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A qualitative study of the utilisation of digital resources in pregnant Chinese migrant women's maternity care in northern England

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ABSTRACT

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Introduction

Digital resources in maternity care

Digital resources have increasingly become an integral component of pregnant women's maternity care in many developed countries (Lewis et al., 2019; Tripp et al., 2014; Eysenbach et al., 2014; Lupton and Maslen, 2019; Slomian et al., 2017; Sayakhot and Carolan-Olah, 2016). In England, the latest national maternity review *Better Births (2016)* recommends that a digital tool that 'offers women the information they need throughout pregnancy and birth' to be made available (NHS England National Maternity Review, 2016). Follow-up reports, projects and initiatives from the NHS maternity service and Royal College of Midwifery further emphasize the importance of the use of digital resources in enhancing women's maternity care experiences through introducing digital medical record, increasing choices and personalization and transforming workforce (NHS, 2018; NHS Medway, 2021; Health Tech Newspaper, 2021; NHS Digital, 2021). Since the publication of the National Maternity Review (2016), studies have examined the use of digital resources by general maternity service users in routine and emergency situations (Mackintosh et al., 2020). However, there is a lack of investigation of how migrant pregnant women engage with digital tools, technologies and resources (Bitar and Oscarsson, 2020; Villadsen et al., 2016), in particular at the interface between personal and professional care (Mackintosh et al., 2020). This is an important but under-studied area, because even digital technologies are being advocated, and sometimes celebrated, as a solution to health inequality and an avenue for patient empowerment (Guendelman et al., 2017; Tripp et al., 2014; Eysenbach et al., 2019), their ability to enable positive health experiences and outcomes remains ambiguous in some cases (Haith-Cooper, 2014). More broadly, it has been widely argued that pregnant women and new mothers face a plethora of, sometimes incorrect, unreliable and conflicting information (Aston et al., 2018). High levels of digital skills and literacy (e.g. consulting, comparing and contrasting multiple websites) are required of women to navigate the information (Aston et al., 2018; Lupton and Maslen, 2019). Lacking these skills, or repeated and excessive searches for information, can cause worries, stress, anxieties, and fears for women (Slomian et al., 2017; Mackintosh et al., 2020; Ruppel et al., 2017; Aston et al., 2018; Fergus and Spada, 2017).

Communication challenges for migrant women

Many migrant women face challenges when accessing maternity care because of cultural, social economic status (SES) and technological barriers (McLeish and Redshaw, 2018; Akhavan and Lundgren, 2012). Women from such backgrounds may also face racism, social stigma and prejudice (Bharj, K. and Salway, S., 2008; Bowler, 1993). amongst these challenges, communication and accessible information are particular areas of concern (Lyons et al., 2008; Hunter-Adams and Rother, 2017; Eysenbach et al., 2019). Limited English language proficiency is frequently identified as a major obstacle to good care and a cause of poor health outcomes (Boerleider et al., 2013; Todd et al., 2011; Sudore et al., 2009; Binder et al., 2012). Meanwhile, studies on midwives providing care to migrant women also point out difficulties including communication problems, suboptimal health literacy, socioeconomic

Abbreviations: SES, Social Economic Status; ONS, Office of National Statistics; NICE, National Institute for Health and Care Excellence; ANA, antenatal appointment.

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problems, cultural and religious differences, and lack of knowledge of the maternity care system identified by midwives (Goodwin et al., 2018; Boerleider et al., 2013).

In high-income countries, efforts and interventions have been made to overcome the communication challenges for ethnic minority groups. These include the provision of in-person or remote interpretation services (Rosenberg et al., 2008; Binder et al., 2012; Hunter-Adams and Rother, 2017; Bell, 2019; Aston et al., 2018), midwife cultural training (Villadsen et al., 2016), cultural bridging using doolas (McLeish and Redshaw, 2018; Akhavan and Lundgren, 2012) and the design and application of apps and electronic portals (Wang et al., 2018; Eysenbach et al., 2018; Bitar and Oscarsson, 2020; Haith-Cooper, 2014). Despite the efforts, communication difficulties have persisted over the past decade in the United Kingdom (UK), as well as globally (Crowther and Lau, 2019; Cross-Sudworth et al., 2011; McKnight et al., 2019 ; Jomeen and Redshaw, 2013; Mao et al., 2015; Yelland et al., 2015). This is in part because of the multifaceted nature of communication, intersecting with the wider healthcare structure, institutional (constraints in workload and human) resources, and individual (including patients and healthcare practitioners) attitudes, abilities and skills (Villadsen et al., 2016; Arora et al., 2012; Johnsen et al., 2020).

