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# A mixed methods study investigating sources of fertility and reproductive health information in the UK

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ABSTRACT

*Objectives:* This study aimed to assess the different sources used by individuals when seeking fertility information in order to understand what's working, what isn't, and opportunities for improvement.
*Methods:* A mixed-method study was conducted via UK-wide cross-sectional survey and semi-structured interviews. 1082 survey-participants were recruited nationwide via online-newspaper and social-media adverts. Of those who agreed to follow-up interview, 35 were purposively sampled to reflect the diversity of gender, age-range, ethnicity and education. Tableau software was used for surveys and NVIVO for interviews. Interview data was transcribed and analysed via thematic framework analysis.
*Results:* Sources of information identified included: school-education; healthcare-professionals; internet, social-media, smartphone-apps, online-forums and blogs; family, friends, and communities; books, magazines, newspapers; fertility-products; workplace, communities and sexual-health clinics/centres, charities, and third-party organisations. Participants reported varying levels of access, reliability, and trust, in relation to these sources. Interview themes around veracity showed that healthcare-professionals were highly trusted but not easily accessible. The internet was very popular due to accessibility and perceived anonymity but untrusted, and "the plethora of information can be overwhelming." There were recurring themes around discomfort. A respondent recalled that her first discussion of sex with her mother was on her wedding night stating, "…Mum, I'm 28! And you're just discussing this with me now?"
*Conclusions:* School education remains a consistent but sometimes inadequate source of fertility information. In addition to online-platforms and products based on robust scientific evidence, opportunities for improvement include using underexploited sources, such as workplace and community settings, with training for providers.

## Introduction

As the trend to delay childbearing continues to rise, health policies have highlighted the importance of good reproductive health education in order to help people make informed decisions. There has also been a concerted effort by various global reproductive health groups to improve fertility awareness. Recently, a group of experts founded the International Fertility Education Initiative, a multidisciplinary global collaboration dedicated to improving fertility awareness, which is supported by the European Society for Human Reproduction and Embryology [1].

An important element of addressing fertility education is through better understanding of the sources of fertility and reproductive health information, whether they meet people's needs and whether the information provided is accurate and reliable, in order to implement the best strategies for disseminating reproductive health knowledge. Furthermore, understanding how reproductive health information is accessed, can provide opportunities for effective communication and dissemination.

Research has shown that the internet has been one of the most popular source of seeking (in)fertility information for a long time [2]. A systematic review [3] highlighted that people used the internet to seek (in)fertility formation in order to feel better informed, meet their emotional, social and psychological support, and to aid decision-

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making. While online educational material via websites and some social media can empower and improve patient care, [4], some of the negative impact of using the internet includes, risk of misinformation or misunderstanding of the data provided, and needs not being met [5].

The importance of health-related information has come to the fore, especially since the COVID-19 pandemic, during which an infodemic contributed to thousands of deaths [6]. The term infodemic, a portmanteau of the words "information" and "epidemic" refers to overabundance of information in digital and physical environments, which can be false or misleading, causing confusion, risk taking and health-harming behaviours [7–9]. It can also lead to mistrust in health authorities, undermining of public health responses, and increased mortality [10–12]. There are several myths and pervasive rumours around the COVID-19 vaccine affecting reproductive health and causing infertility [13–15], highlighting the need for trusted sources.

In addition to healthcare professionals and school education, other sources of fertility and reproductive health information such as books, magazines, television programmes, menstrual cycle tracking apps, friends and family have been reported as sources of fertility information [16–19], with varying levels of usage and trust. However, studies in this area have typically focused on quantitative surveys on student population groups, women, or patients seeking fertility treatments.

This mixed-methods study therefore aimed to assess the different sources used for fertility and reproductive health information among lay population groups and healthcare professions (HCPs); the perception of, and reliability of these sources; as well as barriers and enablers for seeking information; in order to understand what is working, what is not, and any opportunities for improvement.

## Materials and methods

The findings presented in this paper, on the sources used for (in) fertility and reproductive health information are from a mixed-method study. Data from some aspects of the study - exploring fertility awareness - has been previously reported [20]. In summary, a survey was conducted on 1082 participants, thirty-five of whom agreed to participate in follow-up studies. Survey participants were recruited nationwide, via online newspapers and social media adverts with a link to the study provided in the online recruitment advert. Interested participants were provided with the study information and preliminary screening questionnaire to determine eligibility. Population groups recruited included, lay men and women of reproductive age, and healthcare professionals. Those who satisfied the screening criteria were provided with a unique link, which was connected to the email address provided.

The quantitative survey was deployed via the SurveyMonkey® survey software and questionnaire platform. Survey questions covered sociodemographic background, knowledge gained from school education and usefulness later life, as well as usage and trust of sources information on fertility and reproductive health. Questionnaire on the perceived adequacy of school education on pregnancy prevention, safe sex, reproductive biology, fertility protection (see supplementary material) were taken from previously validated survey [21–23]. Comparative analysis of sources information was carried out using Tableau Data Analysis Software, V. 2020.484. 1029 out the 1082 survey respondents agreed to be contacted for follow-up studies.

Criteria-based purposive sampling was used, in order to cover the socio-demographic diversity including: gender, age, ethnicity, and education of the survey participants who had agreed to be contacted for follow-up interviews. Due to the purposive sampling method, emails were sent to participants who met the sociodemographic requirements, until the desired number of participants were reached. Semi-structured interviews were conducted on thirty-five participants via face to face and telephone interviews. Interviews were conducted by a single interviewer, trained in qualitative research methods. Apart from the research study information, participants had no previous knowledge of the interviewer. For depth of insight to expand on survey findings, topic guide included additional questions around, usage, trust, barriers and enablers associated with the sources of information and any other information around sources of fertility and reproductive health information. During interviews, probing continued until a full understanding of the perspectives of each participant - on their circumstances, intentions, feelings, personal situation - was obtained. Interviews lasted one hour on average and were digitally recorded, transcribed verbatim and coded electronically using the NVIVO Pro software (version 11, QSR International).

