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# How do women with a history of gestational diabetes mellitus use mHealth during and after pregnancy? Qualitative exploration of women's views and experiences

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

## **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 healthcare professionals 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

## 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 and 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, C., Newton, K. M., & 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 healthcare professionals. Studies have found pregnant women commonly use their smartphones to access information to help them prepare for birth, (Sanders and Crozier, 2018), share experiences and seek support with others via social media (Sparud-lundin et al., 2011; Naveh and 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 and 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 address prevention of GDM recurrence (O'Reilly and Laws, 2018) and long-term implications such as type 2 diabetes (Nielsen et al., 2020). 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 healthcare professionals, 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.

## **Method**

### Study Design

Women's views and experiences were explored using semi-structured telephone interviews. Commonly used in health research (Holloway and 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 16<sup>th</sup> 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 (20). Analysis followed Braun and Clarke's (20) six-phase approach and findings are presented in narrative form.

## 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 1).

Table 1. Participant time of diagnosis, number of children and GDM pregnancies and status of attending postpartum type 2 diabetes screening.

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

\* oral glucose tolerance test

\*\* glyated haemoglobin



## Key Themes

Through thematic analysis, three key themes were identified from the data (Table 2): 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 2. 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

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. 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 healthcare professionals, as *"on the app, you just know that certain times during the week when they have team meetings [any issues would] get flagged up"*. 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 healthcare professionals 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 healthcare professional 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 healthcare professionals; “*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 healthcare professionals 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).

## **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 healthcare professionals. Trust in online health communities can positively impact trust in healthcare providers (Audrain-Pontevia and 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 healthcare professionals, ultimately placing value on the information they found online.

The lack of recommendation from healthcare professionals 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 and 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, healthcare professionals may not be confident doing this and therefore, educators should consider inclusion of digital professionalism within curriculums in order for healthcare professionals 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 healthcare professionals 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 healthcare professionals 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 healthcare professionals. Increased body confidence and trust in healthcare professionals 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 healthcare professionals, 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, healthcare professionals 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 healthcare professionals.

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