encountering challenges during pregnancy, it is estimated that up to 60% will develop type 2 diabetes mellitus within five years and 30-84% will experience GDM in a subsequent pregnancy (Kim, Newton & Knopp, 2002; Kim *et al.*, 2007). Thus, prevention through the mitigation of modifiable risk factors is central to improving long-term health outcomes for women and their future offspring (Tieu *et al.*, 2017). However, current provision of postpartum and interconception support is often fragmented or altogether lacking (McMillan *et al.*, 2016).

Mobile health (mHealth) interventions can offer the advantage of being low cost, tailored to individual needs and can collect and relay data to HCPs. Studies have found pregnant women commonly use their smartphones to access information to help them prepare for birth, (Sanders & Crozier, 2018), share experiences and seek support with others via social media (Sparud-lundin *et al.*, 2011; Naveh & Bronstein, 2019).

In one study a third of women experiencing GDM said they expected information about their pregnancy to come from the internet and for those aged 30 or more, the internet was perceived as the best source of information, offering more privacy and greater accessibility (Sayakhot *et al.*, 2016). Nevertheless, much less is known about how women access the internet for health, particularly via mobile phone, what they

use it for and how it may facilitate their ability to manage GDM and its longer-term health consequences.

An mHealth economics report found that apps for diabetes were one of the strongest markets within digital health innovation (R2G, 2017), however, apps targeting the prevention and management of GDM are comparatively lacking (Hoppe *et al.*, 2017). The ability for existing diabetes self-management apps to meet the needs of women diagnosed with GDM, has been assessed, however authors found very few contained evidence based educational content or tracking tools, nor did they integrate with electronic health records, suggesting a need for more tailored solutions (Tassone *et al.*, 2020). Several apps, specifically designed to facilitate self-management of GDM, have now been developed and some evidence suggests they may reduce the burden of frequent appointments and are associated with higher satisfaction with care (Mackillop *et al.*, 2018; Skar *et al.*, 2018). However, few are routinely offered to women in the UK, perhaps because of a lack of evidence demonstrating clinical effectiveness (Chen & Carbone, 2017). This is reflected in a recent survey of 63 women, most of whom had GDM, where 43/63 (73%) used smartphones to obtain health or pregnancy related information, but only 5/63 (9%) used them to actively manage their diabetes at home (Alqudah *et al.*, 2019). However, in the same survey only 16/63 (25%) expressed concerns about using an app to monitor diabetes, suggesting an appetite for digitally supported services.

Several apps have also been developed to facilitate behaviour change to prevent T2DM development (Nielsen *et al.*, 2020; O'Reilly & Laws, 2018). While the efficacy of tailored apps are yet to be determined, a qualitative study examining how primary

care services could better support postnatal women with history of GDM, found women thought technology could support flexible and personalised self-management, as well as providing information and facilitate social support (McMillan *et al.*, 2016). Many existing mHealth apps aim to support users through behavioural health changes and may represent highly scalable solutions. However, more in-depth knowledge is required regarding the functions and features women require to meet their goals, maintain engagement, and overcome reported barriers such as lack of motivation and increased fatigue in the postpartum periods (Nicklas *et al.*, 2011).

Women diagnosed with GDM face many challenges during and after pregnancy that may be supported with mHealth. Prior research suggests women are willing to use mHealth resources but there may be barriers. Apps are not routinely recommended by HCPs, and little is known about how women use smartphones to aid information seeking, peer support and behaviour change.

This study aims to explore among women with a history of GDM their views and experiences of using mHealth before, during and after pregnancy to help prevent and manage GDM and its associated long-term health outcomes. Women's expectations for future mHealth are also discussed. Identifying effective and acceptable mHealth interventions, including those already commercially available, relies on understanding user experiences and preferences.

7.2.3 Method

Study Design

Women's views and experiences were explored using semi-structured telephone interviews. Commonly used in health research (Holloway & Wheeler, 2015), semi-structured interviews allow exploration of new topics, creating rich data based on participant knowledge that may be difficult to obtain through alternative methods (Gubrium *et al.*, 2012).

Participants and Setting

Ten female participants from across the UK, experiencing GDM within the past five years, were convenience sampled from a group of individuals participating in a webinar. The webinar about technology to support GDM management was advertised online and all of those who registered were invited, via email, to take part in follow-up semi-structured interviews. The invitation offered webinar registrants to share their views and experiences in more depth. All women who responded to the invitation were interviewed and their data included in this study. It is therefore likely that because all participants either registered for, or took part in a webinar, they were experienced using technology.

Ethical considerations

Favourable ethical opinion was granted by the Faculty of Health Ethics Committee at the University of Plymouth (ref. 18/19-1088) on 16th April 2020. Informed consent was obtained from all participants prior to interview.

Procedure

Participants were provided with study information via email before agreeing to be interviewed. The researcher KE conducted telephone interviews that were audio recorded and later transcribed. Participants provided verbal consent before interviews took place, followed by written consent by post. Interviews were 30-45 minutes long, and focused on participant's experience of GDM, mHealth and their perceptions of mHealth during the postpartum period. The researcher had no prior relationship with participants.

Materials

KE recorded telephone interviews on a portable Dictaphone, and paper copies of participant information sheets, consent forms and debrief were provided by post. Participants also received a small-value shopping voucher.

Data Analysis

Interviews were transcribed verbatim and analysed by two researchers (KE and HB) using NVivo 12 (QSR International) and thematic analysis. Thematic Analysis facilitates effective and rigorous abstraction of salient themes and sub-themes from a complex and detailed textural dataset (Braun & Clark, 2006). Analysis followed Braun and Clarke's (Braun & Clark, 2006) six-phase approach and findings are presented in narrative form. An evidence table with initial themes, codes and evidence is available in Appendix E.

7.2.4 Findings

Participant characteristics

Most (8/10) women were diagnosed with GDM between 24- and 28-weeks' gestation. Two women were diagnosed at 34 weeks. At GDM diagnosis, six women were primiparous, three were pregnant for the second time and one for the third time. Not everyone had experienced GDM in all pregnancies (Table 13).

Table 13. Participant time of diagnosis, number of children and GDM pregnancies and status of attending postpartum type 2 diabetes screening. HbA1c = glycated haemoglobin

Participant	Time of diagnosis	No. of children	Postpartum blood glucose screening
P1	24 weeks	1 child	Attended screening
P2	28 weeks	1 child (11 weeks into second pregnancy)	Refused OGTT* at 6 weeks because of breastfeeding. Attended HbA1c** test at 12 weeks
P3	34 weeks	1 child	Attended postpartum screening
P4	26 weeks	3 children (5 pregnancies, 1 GDM pregnancy with third child)	Attended screening
P5	28 weeks	1 child	Attended screening
P6	28 weeks	2 children (2 GDM pregnancies)	Attended screening
P7	28 weeks	1 child	Refused OGTT* because of breastfeeding. Plans to attend annual HbA1c** test
P8	25 weeks	1 child (11 weeks into second pregnancy)	Attended screening
P9	34 weeks	2 children (GDM in second pregnancy only)	Attended screening
P10	28 weeks	2 children (GDM in second pregnancy only)	Attended screening

Key Themes

Through thematic analysis, three key themes were identified from the data (Table 14): mHealth for blood glucose monitoring and control; mHealth for information seeking

and peer support; mHealth to support lifestyle change. There was some overlap and linkage observed between themes, for clarity they are presented separately. Any relationships between themes will be addressed in the discussion section.

Table 14. Overview of themes and sub-themes

Main theme	Sub-themes
1. mHealth for blood glucose monitoring and control	1.1 Access 1.2 Benefits 1.3 Desires
2. mHealth for information seeking/peer support	2.1 Informal information seeking 2.2 Facebook trumps all 2.3 Key uses and benefits 2.4 Trust of information on social media
3. mHealth for lifestyle change	3.1 Women’s behaviour change goals 3.2 Use of behaviour change apps 3.3 Dissatisfaction with behaviour change apps 3.4 Desires for future behaviour change apps

mHealth for Blood Glucose Monitoring

Access

Only one of the ten women had been given access by her healthcare team to a blood sugar monitoring app during pregnancy and one woman had received a text messaging service to monitor her blood glucose levels.

Benefits

The participant using the app (P4) reported increased awareness of blood sugars, being able to check “*glucose levels six times a day*”, she would record “*which food would make me spike*”, providing an informed approach to diet; “*I had a better idea*

on how to feed myself". The participant using the text messaging service (P9) also appeared more comfortable with the improved awareness of blood glucose levels, reporting that having to "*submit every day*", and the provision of confirmation was "*better*", to feel there was "*some sort of checking in that someone was okay*". The participant using the app (P4) described the feeling of "*being monitored*" appeared to provide "*great comfort*", and "*trust*" in the healthcare team. The increased awareness of the impact of different food also allowed her to feel "*more confident in my own body*" (P4).

A further benefit for the participant using the app (P4) was reduced attendance at hospitals; "*it was pretty awesome not to have to go to hospital every week*" further to improved correspondence with HCPs, as "*on the app, you just know that certain times during the week when they have team meetings [any issues would] get flagged up*".

Desires

Similar benefits were noted by participants who had not been able to access a monitoring service. Two participants reported "*it would be great to have an app that linked direct to the hospital*" (P2), and "*sent that information*" (P3), again reporting the potential for an app to reduce attendance at "*frequent appointments*" (P2), "*so that you didn't have to go and take your folder in like once a week*" (P3). A digital solution to monitor blood glucose levels therefore seemed desirable, with perceived benefits including; increased monitoring, trust, confidence, communication and reductions in hospital attendance.

mHealth for Information Seeking and Peer Support

Informal information seeking

Information seeking at diagnosis was a large part of all of our participants' experience of using mHealth to support themselves at the time of diagnosis. However, women's experience at diagnosis varied, many reporting a delay between receiving a diagnosis and receiving information leading them to do their own research using the internet; *"so I had about a week and a half I think, after I'd been diagnosed, before I got any advice. But in the meantime I did a lot of googling and found gestationaldiabetes.co.uk and the Facebook group"* (P7). The wait for advice was linked to *"anxiety"* (P4), with conducting *"research"* (P4) perceived as a solution. When information was received from HCPs following diagnosis, participants reported it was often too basic or inappropriate. This information included *"information leaflets and the NHS website"* (P3). These two sources were described as; *"the basics"* (P9) and *"very limited"* (P6).

Facebook trumps all

All ten women reported using Facebook to access a particular gestational diabetes support forum. This Facebook group also had a website. Women reported accessing the website first, usually on a phone or a laptop and then going on to find the accompanying Facebook group, which they typically accessed using their phone. One participant described downloading another GDM app, but she felt this was obsolete after finding the Facebook Group. The benefits of accessibility via smartphone were reported, as *"you've always got your phone haven't you, so it's the easiest way to do stuff"* (P3), *"it's just kind of handy to have it in your hand"* (P4). Most women found the website and the forum themselves *"I ended up just doing research myself and found*

..... *the support group on Facebook*" (P2), or were recommended it by a friend or family member; *"my husband's friends wife had had GD and had found the website"* (P1).

Only one woman was recommended the site by a HCP with others receiving recommendations from family members, friends or mums in other online groups. The use of this Facebook group appeared directly linked to the perceived lack of suitable information from formal sources; *"I didn't know where else to look"* (P1). In contrast to negative perceptions of formal information sources, the Facebook group was *"what helped more than anything"* (P1). The page *"was the biggest help"* (P2) in enabling participants to *"manage [their] diet well"* (P2) and *"make the right choices"* (P2).

Participants reported strong emotional reactions to being able to access the information on this page; *"I honestly can't tell you, oh I'm going to get emotional now, how much that group meant to me. It was everything. I got all my information from it. I actually don't know what I would have done if I didn't have it, I probably would never have been able to stay diet controlled"* (P5).

Key uses and benefits

Many women described how they used the website and Facebook group to access information about what they term 'the GD diet'. Many attributed this way of eating and the information they found to greater dietary control of their blood glucose levels; *"it was the best thing I ever did because I'm 100% that's why I stayed diet controlled"* (P6). Participants felt without *"that website I would have definitely ended up on medication and the birth would have ended up a completely different story"* (P10).

Women also reported using the Facebook group as a resource for peer support, reassuring participants that they were “*not alone*” (P9), providing a “*constant feeling of support*” (P2). Women liked that there were others to talk to with experience of GDM and who were going through the same thing as them, creating the “*support element*” (P6). Women reported benefits of gaining real life accounts of “*other people’s experiences*” (P9), providing “*a better overview of risks associated with GD, what could go wrong potentially, and the good stories as well*” (P10). This helped participants to manage their own expectations, and advocate for their wishes, particularly around birth. The information appeared empowering, in contrast to “*the hospital [which] can limit your choices about your birth and monitoring*” (P8). Women also liked that they could talk about GDM in a ‘safe space’ without judgment and stigma that they often felt from other people and healthcare providers; “*I mean I found that I didn’t want to tell anyone really because I thought oh people were gonna say ‘oh well she’s overweight’ so then it’s easier for people to talk about it on a Facebook group*” (P2).

Women reported continuing to use the Facebook support group after pregnancy. Several actively used a separate, but linked, “*follow up group*” (P2) about postpartum life after GDM. This group did not appear to get used as much, suggesting women sought less information and peer support at this time. Some found it motivational to read about how other women were achieving their postpartum goals; “*it’s just inspiring to see other ladies who are actually succeeding at living a post GD life*” (P10), “*that does really make you think ok I wanna do that too*” (P2). Much like at the time of diagnosis, all women described a lack of support postpartum; “*there’s actually no post-birth support plan, action, anything, advice, nothing*” (P9), “*I was never given*

any advice on how to change my lifestyle” (P2). As a solution, our participants often found information on screening and lifestyle changes through the Facebook group; “it’s really a fountain of knowledge within that group, it’s a real life line” (P10). The perceived lack of information from formal sources, considering “the risk of developing type 2 diabetes [which] costs such a lot to deal with and causes so many issues” (P9) was described as “staggering” [P9]. Our participants also supported others through providing their own experiences, as “there’s so little help across the board with the NHS” (P1).

Trust of information on social media

Women reported valuing the information they found on the website and the Facebook group over that which was provided to them by their HCPs; *“because of that Facebook page, and the website and everything, I knew a lot more, because if I didn’t I would have just taken her [midwife] word for it” (P6). Trust in this information was common among all 10 women and seemed to stem from several themes, one being the information source as a person with experience of GDM. The owner of the Facebook group “has had [GDM] before” (P5), so “they know what they’re talking about” (P5). The information was also perceived as high quality; “it just seemed to be very evidence based and I could trust it” (P7). The group was also praised for being “very well monitored” (P4), with diligent admin “always there to say if someone’s giving bad advice” (P5). Further trust appeared to result from “the number of people involved” (P9) in the group, as “a hundred women all saying this one thing, from their experience” (P8) are likely to be providing trusted information. In contrast, information provided by HCPs appeared inconsistent with advice participants found online; “I think*

just the fact it [the information on the Facebook group] seemed more logical to me... it didn't seem to me that what the NHS advise would achieve the right results in terms of reducing blood sugar" (P9)

mHealth for lifestyle change

Behaviour change goals and use of behaviour change apps

Women had confidence that they had good knowledge around their risk of type 2 diabetes development and recurrence of GDM, and this appeared as a motivator for behaviour change, specifically, *"to lose weight" (P7)* and *"get myself back together with exercise and instil good eating habits" (P10)*, being *"the main thing I can do to stop myself from getting type 2 diabetes" (P7)*. The *"risk of [children] developing diabetes later on" (P10)*, also created a *"mindful" (P10)* approach to eating. Awareness of risk therefore appeared to be associated with desire to lose weight after pregnancy. However, despite wanting to enact changes postpartum, women experienced significant goal conflict that prohibited success. Barriers such as tiredness *"I'm just exhausted, all I want to do is eat rubbish" (P8)* and societal pressures *"I'm a completely valid person regardless of what my weight is" (P6)* were reported. Women described using some behaviour change apps before and after pregnancy to change their lifestyle with particular focus on the goal of weight loss *"I've used MyFitnessPal, I probably had a go at every other one going if I'm honest" (P8)*. Apps used included those for *"running" (P3)*, *"calorie" and "exercise" (P1)* tracking. One participant reported *"using apps" to be "quite helpful" (P3)*, but there was limited reported success.

Behaviour change apps often do not meet women's needs

Women reported that behaviour change apps tried previously had not met their needs. Women *“got bored”* (P3) of the apps; *“I’ve used weight watchers it was nice but it wasn’t very exciting either”* (P4). Apps were also perceived as over complicated and requiring too much commitment; *“I find the app err, a bit cumbersome, you have to type in the exact word and I have to mind read the search engine”* (P4); *“my fitness pal was just annoying because it was loads of input and you didn’t seem to get much out of it”*; *“I’ve never managed to do it for a long period, because of the amount of commitment”* (P9).

Women expressed a particular dislike for calorie counting apps, *“I’m not really into calorie counting”* (P9), which seemed to contradict their knowledge of eating while having GDM. Calorie counting was seen as lacking accuracy, *“I find it fairly easy to record generally what I eat, the bit I find difficult is whether you’ve eaten 400 grams or 450 grams”* (P9). However, women did like features which incorporated goal tracking and reward, feeling *“motivated by scores”* (P9). Apps without reward were criticised, *“inputting all this data and it doesn’t even go, hey, well done”* (P3).

Desires for behaviour change apps for support during pregnancy and after

With the knowledge that currently available behaviour change apps often did not meet women’s needs we asked women what they would desire from support delivered via an app. For during pregnancy, women expressed a desire for an app which would provide *“things like recipes, you know maybe giving you ideas, as you can get very much bogged down in like sticking to the same dinners (P2)”*. Women requested specific advice related to GDM dietary needs and for the app to provide *“warnings (P10)”* when entering different stages of pregnancy. Women also expressed a

particular desire to receive postpartum support, particularly focused on weight management, and to help *“prepare your body”* for *“another child”* (P10), to get into *“the best position if I am going to have a third baby to stop that happening again”* (P9). Some expressed concerns that this would need to be done with sensitivity. Women expressed a desire for app based support to keep them motivated; *“just something to keep you focused and motivated for what you’re trying to do. Coz whether you’re trying to lose weight or whatever, if I was doing it to try and avoid getting diabetes, it might help to stay on the right track”* (P3).

Women also desired an element of *“community”* (P9) and peer support and be monitored to keep them accountable. There were additional thoughts on specific considerations such as *“captions”* (P10) for videos, an app that *“doesn’t make a sound”* (P10), this would *“be a lifesaver ... you could read or whatever while you’re doing midnight feeds”* (P10).

7.2.5 Discussion

This study aimed to explore women’s views and experiences of using mHealth before, during and after pregnancy to help prevent and manage GDM and its associated long-term health outcomes. Understanding women’s experiences and perceptions of mHealth is critical to ensuring acceptance and use, particularly with relation to postpartum and interconception periods where support is currently lacking.

Evidence suggests pregnant women, commonly use their smartphones to access information and seek support via social media (Eades *et al.*, 2020; Audrain-Pontevia and Menvielle, 2018). This study found women with experience of GDM engage in

similar activities where accessing information and peer support via smartphone was viewed as convenient, beneficial and trustworthy. These findings suggest already available resources could provide highly scalable ways of supporting women's informational and peer support needs at diagnosis and beyond. However, online peer support and information seeking was frequently self-directed and, in contrast to other findings (Sayakhot *et al.*, 2016), was typically driven by delay and/or discontentment with information provided by HCPs. Trust in online health communities can positively impact trust in healthcare providers (Audrain-Pontevia & Menvielle, 2018) but sometimes can develop support for ideas in conflict with evidence-based healthcare. For example, a recent analysis of posts related to GDM on two open online forums found discussions contained information unlikely to support prevention of type 2 diabetes (Eades *et al.*, 2020). Our participants displayed frustration with the inconsistencies between the information they found online and that received from their HCPs, ultimately placing value on the information they found online.

The lack of recommendation from HCPs seen in this study may reflect concerns about accuracy and misinformation shared online, particularly on social media (Dalton *et al.*, 2014). However, Facebook groups enabled women to rationalise feelings of guilt and shame, and increase empowerment by reading others' experiences. This finding is echoed in the analysis of an online community for pregnant women with diabetes, where empowerment was created by sharing information about births (Naveh & Bronstein, 2019). The use of online peer support groups may have increased during the COVID-19 pandemic where face-to-face interactions have become less accessible.

Therefore, healthcare providers should consider how the information women find online may affect the way women would like their pregnancies to be managed and provide guidance to women on how to navigate online information. However, HCPs may not be confident doing this and therefore, educators should consider inclusion of digital professionalism within curriculums in order for HCPs to develop skills on how to advise the best use of digital resources and judge quality of information. In turn, those who manage online resources could consider actively involving HCPs in the development and running of such resources, in order to increase trust (Sparud-lundin *et al.*, 2011). For example, a recent study examining the use of a social media group mediated by qualified midwives found that pregnant women found the group to be convenient and accessible (McCarthy *et al.*, 2020). Women trusted the moderators to provide reliable information and for many members, the group was their primary source of pregnancy information. Engagement from HCPs in the online spaces women with GDM inhabit will be critical to reducing reliance on peer-led information that has the potential to spread of misinformation.

As well as informational and emotional needs, diagnosis of GDM prompted new behaviour change goals. Changing diet to control blood glucose levels was seen as preferable to medication use, and women described a need for mHealth to support this. Few women had access to blood glucose monitoring apps at the time of their pregnancy, but, in line with previous findings (Mackillop *et al.*, 2018; Skar *et al.*, 2018) they were seen as beneficial for reducing the burden of frequent appointments and improving communication with HCPs. Increased body confidence and trust in HCPs were also discussed as benefits of app use. In addition to a blood glucose monitoring, women expressed a desire for an app to provide information on diet, meal plans and

recipes that complemented the information they found on social media and websites, but in a more easily accessible format.

Behaviour change goals after pregnancy were also important to women. Women reported using existing apps to support weight management, but described limited engagement and frustration with some features. O'Reilly et al. (2018) found women experiencing GDM were familiar with existing fitness apps, and expected common features to be present in specifically developed solutions. However, participants in this study cited calorie counting as contradictory to the way they had managed their diet during pregnancy. Dislike of calorie counting features has been found among the general population who desired weight loss, citing higher need for motivational support (Solbrig *et al.*, 2017). Indeed, despite expressing a desire to make changes postpartum, women encountered competing demands and lack of motivation after giving birth. Women desired mHealth support at this time, with particular focus on striving for a future healthy pregnancy. An app was suggested that could increase motivation to sustain changes, incorporating features such as rewards and peer support. Growing pressures within primary care (Baird *et al.*, 2016), coupled with the COVID-19 pandemic, means innovative ways to reduce the risk of progression from GDM to recurrent GDM and type 2 diabetes are timely.

Limitations

Participants were recruited from webinar registrants, meaning they are likely to be experienced and confident using the internet. Data on women's backgrounds was not collected and thus other factors including age and ethnicity, may impact women's views and experiences with mHealth. Further research is therefore required in order to

understand mHealth usage, particularly for those who are digitally excluded, and have lower levels of health literacy.

Because most women were dissatisfied with the information provided by HCPs, it is possible that the behaviours of this group are distinct from those who are satisfied. However, our findings do represent the experiences and needs of a subset of women for whom mHealth resources provide easily accessible and acceptable support.

Conclusions

Findings demonstrate women's new informational and emotional needs, prompted by GDM diagnosis, could be met with existing mHealth resources. However, HCPs must become involved in order to overcome current mistrust in the information they provide and prevent possible spread of misinformation. Behaviour change was important to women during and after pregnancy, however, existing apps often did not meet their needs, suggesting requirement for tailored solutions. In particular, increased postpartum support was desired that would help to overcome lack of motivation and prepare women for future healthy pregnancies. To maximise adoption and engagement, newly developed solutions should be integrated with the online spaces women currently use and be co-produced with HCPs.

7.3 “It's a question of how clinicians and patients use technology, rather than the technology itself” - UK healthcare professional's views and experiences of using mHealth to support women with gestational diabetes (study 3b)

(Under Review in Applied Nursing Research)

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7.3.1 Abstract

Background: mHealth to support prevention, management and long-term implications of gestational diabetes mellitus (GDM) is growing in traction, however, adoption in practice appears limited. Healthcare professional (HCP) attitudes and perceptions are key determinants for successful implementation. Only two studies have explored professional's views of using mHealth to support women experiencing GDM. This study explored HCPs experience of using mHealth to manage GDM. Barriers to mHealth use were also discussed, including provision of mHealth support postpartum.

Method: Thirteen UK HCPs with a range of 1-38 years in practice, participated in semi-structured interviews. Thematic analysis was used to analyse data.

Findings: HCPs recognised ability for mHealth to deliver information, self-management and peer support. Adoption in practice was limited to resources perceived to be credible. Barriers to adoption included lack of knowledge and skill; organisational cost and credibility. Professionals stressed mHealth must be adaptable and minimise inequalities. No HCPs offered mHealth to support women postpartum. All HCPs discussed shortcomings in conveying long-term implications of GDM and some suggested need for postpartum weight-management interventions to provide behavioural change and motivational support.

Conclusions: Although mHealth for GDM was met with positivity, HCPs expressed limited digital confidence and were apprehensive about credibility. Increasing capacity for digital activities in practice is required to meet women's expectations and take advantage of mHealth resources they already value. HCPs recommendations and concerns should critically inform the development of future mHealth, particularly for postpartum weight management, where support is lacking and a narrative of GDM as a short-term disease prevails.

Key Words: Gestational diabetes mellitus; mHealth; Qualitative research; Healthcare professionals; Adoption; Healthcare provider

7.3.2 Introduction

Gestational diabetes mellitus (GDM), defined as carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or first recognition during pregnancy (WHO, 1999) affects 16% of women in the UK. Consequences include fetal

macrosomia, or birthweight greater than 4000g, which is associated with increased likelihood of birth injuries, cesarean delivery, and shoulder dystocia (Reece, 2010). Infants are also more likely to experience respiratory distress syndrome, neonatal hypoglycemia, hyperbilirubinemia, polycythemia, and hypocalcemia (Reece, 2010). In addition women who develop GDM are 10-fold more likely to develop type 2 diabetes (T2DM) than their normoglycaemic counterparts (Vounzoulaki *et al.*, 2020) and are 35-85% more likely to experience GDM in subsequent pregnancies (Kim *et al.*, 2007).

Effective prevention and management of GDM is crucial for improving maternal and infant outcomes, however, women report difficulties managing the condition once diagnosed, as well as making the necessary lifestyle modifications post-delivery (Carolan-Olah *et al.*, 2015; Nicklas *et al.*, 2011). Indeed, women with history of GDM encounter many barriers to engaging in face-to-face lifestyle interventions postpartum, including time and financial constraints, childcare duties, fatigue, and lack of motivation (Nicklas *et al.*, 2011). Thus, delivery of care via mobile health (mHealth) has been suggested as an optimal way of supporting this population both during and after pregnancy (Phelan, 2017). Commonly used mHealth technologies include smartphone apps, wearable sensors, and social media use.

mHealth interventions can offer the advantage of being low cost, tailored to individual needs and can relay data to HCPs. Several apps, specifically designed to monitor and track the blood glucose levels of women with GDM, have been found to reduce the burden of frequent appointments and are associated with higher satisfaction with care (Mackillop *et al.*, 2018; Skar *et al.*, 2018). mHealth to address prevention of GDM

recurrence (Bogaerts *et al.*, 2017) and type 2 diabetes (O'Reilly & Laws, 2019; Seely *et al.*, 2020) are under early development, however their efficacy is yet to be determined.

Despite advances in development of mHealth for GDM, limited adoption within current practice is reflected in the results of a recent survey where only 8.8% of women experiencing GDM were using apps to actively manage their diabetes at home (Alqudah *et al.*, 2019). Women in the UK with experience of GDM are not routinely offered remote blood glucose management via an app, nor are they frequently directed to online resources by their HCPs (Chapter 7, study 3a). Instead, the study found women highly valued social media for peer support and dietary information, often over and above that provided by their HCPs. These findings suggest a lack of involvement by HCPs could result in overreliance on peer-led information that has strong potential for misinformation spread. Midwives have reported concerns about accuracy and misinformation shared online, particularly on social media (Dalton *et al.*, 2014), suggesting potential barriers to recommending or being involved in such resources. However, a recent study has demonstrated the success of involving qualified midwives as moderators in a social media group for providing information and advice to pregnant women without diabetes (Mcarthey *et al.*, 2020).

In March 2021 the Royal College of midwives launched a position statement that a digital midwife should be present in every maternity service in the UK within the next 12 months, stating: "*investing in digital technology and giving staff the training and equipment they need will lead to better care*" (Health Tech Newspaper, 2021). Because nurses and midwives represent one of the largest groups of technology adopters within healthcare organisations, their attitudes and perceptions of mHealth are key determinants for successful implementation (Hilz, 2000). In a meta-analysis identifying

factors associated with mHealth adoption by HCPs, authors found multiple factors at the individual, organisation and contextual levels impacted mHealth adoption including; familiarity with the tech, design and technical issues, perceived usefulness, cost, time, privacy and security worries, risk-benefit analysis, ease of use, and interaction with others (Gagnon *et al.*, 2016).

To our knowledge only two studies to-date have explored HCP views on using mHealth to support women experiencing GDM. Exploration of a culturally tailored self-management app found HCPs thought the app was appropriate and convenient, and included reliable and trustworthy information (Garnweidner-Holme *et al.*, 2018). Interestingly, women using the same app perceived there to be a lack of input from HCPs and inconsistencies between app information and that provided by their professionals (Skar *et al.*, 2018). Another study involving US based healthcare providers found high acceptance for the use of mHealth to deliver behavioural and self-management interventions to women with gestational or T2DM during pregnancy (Jackson *et al.*, 2021). However, lack of knowledge surrounding apps and concerns regarding credibility were barriers. HCPs mostly desired co-produced solutions that allowed for clinical integration.

With seemingly limited adoption of mHealth in practice and only a handful of studies aiming to understand the perspective of healthcare providers in the implementation of mHealth for GDM, this study aims to explore the experiences of UK HCPs using mHealth to support women to manage GDM and its associated long-term health outcomes. This study is timely as the recent outbreak of COVID-19 has demonstrated the possibility and need for technology driven services (Murphy, 2020). Barriers to mHealth use were also discussed, including provision of mHealth support postpartum.

It is hoped that this study will assist in further understanding some of the contributing factors associated with the uptake of mHealth to support GDM and its longer-term implications among UK based professionals. This knowledge will help facilitate the development and adoption of future co-designed mHealth solutions for women.

7.3.3 Method

Study Design

HCP's experiences were explored using semi-structured telephone interviews. Semi-structured interviews are commonly used in health research (Holloway & Wheeler, 2015), and allow exploration of new topics, creating rich data based on participant knowledge that may be difficult to obtain through other methods (Gubrium *et al.*, 2012).

Ethical considerations

Favourable ethical opinion was granted by the Faculty of Health Ethics Committee at the University of Plymouth (ref. 18/19-1088) on 16th April 2019. Informed consent was obtained from all participants prior to interview.

Participants and setting

In total, 13 participants were interviewed from across the UK. Participant characteristics and their organisation characteristics are described in Table 15. Most HCPs were specialist diabetes midwives (6/13, 46%). Number of years in practiced ranged from 1-38 years (median 26 years). Initially participants were convenience sampled from a group of individuals participating in a webinar. The webinar about technology to support GDM management was advertised online and all of those who

registered were invited, via email, to take part in follow-up semi-structured interviews. The invitation offered webinar registrants to share their views and experiences in more depth. However, due to limited response we widened our recruitment strategy using an email invitation sent to a professional network and one social media group for diabetes midwives. It is worth noting that three of the interviews (P1-3) were conducted prior to outbreak of COVID-19. The pandemic has resulted in the rapid implementation of technologies within everyday healthcare practice (Murphy, 2020) and this should not be ignored when looking at data from P1-3. All HCPs who responded were interviewed and their data included in this study.

Table 15. Participant profession, number of years in practice, type, and size of organisation

ID	Profession	Number of years in practice	Type and size of organisation
P1	Community Midwife	17 years	Acute (medium)
P2	Diabetes midwife	30 years	Acute (Small)
P3	Midwife	34 years	Acute (medium)
P4	Diabetes specialist midwife	26 years	Combined acute and community (large)
P5	Maternity support worker	1 year	Acute (medium)
P6	Diabetes midwife	34 years	Acute (Medium)
P7	Diabetes midwife	5 years	Acute (small)
P8	Community Midwife becoming a diabetes midwife	21 years	Acute (medium)
P9	Consultant Physician	30 years	Acute (medium)
P10	Lead diabetes specialist midwife	34 years	Acute (large)
P11	Diabetes specialist nurse	38 years	Acute (large)
P12	Diabetes specialist nurse	10 years	Acute (medium)
P13	Diabetes specialist nurse	33 years	Acute (small)

Procedure

Participants were provided with study information via email before agreeing to be interviewed. KE conducted telephone interviews that were audio recorded and later

transcribed. Participants were first read the participant information, and provided verbal consent, further to written consent by post. Interviews were 30-45 minutes long and focused on participant's experience of using technology in their practice of supporting women with GDM. The researcher had no prior relationship with participants.

Data Analysis

Interviews were transcribed verbatim and analysed using thematic analysis by two researchers (KE and JM). An example transcription of an interview from this study is available in Appendix F. NVivo 12 (QSR International) was used to facilitate organisation of data. Thematic analysis facilitates effective and rigorous abstraction of salient themes and sub-themes from a complex and detailed textual dataset. Analysis followed Braun and Clarke's six phase approach (Braun and Clarke, 2006). Codes were ordered and grouped into salient themes with supporting quotes associated. Following independent coding, a consensus meeting between the two coders was held and an investigator (JS) to fine themes and resolve any discrepancies through consensus discussion.

7.3.4 Findings

Key themes

Through thematic analysis, four key themes were identified from the data (Table 16): COVID-19 and new ways of working; Online information and social media – a paradox for professionals; doing what is best for women; context is key. There was overlap and linkage observed between themes, but for clarity they are presented separately. Any relationships between themes are addressed in the discussion section.

Table 16. Overview of themes and sub-themes

Main themes	Sub Themes
1. COVID-19 and new ways of working	1.1 Changes to practice and rapid implementation of technology 1.2 Benefits and risks for women and HCPs 1.3 Sustainability of new working practices
2. Online information and social media – a paradox for professionals	2.1 Provision of digital information and education 2.2 Social media benefits and concerns
3. Doing what is best for women	3.1 Meeting women’s needs using mHealth 3.2 Engagement and equality of access 3.3 Postpartum support falls short
4. Context is key	4.1 Individual factors 4.2 Organisational factors 4.3 Managing expectations and adaption

COVID-19 and new ways of working

Changes to practice and rapid implementation of technology

Ten (P4-P13) participants were interviewed 7-8 months after the first lockdown in England on the 26th of March 2020 due to the outbreak of COVID-19.

Changes in practice to reduce the spread of the virus led to the rapid implementation of video and telephone consultations. Participants described this rapid change as “a challenge” (P4) but most felt that it grew easier over time: “...I think at the beginning it was harder and as time went on, we got better at it and the women got better at it” (P10)

Just over half (7/13) moved to video consultations and described that “in the main they work well” (P4). Technological “glitches” (P9) did occur but most women “had the facilities” (P10) and skills to make it work. Some HCPs described problems as being “logistical issues rather than actually affecting the clinical care” (P12).

Benefits and risks for women and HCPs

HCPs discussed the benefits for women including reducing anxiety for those *“frightened of coming in”* (P10) and convenience for those who *“live like an hour and half drive to get here”* (P10). Some also expressed how less face-to-face contact created more autonomy for women who *“just got on with it”* (P5) and this provoked thought around *“do we really need to have all these clinics that we did before?”* (P7). For those using video consultations, there were *“contextual benefits of being able to see women in their own environments”* (P9). For those using telephone consultations, some described being concerned about *“missing certain things”* (P8) or women might not open up about the *“complexities around them”* (P6). There was also concern that women may not *“grasp”* (P8) the importance of advice given to them as seriously compared to a face-to-face session and that as restrictions eased *“the people who are poor with their antenatal care are even more difficult to get hold of”* (P8) leading to potential for widening healthcare inequalities.

Sustainability of new working practices

There were mixed responses as to whether using mHealth to facilitate remote consultations would remain in post-pandemic practice. Continued use would be dependent on women’s needs and HCPs would *“gauge from the conversation whether they [women] might need more support”* (P7). Other professionals’ preferences were also cited as a factor related to continued use; *“We’ve got some doctors that really really like it. And you’ve got a couple of the doctors that don’t want to do it, because that’s not what they’ve done”* (P10).

Online information and social media – a paradox for professionals

Provision of digital information and education

All HCPs recognised the importance of providing information and education regarding GDM management. HCPs experience of directing women to online information varied. However, many innovated their information delivery methods because of COVID-19. Some moved to video-based education, taking advantage of existing materials on “YouTube” (P13), while others made their own; “, *we’ve got an online video of me showing people how to use a blood glucose meter...and, all our new COVID information that we email out to them to try and save paper and to make sure they don’t lose it all*” (P6).

Nearly all (11/13) professionals recommended organisation backed websites such as NHS choices and Diabetes UK as they provided “*good, evidence-based information*” (P2) (Figure 17). However, it was noted that the advice on those websites is not “*specific for GDM patients*” (P12) and thus might be too generic. In addition, there was still heavy reliance on paper-based information, particularly leaflets, within practice. This was despite professionals recognising that “*they never look at them*” (P1).

Some professionals thought digital information might engage women more; “*it’s interesting...how many ladies have said, ‘Oh, yeah, I’ve got the pack... I’ve watched the video, but I haven’t read anything’*” (P13). However, others thought that engagement with information regardless of format would have be balanced with “*work and life and other children*” (P1) and that caution would need to be exercised to not leave women “*overwhelmed with information*” (P13).

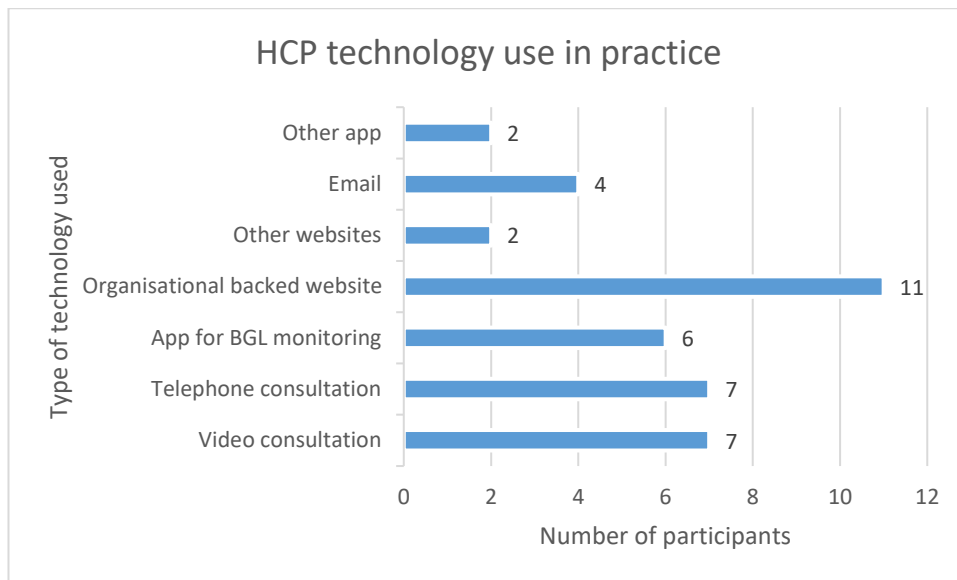


Figure 17. Technologies used by HCPs during their practice supporting women experiencing GDM

Social media benefits and concerns

Professionals were particularly aware of women’s use of social media for accessing information and peer support; *“A lot of my women, go on Facebook, and join a support group on Facebook...it’s quite nice for them to probably talk to non-professionals...or other women that are going through the same thing”* (P10). HCPs recognised that social media use could provide *“benefits...in terms of emotional support for the diagnosis”* (P7) and was *“a bit of a lifeline for some women”* (P6).

However, there was concern that women would be more likely to use social media if they didn’t feel *“well supported”* (P4) by their HCPs and that more vulnerable women would be *“drawn to that sort of place”* (P6) where *“terrible things”* (P1) and *“horror stories”* (P5) could be shared. This concern was related to the fact that they’re *“not all run by healthcare professionals”* (P11) and *“because it doesn’t come with any boundaries, there’s no governance on it”* (P6).

Actively recommending social media to women was seen as risky and linked with fears that women might access inaccurate information; *“I am probably slightly sceptical of the information that they sometimes can get off...Facebook”* (P11). Concerns regarding Facebook were also expressed via fears that women were talking about them on social media groups; *“all I know is, the other year, one of my patients said to me that they've been talking online about me. I definitely don't want to know about that”* (P4).

However, professionals also reported that it was hard to *“compete”* (P6) with social media and that it could be an effective platform through which to push evidenced based information to *“millions [of]...hard to reach women”* (P9).

Doing what is best for women

Meeting women's needs using mHealth

Despite reservations around social media, HCPs were *“open”* (P11) to implementing and adopting technologies if they are *“accessible, and user friendly”* (P9) and made things *“better for women”* (P11). For example, nearly half (6/13) of HCPs were offering women the use of a blood glucose monitoring app as part of their practice (Figure 17) which *“for the majority of people, it works really well”* (P8). HCPs saw benefits for women in terms of reduced *“travelling and inconvenience for the women coming to the hospital”* (P2) and increased empowerment through *“instant feedback”* (P5) that could translate postpartum; *“if you take responsibility for yourself during the pregnancy, you're more likely to do so long term”* (P4). Benefits also extended to professionals who could *“easily”* (P7) review blood and better *“communicate”* (P8) with women and data was *“easier to share amongst the team”* (P11).

Postpartum support falls short

This subtheme focuses on discussion around the support HCPs offer women following their pregnancy and the barriers they face in doing so. This subtheme also focuses on the type of support HCPs perceived would be beneficial to women.

Most HCPs discussed importance of postpartum support for women but felt frustrated as what they currently offer *“absolutely falls short”* (P13); *“I don’t even think they get a leaflet or anything. I mean I think they go back to their GP a few weeks later but, and that’s it and there isn’t any follow up...it’s like go on then, carry on”* (P1). Most HCPs said they would *“love to”* (P2) provide more support but there would need to be significant collaboration with primary care who have *“most contact”* (P7) with women postpartum. However, lack of systems to *“track and monitor”* (P9) women as well as use of *“different computer systems”* (P11) in primary care were cited as barriers.

Engaging women at this time was seen as difficult as women were just *“focusing on their baby”* (P1) and support would need to *“help keep them motivated along the way”* (P9) so that women could be in *“the best health that they can be before they have another baby”* (P2). Others thought women’s barriers could be supported more psychologically *“you can tell them twenty times but there’s some other barrier”* (P6) and that *“behavioural change coaching”* (P6) could be beneficial. Most HCPs also recognised the potential for technology to support women after having their baby, to help increase engagement; *“I think in this generation this is how it works; they want to get more information themselves”* (P8). However, only one participant had plans for introducing an app during pregnancy for postpartum support *“so it can all be in place for once their baby is born”* (P4).

Engagement and equity of access

Despite the recognition that *“a lot of women work really well with their phone”* (P8), there were concerns surrounding the engagement of *“hard to reach groups”* (P3); *“out my patient group, the ones who are using them [mHealth] are the ones who least need them”* (P9). Although, some thought that women who experience issues engaging with the technologies would be *“the people who have problems anyway”* (P12).

With regards to women’s access to mobile phones, HCPs reported high levels of ownership *“everyone, no matter what socioeconomic status they’ve got, they’ve got a phone”* (P1). However, some worried that widespread use of technology could *“widen health care inequalities”* (P9). Factors that played into this concern were language, culture, cost and individual differences such as learning difficulties and hearing loss. HCPs reported that *“accessibility”* (P2) was key and that it was a *“challenge”* (P10) to find apps available in languages other than English.

Context is key

This theme focuses on the contextual factors that impacted, both positively and negatively, HCPs ability to implement mHealth for GDM. These included factors at the individual level such as age and knowledge; factors at the organisational level such as cost and existing systems; and wider issues around women’s expectations and adapting mHealth use to best suit women’s and HCPs needs.

Individual factors

Outside of blood glucose monitoring only three participants recommended apps for diet or antenatal services (Figure 17). Some HCPs felt that if they did not *“have time to get to know these things”* (P11). This was partly due to lack of time, but also because *“there’s so many things out there, that it’s just impossible to keep up with them all”*

(P9). One HCP knew of apps because *“women show me”* but were not happy to recommend them because they didn't have *“much experience of it”* (P6).

As well as lack of time, knowledge and experience, *“age”* (P12) was another characteristic associated with technology adoption; *“it probably goes with my age that I probably don't promote the apps and things”* (P11). Some also thought a lack of skill to be a barrier; *“IT literacy I think is a real issue”* (P3).

Organisational factors

A major barrier to the adoption of mHealth for remote glucose monitoring in particular was the cost incurred at the organisational level being *“not affordable”* (P9). However, some thought this might be justified if it showed to be *“clinically effective”* (P6).

Others had concerns around *“how slow the NHS is in technology”* (P3) and that external apps might not be *“compatible”* (P12) with existing NHS IT infrastructure.

However, having people in the team who were *“proactive with all kinds of technologies”* (P11) enabled those who described themselves as *“not being very good at these things”* (P10) to follow their lead. With others support the process of introducing technology was seen to be less intimidating; *“I think if we can support each other and it doesn't become so scary, then it makes things easier to use”* (P3).

Managing expectations and adaption

HCPs recognised that more women were expecting parts of their pregnancy to be managed digitally, but expressed concerns that it might be hard for service providers to keep up; *“So if you created demand and need and expectation, does it make our lives easier or does it make it harder because we can't deliver on it?”* (P3). Related to this, concerns were discussed around overreliance especially if HCPs did not monitor

use; *“And so part of our philosophy is that we're here to support women to really take control of their lives, for their long-term health. But, if they're relying on this little bit of tech that isn't monitored, 24/7, then that could be problematic”* (P4).

Overall, there was a feeling among HCPs that mHealth could not be a one fits all solution and that *“people need, so many, many different things..._some people are very tech savvy and some people just don't like it”* (P11). However, one specialist diabetes midwife reflected that it was less about the technology but more about how it was used; *“I think... it's a question of how the individual clinicians and patients use that technology, rather than the technology itself”* (P4).

7.3.5 Discussion

This study aimed to explore experiences of UK HCPs using mHealth to support women to manage GDM and its associated long-term health outcomes. Understanding HCPs experiences and barriers is crucial to future implementation, particularly in relation to postpartum use where support is currently lacking. HCPs embraced use of mHealth tools as a way of supporting women with GDM, however, adoption and implementation within practice, varied. One of the main drivers for mHealth adoption was recognition of doing ‘the best’ for women, particularly regarding creation of empowerment and autonomy around women’s ability to self-manage. However, just under half of participants offered women an app to manage their blood glucose, and only two recommended other kinds of apps. Professionals experienced multifaceted barriers to mHealth implementation at individual, organisational and contextual levels. For example, some felt that the sustainability of mHealth would depend on clinician preference, and things like lack of knowledge and familiarity prohibited them from recommending different apps to women. However, having colleagues within a team

who championed technology use was seen as a significant facilitator. These barriers and facilitators to implementation are akin to those found across other HCP groups (Gagnon *et al.*, 2016).

Despite limited implementation, COVID-19 did initiate a shift toward digital service provision and although initial challenges were associated with rapid implementation, this process prompted a sense of what could be achieved digitally within DIP services. It has been suggested that remote consultations will become the 'new normal' (Murphy, 2020). However, our participants stressed mHealth could not be a one size fits all solution, rather it's use would have to be adapted to limit inequalities and meet individual needs. Formal evaluation of mHealth implementation is therefore required to provide data to support continued use and for whom. In addition, gathering evidence of mHealth impact will be important for supporting HCPs to advocate adoption at organisational levels. For example, current evidence suggests many apps for monitoring blood glucose do not significantly improve glucose levels compared to paper-based monitoring (Balaji *et al.*, 2020), however, women report other effects such as increased trust, confidence, and communication (Chapter 7, study 3a) and increased satisfaction with care (Mackillop *et al.*, 2018; Wickramasinghe *et al.*, 2019). Thus, obtaining wider outcomes that influence future adoption will be important.

Only two HCPs recommended websites that were not developed by the NHS or other official organisation, a practice linked to fear of compromising professional security. Concerns regarding lack of credibility and the importance of including reliable information within mHealth for GDM were found by both Jackson *et al.*, (2021) and Garnweidner-Holme *et al.*, (2018). Worries regarding the spread of misinformation via social networking sites have been found previously within the midwifery community

(Dalton *et al.*, 2014). However, women with GDM in the UK who experienced dissatisfaction with information provided by HCPs relied heavily on Facebook communities for information and peer support (Chapter 7, study 3a). Midwife moderated Facebook groups have shown to be successful in providing information and advice to pregnant women without diabetes (Mcarthey *et al.*, 2020).

Increasing HCPs ability to become involved in online spaces women already use, such as Facebook, could be an advantageous way of delivering credible information to a large audience of women. Indeed, increasing capacity and capability for digital activities will be essential for existing and future workforce to prepare for a digital future (Topol, 2019). Inclusion of digital professionalism within curriculums and continued professional develop could not only increase digital skills and confidence but also promote the normalisation of 'digital' in practice. For example, lack of knowledge or confidence regarding the recommendation of apps could be overcome by educating professionals on resources such as ORCHA that aim to guide safe digital adoption in an unregulated digital health market (<https://orchahealth.com>).

In line with HCPs in the USA who care for women with GDM (Jackson *et al.*, 2021) clinical integration was important for our participants. Lack of interoperability was seen as a barrier, particularly postpartum, where systems to monitor, track and communicate with primary care are currently not in place, creating further disparity in an already fragmented transition for women (McCloskey *et al.*, 2019). Despite wanting to provide support to minimise long-term risks, nearly all participants described shortcomings at conveying GDM as a long-term disease, and some described difficulties in having conversations with women regarding their weight.

Midwives have previously reported barriers to the implementation of guidelines related to gestational weight gain including limited time, inadequate training (Schmied *et al.*, 2011) and fear of offending (Laws *et al.*, 2015). Postpartum weight retention and gain has been associated with increased risk of T2DM development (Bao *et al.*, 2015) and reoccurrence of GDM in subsequent pregnancy (Sorbye *et al.*, 2020). Thus, the current narrative of GDM as a short-term disease, requires a paradigm shift to enable HCPs to address lack of information and support available to women to reduce their long-term risks. In order to achieve this, HCPs should be involved in the co-production of interventions to ensure the development of meaningful and engaging mHealth tools, that are more likely to be implemented effectively in practice. Indeed, HCPs included in this study recommended a need for weight management interventions that go beyond information provision and help women with behavioural change and motivation.

Limitations

HCPs were recruited using digital means including a webinar and social media, meaning they may have been experienced with digital technologies. However, our findings suggest lack of digital skills among HCPs and any existing skills, such as social media use, did not necessarily translate to working practices. This study included an experienced, older, population of mostly midwives who are likely to have influence in clinical settings, either informally or formally and thus understanding their views and barriers to the adoption of mHealth for GDM is important. However, it is possible that their views are not reflective of those who are younger or newer to practice.

Triangulation with quantitative data, such as a nationwide survey, could provide further validity to our findings. Indeed, this study did not include HCPs working in

primary care and thus their important perspectives warrant further investigation, particularly regarding postpartum mHealth interventions.

Conclusions

Overall, use of mHealth for GDM was met with positivity from HCPs who were predominantly driven by doing the best for women. While COVID-19 demonstrated the possibilities of what could be achieved digitally, normalisation in practice was not routine, and professionals experienced known barriers to implementation.

Overcoming barriers will be crucial for GDM care to prepare for a digital future.

Evidence should continue to evaluate if, and for whom, mHealth is effective, as this will enable HCPs to better advocate for adoption and implementation. Improving digital capability and capacity among HCPs will be critical for supporting the wider recommendation of resources and involvement in the online spaces women value. In a time where face-to-face information provision and peer support has reduced, co-production of digital interventions with HCPs will be important to reducing opportunities for misinformation spread as well as influencing the development of postpartum interventions, where support is currently lacking.

[7.4 Phase one reflection](#)

Phase one of this project aimed to better understand the need for, and the role of, mHealth to support women with a history of GDM following birth. It was important to undertake this phase as it was unclear what experience women and their HCPs already had with using mHealth and it was unknown if either group would desire digitally delivered motivational support. It was particularly important to understand the latter, as this type of support will only be accessed if it was perceived as needed. Gaining this

knowledge also helped to understand if existing solutions met women's needs, and what barriers might be faced during adoption and implementation.

Studies 1, 2a, 2b, 3a and 3b that made up phase one of the project provided essential data for identifying existing evidence and gaps in knowledge as well as gain an in-depth understanding of the target population. Triangulation of findings presented in this reflection is 'methodological' in that findings are considered across different data sources (survey and interviews). Triangulation is also 'participant-based' as data was collected from two different stakeholder groups (women and HCPs). Data triangulation was also achieved by collecting data using the same methods but from different participants at different times.

7.4.1 Identification of existing evidence base

Synthesis of the current evidence base suggested there was little known about the effectiveness of mHealth interventions used following birth aimed at preventing T2DM and recurrent GDM. Few interventions were developed using behaviour change theory and although some BCTs were used, only half of the 26 techniques listed in a published behaviour change taxonomy were tried. Few used motivational techniques, despite knowledge that women with GDM lack motivation following birth. An overall lack of mHealth interventions for weight management suggests further development and evaluation was required.

7.4.2 In-depth understanding of the target population

Studies 2b, 3a and 3b served to get an in-depth understanding of the target population. Key questions were: are the benefits of FITZ likely to be valued by women and their HCPs? What kind of skills and experience do women and their HCPs already have with using mHealth?

The findings from a survey of key stakeholders (study 2b) suggested women were using existing mHealth to achieve healthy lifestyle following delivery but from the survey alone, it wasn't clear what they used and if it met their needs. The survey also demonstrated that both women and HCPs wanted interventions to support weight management, following a pregnancy complicated by GDM. Over half of participants also expressed desire for motivational support. Qualitative interviews further corroborated the need for motivational support where both women and HCPs expressed a need for something different, that supported women to achieve optimal health before their next baby. Women did use apps for behaviour change but they did not meet their needs.

7.4.3 Triangulation

Desire for motivational support was seen in data collected from different two different stakeholder groups, using two different methods (survey and interviews) providing rationale for further exploration of the FITZ app, as a potential weight management intervention for women with history of GDM. The lack of motivational techniques used in in existing mHealth interventions (study 1) suggests examination of FITZ among women with history of GDM is a novel approach. Questions regarding the

acceptability, practicality and feasibility of FITZ are therefore addressed in the studies described in the following chapters (8 & 9) that make up phase two of this project.

It was also clear from qualitative interviews that social media was highly valued by women for meeting information and support needs during and after pregnancy. HCPs on the other hand, were reluctant to recommend this resource for fear of misinformation and bullying online, but knew women used and valued the social networking site. There is a strong need for further investigation into the information available on social media to understand the real risks associated with misinformation spread, and to increase the involvement of HCPs in creating and running social media groups to promote the spread of consistent and reliable information. Midwife moderated Facebook groups have previously been used to successfully provide information to women without diabetes (McCarthy *et al.*, 2021), suggesting an opportunity to provide women with GDM something similar. However, this line of enquiry was not the focus of the rest of the project, primarily because women predominantly reported using social media during pregnancy, rather than for weight management following birth. However, the use of social media to supplement FITZ is explored through the second phase of this project and is considered in chapters 8 and 9 as well as the overall discussion in chapter 10.

7.5 Chapter Summary

This chapter has focused on taking a qualitative approach to understanding the experiences and desires of women with history of GDM and their HCPs regarding the use of mHealth. While evidence presented in chapter 2 suggested there was scope for providing women with mobile motivational support, it was important to understand if

this type of support was desired by women and their HCPs, as it would only be accessed if people wanted and needed help with sustaining motivation. The work undertaken in this chapter built on work conducted in chapter 6 and provided an opportunity to triangulate findings.

Evidence from studies 1, 2b, 3a and 3b supports the potential for FITZ as a needed intervention for women with history of GDM. The following chapter (Chapter 8) describes the first study (study 4) undertaken as part of phase two of the project which aimed to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM.

Chapter 8 (Phase 2) The acceptability of FITZ among women with recent history of GDM and the feasibility of recruiting and retaining women from a diabetes in pregnancy service in South West England (study 4)

8.1 Overview

This chapter describes the methods, findings, and preliminary discussion of study four, the first stage of phase 2 of the project. Phase two aimed to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM. Part of the process for an intervention to become normalised among end-users is to understand if stakeholders perceive the intervention as a good idea and if they are prepared to invest time and energy into its use and implementation. This stage of the project sought to understand what women thought of the idea behind FITZ, if they would be willing to invest time into using it following birth and which bits, if any, they liked or disliked.

In addition, interventions aimed at postpartum women (both with and without GDM), typically focus on intervention effects, and often don't address implementation factors, penetration, reach and participation, resulting in a lack of translation from efficacy to real-world solutions (Lim *et al.*, 2020a). Thus, it was critical to understand if recruitment and retention of women with recent experience of GDM was possible from a local diabetes in pregnancy service (penetration), and if women would be willing to engage in both the research process and use FITZ following birth

(participation). The findings from this study, and study 5 conducted with HCPS (Chapter 9) would serve to inform the usefulness of continuing to investigate FITZ as a potential intervention for women with history of GDM, any developments needed to FITZ, and the design of any future evaluations.

8.2 Aims and Objectives

8.2.1 Aims

To understand the acceptability of FITZ among recently postpartum women with history of GDM including their willingness to use the app 8-12 weeks following birth, and the feasibility of recruiting and retaining women into the study from a diabetes in pregnancy service.

8.2.2 Objectives

- To explore among women with a recent history of GDM, their views and experiences of undertaking and maintaining healthy behaviour changes, including any use of behaviour change apps.
- To explore if women would engage with FITZ 8-12 weeks following birth, what they thought about the idea behind the app, and which aspects, if any, they liked or disliked.
- To assess ability to recruit recently postpartum women with a history of GDM from a diabetes in pregnancy service, as well as response and retention rates.

8.3 Methods

8.3.1 Study design

This was a mixed methods feasibility study.

The following data were collected to evaluate feasibility of the recruitment strategy:

- Percentage of women with GDM diagnosis who accepted to take part in the study following approach
- Reasons for not taking part
- Percentage of consented women remaining at different stages of the study

Acceptability, including willingness to use FITZ, was captured qualitatively through two semi-structured interviews (Figure 18). mHealth interventions are hard to evaluate, partly due to their complexity (Maar *et al.*, 2017) and often, little is known about the experiences of the technology users (Lupton, 2013). Qualitative exploration can help to uncover how an intervention is perceived by different recipients, how it may work (or not) and any unexpected effects. Qualitative studies can contribute to this process by assessing the intervention from patient and provider points of view. Semi-structured interviews are one of the most common forms of data collection in qualitative health research (Holloway & Wheeler, 2015). The benefits associated with using interviews are well documented and include the collection of rich contextual data, the exploration of new topics and access to a level of participant knowledge that may be difficult to obtain from other, more structured methods of information gathering (Gubrium, Holstein, Marvasti, & McKinney, 2012).

The first interview served to understand women's experiences with behaviour change, including any use of behaviour change apps and to introduce women to FITZ.

Understanding women's previous experiences with weight management was important as this can contribute to successful intervention development by identifying factors that may help or hinder weight-loss efforts and adherence to lifestyle programs (Delahanty *et al.*, 2012). During the first interview the opportunity was given to women to use the app in the following 1-2 weeks (Figure 18). The second Interview aimed to gain feedback on if women had used FITZ, if they liked the concept of FITZ, what barriers, if any, they experienced to using the app and any suggestions they had for improvements.

The concepts of NPT (Murray *et al.*, 2010) were used to help guide interview topics and questions. In particular, NPT was used to include questions aiming to understand if women would see the point in FITZ and think it's a good idea (cognitive participation); if women thought FITZ was different from other behaviour change interventions and easy to understand (coherence); if women would be prepared to invest time and energy into using the app (cognitive participation); if the app impacted on women's resources such as time (collective action); if women thought FITZ might be advantageous for other women (reflexive monitoring).

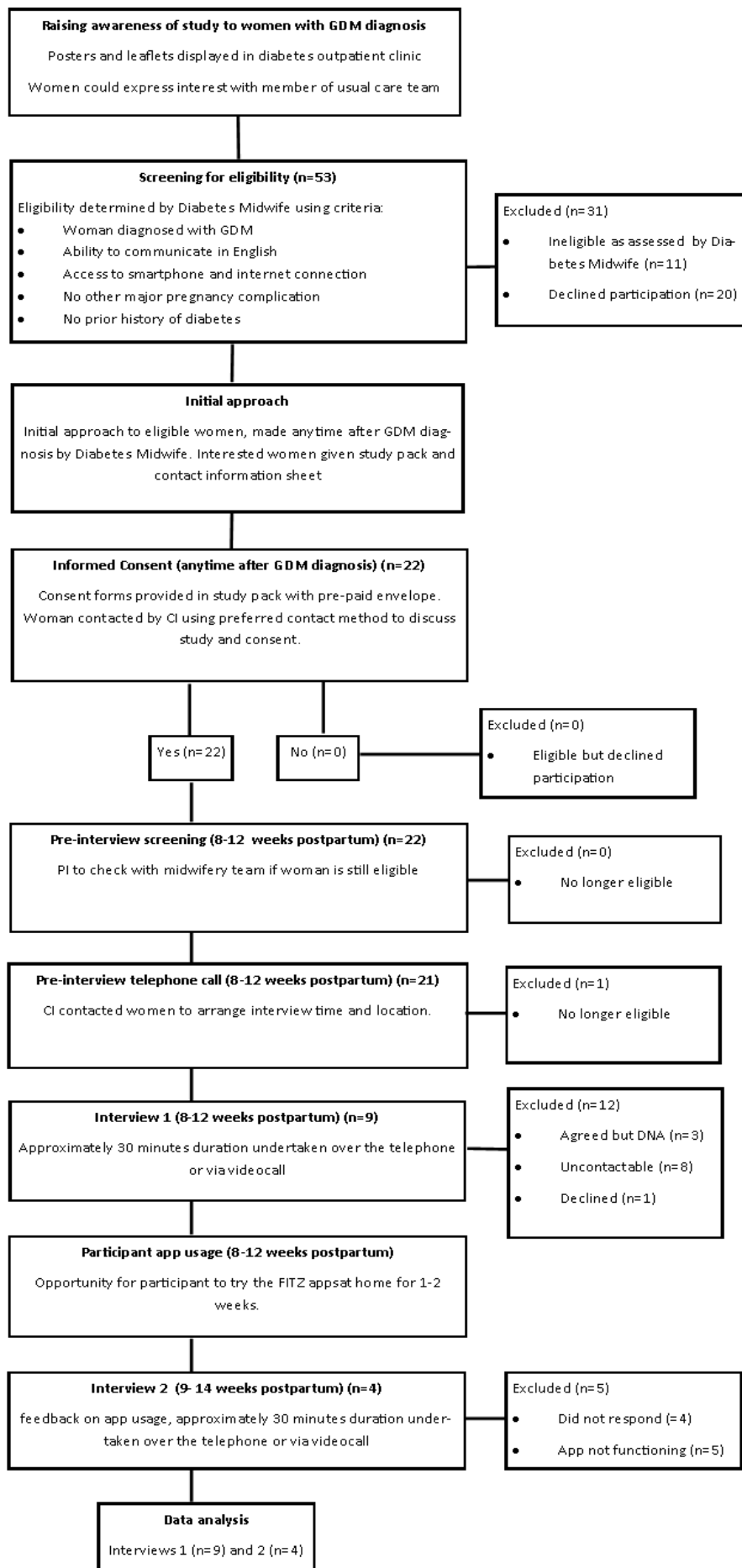


Figure 18. Study 4 flow diagram

8.3.2 Public and Patient involvement

During the development of this study a public and patient involvement session was held on 3.4.2019 and included three women with experience of GDM. Feedback from the group focused on concerns following-up women too soon, as this may result in higher drop-out rates and increased likelihood of hearing narrative around birth experiences, rather than gathering data focused on our aims. As a result, the follow-up time was changed from 6-10 weeks to 8-12 weeks. Group members also suggested the importance of using appropriate language around weight/BMI, given its sensitivity, particularly after having a baby. As a result, the term weight loss was changed to weight management in the study protocol. The interview topic guide focused on the use of the term 'healthy lifestyle' rather than specifically focusing on weight. The group also provided feedback on the appropriateness of remunerating participants with shopping vouchers. The amount of £10 per interview was deemed appropriate amongst the group.

8.3.3 Study setting

Recruitment setting

Participants were recruited from a local NHS Trust Hospital. Participants were recruited into the study at their usual antenatal diabetes clinic. This recruitment setting enabled the research team to access the desired study population and allowed for assessment of the practicalities of recruiting and retaining women from this setting for future studies involving women with GDM. It also allowed to gain understanding if

women would engage with both the app and research activities 8-12 weeks after giving birth.

Interview setting

Interviews took place via Teams or telephone to reduce possibilities COVID-19 transmission. To increase participant comfort and anonymity, women were reassured the researcher was in a private space where they could not be overheard, before the video or telephone call commenced. Full instructions on how to join a Teams call was provided to women in their study pack (Figure 19).

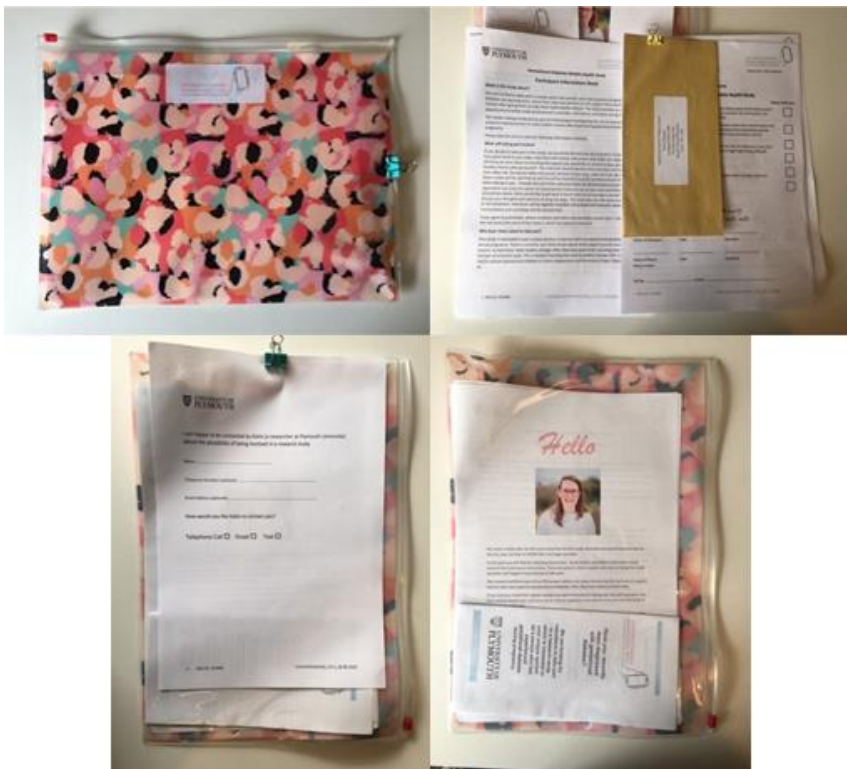


Figure 19. Study packs including study leaflet, 2x consent forms, one pre-paid envelop, PIS, introduction sheet, instruction on how to download FITZ, instructions on how to join a Teams video call, contact information preference sheet

8.3.4 Sample and recruitment

Eligibility Criteria

Inclusion criteria

- Woman of reproductive age (18-45 years)
- Confirmed GDM diagnosis
- Able to use and have access to a smartphone connected to the internet
- Able to have a conversation in English without the need for an interpreter, and able to read and understand printed information at a reading age of at least 10 years.