Data analysis was conducted using the Framework methodology [24]. This covered familiarisation; identification of a thematic framework; indexing; charting; and finally, mapping and interpretation. The coded framework matrix was exported from the NVIVO software into a Microsoft Excel file which was used for further examination. Reflexive journaling [25] was used to minimise personal bias. Feedback from a qualitative data workshop with five colleagues who have extensive experience in qualitative research methods, resulted in additional line by line review of codes, re-categorisation and inclusion of memo and reflective notes from NVIVO. The key themes identified are outlined in the interview results section.

Favourable ethical approval was obtained from UCL Research Ethics committee (Reference 8421/001). All participants gave informed consent.

## Results

### *Survey*

#### *Demographics*

The sociodemographic characteristics of survey and interview

**Table 1**
Sociodemographic characteristics of survey respondents.

| SOCIODEMOGRAPHIC CHARACTERISTICS | N | % |
|---|---|---|
| General Population | **735** | **67.9** |
| -Men | 319 | 29.5 |
| -Women | 413 | 38.2 |
| -Other | 1 | 0.1 |
| -I prefer not to answer | 2 | 0.2 |
| Healthcare professionals | **347** | **32.1** |
| -HCP Men | 132 | 12.2 |
| -HCP Women | 215 | 19.9 |
| -Other | – | – |
| -I prefer not to answer | – | – |
| Ethnicity - all participants | | |
| -White | 827 | 76.4 |
| -Mixed/multiple ethnicity | 112 | 10.2 |
| -Asian | 87 | 8.0 |
| -Black | 45 | 4.20 |
| -Other ethnic groups | 11 | 1.1 |
| Education - all participants | | |
| -Degree or equivalent and above *(tertiary /university education)* | 756 | 69.9 |
| -A levels, vocational level 3 and equivalent or above *(post-secondary, pre-university education)* | 252 | 23.3 |
| -GCSE, vocational level 2 and equivalent *(secondary school education)* | 61 | 5.6 |
| –No qualifications | 6 | 0.6 |
| -Other | 7 | 0.6 |
| Occupation - all participants | | |
| -Higher managerial, administrative or professional | 128 | 11.8 |
| -Intermediate managerial, administrative or professional | 198 | 18.3 |
| -Supervisory or clerical, junior, managerial, administrative or professional | 326 | 30.1 |
| -Skilled manual workers | 237 | 21.9 |
| -Semi and unskilled manual workers | 70 | 6.5 |
| -Not earning, state pensioners, student, casual workers | 123 | 11.4 |
| Age - all participants | | |
| −18–27 years | 234 | 21.6 |
| −28–36 years | 461 | 42.6 |
| −37–45 years | 356 | 32.9 |
| -≥ 46 years | 31 | 2.9 |

participants are outlined in Table 1 and Table 2.

*Sources of information by usage and trust*

Respondents were asked to rank the sources of information by usage and trust. As shown in Fig. 1, sources are ranked from most used (top) to least used (bottom). HCP and lay groups were categorised separately. The colour gradient denotes the difference between usage and trust, which is also represented by an arrow in the right-hand column. The longer the shaft of the arrow, and the darker the colouration, the greater the difference between usage and trust; orange/red left-pointing arrows show a source is more used than trusted, whereas right-pointing blue arrows show that a source is more trusted than used.

*Reflection on school secondary education*

Survey participants were also asked about the knowledge gained from their own secondary school education. Fig. 2 summarises respondents' reflection of their knowledge of the following secondary school education topics: The biology of reproduction, Prevention of pregnancy, Safer sex and prevention of Sexually Transmitted Infections (STIs), Protection of fertility, Factors influencing fertility. Respondents had significantly greater confidence in their knowledge of biology and risk prevention (pregnancy, STIs) than in their knowledge of influencing and protecting fertility.

*Interviews*

*Interview themes*

In addition to the sources highlighted in the survey, others discussed during the interviews include workplace; local communities, university environment, fertility products; sexual-health clinics and centres and charities. Four main themes around veracity - trust and credibility; scope – relevance and timeliness; discomfort discussing the topic - awkwardness and embarrassment; importance of underutilised communities and alternative sources, as well as associated barriers and enablers are presented in this section.

*Veracity - trust, accessibility, credibility, and presentation*

The internet was reported as a popular source due to accessibility and perceived anonymity, but some concerns were raised about the overabundance of information and knowing which to trust. There were recurring themes around Google search engine and the NHS (National Health Service, UK) website being the first port of call.

**Table 2**
Sociodemographic characteristics of interviewees.

| Characteristic | Category | Male (*n = 13*) | Female (*n = 13*) |
|---|---|---|---|
| Age group | 18–27 years | 3 | 4 |
| | 28–36 years | 5 | 5 |
| | 37–45 years | 5 | 4 |
| Ethnicity | Asian | 3 | 4 |
| | Black | – | 2 |
| | White | 10 | 5 |
| | Mixed | – | 2 |
| Education | No university degree | 6 | 8 |
| | University degree or equivalent & above | 7 | 5 |
| Healthcare professionals (*n = 9*) | | **Male (*n = 2*)** | **Female (*n = 7*)** |
| Age group | >35 | 1 | 3 |
| | less than35 | 1 | 4 |
| Training | General practitioner (Primary care) | 1 | 1 |
| | Nurse (Primary care) | – | 3 |
| | Doctor (Secondary care) | 1 | 3 |

> *"The plethora of information can be overwhelming, you just don't know what to trust…"* Male, 27, White, has no child, would like children in future.
>
> *"It's [NHS website] the national health bible. The information on there is verified to an extent that the general population can have that reassurance that the information on there is accurate enough."* Female, Age 21, Black, degree, has no child, would like children in future.