Recently, increasing academic interest in maternity care for migrant women has been directed to more diverse ethnocultural groups from Eastern European and north African countries living in the UK (Henderson et al., 2018; Crowther and Lau, 2019; Jomeen and Redshaw, 2013; Cross-Sudworth et al., 2011; Phillimore, 2016). However, there is very little literature available on the maternity care experience of Chinese women who live in the United Kingdom. The Office of National Statistics (ONS) data indicate that the Chinese is one of the fastest growing non-European Union (EU) immigrant groups in the UK (ONS, 2016a). In 2016, in England and Wales, 3596 births were to Chinese mothers, ranked the 10th place of birth to all non-UK mothers, and accounting for 0.5% of all live births in the UK (ONS, 2016b). To our best knowledge, only three studies of Chinese migrant women's maternity and postnatal care experiences in the UK are in existence, two of which were conducted more than twenty years ago (Cheung, 1997; Chan, 2000; Hogg et al., 2015). This paper therefore addresses the gaps in the literature by exploring the role of digital resources in facilitating/impeding/configuring health communication between pregnant Chinese migrant women and their midwives.

Methods

Study design

This paper is based on an in-depth qualitative study by exploratory qualitative design involving semi-structured interviews with pregnant Chinese migrant women and midwives. Exploratory qualitative design draws upon strengthens of established qualitative methodologies and methods, facilitating flexible adoption of techniques (Percy et al., 2015). Previous research has found that interviews are ideal for drawing out the complexities of how people manage health-related issues (Donovan et al., 2014). In this study, we used semi-structured interviews to explore the complex attitudes, beliefs, perceptions and experiences of pregnant Chinese migrant women and midwives which are subject to negotiation, re-orientation and modification in cross linguo-cultural contexts. The interview guides (see appendix) were designed based on the concept of health literacy. Health literacy refers to 'the personal characteristics and social resources needed for individuals and communities to access, understand, appraise and use information and services to make decisions about health' (WHO, 2020). Our interviews explored the ways in which pregnant Chinese migrant women access, understand, appraise and communicate health information as an important part of their maternity care.

Setting and time period

The study was conducted at two large NHS Trusts (A and B) in northern England July 2017 - November 2018. The regions where these Trusts are located are known to have large Chinese communities (GOV UK, 2020).

Recruitment

Participants were recruited from both Trusts with the assistance of local research midwives. Purposive sampling technique was used to identify pregnant Chinese migrant women who were cared for by communities midwives in both Trusts. Research midwives coordinated with community midwives to show study leaflets to pregnant Chinese migrant women and midwives based on inclusion/exclusion criteria (Table 1). Participants were also recruited from a large Chinese community organization based in the region where Trust B is located. Posters about this study were displayed at the reception, computer center and language classroom. All interested participants were asked to contact the first author who then provided them with participant information sheet (PIS) and informed consent form (ICF). Interviews were arranged upon receiving signed consent form. Participants were provided a twenty-pound gift voucher as a token of appreciation.

Ethic approval

The study was approved by the UK Health Research Authority and Research Ethics Committee (Ref.17-WS-0130).

Participants and data collection

In total 30 participants were recruited including 17 Chinese migrant women of varied SES and 13 midwives with varied experiences of caring for Chinese women. We collected some demographic data from both groups at the beginning of the interviews (see Tables 2 and 3). The interviews with Chinese migrant women were conducted in Mandarin or English, and the interviews with midwives were conducted in English, both by the first (corresponding) author. Interviews were conducted at women's homes and clinics based on interviewees' preferences. Most interviews lasted between 45 minutes to 1 hour and 30 minutes and were audio-recorded with permission. The recordings were then transcribed by a research assistant and checked by the first author during which process all personally identifiable information was anonymized. Chinese women were coded as W1-W17, and midwives were coded as M1-M13.