Exclusion criteria

- Presence of major maternal/neonatal birth complications (e.g. still birth)
- Unable to have a conversation in English without the need for an interpreter, and/or unable to read and understand printed information at a reading age of at least 10 years.
- Unable to access or use a smartphone with internet connection
- Pre-existing type 1 or type 2 diabetes

Participants

Participants taking part in this study were women with recent history of GDM, who were 8 -12 weeks postpartum. Engagement with women thus far in the project involved those at any time point following their pregnancy complicated by GDM. It was important to engage with recently postpartum women as some evidence suggests

early implementation of weight management interventions following birth is optimal for both engagement and health outcomes (Hedeager Momsen *et al.*, 2021; Goveia *et al.*, 2018). In addition, previous studies suggest recruitment during pregnancy or early postpartum can be more successful for engaging women (Dasgupta *et al.*, 2018).

Sample size

This study aimed to recruit between 12 and 20 women. While there is no consensus on an ideal sample size for qualitative investigations (Holloway & Wheeler, 2015), a recent systematic review of qualitative investigations found between 10-20 data units is the most common sample size used to reach data saturation in a purposefully sampled population (Kim *et al.*, 2017). The proposed study sample size was consistent with the material and time resources available. In the end, 22 women were recruited, and nine participants took part in study activities.

Sampling technique

Participants were recruited using a volunteer, purposeful sampling approach. This approach was based on pre-defined inclusion and exclusion criteria outlined above. Purposeful sampling, in the context of this research is defined as a sampling technique that serves an investigative purpose rather than to be statistically representative of a population (Ritchie, Lewis & Elam, 2003).

8.3.5 Recruitment

Advertising

The study was advertised to potential participants using an advertising poster and leaflet placed in the diabetes antenatal clinic. The poster and leaflet provided potential participants with brief details of the study and contact details for the research (Appendix G).

Eligibility (*any time after GDM diagnosis up until birth*)

Eligibility was determined by a diabetes midwife who was a member of the woman's direct healthcare team. Confirmation of GDM diagnosis was made using women's maternity health record.

Approach (*any time after GDM diagnosis up until birth*)

Eligible women were informed about the study by their diabetes midwife who briefly explained the purpose of the study, at women's usual antenatal appointment. This approach was typically made at 24- 28 weeks gestation, the time of GDM diagnosis (NICE, 2015). However, this varied as some women were diagnosed earlier or later in their pregnancies. If women were interested, they were given a study pack (Figure 19) (Appendix G) by their midwife who also collected information about how women would like to be contacted to further discuss taking part. Participants were told by their midwife the researcher (KE) would be in touch with them using their preferred method of contact.

Consent and Enrolment

Following initial approach, interested women were contacted, by the researcher, using their preferred contact method(s). Upon contact the researcher (KE) described the

process of taking part in more detail and asked women to return one of the provided consent forms, in their packs, using the pre-paid envelope also included in the packs, if they were willing to take-part. Women were informed the researcher would be back in touch with them around 8-12 weeks after they had their baby to arrange a day/time for the first stage of the study. Women were provided with the researchers professional telephone number and email address on their information sheet and consent forms. This is standard procedure for an information sheet, however, this was also done to help reduce the likelihood of calls, texts or emails being blocked or perceived to as a 'cold' call. Contact attempts were made a maximum of four times over a four weeklong period until the participant was deemed lost to follow-up. Attempt to make contact happened at different times of the day to maximise the chance of reaching the participant at a convenient time.

Pre-interview eligibility check (8 -12 weeks postpartum)

Prior to contacting women to arrange taking part in the first stage of the study, the researcher contacted the diabetes midwives to ensure no major maternal or neonatal complication had occurred during the time since consent. This was an important process to ensure women were still eligible to take part and future contact was still appropriate.

8.3.6 Data collection procedure

Feasibility of recruitment and retention

Recruitment and retention numbers were monitored throughout the study by the researcher and two diabetes midwives involved in approach and recruitment.

Health behaviour change experiences and app acceptability

Interview 1 (stage one)

At the beginning of the session women were informally, verbally introduced to the structure of the interview, and give a brief description of relevant terms such as 'gestational diabetes' and 'smartphone application'. Participants were reminded of their right to withdraw and leave the interview at any time. The recording device was switched on and the interview began. Participants were asked a series of open-ended questions to explore topics related to their experience of GDM, their health behaviour change goals and their views of receiving support using mHealth apps.

During semi-structured interviews the sequencing of questions was not necessarily the same for every participant and depended on the process of the interview and the responses of each individual. The interview topic guide (Appendix H) ensured the collection of similar types of data from all participants. Interview 1 lasted approximately 30 minutes.

Participants were then introduced to the concept of FITZ and offered the opportunity to download the app and use it for 1-2 weeks. Participants were reassured none of the data inputted into the app would be visible or accessible to anyone on the research team or anyone at the University of Plymouth. Participants were made aware in the

PIS that FITZ was not owned or controlled by the researcher or the University of Plymouth and thus downloading and using it was at their own risk.

FITZ

FITZ could be downloaded for smartphone operating on both android and IOS operating systems, for free (Figure 20). The app could be searched for in the Apple App Store or Google Play Store using the term 'FITZ'. Women were guided through this process during the interview and full instructions were provided in their study pack (Figure 19). Where needed, the link to the app was emailed to participants. After downloading the app, women would arrive at a registration page where they would need to log-in as a new user. From here women could use the app freely for 1-2 weeks and could continue use for as long as they desired.

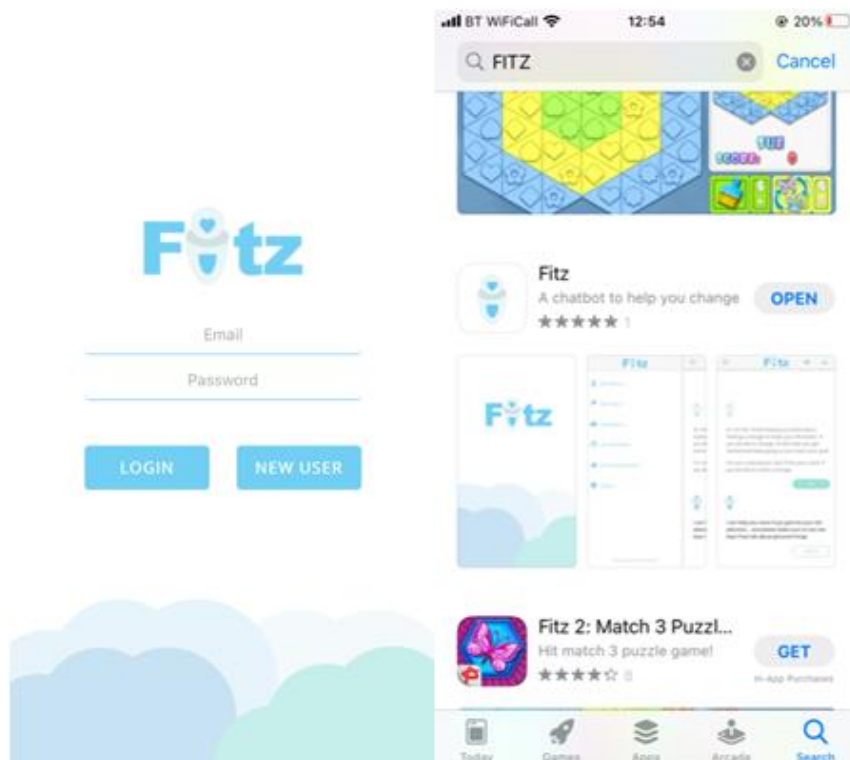


Figure 20. Screenshots of FITZ located in the apple app store and the registration page

At the end of the interview, participants were given the opportunity to ask questions and discuss anything else in relation to the topics addressed. The audio recorder was then switched off. It was discussed with the participant their preference for participation in interview two including willingness to take part, purpose of the interview, location, time and date. Participants were given a debrief sheet which provided them with support resources should they require them. Participants were reminded of their right to withdraw and to contact the study team using the information on the PIS. Participants were thanked for taking part in the study and provided with a £10 shopping voucher as a thank you.

Interview 2 (stage 2) FITZ use and Feedback

Interview two was conducted in the same manner as interview one. During this interview participants were asked a series of open-ended questions exploring their experiences of using the FITZ app (interview topic guide available in Appendix H). If women had not used the app, reasons for this were explored. Interview two lasted for approximately 30 minutes. Participants were thanked for taking part in the study and provided with a £10 shopping voucher reimbursement as a thank you.

8.3.7 Data analysis

Recruitment and retention rates

Participant recruitment and retention rates are presented using a CONSORT diagram (Shultz *et al.*, 2010) (Figure 21). Participant recruitment was calculated as: number of participants agreeing to take part divided by the number of eligible participants

approached. Participant retention rate was calculated as: number of participants remaining at different data collection points divided by the number recruited at the start of the study.

Stage one and two interviews

Transcripts of interviews underwent content analysis by KE and JS. Content analysis was selected for inclusion of frequency of theme occurrence (Vaismoradi *et al.*, 2013), and involved systematic coding and categorising of text (Mayring, 2000). As prescribed by Elo and Kyngäs (2008), researchers undertook data immersion, coding, grouping codes, generating categories, and reporting, with a focus on manifest content. Content analysis was selected for this study as it was deemed advantageous to have a numerical understanding of the thematic patterns, further to the purely qualitative themes, to understand the most common barriers related to FITZ use and any frequently occurring suggestions for improvements.

8.3.8 Protocol changes as a result of COVID-19

This study was heavily impacted by the outbreak of COVID-19 in early 2020. Thus, the final study design has deviated from the original proposed protocol. Originally, face-to-face recruitment was planned by attending the diabetes in pregnancy clinic each week and personally approaching women who had been screened for eligibility by diabetes midwives. This strategy was originally adopted as evidence suggests studies that recruited women during pregnancy or early postpartum using face-to-face methods were more successful at engaging women (Dasgupta *et al.*, 2018). To limit the spread of the virus and comply with government guidelines, I did not attend clinic, and two

diabetes midwives recruited women face-to-face instead. The location of the interview's also changed from being in-person to via telephone or videocall.

8.4 Results

8.4.1 Participant characteristics

Participants ranged in age from 28 to 45 years and had between 1 and 5 children (Table 17). Most (8/9) women had one diagnosis of GDM. All participants identified as white British.

Table 17. Participant age, ethnicity, number of children, number of weeks postpartum and number of GDM diagnoses. Those highlighted are participants who took part in both stages of the study

ID	Age	Ethnicity	No. of Children	Weeks postpartum	No. of GDM diagnoses
P2	29	White British	1	10 weeks	1
P5	41	White British	2	11 weeks	2
P8	32	White British	1	9 weeks	1
P9	45	White British	5	10 weeks	1
P12	35	White British	1	12 weeks	1
P14	34	White British	2	12 weeks	1 (second pregnancy)
P16	28	White British	1	10 weeks	1
P18	32	White British	2	11 weeks	1
P20	33	White British	3	9 weeks	1

8.4.2 Feasibility of recruiting and retaining women from a South West diabetes in pregnancy service

Recruitment rate

Recruitment took place over a six-month period from 28.01.2021 to 24.06.2021.

During this time, 53 eligible women were invited to join the study, following their diagnosis of GDM. Out of the 53 women approached, 22 agreed to take part and signed a consent form (Figure 21). Therefore, the estimated uptake rate was approximately $22/53 = 42\%$.

Reasons for not taking part

Thirty-one of the 53 women who were approached to take part did not participate. Eleven did not meet the inclusion criteria, eight of those eleven did not speak English to a level that would have enabled them to take part and three did not use a smartphone. Twenty women declined to take part. Unfortunately, the reasons for declining were not captured as recruiting midwives did not feel they had time to ask and capture reasons for why eligible women declined.

Retention to stage 1

Out of the 22 women who agreed to take part, nine took part in stage one of the study. Therefore, the estimated retention rate was approximately $9/22 = 41\%$. One participant actively declined to participate but did not give a reason, despite being asked. Eight women were uncontactable, despite trying all their contact details provided. One participant had moved, and midwives were unable to access her notes to assess if she was still suitable to contact, following birth. Three participants agreed to take part in stage 1 of the study, had agreed at time and date but did not attend.

Retention to stage 2

Out of the nine women who took part in stage one of the study, only four took part in stage 2. Therefore, the estimate retention from stage one was approximately $4/9=44\%$. Four participants did not respond to attempts to arrange the second interview and one, who wanted to take part was unable to as the app was no longer functioning for Android users.

Overall retention rate

Of the 22 women who consented to take part, four participated in all study activities. Therefore, the estimate overall study retention rate was approximately $4/22 = 18\%$.

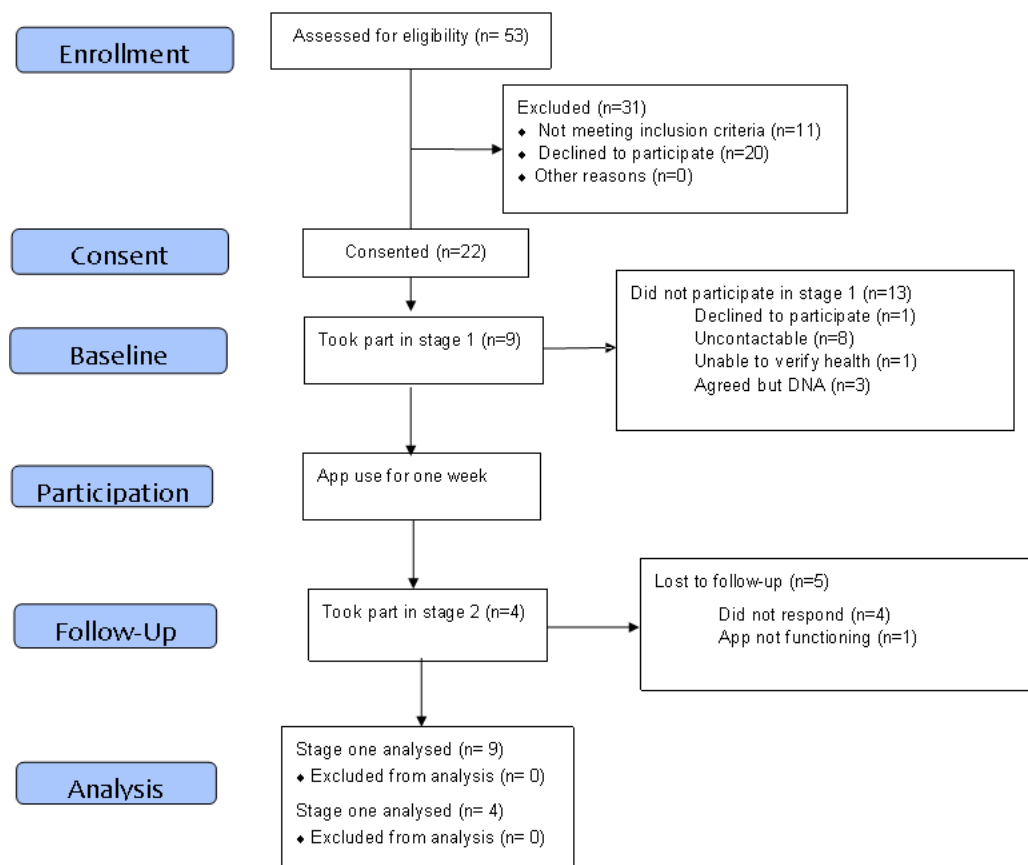


Figure 21. Study recruitment diagram (Shultz et al., 2010)

8.4.3 Stage one interview findings

Key themes

Through content analysis of stage one interviews, three key themes were identified from the data (Table 18): Behaviour change goals during and after pregnancy and App use for behaviour change

Table 18. Overview of themes and sub-themes from stage one interviews

Theme	Sub Theme
Behaviour change goals during and after pregnancy (45)	a) Women's Goals (24) b) Goal conflict (21)
App usage for behaviour change (14)	a) App advantages (5) b) App disadvantages (9)

Behaviour changes goals during and after pregnancy

The theme of behaviour change goals during and after pregnancy arose 45 times from all participants. This theme includes two subthemes, 'women's goals' and 'goal conflict'.

Women's goals

The subtheme of women's goals arose 24 times from all nine participants. Both before and after pregnancy most women (8/9, 89%) mentioned they wanted to "lose weight" (P12):

"I wouldn't have ever said that sort of like I was obese or anything. You know, she's sort of that. You always want to be that little one size less and all that malarkey" (P2).

“Like most people I have at occasions in my life wanted to loose weight. After being particularly active into my early twenties it wasn’t something I ever had to think about but after taking an office job and getting a bad injury I put on quite a bit of weight ” (P16).

“I desperately need to lose weight and get fit...there is never a time when I am happy with my weight” (P9)

Women reported achieving their weight loss goals would help them to be healthier, happier, more confident. One woman noted she wanted to make changes now to prevent possible future diabetes:

“I think its just an eye opener isn't it? Especially because there's the higher risks that I could be diabetic sort of, even now, once that comes back or later in life, so it's kind of try and do the little changes now” (P2).

Two (22%) women also said they had the goal of quitting smoking before becoming pregnant:

“Giving up smoking....which I did as soon as I found out I was pregnant with my first child and I haven’t looked back” (P18).

“So, exercise isn't the problem. It's definitely mainly my diet, stopping smoking” (P5)

Interestingly, two (22%) women said they didn’t have any particular goals following the birth of their baby and they were happy with the way things were and wanted to sustain that:

“I haven’t actively looked to make any changes to my lifestyle but obviously after having a baby things change drastically” (P16)

“I am probably healthier and fitter now than I was before having my two children if I’m being honest. I plan to continue as I am, we are out most days walking etc and going to the park so I’d like to keep that up.” (P14).

Goal Conflict

The subtheme of goal conflict arose 21 times from all nine participant. Despite wanting to make changes to achieve their goals, women reported several factors that

conflicted with this desire and prevented them from achieving their goals both before and after pregnancy. Two of the most significantly discussed barriers were related to food and motivation. Access to unhealthy food, a need for convenience due to being a busy mum and lack of willpower were all barriers related to weight management:

"I have no self control when it comes to food..... I love all things chocolate but I am trying to cut it out!" (P18)

"I think that having a baby makes this difficult as you want to have food that is quick and convenient before they wake up" (P8)

"on reflection, the amount of exercise I do isn't awful, it was more my diet, living in a city where fast food is so easy to come by" (P16).

"I'm a community carer though so sort of like the split shifts and things like that. It's so easy just to grab food" (P2)

Lack of motivation was also a significant barrier for women and was linked to tiredness and lack of will-power surrounding food and lack of time:

"There is never a time when I am happy with my weight, I am often starting and stopping diets. My struggle is motivation and time" (P9)

"motivation to keep exercising and avoiding chocolate is hard" (P12)

"Main issue is being a new mum, I'm so tired and that means lack of motivation" (P12)

"I just need to get motivated and the right mind frame and plan meals ahead is always a winner for me" (P9)

Women also described that motivation and behaviour change was difficult to sustain:

"I am often upset over my weight then I declare a diet tomorrow that doesn't happen until I am really fed up then I get motivated and then maintain for a while before things slip again" (P9)

"I'm definitely like a Yo, yo'er. I can sort of lose it when I need to, and then I'll eat again. And then I go up and down, up and down." (p2)

App usage for behaviour change

The theme of app use for behaviour change arose 14 times. Seven out of the nine women (78%) had used an app for some kind of behaviour change. One used the weight watcher app (P9), two had used MyFitnessPal (P5; P20), one had used the 7 minute app challenge paired with a FitBit (P18), two had used fitness trackers with accompanying apps (P14, P16), and one had used Couch to 5k (P12).

App advantages

The subtheme of advantages of using apps for behaviour change arose 5 times from four different participants. Women in particular found seeing their progress on the screen was motivational:

"I found the app helpful and I would feel happy with myself for completing a good amount of exercise, and seeing it on a screen gives that extra motivation to get it completed, almost like a competition with yourself" (P16).

"I always keep an eye on how many steps I am doing" (P14)

"Used coach to 5km was really good and I stuck to it, I found it very useful" (P12)

Women also valued features that made it easier to input the data required:

"the best bit was that you can scan the barcode on the food to get an accurate calorie intake" (P20)

App disadvantages

The subtheme of disadvantages of apps for behaviour change arose nine times from five different participants. One of the biggest challenges women discussed around the use of behaviour change apps was the burden of inputting data, particularly the input of calorie intake:

"I'm terrible at filling it all in, I'm a nightmare I'm like, I'll do it and then I'm like oh, I haven't done that for a few days" (P2).

“I did it for about a couple of weeks. And then I gave up I was just like, no, this is just too much... it was boring. I had to keep getting my phone out it was monotonous” (P5).

“The problem was, you've got such hard work to motivate yourself to actually do what it is that you want to do. And then the app makes it even harder, because you're trying to do what you want to do. But then you've got to log it all on us all hard work as well. And it's, it's just too much. Yeah. Even though they're trying to help you. They're not they're just creating more hard work” (P14)

Cost was another factor, women felt frustration that some apps had premium functions that were costly:

“The worst bit was a lot of the more detailed analysis was premium and you had to pay for it” (P20).

“But to be honest, if you if it costs money, I ain't got the money to spend on that” (P5).

8.4.4 Stage Two interview findings

Four participants took part in the second stage of the study. Participants who took part in this stage are highlighted in blue in table 17. Through content analysis of stage 2 interviews, three key themes were identified from the data (Table 19): Positive reactions to FITZ; negative reactions to FITZ; and recommendations for improvements.

Key themes

Because only four women took part in this stage of the study, the data here are limited.

Table 19. Overview of themes and sub-themes for stage two interviews

Themes	Sub Themes
--------	------------

Positive reactions to FITZ (8)	a) Perceived benefits (3)
	b) Concept alignment (5)
Negative reactions to FITZ (7)	a) Self-talk feature (2)
	b) Length of content (2)
	c) App malfunction (3)
Recommendations for improvements (9)	a) Implementation (1)
	b) Additional features (4)
	c) Adaption of content (4)

Positive reactions to the FITZ app

Positive reactions to FITZ arose 8 times from all four participants. This theme included two subthemes: perceived benefits and concept alignment.

Concept Alignment

The subtheme of concept alignment arose five times from four different participants and focused on liking the concept of FITZ and feeling that it was something different to other apps:

"I liked the idea of using the mental imagery thing, it's a bit like meditation aint it? So I thought that was good, it was something a bit different." (P5)

"I have used the app and so has my friend. I love the imagery and for me as I like mediation, I like this concept" (P9)

"I've given the app a good go. It's given me the inspiration to get fit and lose weight. Especially visualising an image, so I've been visualising myself fitting in a dress for my husband's cousins wedding" (P8)

Perceived benefits

The subtheme of perceived benefits arose three times from three different participants. Women reported benefits including ease of use and improved motivation.

Two women also introduced the app to their partner and a friend.

"It's a really good idea. At first I was a bit sceptical and thought no this wont work. I'm now motivated to eat healthy to fit into a dress. I've even got my husband involved too" (P8)

"The app is really easy to navigate" (P12)

Negative reactions to the FITZ app

The theme of negative reactions to FITZ arose 7 times from all four participants and included three subthemes: self-talk feature, length of content and app malfunction.

Self-talk feature

The subtheme of 'self-talk feature' arose twice from two different women who didn't enjoy using the self-talk feature of the app because it felt unnatural or weird and odd to hear themselves back and it was difficult to find time and a private space to do it in.

"I really didn't like recording myself, it just felt weird" (P8)

"The one thing I really didn't like was talking into it, with all the kids I just found it hard to find the time where I could do it in private" (P5)

"I don't like hearing myself back either, it sounds weird doesn't it?" (P5)

Length of content

The subtheme 'length of content' arose twice from two different women who felt the app content was too lengthy and it wasn't just something you could stop and come back to, it needed dedicated time which was hard to find:

"It was quite long too, like I had to find quite a bit of time to read it all through, it didn't really feel like something you could like leave and pick up again, you know?" (P5)

"It can also be long winded, so once I got started I'd have to stop once the baby woke up and I'd only get through a short amount" (P8)

App malfunction

The subtheme 'app malfunction' arose three times from two different participant.

Women using the Android operating system encountered problems with the app

freezing or not accepting their registration details (Figure 22):

"The only problem that I've had is the app freezing and I can't get any further. I also couldn't log my email address as it was saying that my user name arc is invalid!" (P8)

"Just tried again now and it said failed again" (P12)

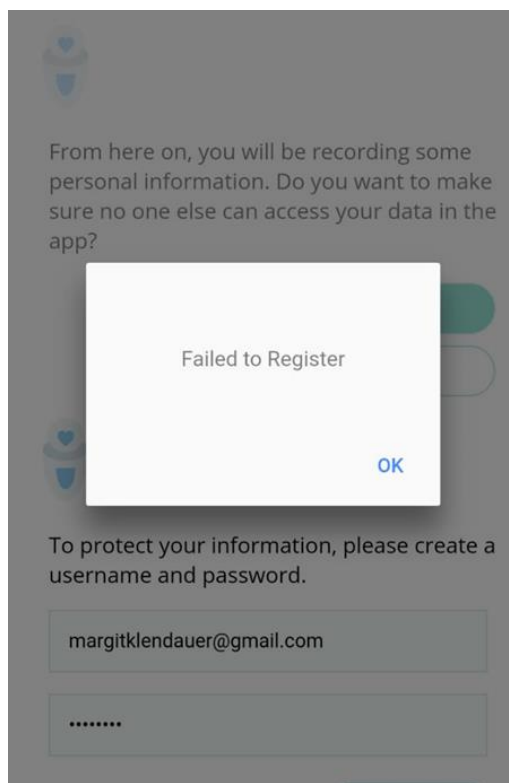


Figure 22. Screenshot of FITZ failure to register

Recommendations for changes to the FITZ app

The theme 'recommendations for improvements' arose 9 times from three participants and included three subthemes: implementation, additional features and adaption of content.

Implementation

The subtheme of implementation arose once from one woman who thought offering other women FITZ while they were pregnant would help its use to become normalised before the baby arrives and time is limited:

“see, I would say you're probably better off doing it in pregnancy where obviously women have got that bit more time and then they can get into it. And it becomes a part of their life and their routine. So when the baby comes, it's almost like a second nature already. And then it doesn't make as much of a difference” (P5)

“It's hard to introduce anything new when you've got a new born, but if you did it before. So it becomes a regular routine. And it's not as difficult to catch on.” (P5)

Adaption of Content

The subtheme 'adaption of content' arose four times from three different participants. Several recommendations were suggested to improve the content, including shortening the content, allowing for writing of goals and including options for a female voice:

“Would there be a way of shortening the areas?” (P8)

“maybe the option to write it in and an option for a male or female voice” (P9)

“I really didn't like recording myself. If you could maybe be able to write down your goals, and have an area where you can read and edit them” (P8)

One woman also thought FITZ should include functions that other behaviour change apps have like physical activity and calorie tracking:

“You know like all the FitBit stuff is counting steps and MyFitnessPal is all about calories. It would be quite good to have all those kind of things together though, wouldn't it? so you don't have to use all different kinds of apps” (P5)

Additional features

The subtheme 'additional features' arose four times from three different participants.

Women saw value in adding a peer support function that would allow users to

communicate with other women and also maybe help to prompt them to use the app:

"a Facebook community would work for me. I think that would be a good idea. It's good to be apart of something and people share what works and doesn't" (P9)

"Have a chat room or discussion room where the FITZ community can ask each other questions, support each other and discuss ideas etc" (P8)

"Having some kind of thing where you could talk to other people would, like you know, on Facebook if you're part of a group the stuff on there just pops up, you don't even have to go looking for it. If I saw something on there that like reminded me to do the imagery practice or like I saw a comment from another woman who was using it, it might make me use it more" (P5)

8. 5 Discussion

This study aimed to understand the acceptability of FITZ among recently postpartum women with history of GDM including their willingness to use the app 8-12 weeks following birth, and the feasibility of recruiting and retaining women into the study from a diabetes in pregnancy service.

The impact of behaviour change interventions among women with history of GDM, at scale, is dependent on programme reach (penetration) and engagement (participation) (Pronk, 2003; Aziz *et al.*, 2015). Interventions aimed at postpartum women (both with and without GDM), typically focus on intervention effects, and often don't address implementation factors, penetration, reach and participation, resulting in a lack of translation from efficacy to real-world solutions (Lim *et al.*, 2020a). Thus, at this stage of the project it was important to understand the feasibility of participation (if women

would use FITZ and engage in the research process) and penetration (if women could be recruited during pregnancy and retained postpartum).

The ability to recruit and retain women into this study was limited. Initial recruitment was relatively successful (42%) compared to other postpartum weight management studies reporting recruitment rates ranging from 7-28% (Gilinsky *et al.*, 2015; Haste *et al.*, 2018). Nevertheless, retention rates to stage one and stage two of the study, undertaken following birth, were poor. The ability for studies exploring postpartum weight management interventions to retain participants has been shown to vary from 0-42% (O'Toole *et al.*, 2003; Leermakers *et al.*, 1998; Craigie *et al.*, 2011; Armstrong & Edwards, 2003). Lack of retention seen in this study could be related to a number of factors.

For example, although recruitment was embedded in an existing diabetes in pregnancy service, the main study activities including FITZ use, were not. This created a lag in contact with women which perhaps contributed to drop-out rates seen at stage one. Evidence suggests penetration and participation rates in lifestyle interventions among postpartum women without history of diabetes, were higher when they were embedded in existing services (Dasgupta *et al.*, 2018; Lim *et al.*, 2020c). Indeed, one woman participating in this study suggested FITZ could be introduced to women during pregnancy, when women are less distracted, to best prepare for continued use following delivery, a strategy that may additionally better embed the app within the diabetes in pregnancy service. This implementation strategy could be additionally advantageous as research suggests that pregnancy related apps delivered by

professionals can increase perceptions of reliability and increase confidence (Bailey *et al.*, 2022).

Low retention rates, particularly to stage two of the study, could also be reflective of a lack of interest in engaging with FITZ and therefore not wanting to provide feedback. Engagement with digital health interventions can be poor (Grady *et al.*, 2018; Baumel *et al.*, 2019; Roberts *et al.*, 2017) and high rates of attrition (Yeager *et al.*, 2018; Etminani *et-al.*, 2020), limit their potential impact. Difficulty in maintaining engagement with apps is possibly limited due to lack of human support which leads to drop-out (Van Gemert-Pijnen *et al.*, 2014). This study asked women to use FITZ over a short period of time (1-2 weeks), suggesting rather than diminishing interest, there may have been other barriers to getting started, such as lack of time, focus on new baby, and tiredness. Barriers such as these are known to prevent women from engaging with behaviour change interventions, following birth (Ryswyk *et al.*, 2015).

It is also possible women experienced other barriers to participation, meaning increasing their motivation maybe have been secondary to other barriers. A person must have both the capability and opportunity, as well as motivation, to engage in healthy behaviour (Michie, van Stralen & West, 2011). For example, a woman living in poverty is less likely to have access to healthy foods and the ability to exercise freely with the constraints of childcare. With those who are overweight at higher risk of GDM development (Torloni *et al.*, 2009) and subsequent progression to T2DM (Bao *et al.*, 2015; Sorbye *et al.*, 2020), it is likely that at least a proportion of women will experience barriers to managing their weight, that are outside of their control. These factors cannot be ignored when thinking about interventions to support women to

manage their weight following a pregnancy complicated by GDM. Nevertheless, even when both opportunity and capability are abundant, motivation is still required (Solbrig *et al.*, 2017). One of the key advantages of a purely motivational intervention, such as FIT and FITZ is they can be used alongside other weight management strategies such as those focusing on reducing societal barriers.

Although women in this study had goals to manage their weight, these conflicted with their commitments to taking care of a young family, creating limited motivation to sustain changes over time. Previous research suggests women with history of GDM experience multifaceted barriers to achieving their weight loss goals creating low levels of motivation to undertake and sustain behaviour change (Gilinsky *et al.*, 2015; Ratner *et al.*, 2007; Nicklas *et al.*, 2011; Christiansen *et al.*, 2021; Ryswyk *et al.*, 2015). Women in this study heavily cited lack of motivation as a factor impeding their weight management goals, particularly over long periods of time, where weight-regain would occur. Weight re-gain is typical in the general population (Dansinger *et al.*, 2007; Dombrowski *et al.*, 2014), and is partly due to an inability to maintain motivation to sustain adherence to behavioural intervention (Elfhag *et al.*, 2005; Silva *et al.*, 2011).

Women's feedback on FITZ suggested the concept aligned with their goals to manage their weight and stay motivated over time, suggesting the app could be a potentially useful tool for women. This finding is supported by others who found postpartum women, without history of GDM, who were obese or overweight, also wanted tools that would inform and motivate them for a healthy lifestyle postpartum (Christiansen *et al.*, 2021). However, it is clear from women's feedback that certain aspects of the app require further development. For example, women expressed their dislike of the 'self-talk' feature and the long nature of the coaching content. Women also felt

frustration when the app failed to work, not an unexpected response considering app failure is one of the key factors affecting mHealth non-adoption (Greenhalg *et al.*, 2017).

In line with these limitations, women spontaneously made suggestions for change. One woman who used the app, suggested FITZ should include other functions such as physical activity tracking, a finding congruent with several other studies reporting postpartum women with history of GDM expected app interventions to be comparable to those already commercially available (Nicklas *et al.*, 2020, O'Reilly & Laws, 2019). Others suggested shortening the content and allowing goals to be written rather than spoken. This suggestion in particular raises a dilemma as literature suggests commitment to a goal and motivation to achieving it can be strengthened when a person articulates and hears their own incentives and plans for change (Galvão *et al.*, 2020). A compromise to this situation may be to include a text to speech translation that allows the goal to be replayed but avoids speaking directly into the app.

Women also suggested adding a form of peer support, so they could connect with other postpartum women using FITZ. The value of peer support as a facilitator for weight management is well documented (Dennis, 2003; Heisler, 2010). One possibility suggested was a co-occurring Facebook community. Kernot *et al.* (2019) found a Facebook-delivered physical activity intervention for postpartum women without diabetes had high engagement with on average women visiting 26 times a week and logging step counts for 48/50 days. Su *et al.* (2021) also found a nurse-led web-based programme for women with GDM that included email and a Facebook group, was effective in improving metabolic outcomes for women during pregnancy. In addition,

the findings of study 3a (Chapter 7) also demonstrated women frequently use and value Facebook during and after pregnancy, suggesting potential as an engaging platform.

8.5.1 Strengths and limitations

Strengths

Despite setbacks from the COVID-19 pandemic this preliminary study aiming to understand the feasibility and acceptability of FITZ was conducted in a 'real-world' setting, with HCPs and women embedded in a diabetes in pregnancy service. This provided the opportunity to understand the feasibility of recruiting women in this setting. In addition, studies undertaken in phase one of this project recruited women who were often more than 12 months postpartum, meaning little was understood regarding women's goals and barriers to change during the early postpartum period.

Limitations

Low retention rates, particularly into stage 2 of the study meant only a minimal amount of feedback on the FITZ app was collected, making understanding of the acceptability of the app among recently postpartum women with history of GDM, limited. Low retention rates may be, in part, reflective of study design. Engaging in two separate interviews, so soon after delivery, was likely burdensome for women, although this was not raised as a potential issue during public and patient consultation. On reflection, a think-aloud usability design could have proved more successful, where women could have attended one session, where they downloaded the app and

completed tasks while giving verbal feedback (Fonteyn *et al.*, 1993). However, this method would not have enabled us to understand women's willingness to download and use the app autonomously, an important real-world insight into participation. It is also possible a lack of face-to-face contact with the researcher, particularly at the recruitment stage, meant women may have been less likely to respond to invitations to interviews. However, with the pandemic ongoing, 'remote' methods will be essential to the continuation of many research activities and thus finding the most effective digital means of engaging and communicating with research participants remains important.

There is also possibility the low retention rates seen in this study were, in part, attributable to the app failing to work for Android users during the study period. This issue only became apparent towards the end of the study. It is possible women who did not respond to the invitation to take part in stage 2, did so because they could not get the app to work. Technology failure is a key pinch point for user frustration and is a major concern, particularly for mHealth adoption (Greenhalg *et al.*, 2017; Gagnon *et al.*, 2016). This demonstrates the importance to monitor app functionality throughout the research process to avoid participants becoming frustrated or not having the opportunity to use an intervention. This situation also raises important questions regarding mHealth sustainability. For example, if FITZ were to be adopted into practice, who is responsible for its maintenance? What systems will be in place for users to report problems and receive technical support?

The women included in this study all identified as white/British, meaning findings cannot be generalised to women from other backgrounds. The study population is

reflective of the demography of the region in which it was conducted were the population is 95.7% white (ONS, 2011). Future studies need to incorporate strategies that reach more diverse populations as the prevalence of GDM in the UK is highest among women with Asian or South Asian backgrounds (Farrar *et al.*, 2016).

It is also likely that this study included women whose circumstances meant that they could take part in the research and potentially have greater resources to overcome life's barriers and therefore did not discuss barriers to weight management that focused on factors outside of their control, such those related to socioeconomic disadvantage. Exploring the acceptability of FITZ among a broader group of women will be essential for future research.

8.5.2 Implications

The finding that women liked the concept of FITZ and it fitted with their goals, suggests further investigation into its applicability as a weight management intervention for women with history of GDM is warranted. However, the limitations highlighted above suggest several changes to future research design are needed. The problems seen in this study regarding effort to recruit and retain women are of key consideration. For example, although recruitment rates were comparable to other studies (Gilinsky *et al.*, 2015; Haste *et al.*, 2018), retention was poor, rendering the sample size small and lacking in diversity. Increasing the number of study sites could be one way of overcoming this, however, the process of gaining ethical approval and initiating study set-up is resource intensive, particularly during the COVID-19 outbreak. In addition, the recruitment process in this study was labour intensive for clinical staff who were recruiting women on a voluntary basis. Indeed, this study stopped recruiting after six

months. With lack of retention and issues with app functionality, the balance between the effort to recruit and the amount of data obtained had to be considered.

One possibility to overcome these issues is to use social media as a tool to recruit women into further research. A recent systematic review of using Facebook to recruit participants for health research suggests, in comparison to traditional methods (print, radio, TV and email), Facebook can provide improved representation and participant selection among those described as hard to reach (Whitaker *et al.*, 2017). Women of childbearing age are frequent users of social media (ONS, 2020) and it has been found women in the UK with history of GDM are avid users of Facebook to find information and seek peer support (Chapter 7, study 3a). This evidence points to social media as a potentially useful platform to facilitate recruitment. Using social media as a recruitment tool for research is increasing and is likely to continue to grow, however, ethical questions remain regarding the protection of privacy, exploiting participants online networks and communicating through online methods (Gelinas *et al.*, 2017).

Regarding implementation, it is still unclear if offering FITZ during the early postpartum period is optimal and it will be important to gain further insights on user engagement from women at different time points in their GDM experience, including during pregnancy. Methodologically, it will also be important to triangulate further qualitative and quantitative data with the limited data collected in this study. In addition, other important aspects of the app are yet to be evaluated, including usability.

Although the concept of FITZ was liked by women and it aligned with their goals women also found issues with some aspects of the app and made some important suggestions for improvements, related to these limitations. Thus, an important future

step will be to co-produce changes to FITZ to maximise engagement with this population. The co-production of lifestyle interventions that include postpartum women and their partners has been described as a key strategy to planning and developing interventions that are most likely to be effective and consider challenges associated with implementation (Kragelund Nielsen *et al.*, 2018b; Keller *et al.*, 2008). Co-production with HCPs will also be important as they are key agents to adoption and implementation (Gagnon *et al.*, 2016), especially as evidence suggests interventions that are supported by professionals and embedded in care pathways create better engagement with women (Hedeager Momsen *et al.*, 2020; Lim *et al.*, 2020c; Dasgupta *et al.*, 2018).

8.6 Chapter Summary

This chapter described the first study undertaken as part of phase two of the project and focused on understanding what women with recent history of GDM thought of FITZ, if they would be willing to invest time into using it following birth and which bits, if any, they liked or disliked. Our findings demonstrated that while women wanted to manage their weight, significant goal conflict related to looking after a new-born, family life and lack of motivation hindered their efforts. The concept of FITZ aligned with women's goals and was seen as a useful tool, suggesting further evaluation of the app among this population is warranted.

However, poor retention resulted in a small, homogeneous sample meaning it is still unclear if women are able and willing to invest time into using the app following birth. Spontaneous suggestions for improvement imply some aspects of FITZ require adjustment to meet women's needs and the addition of peer support was seen as

advantageous. How these findings compare to feedback from HCPs will be important as they are key agents in adoption and implementation. Chapter 9 describes the final study in this project that aimed to assess the acceptability of FITZ among HCPs, including any challenges they foresaw regarding implementation and how these might be overcome by making changes to FITZ.

Chapter 9 (Phase 2) Exploring the acceptability and feasibility of FITZ among UK healthcare professionals (study 5)

9.1 Overview

The final study in this project, presented in the following chapter, aimed to assess the acceptability and perceived usefulness of FITZ among HCPs, including any challenges they foresaw regarding implementation in practice. The study also aimed to explore ways in which HCPs thought these challenges could be overcome by making changes to FITZ. This work in this chapter aims to build on the findings from study 2b (Chapter 6) and 3b (Chapter 7) exploring HCPs barriers and desires regarding mHealth for women with history of GDM.

Important questions at this stage of the project were: will HCPs see the point of FITZ and think it's a good idea? What weight management support do HCPs currently offer and how might FITZ promote or impede that work? How might FITZ be implemented into HCPs current workflows? How might FITZ be improved or adapted to support adoption in practice? Much like the work conducted in chapter 8, the findings of this study served to inform any future development of FITZ and research design.

9.2 Aims and objectives

9.2.1 Aims

The aim of this study was to explore what weight management support HCPs currently offer to women experiencing GDM and to assess the acceptability and perceived

usefulness of FITZ among HCPs. The study also aimed to explore ways in which HCPs thought FITZ could be improved or adapted for use in practice.

9.2.2 Objectives

- To understand if and what weight management support HCP's currently offer to women with GDM, including app support
- To explore with HCPs their views on the acceptability and perceived usefulness of the FITZ app
- To explore with HCPs the feasibility of implementing the FITZ app in their practice (timing and context)
- To explore with HCPs their ideas for how FITZ could be improved or adapted for use in practice

9.3 Methods

9.3.1 Study design

This was a mixed methods study incorporating an online survey and an online co-production workshop (Figure 23). The online survey was used to capture data on weight management support currently offered by HCPs and to explore their views on the acceptability and perceived usefulness of FITZ. The survey also captures participant demographic information. The online co-production workshop explored barriers related to FITZ implementation in practice and ideas on how FITZ could be improved.

The survey incorporated single, multiple choice and free text answers. An online survey was used as it was perceived to be less burdensome than attending an

interview (see section 9.3.2). The survey included a video, made by the researcher, which demonstrated FITZ and included narrative about the purpose of the app and the features it included.

No existing, validated questionnaire would have enabled the collection of data to answer the research aim and objectives. Therefore, a survey was developed by myself and reviewed by my supervisory teams specifically for this study (Appendix J). No attempt was made to assess internal consistency or construct validity of the questions prior to data collection, although expert opinion on the survey questions and length was sought (see section 9.3.2). The concepts of NPT (Murray *et al.*, 2010) were used to help guide the question content. In particular, NPT was used to include questions aiming to understand if HCPs would see the point in FITZ and think it's a good idea (cognitive participation); if HCPs thought FITZ was different from other behaviour change interventions (coherence); how the implementation of FITZ might promote or impede their existing efforts to support women with weight management (collective action); how the app might impact on HCP workload and other resources (collective action).

An online co-production workshop was used to capture feedback from HCPs on how FITZ might be improved. The opportunity for HCPs to engage in co-production, builds on the recommendations in studies 3a and 3b (Chapter 7) that HCPs should be involved in the co-production of mHealth for GDM so their concerns and expertise can be incorporating leading to more effective implementation. Co-production can enhance the design and development of innovations (including digital health innovations) in various ways including; enhancing research quality by ensuring

research relevance and appropriateness (Cornwall & Jewkes, 1995; Kagan, 2013; Locock & Boaz, 2019); increasing the quality and richness of data collection and analysis (Gillard *et al.*, 2012; Locock *et al.*, 2019; Mjøsund *et al.*, 2017); generating capacity, skills, confidence and competence among communities (Jagosh *et al.*, 2012; Kagan, 2013); enhancing research sustainability and likelihood of outcomes being successfully implemented (Cornwall & Jewkes, 1995; Jagosh *et al.*, 2012; Pizzo *et al.*, 2015); and providing opportunity to stimulate the development of alternative ideas and innovative approaches (Alderson *et al.*, 2019; Kagan, 2013; Pizzo *et al.*, 2015).

Workshops are participatory by nature, creating a context whereby participants are active agents in the process and aim to promote genuine participation (Ørngreen & Levinsen, 2017). Workshops are commonly used in co-production and co-design activities and are often used in digital health intervention research (Baines *et al.*, 2022). NPT (Murray *et al.*, 2010) was used to guide the content of the workshop which predominantly sought to understand what could be improved, adapted or added to make FITZ work better in practice for HCPs and women (reflexive monitoring).

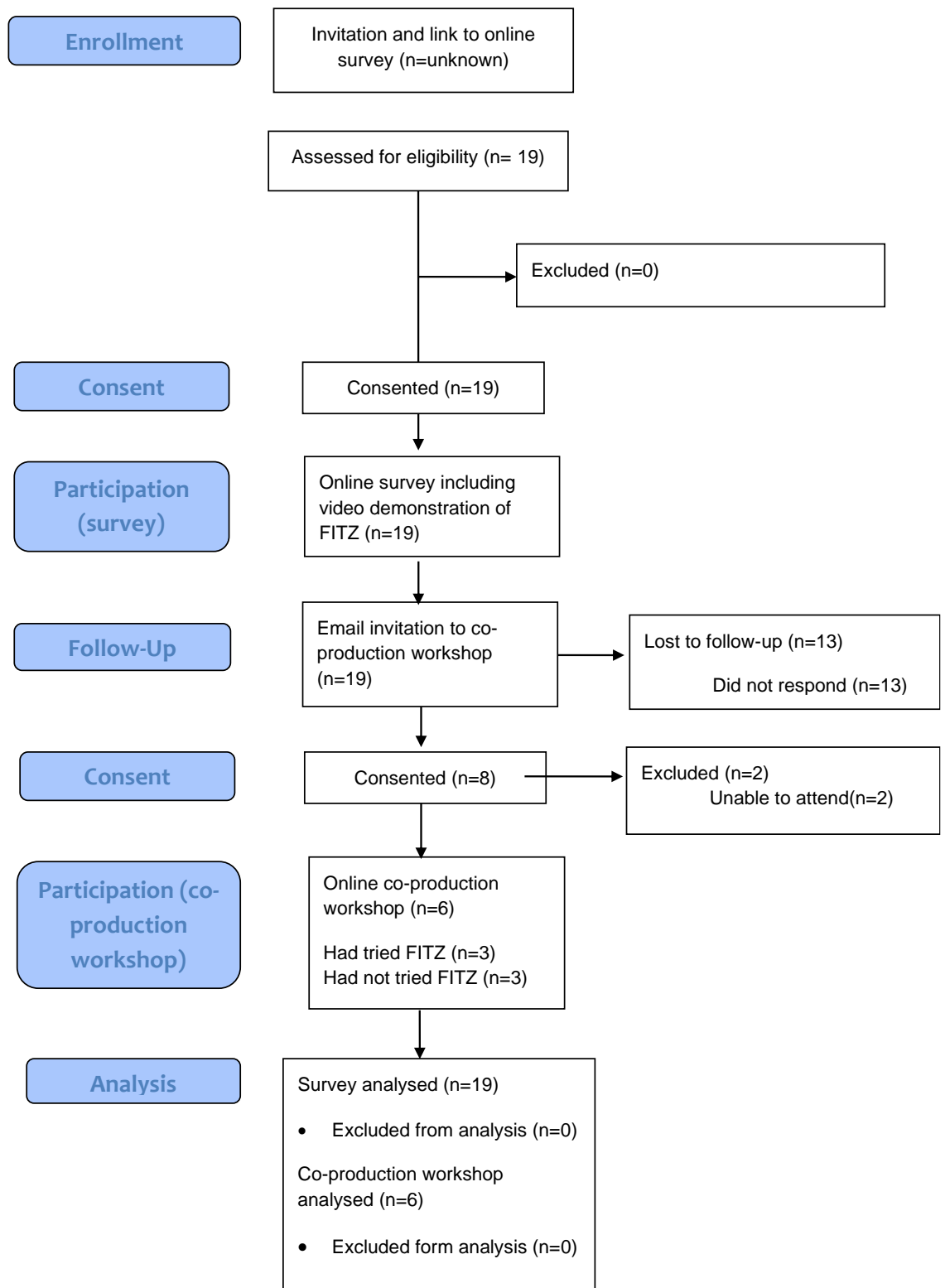


Figure 23. Study 5 flow diagram

9.3.2 Expert Involvement

Two diabetes midwives were consulted during design and development. Midwives were concerned about the burden on HCPs, citing pressures from work, especially during COVID, would hinder their participation. The survey questions and length of the survey were deemed sensible by both midwives. Originally this study involved participants downloading and using FITZ, including some pre-defined tasks, before answering the survey questions. Midwives felt this would lead to high drop-out as HCPs simply wouldn't have the time. During this discussion it was suggested a video could be embedded into the survey where HCPs could get an idea of what the app was about, without having to use it themselves. Midwives also felt the co-production workshops would work well online, meaning busy professionals wouldn't have to make time to attend in person and the interactive elements would help to make the session engaging.

9.3.3 Study setting

This study was conducted online, due to the outbreak of COVID-19. Potential participants were approached and recruited using online methods. The survey was conducted online using the JISC platform (<https://www.onlinesurveys.ac.uk/>). The workshop was held using Microsoft Teams and shared Miro Board (<https://miro.com/>).

9.3.4 Sample and recruitment

Eligibility criteria

Inclusion criteria

- A HCP who was currently or had previously supported women with gestational diabetes
- A HCP who was currently or had previously practiced in the United Kingdom

Exclusion criteria

- Does not currently or has not previously provide health care support to women with gestational diabetes
- Does not currently or has not previously practiced in the United Kingdom

Sample size

It was difficult to estimate how many potential participants would be reached using the recruitment strategies outlined above, however, a survey sample of at least 10 respondents was aimed for alongside the conduct of one workshop, consisting of 2-8 participants. Factors playing into this decision included the workload of busy professionals and difficulties imposed by COVID-19. The proposed sample size was considered feasible for a PhD thesis and capable of achieving data saturation, defined as the point at which no new generic themes or variations of a given theme emerge (Eliacin *et al.*, 2015; Staniszewska *et al.*, 2014). In the end, 19 HCPs responded to the survey, six of whom took part in the workshop (Figure 23).

Participants were recruited using a volunteer, purposeful sampling approach based on the pre-defined inclusion and exclusion criteria outlined above. The definition of purposeful sampling was defined as a technique serving an investigative purpose

rather than to be statistically representative of a population (Ritchie, Lewis & Elam, 2003)

9.3.5 Recruitment

HCPs were recruited via email invitation sent to a professional network of diabetes midwives and nurses; an online invitation was also posted to a social media network of HCPs focused on diabetes in pregnancy. Existing professional contacts were also used as well as snowballing techniques, where participants were asked to invite other potential participants.

This study did not require ethical approval from the Health Research Authority, despite including NHS staff, as taking part was on a voluntary basis, outside of NHS working hours. Participants were also approached, outside of their work environment.

9.3.6 Data collection procedure

Online Survey

HCPs received an invitation to take part via email or via social media (Figure 23). This invitation included a link to the online questionnaire. HCPs expressing interest in the research were provided with a PIS, the opportunity to ask questions and a consent process, all within the online questionnaire. Consented HCPs were automatically directed to the survey questions.

Online co-production workshop

All participants who answered the survey were emailed an invitation to take part in the online co-production workshop (Figure 23). A PIS and consent form were attached to the email invitation and participants were asked to return a signed version of the consent form if they decided to take part. An appropriate time/day for the workshop was found by using Doodle Poll (<https://doodle.com>). Eight people responded via email and returned signed consent forms. Two consented participants dropped out nearer to the arranged time due to competing priorities. The workshop took place on Thursday 4th of November at 7pm and lasted 1 hr and 10 minutes. This time and date was dictated by participant availability and preference. Participants were asked to download FITZ before joining the workshop so they could become more experienced with concept, features and functions. Instructions for joining the workshop, including the Teams video call link and how to sign up to Miro were emailed to participants one week before the workshop commenced.

The workshop was split into two sections. The first section (25 minutes) focused on discussing potential benefits of FITZ and identifying key challenges associated with use and implementation in practice. The second part of the workshop focused on HCPs ideas for improvement to help overcome these challenges. This part of the workshop involved using a Miro Board. A Miro Board is an interactive digital whiteboard that allows multiple users to collaborate at any one time (<https://miro.com/>). Participants were instructed to join Miro, for free, before joining the workshop. As ideas were discussed, participants were encouraged to write their idea on a post-it note and add it to the board. This served the purpose of being able to visualise and organise participants ideas, but also enabled an interactive activity, that aimed to keep participants engaged. A topic guide for the workshop is available in (Appendix K). A

summary of suggested changes (Table 23) and a screenshot of the final Miro board (Figure 29, section 9.4.3, page 301) was sent to workshop participants via email to ensure I had captured their thoughts accurately. The workshop was audio-recorded using a Dictaphone and transcribed verbatim by KE.

At the start of the workshop participants were reminded their involvement was entirely voluntary and the content of any information shared would be confidential and made anonymous through the removal of any identifiable information and use of relevant pseudonyms.

9.3.7 Data analysis

Quantitative survey data were analysed using appropriate descriptive statistics.

Qualitative free text questions from the survey and qualitative data collected from the workshop underwent content analysis. As prescribed by Elo and Kyngäs (Elo and Kyngäs, 2008), researchers (KE and JS) undertook data immersion, coding, grouping codes, generating categories, and reporting, with a focus on manifest content.

Content analysis was selected for this study as it was deemed advantageous to have a numerical understanding of the thematic patterns, further to the purely qualitative themes, to best ensure the most generalisable suggestions for improvements to FITZ and to complement quantitative survey findings.

9.4 Findings

9.4.1 Participant characteristics

Participants predominantly identified as female (18/19, 95%). Five (26%) participants had more than 15 years in practice (Table 20). Nine (47%) participants were from the East of England. Those who are highlighted (P19, P16, P13, P12, P8, P2) all participated in the workshop part of this study. It is important to note P4, P17, and P11 all participated in study 3b. The potential limitations related to responder bias, because of this, are addressed in the discussion section of this chapter.

Table 20. Study 5 Participant characteristics

	Age	Gender	Location	Profession	Time in practice
P1	45-54	Female	East of England	Consultant	6-10 years
P2	65 and over	Female	East of England	Research Midwife (Diabetes in Pregnancy)	6-10 years
P3	45-54	Female	East of England	Consultant Diabetologist	11-15 years
P4	25-34	Female	South East (England)	Diabetes midwife	1-2 years
P5	45-54	Female	East of England	Consultant diabetologist	more than 15 years
P6	35-44	Female	South East (England)	Diabetes Specialist Midwife	3-5 years
P7	45-54	Female	East Midlands (England)	Diabetes midwife specialist	Less than one year
P8	45-54	Female	East of England	Diabetes Midwife Specialist	1-2 years

P9	35-44	Female	East of England	Consultant Obstetrician	1-2 years
P10	55-64	Female	East of England	GP	more than 15 years
P11	25-34	Female	South West (England)	Maternity Support Worker	1-2 years
P12	35-44	Female	Yorkshire and The Humber	Midwife	6-10 years
P13	45-54	Female	South West (England)	Diabetes Specialist Midwife	3-5 years
P14	35-44	Female	South West (England)	Obstetrician	Less than one year
P15	45-54	Female	London	Infant Feeding Support Worker	6-10 years
P16	55-64	Female	South West (England)	Diabetes Specialist Midwife	more than 15 years
P17	55-64	Female	East of England	Diabetes Specialist Nurse	more than 15 years
P18	55-64	Male	South West (England)	Consultant in diabetes	more than 15 years
P19	35-44	Female	East of England	Diabetes Dietitian	3-5 years

9.4.2 Survey Findings

HCPs experiences of delivering weight management to women with experience of GDM

When asked if they currently offered weight management support to women with experience of GDM, nearly two thirds of respondents said they offered weight management both during and after pregnancy (12/19, 63%). Three participants (16%) said they didn't offer weight management support as part of their current role. One

participant (5%) said they only offered weight management support after pregnancy.

Two (11%) said they only offered support during pregnancy (Figure 24).

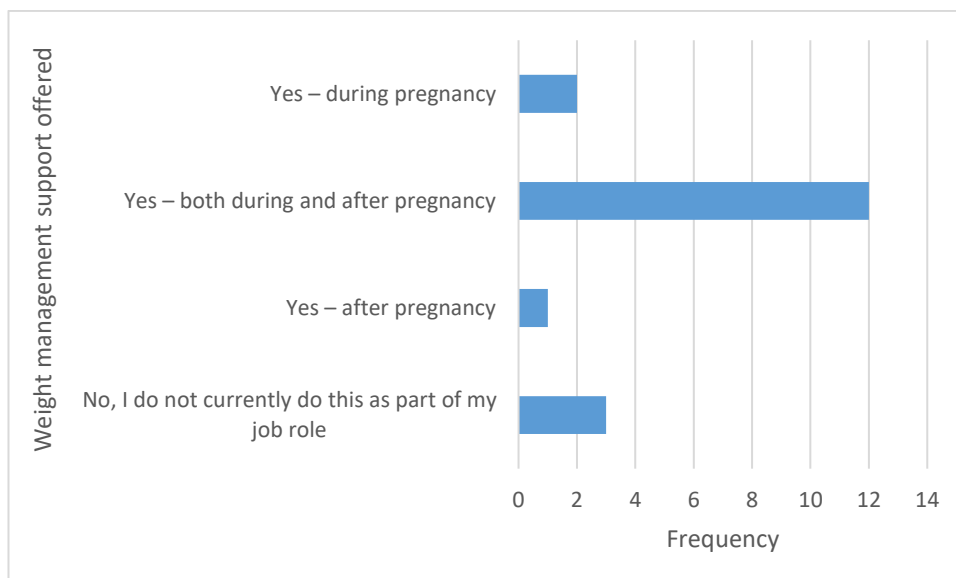


Figure 24. The number of HCPs offering weight management support, and timing, for women with experience of GDM

When asked the type of weight management support they offered women, 12 (75%) HCPs said they offered dietary advice, six (38%) signposted women to other organisations or websites, five (31%) offered advice on physical activity, five (31%) discussed the benefits of weight loss with women, 2 (13%) referred women to weight management programmes and one (6%) provided breastfeeding support (Figure 25). Sixteen HCPs answered this question as three did not provide weight management support as part of their role. HCPs could tick as many options as were applicable to them.

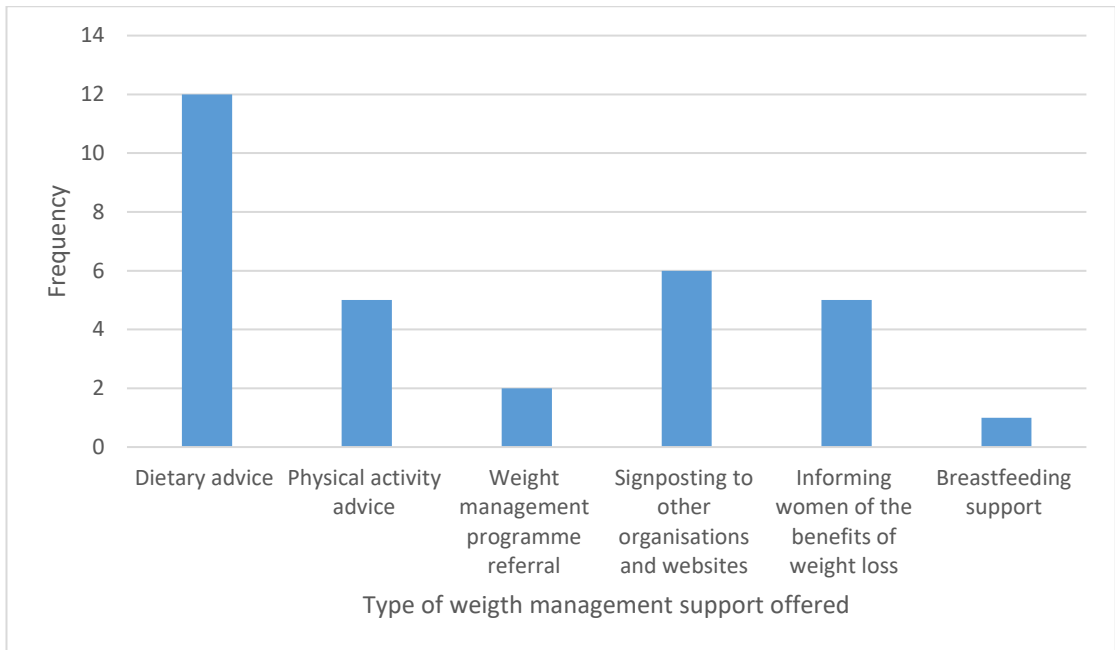


Figure 25. The type of weight management support offered by HCPs

When asked if they had ever recommended an app to help women with experience of GDM manage their weight, nearly half of HCPs (8/19, 42%) said they had never recommended an app (Figure 26). Six (32%) HCPs said they had recommended the MyFitnessPal app and the Couch to 5K app was recommended by four HCPs (21%). The NHS 12-week weight loss app had been recommended by two HCPs (11%). Slimming world, Healthy Plate, Fitbit, Facebook support groups, Carbs and Cals, and the diabetes in pregnancy app all were recommended by one HCP each.

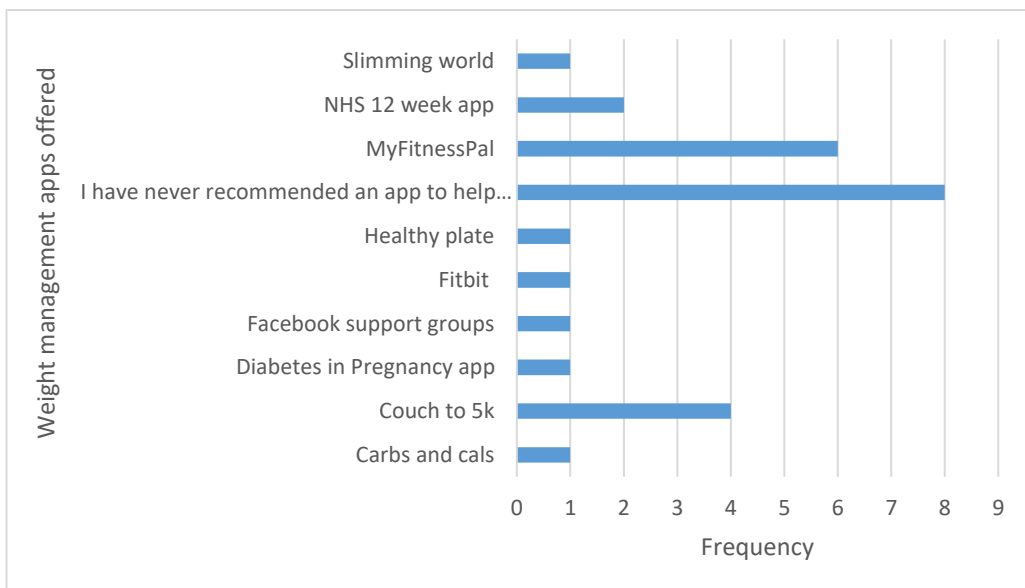


Figure 26. The type of weight management app support delivered by HCPs

Feedback on the FITZ app

Most questions asked for this part of the survey were open questions, and thus data collected were qualitative in nature. Two closed questions related to FITZ were analysed descriptively and are included at the end of this section. Content analysis was conducted on qualitative data and revealed four themes and 12 subthemes (Table 21).

Table 21. Themes and subthemes generated from survey free text answers

Themes	Subthemes
Overall perceptions (35)	Negative (7)
	Neutral (5)
	Positive (21)
Perceived benefits of FITZ (23)	Good accessibility and ease of use (11)
	Support for women (3)
	Functions and features (9)
Perceived barriers of FITZ (48)	Who's it for? (14)
	High Engagement (19)
	FITZ app content (15)
Implementation timing (25)	Preconception (3)
	During pregnancy (17)
	Postpartum (5)

Overall perceptions

The theme of overall perceptions arose on 35 occasions with the subthemes of positive, negative and neutral. Most comments included positive perceptions (21), some negative (9) and some neutral (5).

Positive perceptions

Positive perceptions of FITZ arose 21 times from 13 different participants.

HCPs with positive first perceptions focused on the concept of FITZ suggesting it was an interesting and potentially useful way of looking at weight management:

“I think the focus on helping with the psychological reasons we are overweight is good” (P8)

“I very much liked it, I feel women will respond well to an App on their phone and it focuses much on motivation and goals and positivity support which I feel is essential” (P17)

“Looks simple to access and use. The description is clear. the impression is of a potentially useful app worth trying for weight control” (P18)

Positive perceptions were also focused on the fact FITZ appeared to be different from other apps and women might need something different to help them manage their weight:

“It’s very different, women with a new baby are unlikely to try couch to 5 k or similar because they are looking after a baby, so they need something different” (P10)

“imagery is a new technique which many people may not be aware of which is unique to other apps, many people may find this more useful” (P4)

“It’s looking at weight management from a different but important angle, it’s interesting that it is aiming to be used as a motivational tool - it’s difficult to access help to motivate women with GDM so could be very useful” (P3)

One HCP also thought FITZ could be useful for different populations of people with diabetes:

“Would also be useful to have something similar for all people with type 1 and type 2 diabetes, I’m not aware of anything similar” (P3)

Neutral perceptions

Overall perceptions of the app that were neutral in nature arose five times from five different participants. While HCPs reported that although they thought FITZ was a good idea they had concerns about complexity and engagement with the app, worrying women might not use it:

“It’s a good idea but I don’t think it would be understood or used by most women” (P13)

“Sounds good in theory but can’t see it being taken up postnatally” (P15)

“Looks Ok, but the whole thing about an APP is using it” (P5)

Negative perceptions

Negative perceptions of the app arose seven times from two participants and focused on a number of factors including, appearance, high complexity, and thought other apps offered more:

“The app was too wordy, mental imagery is nor a user-friendly term or provokes thoughts other than those intended. Essentially I feel it over complicated telling someone to think of their happy place” (P6)

“other apps are more concise and constructive with clear benefits results and goals” (P6)

“Couch to 5k seems more motivational” (P7).