In terms of credibility, interviewees were looking for reassurance that online information was written by experts in the, kept up to date, unbiased and not just about trying to "sell a product" or trying to "push an agenda.".

> *"If it was a particularly hard-core religious site pushing stats and stuff like that, I would definitely feel like there was a particular agenda being pushed… I wouldn't feel comfortable accepting that information at face value…."* Female, Age 21, White, Degree, has no child, unsure about having children

In some cases, the "look and feel" of certain websites drive respondents' trust of the information provided. For example, too many adverts or unprofessional-looking websites were typically judged as factually incorrect.

> *"Any website that's really ugly, like just not enough money's been spent on it. If any images look like they're not professionally taken it would make me question the quality of the site in my own mind. If there are horrible background images or too much animation… if it's full of crazy adverts… that would put me off."* Male, Age 36, White, A levels, has no child, no desire for children.

Sometimes technical information or scientific journals information is pitched too high, and some media platforms break down complex information better.

> *"The BBC [British Broadcasting Corporation website] use simple words and language that's easy to understand and not too many medical terms so that you're not kind of wondering what on earth does that mean? They keep the articles short, don't give away too much information but kind of give ideas." FP10 - Female, Age 38, White, degree, has three children, does not want more.*

*Scope - relevance and timeliness of the information*

School education was discussed as a key source of information on fertility and reproductive health. However, there were recurring themes around gaps in the details, range of the different aspects covered and its usefulness for family building in later life.

> *"I don't think that we got any good foundation, the knowledge was far more sketchy and scant*." Male, Age 45, has three children, does not want more.

Educational books were generally trusted but concerns raised were around the fact information is constantly changing and can be quickly become out-dated.

> *"…When I say books, I mean educational books, I'd consider those to be more authentic. The only issue with that is, as information is constantly changing, the information in the books can be outdated."* Age 24, white, has no child, would like children in future.

Some respondents reported that they review the country of website to determine how relevant and applicable the information is to them.

> *"American websites are always going to be a bit different because their health care system is different, I take in information with caution*" Female, HCP, Degree, Age 33, has two children, does not want more.

In terms of tailored information, the use of mobile apps for tracking menstrual cycles, and products such as fertility and ovulation kits to better understand their fertility were discussed. There were concerns