Data analysis

Interview data were analyzed based on the principles of framework analysis which consists of a number of discrete though highly interconnected stages (Ritchie and Spencer, 1993; Parkinson et al., 2016). Whilst this approach is systematic and closely controlled, it relies on the 'creative and conceptual ability of the analyst to determine meaning, salience and connections' (Ritchie and Spencer, 1994). The analysis followed the five steps: familiarization, identifying a theme framework, indexing, charting, and mapping and interpretation (Ritchie et al., 2003). Both authors first read English transcripts several times line by line, and looked for key recurrent words, phrases and sentences that were related to the research question. The authors then identified a working coding

Table 1
Inclusion/exclusion criteria for participants.

Participant group	Inclusion criteria	Exclusion criteria
Pregnant Chinese women		
	• Currently pregnant • of Chinese ethnicity • 18 years old and over	• Under 18 years old • Unable to give consent
Midwives		
	• Previous experience caring for pregnant Chinese women • Current experience caring for pregnant Chinese women	• No experience of caring for pregnant Chinese women • Unable to give consent

Table 2
Women's demographic information.

	Minimum	Maximum	Mean
Age	26	41	33.2
Week of gestation	13	38	26.2
Years residing in the UK	1	31	9.6
Education level	High school and below	High school	Degree and above
	0	3	14 6 (degree) 8 (postgraduate)
English proficiency (self-reported)	high	medium	low
	5	8	4

Table 3
Midwives' demographic information.

	Minimum	Maximum	Mean
Age	28	54	41
Years of practising midwifery	2	31	12
Ethnicity (self-reported)	White British	White Caribbean	other
	12	1	0

framework constituted by these key ideas and recurrent themes in the data. Chinese transcripts were read by the first author and a research assistant. Emerging codes from the Chinese transcripts were noted and translated into English and discussed between two authors to develop the final coding framework. All transcripts were then coded with Nvivo, a qualitative analysis software which is widely used by qualitative researchers to organize, code and make sense of unstructured textual data (Wong, 2008). Our manuscript was sent to six participants who agreed to read our paper in 2017–18. Two out of the six were available and authenticated our findings. Below we present four themes emerging from the data: utilization of digital resources, women's non-use of NHS digital resources; eHealth literacy; digital resources for translation in antenatal appointments.

Findings

Utilization of digital resources

All women in our study reported that they used digital tools and resources during their pregnancy including health/pregnancy apps, websites, YouTube, online forums and social media networks. For example, they search health information on search engines:

> I just search on Baidu. I suppose whichever comes up first…(W14)

Chinese women's use of resources/tools primarily depended on their English language proficiency. Fourteen women (out of seventeen interviewed) whose first language is Chinese primarily used pregnancy app, websites and forums in Chinese language as sources of information. It is worth noting that ten of these fourteen women self-reported high or medium English proficiency and competence in handling everyday conversations. The other three women who are bilingual or English educated used resources such Google, NHS choice, YouTube and Bounty, which are popular sources used by general British maternity service users (Mackintosh et al., 2020). Chinese women's use of digital tools (especially smart phones) was reported by themselves and their midwives:

> *Yes. I use apps from mainland China. (W4)*

> *Well, they nearly all have a mobile phone of some description. I almost cry if they don't. (M4)*

> *Yeah, definitely. To be honest, a lot of them are computer savvy. They use Google translate and stuff like that. (M6)*

In both Trusts where this study was based, a move towards digitised information provision was also noticeable. Midwife (M12) reported that she routinely asked about women's internet access.

> *Yeah, within our booking proformas which is all the questions we ask, there is a tick box at the end says that 'Does the women have internet access at home?' So always ask that. If yes, which is majority of the time, you just highlight our website, and lots of information on our website about pregnancy and birth. (M12)*

M3 said that the websites of the Trusts became depositories of health information, replacing almost all paper-based leaflets and books (M3). However, the online information was mostly in English, which may be less helpful for migrant women. Given the potential of digital platforms to store a large amount of information, not having translated information seemed a missed opportunity:

> *On our booking performa we just have the web address and all the leaflets which are online. But, a lot of them, none of them are translated. Very sad. (M4)*

We don't provide paper leaflets as such. We've tried to give them electronically, so a lot of information is all online, the Trust B's website now. How many languages with these information is in, I am not sure. (M8)

