

## Experiences of pregnant women and healthcare professionals of participating in a digital antenatal CMV education intervention

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### ABSTRACT

**Objective:** The study aimed to explore the perspectives of participating pregnant women and Health Care Professionals (HCPs) towards receiving and providing cytomegalovirus (CMV) education so that barriers and facilitators towards incorporating CMV in routine antenatal care could be better understood.

**Design:** This process evaluation phase employed a qualitative design using individual, semi-structured, face-to-face interviews.

**Setting:** Recruitment and interviews took place within a large teaching hospital from an ethnically diverse area of South-west London

**Participants:** The study sample included 20 participants: 15 pregnant women, and five HCPs. All participants were involved in a single centre randomized controlled trial of a digital CMV educational intervention in pregnancy.

**Findings:** Pregnant participants expressed a strong desire to receive information about CMV as part of routine antenatal care. Although HCPs were accepting of the need for CMV education, it was evident that they felt unequipped to provide this; reasons included lack of time, uncertainty about clinical pathways and concern about the potential emotive impact of CMV education. Pregnant women suggested that expressing behaviour changes as risk reduction rather than prevention, made the behaviours feel more achievable and realistic. The support of partners was considered a key factor in the successful adoption of behavioural changes by pregnant women.

**Key conclusions and implications for practice:** There is an onus on HCPs to consider how CMV can be included as part of antenatal education, with messaging framed as risk reducing rather than prevention.

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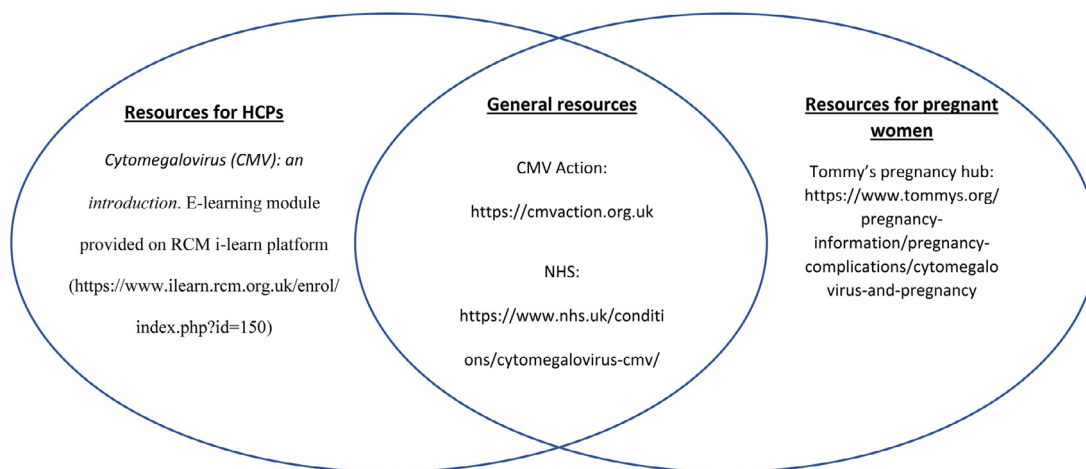
### Introduction

Cytomegalovirus (CMV) is a common infection worldwide that is associated with no symptoms or only mild symptoms in most

healthy individuals who become infected with it (Zuhair et al., 2019). However, if a woman becomes infected with CMV during pregnancy, it can cause harm to the developing fetus. CMV is the most common cause of congenital infection, and in the UK around 1000 babies are born with congenital CMV (cCMV) infection each year. At birth, an estimated 85% of infants are asymptomatic - although some of these infants will go on to develop sequelae later - and 15% of infants have symptoms or signs of CMV at birth, ranging from a single abnormal clinical or laboratory finding to disseminated disease (Marsico and Kimberlin, 2017). The way that cCMV affects infants and children in the long-term is wide-ranging; some children never develop any long-term medical

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**Fig. 1.** Sources of further information about CMV Note: CMV = Cytomegalovirus, NHS = National Health Service, United Kingdom, HCPs = Healthcare Professionals, RCM = Royal College of Midwives.

problems, but around a quarter will have life-long consequences, such as sensorineural hearing loss (SNHL), physical or cognitive impairment, or autistic spectrum disorder. cCMV is the commonest non-genetic cause of sensorineural hearing loss and an important cause of neurodisability (Morton et al., 2006). Resources for further information about CMV can be found outlined in Fig. 1. cCMV presents a significant challenge to families, resulting both from the uncertainty of the outcomes in an individual child and, for some children, the serious and profound consequences of infection (Vandrevala et al., 2020). There are also implications for society more broadly: there is a significant cost associated with the acute and long-term management of affected individuals (Retzler et al., 2019).