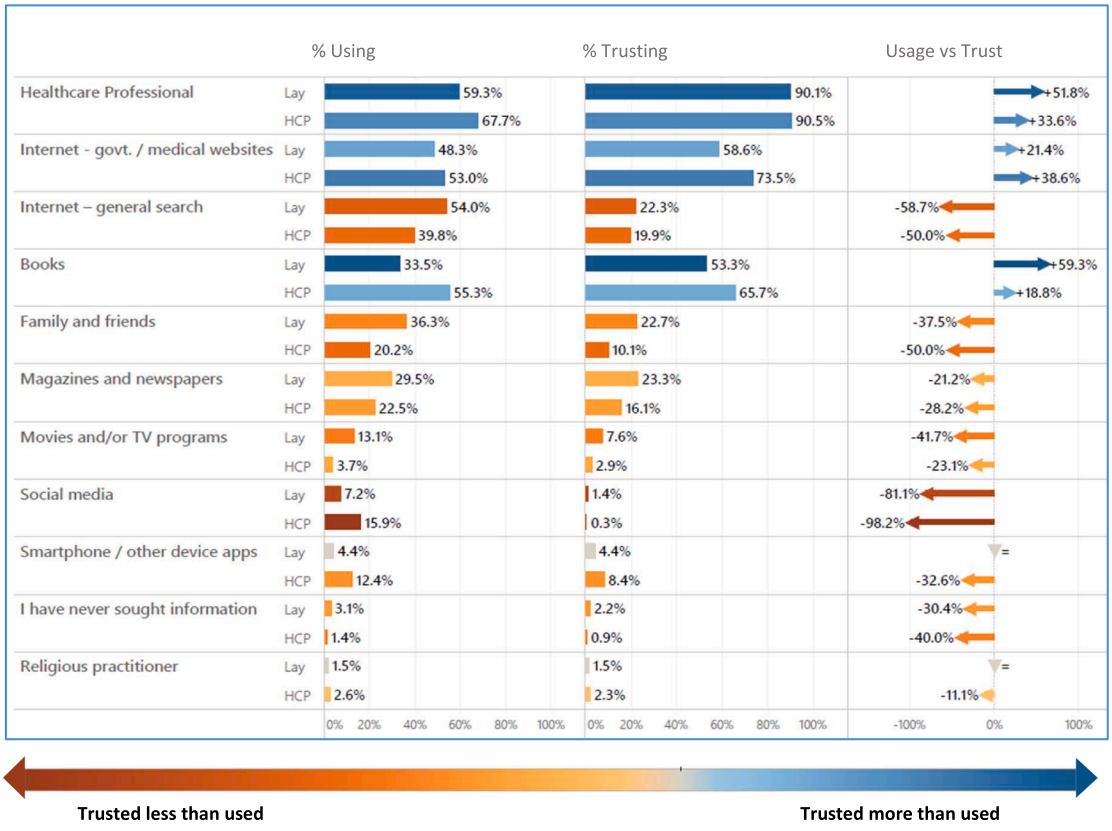


**Fig. 1.** Sources of Information, usage, and trust.

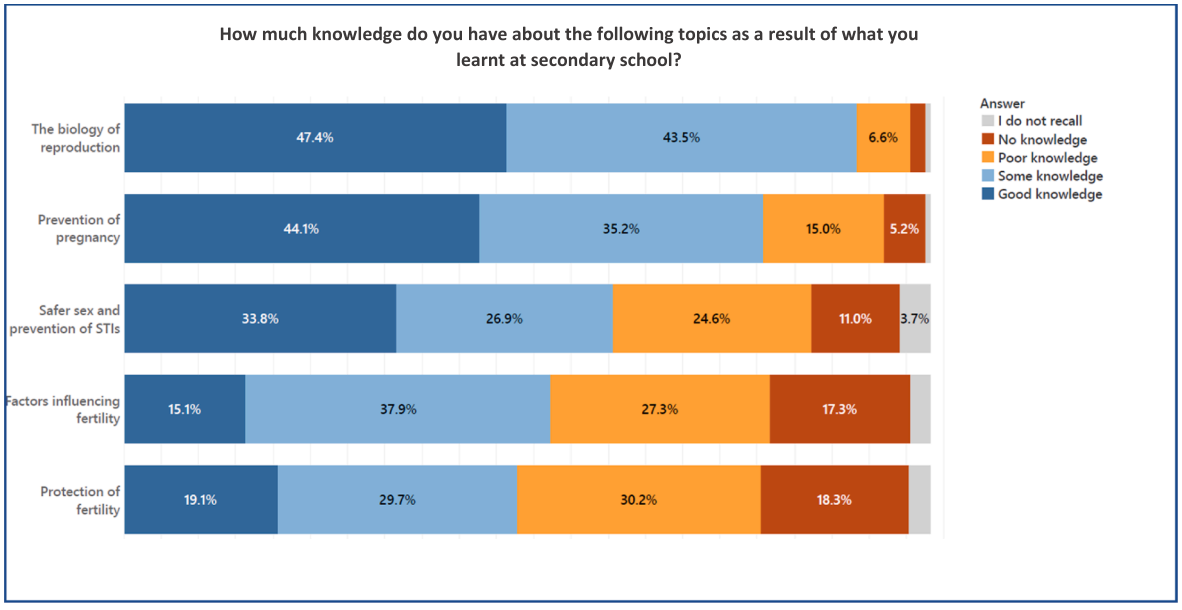


**Fig. 2.** Reflection on school education – all population groups.

raised over the reliability of the information provided within mobile apps, while some mentioned the desire for more technologically advanced products.

> *"[I would like] a product to calculate fertility and probably of having children in future" FP6 - Female, Age 36, White, GCSEs, has one child, would like more.*

> *"I did use an app just to monitor my cycle and try to predict my ovulation, but it was still kind of unreliable for me…"* Female, Age 31, has no child, pregnant.

There were discissions around individuals specifically reading through reviews and comments section when participating in online forums, which closely match their situation, and possibly be guided by the information.

*"…and some of them [websites] normally have people who have comments when people have had similar issues or been through the same experience and they can comment and give you some direction or guidance on what to do if you find yourself in that situation as well."* Female, Age 25, Black, Degree, has no child, would like in future.

*Discomfort - awkwardness, embarrassment, stigma, taboo, and anonymity*

Family was another key source of education, but there were recurring themes towards embarrassment discussing the topic within the home environment. For example, one respondent recalled that her first discussion of the topic with her mother was at on her wedding night, her reaction:

*"…Mum, I'm 28! And you're just discussing this with me now?"* Female, Age 36, Asian, Degree, has two children, would like more.

Parents also highlighted some discomfort and awkwardness broaching the topic with their children. There were suggestions of learning from other countries or cultures that seem to be doing it well. A participant with a Danish wife stated that, culturally, they seem to have a better grasp of this issue.

*"I find it a bit hard, but my wife's family are Danish and they're quite open-minded about these sorts of things… We felt it was important to put things out there (for daughter) about where babies come from.* Male, Age 38, White, Degree, has two children, does not want more.

There were several discussions regarding the use of social medial platforms as sources of information on fertility and reproductive health and mainly due to perceived anonymity. Platforms cited by respondents include Facebook, Instagram, twitter, YouTube, Snapchat, mumset whilst some men discussed the need for more forums where men can exchange ideas (dadsnet).

*"I think social media campaigns have high impact because it's also anonymous. It's something that you put out there in a proactive stance and somebody can take it if they want to. You to have a two-way conversation because I know there is sometimes a bit of a stigma attached to finding out more and more about this topic, that people just feel a bit awkward about."* Male, Age 20, Chinese, A levels, has no child, unsure about having children.

*Underutilised and overlooked sources*

Respondents also discussed other sources which they perceived to be impactful but underused or often overlooked. These included university health centres, sexual health clinics, charities and other third-party organisations which specialise in fertility and reproductive health, as well as the workplace. Local communities were also cited as important sources for improving education on fertility and reproductive health. Examples included religious settings, Youth Groups like Boy Scouts and Girls Guides. A female respondent reported had limited interactions especially with men due to her religion, but her community provided a good support.

*"Well, being a Muslim, female to female interactions are definitely more easier than what they are with males. I found it quite shameful going to ante-classes because obviously it was hard getting out but I was able to speak to other women in my community…"* Female, Age 30, Asian A levels, has one child, would like more.

Additional support for these communities would also help with disseminating accurate information and breaking barriers on this subject.