Most midwives were positive about the digital resources especially the BabyBuddy app which was an official pregnancy app listed in the NHS Apps library (Best Beginnings, 2020). At the time of research, Babybuddy was recommended by Trust A but not Trust B (confirmed by other midwives from Trust B). M7 from Trust B said she had not 'ever recommended any particular App to a woman', partly because her Trust did not endorse any, and partly because of her own concerns:

They (apps) have a place but they're not taking into account what they can see, non-verbal body language, what the partners are doing and social things that might be going on? Well, It's an algorithm. Maternity care is a holistic thing. It's not something that I would advise to women. (M7)

In this case, the midwife controlled what digital information - app - to direct women to based on her evaluation. The majority of the midwives in this study supported the use of digital resources including the app for a number of reasons. Firstly online information could be updated quickly based on the guidance of the National Institute for Health and Care Excellence (NICE), the body that provides national guidance and advice to improve health and social care, whereas the leaflets are more likely to become out of date. Secondly, paper-based leaflets/book are costly and logistically cumbersome to manage (M9). And finally in terms of the quality of care, digital resources should be more accessible. Websites can be used as depositories of leaflets of different language versions. However, as we saw from quotes from M4 and M8 above, the multi-linguistic accessibility had not fully materialised. Nonetheless, midwives believed that apps and video could be more accessible to non-English speaking women because of their non-text based, audio-visual content.

Video information is available on the BabyBuddy app. There is over 100 videos, probably more now, 300 maybe. Videos… realise situations. So, that's a good one for visual information. (M1)

However, although audio-visual materials may require little English language, being able to navigate to them from either an English website or app may still be challenging for non-English speaking women.

We direct them to the Trust B's website with all the leaflets on. However, if they don't speak English, I am not quite sure, they must have it in the different language. That's something we probably need to check out. But I would imagine they do. (M6)

Women's non-use of NHS digital resources

Women whose first language (14 out of 17 women in our study were educated to degree) is not English did not seem to use the NHS digital resources recommended by their midwives. They told us that they would normally use websites and apps in Chinese. For some this was because of language barrier (W1 and W4), whereas others said that reading in Chinese was 'easier' (W3) and 'quicker' (W6):

She (midwife) asked me to download an English app (Babybuddy), but my English isn't good enough so I didn't really use it. I use Chinese apps from 'Meiyou' and 'Well Pregnancy Mums'. The English app has push notifications and pictures every week, but I only just check the size of the baby but don't read anything else. "Meiyou' app tells you how much your baby weighs, length of its body and shows other people's records as references. (W1)

The reason why some women in our study preferred resources in Chinese was that they believed that these resources provided more 'comprehensive' information ranging from clinical statistics to general lifestyle advice. To some extent, this belief originated from women's understanding of the free but resource-limited NHS and the perception that its care was 'minimum' (W3), 'very basic' (W10) or even 'sub-standard' (W14). In the meantime, women's knowledge of risk centred, medicalised and often commercialised maternity practices in China (Gong, 2016) posed sharp contrast to the midwife-led care with a handful of screening tests (e.g. sickle cell test, anomaly scan) for low-risk pregnancy in England, as reflected in following two quotes:

Especially for Chinese women that maybe have a child in China and then moved over, it's very different. It's very much midwife-led here. And I think it's probably a big change from I'm going to trusting the doctors to trusting a woman. (M9)

W: I downloaded a Chinese app ("pregnant mummy'). It'll tell you what to eat, how far along you are, when you need your first and second examination. I'll show you. I think it's very good.

Q: Do you read on NHS Choice or Babycentre?

W: No. I was told off by my British colleagues because I haven't prepared anything for the baby. They gave me all the stuff, like this (print-out) is from the NHS. My colleague downloaded and printed for me. She also told me where to get maternity stuff because she thought I was clueless. (W3)