“It just didn’t shout out happiness or motivation” (P7)

Perceived benefits

The theme of perceived benefits of FITZ arose 23 times with the subthemes of good accessibility and ease of use, support for women and functions and features.

Good accessibility and ease of use

The theme of good accessibility and ease of use around 11 times from nine different participants. HCPs felt FITZ being app based made is accessible and convenient for women and meant less time needed for face-to-face appointments:

“It’s convenient as women are high use of smartphones so it’s a good way to reach people. Does not require appointments which is also better for women” (P18)

“can use the app at their own pace from the comfort of their own home and motivate themselves” (P4)

“It is an app, and most adults spend a lot of time on their phones in this day and age” (P9)

One HCP also felt app-based support meant people had more time to dedicate to weight management:

“no appointment times means more flexibility and arguably less room for excuses not to do it due to time” (P11).

Support for women

The theme of support for women arose 3 times from 3 different participants. HCPs felt FITZ would help support women to stay focused and achieve good habits through self-management:

“It could be a type of contact and continuation of good habits. Something to do for herself not just all for baby” (P13)

“It could be useful for keeping focus through busy post-partum period where there are so many other things going on” (P1)

Functions and Features

The subtheme of functions and features arose nine times from five different participants. HCPs saw benefits in the functions and features of FITZ app including the FITZ avatar, push reminders, audio feedback, photos and records of achievement:

“Push reminders will help in that busy stressful post natal period - to think about themselves and their goals” (P5)

“I think the little FITZ person is cute and many would like that” (P10)

“By offering them the support and the feedback from their own audio recordings it will help them to remember and stick to their goals” (P19)

“It’s free and easily accessible. The prompts are good and the use of photos and own voice to motivate people, also having a record of their achievement is important” (P8)

Perceived Barriers

The theme of perceived barriers to the use of FITZ arose 48 times with subthemes of ‘who’s it for?’, ‘high engagement’ and ‘FITZ app content’.

Who’s it for?

The subtheme of ‘who’s it for?’ arose 13 times from ten different participants.

One of the biggest concerns for HCPs regarding FITZ was that it might not be suitable in its current form for all women. HCPs thought women would need to be willing to want to make changes in their lives and have a fairly high level of literacy to understand what the app was meant to achieve:

“they have to want to make changes for themselves but many women are feeling de-motivated at the moment” (P4)

“Some women, I think it won’t work for them, some women can be hard to reach in terms of doing things to help themselves” (P11).

“The FITZ app seems to be more geared to ‘normal’ women” (P11)

In line with this, some HCPs thought FITZ would be a valuable tool for those already motivated to manage their weight:

“For those that are motivated to lose weight after pregnancy the app would be a valuable resource” (P16)

“It has the potential to engage those already motivated to do something” (P19)

With regards to women’s motivation to lose weight, one HCP suggested putting a motivational assessment at the start of the app to understand if women would be ready:

“Is there a quiz at the start to assess motivation - is this the right time for them” (P5)

Engagement

The subtheme of engagement arose 19 times from eleven different participants. A concern for HCPs regarding the use of FITZ for women with experience of GDM was the requirement for high levels of engagement:

“FITZ app may motivate, but actually engaging in the behaviours suggested is a separate issue” (P18)

“Not sure, seems to require a lot of engagement with it on a day-to-day basis which may be a good thing or may be tiresome” (P2)

“We use an app for sharing blood glucose data and many don't engage with that, sometimes as they don't have the hardware or internet access to be able to do so” (P3)

“Still will require the initial willingness to participate and engagement with mental imagery techniques” (P1)

Some specific issues related to the engagement with FITZ included uploading photos and lengthy set-up time:

“Not sure that I would easily find photos that I could upload” (P10)

“I think women would forget about the app unless alarms or prompts are set” (P18)

“Needing to load the images/goals in and the lengthy set up might put people off” (P9)

Others thought existing apps that didn't require as much engagement might help women reach their goals:

“I only really have experience of using a FitBit which is very goal orientated and doesn't require much engagement other than meeting the goal” (P2).

High levels of engagement were seen to be particularly difficult for postpartum women who would be lacking time, be tired and busy with other things:

“time - having a new baby makes life busy and you are asking them to do tasks” (P10)

“Time constraints of making time for themselves to use the app properly to get the benefits. I don't feel that busy mums with limited time would use this app as their first port of call” (P6).

“Postnatally women are exhausted, sleep deprived and many suffer from Postnatal Depression, Postnatal Anxiety and PTSD” (P15)

In relation to high levels of engagement and lack of time one HCP made the suggestion of adding audio/video content instead of visual text to help limit the burden of reading the app content:

“having a new baby makes life busy and you are asking them to do tasks, whereas something based on listening/watching might be easier in that context?” (P10).

FITZ app content

This subtheme arose 15 times from ten different participants

HCPs saw barriers to women's participation in FITZ based on the content of the FITZ app itself. Some were concerned the concept of using mental imagery wouldn't be liked by some women and for some it might represent idealised or perfectionist views of themselves:

"It clearly has potential but imagery can be a double-edged sword - be disheartening for women as well as encouraging as there is a lot of pressure to be ideal in all sorts of ways" (P2)

"Idealised imagery may feel like trying to be perfect, look perfect, have a perfect lifestyle, look like this, do these things - that's a lot of pressure when you have a new baby which is your focus" (P2)

"I think some women might not like the visualisation type of approach" (P13)

HCPs also thought the app was limited in its ability to help weight management as it only delivers a motivational support and not other factors related to weight management such as information, calorie counting and physical activity tracking:

"Couldn't see any dietary advice on there, or calorie counter - purely motivational?? Myfitness pal works because tracking calories and weight has been shown in studies in helping maintain weight loss" (P5)

"it doesn't address underlying reasons for raised BMI" (P14)

One HCP also thought the app would need to be more directive and tailored to women's needs:

"it is not at all prescriptive which may appeal to some but some people wont know where to start when setting realistic goals" (P12)

A need to tailor the app specifically for women with GDM and their needs was the focus of some suggestions for improving the app including:

"Could the app maybe include targets for women to aim for?" (P18)

“Could add yearly reminder for annual glucose homeostasis check” (P5)

“it could show that evidence shows that women who are supported practically and emotionally to achieve their breastfeeding goals are more likely to put on less weight after each pregnancy and have lower risk of developing type 2 diabetes long term” (P15)

Implementation timing

Preconception

The idea to implement FITZ as a preconception intervention was raised twice by two participants:

“Probably before they become pregnant! They would benefit from this support from the initial diagnosis of GDM, not after delivery” (P3)

“I think for those with gestational diabetes the earlier the better as it then would continue into the postnatal period” (P8)

During pregnancy

Suggestions for FITZ to be implanted during pregnancy was most popular and arose 16 times in responses by 13 participants. Implementation during pregnancy was associated with increased motivation to engage with the app, more time to get used to a new concept and the possibility of tackling weight management at this time:

“at beginning of pregnancy as could be used to prevent excessive weight gain during pregnancy and they will need to be in the habit of using it before they have a new-born to care for otherwise it may never happen!” (P12)

“Antenatal period while the majority have more time to use it. If they like it they will make the time to use it after birth” (P6)

Some also thought this timing would help to overcome a lack of support delivered by maternity care postpartum and would allow for HCPs to support it's use:

“Most women have enough to think about post-delivery - it needs to be introduced during pregnancy when the service users are having frequent contact with HCPs who can encourage and support them to use it” (P3)

“Most units do not follow up GDM, lack of resource. We give all postnatal information at 36 week appointment, which we build up through the pregnancy as a very important appointment” (P5)

Postpartum

Four HCPs thought FITZ would be best delivered postpartum:

“Probably 6-8 weeks. Delivery is not a good time in my view - too many things going on. 36 weeks too late. At 6 weeks, GDM is still fresh in memory, and HbA1c results are being reviewed” (P18)

“I think after delivery, likely 6-8 weeks would be an option” (P9)

Recurrently

One HCP said they would recurrently offer FITZ before, during and after pregnancy to maximise reach:

“offer it recurrently - women will feel ready for something such as this at different points. Most will be very tired between delivery and the first 6 weeks though!” (P10).

When asked if they would like to try the FITZ app for themselves, seven (37%) said maybe, six (32%) said yes and six (32%) said no. When asked in what ways FITZ could be presented to women to make it most engaging, only two (11%) didn't think any of the provided suggestions were viable options (Figure 27). The option for FITZ to be used alongside online peer support (such as Facebook) was the most popular option with 15 (79%) HCPs thinking it was a good idea. This was closely followed by use alongside other apps (14/19, 74%), use alongside face-to-face support (13/19, 68%)

and use alongside videocall support (12/19, 63%). Ten (53%) HCPs selected all the options as being relevant ways of supplementing the use of FITZ.

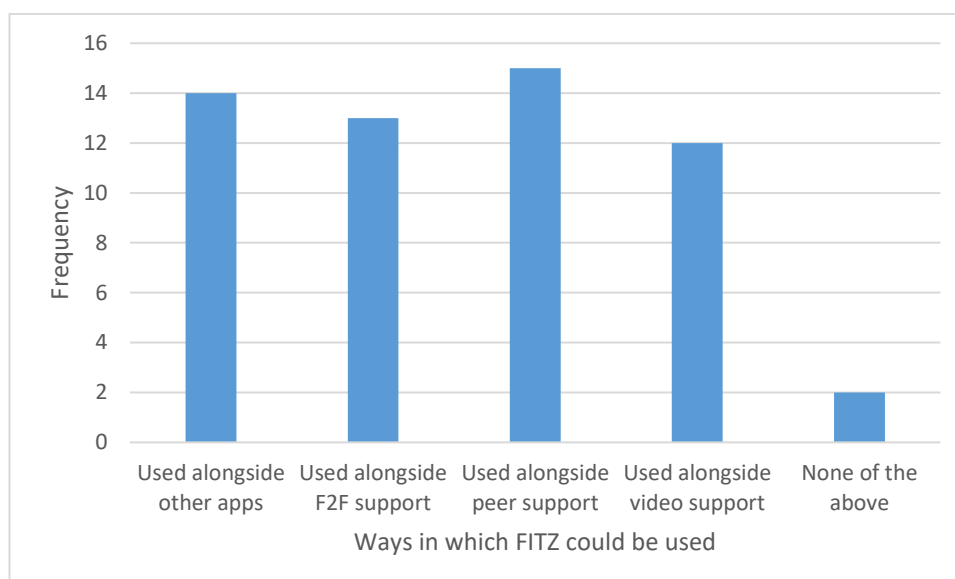


Figure 27. Ways in which FITZ could be delivered for women with history of GDM

9.4.3 Co-production Workshop findings

Those who took part in the workshop are highlighted in table 20. On joining the workshop three participants had downloaded the app and used it, the other three had not due of time constraints.

Themes and subthemes

Table 22. Themes and subthemes from the workshop held with HCPs

Themes	Sub-themes
Workshop Section 1: Experiences of using FITZ: Benefits and Challenges	
Perceived benefits and challenges (32)	Experiences and the concept of FITZ (9)
	Engagement (8)
	Complexity and language (7)
	Implementation issues and timing (8)

Workshop Section 2: suggestions for improvements

FITZ appearance and content (16)	Appearance and navigation (7)
	Length and delivery of content (5)
	Self-talk feature (4)
Ideas for Implementation (13)	Integration with Primary Care (4)
	Integration with other interventions (9)
Tailored content (19)	Breastfeeding (3)
	Dietary advice (4)
	Postpartum T2DM screening reminders (5)
	Peer support (7)

Workshop Section 1: Experiences of FITZ: Perceived benefits and challenges

Perceived benefits and challenges

The theme of perceived benefits and challenges arose on 32 occasions with four subthemes; ‘experiences and the concept of FITZ’, ‘engagement’, ‘complexity and language’ and ‘implementation issues and timing’ (Table 22).

Experiences and the concept of FITZ

Experiences and the concept of FITZ arose nine times for all six participants. At the start of the workshop discussion focused on HCP’s experience of using FITZ, if they’d tried it, and their thoughts around the concept of FITZ and if it could be beneficial for women:

Facilitator: *“For those of you who used the app what was it like, how did you find it?”*

P12: *“I did actually get quite into it, like I wasn’t fully sure on it, you know. But I actually quite enjoyed doing those little practice things, you know like the lemon one, it was just quite a nice thing to do”*

P13: *“I think some women will enjoy doing it, it’s almost a bit like, umm,*

mindfulness

P8: *“yeah overall it was good, there were a few little bits where I was like ‘hmmm’ what do I do here?’ like it wasn’t fully you know clear but it was pretty easy to work out how to use it”*

P13: *“yeah it does get a bit of getting used to like anything”*

All six participants agreed the concept of FITZ was interesting, different and needed and that it had potential to be beneficial for some women:

Facilitator: *“and in terms of the idea behind it [FITZ] what are your thoughts on that in respect of helping women [with GDM] to manage their weight?”*

P19: *“it is different isn’t it, and I think that’s a good thing, like if the other stuff clearly isn’t working then maybe people do need a little extra push with something that’s different”*

P2: *“yeah I agree, for a lot of us we know what we’ve got to do [to lose weight] but it’s a case of doing that and I think that’s where this could come in”*

P8: *“Yeah I think for some women this might be the missing link to do something to make it happen”*

P13 *“there’s already a lot out there isn’t there about kind of what to do, how to eat, how to exercise so it does do something different”*

P16: *“don’t get me wrong it won’t work for everyone, but what does?”*

P12: *“no it won’t”*

P16: *“I do think it has potential though, but yeah maybe some tweaks here and there”*

Engagement

The conversation then moved on to some of the challenges associated with using FITZ, including perceived challenges for women and issues around implementation. The main focus of participants concerns with the app were heavy reliance on women to engage with the content over time and that some women, particularly after having a baby might not have time to engage with all of the content. The subtheme of engagement arose eight times from three participants:

P12: *“my biggest worry with this is, is, the amount that women have to do”*

P8: *“yeah, it’s a lot for women to involve themselves in isn’t it? especially if they*

have a new-born”

P13: “yeah I don’t have a new born, and I struggled a bit to open it up every time it sent those like prompt things, you know... with the calendar”

P12: “at the moment I just worry that it’s not like appealing enough for women to want to open it up and use it”

P13: “I mean you can make it look nice, its just one of those things isn’t it that using something is the key”

Complexity and Language

Other concerns related to engagement with the app focused on its complex content, which participants felt would need to be translated into other languages to limit health inequalities. The subtheme of complexity and language arose seven times from three participants:

P16: “like I said earlier I don’t think its going to be for everyone, you know its got some quite complex things about it, and you know those ladies who maybe don’t have the, um, you know, literacy to understand it, it might not be the right approach for them, but it will be fine for some”

P2: “I agree its complex, that’s what it is, kind of complex to use and doing something quite complex”

P9: “yeah and the language, like if you had that in another language I wonder, like if it’ll translate?”

P16: “that’s a really important thing isn’t it? because so many of our ladies don’t speak, umm, English as their first language and these things really need to be accessible”

P9: “it’s not easy to explain either, like if I think about giving this to a woman I’ve really got to think about will she understand this?”

Implementation issues and timing

Another issues HCPs saw with FITZ was how was it going to be implemented. This subtheme arose eight times from five participants. The main focus here was that women would have many more barriers postpartum, but also they get lost in the healthcare system following birth and often do not attend screening making it difficult to reach women:

Facilitator: So in terms of getting the app to women, are there any issues you can see there?

P12: *"Like I think I said when I answered your survey I really think this needs to be given to women when they're pregnant"*

P2: *"they're too stressed afterwards"*

P12: *"they're too stressed, they're tired and they're probably just keeping above water you know"*

P13: *"they're more engaged when they're pregnant coz they want to do what's best for their baby and you can understand that"*

P2: *"and I think the other thing is they get lost afterwards, we don't see them, the health worker only really sees them once unless there's issues"*

P13: *"and they often don't go to their screening, so they often slip through the net of primary care, who are so busy, but we all are"*

P16: *"it really is the biggest problem is that how do you give these women support when essentially there is no one clear pathway to support them afterwards"*

P2: *"yeah it's a big one because we all know that these ladies are, unfortunate to say, but they probably will be back in our service again with GDM, but how do you stop that? We know they might need to lose weight and be more healthy but they slip off the radar"*

P19: *"we just expect them to do it own their own and actually that's not ok, its hard, they need support"*

Workshop section 2: Ways of improving the app and overcoming issues highlighted in section 1

This part of the workshop focused on what could be improved with FITZ, with focus on the challenges discussed in the first half of the session. The facilitator summarised the points made, and the group agreed that the key challenges were: 'Increasing the likelihood for women to engage with FITZ' and 'Planning Implementation' (Figure 29). Two other main headings were added to the board as the discussion progressed; 'Integration' and 'Tailored Content'. Participants were able to write down their ideas on a coloured 'sticky notes' using the interactive Miro Board. The board was captured at the beginning (Figure 28) and end (Figure 29) of the workshop.

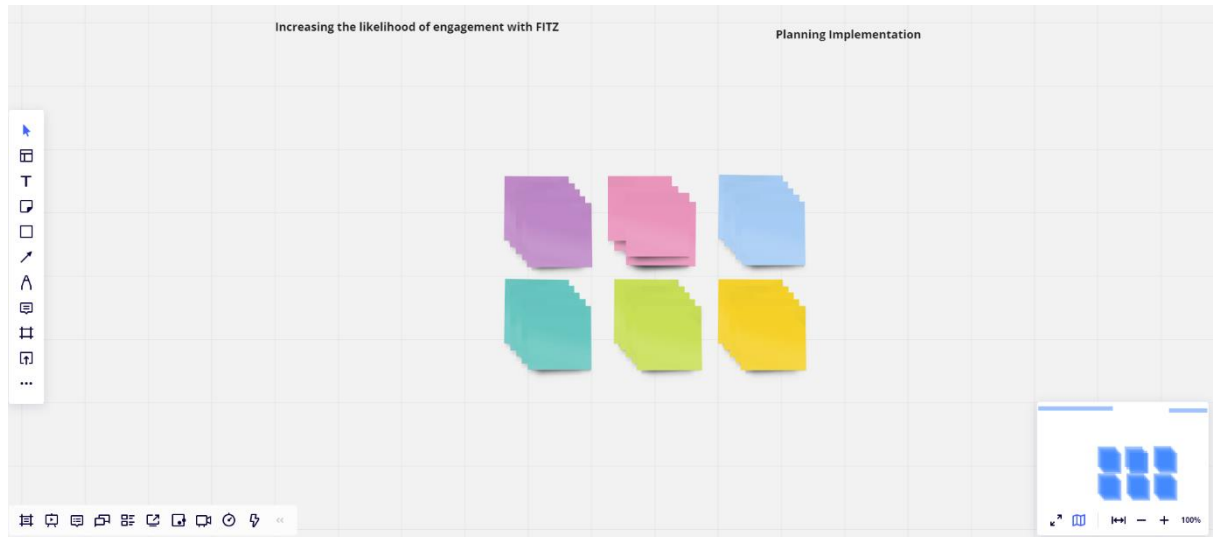


Figure 28. Miro Board at the beginning of the co-production workshop

Three main themes, FITZ appearance and content, Ideas for implementation and tailored content, emerged from the conversations during this part of the workshop and are presented below

FITZ appearance and content

The theme of ‘FITZ’ appearance and content’ arose on 16 occasions with three subthemes: ‘appearance and navigation’, ‘length and delivery of content’ and ‘self-talk feature’.

Appearance and navigation

Appearance and navigation arose on seven occasions from three participants. In relation to engagement all participants agreed the appearance of the app could be improved to help people use it more including making the app look more ‘exciting’:

P12: *“it looks a bit....I dunno....”*

P16: *“clinical?”*

P12: *“yeah, clinical, and just a bit dull”*

P16: *“especially when you’re trying to motivate people, I just thought hmm maybe this could be a bit more exciting, give me inspo you know”*

P12: *“Although saying that I do like the little FITZ person he’s quite cute isn’t*

he, I think people will like him”

P13: “yeah I quite like him”

HCPs also thought the navigation of the homepage of the app could be improved with pictures and logos and having a main ‘front page’:

P13: *“When I was using it, I did notice that like I didn’t really get when I went back into where I was supposed to like go”*

P8: *“all this text on the main screen, its bit like overwhelming”*

P13: *“maybe then we could have like all the stuff that’s hidden in the menu, you know that bit at the top there, perhaps that could be on a main screen?”*

Facilitator: *“do you mean like ‘my goals’, ‘resources’, ‘my calendar’...all of those things?”*

P13: *“yeah, and the you can have one that says something like, I dunno, ‘coaching’ or something to get the bit with all the text and the little fella”*

P12: *“and also have the pictures that you upload on the main screen as well, they were quite hidden I thought”*

P8: *“that actually might make it a bit easier when you open it up”*

P12: *“to like see where to go”*

P8: *“yeah”*

Length and delivery of content

All participants agreed the length of the coaching content could be reduced and instead of reading the text, this could be audio or visually presented to reduce the burden on women when they might be tired. This subtheme arose five times from three participants:

P8: *“All the text it is a bit much, I get why its there but if it could be shorter maybe?”*

P2: *“yeah or in smaller chunks so it’s easier to go back to, I found it tricky to like leave it and then come back to it”*

P12: *“or maybe the little chap could say it as well as it come on the screen as text?”*

P8: *“now I like that idea!!”*

P12: *“yeah either listening or video I reckon would make it so much easier to take in”*

Self-talk feature

The subtheme of 'self-talk feature' arose four times from three different participants.

HCPs felt uncomfortable recording and listening back to their goals and felt women might feel the same:

P12: *"I have to say that I felt proper weird talking into it, and I'm just not sure that if I was a busy mum I'd want to do that"*

P8: *"yeah I really didn't like hearing it back either"*

P12: *"Maybe I'm just not getting why it's important but if it is important they maybe it could offer them to write it or like text it instead of talking into it"*

P13: *"yeah I feel the same, writing it out or at least having the option for that"*

Ideas for Implementation

The theme of 'ideas for implementation' arose 13 times from all six participants and included two subthemes 'integration with primary care' and 'integration with other interventions'.

Integration with primary care

Participants expressed that for FITZ to really be effective after pregnancy it would need to ingrate or be able to feedback information to primary care professionals. This subtheme arose four times from two participants:

P8: *"like I was saying with it being one app it really does need to link with primary care for afterwards"*

P13: *"mmm yeah they're the ones who will see them for the screening and everything"*

P8: *"like if it could relay information to them, it would let them know or like trigger that the woman was wanting to manage her weight in the first place, but maybe then also tell them like how she's getting on, you know, the progress she's making"*

P13: *"yeah just to let them know that she's doing something to manage her*

weight, coz it is a difficult conversation for anyone, but if you know already that it's on that persons radar then it might be I bit easier to bring up, I dunno?"

Integration with other interventions

Integration with other interventions arose nine times from all six participants. HCPs discussed the possibility of FITZ being integrated into the Diabetes Prevention Programme (DPP). This was seen as advantageous as the programme has recently become digital and women with prior GDM have become eligible, regardless of their HBA1C levels. However, some professionals saw issues with women being referred to the programme and if the service would be tailored enough for postpartum women:

P19: "Perhaps it could be a part of the DPP? I know they've moved to a digital format now but I'm not 100% on actually what that involves but it could sit really nicely in that programme".

P16: "but it's a question of how do we get women in? Women have left us after pregnancy and often don't engage with their GP or their GP doesn't actively follow them up. I just think it's risky that women wouldn't actually end up accessing it"

P2: "I went to a conference recently and they said that women with GDM history are now eligible which is good, but how many of us know that? I only know because I went"

P16: "yeah and actually, obviously it's a good programme, but how well is it set up for postpartum women?"

Integration with existing apps, especially those in the NHS app library was seen as a way to increase the ability for other HCPs to recommend FITZ. One participant had experience with the 'Baby Buddy' app and suggested the content of FITZ could be combined as a section within an app like Baby Buddy. Further discussion on this type of integration got the group talking about the wider application of FITZ to other pregnant women. Creating behaviour change among a wider group of pregnant women was

seen as important as there are a lot of issues that require motivational support, not just weight management:

P12: "Have you heard of Baby Buddy? It got presented at a conference I was at and I know they're making improvements to it, but its, it's on the NHS App Library and it's been developed by loads of midwives and professionals, so I kind of think well, could it be part of that somehow?"

P19: "what's it for?"

P12: "so women can use it when pregnant but it's also for use for parenting after pregnancy too, I'm pretty sure its in some maternity pathways already"

P19: "that might be good actually then because *you'd also be able to target other behaviours, couldn't you?* You know like smoking or alcohol, not just the weight and while they're pregnant too"

P12: "that goes back again to giving them this in pregnancy doesn't it?"

However, others thought integration with a generic pregnancy app might reduce the focus on weight management and women might end up just use the parts that were related to the baby:

P2: "hmmm I do wonder though if women would use it if it was in with a load of other stuff?"

P13: "yeah they might get into all the stuff about the baby but as you do, ignore the stuff that's for them"

P8 "yeah I could see that happening"

P2: "I also wonder if it might not be like GDM enough? Like I'm sure it's good but we are talking about women with GDM, they need all the diet and blood sugar stuff on top of everything else"

This led to discussions that perhaps FITZ could be integrated into an app supporting women with GDM specifically:

P2: "*I wonder then if it could be part of a bigger app for GDM, like some services have the blood glucose apps, I dunno?*"

P8: "*like a kind of one stop shop for everything?*"

P2: "*yeah like if you've lots of apps that you have to log into it can be really annoying, can't it? If they [women] could just go to one app to get everything they needed, monitor blood sugar, get diet advice, this motivation stuff that the*

FITZ offers, it could be all there for them during and after pregnancy”

P8: “it would also be easier for us at the professional end to like track it all”

The ideas discussed around tailored content, for an overall app including FITZ were discussed at length and are therefore presented as their own distinct theme below.

Tailored GDM content

The theme of ‘tailored GDM content’ arose 19 times from all six participants and includes four subthemes; ‘breastfeeding’, ‘dietary advice’, postpartum T2DM screening reminders’ and ‘peer support’.

When talking about integrating FITZ into a standalone app for GDM, HCPs discussed potential tailored content to add in, to make the app specific to those with experience of GDM. This included information on breastfeeding, diet and reminders for glucose screening postpartum.

Breastfeeding

The subtheme of breastfeeding arose three times from three different participants.

HCPs expressed it would be important to include information and support on breastfeeding as it impacts postpartum weight management:

P16: “I definitely think something about breastfeeding in there is really important, we know it’s good for baby but also mum, it can help with weight management”

P13: “yeah I think that’s important and its good to even read about that during pregnancy”

P2: “this is something specific too, that you wouldn’t get on the DPP for example, its important”

Dietary advice

The subtheme of dietary advice arose four times from two different participants. The inclusion of dietary advice was seen as important to HCPs who thought women would benefit from practical guidance:

P19: *"obviously I'm going to say I want dietary advice in there, I know the app is supposed to be like stand alone but if we're thinking one app is easier than many then I think it needs to be in"*

Facilitator: *"in terms of diet would you want other functionality other than information? Like for example a calorie counter"*

P19: *"ideally yes, but honestly how many of us actually stick to using them? Maybe recipes and meal planners to give women a really good chance?"*

P8: *"hmm, I don't necessarily think a calorie counter adds much but I like the idea for the recipes, something practical"*

T2DM screening reminders

The subtheme of T2DM screening reminders arose five times from three different participants. HCPs expressed that including reminders and information about T2DM screening might help to increase the likelihood of women attending screening:

P12: *"reminders too for type two screening at whenever it is now, 12 weeks postpartum?"*

P8: *"yeah and maybe some information in there about why it's important for them to attend that appointment and get checked"*

P13: *"also some stuff about what happens like how the glucose gets tested, I know some women are worried about fasting because of breastfeeding, but they do have options, it's just making that clear"*

P8: *"its giving them very chance to attend, isn't it?"*

Peer support

HCPs also discussed the importance of having peer support to help women engage with FITZ, if they could engage with other mums. This subtheme arose seven times from five different participants. The possibility of including a chat room in the existing FITZ app was discussed but HCPs also talked about how Facebook was already used by

women and already had the ability to engage them. However, HCPs wanted any Facebook activity to be monitored and made private and specifically for those using FITZ:

P19: *"what about putting like a chat room in there so that the women could talk to each other?"*

P2: *"having that support is important"*

P19: *"I just don't know if they would use it, I think maybe Facebook might be better but I know it's a bit more open"*

P8: *"women do like it, don't they and I know they use it"*

P2: *"Maybe if it was like monitored by someone like a person from FITZ and they had all the knowledge and could like stop wrong stuff being like said then that could work"*

Facilitator: *"I think you can make Facebook groups to be private too, so only certain people can be invited, like it's not for the whole of Facebook to see"*

P13 *"yeah that would be essential, all the things that get discussed you'd want that to be in a secure group"*

P16: *"as well as all that stuff though it could also be like a way of pushing, that sounds bad but you know what I mean, like information to them and reminders about stuff and even reminders to use the app"*

P13: *"yeah I think that's a really good idea..."*

P8: *"like all the stuff we just talked about could be in the app but it also could be on the Facebook page too"*

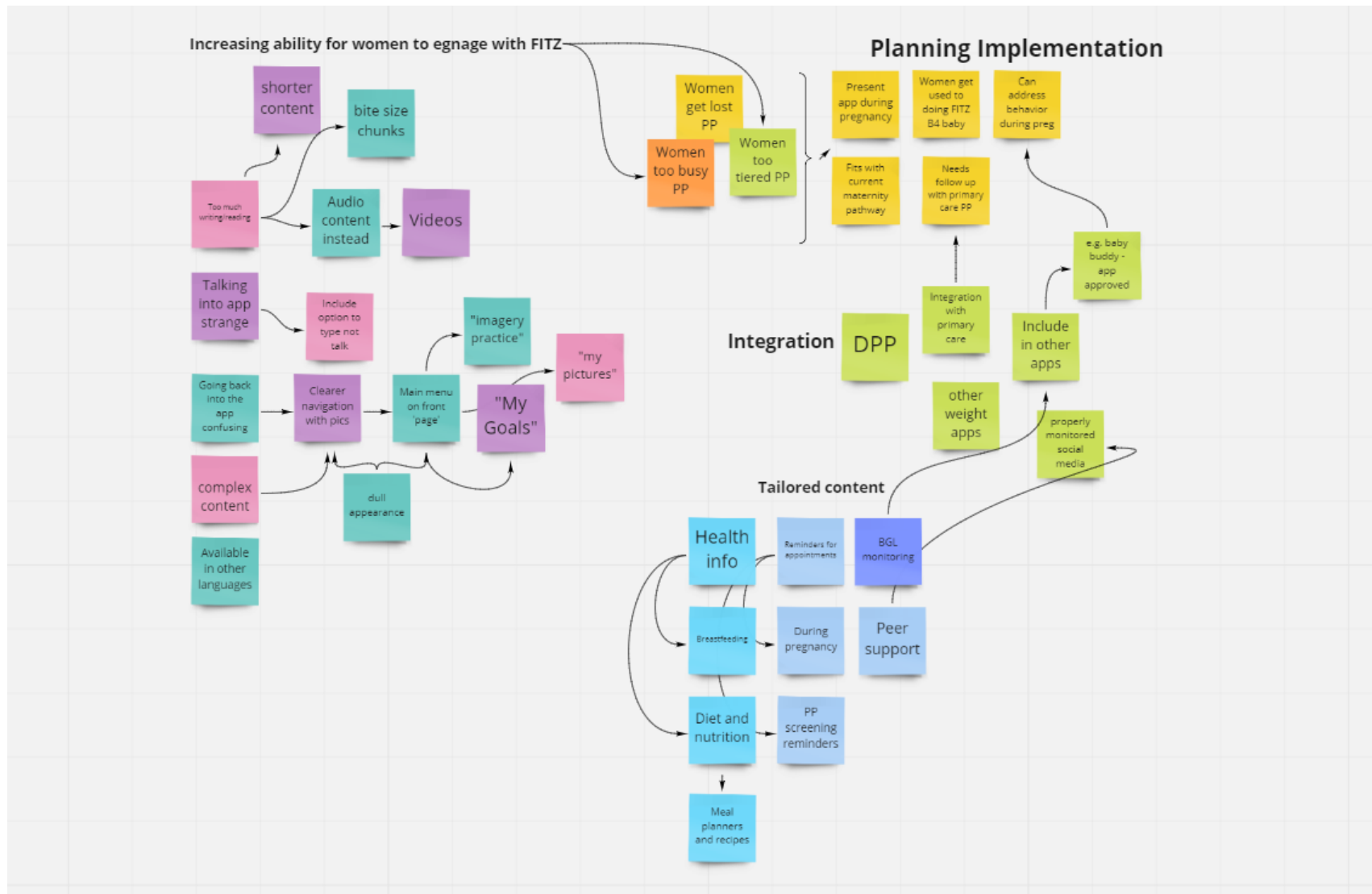


Figure 29. Miro board of suggested improvements and plans for FITZ made by workshop participants

Summary of improvements

A summary of suggested changes (Table 23) and a screenshot of the final Miro board was sent to workshop participants via email to ensure I had captured their thoughts accurately. Five out of six workshop participants responded and said they were satisfied with the summary of suggestions.

Table 23. Table of improvements to FITZ suggested by HCPs during the co-production workshop

Challenges	Proposed benefits	Suggestions for improvement
<ul style="list-style-type: none"> • FITZ appearance dull • Content too long • Navigation confusing • Talking into app undesirable • Limited accessibility (language) • High complexity for women and HCPs 	<p>Increased engagement from busy/tiered women</p> <p>Increase accessibility of FITZ content</p>	<ul style="list-style-type: none"> • Shorter content presented in audio and visual format • More ‘vibrant’ appearance of app overall • New navigation from home page to include icons to direct users to different parts of the app • Ability to translate to other languages • Option to type goals instead of speaking them
<ul style="list-style-type: none"> • Limited engagement from women postpartum • Women not followed up by primary care • FITZ not tailored enough 	<p>HCPs can better support use (Via timing and other credible resources)</p> <p>Improved link with Primary Care</p> <p>Increased engagement from women (via timing and tailoring)</p> <p>Increased accessibility to</p>	<ul style="list-style-type: none"> • Offered during pregnancy • Integrated with Primary care • FITZ content could be added to other popular apps and interventions such as Baby Buddy and DPP • FITZ to be tailored to women with GDM to become a whole package of support

other groups
of women

<ul style="list-style-type: none">• FITZ not tailored enough to postpartum women with GDM	Increased ability to reach women	<ul style="list-style-type: none">• Tailored content to be added to app including breastfeeding, diet, T2DM screening reminders
<ul style="list-style-type: none">• Limited engagement	Provision of peer support	<ul style="list-style-type: none">• Peer support via integrated chat room or via Facebook• Facebook would need to be monitored and private but could also 'push' tailored content to women as well as the app
	Use of platform women already use and engage with	

9.5 Discussion

The final study in this project aimed to assess the acceptability and perceived usefulness of FITZ among HCPs, including any challenges they foresaw regarding implementation in practice. The study also aimed to explore ways in which HCPs thought these challenges could be overcome by making changes to FITZ. The survey conducted as part of this study demonstrated most of the HCPs offered weight

management support, to women, during and after pregnancy. This support typically focused on dietary and physical activity advice. Only two HCPs made referrals to weight management programmes. Half of HCPs hadn't offered weight management support via an app, and those that did, offered MyFitnessPal and Couch to 5k. Previous evidence suggests both the general population wishing to lose weight (Solbrig *et al.*, 2017) and postpartum women with history of GDM (Chapter 7, study 3a) dislike calorie counting, a major focus of the MyFitnessPal app. This finding indicates apps offered to women by HCPs may not align with women's needs. In addition, the finding that HCPs offered few weight management apps to women may also be reflective of a lack of confidence in the credibility and effectiveness of apps, seen in study 3b (Chapter 6) and the evidence very few mHealth interventions for support following birth are tailored to women with GDM (Chapter 7, study 3a).

After watching a video about FITZ, most HCPs had positive perceptions of the app, seeing it as a potentially useful tool that was different from other apps commercially available. Two HCPs did not like the concept and thought other apps such as Couch to 5k would be more motivational. HCPs felt because the intervention was available through an app this made it highly accessible to women, which was seen as a significant benefit. In addition, the app was perceived as a useful tool for helping women to stay focused on their postpartum health. With regards to app features, HCPs saw benefits in push reminders and the FITZ avatar.

Despite mostly positive perceptions, HCPs completing the survey saw significant barriers including high complexity, and high levels of engagement required, leaving them to question if it was appropriate for a range of women. Indeed, a strong

relationship has been established between obesity and low socioeconomic status, especially for women (WHO, 2014). With those who are overweight at higher risk of GDM development (Torloni *et al.*, 2009) and subsequent progression to T2DM (Bao *et al.*, 2015; Sorbye *et al.*, 2020), it is likely that at least a proportion of women will experience barriers to weight management that are outside of their control. These factors cannot be ignored when thinking about interventions to support women to manage their weight following a pregnancy complicated by GDM. Nevertheless, even when opportunity and capability are abundant, motivation is still required (Solbrig *et al.*, 2017). One of the key advantages of a purely motivational intervention, such as FIT and FITZ is they can be used alongside other weight management strategies such as those focusing on reducing societal barriers. Indeed, HCPs in this study suggesting integrating FITZ with other interventions to increase reach and engagement.

The limitations discussed around high complexity and engagement lead HCPs to suggest improvements during the co-production workshop that focused largely on increasing engagement from women, planning implementation, integration, and tailoring content. Reducing the complexity and length of app content was seen as important for maximising the reach of the app. The need for FITZ to be tailored to women with history of GDM was at the forefront of discussion during the co-production workshops, where HCPs discussed the option to have one ‘overarching’ app that included FITZ content but covers other aspects of GDM management. The ability for existing diabetes self-management apps to meet the needs of women diagnosed with GDM, has been assessed (Tassone *et al.*, 2020). Authors found very few apps contained evidence based educational content or tracking tools, nor did they integrate

with electronic health records, suggesting a need for more tailored solutions (Tassone *et al.*, 2020).

Integrating the content of FITZ into the Diabetes Prevention Programme, 'Healthier You' was discussed as an alternative implementation strategy that could increase reach. However, concerns were expressed the programme wouldn't be tailored enough for women and actual referrals to the programme would be minimal. Women with GDM history are now eligible to participate in the digital version of the DPP (Valabhji, 2021). However, to-date it is unknown how many women with history of GDM have been referred to the digital DPP or what its impact has been on diabetes prevention. Another suggestion related to improving implementation, was most HCPs felt offering FITZ during pregnancy would lead to many benefits including being able to embed FITZ within clinical pathways right from diagnosis, engage women before busy new motherhood begins, and support positive health behaviour change during pregnancy. They also felt this strategy would help them to support women to use the app. However, it was still unclear how the app would be managed postpartum. The suggestion for integration into GP systems was made, but there was strong recognition that women often get 'lost in the system' at this time.

Indeed, one of the key challenges identified by HPCs, related to FITZ implementation, was the fragmented transition from maternity care into general practice following birth. An absence of coordination between clinical teams has made communication of consistent advice, and tracking women's data, difficult. Some have described this situation as a 'perfect storm' whereby women must navigate several systems all while dealing with new motherhood (McCloskey *et al.*, 2019). Indeed, uptake of screening

for T2DM in primary care in the UK is poor (Ward *et al.*, 2020). Confusion regarding who's responsibility it is to follow-up women (Rayanagoudar *et al.*, 2015) as well as a lack of evidence on the best way to prevent long-term adverse outcomes (Pedersen, Terkildsen Maindal & Juul, 2017; Hedeager Momsen *et al.*, 2020) means HCPs are left with uncertainty and inertia (Pierce *et al.*, 2011) and women feel abandoned and forgotten (Parsons *et al.*, 2018; McMillan *et al.*, 2016). This situation has a huge impact on the successful implementation of any intervention aiming to support women with history of GDM following birth, particularly considering integration of data with existing healthcare systems is seen as important (Pais *et al.*, 2017) as is delivery by HCPs for increasing credibility (Lim *et al.*, 2019).

Nevertheless, lack of engagement from women in formal healthcare systems and interventions, following birth, brings into question the use of alternative implementation strategies. The option for FITZ to be used alongside peer support (such as Facebook) was the most popular option selected by HCPs for additional ways to FITZ to be presented. This is interesting considering the hesitancy expressed by HCPs to use or recommend social media as a resource to women (Chapter 7, study 3b). However, evidence does suggest some women with history of GDM are highly engaged in this platform (Chapter 7, study 3a) and thus, using Facebook is a possible strategy that could help engagement with FITZ. The use of social networking sites such as Facebook for behaviour-based interventions is still relatively new (Maher *et al.*, 2014), with few exploring it as the primary intervention platform. As early as 2013, women with history of GDM have asserted the importance of using internet and social media as a way of increasing participation in diabetes prevention programmes for women with history of GDM (Dasgupta *et al.*, 2013). However, using the social networking site to deliver

intervention components is increasing. For example, midwife moderated Facebook groups have shown to be successful in providing information and advice to pregnant women without diabetes (Mcarthey *et al.*, 2020) and Facebook groups have been used as part of a walking intervention for pregnant women with obesity (Senek, 2018).

9.5.1 Strengths and Limitations

Strengths

Strengths of this research include good levels of HCP recruitment and representation of HCPs from different geographies and disciplines. Informal feedback shared at the end of the workshop suggested a good level of rapport had been developed. For example, *“it was good to have this discussion with other professions, it really got us thinking”*. The interactive nature of the Miro board was also seen to help generate and organise participants’ thoughts in a fun way; *“I think this thing [Miro] has been really good, it makes it so much more interesting and I feel like we can see what we want instead of just talking about it”*.

Others also acknowledged being involved in the chance to change a possible intervention was important to them indicating a possible appetite for future co-production; *“it’s just nice to be asked, and involved, these things often just get thrust upon us and we don’t get a chance to say ‘well this isn’t going to work because of ‘xyz’ and then we have a hard time making it work, so it’s really good, thank you”*. A further strength of this study was the opportunity for HCPs to engage in co-production, which built on the methodological recommendation found in studies 3a and 3b (Chapter 7)

that HCPs should be involved in the co-production of mHealth for GDM so their concerns and expertise can be incorporated leading to more effective implementation.

Limitations

Firstly, the sample relied on volunteer purposeful sampling, with an ability to speak and understand English. This criterion and sampling method could have introduced potential bias and is therefore acknowledged. Potential biases because of this sampling method including concerns of representation. The 'online' recruitment strategy used in the study may also mean participants were already experienced with digital technologies, limiting the generalisability of findings. However, use of email and social media is relatively commonplace among the general population, and the broad range of years in practice suggests HCPs may have a broad range of technology experience.

When answering the survey HCPs had not used FITZ themselves and were answering questions based on a video, about FITZ, provided in the survey. It is possible the video could have elicited different responses compared to views elicited from actual app use. However, based on feedback from two HCP experts, the design of this study was focused on reducing participant burden for busy HCPs. Actual app use was perceived to take up too much time and would yield limited responses. Indeed, of the six participants taking part in the workshop, three did not manage to use the app prior to taking part in the workshop, due to limited time resources.

The recruitment strategy used in this study also raises important ethical questions regarding asking busy NHS employees to complete research activities in their own

time, despite their professional expertise being relied upon. This approach was taken in this study mainly due to the way HCPs were approached, via separate professional networks, rather than their place of work. The decision to take part was entirely voluntary, nevertheless, questions do remain on how HCPs should be approached to take part in research that relies on their professional experiences.

Despite several recruitment efforts, no HCPs based in primary care took part in either the survey or workshop. The recruitment of HCPs generally is known to be difficult (Parkinson *et al.*, 2015), particularly in unfunded research, this low level of participation is acknowledged as a limitation of this research. This is particularly salient considering the key role played by primary care in screening postpartum women with history of GDM for T2DM, and the typically disjointed nature of postpartum care between maternity and primary care services for women, following delivery (McCloskey *et al.*, 2019).

Finally, three HCPs who took part in the survey within this study also participated in a previous study (study 4, Chapter 7) as part of the overall project. Therefore, their previous interactions may have introduced bias to their survey answers. However, participants were reassured at the start of the survey their answers would remain anonymous and all feedback regarding the app, including negative feedback, was welcome.

9.5.2 Implications

HCPs enjoyed and valued being part of the co-production process, a process that generated unique insight into how FITZ may and may not work in practice. It has also

led to important insights into ways in which the app could be improved, not only to better embed it in practice but also to increase engagement from women. This further supports the recommendation in studies 3a and 3b (Chapter 7) that HCPs should be more involved in co-production of mHealth for GDM to increase the likelihood of successful adoption, use and impact. With clear limitations of FITZ highlighted by HCPs, it will be important for any future iterations of the app, whether in its current form or within an 'overall app for GDM', to include HCPs' suggested changes. These suggestions also require triangulation with women's feedback, to construct a comprehensive set of changes that incorporate both stakeholder perspectives and needs. Finally, the discussion among HCPs regarding the significant challenge of transitioning between maternity and primary care, following birth, further highlights the need for health services research to focus on a re-structure of postpartum GDM care pathways, to help HCPs better deliver the support women require to give them the best possible long-term outcomes. Outcomes from this work are highly likely to have major implications for the design and development of interventions aimed at supporting women with GDM history, following birth and hold significant potential to increase engagement and effectiveness.

9.6 Phase two reflection

Phase two of this project aimed to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM. It was important to undertake this work to understand what women and HCPs thought of the idea behind FITZ, if they would be willing to invest time into its use and implementation and to understand which bits, if any, they

like or disliked. The feedback from this work would be influential in making any decisions regarding the rationale for further work on FITZ within this population including further adaption and evaluation. Triangulation of findings presented in this reflection are 'participant-based' as data was collected from two different stakeholder groups (women and HCPs).

The findings from studies 4 and 5 suggest that FITZ has potential as an intervention for at least a sub-set of women who are looking to manage their weight. Overall, both groups of stakeholders reported that FITZ was a useful and different concept that aligned with women's needs. Difficulties in retention of women in study 4 suggest potential issues with app engagement and HCPs feedback suggested that engaging women was one of their major concerns.

HCPs and women both made suggestions for adaptations to FITZ to help overcome challenges related to engagement and implementation. HCPs contributed most suggestions as they were involved in a co-production workshop. However, both groups suggested shortening the length of the app content, adding in an option to type goals rather than speak them, and add the option for peer support, possibly facilitated via Facebook.

In combination, these findings suggest that further development of FITZ is warranted for the intervention to better meet the needs and context of this population of women and their HCPs. Further cycles of iterative development and feedback are therefore needed with an overall goal of creating an intervention that could be evaluated for its effectiveness in preventing T2DM and recurrent GDM among women with history of GDM. Opportunities and suggestions for future research are presented in chapter 10.

9.7 Chapter Summary

The final study in this project sought to aimed to assess the acceptability and perceived usefulness of FITZ among HCPs, including any challenges they foresaw regarding implementation. The study also aimed to explore ways in which HCPs thought these challenges could be overcome by making changes to FITZ.

The findings from the survey demonstrated FITZ was seen as a useful tool, but it was clear some changes would need to be made to make it fit with both HCPs practice and women's needs. Key challenges expressed by HCPs included 'increasing engagement from women', 'planning implementation' 'integration' and 'tailoring content'. A co-production workshop generated important suggestions and strategies for change. It will be important for any future development of FITZ to include recommendations from both women and HCPs to ensure it meets the needs of both sets of stakeholders.

The next, and final, chapter of this thesis (Chapter 10) will provide an overall discussion of the project, including triangulation of study main findings, strengths and limitations of the project overall, as well as recommendations for future research, practice and policy.

Chapter 10 Discussion and Conclusions

10.1 Overview

The final chapter of this thesis explores the original research question, aims and objectives. The overall findings are summarised and compared with existing literature. Contributions to new knowledge are discussed, along with the overall strengths and limitations of the project. Implications for policy, practice and research are highlighted and suggestions for future research are explored.

10.2 Research question and aims

Using technology to prevent further diabetes in women with previous gestational diabetes has been highlighted as one of the top 10 research priorities for diabetes in pregnancy stakeholders (Ayman *et al.*, 2021). Evaluation of existing lifestyle interventions for postpartum women with history of GDM demonstrate limited impact on weight management. Lack of attention to intervention reach, participation, fidelity and implementation have meant current interventions have minimal ability for translation to real-world contexts (Lim *et al.*, 2020a).

mHealth technology has been suggested as a way of, at least partly, increasing participant reach and intervention fidelity. Despite this, the optimal design of mHealth weight management interventions for women with history of GDM remained unknown. In addition, it was unclear if and what mHealth was already available for women with history of GDM and if they incorporated relevant behaviour change techniques. In addition, relatively little was known about women's views and

experiences of using mHealth or which features they particularly valued to support them achieve their health behaviour change goals following birth.

Evidence also demonstrated women faced considerable barriers to maintaining motivation when undertaking and sustaining weight management, despite desires to improve their health, suggesting they may benefit from the delivery of motivational support. Motivation is a good predictor of long-term weight loss. However, few interventions focused on providing women with prior GDM motivational support and it was unclear if women desired this type of help. A newly developed intervention, FIT, demonstrated promise as an effective weight management intervention among the general population, however the efficacy of delivering the intervention via mobile app was yet to be determined as was its implementation among women with history of GDM.

Guided by the pragmatist paradigm, this project therefore sought to address the following research question:

Could a motivational mHealth app (FITZ) be a needed, acceptable, and feasible weight management intervention for women with history of GDM?

Taking a mixed methods approach, seven studies were conducted over two phases to meet the project aims, which were:

- 1) to better understand the need for, and the role of, mHealth to support women with a history of GDM following birth

- 2) to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM.

10.3 Summary of Key Findings

The systematic scoping review completed as part of study 1 (Chapter 5) demonstrated that most mHealth to support women with GDM currently focused on improving BGC among pregnant women. Few mHealth interventions focused on the provision of support following birth and none focused on reducing GDM recurrence. Most mHealth for GDM included BCTs, however, 13 out of the 26 were not used, including motivational interviewing, suggesting discrepancy between the BCTs integrated and those that might best address women's barriers and needs at this time. Overall, a lack of published studies examining mHealth for postpartum and interconception use indicated that further high-quality primary research was needed to better understand and identify effective ways of using mHealth to reduce risks associated with GDM recurrence and progression to T2DM.

Exploration of key stakeholders' existing experiences of mHealth and their desires regarding the purpose, functionality, and implementation of future mHealth to support women following birth (Study 2b, chapter 6) suggested women and HCPS desired mHealth interventions to support weight management and maintain motivation. Few stakeholders held concerns for the use of mHealth, but improving credibility was important. Differences emerged between HCPs and women in terms of the features they valued in mHealth to support weight management. HCPs were the

only stakeholder group to report preference for calorie counting and step tracking, while women thought information and peer support were more important.

Further in-depth exploration of women and HCPs' experience and views of using mHealth (study 3a & 3b, chapter 7) corroborated the need for motivational support where both women and HCPs expressed a need for something different, that supported women to achieve optimal health before their next baby and beyond. Women did use behaviour change apps, but they did not meet their needs. Women reported using existing commercially available apps to support weight management, but described limited engagement and frustration with some features such as calorie counting, as it was contradictory to the way they had managed their diet during pregnancy. Women highly valued the use of social media, but HCPs were reluctant to recommend this as a source of credible information due to lack of governance and fear of misinformation spread. Findings from both these studies suggested current mHealth interventions may require a broader focus to meet motivational and peer support needs.

The acceptability of FITZ was explored among recently postpartum women, receiving care from a diabetes in pregnancy service (study 4, chapter 8). Findings confirmed that despite wanting to manage their weight, women experienced significant goal conflict related to looking after a new-born and lack of motivation to overcome other barriers they faced. These findings suggesting women wanted help to improve motivation and reduce the barriers they face when making behaviour change following birth. The concept of FITZ aligned with women's goals to manage their weight and the low barriers they experienced to achieving them, such as low motivation. The app was

perceived as a useful tool by the small number of women who tried it. Spontaneous suggestions for improvement implied FITZ required further development to better meet women's needs including the addition of peer support. Due to limited ability to retain women in the study following birth, the willingness for women to use and engage with FITZ, at this time, remains unclear.

Finally, during exploration of FITZ among HCPs the app was seen as useful, but it was clear that several challenges would need to be overcome to help FITZ become embedded and become usable for a wider range of women. Key challenges expressed by HCPs included 'increasing engagement from women', 'planning implementation' 'integration' and 'tailoring content'. A co-production workshop generated important suggestions and strategies for future development of FITZ that focused on improving engagement and overcoming implementation challenges. The main outcome from work carried out in phase two of this project was a comprehensive list of stakeholder informed suggestions that could be applied to further refinement of FITZ.

In summary, and with relation to the research question, the findings from this project suggest that a digitally delivered weight management intervention that is underpinned with relevant BCTs and provides motivational support is a concept both needed and wanted by women and their HCPs. While initial acceptability of the concept of FITZ is implied from findings, further adaptations and feedback are required to further confirm both acceptability and feasibility among this population. With this in mind, opportunities and suggestions for future research are discussed further on in this chapter, as are limitations that should be considered when interpreting project findings.

10.4 Comparison with existing literature

Findings from this project align with exiting literature in several ways. The findings of individual studies are compared to relevant existing literature in their respective chapters to avoid repetition. This section provides a comparison of overall project findings with existing literature.

Firstly, our findings corroborate previous literature that women with history of GDM experience multifaceted barriers to achieving their weight loss goals creating low levels of motivation to undertake and sustain behaviour change (Gilinsky *et al.*, 2015; Ratner *et al.*, 2007; Nicklas *et al.*, 2011; Christiansen *et al.*, 2021; Ryswyk *et al.*, 2015; Lim *et al.*, 2020a). The women included in this project had goals to manage their weight but achieving them was hindered by commitments to taking care of a young family, lack of willpower around food, and limited motivation to sustain changes over time. Women in this study heavily cited lack of motivation as a factor impeding their weight management goals, particularly over long periods of time, where weight-regain would occur. Weight re-gain is typical in the general population (Dansinger *et al.*, 2007; Dombrowski *et al.*, 2014), and is partly due to inability to maintain motivation to sustain adherence to behavioural intervention (Elfhag *et al.*, 2005; Silva *et al.*, 2011).

Our findings also contribute towards the question of which BCTs or combinations of BCTs may or may not enhance the effectiveness of behaviour change interventions for women with history of GDM. Prior literature suggested that while the application of specific BCTs might be effective across population groups (e.g. self-monitoring) (Michie *et al.*, 2009), some findings suggest particular approaches may apply to certain subgroups (Golley *et al.*, 2011; Lara *et al.*, 2014). A systematic review and meta-

analysis aiming to understand which BCTs were effective for changing physical activity and healthy eating behaviours among postpartum women with and without GDM, found no specific strategy was significantly associated with physical activity or weight related outcomes (Lim *et al.*, 2020b). While the results of this project do not imply effectiveness, they suggest that the inclusion of BCTs that focus on building motivation, self-efficacy as well as social support are seen as needed and wanted concepts by women and their HCPS.

Other social and environmental factors that contribute to weight gain include, food availability, advertising, and low socioeconomic status (Lee, Cardel & Donahoo, 2015). The 'social gradient of health' shows that inequalities in health stem from social inequalities, meaning the lower a person's socioeconomic status the worse his or her health is likely to be (Marmot *et al.*, 2020). For example, energy dense foods that have poor nutritional value are often cheaper than healthier alternatives such as fruit and vegetables, and families with less income primarily make food choices to satisfy hunger (Robertson, Lobstein & Knai, 2013). Indeed, motivation does not act in isolation to influence behaviour. A person must have both the capability and opportunity, as well as motivation, to engage in healthy behaviour (Michie, van Stralen & West, 2011).

Opportunity is an attribute of an environmental systems (social and physical) that together with capability make a behaviour possible or facilitates it. All of these factors can be influenced by things that are outside of individual control, such as advertising and marketing, service provision, legislation and environmental and social planning (Michie, van Stralen & West, 2011). For example, a person may struggle to engage in

physical activity if local green spaces are unsafe or find it difficult to eat healthy if 'fast-food' is cheaper and easily accessible. Indeed, a robust relationship has been found between obesity and low socioeconomic status, especially for women (WHO, 2014). With those who are overweight at higher risk of GDM development (Torloni *et al.*, 2009) and subsequent progression to T2DM (Bao *et al.*, 2015; Sorbye *et al.*, 2020), it is likely that at least a proportion of women will experience barriers to weight management, that are outside of their control. These factors cannot be ignored when thinking about interventions to support women to manage their weight following a pregnancy complicated by GDM. Nevertheless, even when opportunity and capability are abundant, motivation is still required (Solbrig *et al.*, 2017). One of the key advantages of a purely motivational intervention, such as FIT and FITZ is they can be used alongside other weight management strategies such as those focusing on reducing societal barriers.

Our findings further support the notion that those who wish to lose weight desire motivational support that helps them to keep themselves motivated to do the required behaviours, rather than help with the behaviours themselves. Solbrig *et al.* (2017) found a group of adults in the general population intending to lose weight, all spontaneously expressed desire for motivational support. Furthermore, this finding has been replicated among obese and overweight postpartum women who expressed a wish for tools that motivate them to take care of their own health (Christensen *et al.*, 2021). These study findings further cement the need for weight management support to go beyond information provision and offer behavioural support that addresses the unique facilitators and barriers that this population face, following birth. It also amplifies the need for interventions to be underpinned by relevant theory, as there is

a broad consensus that weight management interventions that are informed by behaviour change theories are most optimized (Michie *et al.*, 2005). Most researcher-led mHealth interventions for women with GDM were not guided by behavioural theories (Chapter 7, study 3a) and access to specialist behavioural support, in the current obesity care pathways is restricted to those with BMI >40.

Another area of support for existing literature is the finding that HCPs participating in this project expressed barriers to the implementation of mHealth that were akin to those found from other HCPs including lack of familiarity, experience, knowledge, credibility, cost, and threat to professional security (Gagnon *et al.*, 2016). This suggests that HCP barriers are relevant across different healthcare contexts. Nevertheless, barriers unique to the context of GDM care were observed and confirm previous findings that the transition from maternity to primary care is challenging (McCloskey *et al.*, 2019; Parsons *et al.*, 2018; McMillan *et al.*, 2016). One of the key challenges identified by HCPs, related to the possible implementation of FITZ, was poor and fragmented provision of postpartum support. Previous research suggested HCPs felt inertia to provide appropriate long-term support and as a result women felt abandoned. Our findings corroborate this situation highlighting how this challenging implementation context is likely to impact the success of any intervention aiming to support women with history of GDM following birth.

Finally, although weight management interventions delivered via mHealth have clear advantages to increasing intervention reach, fidelity and opportunity (Lim *et al.*, 2020a), many mHealth studies experience problems retaining participants, an issue partly rooted in the challenge of keeping people engaged (Grady *et al.*, 2018; Baumel

et al., 2019; Roberts *et al.*, 2017; Amagai *et al.*, 2022). Low retention rates seen when asking women to use and provide feedback on FITZ possibly reflect a lack of willingness to engage with the app and/or research processes. HCPs also suggested that creating engagement from women would be a significant challenge. Two recent systematic reviews suggest elements of mHealth interventions related to increased engagement including, push reminders, feedback, and in-app support from peers and professionals (Amagai *et al.*, 2022). Interestingly, both women and HCPs who provided feedback on FITZ suggested the inclusion of peer support was fundamental to improving engagement and meeting women's needs.

10.5 Contribution to new knowledge

The project has provided a comprehensive exploration of the use of mHealth for weight management among women with history of gestational diabetes. Seven individual studies were conducted within the UK in response to previously unexplored gaps in knowledge.-The research has explored the application of a novel intervention among an underserved population of women at high risk of several adverse long-term outcomes that contribute to the transgenerational nature of GDM. This has resulted in new findings that have contributed to three published manuscripts in peer reviewed journals, and one peer reviewed abstract for presentation at a conference. It is hoped that these findings will be the catalyst for further new research within this important field.

This section discusses to what extent each aim of this project, and its associated studies, have contributed to new knowledge and have demonstrated originality by reflecting on literature gaps responded to or methodologies improved upon.

The first aim of this project was to better understand the need for, and the role of, mHealth to support women with a history of GDM following birth. It was previously unknown what mHealth interventions were already available for women with history of GDM and if they incorporated behaviour change techniques. Study 1 mapped existing interventions and identified gaps in knowledge that have thus far yet to be explored.

Studies 3a and 3b are the first to explore the experiences and opinions of key stakeholders regarding the use of mHealth to support women with history of GDM. These studies, along with study 2b, addressed the fact that little was known about women and HCPs existing experiences of using mHealth or what their desires were for interventions that supported women following birth. These studies have enhanced understanding of how and why women with GDM use digital resources to meet their needs during and after a pregnancy complicated by GDM. These studies also identified important opportunities to overcome identified barriers to mHealth adoption and take advantage of the online spaces women already use and value.

Important insights were also gained into why existing behaviour change apps did not meet women's needs including that women and HCPs desired 'something different' that would support women to stay motivated, following birth. Despite evidence suggesting women might benefit from digitally delivered motivational support, it was previously unknown if this was what women wanted. Desire for motivational support was seen in data collected from different two different stakeholder groups, using two different methods (survey and interviews) providing rationale for further exploration of the FITZ app, as a potential weight management intervention for women with

history of GDM. The lack of motivational techniques used in existing mHealth interventions (study 1) suggests examination of FITZ among women with history of GDM is a novel approach.

In addition, work carried out as part of chapter 6, employed the novel use of video conferencing software to understand if this method was an effective way of recruiting, retaining and collecting data from key stakeholders. Postpartum women have previously been described as 'hard to reach' (Peindl *et al.*, 2003) and thus it was important to find new ways to increase engagement with this population. Although novel at the time, the onset of COVID-19 meant the use of video-calling platforms, such as Zoom, became common place for conducting qualitative research (Lobe, Morgan & Hoffman, 2020). Indeed, most interviews conducted as part of this project were done using Zoom or Teams. Nevertheless, using video calling technology, including webinars, to augment quantitative data collection (such as a survey) is still relatively limited. As the use of internet research methods becomes more widespread continuing to evaluate their implementation will be important for understanding any impact on recruitment and retention and for whom they make research opportunities most accessible.

The second aim of the project was to explore, among key stakeholders, the feasibility and acceptability of the FITZ app as a potential weight management intervention for women with history of GDM. This was the first project to explore the use of digitally delivered motivational support for women with previous GDM. It was previously unknown if women desired motivational support to achieve their behaviour change goals or if they would think the intervention, FITZ, was a good idea. Triangulation of

findings from studies 2b, 3a and 4 suggest motivational support is wanted and needed by women. Findings from study four, although from a small sample, also imply that the concept of FITZ aligned with women's goals and was seen as a useful tool. Additionally, HCP feedback collected in study 5 suggests taking a motivational approach to supporting women was different and needed.

The work undertaken in this phase also built upon existing co-production methodologies used in previous intervention development in this population (Nielsen et al., 2020; O'Reilly & Laws, 2018) by incorporating the views of HCPs. Capturing HCP feedback and suggestions for improvements was important as HCPs have key insights into the implementation context and key drivers for eventual adoption. As a result of this approach an outcome of this project has been a comprehensive list of stakeholder informed suggestions that could be applied in future development of FITZ to enhance its potential in this population. Taking this approach has highlighted the importance of co-design during the development of mHealth interventions and adds to the growing literature in this area (Baines *et al.*, 2022).

10.6 Strengths and limitations

To properly consider the implications of this project it is necessary to first look at its strengths and limitations. These were discussed in their respective chapters for each individual study but this section provides an overall view.

10.6.1 Strengths

A strength of this project was the use of MMR methods. mHealth interventions are hard to evaluate, partly due to their complexity (Maar *et al.*, 2017) and often, little is known about the experiences of the technology users (Lupton, 2013). Qualitative exploration can reveal how an intervention may work, how it is received by different recipients, and any unanticipated effects. Qualitative studies can contribute to this process by assessing the intervention from patient and provider points of view. Thus, use of one method alone is unlikely to adequately answer research questions (Whittaker *et al.*, 2021; Mummah *et al.*, 2016). The pragmatic approach allowed for the incorporation of different data collection and analysis methods while investigating a complex population and intervention. By not restricting oneself to a constructivist or positivist view, it can be argued that more informative, complete and useful research findings were achieved (Creswell and Plano-Clarke, 2011).

Interventions aimed at postpartum women (both with and without GDM), typically focus on intervention effects, and often don't address implementation factors, penetration, reach and participation, resulting in a lack of translation from efficacy to real-world solutions (Lim *et al.*, 2020a). The ability to deliver solutions that are fit for real-world practice requires a shift away from "binary questions of effectiveness" and towards early engagement with practitioners, policy makers and patients to understand if and how the intervention might be cost effective, scalable, implementable, acceptable, and transferable across contexts (Skivington *et al.*, 2021). Early engagement with stakeholders was the key focus of phase one of this project enabling a solid understanding of the target population to be gained. It was important

to answer questions such as ‘would it be possible to use this?’ by whom? and in ‘what setting’. Indeed, it was unlikely that women would use FITZ if they didn’t desire digital delivered motivational support. The extensive exploration of the target population and implementation context across this project could be considered a particular strength, considering the historical top-down approach to innovation development and evaluation (Duffy *et al.*, 2021).

Related to this, a further strength of the project was its collaborative nature. Experts were consulted at various points of project development and a PPI session was held to guide the development and processes involved in study four. Undertaking public involvement and listening to people with relevant lived experience, can improve both research quality and relevance (NIHR, 2019). Furthermore, co-production methods were used to generate suggestions for adaptations to FITZ to help overcome barriers identified by HCPs. Women also provided spontaneous suggestions for feedback which in combination led to the creation of a comprehensive set of stakeholder informed adaptations that will influence further iterative development of FITZ to ensure it is optimal for the population in question. The co-production of lifestyle interventions that include postpartum women and their partners has been described as a key strategy to planning and developing interventions that are most likely to be effective and consider challenges associated with implementation (Kragelund Nielsen *et al.*, 2018b; Keller *et al.*, 2008). Indeed, further co-production particularly with women with experience of GDM is highlighted as a need for further research, below.