*"I know a lot of stuff is about school, school, school; there are others like communities. When I was younger, I used to go to culture classes, and I think they need to take responsibility as well. You know you go to Brownies and stuff like that, and they teach you life-surviving skills, they should talk about fertility stuff… I don't think we should just rely on the schools all the time and put too much pressure on them."* Female, Age 36, Asian, Degree, has two children, would like more.

Some missed opportunities were highlighted around discussing the topic within the workplace environment as a significant proportion of the reproductive years is spent as part of the workforce.

*"Introducing the conversation within the workplace environment is key, as such places typically don't have this kind of support. Child vouchers are provided for established families, so why don't we think about this [fertility support] along the same lines, especially for young professionals? … optional sessions within the work environment such as workshops, seminars, occupational therapists, and if you're more interested in the topic you can stay behind and ask more questions or have one-to-one sessions or invite people to come in to discuss the topic".* Female, Age 28, Chinese, Degree, has no child, unsure about having children.

## Discussion

This mixed methods study investigated the different sources used by individuals when seeking fertility and reproductive health information, assessing barriers and enablers for seeking information, as well as any opportunities for improvement. The study used criteria-based purposive sampling to ensure sociodemographic diversity including age, ethnicity and education, representative of the UK population of reproductive age. We identified a wide variety of sources with varying degrees of usage, trust, and reliability. As highlighted by an interviewee "the plethora of information can be overwhelming." Our comparative analysis of trust in the source of information versus usage, showed that HCPs, medical websites and books were trusted more than they were used, while general online searches, media, family and friends were used more than trusted.

Unlike other sources, school education remained a consistent baseline across study participants. When asked about the knowledge gained from secondary school education, over three-quarters of all respondents selected good or some knowledge on the biology of reproduction and pregnancy prevention; while only a very small proportion of respondents (less than 5 %), stated that they could not recall these topics. Conversely, over three-quarters reported having no knowledge or do not recall any knowledge of factors affecting fertility and the protection of fertility. Reflection on school education in this study showed that over half of the respondents had poor knowledge, no knowledge or do not recall any information on safer sex and the prevention of STIs. Our findings were consistent with others [26,27] highlighting gaps in school education. It is also important to note that some improvements are being made. Recently, updates have been made to the UK curriculum and Department for Education guidance document [28], bringing in changes regarding reproductive health education. It would be interesting to explore the impact of these changes in the longer term.

Similar to other studies [17,29], we found the internet to be a popular source of information for seeking fertility related information, with Google search engine being the first port of call. Although government and medical websites were more trusted than non-medical ones, more educated respondents stated that they would assess a website to ensure that there no bias; or the information provided was not just about trying to sell a product. However, the extent to which the strategy is effective, was not established. Although potentially efficient for disseminating reproductive health education, the quality of online information can be difficult to police, due to sheer quantity. When used effectively, evidence shows that internet based interventions can provide fertility related support and improve mental health [30]. A recent study showed that over 40 % of reproductive health information online were found to be inaccurate when reviewed by experts [31], highlighting the need for caution. Despite the popularity of online sources, it is important to note that some groups are uncomfortable with the use of internet. Health

literacy research shows a lower preference from those of socio-economic disadvantaged backgrounds, or those from non-English speaking communities [32].

Social media platforms were also discussed by study respondents, in the context of social media being an impactful tool due a much wider reach of varied population groups. Generally, the perceived anonymity of online and social media platforms was seen as key benefits where individuals can find out relevant information without feeling awkward, stigmatised, or uncomfortable due to some perceptions of taboo associated with fertility and reproductive health [33]. Another crucial benefit is the opportunity for community-building, where people or groups can discuss similar experiences. Online social networks and forums can play a crucial role in helping and encouraging individuals or providing a support system with many reproductive health issues from experiences of endometritis, infertility or miscarriages [34]. However, from our survey results, social media was the least trusted source compared to usage, with respondents reporting similar issues as internet searches, around the spread of misinformation and knowing what to trust.

In terms of reliability, we found that healthcare professionals ranked high in trust, consistent with other study findings [16,17]. Although healthcare professionals were perceived to be the most reliable source of information regarding fertility in this study, they were not necessarily the most accessible; as with other studies [16,35], the proportion of women discussing reproductive health issues with their HCPs was relatively low, and HCPs often did not take the initiative to provide fertility information to patients when the opportunity was presented. In line with evidence [36,37], participants agreed that primary health care providers, such as general practitioners, are well placed to provide information regarding pregnancy health, but the need for additional training for healthcare professionals has also been identified [38].

More opportunities to discuss fertility awareness outside the formal education system were seen as beneficial. Respondents cited occupational settings as a good environment for providing support and education. For example, young professionals who are yet to start a family, would be the ideal target audience for information on family building within the workplace [39] as the acceptance of, previously perceived as taboo topics continues to increase as people's reproductive health needs evolve over time [40]. For example, in recent times, previously taboo topics like mental health issues and mindfulness are being widely discussed in the professional environment [41,42]. Reproductive health also ought to be given a similarly high level of importance in the work environment, as a high proportion of peak reproductive years are spent being part of the workforce. In terms of practicality, public and private companies could be encouraged to host opt-in workshops or even invite third parties to provide short lectures for interested employees. The importance of raising awareness, understanding, and normalising the discussion of reproductive health in the workplace has been emphasised in the recently published policy paper on the vision for the Women's Health Strategy for England [43].