W3 worked in a British company. She was introduced to the NHS maternity information by her colleagues without whom, W3 would probably have continued using her Chinese app. More than half of the women in our study did not have day-to-day contact with British friends, family or colleagues as W3 did. They interacted mostly with friends and family from their Chinese social circle in which norms, expectations and perceptions including ideas about 'risky' and 'pathologised' pregnancy and childbirth may have circulated and accentuated. Additionally, the timing of the first midwife appointment may have also played a role in Chinese women's non-use of the NHS information. According to our interviewees (W1,7 and 12), the first booking appointment usually took place around 8–12 weeks when midwives introduced women to NHS sources for information. However, the appointment may have missed the 'window of opportunity for information' when women first found out about their pregnancy around 5–8 weeks and were eager to learn more about it. Many women reported that they had started searching for pregnancy-related information on Chinese websites/apps long before their first midwife appointment.

eHealth literacy

EHealth literacy, closely linked to the concept of health literacy is defined as 'the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem' (Norman and Skinner, 2006). Here we analyze both Chinese women's and midwives' accounts to explore what information is sought/provided and how it is appraised.

Low digital/computer literacy is often a concern for migrant women often because of their lower educational attainment and socio-economic status (Arora et al., 2012). In our study, this particular problem was only mentioned by one older woman (W2) with lower educational attainment. Other Chinese migrant women all seemed competent, or 'technologically savvy' as commented by midwives. On the other hand, some midwives reflected on their own digital/technology literacy. M2 frankly admitted that limited knowledge of digital tools and limited functionalities of her work

mobile phone prohibited her from encouraging women to use digital resources.

I think it's me as the midwife. I am 54, I didn't grow up in that high-tech. It is interesting my children are always teaching me. So yes, that is a way I could be better at. I admit it… I am not good at that. The problem is we don't have an iPhone ourselves. We have a basic phone. It's very basic. (M2)

M8 was unsure about how well the midwife workforce had sufficient knowledge of the availability of digital resources.

We work with Tommy's research centre. So we know what Tommy's have available. Whether other midwives in the Trust who don't have such a close link with Tommy's, whether they'd be aware of these resources? I am not sure they would be. (M8)

Midwives reported that they knew very little about what resources the Chinese migrant women used outside of the clinical context because they did not mention them:

I don't know what will be available for them, if their English isn't very good. Because obviously I only see English apps, I don't know whether there are (Chinese Apps) they use. The Chinese women don't mention it, whereas other white women come and say this app… (M3)

That (NHS website) is in English and that's evidence-based website associated with NICE and the NHS. If they don't know about that, they don't know where to look, they can just type 'pregnancy' and get anything…(M7)

Our study shows the implications for not using NHS endorsed resources such as the NHS Choice website and BabyBuddy app. Midwives warned that information from non-NHS sources can be of poor quality, non-evidence based, or even misleading. Women (W4, 14) in our study also confirmed to us that when they were looking for information, they searched on search engines/portals without checking the sources of the information. They did not distinguish public/government sources from commercial sources which may have vested interests in promoting costly products, medical surveillance service and procedures. Midwives were wary of such information:

There is lots of different Apps and things. But then there's also, how can I put it, how robust is that information? What's the control? (M4)

And I'm presuming it is not under the auspices of NICE. So it's not using the best available evidence? So they could get something very different, not evidence based. (M7)

When women receive health information that is different from or inconsistent with the NICE guidance, they may develop different and unrealistic expectations of the care (e.g. 4-D scan for W13) that they would receive from their midwives. Women in our study told us that the information that they accessed was often indeed 'different' from that provided by the NHS:

There are so much more tests in China. The (Chinese) app reminds you of what tests need doing and when. There are fewer here (in the UK). (W9)

Wanting more than two ultrasound scans (for low-risk pregnancy) is a recurring topic in our interviews. This is partly because pregnant Chinese migrant women were exposed to information from China where the maternity care practices are much more medicalized (Gong, 2016). Not being offered more/4-D scans or given detailed explanation of scan results led to their unsatisfaction and anxieties. This led some of them to purchase private scans (W6) and amniocentesis (W1). The heightened anxiety amongst pregnant Chinese migrant women was acknowledged by midwives (M1, M2, M3, M6, M9 and M12), exemplified by a quote from M1 below:

I would say in terms of anxiety in pregnancy, that Chinese women that I've looked after, there is an element of that in the third trimester where you know they have this expectation that there would be more scans, I would confirm that. Yes. (M1)

Digital resources for translation in antenatal appointments (ANA)

Digital tools especially smart phones apps and Google Translate are frequently used by pregnant Chinese migrant women in their ANA for translation and interpretation. Advanced computer image analysis/interpretation technology that allows apps to process texts in a photo and instantly translate them into another language is convenient to use in fast-paced ANA conversations. The Microsoft Translate app in M1's quote only required picture-taking and was less disruptive and time-consuming than voice-based interpretation. W2 told us digital translation tools greatly improved the face-to-face communication between her and her midwives.