10.6.2 Limitations

The limitations of this thesis must be acknowledged. Similar to existing research (Brooks *et al.*, 2017) this project largely relied on a volunteer sample and the biases inherent with this recruitment method are acknowledged. Despite employing a variety of strategies, participants were predominately of white British background, limiting the generalisability of findings. Future studies need to incorporate strategies that reach more diverse populations as the prevalence of GDM in the UK is highest among women with Asian or South Asian backgrounds (Farrar *et al.*, 2016). Furthermore, due to resource constraints this project did not include participants unable to speak or understand the English language. Possible bias as a result of this exclusion criterion is acknowledged, particularly as there is fear among HCPs that implementation of digital health technologies could exclude people and widen existing healthcare inequalities (Chapter 7, study 3b). A critical component toward population impact is the ability to reach and engage a significant proportion of the target population. Indeed, one of HCPs' key concerns was that FITZ might only be suitable for women who have greater health literacy and have the socioeconomical background that would support them to undertake weight loss activities that they were already motivated to undertake. Indeed, it is likely that this project included women whose circumstances meant that they could take part in the research and potentially have greater resources to overcome life's barriers. Exploring the acceptability of FITZ among a broader group of women will be essential for future research.

The survey data collected across this project suffers from small sample size and limited validity. Due to the nature of the research no existing questionnaires were appropriate

to meet study aims and objectives. Thus, the surveys used in this project were developed specifically for study purposes and although created with relevant expert input, their validity could not be determined. The application of validated quantitative measures should be applied in any future research including the System Usability Scale to understand the usability of FITZ and examination of app usage data to further quantify engagement.

Although recruiting through an NHS site was a strength related to the conduct of this project, this approach led to significant delays. Retaining women to the stage where they used and provided feedback on FITZ proved difficult and as a result the overall sample who provided feedback was small and homogeneous, therefore findings are difficult to generalise. Face-to-face recruitment was planned for this study, as prior findings suggested this strategy could lead to better engagement in the research and intervention processes (Dasgupta *et al.*, 2018; Hedeager Momsen *et al.*, 2021; Goveia *et al.*, 2018). This process was not possible due to COVID-19 and there is a chance that if I had recruited women face-to-face they may have been more likely to respond to my invitations to take part after their baby was born. However, with the pandemic ongoing, 'remote' methods will be essential to the continuation of many research activities and thus finding the most effective digital means of engaging and communicating with research participants remains important.

For the success that this project did experience in recruiting women and HCPs, particularly those outside of the region this research was conducted, social media played a significant role. Using social media to recruit 'hard to reach' groups has been shown as an effective and efficient strategy in comparison to traditional methods

(Benedict *et al.*, 2019). However, group differences are inherent with this approach that likely bias findings and limit generalisability. For example, in the context of this project it is possible that those recruited via social media were inherently more 'technology savvy' and were therefore more open to the use of mHealth to support GDM care. However, findings from study 3b, suggested lack of digital skills among HCPs and any existing skills, such as social media use, did not necessarily translate to confidence using digital in their everyday practice. In addition, many women of childbearing age use social media (Sanders & Crozier, 2018; Sparud-lundin *et al.*, 2011; Naveh & Bronstein, 2019), suggesting opportunity to access a broad range of people. For example, at the time of writing, a UK based GDM Facebook group that was used to recruit women in studies 2a, 2b and 3a had over 16,000 members.

During the conduct of study four, it became clear from women's feedback that FITZ was no longer working properly for those using Android operating systems. This meant that some women tried, but could not use the app, and others missed the opportunity to use the app despite consenting to take part. This situation limited the ability to gain any further feedback from women using this type of phone. During this time, I contacted app developer to see if the bug could be fixed. Because the app had been developed using research funding, the developers no longer had the time or financial resource to fix or make changes to FITZ. Technology failure is a key pinch point for user frustration and is a major concern for providers when considering adoption (Greenhalgh *et al.*, 2017; Gagnon *et al.*, 2016) and user engagement (Amagai *et al.*, 2022). This situation highlights important issues around mHealth sustainability and the significance of ensuring that processes are in place to guarantee the app is maintained and its functionality is sustained throughout. Despite this, FITZ app content is not

under any IP restrictions, meaning the suggestions for adaption, collated in chapter 9 could be made possible with the collaboration of another app developer.

10.7 Reflection on the PhD process

Undertaking this PhD project has been an exceptional learning experience. When reflecting back on the process it is easy to think about how things could have been done differently, nevertheless, I can see how, over time, my approach to different aspects of the research has improved and I have been able to take critical approach when moving forward with the project. In particular I feel that my interviewing skills have improved, and I can now guide conversations much more effectively than when I first started this process.

Nevertheless, my role in this research must be acknowledged and my background and previous interests are likely to have impacted analysis and interpretation of data. In terms of recruitment, I am aware that my personality may have influenced the recruitment process. For example, women who took part in the webinar would have heard me talk and could have been influenced, on this basis, whether they wanted to take part. However, as described in chapter four, consistent efforts have been made to maintain rigour and trustworthiness throughout (Table 10).

During the conduct of study four, I was acutely aware that I was an external researcher, meaning I wasn't a usual part of participants care pathway. Although, in the end, I was not involved in the face-to-face recruitment of women, I made a conscious effort to create and maintain relationships with HCPs involved in the study, who were part of women's usual care. This helped with eventual recruitment, which

was very kindly done voluntarily by these HCPs. My relationships with others were ultimately vital for the successes of the project and demonstrated, to me, the power of collaboration.

Furthermore, I believe that undertaking PPI with women and HCPS was pivotal to some of the success I saw in terms of the practicalities of the project. My personal experience was that engaging with those with lived experience meant I was better prepared for the recruitment process and had a better understanding of how the different studies would be perceived by participants. PPI consultation and collaboration will continue to be a key feature of any future research I undertake in my professional practice.

Coming from a clinical trials management background, I came into this project with ambitions to run a full pilot/feasibility trial of FITZ among women with history of GDM, using predominantly quantitative data collection methods which, at the time, I felt would provide the most impactful data regarding the efficacy of the app. However, as I explored the literature and discussed the project with my supervisory team it became clear that exploratory work was needed to understand women and HCPs existing experiences with mHealth and what their desires were. Immersing myself into the two theoretical frameworks that guided this project, particularly NPT, also solidified the value of taking this approach. Using this methodology and undertaking this initial work not only shaped the way the project unfolded but also helped me to truly recognise the value of qualitative research and I now genuinely appreciate the contrast that exists in taking a mixed-method approach.

Recruitment and data collection at times were challenging. In line with regulations due to the COVID-19 outbreak I had to adjust my approach in terms of recruitment strategies and data collection methods to remain in line with government guidance and reduce the spread of the virus. This involved making several amendments to the HRA which ultimately caused huge delays to the conduct of study four. Being adaptable and responding to project needs was essential and this is a skill I use almost daily in my work as a researcher. The onset of COVID-19 also resulted in a huge shift toward the use of digital technologies to stay connected, particularly video calling, and this really highlighted to me how any research must exist with wider societal and cultural contexts.

I have also at times felt conflicted when conducting this study. Although evidence demonstrates the health implications of being overweight, I was continually challenged by things I was seeing in the media around body positivity and how this was helping women to become comfortable in their own bodies. As a woman I am acutely aware and experience the pressure and expectation that society places on us to look a certain way that often involves going on diets, undertaking extreme exercise regimes, and losing weight. Although I have not experienced it myself, I am aware that this pressure exists particularly for postpartum women who are expected to 'bounce back' to their 'pre-baby body'. This threw up contentious feelings as I progressed throughout the study, however I was always careful to be sensitive in the way I approached the topic of weight management and was led by women in terms of their willingness to discuss the topic.

One of my most memorable moments was undertaking the first interviews with women and getting a small glimpse into what it was like to experience a pregnancy complicated by GDM and to hear their experiences of what it was like for them following birth. These interviews really highlighted that support for women following pregnancy is drastically inadequate, leaving women feeling abandoned, underprepared, and unsupported to achieve the best outcomes for themselves, their families, and future children. The prospect of generating knowledge that may help, even in a small way, to improve postpartum experiences for women with GDM has motivated me throughout this project.

10.8 Implications

With project limitations in mind, there are several implications of this research for policy, practice, and future research.

10.8.1 Practice

Implications for practice include increasing the capacity and capability for HCPs to become better prepared for a digital future. For example, increasing HCPs capacity and ability to become involved in online spaces women already use, such as Facebook, could be an advantageous way of delivering credible information to women who might be otherwise hard to reach. By improving digital skills, knowledge and confidence, professionals may be better placed to judge and recommend a wider range of mHealth resources to women. This is important as HCPS need to consider how the information women find online may affect the way they would like their pregnancies to be managed and provide guidance to women on how to navigate online information.

However, this project demonstrated that HCPs may not be confident doing this and therefore, educators should consider inclusion of digital professionalism within curriculums (Mather & Cummings, 2019). This would not only develop professional skills but also promote the normalisation of 'digital' in practice. There is a consensus that preparing the healthcare workforce to deliver a digital future is vital (Topol, 2019), however, very few university courses for HCPs include modules on digital skills, knowledge or confidence (Utukuri *et al.*, 2022).

HCPs recommendations and concerns should also critically inform the development of future mHealth, particularly for postpartum weight management, where support is lacking and a narrative of GDM as a short-term disease prevails. Providing capacity within professional roles for the involvement in co-production of mHealth solutions. Co-production can enhance the design and development of innovations (including digital health innovations) in various ways including; enhancing research quality by ensuring research relevance and appropriateness (Cornwall & Jewkes, 1995; Kagan, 2013; Locock & Boaz, 2019); increasing the quality and richness of data collection and analysis (Gillard *et al.*, 2012; Locock *et al.*, 2019; Mjøsund *et al.*, 2017); generating capacity, skills, confidence and competence among communities (Jagosh *et al.*, 2012; Kagan, 2013); enhancing research sustainability and likelihood of outcomes being successfully implemented (Cornwall & Jewkes, 1995; Jagosh *et al.*, 2012; Pizzo *et al.*, 2015); and providing opportunity to stimulate the development of alternative ideas and innovative approaches (Alderson *et al.*, 2019; Kagan, 2013; Pizzo *et al.*, 2015).

10.8.2 Policy

The work in this project has highlighted significant issues related to the transition that women experience from maternity to primary care, following birth. Significant questions remain on who takes responsibility for, and how, disease prevention strategies are provided to these high-risk women, following the birth of their baby. Attempting to implement any intervention into this current context has a high chance of failure, regardless of proven intervention components or efficacy.

This highlights a significant need for policy makers and healthcare services researchers to address inadequacies in service provision for postpartum women with history of GDM. Any restructure of care pathways should consider the integration of systems that would likely aid clarity and consistency between services. Consideration of how such integration could be made optimal to support the implementation of digital health solutions is important as aspects of care are becoming increasingly delivered digitally and integration of data is of key importance to HCPs (Pais *et al.*, 2017). Indeed, outcomes from this work are highly likely to have major implications for the design and development of interventions aimed at supporting women with GDM history following birth and hold significant ability to increase their effectiveness.

Policy makers and healthcare providers should also consider the type of evidence they required in order to make decisions regarding the adoption of digital health technologies. Findings from study 3b and study 1 highlighted the need for the continued evaluation of mHealth to provide data to support continued use and for whom. However, it is clear that a wider range of outcomes might be influential to

increasing satisfaction with care and improving women's experiences, and thus wider outcomes should be considered when making decisions regarding adoption.

10.8.3 Research methodology

Undertaking this project has highlighted questions around how digital health technologies should be evaluated, to maximise their chance of adoption and implementation. Particularly, is NHS focused research agile enough to respond to the needs of digital health evaluation? This is not a new matter, and it was well known that clinical evaluation of mHealth needs to keep pace with innovation in order to have meaningful impact for providers, policy makers and patients.

As well as keeping pace with innovation, quick and timely evaluation is also key to keeping with the expectations and needs of patient populations. For example, as demonstrated in study 3a, women resorted to finding their own online resources in the absence of anything similar offered by HCPs, leaving them open to using unreliable or unsafe resources. A lack of evidence-based solutions leaves HCPs with few options to offer alternatives. The conduct of study 4 (chapter 8), demonstrated the difficulty of conducting research in an NHS setting leading to delays and problems reaching a diverse and large enough sample. It is likely that the design of the research contributed to these issues, but the processes for gaining ethical approval, making changes to research protocols and study set up were heavily protracted and significantly contributed to practical setbacks.

This situation remains a catch 22 as those responsible for planning and commissioning healthcare services are expected to base their decisions on criterion that demonstrate

a 'gold standard' of evidence such as RCT and quasi-experimental studies, conducted in clinical settings (NICE, 2021). This predicament is not reserved for researchers, the eHealth sector, dominated by SMEs, often lacks the capacity to produce evidence needed to meet current standards. This is further highlighted in the knowledge that despite a proliferation of digital health technologies, few meet the evidential requirements for adoption in practice (Takian *et al.*, 2012). This project is not able to provide a definitive solution this problem but contributes to a growing base of knowledge that suggests policy makers and providers should consider the value of agile methods to gain insight into the impact of digital health technologies.

In response to finding more agile ways of conducting digital health research, this project has demonstrated that social media can be a successful tool for recruiting previously hard to reach postpartum women with experience of GDM and their HCPs. This, combined with the finding that many women in the UK with history of GDM are avid users of Facebook to find information and seek peer support (Chapter 7, study 3a), suggests social media as a useful platform to facilitate recruitment. The use of social media as a recruitment tool is continuing to grow (Whitaker *et al.*, 2017), however future research needs to consider important ethical questions regarding how to protect privacy, reduce exploitation of participants' online networks. This project did take advantage of existing social media groups, but adverts were never placed directly, and permission was always sought from group administrators.

10.9 Suggestions and opportunities for future research

This project has identified several significant areas for future research. It is clear from the work conducted in chapter seven (studies 3a and 3b) that social media was highly

valued by women for meeting information and support needs during and after pregnancy. HCPs on the other hand, were reluctant to recommend this resource for fear of lack of governance, despite knowing women used and valued the social networking site. There is a strong need for further investigation into the information available on social media to understand the real risks associated with misinformation spread, and to increase the involvement of HCPs in creating and running social media groups to promote the spread of consistent and reliable information. Midwife moderated Facebook groups have previously been used to successfully provide information to women without diabetes (McCarthy *et al.*, 2021), suggesting an opportunity to provide similar support to women with experience of GDM.

Future-development of FITZ, as outlined in chapter 9, should also consider the role that social media could play in both the recruitment of women to future studies but also the delivery of FITZ. Women and HCPs felt that FITZ could be improved by adding peer support, potentially delivered through a moderated Facebook group. HCPs also discussed the possibility of using a private Facebook group to communicate other relevant information to women, such as reminders (study 5, Chapter 9). These suggestions are reflected in the literature whereby 'Plan social support or social change (social support theories)' is one of the core BCTs included in Abraham and Michie's behavioural change taxonomy (Michie *et al.* (2008). In addition, evidence has demonstrated the effectiveness of weight management interventions among women with GDM have the potential to be more effective if they include social support features (Hedeager Momsen *et al.*, 2020). Facebook holds other capabilities in addition to moderated groups, including private messaging and video-calling. There is potential that these features could be exploited to deliver aspects of FITZ. For

example, issues with engaging users in prolonged use of apps has been linked with lack of face-to-face input (Van Gemert-Pijnen *et al.*, 2014) and video calling from a therapist, may help to overcome this issue.

Although already incorporating BCTs related to building motivation and self-efficacy, the addition of further BCTs to a FITZ based intervention, such as social support and face to face contact, has the potential to further impact the existing mental imagery techniques and their ability to initiate behaviour change. Nevertheless, it remains unknown if this combination of BCTs may or may not enhance effectiveness over the long-term. These suggestions should be presented to women and HCPs during further iterative co-production, particularly regarding ethical considerations such as privacy and protection of health data.

In recognition of the limitations of this research, the future research designs should incorporate strategies that allow a diverse range of women to take part including those who are non-English speaking and those from minority ethnic groups. Because the risk of GDM is higher among those from some minority ethnic backgrounds, future research should ensure to embed it's practices and processes in those communities right from the beginning. This could include the creation of patient advisory groups and allocation of resources in funding grants that allow for translation and expert input from researchers with relevant language skills. In addition, it will be important to gain feedback on any further iterations of FITZ from women who are currently pregnant, as both women and HCPs suggested benefits associated with implementing FITZ earlier on in pregnancy (Hedeager Momsen *et al.*, 2021; Goveia *et al.*, 2018).

Any future research should also consider using agile methods of recruitment and data collection that enable adaptations to be made quickly to promote a cycle of responsive feedback and change. Once the intervention has reached satisfactory levels of acceptability by stakeholders, the next phase of development and evaluation can take place to assess feasibility and preliminary response of the intervention pilot the intervention (Skivington *et al.*, 2021; Orsmond & Cohn, 2015). To ensure maximum impact, any future evaluation should be guided by relevant implementation science frameworks, specifically those that cater for digital health technologies such as, RE-AIM (Glasgow, Vogt & Boles, 1999), Proctor's taxonomy of implementation outcomes (Proctor *et al.*, 2011), and the Non adoption, abandonment, scale-up, spread and sustainability (NAAS) framework (Greenhalgh *et al.*, 2017).

10.10 Conclusions

Women in the UK with experience of GDM want support to manage their weight following birth, but commercially available mHealth apps do not meet their needs. HCPs recognised that mHealth was an important way to deliver information, self-management, and peer support to women, but adoption in practice was hindered by lack of digital confidence and concerns over credibility and compromised professional security. Increasing HCP capability and capacity for digital activities in practice is required to meet women's expectations and needs, particularly for postpartum weight management, where support is lacking and a narrative of GDM as a short-term disease prevails.

Despite wanting to manage their weight, women reported significant goal conflict following birth resulting in low motivation that hinders their efforts. Women and their

HCPs expressed desire for an app to overcome lack of motivation and prepare them for future healthy pregnancies and beyond. Findings from the project demonstrated interest and support for FITZ among key stakeholders, an intervention that aims to strengthen motivation and desire for behaviour change, using mental imagery and other BCTs. Preliminary acceptability among HCPs and women is important given their key roles in adoption and implementation. Women and HCPs perceived the app to be a useful tool, that aligned with women's goals for managing their weight and addressed barriers related to reduced motivation. Nevertheless, women and HCPs recognised significant limitations that would impact engagement and implementation with FITZ. Suggestions for adaptations to maximise impact included altering and tailoring content, integrating FITZ with other programmes, and incorporating peer support.

These findings suggest that mHealth interventions underpinned by relevant BCTs, including motivational support, hold potential as being needed and acceptable among women with experience of GDM. Nevertheless, any future development needs to take advantage of the online spaces women already use and value, such as social media and involve co-production with key stakeholders.

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Appendices

Appendix A: Ethical Approvals

Original ethical approval for Studies 2a, 2b, 3a and 3b



16th April 2019

Katie Edwards
School of Nursing and Midwifery
University of Plymouth
S06, The Knowledge Spa
Royal Cornwall Hospital
Treliske
Truro
TR1 3HD

Dear Katie,

**Application for Approval by Faculty Research Ethics and Integrity
Committee**

Reference Number: 18/19-1088

**Application Title: Using mHealth to support women make healthy
behaviour changes during the postpartum and interconception periods,
following a pregnancy complicated by gestational diabetes; key
stakeholder perspectives**

The Chair has granted ethical approval to conduct this research.

This approval is for 12 months (i.e. until 15th April 2020). If you wish to
continue beyond this date, you will need to seek an extension.

Please note that if you wish to make any MAJOR changes to your research
you must inform the Committee. Please contact the Faculty Research
Administrator, Maurice Bottomley (email hhsethics@plymouth.ac.uk).

Yours sincerely

Professor Ruth Endacott

Professor Ruth Endacott

Professor in Clinical Nursing (Critical Care) and Director, University of
Plymouth/Royal Devon and Exeter Hospital Clinical School
Acting Chair, Research Ethics and Integrity Committee -
Faculty of Health & Human Sciences and
Faculty of Medicine & Dentistry

Approval of amendment 1 for studies 2a, 2b, 3a and 3b



1st November 2019

Katie Edwards
School of Nursing and Midwifery
University of Plymouth
S06, The Knowledge Spa
Royal Cornwall Hospital
Treliske
Truro
TR1 3HD

Dear Katie,

Application for Approval by Faculty Research Ethics and Integrity Committee

Reference Number: 18/19-1088

Application Title: Using mHealth to support women make healthy behaviour changes during the postpartum and interconception periods, following a pregnancy complicated by gestational diabetes; key stakeholder perspectives

I am pleased to inform you that the Committee has granted approval for the minor amendment and extension of the existing approval for you to conduct this research.

Please note that this approval is for 12 months (until 30th October 2020), after which you will be required to seek extension of existing approval.

Please note that should any MAJOR changes to your research design occur which effect the ethics of procedures involved you must inform the Committee. Please contact the Faculty Research Administrator, Maurice Bottomley (email hhsethics@plymouth.ac.uk).

Yours sincerely

A handwritten signature in black ink, appearing to read 'Paul H Artes'.

Professor Paul H Artes, PhD MCOptom
Professor of Eye and Vision Sciences
Co-Chair, Research Ethics and Integrity Committee -
Faculty of Health: Medicine, Dentistry & Human Sciences

Professor Paul H Artes, PhD
Co-Chair, Faculty of Health: Medicine, Dentistry & Human Sciences Research Ethics and Integrity Committee,
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Approval of amendment 2 for studies 2a, 2b, 3a and 3b



9th July 2020

Katie Edwards
School of Nursing and Midwifery
University of Plymouth
S06, The Knowledge Spa
Royal Cornwall Hospital
Treliske
Truro
TR1 3HD

Dear Katie

Amendment of Approved Application

Reference Number: 19/20-1306
Original Reference Number: 18/19-1088
Application Title: Using mHealth to support women make healthy behaviour changes during the postpartum and interconception periods, following a pregnancy complicated by gestational diabetes; key stakeholder perspectives.

I am pleased to inform you that the Chair has granted ethical approval for your amendment to the application originally approved on 16th April 2019 and extended on 1st November 2019.

Please note that this approval is until 8th July 2021, after which you will be required to seek extension of existing approval.

Please note that if you wish to make any MAJOR changes to your research you must inform the Committee. Please contact the Faculty Research Administrator, Maurice Bottomley (email hhsethics@plymouth.ac.uk).

Yours sincerely

A handwritten signature in black ink, appearing to read 'S Neill'.

Professor Sarah Neill,
PhD, PGD Res. Deg. Sup., PGDE, MSc, BSc(Hons), RGN, RSCN, RNT
Professor of Nursing
Co-Chair, Research Ethics and Integrity Committee - Faculty of Health

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Ethical approval for Study 4



Mrs Katie Edwards
PhD Student
University of Plymouth
S06 The Knowledge Spa
Royal Cornwall Hospital, Treliske
Truro, Cornwall
TR1 3HD

Email: approvals@hra.nhs.uk

30 March 2020

Dear Mrs Edwards

**HRA and Health and Care
Research Wales (HCRW)
Approval Letter**

Study title: Exploring acceptance of behaviour change apps among women with a history of gestational diabetes to support healthy behaviour change, associated with weight management, in the postpartum and interconception periods

IRAS project ID: 252946

REC reference: 20/LO/0200

Sponsor: Organization not set

I am pleased to confirm that [HRA and Health and Care Research Wales \(HCRW\) Approval](#) has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?

HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report

(including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see [IRAS Help](#) for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?

HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to [obtain local agreement](#) in accordance with their procedures.

What are my notification responsibilities during the study?

The standard conditions document "[After Ethical Review – guidance for sponsors and investigators](#)", issued with your REC favourable opinion, gives detailed guidance on reporting expectations for studies, including:

- Registration of research
- Notifying amendments
- Notifying the end of the study

The [HRA website](#) also provides guidance on these topics, and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?

Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is 252946. Please quote this on all correspondence.

Yours sincerely,
Rebecca Evans
Approval Specialist

Email: approvals@hra.nhs.uk

Copy to: *Mrs Sarah Jones*

Approval of substantial amendment 1 for study 4



London - Bromley Research Ethics Committee

Level 3, Block B
Whitefriars
Lewins Mead
Bristol
BS1 2NT

Tel: 0207 104 8063

Please note: This is the favourable opinion of the REC only and does not allow the amendment to be implemented at NHS sites in England until the outcome of the HRA assessment has been confirmed.

13 October 2020

Mrs Katie Edwards
S06 The Knowledge Spa
Royal Cornwall Hospital Treliske
Truro, Cornwall
TR1 3HD

Dear Mrs Edwards

Study title:	Exploring acceptance of behaviour change apps among women with a history of gestational diabetes to support healthy behaviour change, associated with weight management, in the postpartum and interconception periods
REC reference:	20/LO/0200
Amendment number:	SA1
Amendment date:	24 August 2020
IRAS project ID:	252946

The above amendment was reviewed 12 October 2020 by the Sub-Committee in correspondence.

Acceptance date: 28.07.2020

Review title

mHealth as a primary mode of intervention for women at risk of, or diagnosed with, gestational diabetes: a systematic scoping review protocol

Abstract

Objective: To synthesize current knowledge on the use of mHealth as a primary mode of intervention for the prevention and management of gestational diabetes mellitus (GDM) and its long-term implications among women at risk of, or diagnosed with, GDM.

Introduction: Prevention and management of GDM and its associated adverse outcomes are of paramount importance to both maternal and infant health. However, women with experience of GDM report several barriers to effective disease management and lifestyle change. Supporting women through use of mHealth technology may help overcome these barriers. Recent evidence suggests mobile apps may be useful for prevention and management of GDM, however less is known about the broader application of mHealth from preconception to interconception.

Inclusion criteria: Studies considered for inclusion are those focused on the use of mHealth as primary mode of intervention for the prevention and management of GDM and its long-term implications among, women at risk of, or diagnosed with, GDM. Studies will be limited to those published in English.

Methods: The following Databases will be searched: MEDLINE (Ovid), CINAHL (EBSCO), EMBASE (Ovid), Cochrane Database (Wiley), Scopus, and TRIP. Unpublished studies and grey literature will be searched using Open Grey, ISRCTN Registry, ClinicalTrials.gov, EU Clinical Trials register and ANZCTR. Two reviewers will independently screen abstracts. Reviewers will assess full texts of selected citations against the inclusion criteria. Any disagreements will be discussed with a third

reviewer. Data will be extracted and presented in diagrammatic or tabular form with an accompanying narrative in line with review objectives.

Keywords: GDM; mHealth; digital health; mobile applications; gestational diabetes

Abstract Word Count: 250.

Total manuscript word count: 2113

Introduction

Gestational Diabetes Mellitus (GDM) has been defined as 'carbohydrate intolerance resulting in hyperglycemia of variable severity with onset or first recognition during pregnancy'.¹ Despite a lack of consensus regarding screening and diagnostic criteria, there is widespread agreement that the prevalence of GDM is increasing worldwide.² In the United Kingdom (UK) an estimated 16 out of every 100 women will develop GDM.³ Development of fetal macrosomia, or birthweight greater than 4000g, is a key perinatal consequence of GDM and is associated with increased likelihood of birth injuries, caesarean delivery, and shoulder dystocia.⁴ Infants are also more likely to experience respiratory distress syndrome, neonatal hypoglycemia, hyperbilirubinemia, polycythemia, and hypocalcemia.⁴ Both genetic and environmental risk factors play a role in the pathogenesis of GDM.⁵ High maternal body mass index (BMI) ($\geq 25\text{kg/m}^2$) and prior GDM are both independently associated with increased GDM risk as well as longer term adverse outcomes such as development of type 2 diabetes.^{6,7}

Preventing GDM onset by tackling modifiable lifestyle factors has shown mixed results regarding effectiveness.⁸ However, a recent meta-analysis of data from 11,487 pregnant women concluded that lifestyle interventions implemented before 15 weeks gestation were able to reduce the risk of GDM by 20%.⁹ For women who already have a GDM diagnosis, the importance of effectively managing the condition is central for reducing the likelihood of adverse outcomes. For those who had mild GDM (defined as a fasting glucose level of less than 5.3mmol/l, and two or three timed glucose measurements exceeding established thresholds), dietary intervention, self-monitoring of blood glucose and insulin therapy significantly reduced the risk of macrosomia compared to those who received standard care.¹⁰ Reoccurrence of GDM is thought to

arise in 30% to 84% of subsequent pregnancies, making the interconception and postpartum periods key windows of opportunity to reduce the likelihood of future GDM pregnancies, as well as providing women with interventions aimed at preventing potential type 2 diabetes onset.^{2,11}

While it is clear that effectively preventing and managing GDM is crucial for improving maternal and infant outcomes, women report difficulties in managing the condition once diagnosed, as well as making lifestyle modifications, particularly postpartum.^{12,13} Women with previous diagnosis of GDM encounter a unique set of barriers to engaging in face-to-face lifestyle interventions, including time and financial constraints, childcare duties, fatigue and lack of motivation.¹³ Thus, delivery of care via telephone or through internet has been suggested as an optimal way of supporting this population.¹⁴

mHealth has been defined as the "use of mobile and wireless technologies, such as mobile phones and personal digital assistants (PDAs), to support the achievement of health objectives".¹⁵ Commonly used mHealth technologies include smartphone apps, wearable sensors, and social media use. It is estimated that 79% of adults in the UK own a smartphone, with ownership as high as 95% for 16-24 year olds.¹⁶ The average monthly consumption of mobile network data in the UK has increased by 25% since 2018, suggesting people are increasingly accessing the internet through their mobile phones.¹⁶ Pregnant and postpartum women are high users of mobile phone devices and increasingly rely on social media and mobile apps as sources of pregnancy and health information.¹⁷ The use of apps during pregnancy has been found to be feasible and acceptable among women, however, because of heterogeneity in interventions, comparators and outcome measures, it is difficult to draw conclusions on the effects of apps on maternal knowledge, behavior change and perinatal health outcomes.^{18,19}

Diabetes self-management and remote monitoring was one of the earliest focuses for the application of mHealth.²⁰ However, interventions aimed specifically at supporting women with GDM have significantly lagged in comparison. However, the use of technology in GDM care has evolved in recent years, most notably in the domain of smartphone-facilitated remote blood glucose monitoring, telehealth for supervision of

glycemic control during pregnancy and text messaging reminders for diabetic screening postpartum.^{21,22,23}

The most recent scoping review by Chen et al.²⁴ of mobile apps for gestational diabetes, consolidated knowledge around functionality, implementation, impact, and role of health literacy. The review included 12 articles focusing on seven different mobile apps, aimed at the prevention and management of GDM. The authors concluded that mobile apps have the potential to help prevent GDM and improve GDM management, however, the impact of mobile apps on relevant outcomes needs to be addressed using larger scale randomized controlled trials (RCTs). Additionally, the authors suggested that health literacy should be considered more readily during mobile app development and evaluation in order to increase usability and engagement. Nikolopoulos et al. recently published a literature review aiming to identify and appraise major mobile apps for GDM that were tested and evaluated by clinical studies published in MEDLINE and Scopus.²⁵ The review included 19 studies focused on three apps, and concluded that apps for blood glucose monitoring were a practical and useful way of tackling the growing burden of GDM. While both these reviews demonstrate promising support for mobile apps for use in GDM care, particularly during pregnancy, we aim to broaden the scope of this knowledge by conducting a scoping review focused on all types of mHealth (rather than just apps), that are available to support women at risk of or diagnosed with GDM.

The objective of this scoping review is, therefore, to provide an overview of the extent of knowledge related to the use of mHealth as primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of or diagnosed with GDM. We aim to determine what kind of evidence is available and identify gaps for future research. We aim to better understand how mHealth interventions have been evaluated, the timing and context of their implementation, and their purpose of use. We also aim to summarize study key findings and outcome measures.

A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews and the JBI Database of Systematic Reviews and Implementation Reports was conducted and no current or underway systematic or scoping reviews on the topic

were identified. To the best of our knowledge, the protocol outlined for this scoping review is the first to address the concept of mHealth for GDM, across the full pregnancy journey from preconception, pregnancy, postpartum and interconception.

Review question

What is known about using mHealth as a primary mode of intervention for the prevention and management of GDM and its long-term implications among women at risk of and diagnosed with, gestational diabetes?

Inclusion criteria

Participants

The review will consider studies that include women who are at risk of GDM, currently have or have previously had a diagnosis of GDM. We acknowledge that women who have a history of diabetes (type1 or type 2) will experience diabetes during pregnancy, however, because the focus of this review will be on GDM, we will exclude studies primarily focused on women with pre-existing Type 1 or Type 2 diabetes. Because we wish to understand use of mHealth among women with a previous diagnosis of GDM (inter-conception and postpartum periods) we will consider studies that include participants of any age.

Concept

This review will consider studies examining mHealth for GDM. mHealth has been defined as the use of mobile and wireless technologies to support the achievement of health objectives.¹⁵ We will include studies examining a range of mHealth technologies including, but not limited to, smartphone apps, wearable sensors such as smartwatches, and social media use. As mHealth technologies continue to be developed at a rapid pace, any newly emerging technologies that appear in the literature between protocol development and study selection will also be considered for inclusion. Studies focused on telehealth or telemedicine for GDM care, will be excluded as these have been systematically reviewed elsewhere.²⁶ In cases where studies include mHealth as one component of a broader interventional approach, mHealth must be the primary mode of intervention delivery to be considered for inclusion in this review.

Context

This review will consider studies that are conducted in any geographical location. Possible settings of mHealth use among women with experience of GDM include diabetes clinics, other hospital settings, primary care, community care and at home. With no commonly established implementation route, we aim include all settings in this review. With reference to our aim of understanding mHealth use for GDM before, during and after pregnancy we will consider studies that examine mHealth during preconception, pregnancy, inter-conception and postpartum periods. Studies published in English will be included. We propose no limit on study date as mHealth is a relatively new concept and we aim to ensure the retrieval of all relevant studies.

Types of Sources

This scoping review will consider both experimental and quasi-experimental study designs including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. Study protocols will also be considered for inclusion. Any systematic reviews that meet the inclusion criteria will be retrieved and their original source papers will be searched for eligibility for inclusion.

In addition, analytical observational studies including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review will also consider descriptive observational study designs including case series, individual case reports and descriptive cross-sectional studies for inclusion. Qualitative studies will also be considered that focus on qualitative data including, but not limited to, designs such as phenomenology, grounded theory, ethnography, qualitative description, action research and feminist research.

Methods

The proposed scoping review will be conducted in accordance with the Joanna Briggs Institute methodology for scoping reviews.^{27,28}

Search strategy

The search strategy will aim to locate both published and unpublished studies. An initial limited search of Scopus and MEDLINE was undertaken to identify articles on the topic. The text words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles were used to develop a full search strategy for MEDLINE (see Appendix I). The search strategy, including all identified keywords and index terms, will be adapted for each included information source. The reference list of all studies selected for critical appraisal will be hand searched for additional studies.

Information sources

The databases to be searched include MEDLINE (via Ovid), CINAHL (via EBSCOhost, USA), EMBASE (via Ovid), Cochrane Database (via Wiley, USA) Scopus, and TRIP. Sources of unpublished studies and grey literature to be searched using Open Grey, ISRCTN Registry, ClinicalTrials.gov, EU Clinical Trials register and ANZCTR.

Study selection

Following the search, all identified citations will be collated and uploaded into Endnote X8, 2018 (Clarivate Analytics, PA, USA) and duplicates removed. Titles and abstracts will then be screened by two independent reviewers (KE, KM) for assessment against the inclusion criteria for the review. Potentially relevant studies will be retrieved in full and their citation details imported into the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI; Joanna Briggs Institute, Adelaide, Australia).²⁹ The full text of selected citations will be assessed in detail against the inclusion criteria by two independent reviewers (KE, KM). Reasons for exclusion of full text studies that do not meet the inclusion criteria will be recorded and reported in the systematic scoping review. Any disagreements that arise between the reviewers at each stage of the study selection process will be resolved through discussion, or with a third reviewer (JS). The results of the search will be reported in full in the final systematic scoping review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram.³⁰

Data Extraction

Data will be extracted from full papers included in the scoping review by two independent reviewers (KE, KM) using the draft data extraction table available in Appendix II. This draft data extraction table is adapted from the JBI results extraction instrument. Data extracted will be tabulated and include the following: Author, year of publication, origin, study design, intervention, implementation context, and key findings related to the review objectives. The draft data extraction table may be modified and revised as necessary during the process of extracting data from each included study. Any modifications will be detailed in the full scoping review report. Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer (JS). Authors of papers will be contacted to request missing or additional data, where required.

Data Presentation

Data extracted from included full text articles will be presented in diagrams and/or tables in a way that supports the objective of our planned review. We anticipate the results tabulated will include study design, type and purpose of mHealth intervention, study sample (e.g. women at risk, diagnosed during pregnancy, postpartum after diagnosis), key findings. Tabulated and/or charted results will be accompanied by a narrative summary that will describe how the results relate to the review question and objective.

Funding

The development of this protocol has not received funding.

Conflicts of interest

All authors declare no conflict of interest.

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Appendix C: Scoping review additional data

Database search strategies

MEDLINE (Ovid)

Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations 1946 to March 22, 2021

Search conducted on 22nd March 2021

#	Searches	Results
1	Diabetes, Gestational/	10831
2	"gestational diabet* ".ab,kf,ti.	14857
3	GDM.ab,kf,ti.	7316
4	(pregnancy adj3 diabetes).ab,kf,ti.	5558
5	((pregnan* or gestation* or maternal) adj3 glucose intolerance).ab,kf,ti.	356
6	((pregnan* or gestation* or maternal) adj3 impaired glucose tolerance).ab,kf,ti.	316
7	(hyperglyc#emia adj3 pregnan*).ab,kf,ti.	160
8	(hyperglyc#emia adj3 gestation*).ab,kf,ti.	53
9	(maternal adj2 hyperglyc#emia).ab,kf,ti.	126
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	20535
11	Telemedicine/	23311
12	telemedicine.ab,kf,ti.	12644
13	(ehealth or "e health").ab,kf,ti.	6479
14	(mhealth or "m health").ab,kf,ti.	5199
15	("mobile health" or "mobile technolog*").ab,kf,ti.	6171
16	("digital health" or "digital technolog*").ab,kf,ti.	3630
17	Smartphone/	4496
18	(smartphone* or "smart phone*").ab,kf,ti.	12266
19	Cell Phone/	8547
20	("cell* phone*" or "mobile phone*").ab,kf,ti.	11632
21	Mobile Applications/	6023
22	("mobile app" or "mobile apps" or "mobile application*").ab,kf,ti.	4702
23	Text Messaging/	2918
24	"text messag* ".ab,kf,ti.	4132

25	Social Media/	8027
26	"social media".ab,kf,ti.	11373
27	(website* or online or internet).ab,kf,ti.	172358
28	(whatsapp or facebook or twitter or instagram).ab,kf,ti.	6342
29	Internet/	73031
30	Computers, Handheld/	3611
31	("personal digital assistant" or PDA).ab,kf,ti.	11969
32	(tablet* adj3 (comput* or device*)).ab,kf,ti.	1648
33	bluetooth.ab,kf,ti.	1134
34	"monitoring device* ".ab,kf,ti.	3651
35	"wireless device* ".ab,kf,ti.	402
36	(smartwatch* or "smart watch*").ab,kf,ti.	421
37	("fitness tracker*" or fitbit*).ab,kf,ti.	727
38	Fitness Trackers/	560
39	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38	289282
40	10 and 39	299

EMBASE (Ovid) <1974 to 2021 March 22>

Search conducted on 22nd March 2021

#	Searches	Results
1	pregnancy diabetes mellitus/	30420
2	"gestational diabet* ".ab,kw,ti.	23815
3	GDM.ab,kw,ti.	11938
4	(pregnancy adj3 diabetes).ab,kw,ti.	6887
5	((pregnan* or gestation* or maternal) adj3 glucose intolerance).ab,kw,ti.	567
6	((pregnan* or gestation* or maternal) adj3 impaired glucose tolerance).ab,kw,ti.	423
7	(hyperglyc#emia adj3 pregnan*).ab,kw,ti.	257
8	(hyperglyc#emia adj3 gestation*).ab,kw,ti.	70
9	(maternal adj2 hyperglyc#emia).ab,kw,ti.	174
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	36728
11	telemedicine/	22918
12	telemedicine.ab,kw,ti.	16568

13	(ehealth or "e health").ab,kw,ti.	7294
14	(mhealth or "m health").ab,kw,ti.	4530
15	("mobile health" or "mobile technolog*").ab,kw,ti.	6289
16	("digital health" or "digital technolog*").ab,kw,ti.	3828
17	smartphone/	11579
18	(smartphone* or "smart phone*").ab,kw,ti.	16237
19	mobile phone/	16365
20	("cell* phone*" or "mobile phone*").ab,kw,ti.	14061
21	mobile application/	10300
22	("mobile app" or "mobile apps" or "mobile application*").ab,kw,ti.	5445
23	text messaging/	4746
24	"text messag* ".ab,kw,ti.	5228
25	social media/	18892
26	"social media".ab,kw,ti.	15015
27	(website* or online or internet).ab,kw,ti.	244683
28	(whatsapp or facebook or twitter or instagram).ab,kw,ti.	8807
29	Internet/	107422
30	personal digital assistant/	1433
31	("personal digital assistant" or PDA).ab,kw,ti.	16548
32	(tablet* adj3 (comput* or device*)).ab,kw,ti.	2533
33	bluetooth.ab,kw,ti.	1688
34	"monitoring device* ".ab,kw,ti.	5135
35	"wireless device* ".ab,kw,ti.	530
36	(smartwatch* or "smart watch*").ab,kw,ti.	494
37	("fitness tracker*" or fitbit*).ab,kw,ti.	1006
38	activity tracker/	777
39	11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37	395248
40	10 and 39	647

Cochrane Library (<https://www.cochranelibrary.com/>)

Search conducted on 22nd March 2021

ID	Search	Hits
#1	MeSH descriptor: [Diabetes, Gestational] explode all trees	904
#2	MeSH descriptor: [Telemedicine] explode all trees	2343
#3	MeSH descriptor: [Cell Phone] explode all trees	1238

#4	MeSH descriptor: [Text Messaging] explode all trees	765
#5	MeSH descriptor: [Social Media] explode all trees	129
#6	MeSH descriptor: [Internet] explode all trees	3776
#7	MeSH descriptor: [Computers, Handheld] explode all trees	571
#8	MeSH descriptor: [Fitness Trackers] explode all trees	77
#9	MeSH descriptor: [Smartphone] explode all trees	314
#10	("gestational diabet*"):ti,ab,kw OR (GDM):ti,ab,kw OR ((pregnancy NEAR/3 diabetes)):ti,ab,kw OR (((pregnan* or gestation* or maternal) NEAR/3 glucose intolerance)):ti,ab,kw OR (((pregnan* or gestation* or maternal) NEAR/3 impaired glucose tolerance)):ti,ab,kw in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections (Word variations have been searched)	2945
#11	((hyperglyc#emia adj3 pregnan*)):ti,ab,kw OR ((hyperglyc#emia NEAR/3 gestation*)):ti,ab,kw OR ((maternal NEAR/2 hyperglyc#emia)):ti,ab,kw in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections (Word variations have been searched)	0
#12	#1 OR #10 OR #11 in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections	3015
#13	(telemedicine):ti,ab,kw OR ((ehealth or "e health")):ti,ab,kw OR ((mhealth or "m health")):ti,ab,kw OR (("mobile health" or "mobile technolog*")):ti,ab,kw OR (("digital health" or "digital technolog*")):ti,ab,kw in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections (Word variations have been searched)	6372
#14	((smartphone* or "smart phone*")):ti,ab,kw OR (("cell* phone*" or "mobile phone*")):ti,ab,kw OR (("mobile app" or "mobile apps" or "mobile application*")):ti,ab,kw OR ("text messag*"):ti,ab,kw OR ("social media"):ti,ab,kw in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections (Word variations have been searched)	10170
#15	((website* or online or internet)):ti,ab,kw OR ((whatsapp or facebook or twitter or instagram)):ti,ab,kw OR (("personal digital assistant" or PDA)):ti,ab,kw OR ((tablet* adj3 (comput* or device*)):ti,ab,kw OR (bluetooth):ti,ab,kw in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections (Word variations have been searched)	23186
#16	("monitoring device*"):ti,ab,kw OR ("wireless device*"):ti,ab,kw OR ((smartwatch* or "smart watch*")):ti,ab,kw OR (("fitness tracker*" or fitbit*)):ti,ab,kw in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections (Word variations have been searched)	1560
#17	#13 OR #14 OR #15 OR #16 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 in Cochrane	35890

	Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections	
#18	#12 AND #17 in Cochrane Reviews, Cochrane Protocols, Trials, Clinical Answers, Editorials, Special collections	225

CINHAL (EBSCO) with Full Text – Boolean/Phrase

Search conducted on 22nd March 2021

MH= exact subject heading

TI = Title

AB = Abstract

N2, N3 = Finds the words if they are within two or three words of each other regardless of order

ID	Search	Results
S1	(MH "Diabetes Mellitus, Gestational")	6,870
S2	TI "gestational diabet*" OR AB "gestational diabet*"	7,372
S3	TI gdm OR AB gdm	2,992
S4	TI (pregnancy N3 diabetes) OR AB (pregnancy N3 diabetes)	2,441
S5	TI (((pregnan* or gestation* or 24maternal) N3 glucose intolerance)) OR AB (((pregnan* or gestation* or maternal) N3 glucose intolerance))	128
S6	TI (((pregnan* or gestation* or maternal) N3 impaired glucose tolerance)) OR AB (((pregnan* or gestation* or maternal) N3 impaired glucose tolerance))	126
S7	TI (hyperglyc#emia N3 pregnan*) OR AB (hyperglyc#emia N3 pregnan*)	269
S8	TI (hyperglyc#emia N3 gestation*) OR AB (hyperglyc#emia N3 gestation*)	71
S9	TI (maternal N2 hyperglyc#emia) OR AB (maternal N2 hyperglyc#emia)	168
S10	(S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9)	10,391
S11	(MH "Telemedicine") OR (MH "Telehealth")	19,804
S12	TI telemedicine OR AB telemedicine	5,116
S13	TI ((ehealth or "e health")) OR AB ((ehealth or "e health"))	3,466
S14	TI ((mhealth or "m health")) OR AB ((mhealth or "m health"))	1,817
S15	TI (("mobile health" or "mobile technolog*")) OR AB (("mobile health" or "mobile technolog*"))	2,991
S16	TI (("digital health" or "digital technolog*")) OR AB (("digital health" or "digital technolog*"))	2,103
S17	(MH "Smartphone") OR (MH "Mobile Applications") OR (MH "Text Messaging") OR (MH "Computers, Hand-Held") OR (MH "Cellular Phone")	17,513
S18	TI ((smartphone* or "smart phone*")) OR AB ((smartphone* or "smart phone*"))	6,343
S19	TI (("cell* phone*" or "mobile phone*")) OR AB (("cell* phone*" or "mobile phone*"))	4,970

S20	TI (("mobile app" or "mobile apps" or "mobile application**")) OR AB (("mobile app" or "mobile apps" or "mobile application**"))	2,753
S21	TI "text messag*" OR AB "text messag**"	2,738
S22	(MH "Social Media")	14,813
S23	TI "social media" OR AB "social media"	10,578
S24	(MH "Internet")	49,301
S25	TI ((website* or online or internet)) OR AB ((website* or online or internet))	104,439
S26	TI ((whatsapp or facebook or twitter or instagram)) OR AB ((whatsapp or facebook or twitter or instagram))	7,490
S27	TI (("personal digital assistant" or PDA)) OR AB (("personal digital assistant" or PDA))	2,115
S28	TI ((tablet* N3 (comput* or device*))) OR AB ((tablet* N3 (comput* or device*)))	1,049
S29	TI bluetooth OR AB bluetooth	336
S30	TI "monitoring device**" OR AB "monitoring device**"	1,134
S31	TI "wireless device**" OR AB "wireless device**"	131
S32	TI ((smartwatch* or "smart watch**")) OR AB ((smartwatch* or "smart watch**"))	205
S33	(MH "Fitness Trackers")	191
S34	TI (("fitness tracker**" or fitbit*)) OR AB (("fitness tracker**" or fitbit*))	450
S35	S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34	190,978
S36	(S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34) AND (S10 AND S35)	222

Scopus (ELSEVIER)

Search conducted on 22nd March 2021

((TITLE-ABS-KEY ("Gestational diabetes") OR TITLE-ABS-KEY ("gestational diabet**") OR TITLE-ABS-KEY (gdm) OR TITLE-ABS-KEY (pregnancy W/3 diabetes) OR TITLE-ABS-KEY (((pregnan* OR gestation* OR maternal) W/3 glucose AND intolerance)) OR TITLE-ABS-KEY (((pregnan* OR gestation* OR maternal) W/3 impaired AND glucose AND tolerance)) OR TITLE-ABS-KEY ((hyperglyc#emia W/3 pregnan*)) OR TITLE-ABS-KEY ((hyperglyc#emia W/3 gestation*)) OR TITLE-ABS-KEY ((maternal AND adj2 AND hyperglyc#emia)))) AND ((TITLE-ABS-KEY (telemedicine) OR TITLE-ABS-KEY ((ehealth OR "e health")) OR TITLE-ABS-KEY ((mhealth OR "m health")) OR TITLE-ABS-KEY (("mobile health" OR "mobile technolog*")) OR TITLE-ABS-KEY (("digital health" OR "digital technolog*")) OR TITLE-ABS-KEY ((smartphone* OR "smart phone**")) OR TITLE-ABS-KEY (("cell* phone**" OR "mobile phone**")) OR TITLE-ABS-KEY (("mobile app" OR "mobile apps" OR "mobile application**")) OR TITLE-ABS-KEY ("text messag*") OR TITLE-ABS-KEY ("social media") OR TITLE-ABS-KEY ((website* OR online OR internet)) OR TITLE-ABS-KEY ((whatsapp OR facebook OR twitter OR instagram)) OR TITLE-ABS-KEY (internet) OR TITLE-ABS-KEY ("handheld computer") OR TITLE-ABS-KEY (("personal digital assistant" OR pda)) OR TITLE-ABS-KEY ((tablet* W/3 (comput* OR device*))) OR TITLE-ABS-KEY (bluetooth) OR TITLE-ABS-KEY (

"monitoring device*") OR TITLE-ABS-KEY ("wireless device*") OR TITLE-ABS-KEY ((smartwatch* OR "smart watch*")) OR TITLE-ABS-KEY (("fitness tracker*" OR fitbit*)))

587 records retrieved

TRIP Turning Research into Practice (<https://www.tripdatabase.com/>)

Search conducted on 22nd March 2021

#	Search	Results
1.	("Gestational diabetes") OR ("gestational diabet*") OR (gdm) OR (pregnancy diabetes) OR (((pregnan* OR gestation* OR maternal) glucose AND intolerance)) (((pregnan* OR gestation* OR maternal) impaired AND glucose AND tolerance)) OR ((hyperglyc#emia pregnan*)) ((hyperglyc#emia gestation*)) ((maternal AND hyperglyc#emia)))	4,370
2.	((telemedicine) OR ((ehealth OR "e health")) ((mhealth OR "m health")) OR (("mobile health" OR "mobile technolog*")) ("digital health" OR "digital technolog*")) OR ((smartphone* OR "smart phone*")) ("cell* phone*" OR "mobile phone*")) OR (("mobile app" OR "mobile apps" OR "mobile application*")) OR ("text messag*") OR ("social media" OR (website* OR online OR internet)) OR ((whatsapp OR facebook OR twitter OR instagram)) OR (internet) OR ("handheld computer") OR (("personal digital assistant" OR pda)) OR ((tablet* (comput* OR device*))) OR (bluetooth) OR ("monitoring device*" OR "wireless device*" OR (smartwatch* OR "smart watch*") OR ("fitness tracker*" OR fitbit))))	172
3.	#1 AND #2	186

Open Grey

Search conducted on 22nd March 2021

#	Search	Results
1.	Gestational diabetes	42

ISRCTN Registry (<https://www.isrctn.com/>)

Search conducted on 22nd March 2021

#	Search	Results
1.	Gestational diabetes	194

ClinicalTrials.gov (<https://clinicaltrials.gov/>)

Search conducted on 22nd March 2021

#	Search	Results
1.	Gestational diabetes AND mHealth	11
2.	Gestational diabetes AND eHealth	5
3.	Gestational diabetes AND smartphone	13
4.	Gestational diabetes AND technology	26

EU Clinical Trials Register (<https://www.clinicaltrialsregister.eu/>)

Search conducted on 22nd March 2021

#	Search	Results
1.	Gestational diabetes	61

Australia and New Zealand Clinical Trials Registry (<https://www.anzctr.org.au/>)

Search conducted on 22nd March 2021

#	Search	Results
1.	Gestational diabetes	164

Studies ineligible following full text review

Adepoju IOO, Douwes R, Abugnaba-Abanga R, Van Der Heiden M, Apentibadek N, Zweekhorst M, et al. MHealth for improving quality of antenatal care in northern Ghana: The Bliss4Midwives project. *Trop Med Int Heal*. 2017;22:81.

Reason for exclusion: Ineligible intervention: mHealth not the main intervention component

Albert L, Capel I, Garcia-Saez G, Martin-Redondo P, Hernando ME, Rigla M. Managing gestational diabetes mellitus using a smartphone application with artificial intelligence (SineDie) during the COVID-19 pandemic: Much more than just telemedicine. *Diabetes Res Clin Pract*. 2020;169:108396.

Reason for exclusion: Ineligible source type

ANZCTR. Continuous Glucose Monitoring (CGM) for women with Gestational Diabetes Mellitus (GDM) study: pilot. [Internet]. 2018. [cited 2021 Mar 22]. Available from: <https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=374153>.

Reason for exclusion: Ineligible intervention: Not mHealth

Aranda MIF. Technological advances in the follow-up of diabetic pregnant women. *Matronas Prof*. 2017;18(4):e64–72.

Reason for exclusion: Article not available in English

Artola G, Torres J, Larburu N, Álvarez R, Muro N. Development and Usability Assessment of a Semantically Validated Guideline-Based Patient-Oriented Gestational Diabetes Mobile App. In

Fred A, Salgado A, Aveiro D, Dietz J, Bernardino J, Filipe J. Eds. Knowledge Discovery, Knowledge Engineering and Knowledge Management. Spain: Springer Science and Business Media Deutschland GmbH. 2020; p.237–59.

Reason for exclusion: Unable to access full text

Bartholomew ML, Church K, Graham G, Burlingame J, Zalud I, Sauvage L, et al. Managing diabetes in pregnancy using cell phone/internet technology. Am J Obstet Gynecol. 2011;204(1):S113-S114.

Reason for exclusion: Ineligible intervention: Telemedicine

Bogaerts A, Ameye L, Bijlholt M, Amuli K, Heynickx D, Devlieger R. INTER-ACT: Prevention of pregnancy complications through an e-health driven interpregnancy lifestyle intervention - Study protocol of a multicentre randomised controlled trial. BMC Pregnancy Childbirth. 2017;17(1):1–9.

Reason for exclusion: Ineligible intervention: mHealth not the main intervention component

Borgen I, Garnweidner-Holme LM, Jacobsen AF, Bjerkan K, Fayyad S, Joranger P, et al. Smartphone application for women with gestational diabetes mellitus: A study protocol for a multicentre randomised controlled trial. BMJ Open. 2017;7(3).

Reason for exclusion: Background Article: Protocol with full study results available from included study [Borgen et al., 2019]

Bradley D, Landau E, Wolfberg A, Baron A. 500: Predicting the likelihood of developing gestational diabetes using data collected from a pregnancy mobile app. Am J Obstet Gynecol. 2019;220(1):S336.

Reason for exclusion: Ineligible population

Brough C, Schreder S, Northern A, Hadjiconstantinou M, Davies M, Khunti K. Development of a web-based prevention programme for women with post gestational diabetes (GDM): Baby steps. Diabet Med. 2019;36:100–1.

Reason for exclusion: Ineligible intervention: mHealth not the main intervention component

Cai M, Tan KH, Ang SB. I-ACT: Integrated study on effect of Activity on ComplicaTions in pregnancy: Study protocol of a multiethnic prospective cohort study. *BMJ Open*. 2019;9(4).

Reason for exclusion: Ineligible intervention: mHealth not the main intervention component

Caretto A, Rossi MG, Laurenzi A, Triberti S, Gandolfi A, Barrasso M, et al. The “active ageing” app: Preliminary usability evaluation of a mobile application for diabetes self-management. *Diabetes Technol Ther*. 2018;20:A116.

Reason for exclusion: Ineligible population

Cheung NW, Blumenthal C, Smith BJ, Hogan R, Thiagalingam A, Redfern J, et al. A pilot randomised controlled trial of a text messaging intervention with customisation using linked data from wireless wearable activity monitors to improve risk factors following gestational diabetes. *Nutrients*. 2019;11(3):590.

Reason for exclusion: Ineligible intervention. mHealth not the main intervention component

Chan KL, Chen M. Effects of social media and mobile health apps on pregnancy care: Meta-analysis. *JMIR mHealth uHealth*. 2019;7(1).

Reason for exclusion: Ineligible source type: systematic review searched and no novel studies found

Chen Q, Carbone ET. Functionality, Implementation, Impact, and the Role of Health Literacy in Mobile Phone Apps for Gestational Diabetes: Scoping Review. *JMIR diabetes*. 2017;2(2):e25.

Reason for exclusion: Ineligible source type: scoping review, searched and no novel studies found

Collier J, Fortuin J, Adams S. Development of a gestational diabetes selfmanagement and remote monitoring mobile platform. *J Diabetes Sci Technol*. 2020;14(2):A24.

Reason for exclusion: Ineligible population

Ding B, Gou B, Guan H, Wang J, Bi Y, Hong Z. WeChat-assisted dietary and exercise intervention for prevention of gestational diabetes mellitus in overweight/obese pregnant women: a two-arm randomized clinical trial. Arch Gynecol Obstet. 2021;Epub ahead of print.

Reason for exclusion: Unable to access full text

Garg N, Shaima KA, Arora S, Kaur K. Application of Mobile Technology for Disease and Treatment Monitoring of Gestational Diabetes Mellitus Among Pregnant Women: A Systematic Review. J Diabetes Sci Technol. 2020.

Reason for exclusion: Ineligible source type; review searched and no novel studies found

Garnweidner-Holme L, Henriksen L, Torheim LE, Lukasse M. Effect of the Pregnant+ Smartphone App on the Dietary Behavior of Women With Gestational Diabetes Mellitus: Secondary Analysis of a Randomized Controlled Trial. JMIR mHealth uHealth. 2020;8(11):e18614.

Reason for exclusion: Ineligible source type

Gibson OJ, Loerup L, MacKillop L, Farmer AJ, Levy JC, Bartlett K, et al. GDm-health: Remote monitoring for gestational diabetes. J Diabetes Sci Technol. 2013;7(1):A51.

Reason for exclusion: Background article: full study included [Mackillop et al., 2018]

Hawkins M, Iradukunda F, Paterno M. Feasibility of a Sleep Self-Management Intervention in Pregnancy Using a Personalized Health Monitoring Device: Protocol for a Pilot Randomized Controlled Trial. JMIR Res Protoc. 2019;8(5):e12455.

Reason for exclusion: Ineligible population

Hirst JE, Mackillop LH, Loerup L, Farmer AJ, Kevat DA, Bartlett KJ, et al. GDm-health: Development of a real-time smartphone solution for the management of women with gestational diabetes mellitus (GDM). BJOG An Int J Obstet Gynaecol. 2015;122:403.

Reason for exclusion: Background article: full study included [Mackillop et al., 2018]

Honarvar B, Salehi F, Shaygani F, Hajebrahimi M, Homayounfar R, Dehghan S, et al. Opportunities and threats of electronic health in management of diabetes mellitus: An umbrella review of systematic review and meta-analysis studies. Shiraz E Med J. 2019;20(1):e81794.

Reason for exclusion: Ineligible population

Ilias I. Smartphones for gestational diabetes in the COVID-19 era. J Diabetes Metab Disord. 2021;3:1-2.

Reason for exclusion: Ineligible source type

Immanuel J, Simmons D. Apps and the Woman With Gestational Diabetes Mellitus. Diabetes Care. 2021;44(2):313–5.

Reason for exclusion: Ineligible source type

Isrctn. Comparing continuous glucose monitoring with self-monitoring of blood glucose in gestational diabetes. [Internet]. 2018. [cited 2021 Mar 22]. Available from: <http://www.who.int/trialsearch/Trial2.aspx?TrialID=ISRCTN92877235>.

Reason for exclusion: Ineligible intervention: Not mHealth

Kalhuri SRN, Hemmat M, Noori T, Heydarian S, Katigari MR. Quality evaluation of english mobile applications for gestational diabetes: App review using mobile application rating scale (mars). Curr Diabetes Rev. 2021;17(2):161–8.

Reason for exclusion: Ineligible source type: review searched and no novel studies found

Larsen B, Micucci S, Hartman S, Ramos G. Feasibility and Acceptability of a Counseling- and mHealth-Based Physical Activity Intervention for Pregnant Women With Diabetes: The Fit for Two Pilot Study. JMIR mHealth uHealth. 2020;8(10):e18915.

Reason for exclusion: Ineligible population

Lau Y, Htun TP, Wong SN, Tam WSW, Klainin-Yobas P. Efficacy of Internet-Based Self-Monitoring Interventions on Maternal and Neonatal Outcomes in Perinatal Diabetic Women: A Systematic Review and Meta-Analysis. J Med Internet Res. 2016;18(8):e220.

Reason for exclusion: Ineligible intervention: mHealth not the main intervention component

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Reason for exclusion: Ineligible population

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Reason for exclusion: Ineligible population

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Reason for exclusion: Ineligible source type and Ineligible population

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Reason for exclusion: Ineligible population

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Reason for exclusion: Ineligible intervention. mHealth not the main intervention component

Characteristics of included studies

Author/publication year, country of origin / mHealth intervention	Study focus and design	mHealth type and purpose	mHealth features	Target population and sample	Outcome measures	Implementation context and duration of mHealth use	Behavior change theory and techniques	Key study findings
Borgen <i>et al.</i> ³⁰ 2019 Norway Pregnant+ App	Evaluation Multicenter ^a RCT Intervention: App + standard care Control: standard care	App to support ^b GDM self-management	<ul style="list-style-type: none"> - 'blood glucose' monitoring with real-time visualization - Physical activity – written examples with images of how to perform activities - Culturally adapted information about diet - Diabetes information – general info about GDM, 	Pregnant women aged 18+, with 2-hour ^c OGTT >9 mmol/L who owned a smartphone Intervention (n=112) Control (n=121)	Primary: postpartum ^d BGL 2hr OGTT at 3 months Secondary: postpartum induction of labor; mode of delivery; ^e NICU admission; Apgar Score; birth weight; infant feeding; cessation of breastfeeding; engagement with health via app	App introduced at a diabetes outpatient clinic. Women downloaded the app at hospital or at home. App used ≤33 weeks gestation to 3 months postpartum	Health Belief Model 1) Provides feedback on performance 2) Provide information about behavior-health link 3) Provides information on consequences and benefits	Women who declined to take part (n=61), gave reasons such as too time consuming and no interest in the study. Large loss to follow up at 3 months postpartum meant the value and interpretation of findings is restricted.

			<p>follow-up and postpartum.</p> <ul style="list-style-type: none"> - Interaction with 'HCPs is not possible but information from the app can be printed. 				<p>4) Prompts self-monitoring</p> <p>Provides instruction</p>	
<p>Castorino <i>et al.</i>³¹ 2018</p> <p>USA</p> <p>Tu Puedes App</p>	<p>Pilot study</p> <p>Quasi experimental design with control</p> <p>Intervention: app use alone</p> <p>Control: classroom based education sessions</p>	<p>Culturally and linguistically appropriate educational app for diabetes prevention among Latina women with previous GDM</p>	<ul style="list-style-type: none"> - 4 'lessons' about ⁹T2DM prevention - Culturally applicable information 	<p>Latina women previously diagnosed with GDM aged 18-40 (n=22)</p> <p>Intervention: (n=not reported)</p> <p>Control: (n=not reported)</p>	<p>Primary: qualitative experience of using the app</p> <p>Secondary: self-perceived health; weight; ^hBMI; waist circumference; blood pressure</p>	<p>Not reported</p>	<p>1) Information about behavior-health link</p>	<p>Findings suggest satisfaction with app use and intention among women to continue use.</p>

<p>Crimmins <i>et al.</i>³² 2019 USA Glucose Mamma (App)</p>	<p>Evaluation Prospective RCT Intervention: app use alone Control: standard care</p>	<p>App to support GDM self-management</p>	<ul style="list-style-type: none"> - Manual upload of BGL readings with real-time feedback - Text messages with positive feedback <p>Information on healthy eating, recipes and meal plans</p>	<p>Pregnant women diagnosed with GDM at 24-34 weeks gestation. Intervention (n=13) Control (n=20)</p>	<p>Primary: Need to start pharmacologic therapy (metformin, glyburide and/or insulin). Secondary: compliance; no. of BGL readings logged; mode of delivery; shoulder dystocia; preeclampsia; birthweight; NICU admission; phototherapy; hypoglycemia; completed 2hr OGTT; initiated birth control; arrived at postpartum visit;</p>	<p>App offered to women at a tertiary medical center. App used from diagnosis (24-34 weeks gestation) to delivery</p>	<p>1) Prompt self-monitoring of behavior 2) Provide feedback on performance</p>	<p>Findings suggest compliance among women with weekly log review when using the app.</p>
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					breastfeeding at 6 weeks postpartum; weight loss at postpartum visit			
Dyson <i>et al.</i> ³³ 2019 UK GDmHealth Plus App	Pilot study Mixed methods evaluation	Mobile-phone based system for blood glucose management and behavioral lifestyle change during pregnancy	See Mackillop <i>et al.</i> 2018 (GDmHealth app) for GDM self-management functions. - Weekly self-weighing - Carbohydrate counting - Physical activity monitoring - Real-time feedback on healthy behaviors via specialist dietician and midwives	Pregnant women diagnosed with GDM (n=18)	System usage and satisfaction	App introduced to women at a large tertiary hospital. App used from diagnosis to delivery	1) Prompts self-monitoring behavior 2) Provide feedback on performance 3) Provides instruction	Findings suggest women interacted with the app and were satisfied with features aside from self-weighing and feedback about weight.