The frequency of cCMV, and the personal and societal challenges resulting from it, make primary prevention of CMV infection in pregnancy a priority. However, there is currently no licensed vaccine for CMV and no routinely recommended and available treatment in pregnancy for those at risk of passing the infection to their unborn child. However, antenatal education about CMV risk reduction measures has been shown to result in behaviour change in pregnant women and reduce the risk of CMV infection in pregnancy in some studies (Barber et al., 2020). This strategy relies upon the provision of accurate information to pregnant women, ideally within a context of antenatal education in which a woman's questions can be answered by their trusted health care professionals (HCPs). Currently, information about CMV is not widely provided as part of antenatal education in the UK, in contrast to other less common infections such as listeria and toxoplasmosis. A recent qualitative study in the UK revealed a lack of knowledge about CMV amongst pregnant women and participants reported feelings of disappointment and distress that they had not been informed about CMV as part of their routine antenatal care (Vandrevala et al., 2019), a finding supported by other studies carried out in other countries (Morioka et al., 2014; Lim et al., 2012; Finney et al., 1993).

This frustration is shared by families of children affected by cCMV, who describe receiving little or no information about CMV during pregnancy, and also report limitations in the knowledge of CMV in HCPs looking after their affected child (Vandrevala et al., 2020). Despite the importance placed on antenatal education about CMV by pregnant women and families caring for children with cCMV, a number of studies have highlighted a lack of knowledge about CMV in HCPs (Korver et al., 2009; Wizman et al., 2016; Cordier et al., 2012; Shand et al., 2018). There are significant pressures on antenatal services that can make it difficult to provide information on the large number of topics which need to be cov-

ered. It is necessary therefore to have an educational intervention which can be delivered as part of routine antenatal care and which will empower pregnant women to make decisions about how to reduce the risk of infection in their pregnancy. The success of a CMV antenatal educational intervention will depend on its acceptability to pregnant women and also how it is received by HCPs, as the way the resource is presented and the capacity of HCPs to respond to any questions which result will impact on how the resource is used and valued by pregnant women.

The Reducing Acquisition of CMV through antenatal Education (RACE-FIT) study was designed to evaluate the feasibility of performing a large-scale randomised controlled trial of an antenatal, digital, educational intervention providing information about how to reduce the risk of CMV infection in pregnancy (Clinicaltrials.gov identifier NCT03511274). This current study was nested within RACE-FIT and aimed to explore the perspectives of participating pregnant women and HCPs towards receiving and providing CMV education so that barriers and facilitators towards incorporating CMV in routine antenatal care can be better understood.

**Box 1:**

CMV Risk Reduction Messages developed with the RACE-FIT study

1. Be the first to share:  
Try to avoid eating things which have been in a child's mouth and avoid sharing cups and cutlery
2. Forehead kisses and cuddles:  
Try to avoid kissing a child on the lips, offer kisses on the forehead and cuddles instead
3. Wash with care:  
Clean your hands with soap and water after changing a nappy or wiping a child's nose or mouth.

**Method**

*Design and ethical approval*

In Phase 1 of the RACE-FIT study, a film-based educational intervention was developed in partnership with pregnant women and their partners, and the families of children affected by CMV (Vandrevala et al., 2019, 2020). In phase 2, a feasibility study was conducted to understand the practicalities of running a randomised controlled trial, comparing the educational intervention with routine care (Calvert et al., 2021). As part of phase 2 of RACE-

FIT, we also carried out a process evaluation to explore the perspective of pregnant women and HCPs towards CMV education provision, which is the focus of the current study. This study employed a qualitative design to achieve this, using individual, semi-structured, face-to-face interviews. The study was approved by the NHS Health Research Authority and South-Central Oxford Research Ethics Committee (16/SC/0683). Informed consent was obtained from all participants.

*Recruitment*

In phase 2 of RACE FIT, recruitment took place in a large teaching hospital from an ethnically diverse area of South-west London. Pregnant women were approached upon attending clinics for their first trimester screenings, between September 2018 to September 2019 and were pregnant at the time of participation, seronegative for CMV and living with a child or children aged less than four years. Pregnant women who had participated in the feasibility study were subsequently invited to participate in a short interview to discuss their experiences of participating in an antenatal CMV educational study. HCPs who were involved in the feasibility study were invited to take part in the process evaluation and consider their experiences of delivering antenatal CMV education of pregnant women. All participants in the study were over the age of 18, required to speak English to a sufficient level, were willing to sign a consent form and be available for a video conference or phone interview.