The need for quality and reliable fertility products such as sperm kits and ovulation tests which provide information that present complex scientific information for lay use was highlighted. Some respondents discussed gaining a better understanding of their menstrual cycle and fertile time and that some of these products provided reassurance and confirmation. In the past decade, there has been a significant growth in the use of smartphone applications as well as connected devices for fertility tracking, however, the unregulated nature of these apps continues to be an area of critical concern [18,44,45]. Studies have shown that men have limited knowledge in this area [33,46,47]. Similarly, men in our study also reported gaps, suggesting that there appears to be limited awareness and a dearth of products to educate men, likely because fertility products are often targeted at women or that fertility has been historically seen a woman's problem [33]. Our study participants expressed the need for comprehensive range of quality products to cover both male and female fertility and other areas of reproductive health.

Concerns were raised, especially by HCPs, regarding the quality of the information and biased reporting from the media, TV, newspapers and magazines, including inconsistencies, distortion and misinterpretation of scientific information. Government and public health initiatives were seen as effective means of improving fertility awareness for family building. However, there appears to be limited initiatives, likely due to funding and competing priorities. Cross-sectorial collaborative initiatives between government departments, the NHS, academia, Special Interest Groups and charities to build websites aimed at different population groups including healthcare professionals could prove effective. Content verification badges from public health bodies, on websites containing fertility and reproductive health information could potentially address quality concern, but this might be labour intensive, and may require crowdsourcing.

Study strengths include the mixed methods approach, which provided depth and richness of insights, as most studies on reproductive health information are quantitative survey based, with preidentified selections. The study identified and provided context around some important sources such as workplace, local communities, religious and youth groups, for which there is a dearth of evidence in literature. Another a key strength of this study is the inclusion of men, as their perspectives are underrepresented psychosocial studies on fertility, and are largely excluded from the discourse. In terms of study limitations, although there was a good sociodemographic spread of interviewees, there may be bias towards more educated survey participants, which has implications for generalisability, especially in low-income settings.

## Conclusions

Our study shows that showed that sources used when seeking reproductive health information are not necessarily the most trusted, with accessibility being an important factor. HCPs, medical websites and books were trusted more than they were used while general online searches, media, family and friends were used more than trusted. School education remains a consistent but sometimes inadequate source of fertility information. Ensuring better fertility and reproductive health information during school education may offset the impact of unreliable sources. In addition to websites, apps and products based on robust scientific evidence, there remains an important need for additional training for primary healthcare professionals and educators, as well as the need for intervention from policy makers on unregulated sources. There appears to be a missed opportunity with the discussion of reproductive health within the workplace, where there is a high proportion of people of reproductive age, for whom the information is most relevant. Our findings could inform other governmental polices, women's health initiatives, reproductive health promotion and infertility-prevention education, in order to enable people to fulfil their reproductive intentions.

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## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.srhc.2023.100826.

## References


[1] Harper J, Hammarberg K, Simopoulou M, Koert E, Pedro J, Massin N, et al. The International Fertility Education Initiative: research and action to improve fertility awareness. Hum Reprod Open [Internet] 2021. Aug 25 [cited 2021 Sep 8]; Available from: https://academic.oup.com/hropen/advance-article/doi/10.1093/hropen/hoab031/6357711.

[2] Kahlor LA, Mackert M. Perceptions of infertility information and support sources among female patients who access the Internet. Fertil Steril 2009 Jan 1;91(1):83–90.

[3] Zillien N, Haake G, Fröhlich G, Bense T, Souren D. Internet Use of Fertility Patients: A Systemic Review of the Literature. Available from: J Reproduktionsmed Endokrinol [Internet] 2011 [cited 2022 May 1;8(4):281–7. www.kup.at/reproMedizin.

[4] Jones CA, Mehta C, Zwingerman R, Liu KE. Fertility patients' use and perceptions of online fertility educational material. Fertil Res Pract 2020 61 [Internet]. 2020 Jul 18 [cited 2022 May 1];6(1):1–8. Available from: https://fertilityresearchandpractice.biomedcentral.com/articles/10.1186/s40738-020-00083-2.

[5] Brochu F, Robins S, Miner SA, Grunberg PH, Chan P, Lo K, et al. Searching the Internet for Infertility Information: A Survey of Patient Needs and Preferences. J Med Internet Res 2019;21(12)e15132 https//www.jmir.org/2019/12/e15132 [Internet]. 2019 Dec 12 [cited 2022 May 1];21(12):e15132. Available from: https://www.jmir.org/2019/12/e15132.

[6] World Health Organisation. Fighting misinformation in the time of COVID-19, one click at a time [Internet] [cited 2022 May 7]. Available from: Feature Stories 2021. https://www.who.int/news-room/feature-stories/detail/fighting-misinformation-in-the-time-of-covid-19-one-click-at-a-time.

[7] Zarocostas J. How to fight an infodemic. Lancet [Internet]. 2020 Feb 29 [cited 2022 May 7];395(10225):676. Available from: http://www.thelancet.com/article/S014067362030461X/fulltext.

[8] Islam MS, Sarkar T, Khan SH, Kamal AHM, Murshid Hasan SM, Kabir A, et al. COVID-19–Related Infodemic and Its Impact on Public Health: a Global Social Media Analysis. Available from: Am J Trop Med Hyg [Internet] 2020 Oct 7 [cited 2022 May 7;103(4):1621–9. https://www.ajtmh.org/view/journals/tpmd/103/4/article-p1621.xml.

[9] Gisondi MA, Barber R, Faust JS, Raja A, Strehlow MC, Westafer LM, et al. A Deadly Infodemic: Social Media and the Power of COVID-19 Misinformation. J Med Internet Res 2022;24(2)e35552 https//www.jmir.org/2022/2/e35552 [Internet]. 2022 Feb 1 [cited 2022 May 8];24(2):e35552. Available from: https://www.jmir.org/2022/2/e35552.