Garnweidner-Holme <i>et al.</i> ³⁴ 2015 Norway Pregnant+ App	Development and usability User-centered iterative design and development process and think-aloud interviews.	See Borgen et al. 2019	See Borgen et al. 2019	Pregnant women diagnosed with GDM (n=21)	Design and develop an app	See Borgen et al. 2019	See Borgen et al. 2019	Findings suggest women's user experience was positive. Facilitators included making it easier to manage BGL and having real-time feedback on levels. Inclusion of culturally appropriate information was also seen as key to adoption. Barriers included contradicting information between app and HCPs.
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<p>Ghaderi <i>et al.</i>³⁵ 2019. Iran Unnamed App</p>	<p>Evaluation Quasi-experimental design with control group Intervention: app + paper based education Control: paper based education</p>	<p>Educational app to increase risk perception of T2DM among pregnant women with GDM</p>	<ul style="list-style-type: none"> - Profile creation - Reminders for tests and medications - Video, photo and text education materials FAQ section regarding GDM and T2DM 	<p>Pregnant women with GDM diagnosis using insulin, aged 18-40, have android smartphone</p> <p>Intervention: (n=44) Control: (n=43)</p>	<p>Primary: Risk perception of T2DM measured before and 6 weeks after intervention delivery</p>	<p>App introduced to women at university hospital. App was installed for women, and provided with a guidance booklet. App used for 6 weeks</p>	<ol style="list-style-type: none"> 1) Prompts practice 2) Provide information about behavior-health link 3) Provide information about consequence <p>Provides instruction</p>	<p>No findings regarding engagement or user experience available.</p>
<p>Guo <i>et al.</i>³⁶ 2019 China dNurse App</p>	<p>Evaluation Single center RCT Intervention: app use</p>	<p>App to support GDM self-management</p>	<ul style="list-style-type: none"> - Manual upload of BGL readings with real-time feedback - BGL data transmitted to HCP 	<p>Pregnant women with GDM diagnosis (fasting BGL ≥ 5.1mmol/L or 1HR OGTT ≥ 10.00)</p>	<p>Outcomes: Compliance with BGL monitoring; frequency of outpatient service use; iHbA1c before delivery; mode</p>	<p>App offered to women at university hospital and downloaded the app themselves. App used from 24-28</p>	<ol style="list-style-type: none"> 1) Real-time feedback 2) Prompt self-monitoring of behavior 3) Information on health- 	<p>Findings suggest women successfully used the app for recording their BGL.</p>

	+ standard care Control: standard care		- HCP available to answer questions Provision of information on diet, exercise, treatment and GDM	mmol/L or 2hr OGTT ≥ 8.5 mmol/L) aged 21-45 years, able to use smartphone Intervention (n=64) Control (n=60)	of delivery; no. of off-target BGL measurements; shoulder dystocia; hypoglycemia in newborn; fetal macrosomia; ^K GA at delivery; BLG measured by OGTT 3 months postpartum	weeks gestation to delivery.	behavior link 4) Provides instruction	
Hashmi ³⁷ 2019 Oman SESSPA (App)	Trial registration Feasibility RCT Intervention: app use alone	App to support GDM self-management	- health education content about GDM - goal setting and action planning - videos regarding recommende	Pregnant women with GDM diagnosis aged 18+ (n=15)	Primary outcome: Feasibility measured by: rates of recruitment; retention rate; completion of intervention; participant satisfaction	App introduced to women at university hospital. App used from 22 – 30 weeks gestation until delivery	1) Prompt intention formation 2) Prompts practice 3) Prompts self-monitoring behavior 4) Provides feedback	N/A

			<p>d physical activities</p> <ul style="list-style-type: none"> - video about the steps for blood glucose monitoring - photo examples of the recommended healthy diet - tracking of physical activity, diet and BGL - progress charts of daily self-reported data on healthy diet, physical activity and blood glucose monitoring. - text messages reminder 		<p>Secondary outcomes: Accessibility measured by: usage; focus groups</p>		<p>on performance</p> <ul style="list-style-type: none"> 5) Information on health-behavior link 6) Information on consequences 7) Provides instruction 	
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			twice a day (8:00 am and 8:00 pm) to check their blood glucose level, maintain healthy eating, and maintain an active lifestyle.					
Hirst <i>et al.</i> ³⁸ 2015; UK GDmHealth App	Pilot study Post questionnaire measuring satisfaction	See Mackillop <i>et al.</i> 2018	See Mackillop <i>et al.</i> 2018	Pregnant women with GDM diagnosis, not requiring pharmacological treatment (n=52)	Outcomes: Satisfaction with diabetes care; satisfaction with the GDmHealth system; relationship with diabetes care team	See Mackillop <i>et al.</i> 2018	See Mackillop <i>et al.</i> 2018	Findings suggest overall acceptability and satisfaction with app among women.
Jo and Park ³⁹ 2016 Korea Unnamed App	Development and usability study	App to provide tailored intervention	App includes eight algorithms with 18 decision nodes which	Pregnant women with GDM diagnosis	Outcomes: Usability and acceptance	Women were recruited from an online	1) Prompts self-monitoring behavior	Findings suggest women thought the

	Mixed methods evaluation of usability and acceptability	ns for GDM self-management.	enable the app to generate generic and tailored recommendations based on patient's data and clinical guidelines.	Initial Usability (n=5) Further usability (n=60)		diabetes group to test the app at home. App used for 1 week	2) Provides feedback on performance	app was useful but responses were mixed regarding acceptability including intention and motivation to use.
Kim <i>et al.</i> ⁴⁰ 2021 South Korea (Virtual Reality)	Evaluation Quasi-experimental study with control Intervention: VR program use Control: written educational material	Mobile Virtual reality to support self-management to prevent type 2 diabetes	- 123 options of exercises - Nutrition program - Tracking of dietary intake with feedback on progress via graphs - Laughter therapy and deep breathing for stress relief - Neonatal first aid program	Postpartum women with prior GDM diagnosis, aged 20+ Intervention (n=57) Control (n=62)	Outcomes: Weight; body fat (%); fasting glucose level; HbA1C; diabetes knowledge; self-reported dietary habits; parenting stress; health promoting lifestyle behaviors	Women were asked to download and install the mobile VR program on their mobile phone the day before their scheduled delivery date or day after delivery. VR headsets were provided to	1) Prompts self-monitoring behavior 2) Provides feedback on performance 3) Provides instruction 4) Model or demonstrate behavior 5) Stress management	No findings regarding engagement or user experience available.

						women at hospital delivery setting. How to use the equipment was demonstrated to women. VR use from birth for 12 weeks		
Lechner ⁴¹ 2017 Germany Triangle App	Trial registration (Evaluation) Parallel multi-center RCT Intervention: app use Control: one-time written and	App to deliver lifestyle intervention program to reduce risk of T2DM among postpartum women with prior GDM	Not reported	Postpartum women with prior GDM (3-18 months ago) aged 18-50 (n=64)	Primary outcome: Proportion of women reaching 3 or more of the 5 Diabetes Prevention Program lifestyle aims at final study visit (6 months) which are: 150 mins of high intensity	Women commence app use at 3 – 18 months postpartum for 6 months of use	Not reported	N/A

	in-person lifestyle counselling				<p>physical activity per week; 15g fiber; 30% of energy from fat; 10% energy from saturated fat; BMI</p> <p>Achievement of pre-defined nutrition, exercise and body weight</p> <p>Secondary outcomes: BGL from baseline to follow up; change of insulin sensitivity; BMI; $\dot{m}V_{O2}$ peak; body fat mass; psychological wellbeing</p>			
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<p>Lim <i>et al.</i> ⁴² 2021 Singapore nBuddy app</p>	<p>Evaluation Single center, open-label, RCT Intervention: app use Control: standard care (6 week postnatal check with dietary advice and repeat OGTT)</p>	<p>App to support return to healthy weight</p>	<ul style="list-style-type: none"> - Track diet, exercise and visualization of progress related to goals. - Personalized educational information - Real-time interaction with health and lifestyle coaches 	<p>Postpartum women with prior GDM diagnosis (between 24-34 weeks gestation), aged 21+.</p> <p>Intervention (n=101) Control (n=99)</p>	<p>Primary outcome: % of women achieving first trimester weight at 4 months postpartum If previous booking weight $\leq 23 \text{ kg/m}^2$ OR weight loss of at least 5% of first trimester weight in BMI $>23 \text{ kg/m}^2$.</p> <p>Follow up at 6 weeks and 4 months.</p> <p>Secondary outcome: Fasting BGL; HbA1c; mean weight loss; breastfeeding status; blood pressure; grip</p>	<p>App introduced after delivery, at University Hospital. Women asked to download the app and briefed on its use by a research assistant. App used for 4 months</p>	<ol style="list-style-type: none"> 1) Prompt intention formation 2) Provides feedback on performance 3) Prompts self-monitoring 4) Information on health-behavior link 5) Provides instruction 	<p>Findings suggest that engagement with app was maintained at 4 month follow up.</p>
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					strength; waist circumference; caloric and macronutrient intake; self-efficacy; health education; well-being			
Loerup <i>et al.</i> ⁴³ 2013 UK GDmHealth App	Pilot study Feasibility of GDmHealth system in clinical practice including BG control and user satisfaction	See Mackillop <i>et al.</i> 2018	See Mackillop <i>et al.</i> 2018	Pregnant women with GDM Used the system (n=41) Returned questionnaires (n=31)	Outcomes: Usage and satisfaction	See Mackillop <i>et al.</i> 2018	See Mackillop <i>et al.</i> 2018	Results suggest that overall app usage was high.
Mackillop ⁴⁴ 2020 Stay Active App UK	Trial registration Single Centre	App to motivate women to increase activity levels	- Remote motivational interview - Simple interface to provide two-	Pregnant women with GDM diagnosis, using the GDmHealth	Primary outcomes: adherence to wearing accelerometer; acceptability;	Women offered app in hospital setting and will be shown how to use it.	1) Prompt intention formation 2) Prompt-self monitoring of behavior	N/A

	<p>Feasibility study</p> <p>Intervention: app use alone</p>	during pregnancy	<p>way communication with a HCP to provide feedback on agreed goals.</p> <ul style="list-style-type: none"> - Feedback is given via messages received via the app. - Physical activity goals can be reviewed within the app 	<p>app to monitor BGL, aged 18-45, have and use smartphone (n=60)</p>	<p>physical activity (average daily minutes of total physical activity);</p> <p>recruitment rates</p> <p>Secondary: BGL from baseline to birth; physical activity time and intensity; attitude toward app and usefulness of components</p> <p>Maternal outcomes: weight at baseline to birth; need for pharmacological therapy; hypertension; GA at delivery</p>	<p>App used from 24-33 weeks gestation to 36-38 weeks gestation.</p>	<p>3) Provides feedback on performance</p> <p>4) Motivational interviewing</p>	
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					Neonatal outcomes: birthweight; hypoglycemia; hyperbilirubinaemia; ⁿ SCUB admission; shoulder dystocia Health economic outcomes: no. of clinic visits; time spent by clinical midwife delivering intervention			
Mackillop <i>et al.</i> ⁴⁵ 2018 UK GDmHealth App	Evaluation Single center, non-blinded, parallel group RCT	Mobile-phone based system for blood glucose management	- Bluetooth Transfer of BG readings direct to app, with real-time feedback - Meal details can be manually	Pregnant women with GDM diagnosis (via 75g OGTT), aged 18-45 yrs., with singleton pregnancy	Primary: Rate of change in glycaemia (mmol/L ²⁸ days), from recruitment to delivery Secondary: maternal weight, BMI;	Women receiving care at large UK tertiary hospital were loaned a mobile phone with the preinstalled GDmHealth	1) Real-time feedback 2) Prompts self-monitoring 3) Provides instruction	Findings suggest women using the app were satisfied with their care and recorded their BGL using the app.

	Intervention: app use + standard care Control: standard care		<p>attached to BG readings</p> <ul style="list-style-type: none"> - Women can request a call back to discuss concerns with HCP. - HCPs can view BGL readings and meal tags via an online portal 	Intervention (n=103) Control (n=103)	hypertension; preeclampsia; GA at delivery; birthweight; °LGA; birth mode; perineal trauma; shoulder dystocia; birth injury; neonatal hypoglycemia, neonatal hyperbilirubinaemia; NICU admission	app and taught how to record, tag, and review blood glucose readings by a research midwife. App used at <35 weeks gestation to delivery		
Mackillop <i>et al.</i> ⁴⁶ 2014 UK GDmHealth App	Development and usability Co-design followed by beta testing (focus groups) and service	See Mackillop <i>et al.</i> 2018	See Mackillop <i>et al.</i> 2018	Pregnant women with GDM diagnosis, not requiring pharmacological intervention. Beta testing (n=7)	Outcomes: Usability and reliability	See Mackillop <i>et al.</i> 2018	See Mackillop <i>et al.</i> 2018	Findings suggest women used the app and complied with BGL monitoring.

	development (capture of system usage data)			Service development (n=50)				
Miremberg <i>et al.</i> 47 2018 Israel Glucose Buddy App	Evaluation Prospective, Single center RCT Intervention: app use + standard care Control: standard care	Mobile-phone based system for blood glucose management	- Manual upload of BGL measurement - Daily reports of BGL emailed to HCP - Individualized feedback on BGL emailed to women daily - Emails also include positive messaging, dietary tips, modifications to insulin treatment, and appointment scheduling - Interaction with HCP regarding questions about	Pregnant women with GDM (fasting ≥ 95 mg/dL, 1-hour ≥ 180 mg/dL, 2-hour ≥ 155 mg/dL, 3-hour ≥ 140 mg/dL) aged 18-45 years Intervention (n=60) Control (n=60)	Primary: Compliance with BGL monitoring Secondary: mean BGL; need for insulin therapy; % of off target BGL measurements; polyhydramnios; preeclampsia, hypertension; mode of delivery; shoulder dystocia; perineal trauma; birthweight; LGA; NICU	App offered at diabetes in pregnancy clinic at tertiary hospital. All women received a 10 minute demo regarding the use of the app alongside an information leaflet. App used form diagnosis (<34 weeks gestation) to delivery	1) Personalized feedback 2) Prompt to self-manage 3) Provides instruction	Findings suggest compliance with BG monitoring and satisfaction among women using the app.

			GDM management		admission; infant hypoglycemia; phototherapy; respiratory morbidity; neonatal death; composite adverse neonatal outcome			
O'Reilly <i>et al.</i> ⁴⁸ 2019 Australia Health-e mums Program (App with virtual coaching and social media)	Pilot study User-centered - qualitative focus groups	App for T2DM prevention in women with prior GDM	<ul style="list-style-type: none"> - Tracks weight, exercise and dietary intake - Provides T2DM screening results - Personalized push notifications regarding feedback on body weight, diet, and physical 	Postpartum women with prior GDM (n=26)	Feedback on functionality and user experience	N/A	<ol style="list-style-type: none"> 1) Prompts self-monitoring behavior 2) Provides feedback on performance 3) Provides opportunities for social comparison 	Facilitators for perceived app use included the app being a reliable and credible source of information that was conveniently accessible. The connection with Facebook was seen as a positive way to

			<p>activity progress</p> <ul style="list-style-type: none"> - Virtual health coach guides through seven educational modules 				<p>4) Prompts practice</p> <p>5) Prompt intention formation</p> <p>6) Information on health-behavior link</p> <p>7) Provides instruction</p>	<p>connect with other postpartum women. Barriers to perceived app use included the usefulness of video segments and applying milestones related to diabetes prevention guidelines.</p>
<p>Pais <i>et al.</i> 49 2017 New Zealand My Meal Mate (App) Glucose Buddy (App) On Track (App) Doctor Diet (App) HealthVault (App)</p>	<p>Pilot study Qualitative interviews / focus groups</p>	<p>Five commercially available health and wellness apps to aid self-management</p>	<p>Apps had a mixture of functionalities including food diaries, exercise tracking, glucose monitoring and ability to export data to clinicians.</p>	<p>Pregnant women with GDM diagnosis (n=5)</p>	<p>Outcomes: Perceived usefulness and perceived ease of use</p>	<p>N/A</p>	<p>1) Prompts self-monitoring behavior</p>	<p>Findings suggest women perceived the ecosystem of apps to be useful. Facilitators for use included sharing data with clinicians</p>

								and control over access of data.
Poulter ⁵⁰ 2019 Australia Net Health (App)	Trial registration (Pilot) Non-randomized trial Intervention: app use Control: historical control using standard care	App to support self-management of blood glucose levels	<ul style="list-style-type: none"> - Automatic upload of BGLs in real time to a secure server for review remotely by clinicians. - Automatically generates email alert to clinicians if BGLs are out of target range. - Allows messaging from HCPs to women via the app for dose titration where required. 	Pregnant women with GDM diagnosis, aged 18-45, singleton pregnancy, has and uses smartphone Intervention (n=100) Control (n=100)	Primary outcome; Feasibility (clinic workload); acceptability and patient satisfaction; usage of the system Secondary outcomes: mean weekly BGL; composite neonatal outcomes.	App introduced at diabetes services clinics. The app contains some instructions about its use and women will have direct contact details for the diabetes educators to obtain support. App used from 24-30 weeks gestation to delivery	<ol style="list-style-type: none"> 1) Prompts self-monitoring behavior 2) Provides feedback on performance 3) Provides instruction 	N/A

Pustozarov <i>et al.</i> ⁵¹ 2017 Russia Unnamed App	Pilot study App usage data and post study survey	Mobile system for personalized blood glucose prediction	<ul style="list-style-type: none"> - BGL readings automatically uploaded via continuous glucose monitoring system - Logging of dietary intake - In-built algorithm provides personalized advice regarding upcoming meals based on BGL. 	Pregnant women with GDM (n=138)	System usage and patient satisfaction	N/A	<p>1) Provides feedback on performance</p> <p>2) Prompts self-monitoring behavior</p>	<p>Findings suggest usage of the app among women .Facilitators to using the app were convenience and helpful information. Barriers to usage included lack of food items in the food database when logging meals.</p>
Rawal and Peters ⁵² 2019 Nepal mGDM (App)	Trial registration User-centered design + Parallel	App for increasing knowledge and self-efficacy to adhere to healthy	<ul style="list-style-type: none"> - Health education - Identification and setting of health goals <p>Facilitates support from family members</p>	Pregnant women with GDM diagnosis aged 18+ (n=60)	Primary outcomes: maternal BGL at 6 weeks postpartum; birth weight; mode of delivery; app	App introduced to women at sub-urban tertiary level university hospital. App will be set up	<p>Social cognitive theory</p> <p>1) Prompt intention formation</p>	N/A

	open label RCT Intervention: app use + standard care Control: standard care	lifestyle behaviors			usage; adherence to BGL monitoring; usability; acceptability	for women on their smartphone. App used from 28 weeks gestation to delivery – maximum of 16 weeks	2) Provide opportunities for social comparison 3) Provide information about behavior health link	
Rigla <i>et al.</i> ⁵³ 2017 Spain MobiGuide App	Pilot study Survey and Observational prospective study Intervention: app use Control: historical control of standard care users	AI augmented mobile system for GDM self-management	- Automatic upload of BGL - Messaging system with HCPs to provide personalized advice regarding meals and BGL - Embedded accelerometer to track physical activity	Pregnant women with GDM diagnosed aged 18+ Intervention (n=20) Control (n=247)	Outcomes: Compliance with BGL monitoring; satisfaction; blood pressure; need for insulin therapy; BGL; GA delivery; Mode of delivery; birth weight; LGA	App introduced to women at hospital setting. App used from diagnosis (34 weeks gestation) to delivery	1) Prompts self-monitoring behavior 2) Provides feedback on performance	Findings suggest the system to be feasible and acceptable among women who were compliant with BGL monitoring when using the app.

<p>Seely <i>et al.</i> ⁵⁴ 2020 USA Hola Bebe, Adios Diabetes! App</p>	<p>Pilot study Development, feasibility and preliminary effectiveness Intervention: app use alone</p>	<p>App to reduce risk factors associated with T2DM progression among Hispanic women</p>	<ul style="list-style-type: none"> - Six audio-visual educational modules on healthy eating and physical activity - personal action plans for healthy eating and staying active - Educational and motivational messages targeting self-efficacy - weight tracking - recipes - tiered badges to reward achievements 	<p>Postpartum women with GDM diagnosis in past 5 years, aged 18-45. Acceptability (n=11) Usability (n=4) Pilot (n=21)</p>	<p>Outcomes: Acceptability and usability</p>	<p>A research assistant helped women to download the app and review the 'how-to section'. Women were asked to complete one module, corresponding action plan, weigh themselves and enter this into the app at app introduction. App used for 8 weeks</p>	<p>Social cognitive theory 1) Provide contingent rewards 2) Provide information about behavior-health link 3) Provide instruction 4) Prompt-self monitoring of behavior 5) Prompt specific goal setting 6) Prompt intention formation</p>	<p>Findings suggest the app to be acceptable and usable for women. Facilitators included features such as audio-visual modules, badges, weight-tracking graphics and recipe features most useful. Findings from app data suggest good levels of engagement with the app over 8 weeks of use.</p>
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Skar <i>et al.</i> ⁵⁵ 2018 Singapore Pregnant+ (App)	Evaluation (qualitative) Qualitative process evaluation (nested in RCT Borgen et al. 2019)	See Borgen et al. 2019	See Borgen et al. 2019	Pregnant women with GDM diagnosis who had been allocated to the intervention arm of the RCT (n=17)	Outcomes: Understand women's experiences of using the Pregnant+ app	See Borgen et al. 2019	See Borgen et al. 2019	Barriers to usage included technological difficulties, feelings of obsession around BGL monitoring and frustration at differences in information between the app and HCPs. Findings overall suggest mixed levels of engagement with the app.
Sung <i>et al.</i> ⁵⁶ 2019 Korea Unnamed App	Pilot study Pilot, single center RCT	Mobile system to support GDM self- manageme nt	- Automatic upload of BGL readings - BGL data transmitted to clinical team	Pregnant women with GDM diagnosis with	Obstetric outcomes: GA at delivery; LGA; C-section rate	App introduced to women at hospital setting and were trained	1) Prompts self- monitoring behavior 2) Provides feedback	No findings regarding engagement or user experience available.

	Intervention; mHealth use + standard care Control: standard care		<p>who provide feedback via app 2x per week</p> <ul style="list-style-type: none"> - Recoding of dietary intake - Interaction with HCP who send tailored medical and nutritional guidance via in-app messages. 	<p>singleton pregnancy</p> <p>Intervention (n=11)</p> <p>Control (n=10)</p>	<p>Maternal outcomes: BMI; weight; % of body fat; OGGT result at 5-12 weeks postpartum</p>	<p>on how to use the device on assignment. App used from 24-28 weeks gestation until delivery</p>	<p>on performance</p> <p>3) Provides instruction</p>	
<p>Varnfield <i>et al.</i> 57 2020 Australia MOTHer App</p>	<p>Pilot study</p> <p>Feasibility, satisfaction and preliminary effectiveness</p> <p>Intervention: app use alone</p>	<p>App for remote management of blood glucose levels</p>	<ul style="list-style-type: none"> - Manual upload of BGL readings - BGL readings viewed by HCP via online portal <p>Interventions are tailored based on BGL data</p>	<p>Pregnant women with GDM diagnosis aged 16+.</p> <p>(n=40)</p>	<p>Primary outcome: Usage (number and frequency of BGL readings uploaded); user satisfaction.</p> <p>Secondary outcomes: comparison</p>	<p>App introduced to women after referral from GP to antenatal care maternity services. App used from 24-28 weeks</p>	<p>1) Prompts self-monitoring behavior</p> <p>2) Provides feedback on performance</p>	<p>Findings indicate satisfaction with the app.</p> <p>Facilitators to app use included easy access and convenience.</p> <p>Barriers included technological</p>

					with historical data regarding: no. of clinical reviews; frequency of antenatal contact; need for pharmacologic al treatment; service usage.	gestation to delivery		issues with connectivity.
Wickramasingh <i>et al.</i> ⁵⁸ 2019 Australia DiaMOnd App	Evaluation 2x2 un- blinded, single center, cross-over trial Interventio n: App + standard care Control: standard care	Mobile- based system for blood glucose self- manageme nt and monitoring	- Manual upload of BGL reading - BGL readings sent to HCP who provide real-time feedback and recommenda tions for diet, exercise and insulin titration - System keeps a log of diet, physical	Pregnant women with GDM Diagnosis (n=10)	Outcomes: proof of concept; usability; fidelity measured by: patient compliance; patient satisfaction; level of glycemic control achieved; health	4 weeks	1) Real-time feedback 2) Prompts self- monitoring behavior 3) Provides instruction	Findings suggest women were satisfied with the app. Motivation for using the app was focused on doing the best for their baby. Facilitators for use included the inclusion of a food diary,

			activity and insulin use for future review		professional satisfaction			recommendations for exercise and voice recognition to avoid data entry burden. Facilitators also included receiving support to use the app by HCPs.
Yew <i>et al.</i> ⁵⁹ 2020 Singapore Habits GDM App	Evaluation Parallel, open label, single center RCT Intervention: app use + standard care	App to promote behavior change during pregnancy for a healthy lifestyle	<ul style="list-style-type: none"> - Tracks diet and physical activity - Provides lifestyle coaching via in app messaging - Interactive lessons to support patient education 	Pregnant women with GDM diagnosis (WHO 2013 criteria) aged 21+, had smartphone, Intervention: (n=170) Control: (n=170)	Primary outcome: Proportion of women with excessive gestational weight gain; Secondary outcomes: adherence to BG monitoring; BG control; no off target BG measurements;	App introduced at national university hospital and used from 12-30 week's gestation diagnosis.	<ol style="list-style-type: none"> 1) Prompts self-monitoring behavior 2) Provide feedback on performance 3) Information on health-behavior link 	No findings regarding engagement or user experience available.

	Control: standard care alone				requirement of pharmacologic therapy; Maternal outcomes: hypertension; preeclampsia delivery and neonatal outcomes		4) Provides instruction	
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^aRCT – randomized control trial

^bGDM – gestational diabetes

^cOGTT – oral glucose tolerance test

^dBGL – blood glucose level

^eNICU – neonatal intensive care unit

^fHCP – health care professional

^gT2DM – type 2 diabetes mellitus

^hBMI – body mass index

^jHbA1C - glycated hemoglobin

^kGA – gestational age

^lVR – virtual reality

^mV02 – oxygen uptake

ⁿSCUB – special care baby unit


^oLGA - large for gestational age

Appendix D: Study 2b questionnaire, advert and presentation

Study advert women

Using mHealth for managing and preventing gestational diabetes.

GDmHealth
Gestational Diabetes
Mobile Health Study




Have you got experience of living with gestational diabetes?

We would love for you to join us for an interactive discussion exploring how technology could be used to help manage and importantly prevent, gestational diabetes.

During this webinar, we will explore the latest developments in using technology for caring for women and hear insights from healthcare professionals. There will also be an opportunity for you to give your feedback and opinion.


Join the conversation:
Free Webinar, 30th April 7-8pm BST
Register at <https://bit.ly/2SMWYDG>



Study advert HCP

Using mHealth for managing and preventing gestational diabetes.

GDmHealth
Gestational Diabetes
Mobile Health Study



Have you got experience of caring for women experiencing gestational diabetes?

During this webinar, we will explore developments in using technology for caring for women with GDM and hear insights from other healthcare professionals.

If you work in health and social care, or are studying in this area, and have particular interest in gestational diabetes, we would love for you to join us! There will also be an opportunity for you to give your feedback and opinion.

Join the conversation:
Free Webinar, 30th April 7-8pm BST
Register at <https://bit.ly/2SMWYDG>



Questionnaire

1. Which of these options best describes your current situation?
 - Healthcare Professional
 - Person with experience of GDM
 - Other

2. Which of the following options best describes you?
 - Midwife
 - Health Visitor
 - GP
 - Diabetes specialist (in secondary care)
 - Other healthcare professional
 - Not applicable

3. Which of the following options best describes you?
 - I am currently pregnant and have received a diagnosis of GDM
 - I am currently pregnant without a diagnosis of GDM, but have been diagnosed with GDM in a previous pregnancy
 - I am not currently pregnant, but I have previously received a diagnosis of GDM in the last 12 months
 - I am not currently pregnant, but I have previously received a diagnosis of GDM more than 12 months ago
 - Not Applicable

4. Where do you currently live?
 - Cornwall,
 - Elsewhere in the South West,
 - Elsewhere in the UK,
 - Elsewhere in the World

5. Have you ever used, currently use, or as a HCP recommend the use of, an app or website to (please tick all that apply)
 - Help prevent diabetes in pregnancy
 - Help manage blood sugars during pregnancy
 - Support a healthy lifestyle during pregnancy
 - Support a healthy lifestyle after birth
 - None of the above

6. Which of the following would you be most likely to use, or as a HCP recommend using, to help you live a healthy lifestyle after having a baby? (Please tick one option)
 - An app accessible on a smartphone
 - A website accessible on a smartphone
 - Both apps and websites accessible on a smartphone

- None of the above
7. What are your main concerns about using or recommending the use of an app or website to help support living a healthy lifestyle after experiencing GDM? (please tick all that are appropriate)
- Lack of access to smartphone with internet connection
 - It takes too much time to use
 - It is too expensive to use
 - Too complicated/difficult to use
8. What are your main concerns about using or recommending the use of an app or website to help support living a healthy lifestyle after experiencing GDM? (please tick all that are appropriate)
- Concerns that an app or website won't lead to any benefits
 - Concerns that the app or website may stop working properly
 - Lack of knowledge about which apps and websites are available
 - Lack of credibility or recommendation
9. When thinking about using an app to help support you (or your patients) to live a healthy lifestyle after pregnancy, what is the most important feature for that app to include? (Please tick one option)
- Information about how to maintain a healthy lifestyle (via video or written)
 - Calorie counting
 - Step or activity tracking
 - Gamification – rewards and competition
 - Peer support – chat room or other ability to talk to others
10. When thinking about using an app to help support you (or your patients) to live a healthy lifestyle after pregnancy, what is the most important feature for that app to include? (Please tick one option)
- Information about how to maintain a healthy lifestyle (via video or written)
 - Calorie counting
 - Step or activity tracking
 - Gamification – rewards and competition
 - Peer support – chat room or other ability to talk to others
11. If you are a healthcare professional - Where do you think mHealth for postpartum support is best implemented?
- If you are a woman with experience of GDM, where would you most like to hear about or receive information about apps or websites to help support you live a healthy lifestyle after the birth of your baby? (Please tick one option)
- Secondary Care – (i.e. hospital, diabetes centre, etc.)

- Primary Care – (GP staff)
- Community Care – (Health Visitors and community midwives)
- Other

Consent

The questions you have answered during this webinar will help us to further understand how mHealth can be used within GDM care. We would like to use this data for some further anonymous analysis as part of a PhD project. You do not have to have your data used for this purpose and your participation is entirely voluntary.

Please answer the following question:

12. I consent for my answers given in this survey to be analysed anonymously for research purposes
- No, I would like my data to be deleted from analysis
 - Yes, I would like my data to be analysed anonymously for research purposes

An EPIC webinar: Using mHealth for managing and preventing gestational diabetes



Katie Edwards – Research Assistant



mHealth and GDM care

- 95% used the internet for pregnancy information
- 76% had a smartphone
- 59% of smartphone owners had used a pregnancy smartphone app

(O'Higgins et al. 2014)



Blood Glucose monitoring



GDm-Health

Categories: [Diabetes](#), [Pregnancy and baby](#)

Free

The GDm-Health app is part of a system that helps clinicians manage diabetes in pregnancy.

The system comprises a patient app that can receive readings wirelessly from a blood glucose monitor, and a web-app dashboard for use by medical professionals.

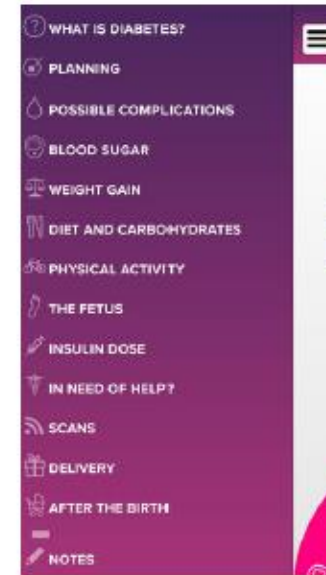
Using the web-app dashboard, clinicians can view your blood glucose readings in real-time and proactively manage your condition.

<https://www.nhs.uk/apps-library/gdm-health/>

<https://www.sensynehealth.com/gdm>

Pregnant with diabetes app

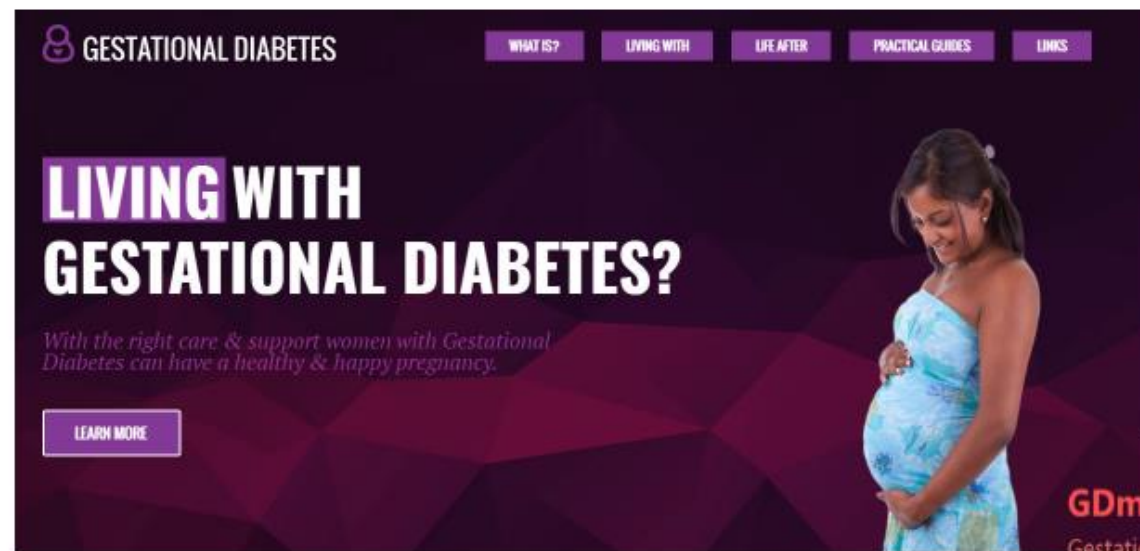
GDMHealth
Gestational Diabetes
Mobile Health Study



https://play.google.com/store/apps/details?id=com.heyworld.pregnantwithdiabetes&hl=en_GB

Women with Gestational Diabetes Website

- <http://www.womenwithgestationaldiabetes.com/>



The screenshot shows the homepage of the website. At the top left, there is a logo of a person with a plus sign and the text "GESTATIONAL DIABETES". To the right of this are five navigation buttons: "WHAT IS?", "LIVING WITH", "LIFE AFTER", "PRACTICAL GUIDES", and "LINKS". The main heading is "LIVING WITH GESTATIONAL DIABETES?" in large, bold, white letters. Below this is a sub-heading in italics: "With the right care & support women with Gestational Diabetes can have a healthy & happy pregnancy." A purple button labeled "LEARN MORE" is positioned below the sub-heading. On the right side of the page, there is a photograph of a pregnant woman in a blue patterned dress, smiling and holding her belly. The background of the page is dark purple with a geometric pattern.



GDmHealth
Gestational Diabetes
Mobile Health Study



Why is postpartum care important?

- Lifetime risk of chronic diseases (T2DM, Heart Disease, Hypertension, metabolic syndrome) (Kaaja & Rönnemaa, 2008)
- GDM recurs in 30-69% of subsequent pregnancies, following a pregnancy complicated by GDM (Major et al., 1998)



 UNIVERSITY OF
PLYMOUTH



The research question

Following a pregnancy complicated by Gestational Diabetes Mellitus (GDM): Is use of mobile health apps an acceptable and desired way of supporting women to make healthy lifestyle behaviour changes in order to prevent future health problems



What apps and websites are out there already?



Online Peer support

mumsnet
by parents for parents

Active discussions 

My Mumsnet 

Talk ▾ Conception ▾ Pregnancy ▾ Parenting ▾ Life & style ▾ Jobs ▾ Reviews ▾ Shopping ▾ 

Talk 

Advanced search

Active | I'm on | I'm watching | I started | Last 15 minutes | Last hour | Last Day

Talk » Pregnancy



Want week-by-week pregnancy updates in your inbox? We've got you covered – start by letting us know your due date

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[Add a message](#)

This is page 1 of 1 (This thread has 4 messages.)

Get updates on how your baby develops, your body changes, and what you can expect during each week of your

 Trending Talk

Husband said he would do housework...

To be disgusted by this?!

Am I alone in hating this trend?

Wife won't make stepdaughter get a...

To think that people on holiday don...

 Refresh

 Topics

 Active

 I'm On



GDMHealth
Gestational Diabetes
Mobile Health Study



Online communities



FIT and FITZ

- Functional Imagery Training (FIT) (Andrade, Khalil, Dickson, May, & Kavanagh, 2016), translates concepts of Elaborated Intrusion Theory (EI) (Kavanagh, Andrade, & May, 2005) into a manualised intervention based on Motivational Interviewing
- Motivation is maintained by training individuals to practise imagery of goal-related behaviours routinely.
- This imagery practice should become a cognitive habit, but until then therapy sessions and a mobile app (FITZ) can help individuals stay on track.



Implementation



Consent

The questions you have answered during this webinar will help us to further understand how mHealth can be used within GDM care. We would like to use this data for some further anonymous analysis as part of a PhD project. You do not have to have your data used for this purpose and your participation is entirely voluntary.

Please answer the following question:



Thank you

- Professor Jill Shawe
- Professor Ray Jones
- Professor Jackie Andrade

- Dr Deb Shenton
- Wendy Preen
- Helen Probert



Appendix E: Example evidence table with examples from study 3a

Initial Theme	Initial Codes	Evidence
Research Question Specifics	Timing of Support	<p>P9: I sort of feel like it should start probably around, coz you go for your 6 week check, when really kind of any outstanding issues should have a plan of what to do about them, whether that be you need physio or you've got issues with stitches or anything and I feel like kind of GD should one of the things that then sets you on a path from there, you know not necessarily you have to change your life in week 6, but, that's normally the time when people are starting to go, I'm starting to feel okay, I might start trying to do a bit more exercise, coming slightly out of the urm, shock of new baby, so I think that should be the start of it, around then, but then it should, I don't think it should be give people a leaflet and then (P9)</p> <p>P8: I think in my head, I had it at my post-natal check so what's that, sort of 6-8 weeks because I think that like when you've had that 6-8 weeks to do what you want, to eat what you want, now it's time to sort of start being sensible again</p> <p>P10: potentially after the first trimester and everything's sort of calmed down with the new baby and you know what you're doing and you can get yourself in and out of the house, without too much trouble, that's probably a good time to head to something like that, its probably the time where you're most confident to do something. Because you think you've got everything and then the baby stops sleeping, or you know, something else happens, yeah I think after the third month everything just go so much easier, because you kind of know you're baby's routine and if you need to you could leave the baby with someone and go to something and just focus on yourself as well.</p>
	Previous App Usage	<p>"I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system" (P9)</p> <p>Urm I've, I mean I use a fitbit to kind of, attempt to have slightly more active days, and we've actually got health insurance linked to it, urm, life insurance, which you know, is kind of a slight extra motivator but it doesn't find you extra time in the day so, and then I have dabbled in recording stuff in myfitnesspal and fitbit like calorie wise before, but I've never managed to do it for a long period, but because of the</p>

		<p>amount of commitment you have to put into it, to get it exact, so I find it fairly easy to record generally what I eat, the bit I find difficult is you have to know whether you've eaten 400 grams or 450 grams (P9)</p> <p>K: have you used anything like that before? P8: Yeah I've used myfitnesspal, I probably had a go at every other one going if I'm honest,</p> <p>K: Yeah, and was there anything else while you were pregnant, either time, the first or second time, were there any other apps or websites that you used to either get information or to get support with anything? P6: Not really, not in terms of the diabetes no it was just that, I mean I looked on the NHS website but their information is very limited urm on there</p> <p>P10: So I had my fitbit. And also my general health monitor thing on my phone that would count steps or any exercise that I was doing, but apart from that nothing else.</p>
mHealth Access	Access during Pregnancy (K)	<p>I would use it mostly on my phone, I've got the Facebook app on my phone (P2)</p> <p>Via my phone, I always use my phone to go on them. Well you've always got your phone haven't you, so it's the easiest way to do stuff (P3)</p> <p>It [the app] was only on my phone, I don't really have, I think I have an Amazon Fire tablet but it wouldn't support it I don't think (P4)</p> <p>Mainly my phone, mainly because we, our laptops are old, our computers getting old. Its just kind of handy to have it in your hand (P4)</p> <p>Mainly the laptop for the actual website and the phone for Facebook. I think she's done quite a lot of work on the website but back in 2017 it was still a bit clunky so it was better on the laptop (P7)</p>
	Facebook Mobile Access (H)	<p>K: For sure, so when you were part of the group, would you normally look at the facebook group on your phone or a laptop P9: Urm phone normally, but I have a kindle tablet as well, that I look at facebook on sometimes like when I'm going to bed, depends</p>

		<p>K: And what about the website, would you have looked at that on your phone or was that on a laptop</p> <p>P9: I did look at the website but not so much, once I'd, I didn't follow lots of specific recipes I just followed the principals if you see what I mean, so I didn't need to look at lots of detailed stuff on the website, so I would read bits on it, and things, on my phone, or on a laptop, but I probably wasn't looking at the website daily</p> <p>K: Okay, fab, and when you were using that, did you mainly use it on a laptop, or a phone?</p> <p>P8: On my phone yeah</p> <p>K: Okay fabulous and did you just use it kind of through the Facebook app</p> <p>P8: Yeah</p> <p>R: Fab, and when you were using those two things did you mainly access it through a phone or a laptop or?</p> <p>P10: I think I used everything going because when you're out and about at work or if you're out having dinner and you just don't know what the best option would be to eat, it's just handy to search on your phone or on the iPad. I also went on holiday, I had Easter to contend with as well so, it was a bit of a tricky time to get the diagnosis.</p>
Trust	Lack of Trust in mhealth (K)	I looked at other websites, a lot of them are American, they don't necessarily have the same, I don't know how to word this but, like the same kind of ethics (P1)
	Concerns around mhealth usage (K)	<p>it kind of scares me that people make these apps and websites and there no background and they're making claims and that does kind of scare me (P2)</p> <p>I just get kind of annoyed with the privacy sort of stuff but that's just everything really, isn't it? Like online. I just sort of think like they always want all your information, it's a bit annoying coz you just think like well, everyone's going to have that now. But yeah, that's the only thing really (P3)</p>
	Concerns – reliable information (K)	it kind of scares me that people make these apps and websites and there no background and they're making claims and that does kind of scare me (P2)

Concern – Boredom, no benefit (K)	my fitness pal actually it was just annoying because it was loads of input and you didn't seem to get much out of it, you put in all your food and activity and stuff and I dunno, it was just a bit pointless. I dunno what I'd want it to do exactly but your inputting all this data and it doesn't even go, hey well done, or anything. It's just all this information and you're just monitoring what you're eating. I dunno I just sort of got bored of it. It was just like having a folder of stuff (P3)
Concerns - Privacy	<p>I just get kind of annoyed with the privacy sort of stuff but that's just everything really, isn't it? Like online. I just sort of think like they always want all your information, it's a bit annoying coz you just think like well, everyone's going to have that now. But yeah, that's the only thing really (P3)</p> <p>in theory the privacy side of it, but in practice you just go ahead and just download something and say yes, yes, yes, but I know that period tracking apps then sell your data on and then target you for buying things at certain times of the month when you're slightly more vulnerable. That would worry me in theory, but probably in practice, I'd just go ahead and download it and not think it through. But I do think it's important. (P7)</p>
Trust of Info on Facebook (K)	<p>and I think that the point is, that Jo isn't medically trained, shes just had 3,4,5 GD pregnancies but shes fought so hard, for other people to be made aware, that it kind of makes you think well, actually she really cares (P1)</p> <p>So I tended to kind of stick towards, because, there was no, on Jo's page there was no kind of like, they didn't bully anyone to say you cant eat cake, but it wasn't like advocated, so if somebody did, they'd say have a look at this page and see what sugars can do to a child, um not scarmongering but, just being truthful and honest. Um, and just not as much cattiness (laughs), (P1)</p> <p>So the main person, the person who founded it is a mum but she seems to have dedicated like years of her own time into research and things that work, you know she's created recipes that, you know they just blow my mind those recipes (P2)</p> <p>I 100 percent trusted it, because it was coming from people who had experience (P2)</p> <p>they don't tolerate people putting up comments about being able to eat a domino's pizza or whatever you know, they're very much by the book and stick to the diet so, I don't know but it works for me so I'm happy to stick with what they're saying, you know? (P2)</p> <p>And it's very well monitored that group...there's no...if anyone asks anything medical, there is its straight away flagged up you know and they say, 'well you have to talk to your team'. And you know you get support, on an emotional level, a practical level like have you tried this phone number or things like</p>

		<p>that but otherwise you know, it's not a dangerous group. You get, uh, like I went to see the American Facebook group for gestational diabetes and it was a car crash it was scary! (P4)</p> <p>so I posted something and within one hour Jo had replied to me and given me lots of support and advice about food, which worked as well, it's not just... and I read some posts as well and it was always a very kind way of talking to people, very understanding so, I also participate, I'm in the post GD group, so I try to keep that in mind (P4)</p> <p>I don't know how to explain but I try to be considerate, because on Facebook or online there's a real problem with trolling and people being judgemental so. (P4)</p> <p>I think its because you know the person who's kind of developed it has had it before that they know what they're doing. And I think the things that are talked about in the group, just make you feel like they know what they're talking about. (P5)</p> <p>I think it's because it had the research and it had the articles, it just seemed to be very evidence based and I could trust it (P7)</p>
	Facebook Page Monitoring (K)	<p>Um yeah so I mean, theres admins on Jo's page, um so theres quite a few admins, theyre there to kind of, take, so you like listen to other mums advice, but admin will step in if they're giving wrong things, like wrong advice (P1)</p> <p>you could ask and the moderators would answer and say no its fine. You know, so it was just a constant feeling of support, I even messaged them when I was in induction at like 2 o'clock in the morning (P2)</p> <p>And I mean its super well monitored you can't be going round posting picture of chocolate cake, the monitors are always there to say if someone's giving bad advice, and not in a nasty way but in a way that's like 'oh I think you may have got your facts wrong there, its actually this' (P5)</p>
	Trust of Information (K)	<p>The admins come in and step in be like actually no, actually any spike in sugar is gunn increase the babies sugars, which is going to make things harder when they come out. So, yes, other mums advice was valuable, but I would always fall back on the admins advice. (P1)</p>

		<p>I mean I suppose, if its endorsed by any organisations or anything like Diabetes UK or something like if they said it was good then you'd probably think oh well that's going to be alright then. I don't know what it is, you sort of just feel your way with that sort of stuff don't you? (P3)</p>
	Trust (H)	<p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>K; Hm and did you come across any other facebook groups at that time</p> <p>P9: Urm no but then I probably wouldn't have looked for any, I think I came across the GD one through the website, I don't, I would have had less faith in just a facebook group</p> <p>K: Yeah</p> <p>P9: That didn't have anything behind it</p> <p>P9: No, no and I think that's the thing with the UK Gestational Diabetes one is that, there's a real person behind it with some experience and a passion for what she's doing, who I think makes sure, you know along with others I'm sure, makes sure that the group stays on track and doesn't stray into just random people giving random advice, which I suspect you probably get a lot on most other facebook groups unless you monitor them very carefully</p> <p>P9: Yeah, yeah I'm probably quite, low level of concern over people having my data, and, if it makes my life easier then I'm happy with it, I'm not concerned about sending my blood sugar levels via an app, it doesn't worry me at all because I'm not worried about anyone having those (laughs)</p> <p>K: (Laughs)</p> <p>P9: I know some people would be, eventually, but I would always go for the there's got to be a more efficient way of doing this option rather than secrecy</p>

		<p>Okay, interesting, I'm intrigued as well because quite often women say they find the group and then they join, what was it that made you feel like you could trust the information that was on there, if you did trust it that is?</p> <p>P8: Yeah I think, well, I kind of take it with a pinch of salt, but, I think because the lady that started the group, she's had 3 previous pregnancies with GD, and I think all the people, at the time, I don't know if they still moderate the group or if they're different groups, she's got like sort of splinter groups off of it, but at the time one of them, they stopped moderating because they just couldn't cope with it, but at the time all the moderators they'd also had GD and they were quite sort of this is the advice you need to follow this and ask this, and I guess it was a majority thing as well really, if there's sort of a hundred women all saying this one thing, from their experience, then maybe there's something in it</p> <p>P8: Yeah I think I mean yeah probably the accuracy, you don't always know who's come up with this information or where they've got it from urm, and, yeah probably who's got my details as well and who's sending me stuff although probably email it doesn't bother me as much, if I have to put my phone number in or something like that I'm probably going to be more bothered than if I put my email address in,</p>
	Facebook Real Person Admin (H)	<p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think</p> <p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>P9: Urm no but then I probably wouldn't have looked for any, I think I came across the GD one through the website, I don't, I would have had less faith in just a facebook group</p>

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	Number of People Creates Trust (H)	<p>and the number of people involved, a real person behind the website seeming to kind of you know (P9)</p> <p>P8: Yeah I think, well, I kind of take it with a pinch of salt, but, I think because the lady that started the group, she's had 3 previous pregnancies with GD, and I think all the people, at the time, I don't know if they still moderate the group or if they're different groups, she's got like sort of splinter groups off of it, but at the time one of them, they stopped moderating because they just couldn't cope with it, but at the time all the moderators they'd also had GD and they were quite sort of this is the advice you need to follow this and ask this, and I guess it was a majority thing as well really, if there's sort of a hundred women all saying this one thing, from their experience, then maybe there's something in it</p>
Information Source	Conflict Related to Diet Information (K)	slimming world massively contradicts the GD way. (P1)
	Formal Information vs Facebook Info (K)	<p>and I met with the dietician again, the same lady and she was a bit like, I said to her about the Facebook group and everything, and she said "well I just say everything in moderation I think, so you don't need to be totally strict," so I don't know if maybe the NHS here it fully in support of it [the Facebook group] (P2)</p> <p>so someone commented on something last week, about how they went to their first appointment and how they were told not to google anything and they specifically mentioned that Facebook group and not to go on it and not to trust Dr google. So it's just such a different picture in different places (P7)</p>
	Confusion around Diet (K)	I cut out like sweet stuff, that kind of stuff. But, I wasn't aware, because obviously my dad was diagnosed many moons ago, that carbs have such an impact on the sugars. (P1)
	Facebook valued over HCPs (H)	<p>P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective</p> <p>K: Yeah</p> <p>P9: So I followed more closely a website that I'd found which was UK Gestational Diabetes</p> <p>K: Yeah yeah</p> <p>P9: And they have a, they have a Facebook group, so I ate less carbs stuff than the hospital would have told me, because they were still recommending having things like cereal for breakfast which just would have sent me way higher, so, I kind of, I did have the advice but I didn't really follow it very much what they said, so after, following the diet I kind of came up with I guess from reading then my after food</p>

		<p>levels were always fine, I struggled a bit with fasting levels first thing in the morning which is why they increased my metformin</p> <p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think</p> <p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>P8: Yeah, ideas for food, because I was just getting to the point I was like sick of eating cheese and nuts and greek yoghurt (laughs) and it just gets, you want something quick, or sort of dinner and you think cor I'm sick of eating the same thing and then people, and that's where I kind of learnt, people were saying, I couldn't eat cereal for breakfast then I couldn't eat toast for breakfast, but then I learnt from that group that if I ate cheese on toast, a lot of cheese on toast, then I could eat toast, or cheese and crackers, I could eat a couple of crackers and get away with it, and like, the really dark chocolate and stuff, so I took a lot of that away, learning how to put stuff together really, and when to worry and when to not about my sugar levels and what I needed to watch out for, yeah</p>
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		<p>P8: Yeah, it's really good, there is a lot, I learnt a lot as well about the complications and how the hospital can limit your choices about your birth and monitoring and stuff so I kinda knew what to expect, what might happen, because I didn't expect to have a caesarean until I come on this group and thought okay well it might be a possibility because I know my babies big and I've got this polyhydro urm, so it's, it's potentially an option but</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>spoke to my midwife, she was awful, and basically told me it was impossible to get it this early, and I knew it wasn't, I'm on the GD facebook page so I know there's a lot of people who do, (P6)</p> <p>P6: Yeah and to be honest there's a lot, because of that facebook page, and the website and everything, that I knew a lot more, because if I didn't I would have just taken her word for it</p> <p>they couldn't understand why I couldn't tolerate porridge and things like that, and the only bread I could tolerate was protein rolls from Lidl, but they didn't even know what they were and it was only because of the facebook page that I found them (P6)</p> <p>I think I was a bit more naïve the first time round, because I asked my midwife about cholostrum? Harvesting and she was like no no you won't need that, your body with automatically know what to do but I ended up with an emergency c-section and it took ages to phone me up to come in and I very nearly gave up on breastfeeding it was only because I knew it lowered his risk of diabetes that I really stuck at it and I fed him for two years in the end (P6)</p> <p>K: And there was, so you actually found that website, the facebook group yourself, it wasn't recommended to you,</p> <p>P6: No it was recommended through this mums, this other mums group I was on, another lady who was having a baby on the page recommended it</p> <p>K: Yeah but it wasn't a midwife or a dietician or</p> <p>P6: No no</p>
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		<p>K: Yeah, and was there anything else while you were pregnant, either time, the first or second time, were there any other apps or websites that you used to either get information or to get support with anything?</p> <p>P6: Not really, not in terms of the diabetes no it was just that, I mean I looked on the NHS website but their information is very limited urm on there</p> <p>P6: I know, I know, some of the things that I was told to eat was just I remember I had (ketos?) in my urine and they said well what are you eating and what did you eat last night and I was like well I had pasta and I had 20 pieces of pasta because I used to count it out because it's easier and she was just like ah oh it's not that then because you know they thought that I wasn't eating enough carbs, there was very little about the carbs it was very much just about this plate and make sure you've got an equal amount of everything, it was only the facebook group that told me about the pairing and everything which seems to really work for me</p> <p>P6: Well my friends daughter is diabetic and she uses them so she had a spare scanner so all I had to do was buy the actual like plug into my arm bit, so I used them a couple of times, which was so useful just for knowing what I could and couldn't tolerate because the NHS is very much about not testing, don't test, after an hour, somethings I'd have a curry for example, I wouldn't have any rice or anything like that just chicken korma urm, I'd be fine after an hour but then I'd reach a certain level in my pregnancy and an hour and a half, 2 hours, I'd start going over, just testing at an hour I wouldn't know that</p> <p>P6: And again, urm, especially for the first time round, I only knew that I had to have regular HBA1c's due to that facebook group and actually when I went for my six week check actually the GP was good because I said to her I need checks, she said oh have you had diabetes and I said yeah, she said oh that's really good that you've asked for it, there's lots of people who ignore it</p> <p>P6: But the consultant didn't tell me anything about it, it was only through the facebook grou</p> <p>K: Through that facebook group,</p> <p>K: It's just fascinating, I think that facebook group to kind of be credited for you know</p> <p>P6: Absolutely, and do you know the really strange, well not strange, but, the thing is, in my first pregnancy obviously they gave me this eat well plate, the second pregnancy there wasn't even a dietician available to see and urm but then, what they were advocating to a big degree was what was on the website and on the facebook page</p>
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		<p>P6: So that that is what he wants all the time, it's just a case of well these are the choices and I mean he's at greater risk of getting it now and I really don't want him to get it,</p> <p>K: yeah yeah for sure,</p> <p>P6: Which again is something not discussed really either by the NHS, it's only through the facebook page that I even know about that</p> <p>P6: Yeah I think the key think for it is, people being informed about what they can and can't eat really, and I don't just mean that in terms of like oh don't eat chips, because it's not a case of don't eat chips, but I remember when I saw the dietician in the first pregnancy, she went oh well if you have chips you can have 6, I was just like well what's the point in me eating 6, I'm not going to put 6 chips on my place</p> <p>K: No,</p> <p>P6: There was no offer of an alternative, or pairing it, or sweet potato fries which I actually could tolerate, nothing about the fact of, oh, when you cook a potato like a jacket potato, the sugars increase and that will effect you a lot so you might be able to tolerate if you say, mash it, but you wouldn't be able to tolerate a jacket potato, there's a real lack of anything like that and explaining things, which urm it might sound, it might sound well oh well that's kind of quite obvious but it's not necessary because we're just in this minefield of what can I and can't I eat and also just making people aware that just because I can eat it doesn't mean you're going to be able to because our bodies react so differently</p> <p>P10: yeah, thankfully I used the wonderful internet! And a search engine called google [laughs], and I came across Jo's website, gestational diabetes,.co.uk, and I don't think if it was...If I hadn't found that website I would have definitely ended up on medication and the birth would have ended up a completely different story. Literally the advice on that website and all the reach papers where she had got all her information from....because I started to just read up as much as I could about the condition and just sort of tried to make my own informed decisions about what I could try....because loads of people had sort of said drink two shots of apple cider vinegar every night and you'll be fine [laughs] so I just really wanted to see if there was research out there and Jo had already done half of the job by putting together a lot of the information, which was a real life saver for me.</p> <p>P10: well I hope it does happen because there's a real gap in the market, I mean I was talking to some women who've had GD in the past and we just don't know what to do next, and there's a huge lack of information from the NHS, and I think that's partially because they don't know themselves what is the best advice. I mean the midwives didn't have a clue really, and I don't blame them they've already got enough to deal with. There is definitely a need for something out there.</p>
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	<p>Facebook Information Source (H)</p>	<p>P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective</p> <p>K: Yeah</p> <p>P9: So I followed more closely a website that I'd found which was UK Gestational Diabetes</p> <p>K: Yeah yeah</p> <p>P9: And they have a, they have a Facebook group, so I ate less carbs stuff than the hospital would have told me, because they were still recommending having things like cereal for breakfast which just would have sent me way higher, so, I kind of, I did have the advice but I didn't really follow it very much what they said, so after, following the diet I kind of came up with I guess from reading then my after food levels were always fine, I struggled a bit with fasting levels first thing in the morning which is why they increased my metformin</p> <p>K: Yeah, and how did you find that?</p> <p>P9: Good, I mean I'm not very much of a kind of engager in lots of chat and social media because I just don't have the time, so I picked up snippets of it probably rather than avidly reading everything, so I kind of I found the kind of chat about what would happen in birth and what other people's experiences were and what kind of their medical team were saying to them a kind of useful (inaudible) check more than asking for advice on recipes kind of stuff, that was quite a good kind of, what other people had had, and what had happened to them and what their team had told so just as a, partly, you're not alone I guess, but partly is what you're being told unusual or is it kind of fairly standard</p> <p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think</p> <p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the</p>
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	<p>right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>P8: Yeah, ideas for food, because I was just getting to the point I was like sick of eating cheese and nuts and greek yoghurt (laughs) and it just gets, you want something quick, or sort of dinner and you think cor I'm sick of eating the same thing and then people, and that's where I kind of learnt, people were saying, I couldn't eat cereal for breakfast then I couldn't eat toast for breakfast, but then I learnt from that group that if I ate cheese on toast, a lot of cheese on toast, then I could eat toast, or cheese and crackers, I could eat a couple of crackers and get away with it, and like, the really dark chocolate and stuff, so I took a lot of that away, learning how to put stuff together really, and when to worry and when to not about my sugar levels and what I needed to watch out for, yeah</p> <p>P8: Yeah, it's really good, there is a lot, I learnt a lot as well about the complications and how the hospital can limit your choices about your birth and monitoring and stuff so I kinda knew what to expect, what might happen, because I didn't expect to have a caesarean until I come on this group and thought okay well it might be a possibility because I know my babies big and I've got this polyhydro urm, so it's, it's potentially an option but</p> <p>P8: There might have been one more, but that particular one, I'm in a couple of splinter ones as well that post GD health, a couple of others, but that seemed to be mainly the one with the most helpful information in, and there's lots of files and things in the group that you can refer to, like, examples of babies weight and birth stories and loads of different other things that they point you in the direction of,</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next</p>
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	<p>Harvesting and she was like no no you won't need that, your body with automatically know what to do but I ended up with an emergency c-section and it took ages to phone me up to come in and I very nearly gave up on breastfeeding it was only because I knew it lowered his risk of diabetes that I really stuck at it and I fed him for two years in the end</p> <p>K: Yeah, and was there anything else while you were pregnant, either time, the first or second time, were there any other apps or websites that you used to either get information or to get support with anything?</p> <p>P6: Not really, not in terms of the diabetes no it was just that, I mean I looked on the NHS website but their information is very limited urm on there</p> <p>P6: I know, I know, some of the things that I was told to eat was just I remember I had (ketos?) in my urine and they said well what are you eating and what did you eat last night and I was like well I had pasta and I had 20 pieces of pasta because I used to count it out because it's easier and she was just like ah oh it's not that then because you know they thought that I wasn't eating enough carbs, there was very little about the carbs it was very much just about this plate and make sure you've got an equal amount of everything, it was only the facebook group that told me about the pairing and everything which seems to really work for me</p> <p>P6: And again, urm, especially for the first time round, I only knew that I had to have regular HBA1c's due to that facebook group and actually when I went for my six week check actually the GP was good because I said to her I need checks, she said oh have you had diabetes and I said yeah, she said oh that's really good that you've asked for it, there's lots of people who ignore it</p> <p>P6: But the consultant didn't tell me anything about it, it was only through the facebook grou</p> <p>K: Through that facebook group,</p> <p>K: It's just fascinating, I think that facebook group to kind of be credited for you know</p> <p>P6: Absolutely, and do you know the really strange, well not strange, but, the thing is, in my first pregnancy obviously they gave me this eat well plate, the second pregnancy there wasn't even a dietician available to see and urm but then, what they were advocating to a big degree was what was on the website and on the facebook page</p>
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		<p>P6: So that that is what he wants all the time, it's just a case of well these are the choices and I mean he's at greater risk of getting it now and I really don't want him to get it,</p> <p>K: yeah yeah for sure,</p> <p>P6: Which again is something not discussed really either by the NHS, it's only through the facebook page that I even know about that</p> <p>P6: yes, yeah well it's part of their website and then do you know what I mean, every now and then somebody will ask a question about it and it'll come up again, urm, but I was reading a study that somebody put on the facebook page the other day, saying urm, that there's a study been done about breast feeding and how it reduces your risk of getting diabetes by 30% and hypertension by 11% and stuff which was nice to see,</p> <p>P6: Well no, like I said, just letting people know that they're now at risk because no body had told me that from like the NHS</p> <p>K: Really</p> <p>P6: It was all from this facebook page that I seen it and I suddenly thought oh my God my sons now at risk and like no body told me either that my son had to have his blood glucose checked and actually with my first son I had to chase it up because they didn't do it, but that would be another story to complain about, the whole, after bit</p> <p>P6: Yeah I think the key think for it is, people being informed about what they can and can't eat really, and I don't just mean that in terms of like oh don't eat chips, because it's not a case of don't eat chips, but I remember when I saw the dietician in the first pregnancy, she went oh well if you have chips you can have 6, I was just like well what's the point in me eating 6, I'm not going to put 6 chips on my place</p> <p>K: No,</p> <p>P6: There was no offer of an alternative, or pairing it, or sweet potato fries which I actually could tolerate, nothing about the fact of, oh, when you cook a potato like a jacket potato, the sugars increase and that will effect you a lot so you might be able to tolerate if you say, mash it, but you wouldn't be able to tolerate a jacket potato, there's a real lack of anything like that and explaining things, which urm it might sound, it might sound well oh well that's kind of quite obvious but it's not necessary because we're just in this minefield of what can I and can't I eat and also just making people aware that just because I can eat it doesn't mean you're going to be able to because our bodies react so differently</p>
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		<p>P6: Yeah absolutely, like with my first pregnancy was when the protein bars came out and I remember Joe on the facebook page said like is anybody willing to like spike test these and I said yeah I'll do it and I couldn't tolerate them and I was gutted, but so many other people could, but then this time round I was able to</p> <p>K: Yeah yeah, I wonder why that is, that's just crazy isn't it, really, kind of like with the curry as well, it's fine one minute</p> <p>P6: Yeah your body reacts so differently to like different things, I remember at Christmas insulin this time, so I knew constantly what my levels were and I tried a bit (inaudible) and it barely affected my levels and I was like wow, and I even finger pricked as well because I thought oh there's something wrong with this sensor and I was finger pricking literally every ten minutes</p> <p>P6: And I didn't go over at all, where as I now previously I would have, oh yeah that was it, it was my first pregnancy, I found out just before urm, Christmas and I'd eaten a couple of chocolates, naively thinking oh it would be fine, I'd only just found the facebook page at this time, and then I happened to read something saying try the spike testing and then I had, I think my husband counted for me, I had 10 jelly tots it was and my level was like 12 or something</p> <p>P10: yeah, thankfully I used the wonderful internet! And a search engine called google [laughs], and I came across Jo's website, gestational diabetes,.co.uk, and I don't think if it was...If I hadn't found that website I would have definitely ended up on medication and the birth would have ended up a completely different story. Literally the advice on that website and all the reach papers where she had got all her information from....because I started to just read up as much as I could about the condition and just sort of tried to make my own informed decisions about what I could try....because loads of people had sort of said drink two shots of apple cider vinegar every night and you'll be fine [laughs] so I just really wanted to see if there was research out there and Jo had already done half of the job by putting together a lot of the information, which was a real life saver for me.</p> <p>R: So when you went on the Facebook group and the website, what were the most useful things about it?</p> <p>P10: So, I was really trying to understand how the gestational diabetes would affect the unborn child. And sort of how I could try to keep my blood sugar levels stable, throughout the period and sort of understanding when...because at certain points during the pregnancy I was becoming more insulin resistant...things like that....just trying to get a better overview of exactly what were the risks associated</p>
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		<p>with GD, what could go wrong potentially, and the good stories as well from women who had got through to the other side and their babies were ok and they were able to do it diet controlled as well so. So yeah a lot</p> <p>P10: No, not really. There were a couple of TED talks that were posted on the Facebook support group that I did watch and they helped me to understand a little bit more about how eating carbs actually affects your blood sugar. And how pairing your food sort of helps to combat the sugar spikes. So that was probably the only other resource I did use and then went on....oh god what are they called....the association for gynaecologists....that lot....and the NICE guidelines, I used to read them a lot, to help me understand.</p> <p>K: Your certainly not alone in feeling unsupported at that time, lots of other people also mention similar thing. So, as part of the Facebook group, some women have mentions that there's some groups for afterwards, are you part of any of those?</p> <p>P10: Yes, there is a magical group called 'post GD ladies'. It's just inspiring to see, like if you're having a bad day or, having a bad month with diet, it's just quite nice to read up on other ladies who are actually succeeding at living a post GD life and also a little things like if you are planning to have another child, you'll automatically be classed as a GD pregnancy, and things like you should be taking folic acid well before you're conceiving, if you had GD previously. Someone else was also saying [another supplement not know], to take those supplements as well, so it's a really fountain of knowledge within that group, it's a real life line.</p>
	Lack of Information (H)	<p>K: Aw nice, yeah yeah, and so after you got the diagnosis, did they give you any advice about changes you needed to make, like dietary or?</p> <p>P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective</p> <p>P9: No, no I mean not that I remember finding anything that was I mean there was obviously NHS website, that I read about it, and I think the hospital give you a leaflet which covers much of what the website did so that was kind of fine for the basics of what the issue is and why you've got it and the NHS's view of what that means, for kind of birth and things,</p> <p>K: Yeah</p>