She (midwife) asked if I had surgery before. I was in China last year had a surgery to remove ovarian cysts. I didn't know how to say that so I used the app to translate, put the word in (the app) and showed it to the midwife. She understood immediately. (W2)

We were trying to explain about foods that you should avoid during pregnancy, which obviously there was a lengthy list. Rather doing it point by point, she took a photo of this, and then was able to run down the list quite efficiently. (M1)

Professional face-to-face or telephone translation can be arranged by through the Trust, however this service can be problematic. Sometimes midwives had no idea that her client was non-English-speaking until the moment she showed up, in which case it would be too late to arrange face-to-face interpretation. Telephone interpretation could be arranged but was thought to be problematic, especially in the first booking appointment where extensive family medical history was discussed. As a result, most midwives were happy for Chinese migrant women or their partner to carry out small translation jobs by themselves using their smart phones, which was commented as efficient and inclusive (of partners and women with low SES):

Sometimes they'll translate. Refugee women have phones and can translate. (M4)

I think the other lady that I had, her partner I think was using that (phone translation), sometimes because he would tend to communicate more than her. (M10)

On some occasions the digital tools were not only used by Chinese migrant women and their partners, but also by professional translators to assist their work:

Well, usually if the interpreter doesn't know I mean. Because I do have to ask a lot of medical conditions. And sometimes they don't really know what it is. They said 'what's this'? Then I explain, or they'll Google it. Then I explain to them, and then they will ask them (Chinese women). (M3)

Despite the wide use of the digital resources (phone apps and websites) and generally positive appraisals, these resources are not always reliable. Translating using digital resources can also be problematic because of technical issues such as bugs or functional errors in apps:

I used it (Microsoft Translate app) in my booking appointment…But the order (of the medical history questions) was wrong (on the app), I zoomed in but I read the wrong line so she (midwife) arranged a (telephone) translator for me. (W1)

Internet connection was another technical problem discussed. Most clinics and hospitals as well as women's homes were covered by mobile networks but in some rare cases there was no reception so online translation is unavailable. This resulted in W10 not fully understanding what the midwife said but it was too late to book an interpreter for her ANA.

When translating during the appointment is not possible for various reasons, W16 said that she would look words up on the internet after she returned home. Using technologies outside of appointment at home afforded her with ease, pace and relaxation that were sometimes lacking in ANAs.

Discussion

In this study we have found that digital tools and resources (smart phones, websites, apps, forums) are widely used by Chinese migrant women in search for health information. The two NHS Trusts included in our study have incorporated digital information provision as their routine practices. These corroborate with findings from other recent studies regarding the wide use/inclusion of digital tools and resources in maternity care (Eysenbach et al., 2014; Mackintosh et al., 2020, 2018; Lewis et al., 2019; Sayakhot and Carolan-Olah, 2016). Midwives are generally positive about NHS endorsed digital resources (websites of their Trusts, NHS Choice, Babybuddy apps) but they know very little about what resources pregnant Chinese migrant women use exactly, especially those who do not speak English. This finding is supported by Mackintosh et al. (2020)'s study that pregnant women tend not to mention the digital resources that they use to health professionals, suggesting that women's information seeking and clinical care remain two distinct and separate spaces (Mackintosh et al., 2020). Recent initiatives such as digital midwives (NHS, 2018; NHS Medway, 2021; Health Tech Newspaper, 2021; NHS Digital, 2021) need to be aware of this gap between personal care and professional care. Many midwives expressed their regret that current digitized information was not translated into different languages, and therefore was unable to fulfil their full potential in maximizing accessibility for non-English speaking women.