[10] The Lancet Infectious Diseases. The COVID-19 infodemic. Lancet Infect Dis [Internet]. 2020 Aug 1 [cited 2022 May 7];20(8):875. Available from: http://www.thelancet.com/article/S147330992030565X/fulltext.

[11] Dash S, Parray AA, De Freitas L, Mithu MIH, Rahman MM, Ramasamy A, et al. Combating the COVID-19 infodemic: a three-level approach for low and middle-income countries. BMJ Glob Heal [Internet]. 2021 Jan 1 [cited 2022 May 7];6(1):e004671. Available from: https://gh.bmj.com/content/6/1/e004671.

[12] World Health Organisation. Infodemic [Internet]. Health Topics. [cited 2022 May 7]. Available from: https://www.who.int/health-topics/infodemic#tab=tab_1.

[13] Wesselink AK, Hatch EE, Rothman KJ, Wang TR, Willis MD, Yland J, et al. A Prospective Cohort Study of COVID-19 Vaccination, SARS-CoV-2 Infection, and Fertility [cited 2022 May 7]; Available from: Am J Epidemiol [Internet] 2022 Jan 20. https://academic.oup.com/aje/advance-article/doi/10.1093/aje/kwac011/6511811.

[14] Abbasi J. Widespread Misinformation About Infertility Continues to Create COVID-19 Vaccine Hesitancy. JAMA [Internet]. 2022 Mar 15 [cited 2022 May 8];327(11):1013–5. Available from: https://jamanetwork.com/journals/jama/fullarticle/2789477.

[15] Hsu AL, Johnson T, Phillips L, Nelson TB. Sources of Vaccine Hesitancy: Pregnancy, Infertility, Minority Concerns, and General Skepticism. Open Forum Infect Dis [Internet]. 2022 Mar 1 [cited 2022 May 8];9(3). Available from: /pmc/articles/PMC8385996/.

[16] Lundsberg LS, Pal L, Gariepy AM, Xu X, Chu MC, Illuzzi JL. Knowledge, attitudes, and practices regarding conception and fertility: A population-based survey among reproductive-age United States women. Fertil Steril [Internet] 2014:101. https://doi.org/10.1016/j.fertnstert.2013.12.006. Available from:.

[17] Almeida-Santos T, Melo C, Macedo A, Moura-Ramos M. Are women and men well informed about fertility? Childbearing intentions, fertility knowledge and information-gathering sources in Portugal. Available from: Reprod Health [Internet] 2017;14(1):91. http://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-017-0352-z.

[18] Worsfold L, Marriott L, Johnson S, Harper JC. Period tracker applications: What menstrual cycle information are they giving women? Women's Heal [Internet]. 2021 Oct 9 [cited 2022 May 1];17. Available from: https://journals.sagepub.com/doi/10.1177/17455065211049905.

[19] Soumpasis I, Grace B, Johnson S. Real-life insights on menstrual cycles and ovulation using big data. Available from: Hum Reprod Open [Internet] 2020 Feb 1 [cited 2021 Oct 22,;2:1–9. https://academic.oup.com/hropen/article/2020/2/hoaa011/5820371.

[20] Grace B, Shawe J, Stephenson J. Exploring fertility knowledge amongst healthcare professional and lay population groups in the UK: a mixed methods study. Hum Fertil [Internet]. 2023; Available from: https://doi.org/10.1080/14647273.2022.2153349.

[21] Hammarberg K, Setter T, Norman RJ, Holden C a., Michelmore J, Johnson L. Knowledge about factors that influence fertility among Australians of reproductive age: A population-based survey. Fertil Steril [Internet]. 2013;99(2):502–7. Available from: https://doi.org/10.1016/j.fertnstert.2012.10.031.

[22] Lampic C, Svanberg a. S, Karlström P, Tydén T. Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among female and male academics. Hum Reprod. 2006;21(2):558–64.

[23] Zinaman MJ, Johnson S, Foster L, Zanzi G, Mollard C. Fertility Knowledge of Women in the United States [6M]. Obstet Gynecol [Internet]. 2019 May [cited 2021 Aug 13];133(1):141S-141S. Available from: https://journals.lww.com/greenjournal/Fulltext/2019/05001/Fertility_Knowledge_of_Women_in_the_United_States.490.aspx.

[24] Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. Available from BMC Med Res Methodol [Internet] 2013;13:117. http://www.ncbi.nlm.nih.gov/pubmed/24047204%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3848812.

[25] Dodgson JE. Reflexivity in Qualitative Research. J Hum Lact [Internet]. 2019 May 1 [cited 2022 Jan 6];35(2):220–2. Available from: https://journals.sagepub.com/doi/10.1177/0890334419830990.

[26] Ekstrand Ragnar M, Grandahl M, Stern J, Mattebo M. Important but far away: adolescents' beliefs, awareness and experiences of fertility and preconception health. https://doi.org/101080/1362518720181481942 [Internet]. 2018 Jul 4 [cited 2022 May 6];23(4):265–73. Available from: https://www.tandfonline.com/doi/abs/10.1080/13625187.2018.1481942.

[27] Maslowski K, Biswakarma R, Reiss MJ, Harper J. Sex and fertility education in England: an analysis of biology curricula and students' experiences. https://doi.org/101080/0021926620222108103 [Internet]. 2022 [cited 2022 Dec 18]; Available from: https://www.tandfonline.com/doi/abs/10.1080/00219266.2022.2108103.

[28] The UK Department for Education. Relationships and Sex Education and Health Education guidance. Relationships Educ. 2021.

[29] Hammarberg K, Zosel R, Comoy C, Robertson S, Holden C, Deeks M, et al. Fertility-related knowledge and information-seeking behaviour among people of reproductive age: a qualitative study. Hum Fertil 2017 Apr 3;20(2):88–95.