		<p>P9: But it's quite generic and each trust seems to have a different approach anyway so it wasn't that useful in terms of what was going to happen, it was more of a basic, this is what GD is rather than much more than that</p> <p>P9: Yeah I think I found the website before I'd actually had my dietician appointment, from memory K: Ah okay P9: Because it was kind of Christmas I was diagnosed so it was a few days before I could actually get to see somebody</p> <p>: They don't give you a reading P9: Which I just think is really bad, because they're actually wanting people to make lifestyle changes as well, you know, giving people more information as to actually, where they are and what the kind of range is I think is fairly essential, but you just don't get it at all and I don't think anyone would remind me if I didn't go for it either</p> <p>P9: It's just up to me to remember, around BABYS NAME REMOVED birthday to make an appointment and then ring up to check the results</p> <p>P9: Yeah I just think if it's genuinely the risk of developing type 2 diabetes is so much more and that costs such a lot to deal with and causes so many issues, I find it quite staggering that there's actually no post-birth support plan, action, anything, advice, nothing</p> <p>P8: Urm, I was, I think, they told me I had it on the Tuesday or the Wednesday and I had to go to a like, a group, on the Friday, I think it's about 2 hours, urm, and I went with my partner, and they went through kind of what diabetes is, it's very very general, urm, all what sort of things we should avoid, what would be the possible complications if our sugars weren't controlled, urm, possibility of needing medication, and then they showed us how to use blood urm, blood testing kit, but yeah it was very general</p> <p>P8: It was just, it was very sort of urm, you just sort of need to, if you normally eat bran flakes then eat bran flakes and if your sugars too high then don't eat them again, that kind of thing, you know don't go and eat a pot of jam, just be careful, limit your milk and bread and stuff like that, urm, but they, they</p>
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		<p>didn't come across that we needed to be as strict as the diabetes doctor was telling me, because obviously the diabetes doctor when I saw them was sort of like no if you blood sugar goes above this number then we need to put you on medication rather than it's okay just don't do it again,</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>K: So was that your GP you went to for that test P8: Yeah, well I saw a nurse, I booked it myself, but yeah K: And did that come back all fine? P8: I never heard, so I'm assuming yes (laughs)</p> <p>P6: There is a misconception of course that it's just sugar,</p> <p>K: Yeah yeah, sometimes you have to just, you know if you're empowered you just have to go for it and do what's right for you P6: Yeah and to be honest there's a lot, because of that facebook page, and the website and everything, that I knew a lot more, because if I didn't I would have just taken her word for it</p> <p>P6: it's limited what you can read online</p> <p>P6: I think I was a bit more naïve the first time round,</p> <p>K: Yeah, and was there anything else while you were pregnant, either time, the first or second time, were there any other apps or websites that you used to either get information or to get support with anything? P6: Not really, not in terms of the diabetes no it was just that, I mean I looked on the NHS website but their information is very limited urm on there</p>
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		<p>K: Yeah, interesting, so urm after you'd had your baby, did anyone say anything to you or offer you any kind of support in terms of kind of looking after yourself? With regards to the diabetes</p> <p>P6: No (scoffs)</p> <p>K: It's just fascinating, I think that facebook group to kind of be credited for you know</p> <p>P6: Absolutely, and do you know the really strange, well not strange, but, the thing is, in my first pregnancy obviously they gave me this eat well plate, the second pregnancy there wasn't even a dietician available to see and urm but then, what they were advocating to a big degree was what was on the website and on the facebook page</p> <p>P6: So that that is what he wants all the time, it's just a case of well these are the choices and I mean he's at greater risk of getting it now and I really don't want him to get it,</p> <p>K: yeah yeah for sure,</p> <p>P6: Which again is something not discussed really either by the NHS, it's only through the facebook page that I even know about that</p> <p>P6: Well no, like I said, just letting people know that they're now at risk because no body had told me that from like the NHS</p> <p>K: Really</p> <p>P6: It was all from this facebook page that I seen it and I suddenly thought oh my God my sons now at risk and like no body told me either that my son had to have his blood glucose checked and actually with my first son I had to chase it up because they didn't do it, but that would be another story to complain about, the whole, after bit</p> <p>P6: Yeah I think the key think for it is, people being informed about what they can and can't eat really, and I don't just mean that in terms of like oh don't eat chips, because it's not a case of don't eat chips, but I remember when I saw the dietician in the first pregnancy, she went oh well if you have chips you can have 6, I was just like well what's the point in me eating 6, I'm not going to put 6 chips on my place</p> <p>K: No,</p> <p>P6: There was no offer of an alternative, or pairing it, or sweet potato fries which I actually could tolerate, nothing about the fact of, oh, when you cook a potato like a jacket potato, the sugars increase and that will effect you a lot so you might be able to tolerate if you say, mash it, but you wouldn't be able to tolerate a jacket potato, there's a real lack of anything like that and explaining things, which urm</p>
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	<p>one appointment, I'm going to be able to blitz so many questions and figure out how we're gonna deal with this. But it was a group appointment, with five other women, which was a bit of a shock to start off with. And then this nurse just started to proceed with 'right you're all here because you've got gestational diabetes, yes its rubbish, most of you are probably going to go on medication, just avoid white carbs, eat brown carbs, and you'll be fine. I've written down in your booklets when you need to test your bloods, this is how you use the machine, and off you go'. And that was that. And it was really, really rubbish.</p> <p>P10: yeah, thankfully I used the wonderful internet! And a search engine called google [laughs], and I came across Jo's website, gestational diabetes,.co.uk, and I don't think if it was...If I hadn't found that website I would have definitely ended up on medication and the birth would have ended up a completely different story. Literally the advice on that website and all the reach papers where she had got all her information from....because I started to just read up as much as I could about the condition and just sort of tried to make my own informed decisions about what I could try....because loads of people had sort of said drink two shots of apple cider vinegar every night and you'll be fine [laughs] so I just really wanted to see if there was research out there and Jo had already done half of the job by putting together a lot of the information, which was a real life saver for me.</p> <p>R: I think that's the key isn't it, that it's for everyone. So after you had your baby did anyone give you any advice about what would happen to the GD?</p> <p>P10:]laughs]...no, absolutely nothing. I mean the midwives were just very surprised that my son passed all of his blood sugars because I had to fight to have a home birth as well, because I had previously had a c-section so I was already high risk and it was all full on drama, I had to get new hospital polices written up and everything. I was a real pain! So, I think when they did the last sugar test for the baby they were like, right, that's it, let's just get out of here and not talk to her every again so, no one really mentioned anything. And then I had an 8 week check up at the GP where she proclaimed that I would be diabetic really soon because I had GD and I'd had to go in for an annual blood test every year. That was it.</p> <p>P10: well I hope it does happen because there's a real gap in the market, I mean I was talking to some women who've had GD in the past and we just don't know what to do next, and there's a huge lack of information from the NHS, and I think that's partially because they don't know themselves what is the</p>
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		<p>best advice. I mean the midwives didn't have a clue really, and I don't blame them they've already got enough to deal with. There is definitely a need for something out there.</p>
	<p>Poor Communication (H)</p>	<p>P9: Yeah I think I found the website before I'd actually had my dietician appointment, from memory K: Ah okay P9: Because it was kind of Christmas I was diagnosed so it was a few days before I could actually get to see somebody</p> <p>K: Yeah that's a common experience actually, some women it's been a week or two weeks P9: Yeah it was, I went in for the testing thing then it was a couple of days later before I could actually see a dietician and so it was a little bit dragged out so I went and looked on my own in the mean time</p> <p>K: I think that the monitoring thing is really important, just thinking back to apps and things, if there had been something, say an app, that your midwife had offered you, what would you have most wanted it to support you with, at that time? P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I , before the paper thing, I would have expected at least that functionality that someone was actually looking at what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>P9: Yes, because the paper system is terrible, but at least the kind of sending, you know they chased me up via text if I hadn't sent them a reading, it was an automatic thing I'm sure but you got chasings and then I assume it would have escalated to someone if I hadn't done anything about</p>

		<p>K: Brilliant, yeah I was just going to ask you that actually that was going to be my next question, fab, and so after you'd had your baby, did anyone talk to you about what would happen afterwards with the diabetes?</p> <p>P9: Urm not much, no, so, urm, I think I was asked to do testing for like a couple of days afterwards, finger prick testing, but I'm not sure anyone was actually really interested,</p> <p>P9: In whether or not I was doing that, they obviously checked blood sugar levels just after kind of labour, but, then, they didn't really seem fussed after that, I was in hospital for a night and then went home, urm, and then I was told to book in for the, is it 6 weeks afterwards blood test, but there didn't seem to be any process for making sure I did that, or I find that haphazard whether people know they're actually supposed to do that in the midst of having just had a baby, I suspect lots of people miss that, I'm amazed that's not an automated, you know we've made an appointment for you, make sure you come in kind of process, so, there's no kind of follow up, I just have to ring up and ask if the results are okay, and they don't tell me what the numbers are or anything, so I find it really, kind of, I don't know whether I'm high, low, I'm obviously what they class as not needing to do anything about it phase, so I've had the one from birth and the annual, the one after that, I've had one more and that was exactly the same, the just say it's fine over the phone the receptionist, they don't give you actual numbers</p> <p>They don't give you a reading</p> <p>P9: Which I just think is really bad, because they're actually wanting people to make lifestyle changes as well, you know, giving people more information as to actually, where they are and what the kind of range is I think is fairly essential, but you just don't get it at all and I don't think anyone would remind me if I didn't go for it either</p> <p>P9: It's just up to me to remember, around BABYS NAME REMOVED birthday to make an appointment and then ring up to check the results</p> <p>P9: Yeah I just think if it's genuinely the risk of developing type 2 diabetes is so much more and that costs such a lot to deal with and causes so many issues, I find it quite staggering that there's actually nono post-birth support plan, action, anything, advice, nothing</p> <p>P8: Urm, I was, I think, they told me I had it on the Tuesday or the Wednesday and I had to go to a like, a group, on the Friday, I think it's about 2 hours, urm, and I went with my partner, and they went through kind of what diabetes is, it's very very general, urm, all what sort of things we should avoid, what would</p>
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		<p>be the possible complications if our sugars weren't controlled, urm, possibility of needing medication, and then they showed us how to use blood urm, blood testing kit, but yeah it was very general</p> <p>P8: It was just, it was very sort of urm, you just sort of need to, if you normally eat bran flakes then eat bran flakes and if your sugars too high then don't eat them again, that kind of thing, you know don't go and eat a pot of jam, just be careful, limit your milk and bread and stuff like that, urm, but they, they didn't come across that we needed to be as strict as the diabetes doctor was telling me, because obviously the diabetes doctor when I saw them was sort of like no if you blood sugar goes above this number then we need to put you on medication rather than it's okay just don't do it again,</p> <p>K: I didn't know if you thought that was something that was useful or something that you would use, I mean obviously maybe, you said you're pregnant again, hopefully you won't get it again, but maybe next time around?</p> <p>P8: Yeah I think I would because then you haven't got to wait the 2 weeks or however long it is before someone gets to see the results, even if they're not over the range they might be near the top of near the bottom, sometimes I had really low readings but they say only contact us if you're above, urm, but no I think that would be a good idea</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>K: So was that your GP you went to for that test</p> <p>P8: Yeah, well I saw a nurse, I booked it myself, but yeah</p> <p>K: And did that come back all fine?</p> <p>P8: I never heard, so I'm assuming yes (laughs)</p> <p>P6: I had a midwife appointment and she said oh did you find out your results and I said no I assumed you were going to contact me if there was a problem and then she called the hospital and my after reading was 8.2 so</p>
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	<p>P6: Urm, but obviously it wasn't just that, so yeah I got tested earlier than the 28 weeks and that was on Monday, I had an appointment (on the Tuesday?) they do clinic on the Tuesday but they had no availability so I then had to wait a whole nother week not really knowing what was going on, what I should or shouldn't be eating</p> <p>P6: My BMI was healthy, and everything, but my results were all coming pretty much over, all 10's and things, so I spoke the midwife and she said oh no absolutely not, and then she said it's just because you're feeling nauseous because I had urm, it wasn't morning sickness it was just nausea all day basically</p> <p>P6: Urm, and I was like ah that doesn't really ring true and she told me that there wasn't a clinic at my local hospital anymore because I knew that it was on a Tuesday and I was willing to just pop up and see somebody, she said oh no no it's all in Canturbery now it's all changed, and I thought okay, and I had it about a week later, I had to go for an early pregnancy scan, because I had a little bit of bleeding when I found out</p> <p>K: Yeah</p> <p>P6: And Urm I noticed signs up about the diabetic clinic so I happened to say to the midwife like do you know anybody who I could speak to and she said oh yeah they're all here today and she got me a lady urm, Natalie, who was so helpful, and I'd been writing down all my readings, so they got me a book and got me urm just got me everything that I needed basically, and said right do a week of readings and then send them over to me and we'll take it from there, so I did that, sent them over to her called me back, she spoke to the consultant and they said yeah he'd like to see you, so then I got to see him, a week later and urm she said on the phone oh yeah he wants to put you on (Metformin?) straight away, so urm, I went to see him, and he was like hm yeah while your readings fine this week they weren't the week before and I was like yeah because the week before I had to eat normally to show you I've got it</p> <p>K: Yeah, interesting, so urm after you'd had your baby, did anyone say anything to you or offer you any kind of support in terms of kind of looking after yourself? With regards to the diabetes</p> <p>P6: No (scoffs)</p> <p>P6: But the consultant didn't tell me anything about it, it was only through the facebook group</p> <p>K: Through that facebook group,</p> <p>P6: Well no, like I said, just letting people know that they're now at risk because no body had told me that from like the NHS</p> <p>K: Really</p>
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		P6: It was all from this facebook page that I seen it and I suddenly thought oh my God my sons now at risk and like no body told me either that my son had to have his blood glucose checked and actually with my first son I had to chase it up because they didn't do it, but that would be another story to complain about, the whole, after bit
<p>Diagnostic Delay</p> <p>(Delays in diagnosis and advice, appointments link to Information Sources. Issues in quick access to advice, 'lack of information' available on NHS sites, creates a need to be 'own expert' and therefore turn to other information sources).</p>	<p>Delay between Diagnosis and Advice (K)</p>	<p>P7: So I had about a week and a half I think, after id been diagnosed, before I got any advice. But in the meantime I did a lot of googling and found gestational diabetes.co.uk and the Facebook group and everything, so I felt like I had quite a lot of information before my first meeting</p> <p>P7: So yeah I think it was about a week and half between diagnosis and any advice.</p>
	<p>Diagnostic Delay (H)</p>	<p>P9: I had a urine kind of dip test with the midwife and that indicated that I think there was sugar in the urine so they thought I probably did have it</p> <p>K: Okay</p> <p>P9: I had missed a test before that, they hadn't done one, so I do have a sneaking suspicion that I had it for longer than they found it for</p> <p>P9: Yeah I think I found the website before I'd actually had my dietician appointment, from memory</p> <p>K: Ah okay</p> <p>P9: Because it was kind of Christmas I was diagnosed so it was a few days before I could actually get to see somebody</p> <p>P8: Okay, urm, well I had the urm, the GDT at about, I think it was 25, 26 weeks, because my dad's got type 2 diabetes,</p> <p>K: Right, okay</p> <p>P8: And my bmi was 30, and urm, it was all fine and then about 3 or 4 weeks later I saw the midwife and urm she felt baby and she said there is a lot of fluid in there, I think we need to get you for a scan, I think there might be too much fluid, so I had the scan and they said yes and they diagnosed polyhydramnios, urm, and then they said we need to do another GDT and the results of that came back that I had GD,</p> <p>K: Yeah okay, yeah that's strange it didn't come up the first time isn't it, how interesting,</p> <p>P8: Yeah, about 3 or 4 weeks apart,</p> <p>K: Yeah, yeah, how funny, I've not heard of that experience before</p>

	<p>P6: First time I had it, I got diagnosed well, I got diagnosed officially at 28 weeks, but due to no one informing me I didn't find out until about 29 30 weeks</p> <p>K: Okay</p> <p>P6: I had a midwife appointment and she said oh did you find out your results and I said no I assumed you were going to contact me if there was a problem and then she called the hospital and my after reading was 8.2 so</p> <p>K: Okay</p> <p>P6: And then, no it must have been earlier than 28 weeks, it must have been 26 weeks that I had it, because I had glucose in my urine, but I'd had frosties that morning so she thought oh it might be that we'll do a test just in case</p> <p>P6: and then my second pregnancy was a nightmare to get diagnosed</p> <p>P6: Urm, and I was like ah that doesn't really ring true and she told me that there wasn't a clinic at my local hospital anymore because I knew that it was on a Tuesday and I was willing to just pop up and see somebody, she said oh no no it's all in Canturbery now it's all changed, and I thought okay, and I had it about a week later, I had to go for an early pregnancy scan, because I had a little bit of bleeding when I found out</p> <p>K: Yeah</p> <p>P6: And Urm I noticed signs up about the diabetic clinic so I happened to say to the midwife like do you know anybody who I could speak to and she said oh yeah they're all here today and she got me a lady urm, Natalie, who was so helpful, and I'd been writing down all my readings, so they got me a book and got me urm just got me everything that I needed basically, and said right do a week of readings and then send them over to me and we'll take it from there, so I did that, sent them over to her called me back, she spoke to the consultant and they said yeah he'd like to see you, so then I got to see him, a week later and urm she said on the phone oh yeah he wants to put you on (Metformin?) straight away, so urm, I went to see him, and he was like hm yeah while your readings fine this week they weren't the week before and I was like yeah because the week before I had to eat normally to show you I've got it</p> <p>P10: ok so this is my second pregnancy, with my first I didn't have gestational diabetes, but because my parents are Sri Lankan, I'm automatically told that I need to go for a gestational diabetes test. So I umm, did the test with my hospital and they do it slightly differently to the way that the hospital who I was with for my first do it, so I um, I actually lost the instructions, I just downed the drink and hoped for the best, and I didn't hear any more about the results until I decided I was going to have a home birth, and</p>
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		<p>then the home birthing team followed up and they discovered that I was 0.1 over the borderline test results. So then I was immediately put onto the GD conveyor belt at the hospital and enrolled.</p> <p>R: yeah and so how long was it before they followed up with you?</p> <p>P10: well it was a good two weeks from the test, and yeah I'm really cross. I already raised a complaint with the hospital, especially after I'd done my own research and realised how sort of, how wrong GD can go, and how important it is to just nip it in the bud and be conscious of what you're doing from the very beginning. Yeah, it was a bit scary.</p>
<p>App Requirements</p> <p>(Links with App Benefits).</p>	<p>Desire for App (K)</p>	<p>P2: it would be great to have an app where you can upload your numbers and have that linked direct to the hospital, and they could recommend if you need to change anything or go to see the dietician, that would definitely be good because one of the big drawbacks is, and particularly because I'm now at a hospital which is over half an hour away from me, is the frequent appointments, so it would be brilliant to be able to do something over an app, instead of going in</p> <p>P2: maybe the likes of things like recipes, you know maybe giving you ideas, as you can get very much bogged down in like sticking to the same dinners and the same lunches because you know you can tolerate it ok</p> <p>P2: Errm maybe some, I would be great to have an online way of maybe contacting a diabetic nurse or somebody if you had concerns about something</p> <p>P3: But also somewhere that you could also manage your diet and your blood sugars and all of that because they give you a booklet that you fill in and show them the information. But yeah if you had an app that just did all of that, and then maybe if the app sent that information to the hospital, so that you didn't have to go and take your folder in like once a week, [laughs]...</p> <p>P3: Well, tell you all the stuff and sort of sign post you to all the sort of groups you could join, things you could go to and things you could look up. But also somewhere that you could also manage your diet and your blood sugars and all of that because they give you a booklet that you fill in and show them the information. But yeah if you had an app that just did all of that, and then maybe if the app sent that information to the hospital, so that you didn't have to go and take your folder in like once a week</p> <p>P4: So, there's a bit of that and I think that the hospital know that, they see it regularly, they're very kind, but I think maybe just addressing it a little bit more, like maybe some videos in the app would be</p>

		<p>great, or links to like links to newspaper articles that would be more positive than other that you see online. Like I saw one that basically said you just get it because you're old and fat.</p> <p>P4: But it would be nice to have an app with recipes actually, that would be great.</p> <p>P7: yeah I mean I was looking for an app for actually monitoring my numbers, because I was logging mine using the paper diary, you know and you get your monitor and I actually set an alarm on my phone, to remind me to test an hour after eating and so yeah I think I was looking for an app that would, that urm I could record it all, rather than writing it all down.</p> <p>P3: if were thinking about something related to diabetes, something that like knows you're at risk of type2 and would possibly flag up stuff that you shouldn't be doing, like oh nah you shouldn't be eating that doughnut or whatever [laughs], just something to keep you focused and motivated for what you're trying to do.</p> <p>P4: physical support so encouraging people to go for a walk or you know like exercise that you can do every day that doesn't require you to sign up for the gym, or buying lots of gear or anything, and also emotional help, you know I think making sure you've got someone, not a friend, but someone you can talk to about things.</p>
	Gamification (H)	<p>P9: Urm, I guess, I'd quite like it to be a kind of, suggested sort of suggesting things to eat in a way rather than just recording things I eat, so, I don't mean necessarily full recipes, although having links to those would be good, but urm, that just makes it easier to use, but in kind of, encouraging good meals and discouraging bad meals in a way, and that's difficult to do because it's sometimes a personal thing, but, urm, I'm sort of motivated by scores on things, and it doesn't even need to be a physical sticker, like a virtual sticker is good for me, urm, which is why I like park run, because you know you get credit for it, but urm so sort of, having done well in a day compared to not somehow, I think our marketing team at work call it gamification</p>
	App as Motivator (H)	<p>P9: Yeah, that, particularly, if no one else is looking at it, if someone else is looking at it then that gives you that, but if no one else is looking at it, and it's just you, kind of motivating yourself, then I am sadly motivated by that kind of thing (laughs)</p>

		<p>P9: I think the community element is good, depending on where it ends up, in terms of you know, urm, just other people being in the same boat as you, and I think that fitbit kind of does that a little bit, with you know, inviting people in to steps challenges and things but I don't think it's very good at that part of it, in that you don't, there's no real interaction with the other people, you don't, you can see how many steps they've done but that's about it, and obviously a facebook group is the other extreme of that where it's almost too much to actually dip into to, urm, but, you know, some being able to link with other people is a good thing, I almost think, you know, you can get away without some of this by relying on what's already there, I think there's a group called Healthy Mummy which is like a sort of, think like diet programme really, but they seem to enable you to link workouts from your fitbit and record them and they have a recipe database so it seems to kind of cover stuff from elsewhere that enables people to link in in quite a good way</p>
	<p>App as Rewarding (H)</p>	<p>P9: Urm, I guess, I'd quite like it to be a kind of, suggested sort of suggesting things to eat in a way rather than just recording things I eat, so, I don't mean necessarily full recipes, although having links to those would be good, but urm, that just makes it easier to use, but in kind of, encouraging good meals and discouraging bad meals in a way, and that's difficult to do because it's sometimes a personal thing, but, urm, I'm sort of motivated by scores on things, and it doesn't even need to be a physical sticker, like a virtual sticker is good for me, urm, which is why I like park run, because you know you get credit for it, but urm so sort of, having done well in a day compared to not somehow, I think our marketing team at work call it gamification</p> <p>P9: Yeah, that, particularly, if no one else is looking at it, if someone else is looking at it then that gives you that, but if no one else is looking at it, and it's just you, kind of motivating yourself, then I am sadly motivated by that kind of thing (laughs)</p>
	<p>App for Monitoring (H)</p>	<p>K: I think that the monitoring thing is really important, just thinking back to apps and things, if there had been something, say an app, that your midwife had offered you, what would you have most wanted it to support you with, at that time?</p> <p>P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I, before the paper thing, I would have expected at least that functionality that someone was actually looking at</p>

		<p>what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>P9: So urm, that at least was some sort of checking in that someone was okay rather than relying on them to raise an issue, urm, and the more I think you can automate that the better, the only reason that I got chased was not coz I'd done it, it was coz I'd done it and not got round to sending the text, so anything that you can cut stages out of is better I think</p> <p>P9: With those types of apps, that requires a level of commitment that urm, I would have had time for, but I didn't need to have time for it then, where as now I should be doing it and don't have time for it, I think something like, diet tracking I think would be good but I think it needs to be a bit more flexible than some of the stuff that's there at the minute which require you to be so accurate for it to be useful, which is the difficult thing</p> <p>K: Yeah, would you say that's ultimately what stopped you from carrying on using it?</p> <p>P9: Urm yes, but also, I mean that's my main issue with it, I think it I've always kind of thought actually I know what I need to be doing, and I don't need to record it to know in the same way, but it would be slightly different if you had someone else being interested, if you've got kind of an ongoing relationship with someone who can help you through something then they would need to kind of see something like that and they can't just rely on me going oh well I've had a mostly good week, urm, so, urm, that would be a slightly different incentive to do it than it would be just for my own benefit</p> <p>P9: Urm, I guess, I'd quite like it to be a kind of, suggested sort of suggesting things to eat in a way rather than just recording things I eat, so, I don't mean necessarily full recipes, although having links to those would be good, but urm, that just makes it easier to use, but in kind of, encouraging good meals and discouraging bad meals in a way, and that's difficult to do because it's sometimes a personal thing, but, urm, I'm sort of motivated by scores on things, and it doesn't even need to be a physical sticker, like a virtual sticker is good for me, urm, which is why I like park run, because you know you get credit for it, but urm so sort of, having done well in a day compared to not somehow, I think our marketing team at work call it gamification</p>
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	<p>App for diet advice (H)</p>	<p>K: I think that the monitoring thing is really important, just thinking back to apps and things, if there had been something, say an app, that your midwife had offered you, what would you have most wanted it to support you with, at that time?</p> <p>P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I , before the paper thing, I would have expected at least that functionality that someone was actually looking at what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>P9: Urm, I guess, I'd quite like it to be a kind of, suggested sort of suggesting things to eat in a way rather than just recording things I eat, so, I don't mean necessarily full recipes, although having links to those would be good, but urm, that just makes it easier to use, but in kind of, encouraging good meals and discouraging bad meals in a way, and that's difficult to do because it's sometimes a personal thing, but, urm, I'm sort of motivated by scores on things, and it doesn't even need to be a physical sticker, like a virtual sticker is good for me, urm, which is why I like park run, because you know you get credit for it, but urm so sort of, having done well in a day compared to not somehow, I think our marketing team at work call it gamification</p>

		<p>R: I'll definitely remember that! So if there was a magic app out there now, what would you most like it to help you with?</p> <p>P10: Diet. Definitely diet. So just little ideas, I think when I was at work and trying to come up with something imaginative for lunch, it would quickly become quite boring having just eggs for breakfast for example. Just having a wealth of different recipe ideas and tips and maybe warnings to say youre entering week 36 of the pregnancy and this the time where, you know, your sugars might go all over the place but don't panic</p> <p>R:mmm, ok fabulous. And what about now? would it still be diet?</p> <p>P10: mmmm yeah diet but also maybe something on, if you wanted to have another child, what can you do to start to prepare yourself, what can you do for your body to get yourself into the best place possible, because there's not a lot of that advice out there I mean I wouldn't have known that I needed to take folic acid even before I began trying again, because I had a GD pregnancy, it wouldn't have crossed my mind, so...</p>
	App for Next Pregnancy Advice (H)	<p>R:mmm, ok fabulous. And what about now? would it still be diet?</p> <p>P10: mmmm yeah diet but also maybe something on, if you wanted to have another child, what can you do to start to prepare yourself, what can you do for your body to get yourself into the best place possible, because there's not a lot of that advice out there I mean I wouldn't have known that I needed to take folic acid even before I began trying again, because I had a GD pregnancy, it wouldn't have crossed my mind, so...</p>
	App for Social Contact (H)	<p>P9: I think the community element is good, depending on where it ends up, in terms of you know, urm, just other people being in the same boat as you, and I think that fitbit kind of does that a little bit, with you know, inviting people in to steps challenges and things but I don't think it's very good at that part of it, in that you don't, there's no real interaction with the other people, you don't, you can see how many steps they've done but that's about it, and obviously a facebook group is the other extreme of that where it's almost too much to actually dip into to, urm, but, you know, some being able to link with other people is a good thing, I almost think, you know, you can get away without some of this by relying on what's already there, I think there's a group called Healthy Mummy which is like a sort of, think like diet programme really, but they seem to enable you to link workouts from your fitbit and record them and they have a recipe database so it seems to kind of cover stuff from elsewhere that enables people to link in in quite a good way</p>

	App for Support (H)	<p>K: I think that the monitoring thing is really important, just thinking back to apps and things, if there had been something, say an app, that your midwife had offered you, what would you have most wanted it to support you with, at that time?</p> <p>P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I, before the paper thing, I would have expected at least that functionality that someone was actually looking at what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>P9: I think the community element is good, depending on where it ends up, in terms of you know, urm, just other people being in the same boat as you, and I think that fitbit kind of does that a little bit, with you know, inviting people in to steps challenges and things but I don't think it's very good at that part of it, in that you don't, there's no real interaction with the other people, you don't, you can see how many steps they've done but that's about it, and obviously a facebook group is the other extreme of that where it's almost too much to actually dip into to, urm, but, you know, some being able to link with other people is a good thing, I almost think, you know, you can get away without some of this by relying on what's already there, I think there's a group called Healthy Mummy which is like a sort of, think like diet programme really, but they seem to enable you to link workouts from your fitbit and record them and they have a recipe database so it seems to kind of cover stuff from elsewhere that enables people to link in in quite a good way</p> <p>P2: that is the other thing, especially if you did an app, it's the comfort,</p>

		<p>R: Alright, fabulous. So you've said there that you would have been happy to attend a face to face sort of thing. Do you think you would have been happy to receive something online? Or via your phone?</p> <p>P10: oh definitely, I mean that would a lifesaver, I mean something that you could read or whatever whilst you're doing midnight feeds, whilst your trying to stay awake, something that you could just scroll through would be perfect and something that doesn't make a sound. I think something that's captioned, so if there are videos then they definitely need to have captions.</p>
	<p>App to Improve Communication (H)</p>	<p>P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I , before the paper thing, I would have expected at least that functionality that someone was actually looking at what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>K: Yeah yeah, they have got an app now, it's not available everywhere, it's available in Oxford I think, so the reader sends the</p> <p>P9: Yep automatically</p> <p>K: Automatically yeah and that goes off to your health care professional and I think they ring you if there's an issue or they text you, so yeah that's out there now, but whether it will be made more widely available I'm not sure, but you would have been open to using something like that had it been available?</p> <p>P9: Yes, because the paper system is terrible, but at least the kind of sending, you know they chased me up via text if I hadn't sent them a reading, it was an automatic thing I'm sure but you got chasings and then I assume it would have escalated to someone if I hadn't done anything about it</p> <p>P9: So urm, that at least was some sort of checking in that someone was okay rather than relying on them to raise an issue, urm, and the more I think you can automate that the better, the only reason that I got chased was not coz I'd done it, it was coz I'd done it and not got round to sending the text, so anything that you can cut stages out of is better I think</p>

		<p>P9: Yeah, yeah I'm probably quite, low level of concern over people having my data, and, if it makes my life easier then I'm happy with it, I'm not concerned about sending my blood sugar levels via an app, it doesn't worry me at all because I'm not worried about anyone having those (laughs)</p> <p>K: (Laughs)</p> <p>P9: I know some people would be, eventually, but I would always go for the there's got to be a more efficient way of doing this option rather than secrecy</p> <p>K: Yeah, would you say that's ultimately what stopped you from carrying on using it?</p> <p>P9: Urm yes, but also, I mean that's my main issue with it, I think it I've always kind of thought actually I know what I need to be doing, and I don't need to record it to know in the same way, but it would be slightly different if you had someone else being interested, if you've got kind of an ongoing relationship with someone who can help you through something then they would need to kind of see something like that and they can't just rely on me going oh well I've had a mostly good week, urm, so, urm, that would be a slightly different incentive to do it than it would be just for my own benefit</p> <p>P9: Yeah, that, particularly, if no one else is looking at it, if someone else is looking at it then that gives you that, but if no one else is looking at it, and it's just you, kind of motivating yourself, then I am sadly motivated by that kind of thing (laughs)</p> <p>K: I didn't know if you thought that was something that was useful or something that you would use, I mean obviously maybe, you said you're pregnant again, hopefully you won't get it again, but maybe next time around?</p> <p>P8: Yeah I think I would because then you haven't got to wait the 2 weeks or however long it is before someone gets to see the results, even if they're not over the range they might be near the top of near the bottom, sometimes I had really low readings but they say only contact us if you're above, urm, but no I think that would be a good idea</p>
	<p>Frame Weight Management as Risk Reduction (H)</p>	<p>K: 100% I think that's what we're kind of getting at, people kind of seem to be abandoned a little bit afterwards, how would you have felt if someone did come to you with a plan, or come and said we want to kind of support you to help prevent that risk of type 2, would you have been open to that do you think?</p> <p>P9: Urm I mean yes, I think, I think it is a difficult thing particularly at that time, when someone has just had a baby and, it's never the most, emotionally sane part of your life, so to then have someone going yes and you need to make sure you exercise and eat healthy when I'd had like two hours sleep is a difficult conversation but I think it needs to happen at some point, even if it's not you know, week 2, urm, I think it needs to happen at some point, and you might not particularly want to have the</p>

		<p>conversation but I'm not sure that's a reason not to have it, you know nobody ever wants to have conversations about potentially negative things, but the reason for doing them is to stop something worse happening so, I think open to it is always a slightly difficult thing because I think most people would always prefer to put their head in the sand in a way, and go, I hope it will all be fine, but I don't think that's necessarily the right approach coz we'd never have vaccinations, we'd never have smear tests, we'd never go to the doctor about anything if you took that approach</p> <p>felt if someone had approached you about weight management after you'd had your baby? P6: Urm, I would have felt quite happy to be honest, and I think if it's approached in the right way and said like because you had this you're not at high risk of actually getting diabetes, how can we support you, I mean, to be honest, I probably would have said no because they probably would have stuck me on slimming world or something like that, which is so carb heavy</p> <p>R: fantastic and now that you've had your baby would you say that that motivation is still there? P10: ummm, yeah I will not lie for about three months after everything just went out the window, it was like finally I can eat chocolate, I can have as much pizza as I want. But now I'm just sort of slowly trying to get myself back together with exercise and I am quite mindful of diet, especially with the children, so I've got a toddler and I've just started to wean my baby as well so, I am aware that they might be at a higher risk of developing diabetes later on, so I'm just trying to instil good eating habits for later on and for everyone.</p> <p>R: so after you'd had your baby and the support afterwards, if somebody had come to you and said we want to support you to stay healthy, how do you think that would have felt? P10: I would definitely have been open to it, I mean I definitely couldn't of committed to weekly appointments or weekly meetings but perhaps just attending one session to just discuss the implications of you know, what diabetes could look like in the future and to understand how its not just important to make changes for myself but also for the children as well, it would have been quite beneficial because I did feel that the very first appointment I had with diabetic nurse was just a waste of time, it took about 10 minutes in total. And it's a big thing, learning about how to eat probably because you don't really do it, not unless your parents were very good. It's a big lifestyle change when you're trying to sort yourself out</p>
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<p>Barriers to Health Changes</p> <p>(Which of these can/will need to be addressed by/for mHealth in order for successful intervention).</p>	<p>Emotional Eating (K)</p>	<p>P1: I know I need to give up carbs, that's where my downfall is, um but with the emotional struggles with having these infertility issues, I find it very difficult not to eat my emotions. So whilst I know I need to, whilst this goes on, I'm struggling.</p> <p>P1: And um in order to lose weight, obviously, you need to diet, but at the moment everytime, so obviously we're still actively trying and every time we get a negative pregnancy result the emotions take over, then I comfort eat</p> <p>P1: Well a normal person might think, well surly that's your motivation if you want another child to loose the weight, but the the kind of emotions that im dealing with are making it extremely difficult to not just go and have a box of chocolates or a loaf of bread. Um, so I think motivation yeah, but I also think you need to be in a healthy state of mind.</p> <p>P4: But also the other thing is that gestational diabetes helped me to realise that I do have quite an emotional link to food... and quite a few women are like that in the group, you can see that. And I think and perhaps that's lacking in the application...</p>
	<p>Child as Barrier to Health Changes (H)</p>	<p>P9: Urm I mean yes, I think, I think it is a difficult thing particularly at that time, when someone has just had a baby and, it's never the most, emotionally sane part of your life, so to then have someone going yes and you need to make sure you exercise and eat healthy when I'd had like two hours sleep is a difficult conversation but I think it needs to happen at some point, even if it's not you know, week 2, urm, I think it needs to happen at some point, and you might not particularly want to have the conversation but I'm not sure that's a reason not to have it, you know nobody ever wants to have conversations about potentially negative things,</p> <p>P9: I sort of feel like it should start probably around, coz you go for your 6 week check, when really kind of any outstanding issues should have a plan of what to do about them, whether that be you need physio or you've got issues with stitches or anything and I feel like kind of GD should one of the things that then sets you on a path from there, you know not necessarily you have to change your life in week 6, but, that's normally the time when people are starting to go, I'm starting to feel okay, I might start trying to do a bit more exercise, coming slightly out of the urm, shock of new baby, so I think that should be the start of it, around then, but then it should, I don't think it should be give people a leaflet and then</p>

		<p>P9: Urm, so it is a motivator but it's difficult for that to be a motivator like every moment if you see what I mean, it's like a long-term motivator, but, urm, you know, as with all of these things, you've got to be consistent all the time and that's the</p> <p>K: That's the hard part isn't it, I mean we can all make changes but actually keeping up with them is really, really difficult</p> <p>P9: Yeah and I think, trying to do that alongside adjusting to having small children is the hardest time to do it, which isn't that helpful in this circumstance really (laughs)</p> <p>P9: Because before I had children I was urm I was really fit and thin, and it's more of a struggle now</p> <p>P9: Urm, I mean, I'm kind of, I'm working on doing a bit more exercise without feeling guilty about being out, which is sort of doable apart from the fact I've now got to have an operation next week which has sort of damaged that slightly, I've got a gall stone,</p> <p>P9: Urm, so I think, assuming I can get back to exercising properly I'm kind of working on the, we do a park run together every Saturday morning which is religious and I've kept that up religiously, as we all go out and do that so I don't feel guilty about that but doing anything in the evenings I feel guilty about because I'm the one out at work all day, and then if I go out in the evening then I feel like I'm not seeing my children at all, so that is a struggle for me, but I've decided to just do it once a week and just go with it because it's better for them healthy longer term but it depends how work goes to be honest as to if I manage that,</p> <p>P9: our biggest issue is then cooking things that are reasonably healthy that the boys will eat, at least some common ground so we're not making two entirely separate meals, urm, and they're just fussy at the minute,</p> <p>P9: So it was fairly easy, our problem is now that, coz the boys don't eat loads of things and don't eat vegetables much, that it's finding that common ground of food, so it's them that's the issue really rather than him</p> <p>K: Yeah and either, after you have your next baby or after you had your last child, how would you feel about someone supporting you with your weight loss journey at that time?</p> <p>P8: I would have loved it. I think it would have been the best thing for me, I think because at that point especially so soon after the birth, because I breast fed as well, so you're thinking I'm just absolutely exhausted all I want to do is eat rubbish, and then because my partner is tired because he's up in the</p>
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		<p>night with the baby as well and then so he's, although he's supportive he just wants to eat crap as well whereas if I've got someone going actually come on no remember, remember how it was when you were eating so strictly because of the diabetes, do you really want to get that again, you know, you don't want to keep feeling like you've not lost enough weight and the rest of it, I think that would, yeah, it would have been massive, a massive massive help</p> <p>P6: It's being able to actually make these different changes to your food as well, the first time it was a lot easier, it was just me and my husband, the second time round, I had a two year old as well who was trying to feed</p> <p>P6: And it did, it changed things, it made it much harder, and equally, I had different things in the house as well for him, so there's almost that temptation whereas if it's not there you're not going to eat it are you, so yeah it does it changes it quite a lot</p> <p>R: fantastic and now that you've had your baby would you say that that motivation is still there?</p> <p>P10: ummm, yeah I will not lie for about three months after everything just went out the window, it was like finally I can eat chocolate, I can have as much pizza as I want. But now I'm just sort of slowly trying to get myself back together with exercise and I am quite mindful of diet, especially with the children, so I've got a toddler and I've just started to wean my baby as well so, I am aware that they might be at a higher risk of developing diabetes later on, so I'm just trying to instil good eating habits for later on and for everyone.</p> <p>P10: potentially after the first trimester and everything's sort of calmed down with the new baby and you know what you're doing and you can get yourself in and out of the house, without too much trouble, that's probably a good time to head to something like that, its probably the time where you're most confident to do something. Because you think you've got everything and then the baby stops sleeping, or you know, something else happens, yeah I think after the third month everything just go so much easier, because you kind of know you're baby's routine and if you need to you could leave the baby with someone and go to something and just focus on yourself as well.</p>
	Time as Barrier to Health Changes (H)	<p>P9: Urm, yes, urm, I think it's difficult with all of these things, because I'm a, I've lost a bit of weight since I had BABYS NAME, but not as much as I would have liked to have done, and that's primarily a kind of time thing for me, in that, I just don't have much time in my life to do much exercise and cook any meals that aren't what the children want to eat, urm, I would like to have a third baby, but I, in my head, I need</p>

		<p>to kind of got myself into the best position if I am going to have a third baby to stop that happening again</p> <p>P9: Urm, so it is a motivator but it's difficult for that to be a motivator like every moment if you see what I mean, it's like a long-term motivator, but, urm, you know, as with all of these things, you've got to be consistent all the time and that's the</p> <p>K: That's the hard part isn't it, I mean we can all make changes but actually keeping up with them is really, really difficult</p> <p>P9: Yeah and I think, trying to do that alongside adjusting to having small children is the hardest time to do it, which isn't that helpful in this circumstance really (laughs)</p> <p>P9: Because before I had children I was urm I was really fit and thin, and it's more of a struggle now</p> <p>P9: Urm I've, I mean I use a fitbit to kind of, attempt to have slightly more active days, and we've actually got health insurance linked to it, urm, life insurance, which you know, is kind of a slight extra motivator but it doesn't find you extra time in the day so, and then I have dabbled in recording stuff in myfitnesspal and fitbit like calorie wise before, but I've never managed to do it for a long period, but because of the amount of commitment you have to put into it, to get it exact, so I find it fairly easy to record generally what I eat, the bit I find difficult is you have to know whether you've eaten 400 grams or 450 grams</p> <p>P9: With those types of apps, that requires a level of commitment that urm, I would have had time for, but I didn't need to have time for it then, where as now I should be doing it and don't have time for it, I think something like, diet tracking I think would be good but I think it needs to be a bit more flexible than some of the stuff that's there at the minute which require you to be so accurate for it to be useful, which is the difficult thing</p> <p>P9: Urm, so I think, assuming I can get back to exercising properly I'm kind of working on the, we do a park run together every Saturday morning which is religious and I've kept that up religiously, as we all go out and do that so I don't feel guilty about that but doing anything in the evenings I feel guilty about because I'm the one out at work all day, and then if I go out in the evening then I feel like I'm not seeing my children at all, so that is a struggle for me, but I've decided to just do it once a week and just go with it because it's better for them healthy longer term but it depends how work goes to be honest as to if I manage that,</p>
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		<p>P8: Yeah, yes, well this pregnancy was very much unexpected, urm, so my kind of plan was to let myself go loose for a little while after the birth in terms of food and then to get back on it and lose some weight, start exercising and eating healthily because I just thought I don't want to spend the rest of my life like I've just done for the last 12 weeks and urm, it then I never really got back on track, but my plan before I got pregnant again was to lose weight and get healthy so I could reduce the risk of getting diabetes again and then kind of have the birth that I want, etc etc. urm but unfortunately it's not worked that way</p> <p>K: Yeah and either, after you have your next baby or after you had your last child, how would you feel about someone supporting you with your weight loss journey at that time?</p> <p>P8: I would have loved it. I think it would have been the best thing for me, I think because at that point especially so soon after the birth, because I breast fed as well, so you're thinking I'm just absolutely exhausted all I want to do is eat rubbish, and then because my partner is tired because he's up in the night with the baby as well and then so he's, although he's supportive he just wants to eat crap as well whereas if I've got someone going actually come on no remember, remember how it was when you were eating so strictly because of the diabetes, do you really want to get that again, you know, you don't want to keep feeling like you've not lost enough weight and the rest of it, I think that would, yeah, it would have been massive, a massive massive help</p> <p>R: fantastic and now that you've had your baby would you say that that motivation is still there?</p> <p>P10: ummm, yeah I will not lie for about three months after everything just went out the window, it was like finally I can eat chocolate, I can have as much pizza as I want. But now I'm just sort of slowly trying to get myself back together with exercise and I am quite mindful of diet, especially with the children, so I've got a toddler and I've just started to wean my baby as well so, I am aware that they might be at a higher risk of developing diabetes later on, so I'm just trying to instil good eating habits for later on and for everyone.</p>
	<p>Access to Bad Food as Barrier (H)</p>	<p>P9: So, urm, my main issue I think is urm, my meals are pretty good and I eat well at meals and then I'll fall down about half past 8 in the evening when I'll have some sort of snack</p> <p>K: Yeah</p> <p>P9: Urm, and if I could stop that I think I'd be fine, which is kind of it's entirely psychological, but urm, I don't really struggle in the day, particularly,</p> <p>P9: either eat well or badly depending on what is in the house really, so we don't tend to buy much food that's rubbishy,</p>

	<p>P8: Urm, the GD diet I suppose, because I did lose weight while I was doing that while I was pregnant urm, and really it is stuff that I like, but I just think because there is all the other stuff lying around it is, you eat stuff you shouldn't, I do like nuts and yoghurt and cheese and meats and things, and I know that it works, but yeah</p> <p>K: Yeah and either, after you have your next baby or after you had your last child, how would you feel about someone supporting you with your weight loss journey at that time?</p> <p>P8: I would have loved it. I think it would have been the best thing for me, I think because at that point especially so soon after the birth, because I breast fed as well, so you're thinking I'm just absolutely exhausted all I want to do is eat rubbish, and then because my partner is tired because he's up in the night with the baby as well and then so he's, although he's supportive he just wants to eat crap as well whereas if I've got someone going actually come on no remember, remember how it was when you were eating so strictly because of the diabetes, do you really want to get that again, you know, you don't want to keep feeling like you've not lost enough weight and the rest of it, I think that would, yeah, it would have been massive, a massive massive help</p> <p>P6: Christmas and I'd eaten a couple of chocolates, naively thinking oh it would be fine, I'd only just found the facebook page at this time, and then I happened to read something saying try the spike testing and then I had, I think my husband counted for me, I had 10 jelly tots it was and my level was like 12 or something</p> <p>K: Yeah</p> <p>P6: I was crying my eyes out, that was after like 15 minutes</p> <p>P6: And it did, it changed things, it made it much harder, and equally, I had different things in the house as well for him, so there's almost that temptation whereas if it's not there you're not going to eat it are you, so yeah it does it changes it quite a lot</p> <p>K: Yeah, that kind of willpower gets tested doesn't it when there's things in the cupboard that,</p> <p>P6: Yeah absolutely</p> <p>R: Fab, and when you were using those two things did you mainly access it through a phone or a laptop or?</p> <p>P10: I think I used everything going because when you're out and about at work or if you're out having dinner and you just don't know what the best option would be to eat, it's just handy to search on your phone or on the iPad. I also went on holiday, I had Easter to contend with as well so, it was a bit of a tricky time to get the diagnosis.</p>
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	<p>Post-partum Lack of Motivation (K)</p>	<p>P1: I mean I was nearly always completely disciplined, which is why I was lucky enough to remain completely diet controlled, um but, since she's been born, I could eat half a loaf of bread, and I have no self control, like theres no....its only me, its only my body it's affecting, I don't care that much, um about my body.</p> <p>P1: I know I need to give up carbs, that's where my downfall is, um but with the emotional struggles with having these infertility issues, I find it very difficult not to eat my emotions. So whilst I know I need to, whilst this goes on, im struggling.</p> <p>P2: My motivation was nowhere near as strong, no where near as strong but like, I would have thought of him [the child], like I would want to get fit for him, I would want to be not very overweight, and like he would still have been a motivator but it's much much easier to say oh do you know what I'm just gunna order that pizza or whatever because you're not, you don't feel, its just totally different, like whenever you think like I'm 100% responsible for keeping this baby safe then when its just you you're kind of like, I dunno, a bit more flippant about it I guess.</p> <p>P3: Well no not really, I don't feel much motivation at all, it's like well yesterday for instance I had breakfast but then I had a muffin, some soup for my dinner and then some crumpets because actually I'm looking after him the whole time and unless I pre plan it, I actually don't eat properly which is quite bad really but it happens a lot coz you're just so busy and then like I feed him and he's having all his good healthy food and then I'm like Oh I haven't eaten anything so I just quickly have a pizza or something</p>
	<p>Post-Partum Goal Conflict (K)</p>	<p>P7: I just can't get my mind-set right because I know what would be better for my health would be to lose weight, because I don't want to spend all my time and energy worrying about what I look like and women spend so much time worry about what they look like and what they're eating instead of doing important things like smashing the patriarchy!</p> <p>P7: So I'm really really conflicted because on one hand...but I just don't want to waste my life worrying about what I'm eating and how much I weigh. But I also don't want to get diabetes and lose my feet.</p> <p>P7: and for me I know it is, the main thing that I can do to stop myself from getting type2 diabetes is to lose weight and lose weight around my internal organs. But, I'm also a completely valid person regardless of what my weight is</p>

	<p>Rules Rebellng and Perceived Control (H)</p>	<p>P8: Yeah, yes, well this pregnancy was very much unexpected, urm, so my kind of plan was to let myself go loose for a little while after the birth in terms of food and then to get back on it and lose some weight, start exercising and eating healthily because I just thought I don't want to spend the rest of my life like I've just done for the last 12 weeks and urm, it then I never really got back on track, but my plan before I got pregnant again was to lose weight and get healthy so I could reduce the risk of getting diabetes again and then kind of have the birth that I want, etc etc. urm but unfortunately it's not worked that way</p> <p>P8: I think when I've used it yeah, I do, I think for me I just get so overwhelmed because there's just so many different things, well this one is telling me to cut carbs, this one is telling me that I need carbs, it just gets so confusing for me sometimes and I panic that I'm not taking the right advice, urm, but when I have calorie counted, but I think because I love, I really love my food, and when, on the GD diet I can sit with a big bag of nuts and a nice pot of yoghurt, urm and a block of cheese and not have to feel guilty about it that's the one I lean to, I can eat the most of the things I want to so</p> <p>P6: No I've looked at a couple but I'm not really in to calorie counting or anything like that and I think the moment someone says to me you're on a diet I kind of rebel (laughs)</p> <p>P6: I don't necessarily limit myself, and yeah I can have treats if I want a bit of chocolate I can have a bit of chocolate</p> <p>P6: No exactly, it just I'm a big believed of everything in moderation, so nothing is off bounds because if it's off bounds that's the moment I'll go no no I want it I want it, but it's just a case of, I mean, everything in moderation,</p> <p>P6: I mean I've, I was lucky in a way, after (?) I didn't want to eat at all, I just lost my appetite, and it shrunk my stomach and then I was like right let's do this type of thing, urm, but, I can't remember what I was going to say now, lost my train of thought</p> <p>K: You and me both, it's getting late isn't it (laughs)</p> <p>P6: No I don't know what I was going to say</p> <p>K: (laughs) don't worry, don't worry, it's just interesting, I haven't really brought it up with many other people because it is a very sensitive subject I think,</p> <p>P6: Yeah</p>
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<p>Motivators for Health Changes</p> <p>(Which of these can/will need to be utilised by mHealth)</p>	<p>Emotional Impact on Motivation (K)</p>	<p>P1: Well a normal person might think, well surly that's your motivation if you want another child to loose the weight, but the the kind of emotions that im dealing with are making it extremely difficult to not just go and have a box of chocolates or a loaf of bread. Um, so I think motivation yeah, but I also think you need to be in a healthy state of mind</p>
	<p>Postpartum Behaviour Change Goals (K)</p>	<p>P1: I know I need to give up carbs, that's where my downfall is, um but with the emotional struggles with having these infertility issues, I find it very difficult not to eat my emotions. So whilst I know I need to, whilst this goes on, im struggling.</p> <p>P2: That I knew I should actively try and lose weight and try to be more active and things.</p> <p>P4: I mean now I've gone down to a BMI of 23, so I'm quite pleased with myself the fact that I walk 8-9 kilometres a day helps. We don't have a car anymore... they did tell me, keep active, eat well and take care of yourself as grey guidelines, but it's true that what else can you say?</p> <p>P7: and for me I know it is, the main thing that I can do to stop myself from getting type2 diabetes is to lose weight and lose weight around my internal organs. But, I'm also a completely valid person regardless of what my weight is</p>
	<p>Motivation to Change (K)</p>	<p>P1: Yeah I mean, I love carbs, me and carbs we are fast friends. But it was easier, knowing that it was for my child, than if it was for me on my own, because I had to protect her.</p> <p>P2: I was 100% motivated by the baby</p>

		<p>P2: if I go over, then that insulin is going into my baby and I can not in any good conscience, you know it would be different if it was just me and my sugars are high occasionally, but 100% it was keeping the baby safe, that was my biggest motivation and still is again now in this because I'm so concerned that I've got it early, you know I'm constantly like is everything going to be ok, it's a big worry like, so its like, and because you have your extra scans and they're monitoring the growth and everything, I just hope that like god, everything is on the right track and the baby's not measuring too big and that's just always in your mind.</p> <p>P4: I know she's that usual, but we try to communicate this to our children....I don't know...my husband has always been overweight, since he was a child I think, and I think it's a worry for us to pass on unhealthy habits to our children, but also we don't want them to be overly worried either. But we are all learning together!</p>
	<p>Motivation Linked to Unborn Child (K)</p>	<p>Same as above pretty much.</p>
	<p>Reasons for Motivation Post-Partum (K)</p>	<p>P2: The reason I became motivated to try and loose weight at that time, was because we were on holidays and I started to get a couple of dizzy spells and it was probably just because we were away in the heat, but I was convinced, I said to my husband, oh my god I must be type2, I must have this, I can't believe I didn't act on this, I should have lost more weight. So then, even though I didn't have it then, that was a big thing to push me then because I thought oh my god, I can't get this, you know. So that really keeps me motivated.</p> <p>P4: I don't know how to explain but I sort of liked the way I looked, and I liked how I felt and at this time in my life I was able to recognise that so that was particularly helpful for motivating me</p> <p>P4: I also realise how tough it is to have diabetes, even for just a short period of time, and I just thought if I can put off having it for just a little while, then why not.</p> <p>P5: I've gone on and lost a lot of weight now. I just felt good on it [the GD diet] and that's why I carried it on. I think I was motivated by how much energy I had and just how good I felt really.</p>

		<p>P7: So in theory I'm motivated but in practice I've got a two year old who still doesn't sleep very well and I work 4 days per week...and I eat too much sugar....but yeah...</p>
	<p>Next Child as Motivator (H)</p>	<p>P9: Urm, yes, urm, I think it's difficult with all of these things, because I'm a, I've lost a bit of weight since I had BABYS NAME, but not as much as I would have liked to have done, and that's primarily a kind of time thing for me, in that, I just don't have much time in my life to do much exercise and cook any meals that aren't what the children want to eat, urm, I would like to have a third baby, but I, in my head, I need to kind of got myself into the best position if I am going to have a third baby to stop that happening again</p> <p>P8: Yeah, yes, well this pregnancy was very much unexpected, urm, so my kind of plan was to let myself go loose for a little while after the birth in terms of food and then to get back on it and lose some weight, start exercising and eating healthily because I just thought I don't want to spend the rest of my life like I've just done for the last 12 weeks and urm, it then I never really got back on track, but my plan before I got pregnant again was to lose weight and get healthy so I could reduce the risk of getting diabetes again and then kind of have the birth that I want, etc etc. urm but unfortunately it's not worked that way</p> <p>K: These things never do do they, and would you say that, that reducing the risk of getting it again was that quite a strong motivation for you?</p> <p>P8: Urm, yeah yeah</p> <p>K: Yeah, quite a few women say there's a really strong motivation to eat healthily whilst you're pregnant because you know, the baby essentially,</p> <p>P8: The baby yeah, and then as soon as the babies out (laughs)</p> <p>K: (laughs) yeah sure</p> <p>P8: Yeah I mean it's definitely not enjoyable to have it whilst you're pregnant, and I think, because I did have a few complications with my last pregnancy I didn't want to go through that again but</p> <p>R: Your certainly not alone in feeling unsupported at that time, lots of other people also mention similar thing. So, as part of the Facebook group, some women have mentions that there's some groups for afterwards, are you part of any of those?</p> <p>P10: Yes, there is a magical group called 'post GD ladies'. It's just inspiring to see, like if you're having a bad day or, having a bad month with diet, it's just quite nice to read up on other ladies who are actually succeeding at living a post GD life and also a little things like if you are planning to have another child,</p>

	<p>you'll automatically be classed as a GD pregnancy, and things like you should be taking folic acid well before you're conceiving, if you had GD previously. Someone else was also saying [another supplement not know], to take those supplements as well, so it's a really fountain of knowledge within that group, it's a real life line.</p> <p>R:mmm, ok fabulous. And what about now? would it still be diet? P10: mmmm yeah diet but also maybe something on, if you wanted to have another child, what can you do to start to prepare yourself, what can you do for your body to get yourself into the best place possible, because there's not a lot of that advice out there I mean I wouldn't have known that I needed to take folic acid even before I began trying again, because I had a GD pregnancy, it wouldn't have crossed my mind, so...</p>
<p>Child as Motivator (H)</p>	<p>P9: So, I think that's difficult to resolve, but I think GD is a bit difficult because you have that kind of you know, is it because I didn't eat well enough, is it because I'm overweight, is it because I didn't do enough exercise kind of, and no one can say to you definitely no because all of those things are factors and, but, you know, I guess it's about having more, the positive, fixing it for the future and I think particularly if people are going to go on to have more children, urm, that's even more important, because you're fairly likely to have the same issue the next time</p> <p>P9: Urm, yes, urm, I think it's difficult with all of these things, because I'm a, I've lost a bit of weight since I had BABYS NAME, but not as much as I would have liked to have done, and that's primarily a kind of time thing for me, in that, I just don't have much time in my life to do much exercise and cook any meals that aren't what the children want to eat, urm, I would like to have a third baby, but I, in my head, I need to kind of got myself into the best position if I am going to have a third baby to stop that happening again</p> <p>P9: Urm, so it is a motivator but it's difficult for that to be a motivator like every moment if you see what I mean, it's like a long-term motivator, but, urm, you know, as with all of these things, you've got to be consistent all the time and that's the</p> <p>K: That's the hard part isn't it, I mean we can all make changes but actually keeping up with them is really, really difficult</p> <p>P9: Yeah and I think, trying to do that alongside adjusting to having small children is the hardest time to do it, which isn't that helpful in this circumstance really (laughs)</p> <p>P9: Urm, so I think, assuming I can get back to exercising properly I'm kind of working on the, we do a park run together every Saturday morning which is religious and I've kept that up religiously, as we all go</p>

		<p>out and do that so I don't feel guilty about that but doing anything in the evenings I feel guilty about because I'm the one out at work all day, and then if I go out in the evening then I feel like I'm not seeing my children at all, so that is a struggle for me, but I've decided to just do it once a week and just go with it because it's better for them healthy longer term but it depends how work goes to be honest as to if I manage that,</p> <p>P8: Yeah, yes, well this pregnancy was very much unexpected, urm, so my kind of plan was to let myself go loose for a little while after the birth in terms of food and then to get back on it and lose some weight, start exercising and eating healthily because I just thought I don't want to spend the rest of my life like I've just done for the last 12 weeks and urm, it then I never really got back on track, but my plan before I got pregnant again was to lose weight and get healthy so I could reduce the risk of getting diabetes again and then kind of have the birth that I want, etc etc. urm but unfortunately it's not worked that way</p> <p>K: These things never do do they, and would you say that, that reducing the risk of getting it again was that quite a strong motivation for you?</p> <p>P8: Urm, yeah yeah</p> <p>K: Yeah, quite a few women say there's a really strong motivation to eat healthily whilst you're pregnant because you know, the baby essentially,</p> <p>P8: The baby yeah, and then as soon as the babies out (laughs)</p> <p>K: (laughs) yeah sure</p> <p>P8: Yeah I mean it's definitely not enjoyable to have it whilst you're pregnant, and I think, because I did have a few complications with my last pregnancy I didn't want to go through that again but</p> <p>K: Yeah yeah yeah, in terms, so you mentioned earlier that you'd lost some weight, was that after your first, after your first baby</p> <p>P6: Yes it was yes</p> <p>K: So how did you go about doing that?</p> <p>P6: Urm low carb low sugar, full fat everything and high protein basically which is what I try and follow now because I'm still not quite at my pre-pregnancy weight at the moment but not far off it</p> <p>K: That's incredible, that's really incredible</p> <p>P6: And but the other thing is I don't want to get the diabetes, I want to be around for the kids,</p> <p>P6: he's at greater risk of getting it now and I really don't want him to get it,</p>
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		<p>succeeding at living a post GD life and also a little things like if you are planning to have another child, you'll automatically be classed as a GD pregnancy, and things like you should be taking folic acid well before you're conceiving, if you had GD previously. Someone else was also saying [another supplement not know], to take those supplements as well, so it's a really fountain of knowledge within that group, it's a real life line.</p> <p>R: so after you'd had your baby and the support afterwards, if somebody had come to you and said we want to support you to stay healthy, how do you think that would have felt?</p> <p>P10: I would definitely have been open to it, I mean I definitely couldn't of committed to weekly appointments or weekly meetings but perhaps just attending one session to just discuss the implications of you know, what diabetes could look like in the future and to understand how its not just important to make changes for myself but also for the children as well, it would have been quite beneficial because I did feel that the very first appointment I had with diabetic nurse was just a waste of time, it took about 10 minutes in total. And it's a big thing, learning about how to eat probably because you don't really do it, not unless your parents were very good. It's a big lifestyle change when you're trying to sort yourself out</p>
	Consistent Progress as Motivator (H)	<p>P9: Urm, and if I could stop that I think I'd be fine, which is kind of it's entirely psychological, but urm, I don't really struggle in the day, particularly, it's that evening thing, and actually if I've managed to do some exercise then I don't really have that, the two go together for me, in that, if I've exercised I feel like well that was a good day so therefore I'll keep it up with eating well, whereas if I think, well I've barely moved from my desk today I might as well have a biscuit, there's no logic to that at all</p>
Reasons for Facebook Use (Could these needs be fulfilled by mhealth, also shows what needs people are open to	Facebook Group During Pregnancy (K)	<p>P1: So I went on to her Facebook page, the gestational diabetes one and that's what helped me more than anything</p> <p>P1: Um, and I 100% believe that if I hadn't found her website I wouldn't have been able to stay diet controlled.</p> <p>P2: errrm, not really. They did direct me to gestationaldiabetes.co.uk, I think. But I ended up just doing research myself and found the gestational diabetes mums website, and err the support group on Facebook. So I found that, and to be honest, that was the biggest help in my gestational diabetes journey, for sure because it really helped me to manage my diet well. I made the right choices.</p>

having met through mobile accessed platforms)		<p>P4: I'm tired of having to go for a walk after each meal and you know you just say that and people are like 'I hear you, it's really hard but it's all worth it' and just like moral support really. And also recipes, because this woman has created recipes that are really really delicious.</p>
	Facebook Page Diet (K)	<p>P1: Um, and I 100% believe that if I hadn't found her website I wouldn't have been able to stay diet controlled</p> <p>P1: Its really hard, especially when you know, your out on an outings and some special event, and you're having to really think about everything, but the brilliant thing about that page is is that you could ask questions, like people post menus saying oh you know I've got this big event, this is the menu for it, im thinking about having this this and this from it do you think that's the best on? And the admins would always say oh maybe do this and tweak that and they really help you.</p> <p>P2: But I ended up just doing research myself and found the gestational diabetes mums website, and err the support group on Facebook. So I found that, and to be honest, that was the biggest help in my gestational diabetes journey, for sure because it really helped me to manage my diet well. I made the right choices.</p> <p>P2: but when you have those recipes there it's such a life saver</p> <p>P5: I honestly can't tell you, oh im going to get emotional now, how much that group meant to me. It was everything. I got all of my information from it. I actually don't know what I would have done if I didn't have it, I probably would never have been able to stay diet controlled.</p> <p>P7: So I literally just read that, read the whole website, and was like right! I'll just do that then and I did it for the full 3 months and my diet control was you know absolutely fine, it was just my fasting levels.</p>
	Facebook Page Info Seeking (K)	<p>P1: I didn't know where else to look. I was following the NHS. But, my husbands friends wife, had had GD and had found the website, um, you know, Jo, I'm sure you must know Jo Patterson because, I'm pretty sure I found the link, the link through to you on her website. So I went on to her Facebook page, the gestational diabetes one and that's what helped me more than anything.</p> <p>P3: So that was all about just basically just information, and basically what its like from the patients perspective, rather than like, coz the nurses and doctors are all just like, right you've got this and you need to take this, and this means we'll have to induce you and its all very matter of fact and clinical</p>

		<p>P5: I honestly can't tell you, oh im going to get emotional now, how much that group meant to me. It was everything. I got all of my information from it. I actually don't know what I would have done if I didn't have it, I probably would never have been able to stay diet controlled.</p> <p>P7: the website is brilliant, the Facebook group is brilliant, the advice is spot on and it makes a lot of sense...and because my mum had had type2 and she reversed it through low carb eating...it just made a lot of sense.</p> <p>P7: So I literally just read that, read the whole website, and was like right! I'll just do that then and I did it for the full 3 months and my diet control was you know absolutely fine, it was just my fasting levels.</p>
	<p>Facebook Peer Support (K)</p>	<p>P1: Its really hard, especially when you know, your out on an outings and some special event, and you're having to really think about everything, but the brilliant thing about that page is is that you could ask questions, like people post menus saying oh you know I've got this big event, this is the menu for it, im thinking about having this this and this from it do you think that's the best on? And the admins would always say oh maybe do this and tweak that and they really help you.</p> <p>P2: there was just constant support, so like even if you didn't necessarily want to comment in the group, you know, somebody might have put a comment post in that may have had a similar type of experience to you</p> <p>P2: you could ask and the moderators would answer and say no its fine. You know, so it was just a constant feeling of support, I even messaged them when I was in induction at like 2 o'clock in the morning</p> <p>P2: so it was just nice to have that kind of support</p> <p>P2: I mean I found that I didn't want to tell anyone really because I thought oh people were gonna say 'oh well she's overweight' and when I did tell people, like some of my colleagues, they would come out with the most ridiculous comments like one woman said 'well oh you do eat a lot of fruit'.... And that's not you know, that's not why I got this like, there's such a misunderstanding around it and I think people don't really talk about it like, so then its easier for people to talk about it on a Facebook group or whatever</p>