While the increasingly digitized maternity service represents progress, there is a need to further investigate how the digital intersects with women's embodied experience (Mackintosh et al., 2020) in their antenatal appointment. Our study further reveals that most pregnant Chinese migrant women do not use NHS information. A similar finding was found by Grimes et al. (2014) that women from non-English speaking backgrounds were less likely to use written and online resources. This is in part because of language barrier, but also because of women's SES and cultural background. The majority of women in our study are educated to degree level but their limited social connections with the mainstream British society means that they have little exposure to English NHS/health information through British friends, family or colleagues. This coupled with the late arrival of the NHS information via midwife, usually 4–8 weeks after women first find out about their pregnancy, has led to them looking for information and resources in Chinese and continuing using the Chinese resources throughout their pregnancy.

Meanwhile, increasingly risk-centered and medicalized discourse has been dominating the maternity care in China (Gong, 2016) where women in our study still maintain strong connections with. Other studies also found influence from home country on childbirth and maternity care (Katbamna, 2000). In the medicalized discourse, pregnancy and childbirth are often framed as pathologies that need close surveillance and management (Lupton and Pedersen, 2016). Our women's knowledge of highly medicalized, risk centered maternity care practices in China, Malaysia, Belgium, Scotland and Singapore, which are not necessarily consistent with the NICE guidance, underpin our women's expectations of medicalized maternity care. Highly medicalized maternity care in those countries forms sharp contrast with the midwife-led low-risk pregnancy care with minimum medical intervention. This has resulted in some women in our study developing a perception of 'minimum' NHS care and anxieties about the quality of the care.

Our study also shows that many pregnant Chinese migrant women have low health/digital literacy and are unable to discern credible sources from a plethora of online information. This is line with the findings from other studies that users find it difficult to assess the reliability of the information provided by health apps from an under regulated commercial market (Ruppel et al., 2017; Slomian et al., 2017). In our study, some midwives also reflect on their own limited digital skills or knowledge of the digital resources, suggesting digital literacy trainings of the workforce may be necessary. They are also unsure about the quality of non-NHS endorsed information, a common concern often expressed by midwives and other health professionals (Eysenbach et al., 2018). As pregnant women now routinely use digital resources in their self-care, developing and regulating these resources in relation to local health care context and with the assistance of health professionals requires immediate attention (Wallwiener et al., 2016; Eysenbach et al., 2018; Mackintosh et al., 2020). Our study also demonstrates that digital tools especially smart phones are frequently used for translation during antenatal appointments and at home. Generally pregnant Chinese migrant women and their midwives are positive about the convenient, instant and discreet smartphone translation afforded by advanced image analysis technologies. Digital translation tools are believed to improved face-to-face communication and facilitate inclusion of family members.

Limitations

This study has a small sample size of 17 Chinese women and 13 midwives. Most of these women are well educated. We were only able to recruit one refugee woman therefore women with low SES are under-represented in our study. Further investigation is needed to understand their experience of using digital resources in maternity care.

Conclusion

Digitised information provision has become routine practice of the two NHS maternity services where the study is based. Digital resources are widely used by pregnant Chinese migrant women in search for health information. Midwives are generally positive about NHS endorsed digital resources but they know very little about what resources pregnant Chinese migrant women use exactly. In our study, women whose first language is not English mostly used resources in Chinese due to language barrier, the late arrival of NHS information, limited social connections in England and influence from home country. Their use of Chinese resources sometimes leads them to develop expectations of highly medicalized care which are inconsistent with the NICE guidance. Using digital tools for translation in antenatal appointments is generally welcomed by both pregnant Chinese migrant women and midwives. Despite occasional glitches, translation tools such as Google Translate and apps (Health Tech Newspaper, 2021) are thought to improve face to face communication in antenatal appointments.

Implications for practice

Maternity service should consider moving up the first booking appointment, or promptly directing women to maternity care in-

formation upon their initial contact with their GP when women find out about their pregnancy. Different language versions of key maternity healthcare information should be developed and published on local Trusts' websites which women should be directed to. Digital health literacy training should be provided to both women and midwives to help them identify credible and trustworthy sources of information (e.g. NHS choices).

Ethical approval

Ref. 17/WS/0130
Sub-Committee of the West of Scotland REC 3

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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.

CRediT authorship contribution statement

Qian (Sarah) Gong: Conceptualization, Methodology, Resources, Investigation, Data curation, Formal analysis, Validation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Kuldip Bharj:** Conceptualization, Methodology, Investigation, Formal analysis, Writing – review & editing.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.midw.2022.103493.

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