[30] Aarts JWM, van den Haak P, Nelen WLDM, Tuil WS, Faber MJ, Kremer JAM. Patient-focused Internet interventions in reproductive medicine: a scoping review. Hum Reprod Update [Internet]. 2012 Mar 1 [cited 2022 May 1];18(2):211–27. Available from: https://academic.oup.com/humupd/article/18/2/211/619078.

[31] Kedzior SGE, Bianco-Miotto T, Breen J, Diener KR, Donnelley M, Dunning KR, et al. It takes a community to conceive: an analysis of the scope, nature and accuracy of online sources of health information for couples trying to conceive. Reprod Biomed Soc online [Internet]. 2019 Dec 1 [cited 2022 May 1];9:48–63. Available from: https://pubmed.ncbi.nlm.nih.gov/32021914/.

[32] Stanzel KA, Hammarberg K, Fisher J. 'Not everybody is an internet person': Barriers for menopause-related health literacy among immigrant women from the Horn of Africa nations. Heal Promot J Aust [Internet]. 2021 Feb 1 [cited 2022 May 5];32(S1):61–8. Available from: https://onlinelibrary.wiley.com/doi/full/10.1002/hpja.326.

[33] Grace B, Shawe J, Johnson S, Stephenson J. You did not turn up… I did not realise I was invited…: understanding male attitudes towards engagement in fertility and reproductive health discussions. Hum Reprod Open. 2019 Mar 1;2019(3).

[34] Cesare N, Oladeji O, Ferryman K, Wijaya D, Hendricks-Muñoz KD, Ward A, et al. Discussions of miscarriage and preterm births on Twitter. Paediatr Perinat Epidemiol [Internet]. 2020 Sep 1 [cited 2022 May 6];34(5):544–52. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/ppe.12622.

[35] Ojukwu O, Patel D, Stephenson J, Howden B, Shawe J. General practitioners' knowledge, attitudes and views of providing preconception care: a qualitative investigation. Ups J Med Sci [Internet]. 2016 Sep 20 [cited 2021 Aug 13];121(4):256–263–256–263. Available from: https://ujms.net/index.php/ujms/article/view/6276.

[36] Stephenson J, Heslehurst N, Hall J, Schoenaker DAJM, Hutchinson J, Cade JE, et al. Before the beginning: nutrition and lifestyle in the preconception period and its importance for future health. Lancet [Internet] 2018;391(10132):1830–41. https://doi.org/10.1016/S0140-6736(18)30311-8. Available from:.

[37] Schoenaker D, Connolly A, Stephenson J. Preconception care in primary care: supporting patients to have healthier pregnancies and babies. Br J Gen Pract [Internet]. 2022 Apr 1 [cited 2022 May 7];72(717):152–152. Available from: https://bjgp.org/content/72/717/152.

[38] García D, Vassena R, Prat A, Vernaeve V. Poor knowledge of age-related fertility decline and assisted reproduction among healthcare professionals. Reprod Biomed Online 2017;34(1).

[39] Grace B, Shawe J, Barrett G, Usman NO, Stephenson J. What does family building mean? a qualitative exploration and a new definition: a UK-based study. Reprod Health [Internet] 2022;19(1):1–9. https://doi.org/10.1186/s12978-022-01511-w. Available from:.

[40] Grace B, Shawe J, Johnson S, Usman NO, Stephenson J. The ABC of reproductive intentions: a mixed-methods study exploring the spectrum of attitudes towards family building. Hum Reprod [Internet]. 2022 Mar 3 [cited 2022 Apr 29];1–9. Available from: https://academic.oup.com/humrep/advance-article/doi/10.1093/humrep/deac036/6541644.

[41] Hilton LG, Marshall NJ, Motala A, Taylor SL, Miake-Lye IM, Baxi S, et al. Mindfulness meditation for workplace wellness: An evidence map. Work [Internet]. 2019 [cited 2022 May 7];63(2):205. Available from: /pmc/articles/PMC6598008/.
[42] Vonderlin R, Biermann M, Bohus M, Lyssenko L. Mindfulness-Based Programs in the Workplace: a Meta-Analysis of Randomized Controlled Trials. Mindfulness (N Y) [Internet]. 2020 Jul 1 [cited 2022 May 7];11(7):1579–98. Available from: https://link.springer.com/article/10.1007/s12671-020-01328-3.
[43] Department for Health & Social Care. Our Vision for the Women's Health Strategy for England. 2021;.
[44] Ali R, Gürtin ZB, Harper JC. Available from: Do fertility tracking applications offer women useful information about their fertile window? Reprod Biomed Online [Internet] 2021 Jan 1 [cited 2022 May 6;42(1):273–81. http://www.rbmojournal.com/article/S1472648320305095/fulltext.
[45] Broad A, Biswakarma R, Harper JC. A survey of women's experiences of using period tracker applications: Attitudes, ovulation prediction and how the accuracy of the app in predicting period start dates affects their feelings and behaviours: https://doi.org/101177/17455057221095246 [Internet]. 2022 Apr 25 [cited 2022 May 22];18:17455057221095246. Available from: https://journals.sagepub.com/doi/10.1177/17455057221095246.
[46] Daumler D, Chan P, Lo KC, Takefman J, Zelkowitz P. Men's knowledge of their own fertility: a population-based survey examining the awareness of factors that are associated with male infertility. Hum Reprod 2016;31(12):2781–90.
[47] Hammarberg K, Collins V, Holden C, Young K, McLachlan R. Men's knowledge, attitudes and behaviours relating to fertility. Hum Reprod Update 2017;23(4):458–80.