		<p>P4: I'm tired of having to go for a walk after each meal and you know you just say that and people are like 'I hear you, it's really hard but it's all worth it' and just like moral support really. And also recipes, because this woman has created recipes that are really really delicious.</p>
	<p>Facebook Aiding Diet Control (H)</p>	<p>P9: So I followed more closely a website that I'd found which was UK Gestational Diabetes K: Yeah yeah P9: And they have a, they have a Facebook group, so I ate less carbs stuff than the hospital would have told me, because they were still recommending having things like cereal for breakfast which just would have sent me way higher, so, I kind of, I did have the advice but I didn't really follow it very much what they said, so after, following the diet I kind of came up with I guess from reading then my after food levels were always fine, I struggled a bit with fasting levels first thing in the morning which is why they increased my metformin</p> <p>K: How did you find out about that? P9: I can't remember, but I think I was just googling and came across it, because as with all this things I always want to read up on my own, so I think I just came across it and then kind of I guess what they said seemed logical to me in terms of the kind of food they were recommending, so I didn't eat massively high fat which I think some people interpret it as, urm, but I, I definitely kind of found the types of meals they were suggesting better</p> <p>K: And what about the website, would you have looked at that on your phone or was that on a laptop P9: I did look at the website but not so much, once I'd, I didn't follow lots of specific recipes I just followed the principals if you see what I mean, so I didn't need to look at lots of detailed stuff on the website, so I would read bits on it, and things, on my phone, or on a laptop, but I probably wasn't looking at the website daily</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p>

	<p>P8: Yeah, ideas for food, because I was just getting to the point I was like sick of eating cheese and nuts and greek yoghurt (laughs) and it just gets, you want something quick, or sort of dinner and you think cor I'm sick of eating the same thing and then people, and that's where I kind of learnt, people were saying, I couldn't eat cereal for breakfast then I couldn't eat toast for breakfast, but then I learnt from that group that if I ate cheese on toast, a lot of cheese on toast, then I could eat toast, or cheese and crackers, I could eat a couple of crackers and get away with it, and like, the really dark chocolate and stuff, so I took a lot of that away, learning how to put stuff together really, and when to worry and when to not about my sugar levels and what I needed to watch out for, yeah</p> <p>P6: They couldn't understand why I couldn't tolerate porridge and things like that, and the only bread I could tolerate was protein rolls from Lidl, but they didn't even know what they were and it was only because of the facebook page that I found them</p> <p>K: Yeah so what sort of things do you think you mainly use that group for?</p> <p>P6: Urm a lot of it was ideas on things that you can eat and replace that was definitely the main thing but I think also the support element, knowing a bit more what's going to go on with induction and things like that, I think I was a bit more naïve the first time round, because I asked my midwife about cholostrum? Harvesting and she was like no no you won't need that, your body with automatically know what to do but I ended up with an emergency c-section and it took ages to phone me up to come in and I very nearly gave up on breastfeeding it was only because I knew it lowered his risk of diabetes that I really stuck at it and I fed him for two years in the end</p> <p>P6: I know, I know, some of the things that I was told to eat was just I remember I had (ketos?) in my urine and they said well what are you eating and what did you eat last night and I was like well I had pasta and I had 20 pieces of pasta because I used to count it out because it's easier and she was just like ah oh it's not that then because you know they thought that I wasn't eating enough carbs, there was very little about the carbs it was very much just about this plate and make sure you've got an equal amount of everything, it was only the facebook group that told me about the pairing and everything which seems to really work for me</p> <p>K: It's just fascinating, I think that facebook group to kind of be credited for you know</p> <p>P6: Absolutely, and do you know the really strange, well not strange, but, the thing is, in my first pregnancy obviously they gave me this eat well plate, the second pregnancy there wasn't even a dietician available to see and urm but then, what they were advocating to a big degree was what was on the website and on the facebook page</p>
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	<p>Facebook Fear Mitigated (H)</p>	<p>K: Yeah, and how did you find that?</p> <p>P9: Good, I mean I'm not very much of a kind of engager in lots of chat and social media because I just don't have the time, so I picked up snippets of it probably rather than avidly reading everything, so I kind of I found the kind of chat about what would happen in birth and what other people's experiences were and what kind of their medical team were saying to them a kind of useful (inaudible) check more than asking for advice on recipes kind of stuff, that was quite a good kind of, what other people had had, and what had happened to them and what their team had told so just as a, partly, you're not alone I guess, but partly is what you're being told unusual or is it kind of fairly standard</p> <p>P8: There might have been one more, but that particular one, I'm in a couple of splinter ones as well that post GD health, a couple of others, but that seemed to be mainly the one with the most helpful information in, and there's lots of files and things in the group that you can refer to, like, examples of babies weight and birth stories and loads of different other things that they point you in the direction of,</p> <p>P6: I posted something on I think it was, I don't know, some mums group, and I just said has anybody got know anything about GD because it's limited what you can read online and you don't want to scare yourself</p> <p>P6: oh join this group and I joined it, and it was the best thing I ever did because I'm 100% that's why I stayed diet controlled in my first pregnancy</p> <p>R: So when you went on the Facebook group and the website, what were the most useful things about it?</p>

		<p>P10: So, I was really trying to understand how the gestational diabetes would affect the unborn child. And sort of how I could try to keep my blood sugar levels stable, throughout the period and sort of understanding when...because at certain points during the pregnancy I was becoming more insulin resistant...things like that....just trying to get a better overview of exactly what were the risks associated with GD, what could go wrong potentially, and the good stories as well from women who had got through to the other side and their babies were ok and they were able to do it diet controlled as well so. So yeah a lot</p> <p>P10: There's actually some really good positive birth stories on the GD website, some great ones, so I did read up on those and then a couple of ladies on the Facebook group as well had written about their experiences....</p>
	<p>Facebook Information Source (H)</p>	<p>P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective</p> <p>K: Yeah</p> <p>P9: So I followed more closely a website that I'd found which was UK Gestational Diabetes</p> <p>K: Yeah yeah</p> <p>P9: And they have a, they have a Facebook group, so I ate less carbs stuff than the hospital would have told me, because they were still recommending having things like cereal for breakfast which just would have sent me way higher, so, I kind of, I did have the advice but I didn't really follow it very much what they said, so after, following the diet I kind of came up with I guess from reading then my after food levels were always fine, I struggled a bit with fasting levels first thing in the morning which is why they increased my metformin</p> <p>K: Yeah, and how did you find that?</p> <p>P9: Good, I mean I'm not very much of a kind of engager in lots of chat and social media because I just don't have the time, so I picked up snippets of it probably rather than avidly reading everything, so I kind of I found the kind of chat about what would happen in birth and what other people's experiences were and what kind of their medical team were saying to them a kind of useful (inaudible) check more than asking for advice on recipes kind of stuff, that was quite a good kind of, what other people had had, and what had happened to them and what their team had told so just as a, partly, you're not alone I guess, but partly is what you're being told unusual or is it kind of fairly standard</p>

		<p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think</p> <p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>P8: Yeah, ideas for food, because I was just getting to the point I was like sick of eating cheese and nuts and greek yoghurt (laughs) and it just gets, you want something quick, or sort of dinner and you think cor I'm sick of eating the same thing and then people, and that's where I kind of learnt, people were saying, I couldn't eat cereal for breakfast then I couldn't eat toast for breakfast, but then I learnt from that group that if I ate cheese on toast, a lot of cheese on toast, then I could eat toast, or cheese and crackers, I could eat a couple of crackers and get away with it, and like, the really dark chocolate and stuff, so I took a lot of that away, learning how to put stuff together really, and when to worry and when to not about my sugar levels and what I needed to watch out for, yeah</p>
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		<p>P8: Yeah, it's really good, there is a lot, I learnt a lot as well about the complications and how the hospital can limit your choices about your birth and monitoring and stuff so I kinda knew what to expect, what might happen, because I didn't expect to have a caesarean until I come on this group and thought okay well it might be a possibility because I know my babies big and I've got this polyhydro urm, so it's, it's potentially an option but</p> <p>P8: There might have been one more, but that particular one, I'm in a couple of splinter ones as well that post GD health, a couple of others, but that seemed to be mainly the one with the most helpful information in, and there's lots of files and things in the group that you can refer to, like, examples of babies weight and birth stories and loads of different other things that they point you in the direction of,</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>P6: and so they gave me kit and some testing stuff, I started testing, I spoke to my midwife, she was awful, and basically told me it was impossible to get it this early, and I knew it wasn't, I'm on the GD facebook page so I know there's a lot of people who do, I was hopeful I didn't because I've lost a lot of weight as well so</p> <p>P6: It was funny because when I went in to see the midwife because I didn't have a midwife at this stage you see so I was just calling up saying I need some help, and then I was like yeah yeah I've got GD, and she was like what what, and I was like yeah I've spoken to the consultant myself I've got an appointment this week and she was just a bit like uh uh uh uh</p> <p>K: Yeah yeah, sometimes you have to just, you know if you're empowered you just have to go for it and do what's right for you</p>
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		<p>levels and I was like wow, and I even finger pricked as well because I thought oh there's something wrong with this sensor and I was finger pricking literally every ten minutes</p> <p>P6: And I didn't go over at all, where as I now previously I would have, oh yeah that was it, it was my first pregnancy, I found out just before urm, Christmas and I'd eaten a couple of chocolates, naively thinking oh it would be fine, I'd only just found the facebook page at this time, and then I happened to read something saying try the spike testing and then I had, I think my husband counted for me, I had 10 jelly tots it was and my level was like 12 or something</p> <p>P10: yeah, thankfully I used the wonderful internet! And a search engine called google [laughs], and I came across Jo's website, gestational diabetes,.co.uk, and I don't think if it was...If I hadn't found that website I would have definitely ended up on medication and the birth would have ended up a completely different story. Literally the advice on that website and all the reach papers where she had got all her information from....because I started to just read up as much as I could about the condition and just sort of tried to make my own informed decisions about what I could try....because loads of people had sort of said drink two shots of apple cider vinegar every night and you'll be fine [laughs] so I just really wanted to see if there was research out there and Jo had already done half of the job by putting together a lot of the information, which was a real life saver for me.</p> <p>R: So when you went on the Facebook group and the website, what were the most useful things about it?</p> <p>P10: So, I was really trying to understand how the gestational diabetes would affect the unborn child. And sort of how I could try to keep my blood sugar levels stable, throughout the period and sort of understanding when...because at certain points during the pregnancy I was becoming more insulin resistant...things like that....just trying to get a better overview of exactly what were the risks associated with GD, what could go wrong potentially, and the good stories as well from women who had got through to the other side and their babies were ok and they were able to do it diet controlled as well so. So yeah a lot</p> <p>P10: No, not really. There were a couple of TED talks that were posted on the Facebook support group that I did watch and they helped me to understand a little bit more about how eating carbs actually</p>
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		<p>affects your blood sugar. And how pairing your food sort of helps to combat the sugar spikes. So that was probably the only other resource I did use and then went on....oh god what are they called....the association for gynaecologists....that lot....and the NICE guidelines, I used to read them a lot, to help me understand.</p> <p>R: Your certainly not alone in feeling unsupported at that time, lots of other people also mention similar thing. So, as part of the Facebook group, some women have mentions that there's some groups for afterwards, are you part of any of those?</p> <p>P10: Yes, there is a magical group called 'post GD ladies'. It's just inspiring to see, like if you're having a bad day or, having a bad month with diet, it's just quite nice to read up on other ladies who are actually succeeding at living a post GD life and also a little things like if you are planning to have another child, you'll automatically be classed as a GD pregnancy, and things like you should be taking folic acid well before you're conceiving, if you had GD previously. Someone else was also saying [another supplement not know], to take those supplements as well, so it's a really fountain of knowledge within that group, it's a real life line.</p>
	<p>Facebook Recipe Food Ideas (H)</p>	<p>K: How did you find out about that?</p> <p>P9: I can't remember, but I think I was just googling and came across it, because as with all this things I always want to read up on my own, so I think I just came across it and then kind of I guess what they said seemed logical to me in terms of the kind of food they were recommending, so I didn't eat massively high fat which I think some people interpret it as, urm, but I, I definitely kind of found the types of meals they were suggesting better</p> <p>K: Yeah, and how did you find that?</p> <p>P9: Good, I mean I'm not very much of a kind of engager in lots of chat and social media because I just don't have the time, so I picked up snippets of it probably rather than avidly reading everything, so I kind of I found the kind of chat about what would happen in birth and what other people's experiences were and what kind of their medical team were saying to them a kind of useful (inaudible) check more than asking for advice on recipes kind of stuff, that was quite a good kind of, what other people had had, and what had happened to them and what their team had told so just as a, partly, you're not alone I guess, but partly is what you're being told unusual or is it kind of fairly standard</p> <p>K: And what about the website, would you have looked at that on your phone or was that on a laptop</p>

		<p>P9: I did look at the website but not so much, once I'd, I didn't follow lots of specific recipes I just followed the principals if you see what I mean, so I didn't need to look at lots of detailed stuff on the website, so I would read bits on it, and things, on my phone, or on a laptop, but I probably wasn't looking at the website daily</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>P8: Yeah, ideas for food, because I was just getting to the point I was like sick of eating cheese and nuts and greek yoghurt (laughs) and it just gets, you want something quick, or sort of dinner and you think cor I'm sick of eating the same thing and then people, and that's where I kind of learnt, people were saying, I couldn't eat cereal for breakfast then I couldn't eat toast for breakfast, but then I learnt from that group that if I ate cheese on toast, a lot of cheese on toast, then I could eat toast, or cheese and crackers, I could eat a couple of crackers and get away with it, and like, the really dark chocolate and stuff, so I took a lot of that away, learning how to put stuff together really, and when to worry and when to not about my sugar levels and what I needed to watch out for, yeah</p> <p>P8: Urm, probably meal ideas, food ideas, because, that was the thing I used to just get so fed up, what can I have, I got to the point where I couldn't have mashed potato and I couldn't have urm, and it's then all these different things but have a jacket rather than mash and have a certain type of bread instead of this type of bread so there's all these different kind of codes (laughs), you can have it in this form but not this form, yeah just meal ideas because you just get so fed up with the same thing,</p> <p>K: Yeah so what sort of things do you think you mainly use that group for? P6: Urm a lot of it was ideas on things that you can eat and replace that was definitely the main thing</p>
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		<p>something saying try the spike testing and then I had, I think my husband counted for me, I had 10 jelly tots it was and my level was like 12 or something</p> <p>R: So when you went on the Facebook group and the website, what were the most useful things about it?</p> <p>P10: So, I was really trying to understand how the gestational diabetes would affect the unborn child. And sort of how I could try to keep my blood sugar levels stable, throughout the period and sort of understanding when...because at certain points during the pregnancy I was becoming more insulin resistant...things like that....just trying to get a better overview of exactly what were the risks associated with GD, what could go wrong potentially, and the good stories as well from women who had got through to the other side and their babies were ok and they were able to do it diet controlled as well so. So yeah a lot</p> <p>P10: Errm, no not at all, I mean one thing is price point, if it's something...I mean I think even the NHS have got an app for pelvic floor but its £2.99, just for something to remind you to do your pelvic floor exercises so, I'd probably just set an alarm, for free. I think that if there was something out there that you had to pay ten pounds for it, I might not do it but it depends, because saying that I did pay for membership on the GD website to help with dietary advice, so it just really depends on what content would be available.</p>
	Facebook Support (H)	<p>K: Yeah, and how did you find that?</p> <p>P9: Good, I mean I'm not very much of a kind of engager in lots of chat and social media because I just don't have the time, so I picked up snippets of it probably rather than avidly reading everything, so I kind of I found the kind of chat about what would happen in birth and what other people's experiences were and what kind of their medical team were saying to them a kind of useful (inaudible) check more than asking for advice on recipes kind of stuff, that was quite a good kind of, what other people had had, and what had happened to them and what their team had told so just as a, partly, you're not alone I guess, but partly is what you're being told unusual or is it kind of fairly standard</p>

		<p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think</p> <p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>P8: Yeah, it's really good, there is a lot, I learnt a lot as well about the complications and how the hospital can limit your choices about your birth and monitoring and stuff so I kinda knew what to expect, what might happen, because I didn't expect to have a caesarean until I come on this group and thought okay well it might be a possibility because I know my babies big and I've got this polyhydro urm, so it's, it's potentially an option but</p> <p>P8: There might have been one more, but that particular one, I'm in a couple of splinter ones as well that post GD health, a couple of others, but that seemed to be mainly the one with the most helpful</p>
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		<p>information in, and there's lots of files and things in the group that you can refer to, like, examples of babies weight and birth stories and loads of different other things that they point you in the direction of,</p> <p>P6: I think also the support element, knowing a bit more what's going to go on with induction and things like that</p> <p>R: Your certainly not alone in feeling unsupported at that time, lots of other people also mention similar thing. So, as part of the Facebook group, some women have mentions that there's some groups for afterwards, are you part of any of those?</p> <p>P10: Yes, there is a magical group called 'post GD ladies'. It's just inspiring to see, like if you're having a bad day or, having a bad month with diet, it's just quite nice to read up on other ladies who are actually succeeding at living a post GD life and also a little things like if you are planning to have another child, you'll automatically be classed as a GD pregnancy, and things like you should be taking folic acid well before you're conceiving, if you had GD previously. Someone else was also saying [another supplement not know], to take those supplements as well, so it's a really fountain of knowledge within that group, it's a real life line.</p> <p>P10: There's actually some really good positive birth stories on the GD website, some great ones, so I did read up on those and then a couple of ladies on the Facebook group as well had written about their experiences....</p>
<p>Own Expert</p> <p>(Delays in access to Information, 'Lack of Information' and discontentment</p>	<p>Own expert (K)</p>	<p>P1: I knew I had it before I had it, my dad was diabetic, um and I have PCOS which are two of the highest risk factors for it. Um and I was asking my midwife to be tested from 8 weeks. Um and nobody would do it until the uh is it 24 or 26 weeks</p> <p>P1: So like I was already eating smarter, because I thought that I would get it.</p> <p>P2: my own using my dads monitor and take them to the midwife. You see last time I didn't know anything about that, that I could do that, that is was an option. So I was very much just, I would just chase it up and midwives would do you know the wee stick, and say I didn't have any sugars, and say it was fine to wait until 20 whatever weeks I was, where as this time round I'd just do it myself</p>

<p>with NHS/HCP advise and available information may create need to become 'Own Expert').</p>	<p>Own Expert (H)</p>	<p>I was diagnosed reasonably late on in my so from memory it was about 34 weeks, something like that, K: Yeah that's a little bit later isn't it P9: Yeah so then they said they would induce me 2 weeks early, and I managed to push them to 1 week early and in the end I went in to labour on the day anyway, so</p> <p>K: Aw nice, yeah yeah, and so after you got the diagnosis, did they give you any advice about changes you needed to make, like dietary or? P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective K: Yeah P9: So I followed more closely a website that I'd found which was UK Gestational Diabetes</p> <p>K: How did you find out about that? P9: I can't remember, but I think I was just googling and came across it, because as with all this things I always want to read up on my own, so I think I just came across it and then kind of I guess what they said seemed logical to me in terms of the kind of food they were recommending, so I didn't eat massively high fat which I think some people interpret it as, urm, but I, I definitely kind of found the types of meals they were suggesting better</p> <p>K: Yeah that's a common experience actually, some women it's been a week or two weeks P9: Yeah it was, I went in for the testing thing then it was a couple of days later before I could actually see a dietician and so it was a little bit dragged out so I went and looked on my own in the mean time</p> <p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the</p>
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		<p>number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>P9: No, no they say they will ring if there's anything wrong but I don't trust that, because they never managed to get anything else kind of consistent, so I always ring up just to say was it alright and they always go yes it was fine but you don't get anything more than that</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>P8: Yeah and I think, I did join slimming world when she was I think she was about 8 weeks old, but, I because I was breast feeding I was aware I could lose weight but very slowly and steadily and what put me off was I went, and because I'd lost like 1 and a half pounds and the consultant said to me so what are you going to do next week to up that, you know we need to increase your weight loss, I sort of sat there and thought no, because I've been told, I'm breast feeding and I need to be losing 1 pound a week, so 1 and a half, so you're clearly not clued up on this and she knew I was breast feeding and that's kind of what put me off going back, so I think having somebody that know their stuff is more important especially</p> <p>P8: There is a misconception of course that it's just sugar, and of course sugar doesn't mean just like that, it means carb sugar and every type of sugar going</p>
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		<p>P6: And we never really got into a discussion that much about food because I think every time they kind of started to discuss it I'd go well I've had this that and the other and they kinda knew that I knew what I was doing</p> <p>P6: Whereas with my second one I was very on the ball and kind of when are you checking his blood sugars and if I feed him now when do you want to check and I knew a bit more</p> <p>P6: Yeah I think the key think for it is, people being informed about what they can and can't eat really, and I don't just mean that in terms of like oh don't eat chips, because it's not a case of don't eat chips, but I remember when I saw the dietician in the first pregnancy, she went oh well if you have chips you can have 6, I was just like well what's the point in me eating 6, I'm not going to put 6 chips on my place</p> <p>K: No,</p> <p>P6: There was no offer of an alternative, or pairing it, or sweet potato fries which I actually could tolerate, nothing about the fact of, oh, when you cook a potato like a jacket potato, the sugars increase and that will effect you a lot so you might be able to tolerate if you say, mash it, but you wouldn't be able to tolerate a jacket potato, there's a real lack of anything like that and explaining things, which urm it might sound, it might sound well oh well that's kind of quite obvious but it's not necessary because we're just in this minefield of what can I and can't I eat and also just making people aware that just because I can eat it doesn't mean you're going to be able to because our bodies react so differently</p> <p>P6: Yeah absolutely, like with my first pregnancy was when the protein bars came out and I remember Joe on the facebook page said like is anybody willing to like spike test these and I said yeah I'll do it and I couldn't tolerate them and I was gutted, but so many other people could, but then this time round I was able to</p> <p>K: Yeah yeah, I wonder why that is, that's just crazy isn't it, really, kind of like with the curry as well, it's fine one minute</p> <p>P6: Yeah your body reacts so differently to like different things, I remember at Christmas insulin this time, so I knew constantly what my levels were and I tried a bit (inaudible) and it barely affected my levels and I was like wow, and I even finger pricked as well because I thought oh there's something wrong with this sensor and I was finger pricking literally every ten minutes</p> <p>P6: A lot of people would go no I'm going to 40 weeks because they do their own research and things but,</p>
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		<p>R: yeah and so how long was it before they followed up with you?</p> <p>P10: well it was a good two weeks from the test, and yeah I'm really cross. I already raised a complaint with the hospital, especially after I'd done my own research and realised how sort of, how wrong GD can go, and how important it is to just nip it in the bud and be conscious of what you're doing from the very beginning. Yeah, it was a bit scary.</p> <p>P10: yeah, thankfully I used the wonderful internet! And a search engine called google [laughs], and I came across Jo's website, gestational diabetes.co.uk, and I don't think if it was...If I hadn't found that website I would have definitely ended up on medication and the birth would have ended up a completely different story. Literally the advice on that website and all the reach papers where she had got all her information from....because I started to just read up as much as I could about the condition and just sort of tried to make my own informed decisions about what I could try....because loads of people had sort of said drink two shots of apple cider vinegar every night and you'll be fine [laughs] so I just really wanted to see if there was research out there and Jo had already done half of the job by putting together a lot of the information, which was a real life saver for me.</p> <p>P10: No, not really. There were a couple of TED talks that were posted on the Facebook support group that I did watch and they helped me to understand a little bit more about how eating carbs actually affects your blood sugar. And how pairing your food sort of helps to combat the sugar spikes. So that was probably the only other resource I did use and then went on....oh god what are they called....the association for gynaecologists....that lot....and the NICE guidelines, I used to read them a lot, to help me understand.</p>
	Looking up Info (K)	<p>P2: But I ended up just doing research myself and found the gestational diabetes mums website, and err the support group on Facebook.</p> <p>P3: Umm probably the support group I think, because the medical side of things is like oh well you can kind of look that up and find it out yourself, because I did that anyway because the information on the leaflets was very simplistic, and didn't really go into anything and I suppose they make it that way so that everyone can understand but it was a bit like no, so I went and looked it all up anyway</p>

		<p>P4: I got a voicemail on a Friday at 6pm saying 'oh your levels were slightly too high, so we'll see you in about a weeks' time' and that will trigger anxiety in me so I went to do some research and I just googled, 'gestational diabetes Oxford JR' and then I noticed that there was a couple of old newspaper articles about that particular application, so I went to look at it and downloaded it, it was already downloaded by the time I went to hospital. I've got the Hermione Granger syndrome [laughs]. It's just how I cope. I don't want to be too much, but if I'm faced with a problem I'm going to have to find a solution. So that was it.</p> <p>P4: I googled and I found the website gestationaldiabetesuk and I think she has links to that as well and she has an Instagram page which is good as well</p> <p>P7: So I had about a week and a half I think, after id been diagnosed, before I got any advice. But in the meantime I did a lot of googling and found gestational diabetes.co.uk and the Facebook group and everything, so I felt like I had quite a lot of information before my first meeting</p> <p>P7: I mean there might have been a bit of a conversation, but I mean I had already gone and read lots of the follow up stuff on the website, so I felt informed...so it wasn't like oh, what happens now... I've read all the stuff I've read all the nice guidelines, I'll book in for my annual HBA1C, yeah so I didn't really feel like I needed anything else,</p>
Risk Awareness	Type 2 Risk Awareness (K)	<p>P1: But because my dad's diabetic its always in my mind anyway so I proactively chased, but yeah no one followed me up</p> <p>P4: I just kept eating, along roughly with the idea of snacks in the morning but I've developed a really liked for peanut butter with flax seed in it, it's really crunchy and nice and I have that with apples... just my portions of carbs, like a portion of pasta for example has gone down so much. I mean its benefited by whole family, my husband has gone down 11kg over the summer months, I mean he was part of a study so he was really encouraged, but my two daughters we'd spoken about it because there's type2 in both of our families, but we don't stop them from having sweets or whatever, it's just being mindful of it.</p>

	GD Reoccurrence Awareness (K)	<p>P1: Oh, oh no I'm convinced I would have it. But this time around I would start testing my bloods on my own using my dad's monitor and take them to the midwife.</p> <p>P4: it doesn't concern me in the sense that oh my word I don't know what I'm doing or whatever, but it does, I mean I don't have the energy right now I have an 8 month old, I just feel too exhausted. There was one person who told me, I had just been diagnosed, and she gave me the most British and the most freeing answer, remark ever and she said 'oh what a bore!!' and that really defines it so well it really is just fucking boring, to check all the time and think about what food to have</p>
	Fears (H)	<p>P9: Yeah, well I ended up with forceps on my first birth coz I had to have the drip to speed things up because it had been too long, so I was like, a bit of the induction bit, and I'd been so frightened of that that I had an epidural and then ended up with forceps and I kind of just felt like that was all going to happen again, you know what I mean, so, as it turned out it didn't, it doesn't help the, not only worrying about damage to your baby, daily, with what you're eating and if you're levels are too high and all that sort of thing, then you're worrying about if the birth will be horrendous as well as a result of it, and you're already thinking they're at increased risk anyway, so it kind of, it's a combination of all of those things I think</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>K: These things never do do they, and would you say that, that reducing the risk of getting it again was that quite a strong motivation for you?</p> <p>P8: Urm, yeah yeah</p> <p>K: Yeah, quite a few women say there's a really strong motivation to eat healthily whilst you're pregnant because you know, the baby essentially,</p> <p>P8: The baby yeah, and then as soon as the babies out (laughs)</p> <p>K: (laughs) yeah sure</p>

		<p>P8: Yeah I mean it's definitely not enjoyable to have it whilst you're pregnant, and I think, because I did have a few complications with my last pregnancy I didn't want to go through that again but</p> <p>R: yeah and so how long was it before they followed up with you?</p> <p>P10: well it was a good two weeks from the test, and yeah I'm really cross. I already raised a complaint with the hospital, especially after I'd done my own research and realised how sort of, how wrong GD can go, and how important it is to just nip it in the bud and be conscious of what you're doing from the very beginning. Yeah, it was a bit scary.</p> <p>R: So when you went on the Facebook group and the website, what were the most useful things about it?</p> <p>P10: So, I was really trying to understand how the gestational diabetes would affect the unborn child. And sort of how I could try to keep my blood sugar levels stable, throughout the period and sort of understanding when...because at certain points during the pregnancy I was becoming more insulin resistant...things like that....just trying to get a better overview of exactly what were the risks associated with GD, what could go wrong potentially, and the good stories as well from women who had got through to the other side and their babies were ok and they were able to do it diet controlled as well so. So yeah a lot</p> <p>R: fantastic and now that you've had your baby would you say that that motivation is still there?</p> <p>P10: ummm, yeah I will not lie for about three months after everything just went out the window, it was like finally I can eat chocolate, I can have as much pizza as I want. But now I'm just sort of slowly trying to get myself back together with exercise and I am quite mindful of diet, especially with the children, so I've got a toddler and I've just started to wean my baby as well so, I am aware that they might be at a higher risk of developing diabetes later on, so I'm just trying to instil good eating habits for later on and for everyone.</p>
<p>Current Lack Of Information (Lack of Information felt,</p>	<p>HCP Recommending mhealth (K)</p>	<p>P2: They did direct me to gestationaldiabetes.co.uk, I think.</p> <p><Files\Webinar Interviews\P3 15.10.2019 transcription> - § 1 reference coded [0.89% Coverage]</p> <p>Reference 1 - 0.89% Coverage</p>

poor communication with HCP, limited NHS information, desire for more information and better communication, this need could be met with mhealth, which stakeholders identified a desire for, and reported being open to post-partum support).		I cant remember exactly what they were called but basically there's a support group for gestational diabetes which had their website on one of the leaflets
	HCP Recommendation for mhealth desired (K)	<p>P2: You mean like who would I take seriously if someone offered me an app? I suppose like if a doctor said to me like you need to, then I would. But even with the HBAC1 I don't even see the doctor for that, it's just done with the nurse at the practice so. But yeah, if a doctors had recommended it to me then I would take it seriously</p> <p>P3: I mean I suppose, if its endorsed by any organisations or anything like Diabetes UK or something like if they said it was good then you'd probably think oh well that's going to be alright then. I don't know what it is, you sort of just feel your way with that sort of stuff don't you?</p> <p>P3: yeah I think like midwives, I think GP's not so much because you don't really see them very much but definitely if it was something that the midwives would recommend to you I think that would be pretty good</p>
	Lack of NHS info (K)	<p>P1: the NHS guidance with their wheel and sections within in the wheel was saying things like....wheatabix, but one wheatabix would raise my blood sugars up to like 9 point something which was way over the NICE guidelines, when then obviously made me feel crap. And, I was putting unnecessary sugar into my unborn daughter,</p> <p>P1: just a lot of things that the NHS guidance didn't say. There was no guidance on pairing foods or making sure were eating protein and fat with your carbs to balance out the sugars. There was nothing like that.</p> <p>P2: errrm, not really. They did direct me to gestationaldiabetes.co.uk, I think. But I ended up just doing research myself and found the gestational diabetes mums website, and err the support group on Facebook. So I found that, and to be honest, that was the biggest help in my gestational diabetes journey, for sure because it really helped me to manage my diet well. I made the right choices.</p>

		<p>P3: Well not hugely really because they just gave me metformin, umm and then said about oh stick to a low GI diet, and they didn't tell me a whole lot about that they just gave me the information leaflets and told me like go on the NHS website and things</p> <p>P3: No, not really no. They just gave me quite a lot of bumpf to read and that was it really</p> <p>P3: Umm probably the support group I think, because the medical side of things is like oh well you can kind of look that up and find it out yourself, because I did that anyway because the information on the leaflets was very simplistic, and didn't really go into anything and I suppose they make it that way so that everyone can understand but it was a bit like no, so I went and looked it all up anyway</p> <p>P4: Yes so I went to the dietician, who gave us the advice from the type2 diabetes, she was like oh you can have one scoop of ice cream and I was like no I can't have one scoop of ice cream, it's not possible I'll have to wait.</p>
	Lack of Info Post Partum (K)	<p>P1: Nope, I had to call my doctors up and ask for a HBA1c. And then when I had the following year, you know your meant to have them yearly, I had to do it again. Like....laughs They tell you that once you've birthed the placenta, that's the end of it</p> <p>P2: I was never given any advice on how to, you know, change my lifestyle or maybe try and lose weight, again those thigs I got from that website. That I knew I should actively try and lose weight and try to be more active and things.</p> <p>P3: And then they just said that umm, its leaves you at risk of type2 so yeah I've just got to be kind of careful not to get too overweight and be careful of what I'm eating and not too much naughty things and all that sort of stuff and too much booze and everything</p> <p>P3: Yeah there is that disconnect for sure, like once you've had your baby and you've had your 6 weeks checks and all your stuff and they've had all their vaccinations, cos he's had all his until he's one, then you don't see anyone....at all... and your like oh, this is a bit weird because there's been so much healthcare stuff and then its like yeah you don't need anyone now.</p>

		<p>P7: I mean there might have been a bit of a conversation, but I mean I had already gone and read lots of the follow up stuff on the website, so I felt informed...so it wasn't like oh, what happens now... I've read all the stuff I've read all the nice guidelines, I'll book in for my annual HBA1C, yeah so I didn't really feel like I needed anything else,</p>
	<p>Open to Post Partum Weight Support (H)</p>	<p>K: 100% I think that's what we're kind of getting at, people kind of seem to be abandoned a little bit afterwards, how would you have felt if someone did come to you with a plan, or come and said we want to kind of support you to help prevent that risk of type 2, would you have been open to that do you think?</p> <p>P9: Urm I mean yes, I think, I think it is a difficult thing particularly at that time, when someone has just had a baby and, it's never the most, emotionally sane part of your life, so to then have someone going yes and you need to make sure you exercise and eat healthy when I'd had like two hours sleep is a difficult conversation but I think it needs to happen at some point, even if it's not you know, week 2, urm, I think it needs to happen at some point, and you might not particularly want to have the conversation but I'm not sure that's a reason not to have it, you know nobody ever wants to have conversations about potentially negative things, but the reason for doing them is to stop something worse happening so, I think open to it is always a slightly difficult thing because I think most people would always prefer to put their head in the sand in a way, and go, I hope it will all be fine, but I don't think that's necessarily the right approach coz we'd never have vaccinations, we'd never have smear tests, we'd never go to the doctor about anything if you took that approach</p> <p>P9: I sort of feel like it should start probably around, coz you go for your 6 week check, when really kind of any outstanding issues should have a plan of what to do about them, whether that be you need physio or you've got issues with stitches or anything and I feel like kind of GD should one of the things that then sets you on a path from there, you know not necessarily you have to change your life in week 6, but, that's normally the time when people are starting to go, I'm starting to feel okay, I might start trying to do a bit more exercise, coming slightly out of the urm, shock of new baby, so I think that should be the start of it, around then, but then it should, I don't think it should be give people a leaflet and then</p> <p>K: I didn't know if you thought that was something that was useful or something that you would use, I mean obviously maybe, you said you're pregnant again, hopefully you won't get it again, but maybe next time around?</p>

		<p>P8: Yeah I think I would because then you haven't got to wait the 2 weeks or however long it is before someone gets to see the results, even if they're not over the range they might be near the top of near the bottom, sometimes I had really low readings but they say only contact us if you're above, urm, but no I think that would be a good idea</p> <p>K: Yeah and either, after you have your next baby or after you had your last child, how would you feel about someone supporting you with your weight loss journey at that time?</p> <p>P8: I would have loved it. I think it would have been the best thing for me, I think because at that point especially so soon after the birth, because I breast fed as well, so you're thinking I'm just absolutely exhausted all I want to do is eat rubbish, and then because my partner is tired because he's up in the night with the baby as well and then so he's, although he's supportive he just wants to eat crap as well whereas if I've got someone going actually come on no remember, remember how it was when you were eating so strictly because of the diabetes, do you really want to get that again, you know, you don't want to keep feeling like you've not lost enough weight and the rest of it, I think that would, yeah, it would have been massive, a massive massive help</p> <p>P8: I think in my head, I had it at my post-natal check so what's that, sort of 6-8 weeks because I think that like when you've had that 6-8 weeks to do what you want, to eat what you want, now it's time to sort of start being sensible again</p> <p>how would you have felt if someone had approached you about weight management after you'd had your baby?</p> <p>P6: Urm, I would have felt quite happy to be honest, and I think if it's approached in the right way and said like because you had this you're not at high risk of actually getting diabetes, how can we support you, I mean, to be honest, I probably would have said no because they probably would have stuck me on slimming world or something like that, which is so carb heavy</p> <p>K: yeah</p> <p>P6: And also, I've done slimming world before, and do you know what I did, I ate loads and loads and loads of foods that were free it's only in retrospect that I can see, I was actually eating more than I was before, because I was eating these so called free food which I don't think is the way, well it's certainly not the way to go for me, I'm not saying for everybody because a lot of people have lost weight using it, for me it's certainly not, so yeah I would have been very open to it, especially if it's approached in the right way,</p>
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		<p>P10: so after you'd had your baby and the support afterwards, if somebody had come to you and said we want to support you to stay healthy, how do you think that would have felt?</p> <p>P10: I would definitely have been open to it, I mean I definitely couldn't of committed to weekly appointments or weekly meetings but perhaps just attending one session to just discuss the implications of you know, what diabetes could look like in the future and to understand how its not just important to make changes for myself but also for the children as well, it would have been quite beneficial because I did feel that the very first appointment I had with diabetic nurse was just a waste of time, it took about 10 minutes in total. And it's a big thing, learning about how to eat probably because you don't really do it, not unless your parents were very good. It's a big lifestyle change when you're trying to sort yourself out</p>
	<p>Discontentment with HCP (H)</p>	<p>P9: I had a urine kind of dip test with the midwife and that indicated that I think there was sugar in the urine so they thought I probably did have it</p> <p>K: Okay</p> <p>P9: I had missed a test before that, they hadn't done one, so I do have a sneaking suspicion that I had it for longer than they found it for</p> <p>K: Aw nice, yeah yeah, and so after you got the diagnosis, did they give you any advice about changes you needed to make, like dietary or?</p> <p>P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective</p> <p>P9: So I followed more closely a website that I'd found which was UK Gestational Diabetes</p> <p>K: Yeah yeah</p> <p>P9: And they have a, they have a Facebook group, so I ate less carbs stuff than the hospital would have told me, because they were still recommending having things like cereal for breakfast which just would have sent me way higher, so, I kind of, I did have the advice but I didn't really follow it very much what they said, so after, following the diet I kind of came up with I guess from reading then my after food levels were always fine, I struggled a bit with fasting levels first thing in the morning which is why they increased my metformin</p>

	<p>P9: No, no and I don't know whether that has actually changed in the last couple of years, it's a slowly changing thing in different NHS trusts, so it may not be the same today, but it was, I wasn't convinced by it as I said</p> <p>P9: Yeah, so I had a bit of a meltdown with my hospital because I wasn't allowed a water birth because there was no water pool in the high monitoring bit because it had been broken for like 8 months or something, which my first birth was fairly horrendous and the water bit was the only bit where I'd felt vaguely comfortable, so I found that very difficult, the thought of having to be monitored on a bed, not being able to move around as much, not being able to go in a pool, was a bit kind of, not a great prospect to think about, as it turned out, because I went into labour naturally and it was quite quick it was miles better as a second birth anyway</p> <p>P9: No, no I mean not that I remember finding anything that was I mean there was obviously NHS website, that I read about it, and I think the hospital give you a leaflet which covers much of what the website did so that was kind of fine for the basics of what the issue is and why you've got it and the NHS's view of what that means, for kind of birth and things,</p> <p>K: Yeah</p> <p>P9: But it's quite generic and each trust seems to have a different approach anyway so it wasn't that useful in terms of what was going to happen, it was more of a basic, this is what GD is rather than much more than that</p> <p>P9: Yeah I think I found the website before I'd actually had my dietician appointment, from memory</p> <p>K: Ah okay</p> <p>P9: Because it was kind of Christmas I was diagnosed so it was a few days before I could actually get to see somebody</p> <p>K: Yeah that's a common experience actually, some women it's been a week or two weeks</p> <p>P9: Yeah it was, I went in for the testing thing then it was a couple of days later before I could actually see a dietician and so it was a little bit dragged out so I went and looked on my own in the mean time</p> <p>K: Yeah I think a lot of people do that, I'm just intrigued as to what it is, a lot of women talk to me about the website and the Facebook page and it's clearly a fantastic resource, I'm just intrigued on what made you trust it, because there's so much information online isn't there that you kind of think</p> <p>P9: Yes, and I think there's something obviously about how the website is done that's it's a reasonable professional website but it also seems to have a real person behind it, and I know you can never trust</p>
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		<p>these things, but that does at least give you some element of reassurance I think, urm, and I think the fact that it had the corresponding facebook group with so many people talking about what they found and saw and did and what their results were and you know, it wasn't just reading a page on a website on it's own, and I think just the fact it seemed more logical to me, in a kind of you know, knowledge of nutrition to the extent that I had any, it didn't seem to me that what the NHS advice was would achieve the right results in terms of reducing blood sugar, so a combination of all of those things I think, and the number of people involved, a real person behind the website seeming to kind of you know, have the right interests at heart, and just logic of what they were saying, if it had been something ridiculously outlandish then I would have felt differently about it, but it's not ridiculous advice it's just slightly different to what the standard NHS advice is,</p> <p>K: I think that the monitoring thing is really important, just thinking back to apps and things, if there had been something, say an app, that your midwife had offered you, what would you have most wanted it to support you with, at that time?</p> <p>P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I, before the paper thing, I would have expected at least that functionality that someone was actually looking at what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>P9: Yes, because the paper system is terrible, but at least the kind of sending, you know they chased me up via text if I hadn't sent them a reading, it was an automatic thing I'm sure but you got chasings and then I assume it would have escalated to someone if I hadn't done anything about</p> <p>K: Brilliant, yeah I was just going to ask you that actually that was going to be my next question, fab, and so after you'd had your baby, did anyone talk to you about what would happen afterwards with the diabetes?</p>
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		<p>P9: Urm not much, no, so, urm, I think I was asked to do testing for like a couple of days afterwards, finger prick testing, but I'm not sure anyone was actually really interested,</p> <p>P9: In whether or not I was doing that, they obviously checked blood sugar levels just after kind of labour, but, then, they didn't really seem fussed after that, I was in hospital for a night and then went home, urm, and then I was told to book in for the, is it 6 weeks afterwards blood test, but there didn't seem to be any process for making sure I did that, or I find that haphazard whether people know they're actually supposed to do that in the midst of having just had a baby, I suspect lots of people miss that, I'm amazed that's not an automated, you know we've made an appointment for you, make sure you come in kind of process, so, there's no kind of follow up, I just have to ring up and ask if the results are okay, and they don't tell me what the numbers are or anything, so I find it really, kind of, I don't know whether I'm high, low, I'm obviously what they class as not needing to do anything about it phase, so I've had the one from birth and the annual, the one after that, I've had one more and that was exactly the same, the just say it's fine over the phone the receptionist, they don't give you actual numbers</p> <p>K: They don't give you a reading</p> <p>P9: Which I just think is really bad, because they're actually wanting people to make lifestyle changes as well, you know, giving people more information as to actually, where they are and what the kind of range is I think is fairly essential, but you just don't get it at all and I don't think anyone would remind me if I didn't go for it either</p> <p>P9: It's just up to me to remember, around BABYS NAME REMOVED birthday to make an appointment and then ring up to check the results</p> <p>P9: No, no they say they will ring if there's anything wrong but I don't trust that, because they never managed to get anything else kind of consistent, so I always ring up just to say was it alright and they always go yes it was fine but you don't get anything more than that</p> <p>P9: Yeah I just think if it's genuinely the risk of developing type 2 diabetes is so much more and that costs such a lot to deal with and causes so many issues, I find it quite staggering that there's actually no post-birth support plan, action, anything, advice, nothing</p> <p>P8: Urm, I was, I think, they told me I had it on the Tuesday or the Wednesday and I had to go to a like, a group, on the Friday, I think it's about 2 hours, urm, and I went with my partner, and they went through kind of what diabetes is, it's very very general, urm, all what sort of things we should avoid, what would</p>
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		<p>be the possible complications if our sugars weren't controlled, urm, possibility of needing medication, and then they showed us how to use blood urm, blood testing kit, but yeah it was very general</p> <p>P8: It was just, it was very sort of urm, you just sort of need to, if you normally eat bran flakes then eat bran flakes and if your sugars too high then don't eat them again, that kind of thing, you know don't go and eat a pot of jam, just be careful, limit your milk and bread and stuff like that, urm, but they, they didn't come across that we needed to be as strict as the diabetes doctor was telling me, because obviously the diabetes doctor when I saw them was sort of like no if you blood sugar goes above this number then we need to put you on medication rather than it's okay just don't do it again,</p> <p>P8: Urm, I had a little bit of knowledge because of my dad and I used to work in care, but, I had no knowledge what so ever in terms of GD, so I used a, there's a group on Facebook, and I can't remember the ladies last name but she's Jo something, and she does lots of recipes and there's lots of chats on there and that was the main thing that I used really and that's where I learnt about the food pairing, urm, and urm, all the rest of it, so I kind of got more from that, and sometimes the internet I suppose, urm, than</p> <p>K: So was that your GP you went to for that test P8: Yeah, well I saw a nurse, I booked it myself, but yeah K: And did that come back all fine? P8: I never heard, so I'm assuming yes (laughs)</p> <p>P6: First time I had it, I got diagnosed well, I got diagnosed officially at 28 weeks, but due to no one informing me I didn't find out until about 29 30 weeks K: Okay P6: I had a midwife appointment and she said oh did you find out your results and I said no I assumed you were going to contact me if there was a problem and then she called the hospital and my after reading was 8.2 so</p> <p>P6: my second pregnancy was a nightmare to get diagnosed</p> <p>P6: I knew I was high risk of getting it again, so I basically had to call the doctor and lie and told them that the consultant had told me that if I got pregnant again I had to start testing straight away</p>
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	<p>P6: My BMI was healthy, and everything, but my results were all coming pretty much over, all 10's and things, so I spoke the midwife and she said oh no absolutely not, and then she said it's just because you're feeling nauseous because I had urm, it wasn't morning sickness it was just nausea all day basically</p> <p>K: yeah</p> <p>P6: Urm, and I was like ah that doesn't really ring true and she told me that there wasn't a clinic at my local hospital anymore because I knew that it was on a Tuesday and I was willing to just pop up and see somebody, she said oh no no it's all in Canturbery now it's all changed, and I thought okay, and I had it about a week later, I had to go for an early pregnancy scan, because I had a little bit of bleeding when I found out</p> <p>P6: And Urm I noticed signs up about the diabetic clinic so I happened to say to the midwife like do you know anybody who I could speak to and she said oh yeah they're all here today and she got me a lady urm, Natalie, who was so helpful, and I'd been writing down all my readings, so they got me a book and got me urm just got me everything that I needed basically, and said right do a week of readings and then send them over to me and we'll take it from there, so I did that, sent them over to her called me back, she spoke to the consultant and they said yeah he'd like to see you, so then I got to see him, a week later and urm she said on the phone oh yeah he wants to put you on (Metformin?) straight away, so urm, I went to see him, and he was like hm yeah while your readings fine this week they weren't the week before and I was like yeah because the week before I had to eat normally to show you I've got it</p> <p>K: (laughs) oh my gosh</p> <p>P6: You don't believe me and I don't want to do the glucose tolerance test</p> <p>P6: It was funny because when I went in to see the midwife because I didn't have a midwife at this stage you see so I was just calling up saying I need some help, and then I was like yeah yeah I've got GD, and she was like what what, and I was like yeah I've spoken to the consultant myself I've got an appointment this week and she was just a bit like uh uh uh uh</p> <p>P6: Yeah and to be honest there's a lot, because of that facebook page, and the website and everything, that I knew a lot more, because if I didn't I would have just taken her word for it</p> <p>P6: Yeah, they couldn't understand why I couldn't tolerate porridge and things like that, and the only bread I could tolerate was protein rolls from Lidl, but they didn't even know what they were and it was only because of the facebook page that I found them, and it was the same this time, they don't do them now but I have got low GI rolls that they do now because I just couldn't tolerate anything and I normally just, I normally eat seed sensations bread which in theory should be fine</p>
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		<p>P6: she was like no no you won't need that, your body with automatically know what to do but I ended up with an emergency c-section and it took ages to phone me up to come in and I very nearly gave up on breastfeeding it was only because I knew it lowered his risk of diabetes that I really stuck at it and I fed him for two years in the end</p> <p>P6: I mean I looked on the NHS website but their information is very limited urm on there</p> <p>P6: there was very little about the carbs it was very much just about this plate and make sure you've got an equal amount of everything, it was only the facebook group that told me about the pairing and everything which seems to really work for me</p> <p>P6: the NHS is very much about not testing, don't test, after an hour</p> <p>P6: Yeah yeah definitely, and, I don't know if it's part of your thing, but the hospital being able to cater for somebody with diabetes was just unbelievably poor</p> <p>P6: Yeah, I mean this time I went in prepared, I mean my little one is only 7 months it was only recent but urm, I've had a hypo during the night and their answer to that was to give me a couple of biscuits K: Brilliant</p> <p>P6: I'd been really shakey and then I was so hungry because of it but then in the morning I was literally just waiting for breakfast and she came around and basically offered me cereal or I could have a slice of bread K: Toast with jam probably (laughs) P6: No didn't even get toast it was a slice of bread didn't have toast, just a slice of bread K: Wow P6: At that point I literally went, I had a meltdown, the head midwife came in and everything, and I was just like that, I said I'm not sending my levels sky high knowingly because you can't cater for me</p> <p>P6: And I didn't even take my insulin that morning, which I'm glad I didn't because my levels were massively low when I was in labour and I had to have glucose drink and everything, and I was very lucky in labour the second time round because the midwife was diabetic K: yeah P6: So she had such a good knowledge herself</p>
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		<p>K: Yeah</p> <p>P6: Where as everybody else was kind of like oh eat a biscuit eat a biscuit and and she was like right what have you done and I was like right I've eaten jelly babies, (inaudible) minutes later, in the 4's in the 3's and she was like right okay let's get a glucose drink, where as I think had I spoken to anybody else they wouldn't have done that</p> <p>K: Yeah yeah it's almost like a kind of lack of knowledge ins't it really</p> <p>P6: Absolutely, I that is what it is, it's just a lack of training and a lack of understanding and you know people don't realise how serious it can be</p> <p>P6: I know, you know a lot of women don't take it very seriously but I think a lot of the time they don't take it seriously because of the way it's kind of proposed to them, it's just like oh yeah you can take this medication and this will magically allow you to eat everything, well.. no</p> <p>K: Yeah, interesting, so urm after you'd had your baby, did anyone say anything to you or offer you any kind of support in terms of kind of looking after yourself? With regards to the diabetes</p> <p>P6: No (scoffs)</p> <p>P6: And again, urm, especially for the first time round, I only knew that I had to have regular HBA1c's due to that facebook group and actually when I went for my six week check actually the GP was good because I said to her I need checks, she said oh have you had diabetes and I said yeah, she said oh that's really good that you've asked for it, there's lots of people who ignore it</p> <p>P6: But the consultant didn't tell me anything about it, it was only through the facebook grou</p> <p>K: Through that facebook group,</p> <p>K: It's just fascinating, I think that facebook group to kind of be credited for you know</p> <p>P6: Absolutely, and do you know the really strange, well not strange, but, the thing is, in my first pregnancy obviously they gave me this eat well plate, the second pregnancy there wasn't even a dietician available to see and urm but then, what they were advocating to a big degree was what was on the website and on the facebook page</p> <p>P6: And we never really got into a discussion that much about food because I think every time they kind of started to discuss it I'd go well I've had this that and the other and they kinda knew that I knew what I was doing</p>
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	<p>P6: So that that is what he wants all the time, it's just a case of well these are the choices and I mean he's at greater risk of getting it now and I really don't want him to get it,</p> <p>K: yeah yeah for sure,</p> <p>P6: Which again is something not discussed really either by the NHS, it's only through the facebook page that I even know about that</p> <p>P6: Yeah and well, the first, during my first pregnancy, I saw this lady consultant, for my first appointment actually I was with my husband at the time, she basically turned around and told me that I had diabetes because I was fat, and I then had to go outside and wait to see somebody else, and I literally sat in that waiting room crying my eyes out with my husband going to me, it's not your fault,</p> <p>K: Yeah</p> <p>P6: And urm I actually refused to see her this time, I saw her and I said to the midwife whoever that is, I don't want to see her, and I didn't I saw, urm, not the consultant, whoever is above them, registrar is it, I'm not sure, but then I seen somebody else and I saw the same person the whole way through, because it's hard enough having diabetes, and I'm not stupid, of course my weight probably was a risk factor but people who are really skinny get it as well,</p> <p>P6: So to make me feel that low and to feel so responsible was just, it wasn't necessary,</p> <p>P6: Well no, like I said, just letting people know that they're now at risk because no body had told me that from like the NHS</p> <p>K: Really</p> <p>P6: It was all from this facebook page that I seen it and I suddenly thought oh my God my sons now at risk and like no body told me either that my son had to have his blood glucose checked and actually with my first son I had to chase it up because they didn't do it, but that would be another story to complain about, the whole, after bit</p> <p>P6: Whereas I think my son was born about half 2 and nothing was checked until about 8 o'clock that night, and luckily he was fine, but it could have easily gone the other way (34:42)</p> <p>P6: Yeah I think the key think for it is, people being informed about what they can and can't eat really, and I don't just mean that in terms of like oh don't eat chips, because it's not a case of don't eat chips, but I remember when I saw the dietician in the first pregnancy, she went oh well if you have chips you can have 6, I was just like well what's the point in me eating 6, I'm not going to put 6 chips on my place</p>
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		<p>K: No, P6: There was no offer of an alternative, or pairing it, or sweet potato fries which I actually could tolerate, nothing about the fact of, oh, when you cook a potato like a jacket potato, the sugars increase and that will effect you a lot so you might be able to tolerate if you say, mash it, but you wouldn't be able to tolerate a jacket potato, there's a real lack of anything like that and explaining things, which urm it might sound, it might sound well oh well that's kind of quite obvious but it's not necessary because we're just in this minefield of what can I and can't I eat and also just making people aware that just because I can eat it doesn't mean you're going to be able to because our bodies react so differently</p> <p>K: health care professionals like to think that they inform women about, you know, what GD is and what your risks are but then that's not what I'm hearing back you know so yeah P6:I don't think the midwives even know themselves, I don't know what their training is but, with my first pregnancy my midwife was amazing, I remember her calling me and going I can't get you an appointment for another week, and just don't eat sugary things up until then, and that was just her being genuine it wasn't, she was trying to help me because that was her knowledge of it, and even when we popped in to see her when I had my son, she saw how much weight I'd lost and she said oh you won't get diabetes next time, and I bit my tongue coz I was like that, I'm not gonna say anything because you're so nice, but saying things like that is so upsetting, because it's almost oh well you had it because you were fat</p> <p>K: Flip side of it P6: Just the education among the NHS staff is just so lacking, and I think even if they could do, like I don't know, I don't know how they do their training, but like interviews with people who've had it for example and even like conversation like this, so they can see how it affects somebody and what they were missing out on, and they all had to view something like that, it would be so beneficial for them to actually see it from that perspective</p> <p>P6: What it means to that individual, like that consultant who said to me I got it cause I'm fat, that wasn't what made me follow that diet, what made me follow that diet was I had a baby inside of me to care for, you making me cry, just made me want to go out and eat everything in sight,</p> <p>R: yeah and so how long was it before they followed up with you? P10: well it was a good two weeks from the test, and yeah I'm really cross. I already raised a complaint with the hospital, especially after I'd done my own research and realised how sort of, how wrong GD can</p>
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		<p>go, and how important it is to just nip it in the bud and be conscious of what you're doing from the very beginning. Yeah, it was a bit scary.</p> <p>R: so, once they had got round to following you up, what kind of advice did they give you in terms of managing the diabetes?</p> <p>P10: [Laughs] Oh my god, right so, I got a lovely letter through the post saying please go and see the diabetic nurse for an appointment to discuss your GD. Turned up thinking yes, this is gunna be a one-on-one appointment, I'm going to be able to blitz so many questions and figure out how we're gunna deal with this. But it was a group appointment, with five other women, which was a bit of a shock to start off with. And then this nurse just started to proceed with 'right you're all here because you've got gestational diabetes, yes its rubbish, most of you are probably going to go on medication, just avoid white carbs, eat brown carbs, and you'll be fine. I've written down in your booklets when you need to test your bloods, this is how you use the machine, and off you go'. And that was that. And it was really, really rubbish.</p> <p>P10: Oh god yeah, because my first consultant appointment, he looked at me and said 'well your numbers are all perfect but we'll see how you go, you'll probably need to end up on the ward' I said, 'well, that's not what I want and that's not very proactive', because surly it's cheaper for the NHS to give out dietary advice than it is for signing everyone up onto drugs but yeah that kind of just made me more determined to just do everything that they wanted.</p> <p>R: I think that's the key isn't it, that it's for everyone. So after you had your baby did anyone give you any advice about what would happen to the GD?</p> <p>P10:]laughs]...no, absolutely nothing. I mean the midwives were just very surprised that my son passed all of his blood sugars because I had to fight to have a home birth as well, because I had previously had a c-section so I was already high risk and it was all full on drama, I had to get new hospital polices written up and everything. I was a real pain! So, I think when they did the last sugar test for the baby they were like, right, that's it, let's just get out of here and not talk to her every again so, no one really mentioned anything. And then I had an 8 week check up at the GP where she proclaimed that I would be diabetic really soon because I had GD and I'd had to go in for an annual blood test every year. That was it.</p> <p>P10: well I hope it does happen because there's a real gap in the market, I mean I was talking to some women who've had GD in the past and we just don't know what to do next, and there's a huge lack of information from the NHS, and I think that's partially because they don't know themselves what is the</p>
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		<p>best advice. I mean the midwives didn't have a clue really, and I don't blame them they've already got enough to deal with. There is definitely a need for something out there.</p>
	<p>Lack of Information (H)</p>	<p>K: Aw nice, yeah yeah, and so after you got the diagnosis, did they give you any advice about changes you needed to make, like dietary or? P9: Ur they did, they gave me a sort of booklet and I had a meeting with a dietician person, ur bring honest I'm not entirely convinced about the dietary advice they give, in that I think it seems a bit carb-heavy and a bit basic really to actually be effective</p> <p>P9: No, no I mean not that I remember finding anything that was I mean there was obviously NHS website, that I read about it, and I think the hospital give you a leaflet which covers much of what the website did so that was kind of fine for the basics of what the issue is and why you've got it and the NHS's view of what that means, for kind of birth and things, K: Yeah P9: But it's quite generic and each trust seems to have a different approach anyway so it wasn't that useful in terms of what was going to happen, it was more of a basic, this is what GD is rather than much more than that</p> <p>P9: Yeah I think I found the website before I'd actually had my dietician appointment, from memory K: Ah okay P9: Because it was kind of Christmas I was diagnosed so it was a few days before I could actually get to see somebody</p> <p>K: They don't give you a reading P9: Which I just think is really bad, because they're actually wanting people to make lifestyle changes as well, you know, giving people more information as to actually, where they are and what the kind of range is I think is fairly essential, but you just don't get it at all and I don't think anyone would remind me if I didn't go for it either</p> <p>P9: It's just up to me to remember, around BABYS NAME REMOVED birthday to make an appointment and then ring up to check the results</p>

		<p>P9: Yeah I just think if it's genuinely the risk of developing type 2 diabetes is so much more and that costs such a lot to deal with and causes so many issues, I find it quite staggering that there's actually no post-birth support plan, action, anything, advice, nothing</p> <p>P8: Urm, I was, I think, they told me I had it on the Tuesday or the Wednesday and I had to go to a like, a group, on the Friday, I think it's about 2 hours, urm, and I went with my partner, and they went through kind of what diabetes is, it's very very general, urm, all what sort of things we should avoid, what would be the possible complications if our sugars weren't controlled, urm, possibility of needing medication, and then they showed us how to use blood urm, blood testing kit, but yeah it was very general</p> <p>P8: It was just, it was very sort of urm, you just sort of need to, if you normally eat bran flakes then eat bran flakes and if your sugars too high then don't eat them again, that kind of thing, you know don't go and eat a pot of jam, just be careful, limit your milk and bread and stuff like that, urm, but they, they didn't come across that we needed to be as strict as the diabetes doctor was telling me, because obviously the diabetes doctor when I saw them was sort of like no if you blood sugar goes above this number then we need to put you on medication rather than it's okay just don't do it again,</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>K: So was that your GP you went to for that test P8: Yeah, well I saw a nurse, I booked it myself, but yeah K: And did that come back all fine? P8: I never heard, so I'm assuming yes (laughs)</p> <p>P6: There is a misconception of course that it's just sugar,</p> <p>K: Yeah yeah, sometimes you have to just, you know if you're empowered you just have to go for it and do what's right for you P6: Yeah and to be honest there's a lot, because of that facebook page, and the website and everything, that I knew a lot more, because if I didn't I would have just taken her word for it</p>
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		<p>with this. But it was a group appointment, with five other women, which was a bit of a shock to start off with. And then this nurse just started to proceed with 'right you're all here because you've got gestational diabetes, yes its rubbish, most of you are probably going to go on medication, just avoid white carbs, eat brown carbs, and you'll be fine. I've written down in your booklets when you need to test your bloods, this is how you use the machine, and off you go'. And that was that. And it was really, really rubbish.</p> <p>P10: yeah, thankfully I used the wonderful internet! And a search engine called google [laughs], and I came across Jo's website, gestational diabetes.co.uk, and I don't think if it was...If I hadn't found that website I would have definitely ended up on medication and the birth would have ended up a completely different story. Literally the advice on that website and all the reach papers where she had got all her information from....because I started to just read up as much as I could about the condition and just sort of tried to make my own informed decisions about what I could try...because loads of people had sort of said drink two shots of apple cider vinegar every night and you'll be fine [laughs] so I just really wanted to see if there was research out there and Jo had already done half of the job by putting together a lot of the information, which was a real life saver for me.</p> <p>R: I think that's the key isn't it, that it's for everyone. So after you had your baby did anyone give you any advice about what would happen to the GD?</p> <p>P10:]laughs]...no, absolutely nothing. I mean the midwives were just very surprised that my son passed all of his blood sugars because I had to fight to have a home birth as well, because I had previously had a c-section so I was already high risk and it was all full on drama, I had to get new hospital polices written up and everything. I was a real pain! So, I think when they did the last sugar test for the baby they were like, right, that's it, let's just get out of here and not talk to her every again so, no one really mentioned anything. And then I had an 8 week check up at the GP where she proclaimed that I would be diabetic really soon because I had GD and I'd had to go in for an annual blood test every year. That was it.</p> <p>P10: well I hope it does happen because there's a real gap in the market, I mean I was talking to some women who've had GD in the past and we just don't know what to do next, and there's a huge lack of information from the NHS, and I think that's partially because they don't know themselves what is the best advice. I mean the midwives didn't have a clue really, and I don't blame them they've already got enough to deal with. There is definitely a need for something out there.</p>
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	<p>Poor Communication (H)</p>	<p>P9: Yeah I think I found the website before I'd actually had my dietician appointment, from memory K: Ah okay P9: Because it was kind of Christmas I was diagnosed so it was a few days before I could actually get to see somebody</p> <p>K: Yeah that's a common experience actually, some women it's been a week or two weeks P9: Yeah it was, I went in for the testing thing then it was a couple of days later before I could actually see a dietician and so it was a little bit dragged out so I went and looked on my own in the mean time</p> <p>K: I think that the monitoring thing is really important, just thinking back to apps and things, if there had been something, say an app, that your midwife had offered you, what would you have most wanted it to support you with, at that time? P9: Urm, I'm trying to think, I think I did at one stage have an app that I recorded blood sugar on, but not at the beginning, I think some later stage, they, it might be more a text message system rather than an app, but it moved on slightly from a bit of paper that they expected me to bring in, which I just thought was madness in this day and age to have that level of monitoring where you had to ring up if you had a level that was, and try and get through to somebody if you had a level that you thought was worrying, so there was some kind of a, a text message system that I had to submit every day by a certain time and they would reply saying that's okay or that's not, please ring us, which was, better I thought, I , before the paper thing, I would have expected at least that functionality that someone was actually looking at what you were doing, urm, in terms of whether you're recording numbers and whether they're okay so I guess I would expect that from an app, but then ideally, urm, better dietary support, I don't think an app is the place for anything around kind of birth plan issues, that I think just needs to be improved discussion and support really, but an app would be great for the day to day managing it</p> <p>P9: Yes, because the paper system is terrible, but at least the kind of sending, you know they chased me up via text if I hadn't sent them a reading, it was an automatic thing I'm sure but you got chasings and then I assume it would have escalated to someone if I hadn't done anything about</p> <p>K: Brilliant, yeah I was just going to ask you that actually that was going to be my next question, fab, and so after you'd had your baby, did anyone talk to you about what would happen afterwards with the diabetes? P9: Urm not much, no, so, urm, I think I was asked to do testing for like a couple of days afterwards, finger prick testing, but I'm not sure anyone was actually really interested,</p>
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	<p>P9: In whether or not I was doing that, they obviously checked blood sugar levels just after kind of labour, but, then, they didn't really seem fussed after that, I was in hospital for a night and then went home, urm, and then I was told to book in for the, is it 6 weeks afterwards blood test, but there didn't seem to be any process for making sure I did that, or I find that haphazard whether people know they're actually supposed to do that in the midst of having just had a baby, I suspect lots of people miss that, I'm amazed that's not an automated, you know we've made an appointment for you, make sure you come in kind of process, so, there's no kind of follow up, I just have to ring up and ask if the results are okay, and they don't tell me what the numbers are or anything, so I find it really, kind of, I don't know whether I'm high, low, I'm obviously what they class as not needing to do anything about it phase, so I've had the one from birth and the annual, the one after that, I've had one more and that was exactly the same, the just say it's fine over the phone the receptionist, they don't give you actual numbers</p> <p>K: They don't give you a reading</p> <p>P9: Which I just think is really bad, because they're actually wanting people to make lifestyle changes as well, you know, giving people more information as to actually, where they are and what the kind of range is I think is fairly essential, but you just don't get it at all and I don't think anyone would remind me if I didn't go for it either</p> <p>P9: It's just up to me to remember, around BABYS NAME REMOVED birthday to make an appointment and then ring up to check the results</p> <p>P9: Yeah I just think if it's genuinely the risk of developing type 2 diabetes is so much more and that costs such a lot to deal with and causes so many issues, I find it quite staggering that there's actually no post-birth support plan, action, anything, advice, nothing</p> <p>P8: Urm, I was, I think, they told me I had it on the Tuesday or the Wednesday and I had to go to a like, a group, on the Friday, I think it's about 2 hours, urm, and I went with my partner, and they went through kind of what diabetes is, it's very very general, urm, all what sort of things we should avoid, what would be the possible complications if our sugars weren't controlled, urm, possibility of needing medication, and then they showed us how to use blood urm, blood testing kit, but yeah it was very general</p> <p>P8: It was just, it was very sort of urm, you just sort of need to, if you normally eat bran flakes then eat bran flakes and if your sugars too high then don't eat them again, that kind of thing, you know don't go and eat a pot of jam, just be careful, limit your milk and bread and stuff like that, urm, but they, they didn't come across that we needed to be as strict as the diabetes doctor was telling me, because</p>
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		<p>obviously the diabetes doctor when I saw them was sort of like no if you blood sugar goes above this number then we need to put you on medication rather than it's okay just don't do it again,</p> <p>K: I didn't know if you thought that was something that was useful or something that you would use, I mean obviously maybe, you said you're pregnant again, hopefully you won't get it again, but maybe next time around?</p> <p>P8: Yeah I think I would because then you haven't got to wait the 2 weeks or however long it is before someone gets to see the results, even if they're not over the range they might be near the top of near the bottom, sometimes I had really low readings but they say only contact us if you're above, urm, but no I think that would be a good idea</p> <p>P8: Urm no (laughs), no in fact when I went to my doctors for, I can't remember what the rest is, when they test for diabetes 6 weeks after the birth, urm, they weren't sure why I was having it, but I know probably from this group that it means actually I'm probably going to get it when I'm older or in the next 10 years or something like that, but I kind of knew that anyway because my dad's got it and I kind of expected that anyway</p> <p>K: So was that your GP you went to for that test</p> <p>P8: Yeah, well I saw a nurse, I booked it myself, but yeah</p> <p>K: And did that come back all fine?</p> <p>P8: I never heard, so I'm assuming yes (laughs)</p> <p>P6: I had a midwife appointment and she said oh did you find out your results and I said no I assumed you were going to contact me if there was a problem and then she called the hospital and my after reading was 8.2 so</p> <p>P6: Urm, but obviously it wasn't just that, so yeah I got tested earlier than the 28 weeks and that was on Monday, I had an appointment (on the Tuesday?) they do clinic on the Tuesday but they had no availability so I then had to wait a whole nother week not really knowing what was going on, what I should or shouldn't be eating</p> <p>P6: My BMI was healthy, and everything, but my results were all coming pretty much over, all 10's and things, so I spoke the midwife and she said oh no absolutely not, and then she said it's just because you're feeling nauseous because I had urm, it wasn't morning sickness it was just nausea all day basically</p>
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	<p>P6: Urm, and I was like ah that doesn't really ring true and she told me that there wasn't a clinic at my local hospital anymore because I knew that it was on a Tuesday and I was willing to just pop up and see somebody, she said oh no no it's all in Canturbery now it's all changed, and I thought okay, and I had it about a week later, I had to go for an early pregnancy scan, because I had a little bit of bleeding when I found out</p> <p>K: Yeah</p> <p>P6: And Urm I noticed signs up about the diabetic clinic so I happened to say to the midwife like do you know anybody who I could speak to and she said oh yeah they're all here today and she got me a lady urm, Natalie, who was so helpful, and I'd been writing down all my readings, so they got me a book and got me urm just got me everything that I needed basically, and said right do a week of readings and then send them over to me and we'll take it from there, so I did that, sent them over to her called me back, she spoke to the consultant and they said yeah he'd like to see you, so then I got to see him, a week later and urm she said on the phone oh yeah he wants to put you on (Metformin?) straight away, so urm, I went to see him, and he was like hm yeah while your readings fine this week they weren't the week before and I was like yeah because the week before I had to eat normally to show you I've got it</p> <p>K: Yeah, interesting, so urm after you'd had your baby, did anyone say anything to you or offer you any kind of support in terms of kind of looking after yourself? With regards to the diabetes</p> <p>P6: No (scoffs)</p> <p>P6: But the consultant didn't tell me anything about it, it was only through the facebook grou</p> <p>K: Through that facebook group,</p> <p>P6: Well no, like I said, just letting people know that they're now at risk because no body had told me that from like the NHS</p> <p>K: Really</p> <p>P6: It was all from this facebook page that I seen it and I suddenly thought oh my God my sons now at risk and like no body told me either that my son had to have his blood glucose checked and actually with my first son I had to chase it up because they didn't do it, but that would be another story to complain about, the whole, after bit</p> <p>P6: Yeah I think the key think for it is, people being informed about what they can and can't eat really, and I don't just mean that in terms of like oh don't eat chips, because it's not a case of don't eat chips, but I remember when I saw the dietician in the first pregnancy, she went oh well if you have chips you can have 6, I was just like well what's the point in me eating 6, I'm not going to put 6 chips on my place</p>
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		<p>K: No,</p> <p>P6: There was no offer of an alternative, or pairing it, or sweet potato fries which I actually could tolerate, nothing about the fact of, oh, when you cook a potato like a jacket potato, the sugars increase and that will effect you a lot so you might be able to tolerate if you say, mash it, but you wouldn't be able to tolerate a jacket potato, there's a real lack of anything like that and explaining things, which urm it might sound, it might sound well oh well that's kind of quite obvious but it's not necessary because we're just in this minefield of what can I and can't I eat and also just making people aware that just because I can eat it doesn't mean you're going to be able to because our bodies react so differently</p> <p>K: health care professionals like to think that they inform women about, you know, what GD is and what your risks are but then that's not what I'm hearing back you know so yeah</p> <p>P6: I don't think the midwives even know themselves, I don't know what their training is but, with my first pregnancy my midwife was amazing, I remember her calling me and going I can't get you an appointment for another week, and just don't eat sugary things up until then, and that was just her being genuine it wasn't, she was trying to help me because that was her knowledge of it, and even when we popped in to see her when I had my son, she saw how much weight I'd lost and she said oh you won't get diabetes next time, and I bit my tongue coz I was like that, I'm not gonna say anything because you're so nice, but saying things like that is so upsetting, because it's almost oh well you had it because you were fat</p> <p>R: so, once they had got round to following you up, what kind of advice did they give you in terms of managing the diabetes?</p> <p>P10: [Laughs] Oh my god, right so, I got a lovely letter through the post saying please go and see the diabetic nurse for an appointment to discuss your GD. Turned up thinking yes, this is gunna be a one-on-one appointment, I'm going to be able to blitz so many questions and figure out how we're gunna deal with this. But it was a group appointment, with five other women, which was a bit of a shock to start off with. And then this nurse just started to proceed with 'right you're all here because you've got gestational diabetes, yes its rubbish, most of you are probably going to go on medication, just avoid white carbs, eat brown carbs, and you'll be fine. I've written down in your booklets when you need to test your bloods, this is how you use the machine, and off you go'. And that was that. And it was really, really rubbish.</p> <p>R: I think that's the key isn't it, that it's for everyone. So after you had your baby did anyone give you any advice about what would happen to the GD?</p>
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		<p>P10:]laughs]...no, absolutely nothing. I mean the midwives were just very surprised that my son passed all of his blood sugars because I had to fight to have a home birth as well, because I had previously had a c-section so I was already high risk and it was all full on drama, I had to get new hospital polices written up and everything. I was a real pain! So, I think when they did the last sugar test for the baby they were like, right, that's it, let's just get out of here and not talk to her every again so, no one really mentioned anything. And then I had an 8 week check up at the GP where she proclaimed that I would be diabetic really soon because I had GD and I'd had to go in for an annual blood test every year. That was it.</p> <p>P10: well I hope it does happen because there's a real gap in the market, I mean I was talking to some women who've had GD in the past and we just don't know what to do next, and there's a huge lack of information from the NHS, and I think that's partially because they don't know themselves what is the best advice. I mean the midwives didn't have a clue really, and I don't blame them they've already got enough to deal with. There is definitely a need for something out there.</p>
	Facebook Group recommended through GD Community (H)	<p>K: And there was, so you actually found that website, the facebook group yourself, it wasn't recommended to you,</p> <p>P6: No it was recommended through this mums, this other mums group I was on, another lady who was having a baby on the page recommended it</p> <p>K: Yeah but it wasn't a midwife or a dietician or</p> <p>P6: No no</p>
App benefits (Links with Reasons for App)	Mhealth Benefit – Reduced Appointments (K)	<p>P2: it would be great to have an app where you can upload your numbers and have that linked direct to the hospital, and they could recommend if you need to change anything or go to see the dietician, that would definitely be good because one of the big drawbacks is, and particularly because I'm now at a hospital which is over half an hour away from me, is the frequent appointments, so it would be brilliant to be able to do something over an app, instead of going in. Of course you'd want to see them pretty regularly but you don't just have to go every two weeks you know to show them your numbers, like that would be great.</p> <p>P3: But also somewhere that you could also manage your diet and your blood sugars and all of that because they give you a booklet that you fill in and show them the information. But yeah if you had an app that just did all of that, and then maybe if the app sent that information to the hospital, so that you didn't have to go and take your folder in like once a week,]laughs]...</p>

		<p>P3: yeah I mean that would be great because that was the most annoying thing, oh god just like trying to find a parking space when all I could of done is just send it across</p>
	Positives for Apps (K)	<p>P2: I think its definitely its convenient to just have all that information at your fingertips, and just have an app on your phone. I think it definitely helps with motivation</p> <p>P2: it would be great to have an app where you can upload your numbers and have that linked direct to the hospital, and they could recommend if you need to change anything or go to see the dietician, that would definitely be good because one of the big drawbacks is, and particularly because I'm now at a hospital which is over half an hour away from me, is the frequent appointments, so it would be brilliant to be able to do something over an app, instead of going in.</p>
Family Dynamics	Partners Use of Apps (K)	<p>P1: Oh yeah deffinitely. Um he's more on his phone than I am, so he's all like app central, and you know I think it makes it easier, especially men like you know their stereotypical way they don't really like complicated do they? Laughs. Youi know something nice and easy and they can get it on an app and it makes their life easy they're more likely to follow.</p> <p>P2: Yeah, I mean he does use My Fitness Pal, errrm run keeper as well is another one. Yeah he's more into apps, like he would download a lot</p> <p>P3: I dunno, I guess he just try's to do stuff on his own, because when he gave up smoking he just went ahead and did it, and he wouldn't go to the doctors or anything like that, he was just quite determined to do it by himself. Yeah bit stubborn I think</p>

	Family System Change (H)	<p>K: And would you have liked your partner to have been involved in that as well, do you think that would have been useful,</p> <p>P8: I think so yeah, I think for our family anyway, a whole approach is better, because he is, he likes his food as well, urm, and I think by getting everybody in on it, when you remove that, that support then we're all kind of supporting each other, yeah</p> <p>R: and do you think he would be keen to support you if you decided you wanted to make a change?</p> <p>P10: yeah definitely, I think our sort of generation we're on the weird cusp of like we're not exactly millennials but we are kind of embracing technology and I think he's actually much better at using an app than reading a book so with both pregnancies he's never read a book, but we had a hypno birthing online course and he loved it because it was all accessible through his phone. But I mean it was exactly the same thing as written down in the book but...[laughs]...he just liked it coz it was a different format, so yeah I think he would definitely like to be involved with something like that.</p>
Shame (Theme highlights the need to avoid guilt and blame for interventions, evidence of guilt induced through HCP, and mitigated through Facebook group, may explain greater trust in Facebook group than HCP).	Self-blame, shame (K)	<p>P2: I mean I found that I didn't want to tell anyone really because I thought oh people were gonna say 'oh well she's overweight' and when I did tell people, like some of my colleagues, they would come out with the most ridiculous comments like one woman said 'well oh you do eat a lot of fruit'.... And that's not you know, that's not why I got this like, there's such a misunderstanding around it and I think people don't really talk about it like, so then its easier for people to talk about it on a Facebook group or whatever</p> <p>P4: oh can I just say, I forgot, there are people I didn't tell about this gestational diabetes because I knew that they would make comments like well you are overweight,</p>
	Guilt (H)	<p>P9: Yeah, well I ended up with forceps on my first birth coz I had to have the drip to speed things up because it had been to long, so I was like, a bit of the induction bit, and I'd been so frightened of that that I had an epidural and then ended up with forceps and I kind of just felt like that was all going to happen again, you know what I mean, so, as it turned out it didn't, it doesn't help the, not only worrying about damage to your baby, daily, with what you're eating and if you're levels are too high and all that sort of thing, then you're worrying about if the birth will be horrendous as well as a result of it, and you're already thinking they're at increased risk anyway, so it kind of, it's a combination of all of those things I think</p>

		<p>P9: I think that's difficult, because I think, with any medical issue that anyones get, GD is one of them, there will always be an element of potential guilt, extra appointments that other people don't have</p> <p>P9: So, I think that's difficult to resolve, but I think GD is a bit difficult because you have that kind of you know, is it because I didn't eat well enough, is it because I'm overweight, is it because I didn't do enough exercise kind of, and no one can say to you definitely no because all of those things are factors and, but, you know, I guess it's about having more, the positive, fixing it for the future and I think particularly if people are going to go on to have more children, urm, that's even more important, because you're fairly likely to have the same issue the next time</p> <p>P9: Urm, yes, urm, I think it's difficult with all of these things, because I'm a, I've lost a bit of weight since I had BABYS NAME, but not as much as I would have liked to have done, and that's primarily a kind of time thing for me, in that, I just don't have much time in my life to do much exercise and cook any meals that aren't what the children want to eat, urm, I would like to have a third baby, but I, in my head, I need to kind of got myself into the best position if I am going to have a third baby to stop that happening again</p> <p>P9: Urm, I mean, I'm kind of, I'm working on doing a bit more exercise without feeling guilty about being out, which is sort of doable apart from the fact I've now got to have an operation next week which has sort of damaged that slightly, I've got a gall stone,</p> <p>P9: Urm, so I think, assuming I can get back to exercising properly I'm kind of working on the, we do a park run together every Saturday morning which is religious and I've kept that up religiously, as we all go out and do that so I don't feel guilty about that but doing anything in the evenings I feel guilty about because I'm the one out at work all day, and then if I go out in the evening then I feel like I'm not seeing my children at all, so that is a struggle for me, but I've decided to just do it once a week and just go with it because it's better for them healthy longer term but it depends how work goes to be honest as to if I manage that,</p> <p>P6: Yeah and well, the first, during my first pregnancy, I saw this lady consultant, for my first appointment actually I was with my husband at the time, she basically turned around and told me that I had diabetes because I was fat, and I then had to go outside and wait to see somebody else, and I literally sat in that waiting room crying my eyes out with my husband going to me, it's not your fault,</p>
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		<p>won't get diabetes next time, and I bit my tongue coz I was like that, I'm not gonna say anything because you're so nice, but saying things like that is so upsetting, because it's almost oh well you had it because you were fat</p> <p>P6: What it means to that individual, like that consultant who said to me I got it cause I'm fat, that wasn't what made me follow that diet, what made me follow that diet was I had a baby inside of me to care for, you making me cry, just made me want to go out and eat everything in sight,</p>
	Stigma (H)	<p>K: 100% I think that's what we're kind of getting at, people kind of seem to be abandoned a little bit afterwards, how would you have felt if someone did come to you with a plan, or come and said we want to kind of support you to help prevent that risk of type 2, would you have been open to that do you think?</p> <p>P9: Urm I mean yes, I think, I think it is a difficult thing particularly at that time, when someone has just had a baby and, it's never the most, emotionally sane part of your life, so to then have someone going yes and you need to make sure you exercise and eat healthy when I'd had like two hours sleep is a difficult conversation but I think it needs to happen at some point, even if it's not you know, week 2, urm, I think it needs to happen at some point, and you might not particularly want to have the conversation but I'm not sure that's a reason not to have it, you know nobody ever wants to have conversations about potentially negative things, but the reason for doing them is to stop something worse happening so, I think open to it is always a slightly difficult thing because I think most people would always prefer to put their head in the sand in a way, and go, I hope it will all be fine, but I don't think that's necessarily the right approach coz we'd never have vaccinations, we'd never have smear tests, we'd never go to the doctor about anything if you took that approach</p> <p>P9: I think that's difficult, because I think, with any medical issue that anyones get, GD is one of them, there will always be an element of potential guilt, extra appointments that other people don't have</p> <p>P9: So, I think that's difficult to resolve, but I think GD is a bit difficult because you have that kind of you know, is it because I didn't eat well enough, is it because I'm overweight, is it because I didn't do enough exercise kind of, and no one can say to you definitely no because all of those things are factors and, but, you know, I guess it's about having more, the positive, fixing it for the future and I think particularly if</p>

		<p>people are going to go on to have more children, urm, that's even more important, because you're fairly likely to have the same issue the next time</p> <p>P6: Do you know what I am quite passionate about it and I think it's so important and the problem is there's such a stigma about it as well</p> <p>K: Yeah</p> <p>P6: I was embarrassed when I first got it and it was like oh everybody is just going to go aw it's because you're fat and it then went on that I lost three stone and still got it</p> <p>K: Yeah yeah I think the stigma thing is just really, really, it's just really sad, I spoke to somebody else today who said they actively hid it from members of their own family because they were so ashamed and so kind of guilt ridden about it because they felt like as you said because of their weight that they felt other people would think it was their fault, which is just, it's really really sad because it's just</p> <p>P6: Yeah, I was going to say, if I said oh I've got GD, then oh no more chocolate for you then, and I don't actually eat chocolate</p> <p>K: health care professionals like to think that they inform women about, you know, what GD is and what your risks are but then that's not what I'm hearing back you know so yeah</p> <p>P6: I don't think the midwives even know themselves, I don't know what their training is but, with my first pregnancy my midwife was amazing, I remember her calling me and going I can't get you an appointment for another week, and just don't eat sugary things up until then, and that was just her being genuine it wasn't, she was trying to help me because that was her knowledge of it, and even when we popped in to see her when I had my son, she saw how much weight I'd lost and she said oh you won't get diabetes next time, and I bit my tongue coz I was like that, I'm not gonna say anything because you're so nice, but saying things like that is so upsetting, because it's almost oh well you had it because you were fat</p>
	Justification (H)	<p>P9: So, I think that's difficult to resolve, but I think GD is a bit difficult because you have that kind of you know, is it because I didn't eat well enough, is it because I'm overweight, is it because I didn't do enough exercise kind of, and no one can say to you definitely no because all of those things are factors and, but, you know, I guess it's about having more, the positive, fixing it for the future and I think particularly if people are going to go on to have more children, urm, that's even more important, because you're fairly likely to have the same issue the next time</p> <p>P9: Urm, yes, urm, I think it's difficult with all of these things, because I'm a, I've lost a bit of weight since I had BABYS NAME, but not as much as I would have liked to have done, and that's primarily a kind of</p>

		<p>time thing for me, in that, I just don't have much time in my life to do much exercise and cook any meals that aren't what the children want to eat, urm, I would like to have a third baby, but I, in my head, I need to kind of got myself into the best position if I am going to have a third baby to stop that happening again</p> <p>P6: I was hopeful I didn't because I've lost a lot of weight as well so K: Yeah P6: My BMI was healthy, and everything, but</p> <p>P6: That's it yeah and it's like with my second pregnancy I ended up on insulin and with my first I didn't and the consultant did say to me at the very beginning he did say I really expect you to be on insulin by the end to kind of have that expectation K: Yeah P6: But I managed to do quite a long time just diet but K: Good for you P6: The thing that set me off, I had a steroid injection in my shoulder, and they said to me it wouldn't effect my levels because it was such a small amount, well it sent me sky rocketing, so I was put on metformin then and then two weeks before I gave birth I got urm a viral a virus infection and I was so ill with it, and again it sent my levels sky rocketing and I couldn't tolerate anything so he put my on insulin for two weeks</p> <p>P6: I literally sat in that waiting room crying my eyes out with my husband going to me, it's not your fault,</p> <p>P6: And urm I actually refused to see her this time, I saw her and I said to the midwife whoever that is, I don't want to see her, and I didn't I saw, urm, not the consultant, whoever is above them, registrar is it, I'm not sure, but then I seen somebody else and I saw the same person the whole way through, because it's hard enough having diabetes, and I'm not stupid, of course my weight probably was a risk factor but people who are really skinny get it as well,</p> <p>P6: And also people who are really fat don't get it, so it's not followed because I was overweight I had to get it and that was the reason,</p> <p>P6: I mean they still don't know the exact reason</p>
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		<p>P6: So to make me feel that low and to feel so responsible was just, it wasn't necessary,</p> <p>P6: My niece was, well, probably about 20 stone when she had her daughter</p> <p>K: Yeah and she didn't get it</p> <p>P6: She didn't get it no</p> <p>P6: Yeah it, I mean I was big, I'm not going to lie, I was 13 stone, but in the grand scale of things, there's a lot of people who are a lot lot bigger than that who haven't got it so</p>
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Appendix F: Example anonymised transcript of interview from study 3b

- I I've got a set of questions but we'll just informally chat and hopefully we'll get to the relevant points. So normally I just start off by asking people just to tell me a little bit about their working [practice and how long you've been a midwife for, and stuff like that
- P So a lifetime away, so I qualified as a midwife in 1986 and worked across a range of settings, ran antenatal services, worked on labour wards, jobbing midwife across integrated service, sort of moved more into training really more than necessarily education locally, and then moved into education over the last six or so years really. Still retain some clinical practice but limited now because of having an academic role, but kind of very much keep my eye on that side really to see what's happening in that world, and also that's your first love, clinical practice for me anyway, very much so. So you can work that out backwards, 30 years doesn't seem much now, 30 years nursing, 25 midwifery. So I was a nurse beforehand so I trained in the former way where you did nursing and then we did midwifery afterwards
- I And what's your experience with women with gestational diabetes, would you normally see them coming through?
- P So limited obviously now in terms of my day-to-day; so I would see those as women I would see along the way, so I've never had any specialist roles. When I ran antenatal clinic services and outpatient services that was around the time when we started to get some type of national guidance of some sort and things were kind of beginning to be standardised a bit, it was very random before then, it was very much Mr so and so does this, Mr so and so does that, midwife there doesn't think that's really diabetes, there was no care pathways, which is a very different landscape to what we seem to have these days really for lots of different conditions, whether it's diabetes, heart disease etc., where we have more of a pathway approach. So we'll see women in any of the care settings if I'm working, and to be honest if I do do any clinical shifts they tend to be more labour ward-based, it's where I've spent more time and have more experience, it's easier to drop in and do a shift and walk away again rather than interfering with community work so much
- I And in your practice either before or now, how do you think that's changed in terms of kind of digital solutions and things that you might offer women? It doesn't have to necessarily be women with gestational diabetes it could be any women that you, I'd just be interested to see if you've got any thoughts on that about the digital side of things
- P I think the practice area that I've linked to and worked in has been very slow, very, very slow with digital opportunities and information that can be used, not even there,

so this is thinking from a slightly different way, I'm working with a caseworker student at the moment and one she's doing is designing a leaflet, and it just seemed to me so 1980s really in what she's doing, but she sees the value in it so therefore, who am I to negate that, but it's very much down the culture of here's the leaflet and we're giving it to you, and it's still quite paternalistic really rather than necessarily encouraging those kind of those health behaviours, I think there is an area for clinical guidance and navigating and all that kind of stuff, very much so, but I think we're still enormously paternalistic and actually not necessarily comfortable when, whether it's women, other healthcare users, we want it but we don't want it, we want them to be responsible, accountable for themselves etc., but actually we'll almost say if they're doing what we're telling them what to do, it seems to be that mixed message really I'd say would be my observation

I And you said it was kind of slow to get that kind of uptake or adoption, what do you think is maybe causing that, what are the barriers there?

P So I think IT literacy I think is a real issue, and people joke about it the same they do about maths, yeah oh maths terrible ha, ha, yeah IT terrible he, ha, but actually where people use intuitive systems or systems that do what they want them to do, they use them really well, and we see that in our own lives how people use TripAdvisor or online banking, or don't use those things cos they find them difficult or whatever else. So I think that's one aspect. I think the actual access to technology it's painful if we look at the IT infrastructure in the NHS, and certainly that's been recognised in lots of the big national documents that we have coming through, and certainly in maternity in our world it's better births, there's a digital component to that along with the long-term plan and everything else. So I think there is [06.54] but also people have been around a while and seen these things come along and this is what we're going to do, and then it doesn't sustain for whatever reason. So I think there's things around even if we've got something that's good and useful is actually is it sustainable, can it be maintained, or is it just a pilot or just a project or just a person thing led by individuals, which again often tends to be what happens rather than having an embedded change. I think also it's not seen as work, you hang out with women supporting and guiding and navigating, that's not seen as work in the same way, so I think there's something around a willingness really for actually being with just in day-to-day practice when they're set against so many other competing demands, taking your blood pressure's not the thing you're doing but sitting down talking to someone about where they're getting their information from isn't necessarily valued in the same way by individuals collegially really

I That's really interesting, I hadn't really thought about that before, kind of actually you've got a lot of other things to do and get done and there's almost like a check-list, and sitting down and talking to someone about where they can find out and get support isn't necessarily on the top of the agenda

P No, it's easier for me to tell you what I think you should do because I do, cos I've done it a hundred times over, than for me to ask you what you're using and whether it's helpful and valuable. And that's me, collectively that's my observation, that's what I see, and the longer I'm out of I see that, it's really interesting, the actual listening component of clinical practice is so limited when you really watch it properly and take a step back from it, same reason people talk about it, midwives talk about it all the time, doctors talk about it all the time, it's still very much in the telling of

I So you mentioned there about IT literacy; were you thinking about staff members there or women themselves?

P I was thinking more about the staff really more than the women, it might be an issue for the women but I think looking at the population that we're working with I think that's better than it ever has been, and that's always improving. So I was thinking more about the staff, just the staff's willingness, and I think there's a thing as well around their fear of recommending, is it actually a Cow and Gate website in disguise, or is it an app that's sponsored by Pamper that they didn't realise, so there's definitely something around that. And I think within midwifery, and particularly we're very, very cautious, we don't like to work with commercial companies comparable to some other areas, other specialities, they're much more comfortable with working with some of their commercial partners than we are because it's enshrined in so much of the political direction really, which came mainly from infant feeding but from other areas as well

I I was going to ask you if you thought that either yourself or your colleagues had any concerns just in general about either recommending a website or an app or any really kind of digital tool

P Yeah, they'll do it when you tell them if you tell them it's a good one, but again their willingness to do that by themselves is; there's a funny thing, people talk a lot about being autonomous, they are, but they still like to be told what to do, it's a really interesting thing and again I see it really starkly the more and more I'm away from day-to-day clinical practice, I see that kind of what you think you are in terms of your independence autonomy as your day-to-day leadership, and actually where you really are and they're not necessarily aligned I think, and that's across all practice areas

I And so if there was an app or website out there that you kind of thought this is really good, could be anything, could be the contraceptive choices or an NHS website, if midwives were told by like a line manager or someone senior to them, do you think that's the important link, or do you think it's more that they've gone and looked at the evidence themselves and thought oh this is good, or even used it themselves maybe

P That's really interesting, I think we're not going to have any more leaflets, you're expected to use this, then I think that's what midwives, oh again it's interesting because I think some would self-sabotage because they wouldn't want to, they're building up the skills themselves, or they wouldn't have a tablet or whatever it is to sit and share it with women, so they'd still then go and find the leaflet and print it off even if it's 75 copies old and it's terrible, I think they might do that, that's a terrible thing to say isn't it. It's something when someone comes back from a conference and they've seen something and then they'll come back, they'll have Evangelical moment when they see something as being good. So I think there's something around their own experience of. What I haven't got actually is the knowledge of that group as reproductive women and whether they are recommending stuff that they've reviewed, and that's something really interesting, when I next go to practice I'll question people I think whether they are using stuff that they would use, I wonder if that generation who are having babies now who are staff members are doing that, or not. Again I think there's such a fear of needing to be neutral, that recommendation bit is, unless it's got that rubber stamp of an organisation I think they're very cautious of it, they're particularly cautious of it I'd say really

I You can understand why

P Don't know really, that's an interesting question, a good question

I I know that I've spoken to someone before and she was very focused on, she said that she would be happy to recommend something to somebody that she's used herself, which I thought was really interesting, and actually if you think about everyday life I might recommend an app to somebody, be like I've been using this, it's brilliant, and it's not based on any kind of proper peer reviewed evidence, it's just my experience and sometimes that can really help. And especially when we're thinking about the digital health champions, it's kind of like do we ask them to use the app and then that might increase their kind of confidence to then recommend that to somebody that they're working with. But yeah it is interesting

P Yeah, and I think it's about whatever you're using something for, some people are very routine-based people and so therefore, do what they do on a Monday or a Tuesday and that's something you might build in to, whereas other people aren't, and again this is my experience of some digital things, if you've got something that's giving you an alert telling you something, I personally find that really unhelpful so therefore, it gets deleted from me, whereas others people it's a really good idea, I need to go and walk my 10,000 steps cos my machine's beeping at me, whereas I'll swear at it. So I think they evoke different responses in us, the way just how things are, how platforms function or work or do or whatever

I I agree, like if something's telling me to do something I'm just like no that's getting deleted immediately. And if there was something out there, it could be a website or an

app, if it supported women, and it doesn't have to be women with gestational diabetes, it could be kind of any pregnant or postpartum women, what would you ideally want it to support them with? And we're talking really hypothetically now, like a magic app out there

P I think it's about sort of anticipating what might be happening or might be needing to know maybe, and there's an old American book 'what to expect when you're expecting', and it takes women on through things on a week-by-week basis, and I think there is stuff out there that is like that but again it's quite passive, it's all quite biological, so it would be your baby is 2.5 grams etc., so I think something around where the things you might want to be curious about, so again turn that action in women, so things you might want to talk about with your midwife is are you still going to have the baby where you planned you were going to have your baby, that kind of stuff, that triggering really, and I think particularly when we're looking at women and consent and making sure that they do understand, and I think we've got such a long way to go post-Montgomery with consent and maternity care. I think something around actually making sure that we are fully active really but in a partnership way that's working, getting information, there's a plethora of information, big books, television programmes, videos etc., about what is happening as it's going on, but it's just about what might be helpful to be curious about, to know about, or to understand the why, I think as a woman who's a midwife who speaks to people, the things they ask me and stuff like that I'm like I can't believe you don't know that, why do you now know, it's stuff you should know so you're therefore, not engaged with that bit for whatever reason because that's either not important, something that just encourages that curiosity. But that's a big ask, with that then becomes more informed users, which actually that's quite difficult because services that we have do not necessarily deliver, align to the expectations of national guidance. So if you created demand and need and expectation does it make our life easier or does it make it harder because we can't deliver on it, I don't know, that's another big question. And what that looks like I don't know, it might just be like an alert thing really, and I know there's lots of very popular things about monitoring baby's movements and all those kind of stuff, and personally I'm not a fan of those kind of things, I think there's some women, some groups, that those types of things can be helpful for but for me it's about things that develop oneself, so resourcefulness

I Empowerment

P And independence, and question and challenging rather than a reliance on oh I had 12 movements by 10 o'clock and I've only had three by six, is that ok, I don't think that's helpful necessarily

I Certainly not for everybody, especially if you've got kind of anxious tendencies, I think it can kind of lead to a lot of over-monitoring maybe

P Yeah, and I think with our compliance kind of culture that we have around healthcare, particularly around maternity healthcare, very much so, you could then create a whole extra tier of additional care that's not doing anybody any favours and not necessary either, not evidence-based or necessary

I Do you see a lot of women that are using those kind of things?

P Not necessarily cos I'm not working in the community in the same way, but anecdotally I can say that colleagues do, they do talk to women about things they're looking at and things going on, and all the rest of it, and even their health ones with how much sleep they're getting, and they'll say I'm only getting so many hours sleep and I should be, that I should be, they talk about those conversations, and they'll check curves and normals and pieces of string and all that kind of stuff but it's kind of around them what is normal. I think there's another whole pile of stuff of self-monitoring technology that can interface with clinicians, with regard to some of those monitoring their sugars and they're putting their information in and that's being able to be shared, and that really does reduce the clinic times potentially and waiting and all that kind of stuff that goes, and creates that self-resourcefulness. So I think there's a whole bolt-on around that, whether it's taking blood pressures and testing wees, and then it goes on doesn't it, the whole aspect of how much of care can be digitalised anyway. But there's definitely something around that, but then you can do that all you like but sometimes when you just see somebody you go ooh you're not right, what's going on there, and so you can have remote monitoring or whatever else it may be, but there is something around experience and exposure as well in any event. And I think caution is about if you're adding on, or putting things in, then what are you taking away, and I think that's always if you're doing some kind of digital interface that might happen

I That's interesting, somebody else that I spoke to last week said that, she said that they actually use one of those tools where the blood glucose is remotely monitored, but then that reduced the number of appointments, which obviously favourable for women because they were coming in every week, but it also reduced the number of blood pressure measurements that they were taking, and that was a concern for this lady, she was a midwife as well. It's interesting, you add something in but then what are you taking away, and I think there is some kind of trade-off there somehow, which certainly needs thinking about 100%

P I think so and I think that's that fear isn't it, and I think there's also that fear of the ones that you need to see the most are they the ones that are not going to have the access to the right type of platform or the right information etc., and not be able to come to the appointments either as well, and I think that's always a big fear is about equity of service and resource and everything else, access to health professions and everything, the ones who they're going to be a worry to us, who have got something going on with them, but the ones that you're compliant and concordant patient group or women's group anyway are going to be fine whatever you're offering and you're

doing, and it's just about making sure that those harder to reach groups are engaging really

I And they are hard to reach, I'm trying to reach them now and I'm just like oh

P Yeah exactly, and so then you start adding in really serious complications or other co-morbidities, or other family dependent needs etc., it's very difficult

I And I think it demonstrates as well that I think about how research can inform practice, and I'm no way saying that my research will inform practice, but I've been speaking to women who've actually said they're very well informed, they're very well educated, they've got access to all of these things, they're very up for using them. So my research is going to say that, and obviously I'm going to say that a limitation is that I've certainly managed to recruit a subset of women who are from a certain background or whatever, but it's kind of scary that then hopefully that will go on and get published but that's not representing the full picture

P Yeah, certainly inequities in health is a massive thing

I I'd just be interested to hear what your thoughts were on social media. So you might not know but whether you've come across or heard anecdotally about women using social media, particularly maybe kind of groups where there's kind of peer support and discussion around either pregnancy or gestational diabetes or anything like that?

P I haven't got any experience of it in terms of women doing that. I think certainly in terms of consumer voice and the access to any sort of digital platforms, whether it's social media or otherwise, I think since we've had out change moving to maternity services liaison committees to things like the partnership, having a digital way of gathering, for want of a better word, those women, and then whether those women find each other or not is another matter, is useful and is good and is a way of capturing really, whether it's just drip pass on, random, or whether it's doing a big whatever they call them, cloudburst, I don't know, whatever the team say, but whether you're deliberately going up to go and get something, or whether you're just getting stuff by default. I think the challenge is always though what's out there in terms of, so I'm thinking about when there's been adverse outcomes that have occurred in a particular organisation, so rather than us having a supportive kind way to look after one another or to give advice or support etc., but when there's been, particularly something that may occurred than actually they can be quite inflammatory and derisory stuff that is out there very quickly, very straightaway, that does get picked up by local press, that there is in my experience no right to reply to from midwives and / or an organisation etc, and the coroner, all sorts of people. So again it's the same, it's that caution with encouraging, some of it is incredibly toxic, and the truth is always a peculiar thing cos there's no such thing, there's very different perspectives of the truth that will be out

there and very, very public, which therefore, is out there so therefore, it is true, and I think that's a really hard thing. I think anything that is peer though in terms of health behaviours I think we know that that's a good way to sustain, particularly with this group because they become ongoing meaningful relations often, which can last for lots of different points in time and later on potentially, thinking back to the old days when people used to have antenatal classes they'd get to know each other and they would literally form lifelong friendships, and I think there is that ability to use social media in that way to build those long-lasting. And I guess with that some coaching aspects; I think again it's like caution, the health industry, for want of a better word, I mean clean living is our latest one at the moment, these are global brands, people become global brands, multimillion pound business. So again my caution would be around oh we've got this group and you can go and join this group and actually those groups will often be infiltrated with somebody, even somebody locally, who's looking for a spin on a business, and they might be a criminal at a particularly time who is able to join the group and actually before you know it they're recommending their cranialogy or osteopath four times a, which again we have no control over that, but they do morph into that because it's a very lucrative market really. So again it's just a caution about where we sit within those things. But at the end of it is people can help each other in a meaningful way it's got to be a good thing, and people can help each other out with behaviours, and even just practical things to do, thinking about diabetes actually can make an apple pie and you replace X with Y and out whatever it is. I think sometimes we forget how little some people know about some of the stuff that we do just know about, whether that's diet, exercise, whatever it may be, and we do know a lot of stuff about a lot of stuff really, sort of things people say I'm going to go on a course for that, why are you going on a course for that, just look it up, just do it, we would do because we're a socioeconomic group, one, two people who are professionals who've got training and education, so we'd just see the world in a different way, so there definitely is a need I think there

- I Yeah definitely, it is tricky with social media, I can understand it from both sides really, like I say, the group of women that I've spoken to they pretty much all get their information and their kind of peer support from this one Facebook group, and it's really, really, really heavily monitored, and from what I can tell, I can't get into it because I haven't got gestational diabetes, so it's very, very strict in terms of who they allow in and who they don't. But women just say that it's the most incredible resource, there's recipes, information about kind of, they had a certain expectation in their mind about their birth for example, and there's information in there about ok well this happened to me, I wanted to have a water birth for example but I had to go in and have this, that and whatever it might be. And they just say it's this incredible resource and that the environment is not toxic in any kind of way, and it's very supportive and there's no kind of like bullying and there's no judgement. Which I think is really rare because just from general use on Facebook you can see kind of trolling and just nasty...
- P Yeah it is interesting, so in my life, I told you about my daughter, I don't belong to many groups at all but I do belong to this group my kid's got cancer, or whatever it is, and it is just very much a place where, it's got tons of members now internationally, and you just go my kid's having this regime, what's your thoughts anybody, and you do

get just people's ideas or signposts, it's very interesting the American people in the group, you want to go here, you want to go there, it's all very much the prestigious place, the main place, we realise how lucky we are in the UK that we have a pathway and it doesn't matter where you are, what you can pay, just having a pathway, very, very different. But again it is heavily monitored so maybe there is something around if it was not monitored and there wasn't that level of caution whether it would be different, cos I think it's the same, and the parents their kids did have cancer as well so they're monitoring it in a, people are doing it, it's not anybody professional monitoring but it is just monitored and they spend a lot of time doing the admin, so maybe that's what prevents that part maybe a little bit

I Maybe that's the key

P Well just to keep in on-message I think really maybe, and off the back of that you end up sometimes with some other groups that's fine isn't it, that's absolutely fine

I I've been asking women as well why they trust it, cos they seem to trust this more than anything else, and it's like why, just why is it, and none of them can really quantify it, which is totally understandable, they're like well you just know, you can just see it or feel it, it's interesting. So thinking about postpartum women, so after they've had their baby, and enabling women to stay healthy in that kind of postpartum and beyond period, there's obviously lots of evidence to suggest that when women are healthy then their families are healthy and all that kind of stuff, but it's kind of confusing, particularly with gestational diabetes about where that support should come from, so women are obviously going back to their GP for their HbA1cs, they see a health visitor sometimes, but their kind of interaction with the midwifery team and diabetes kind of just completely stops. So I just wondered if you had any thoughts on that about where that support might kind of best be coming from

P Yeah I think that's really, really important, I think midwives want it, I would say midwives would really happily help women over a year I think in many, many ways, and I think letting go is, our option lines of 28 days or whatever else it is, which is usually down to 10 days, which is usually down to day five thank you very much, tell me if you need anything, it's got less and less and less. I think primary care is where the continuing health sits, and I think that would be where it is, but the problem is we exclude, well looking at this area in particular, we do exclude primary care pretty much in maternity, even in our latest government guidance that we're working to, GP's not even an afterthought, they're kind of chucked in right on the end, we espouse on one level that women have become more complicated and needed etc., but then we kind of just ignore a whole aspect of care, midwives have moved out of GP surgeries, completely reasonable, it's completely fine and absolutely ok, but actually it's about trying to understand what is the relationship and what are we trying to do, what are we trying to achieve, and where do we go almost from there. I think health visiting, I don't know whether you're specking to health visitors, they're absolutely rammed with safeguarding, the health part of their job, the visiting part of their job is not in

their world either, their world is safeguarding. I think across the board we espouse to self-promotion, how important it is etc., but actually I don't think it's given necessarily the time and the energy that it necessarily needs and warrants, and it's invaluable, and I think some of those aspects are being, I think as we go forward we develop more of the role of the maternity support worker, on a national level I think we will pick up some of that a little bit more and potentially some of those roles will maybe bridge across, possibly that could involve a practice type community health work, I don't know, I'm just trying to come up with a vision or a picture of what something might look like. Because somebody somewhere needs to, because I think the other thing is that often people can be, not dismissive just in pregnancy, whether it's raised blood pressure, it's gestational diabetes etc., and just forget the impact of the long-term health and wellbeing, or subsequent pregnancies and next time and everything else, and it's that oh what was this again, oh surprise, surprise, well it's not a surprise, you've know about this forever but we're still, we not really truly changing what we do or what we're not doing or whatever, and I think it probably is a bit hit and miss really of being on it or not being on it. So yeah I haven't really helped you with the solution but it's got be to working in place in primary care, whatever that look like, practice nursing, there's no reason why we couldn't hand over to primary practice nursing would be another opportunity that we could take

I Somebody else said that actually

P The practice nurse role is changing and evolving as well in the same way and I think they're a very useful link because women will see them with their children having vaccinations etc., over a period of time. From an indemnity point of view I'm not sure where it all quite fits, but that's a whole another bit

I Oh gosh no. I guess the thing with a lot of health promotion stuff that it's not just about pregnancy is it, it's about long-term outcomes that could be anything

P Exactly

I So it's kind of like it's such a good thing to do, especially with subsequent pregnancies it's really important to think about that preconception care, which I think a lot of women just don't get

P No it completely gets left and forgotten and somebody else's responsibility on another day etc.

I I'm conscious that I've taken up a lot of your time

P If there's any other wash-up bits you need in particular I'm really happy to talk again if needs me

I Thank you very much, and I'll get in touch soon

P I'm aware that I talk very fast, I'm not sure if you're transcribing but if you are I'm really sorry

I It's fine, I really, really appreciate it so thank you very much

P No problem at all

I I'll send you an email, I spoke to [Toni] last week and we started talking about the digital health champion programme and getting going with that again, cos I know we talked maybe in March time

P Yes we did and I've got a team meeting this week so I can just see where we are with that again

I I'm speaking to [Jill] on Thursday so hopefully I'll be able to get that ethics application in sooner rather than later and then we can get going, so that will be good

P Excellent, brilliant

I Thank you so much

P Alright, and it's lovely to talk to you, keep going, you're doing a great job

I Thank you very much

P Bit by bit isn't it, that's all it is isn't it, it's just little steps to keep this going forward just a bit

I I think that's the thing is to focus on and to just think oh yeah I have done that and it's o and it's fine, I'll get there one day

P And good enough is a good word as well

I I'll speak to you soon

P Lovely to speak to you and I'll speak to you or whatever soon, bye

I Bye

Appendix G: Study 4 Participant Packs

Introduction sheet

Hello



My name is Katie and I am the lead researcher for this study. Normally we would have met face to face by now, but due to COVID that's no longer possible.

In this pack you will find the following documents: Study leaflet, participant information sheet, consent form and some instructions. These documents help to explain why we are doing the study and what will happen if you choose to take part.

If you provided your maternity support worker with your contact information I will be in touch soon to organise a chat and to enrol you into the study if you decide to take-part.

This research will form part of my PhD project which is all about discovering the best way to support women who have experienced gestational diabetes, after they have delivered their baby.

If you have any questions about taking part or would like to find out more, please get in touch with me using the details below.

Email: Katie.edwards@plymouth.ac.uk

Phone/text: 07432155243

Thank you for taking the time to consider taking part.

Best wishes, *Katie*

Study Leaflet

If you have any questions related to any aspect of this study, including taking part or withdrawing please contact the researcher, Katie Edwards, or Director of Studies, Professor Jill Shawe.

Katie Edwards
Katie.edwards@plymouth.ac.uk
Telephone number:
07511629487
Address: S06 Knowledge Spa, Royal Cornwall Hospital, Truro, TR1 3HD

Professor Jill Shawe
jill.shawe@plymouth.ac.uk
Telephone Number: 01752 586558

GDMHealth
Gestational Diabetes
Mobile Health Study



IRAS ID: 252946

studyLeaflet_V2.0_04.09.2020

GDMHealth
Gestational Diabetes
Mobile Health Study



**Have you recently
been diagnosed
with gestational
diabetes?**

**We are looking for
volunteers to take part
in a research study
which is interested in
your unique opinion
as a person who has
experienced
gestational diabetes
during pregnancy.**

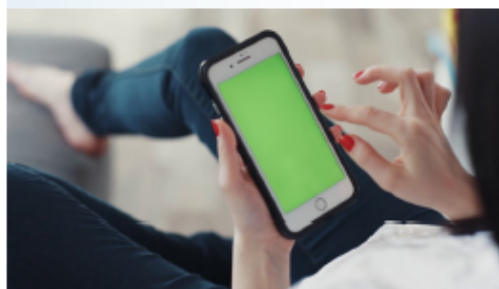


What is this study about?

You are invited to take part in a study which asks women who have experienced gestational diabetes, about their views and opinions on the support they would like to receive after giving birth, to help them make healthy choices.

Why is this study being done?

There is currently very little known about what support women would like to receive to help them make healthy changes after they have given birth, including help delivered through smartphone apps. This is despite knowing that making healthy changes after birth may help to prevent the recurrence of gestational diabetes in future pregnancies and the onset of type 2 diabetes later in life.



What will I have to do if I decide to take part?

Taking part in the study will involve attending at least one interview after you have given birth to your baby, with the researcher, Katie Edwards. This interview will also include a short demonstration of some smartphone apps. You may also choose to use some of these smartphone apps (for free) at home and provide your feedback at a second interview.

Due to COVID-19 interviews will take place over video-call or telephone.

For each interview you decide to take part in, you will be offered a £10 shopping voucher, as a thank you.

Do I have to take part?

No, you do not have to take part in this study and your participation is entirely voluntary. Even if you decide to take part, you are free to withdraw at any time, including during the interviews.

Who is doing this research?

This study is being conducted by Katie Edwards who is completing her PhD with the School of Nursing and Midwifery at the University of Plymouth.

How do I sign up?

If you would like some more information about taking part please ask your Diabetes Midwife or get in touch with Katie Edwards who is the main researcher Katie.edwards@plymouth.ac.uk 07432155243

Participant Information Sheet

Gestational Diabetes Mobile Health Study

Participant Information Sheet

What is this study about?

You are invited to take part in a study which asks women who have experienced gestational diabetes during pregnancy, about their views and opinions on the support they would like to receive after giving birth, to help them make healthy choices. This study provides an interesting opportunity to better understand women's priorities, motivations and needs during this time.

This study is being conducted as part of a PhD project investigating the use of smartphone apps aimed at helping women to make healthy choices after experiencing gestational diabetes during pregnancy.

Please take the time to read the following information carefully.

What will taking part involve?

If you decide to take part in this study, we would like to interview you around 8 -12 weeks after you have given birth to your baby. Interviews will involve a discussion with Katie, the researcher, and will focus on your views surrounding the support you would like to receive to help you making healthy choices after giving birth. This interview should take less than one hour and will take place over video-call. During the video-call you do not have to turn your video on if you do not wish to. Katie's video will be switched on and she will be located in a quiet, confidential part of her home when talking to you. Towards the end of the interview Katie will demonstrate several smartphone apps which you have the option to download (for free) and use on your own smartphone for around two weeks. Katie would like to get back in touch with you to arrange a second interview, to discuss your thoughts and opinions of using the apps. This interview can take place over video-call or the telephone. Interviews will be digitally recorded, transcribed and analysed, however all transcriptions and recordings will be anonymised.

If you agree to participate, please complete and return the attached consent form, indicating (using the tick boxes) the parts of the study in which you agree to take part.

Why have I been asked to take part?

This study is interested in your unique opinion, as person who has experienced gestational diabetes during pregnancy. There is currently very little known about what support women would like to receive, to help them make healthy changes after they have given birth, including help delivered through smartphone apps. This is despite knowing that making healthy changes after birth may help to prevent gestational diabetes in future pregnancies and the onset of type 2 diabetes later on.

Do I have to take part?

No, you do not have to take part in this study and your participation is entirely voluntary. If you decide not to take part this decision will not impact your or your child's usual healthcare or your relationship with the research team. Even if you decide to take part, you are free to withdraw at any time, including during the interview. If there are any questions you do not wish to answer during the interview, please let Katie know and she will move onto the next question.

What will happen if I do not want to carry on with the study?

You may choose to no longer take part in the study at any time, including during the interviews. You do not need to provide a reason for withdrawing and this decision will not impact your or your child's usual healthcare or your relationship with the research team. If you wish for your interview data to also be removed from the study, this is possible for up to 30 days after your first interview has taken place, as once the process of analysis and reporting begins, it will be difficult to remove your data. If you no longer wish to take part and/or would like your interview data removed from the study please let Katie know using the contact details below.

Are there any risks associated with taking part?

There are no expected risks connected with taking part in this study. However, if you feel uncomfortable with any of the topics discussed please let the Katie know during or after the interview. The contact details for Katie Edwards and her Director of Studies, Jill Shawe are available at the bottom of this information sheet. As part of this study, you will have the opportunity to download several apps onto your smartphone. The University of Plymouth and the study researchers do not own these apps and are not able to see or change any of the data you put into them. Although we anticipate no problems, downloading apps onto your phone is done so at your own risk.

What will happen with the information I provide you with?

We will need to use information from you for this research project. The information will include your name and contact details. People will use this information to do the research or to check to make sure that the research is being done properly. People who do not need to know who you are will not be able to see your name or contact details. Your data will have a code number instead. We will keep all information you provide us with safe and secure. Once we have finished the study, we will keep some of the data so we can check the results. We will write our reports in a way that no-one can work out that you took part in the study.

You can stop being part of the study at any time, without giving a reason, but we will keep information about you that we already have. We need to manage your information in specific ways for the research to be reliable. This means that we won't be able to let you see or change the data we hold about you.

You can find out more about how we use your information at <https://www.plymouth.ac.uk/your-university/governance/information-governance> or by contacting the University Data Protection Officer at dpo@plymouth.ac.uk. You may also find out more by asking one of the research team by sending an email to Katie.edwards@plymouth.ac.uk or ringing us on 07432155243. . You can read more about how researchers use your data at the following link:

<https://www.hra.nhs.uk/planning-and-improving-research/policies-standards-legislation/data-protection-and-information-governance/gdpr-guidance/templates/template-wording-for-generic-information-document/>

Will I be reimbursed for taking part?

If you decide to take part we can reimburse you for your travel and parking expenses. For each interview you decide to take part in, you will be offered a shopping voucher to the value of £10, as a thank you. You can choose to take part in a maximum of two interviews.

Ethics – Has this study been approved?

Yes. This study has been considered and approved by the Health Research Authority (IRAS Project ID: 252946) and the University of Plymouth Faculty Research Ethics and Integrity Committee, Faculty of Health and Human Sciences.

Contact Information

If you have any questions related to any aspect of this study, including taking part or withdrawing please contact the researcher, Katie Edwards, or Director of Studies, Professor Jill Shawe.

Email: Katie.edwards@plymouth.ac.uk

Telephone number: 07511629487

Address: S06 Knowledge Spa, Royal Cornwall Hospital, Truro, TR1 3HD

Email: jill.shawe@plymouth.ac.uk

Telephone Number: 01752 586558

Address: Knowledge Spa, Royal Cornwall Hospital, Truro, TR1 3HD

Complaints

If you wish to formally complain, you can do so by contacting Maurice Bottomley, Research Ethics Administrator, Faculty of Health and Human Sciences, 4th Floor Rolle Building, Drake Circus, Plymouth PL4 8AA.

You can also contact the Royal Cornwall Hospital Trust Patient Liaison Service by telephoning 01872 252793 or via email on rcht.pals@nhs.net

Participant consent form

IRAS ID: 252946
Researcher: Katie Edwards

Participant ID:

Consent Form

Gestational Diabetes Mobile Health Study

1. I confirm that I have read the participant information sheet dated 24.08.2020 (version 3) for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
2. I understand that all information will remain confidential within the research team and will not be shared with any third parties. Direct quotations from interviews may be used in publications, however, all reports, evaluations and publications will be anonymised.
3. I understand that my participation is voluntary and I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.
4. I understand that interviews will be recorded.
5. I am happy for the researcher to contact me 8-12 weeks after my baby is born to organise the first interview
6. I agree to take part in the above study

Pleas

My preferred method of contact is: Telephone Text email

I would like to be informed of the outcomes of this study: Yes No

Name of Participant Date Signature

Name of Person Date Signature
taking consent

Tel No: Email:
.....

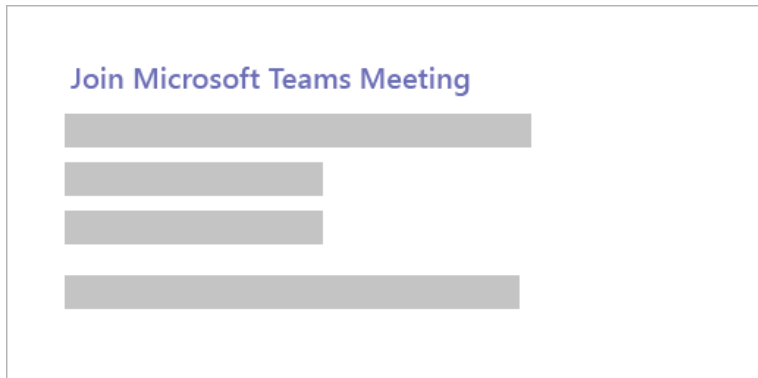
Instructions on joining a Teams call

How to join a video-call using Microsoft Teams

You can join a Teams meeting anytime, from any device, whether or not you have a Teams account. If you don't have an account, follow these steps to join as a guest.

Joining from a laptop or desktop computer

1. Go to the meeting invite and select Join Microsoft Teams Meeting.

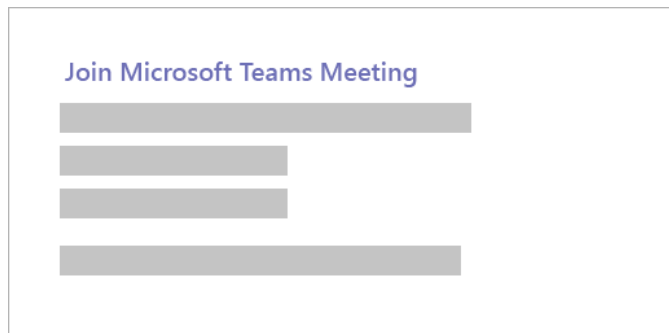


2. That'll open a web page, where you'll see two choices: **Download the Windows app** and **Join on the web instead**. If you join on the web, you can use either Microsoft Edge or Google Chrome. Your browser may ask if it's okay for Teams to use your mic and camera. Be sure to allow it so you'll be seen and heard in your meeting.
3. Enter your name and choose your audio and video settings.
4. When you're ready, hit **Join now**.
5. This will bring you into the meeting lobby. We'll notify the meeting organizer that you're there, and someone in the meeting can then admit you.

Joining from a mobile phone

Even if you don't have a Teams account, you can still join a Teams meeting on the mobile app. Here's how:

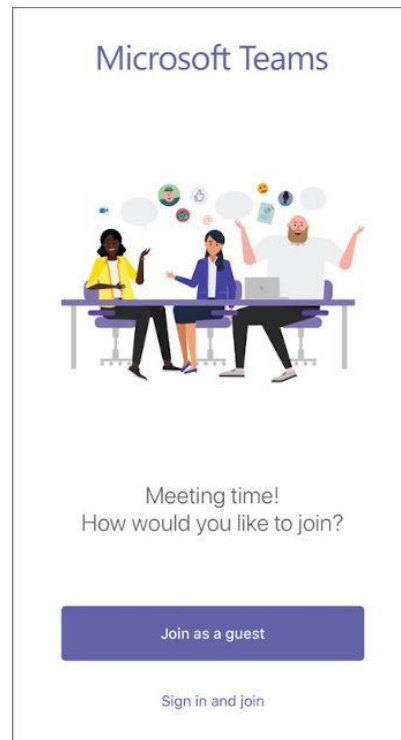
1. In the meeting invite, select **Join Microsoft Teams Meeting**.



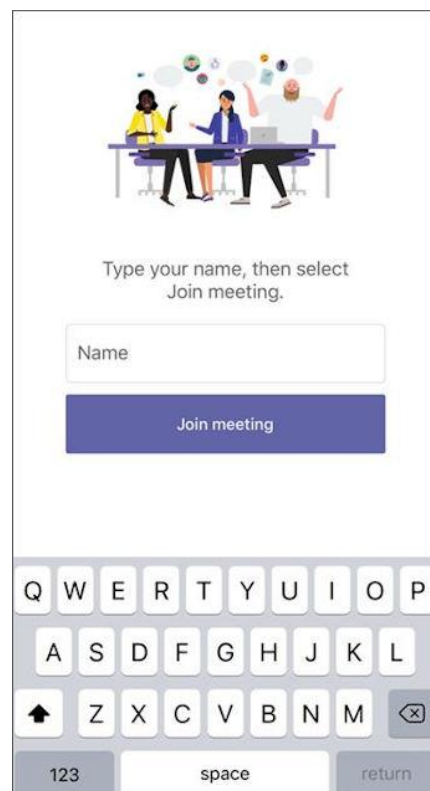
2. If you don't already have the Teams mobile app, you'll be taken to your app store to download it.
3. Download the app and open it right from the app store page.

Teams will ask if it's okay to use your mic. Be sure to allow it so others in the meeting will be able to hear you.

- Next, you'll be given two options for joining your meeting: **Join as a guest** or **Sign in and join**. Choose **Join as a guest**.



- Type your name and tap **Join meeting**.



6. Once you're in the meeting, you can turn your video or mic on or off by tapping on the center of your screen to show the meeting controls. Tap again to hide them.

Appendix H: Study 4 interview topic guides

Interview One - Topic Guide

Introduction:

[Brief overview of interview structure and timing – roughly 30 mins]

[Reminder of participant right to withdraw at any time]

[Remind participant that the interview is recorded and why, ask again if ok with this]

[Ask participant if they are happy to go ahead with interview]

Interview 1 prompts:

Pregnancy/GDM diagnosis/ice breakers

To start with I'd be really interested to hear a little bit about your pregnancy, and how you found out that you had gestational diabetes.

How did you find managing the diabetes when you were pregnant?

Were there any issues or concerns you encountered whilst you were trying to manage?

When trying to get your sugar levels right/balanced did you ever use an app to help you with that?

Were you aware of any apps or websites out there that could help support you with your gestational diabetes?

When they told you that you had the diabetes, did they say anything about it after you'd had your baby?

And did your doctor say anything about what would happen with the diabetes after you gave birth to your baby?

Postpartum/ healthy behaviour change/

What happened to the diabetes once you'd given birth?

Have you seen a midwife or health visitor yet since you've had him/her? – closed questions

Sometimes women go for a check-up at the GP afterwards, to check their blood glucose levels, did that happen with you?

Did they have any advice for you about how you can stay healthy?

I'm curious to know if you've had any thoughts or ideas about how you'd like to stay healthy moving forward?

If you were going to make some of those changes to your lifestyle, what kind of things do you think you would do? What would be your main priority?

What do you feel would be the main benefit of making those changes?

Making those kinds of changes can be really hard, especially with a new baby to look after. What do you think is or would be the main thing that might hold you back from making these changes?

Do you think motivation plays a role in that? [expand on motivation across pregnancy]

Apps

So you've said that you'd quite like to [insert woman's goal] How would you feel about using an app to help you do that?

[If woman has stated no particular goal] – If in the future you felt ready to make some changes, for example stopping smoking, how would you feel about using an app to help you do that?

What do you think the main benefits would be (from using an app)?

If there was a magic app out there to help you [insert woman's goal] what features would you like it to include? (for example....step counting)

Would your partner or person who most supports you be interested in using an app to help them stay healthy as well as you?

Thinking back to before you were pregnant, were there any things or goals you wanted to do you had to try and stay healthy?

Did you ever use an app to help with that?

Do you remember which ones have you used in the past?

What was good about them?

Was there anything that frustrated you about using them?

What was it do you think that made you stop using the app in the end?

How did you mostly access the app? For example by phone or laptop?

I'm coming to my last couple of questions now...

A part of this study is looking at the FITZ app which we've just looked at, and we would really like some feedback on what it's like to use it, both good and bad. Would you be happy to use it for a week or two and I can come back and ask you about your feedback on it?

[Guide participant through the download process where required]

[Reassure participant that apps are free to use]

[Reassure participant that none of their data inputted into the app will be collected]

Debrief:

Do you have any questions you would like to ask me?

Thank you so much for taking the time to talk to me today.

How are you feeling after our chat? I know we have talked about a lot of things today, if you feel you need some extra support in any area I've got some resources here for you to keep if you need them. You can contact me using the details in the information sheet which I'll give you again here.

[Remind participant of research team contact details]

[Reminder of withdrawal]

[Refer participant to support resources where relevant]

[Schedule next interview: offer telephone interview]

Interview Two (app feedback) – Topic Guide

Introduction:

[Brief overview of interview structure and timing – roughly 30 mins]

[Reminder of participant right to withdraw at any time]

[Remind participant that the interview is recorded and why, ask again if ok with this]

[Ask participant if they are happy to go ahead with interview]

Interview 2 Prompts:

So how did it go using FITZ? What were your initial thoughts on trying to use them [it]?

How often did you find yourself using them [it]?

What was the most enjoyable part of using it? Which bits were good?

Where there any parts of the experience that were frustrating?

What was the easiest bit about using it?

Did you feel it helped you? In what way?

Is there anything that would put you off using it again, or continuing to use it?

Is there anything you could think of that could make it better?

I'm coming to my last couple of questions now.....

How did you find logging in a setting up an account?

What about navigating through the features?

What was it like to talk into the app and then hear your own voice?

In terms of the mental imagery practice, how did you find that?

How did it make you feel?

How did your partner feel about it? Did he/she manage to give it a go?

Debrief:

Do you have any questions you would like to ask me?

Thank you so much for taking the time to talk to me today.

How are you feeling after our chat? I've got a copy of the sheet with resources on here, so I'll leave that with you. You can contact me using the details in the information sheet which I'll give you again here.

[Remind participant of research team contact details]

[Reminder of withdrawal]

[Refer participant to support resources where relevant]

[Ask participant if they would like to be informed of study results]

Appendix J: Study 5 Healthcare professional survey

Eligibility

Are you a healthcare professional who currently, or has previously, supported women experiencing gestational diabetes?

Yes/ No

PIS and Consent

Before completing this survey, please read the downloadable participant information sheet found [HERE](#) [*link to PIS*]

Once you have read the information sheet, please complete this consent form, then you will be taken to the questionnaire.

We are asking you for your contact details, as we would like to invite you to continue to provide feedback during a co-production workshop to share your thoughts further. Please be assured that this information will be held securely and only accessed by the research team. Your survey responses will remain anonymous.

Name: [free-text box]

Email address: [free-text box]

	Yes	No
I have read and understand all the information provided		
I have asked, and had answered, any questions I had, and understand that I can request more information at any time		
I understand my participation is entirely voluntary		
I understand my details will remain anonymous and I will not be able to be identified in any reports that come from this work		
I understand that I am free to withdraw at any time without providing a reason. Any data collected will be used anonymously.		
I understand my data will be stored securely		
I understand my personal details will be stored only for contact purposes and will be deleted following the completion of the study. No		

details will be given to a third party.		
The results of the research may be published. I understand that some of my quotes might be published but they will be anonymised.		
I understand that taking part in this study should be done in my own time, not NHS time.		
I consent to take part in this research.		

1 What is your age?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 and over

2 What is your gender?

- Male
- Female
- Other
- Prefer not to say

3 Where are you located?

- North East (England)
- North West (England)
- Yorkshire and The Humber
- East Midlands (England)
- West Midlands (England)
- East of England
- London
- South East (England)
- South West (England)
- Scotland
- Wales
- Northern Ireland

4 What is your job role? (e.g. Diabetes Specialist Nurse)

[free-text]

5 How long have you been in your current role?

- Less than one year
- 1-2 years; 3-5 years
- 6-10 years

11-15 years
more than 15 years

6 Do you currently, or have you ever, offered women experiencing gestational diabetes information or support on how they can manage their weight during or after pregnancy?

Yes – during pregnancy
Yes – after pregnancy
Yes – both during and after pregnancy
No, I do not currently do this as part of my job role

6.1 Please briefly describe the information or support you offer below

[free text box]

7 Have you ever recommended or suggested any of the following apps to help women who have experienced gestational diabetes manage their weight, either during or after their pregnancy? (please tick all that apply)

MyFitnessPal
NHS 12 week app
Couch to 5k
Sidekick Health
Other (please describe) [free text]
I have never recommended an app to help women with weight management

8 We would like you to watch this short video about an app designed to help people stay motivated when making changes, such as those needed for weight management. Afterwards we will ask you some short questions about what you think of the app shown in the video.

[insert embedded video here – approx. 3 mins long]

9 Thinking about using the FITZ app to support women with experience of GDM with weight management AFTER pregnancy, please answer the following questions. Remember, your answers are anonymous and you are free to give both positive and negative feedback.

10 Overall, what do you think of the FIT intervention and FITZ app?

[free-text response]

11 In what ways do you think the FITZ app could be beneficial to support women with weight management post-delivery? (for example, provide convenience to women as online)

[free-text response]

12 What do you think may inhibit/stop women from using and/or benefiting from the FITZ app?

[free-text response]

13 What do you think about the FITZ app in comparison to other weight management apps? (e.g. MyFitnessPal, Couch to 5k)

[free-text response]

14 When do you think it would be best to introduce women to the FITZ app for helping them stay motivated to make changes after they have had their baby? (for example 6-8 weeks after delivery/ during pregnancy/ 36 week check etc.)

[Free text box]

15 If you or another healthcare professional were offering the FITZ app to women how would you, want to present it?

[free text box – for example: would you prefer the FITZ app to be part of package of online support?]

16 In order to guide our future work, we are interested in understanding different ways in which the FITZ app could be presented and used to make it most engaging for women. Please tick below all that apply

To make the app more engaging/effective....

The FITZ app could be used alongside other apps (e.g. couch to 5k)

The FITZ app could be used alongside face-to-face support (e.g. slimming world/ weight watchers)

The FITZ app could be used alongside online peer support (e.g. private Facebook group community or WhatsApp group)

The FITZ app could used alongside video based support – e.g. group videocall

None of the above

Other [free text box]

17 If there is anything else you would like to say about the FITZ app, or anything else, please use the box below: [free-text answer]

18 Would you consider using the FITZ app yourself?

Yes

No

Maybe

Here is the link to download the FITZ app for IOS and Android devices, or type into the App or Google Play stores “FITZ” and look for this icon - Please feel free to download and use the app.

This is the end of this questionnaire.

Thank you for taking the time to fill out this survey. We will be in touch soon regarding the co-production workshop

Appendix K: Study 4 co-production workshop topic guide

Based on what you've seen of the app and the FIT intervention so far, what is your overall impression of the idea to use this app as a way of supporting women?

Do you see women using this app?

How would you want to present the app or package of support to women? And when?

What would be the benefits of timing the intervention at this point?

What would be the potential disadvantages of timing the intervention at this point?

If we set up some kind of peer support function, such as a WhatsApp group or a Facebook group what content would you like to see on there? (e.g. breastfeeding support, reminders for screening,)

How could we make the peer support function as safe as possible? (e.g. monitoring)

What are your thoughts on adding video group sessions to the package? These could be recorded so women could watch them back.