*Procedure*

Semi structured interviews were chosen to ensure that core questions were asked of participants, while providing scope for participants to explore relevant, but unanticipated domains of experience and reflection that were important to them. Twenty interviews were conducted (each lasting between 30 and 75 min), audio-recorded and transcribed.

The interview guides were developed collaboratively by the research team consisting of a short list of topic areas using open-ended questions and prompts, which was frequently annotated/moderated during the progression of the study. For pregnant participants, the interviews explored the experiences of women participating in the trial and factors which facilitate and impede adherence to the suggested behavioural modifications (see Box 2). The interview guide for HCPs focused on understanding the delivery of CMV education from a professional's perspective, including barriers and ways to integrate CMV information into routine care (see Box 3).

What did you find particularly difficult to change?  
 Did you manage to keep these changes going through the whole of your pregnancy – any stages of pregnancy that were easier or more difficult?  
 Did you feel that any changes in your behaviour had any impact on your older child? Did they notice that you were doing anything different?  
 Part 3 – Involvement of family  
 Did you show the film to your partner, other family members or other pregnant women?  
 Did your partner make any of these changes? Did you speak to your partner about the study?  
 How supportive were other family members and friends about the changes you were trying to incorporate?  
 Have these changes now become normal in your household?  
 What advice would you give to a close friend to help them make these changes?  
 Part 4 – Sharing of CMV information.  
 How do you think we should give these messages to pregnant women?  
 Would you recommend any changes to the film?  
 Did you access information about CMV elsewhere?

**Box 2. Box 3**

Interview guide 1, Health Care Professionals We will ask you some questions about your opinions of the film, your experience of the study and how you think it could be improved.  
 Part 1 – Feedback on CMV educational film  
 What are your impressions of the film?  
 How informative is the film? Do you feel you learnt something new? If so what?  
 Do you think the film has made you change your practice?  
 Did you discuss the film with other health care Professionals in your unit?  
 Part 2 – Film influencing practice.  
 Did you discuss the film with other health care Professionals in your unit?  
 What advice would you give pregnant women to help them make these changes?  
 Have these changes now become part of the routine care you give pregnant women?  
 Part 3 – Film feedback and future directions  
 Would you recommend any changes to the film?  
 Do you have any further comments on the film?  
 What are the best ways of the delivering this information to pregnant women in routine clinical care?  
 How can we integrate this information as part of routine clinical care? How can we do this in a way that does not impact on HCPs?

Interview guide 1, pregnant women  
 Through this interview we will be asking you some questions about your opinions of the film, your experience of being in the study and how you think it could be improved.  
 Part 1 – Feedback on CMV educational film  
 What are your impressions of the film?  
 How informative was the film? Do you feel you learnt something new? If so what?  
 Did the film leave you feeling anxious of did you feel the knowledge empowered you to protect yourself and baby?  
 Considering the 3 messages in the film, do you remember the messages? Which one most? Did you find them easy to understand?  
 Did the film motivate you to change your behaviour?  
 What behaviours did you change?  
 Part 2 – Behaviour change  
 How easy was it to change these behaviours?

*Data analysis*

Data was collected and analysed using Thematic Analysis (Braun and Clarke, 2006). The following six phases were implemented following the steps of Thematic Analysis: (1) familiarization, which was necessary to be able to fully understand the data to be able to identify repeated patterns; (2) initial coding then took place to extract the most important information and features; (3) searching for themes, using the previous coding, data was grouped into themes and sub-themes to reflect the patterns identified; (4) reviewing themes, which took place collaboratively across the research team to reflect upon the themes, alongside the dataset and confirm they provide an intelligible story; (5) defining and naming themes, providing a coherent name of each theme and subtheme

**Table 1**  
Participant demographics for pregnant women groups; intervention, and treatment as usual.

Demographic		IG	TAU
Age	26–30	0	1
	31–34	2	3
	35–40	5	2
	41–45	2	0
Marital Status	Single (never married)	0	1
	Married/ Civil partnership	9	5
Ethnicity	White	8	5
	Black/ African/ Caribbean/ Black British	1	0
	Mixed	0	1
Years in UK	Born in UK	8	4
	5–15 Years	1	1
	15+ years	0	1
Education	Undergraduate degree	5	3
	Masters degree or equivalent	3	3
	Postgraduate certificate, diploma or equivalent	1	0
	Number of pregnancies Mean (sd)	2.50 (0.76)	2.33 (0.52)
Number of children under 4 yrs	1	1	

to fit with their meaning; (6) producing the report, which was the process of collating the themes and subthemes in a coherent way for this research paper (Braun and Clarke, 2006).

In the extracted quotes, “(...)” signifies that materials have been omitted. For each quote it is specified whether the participant was in the TAU (treatment as usual) or IG (intervention) group of the randomized controlled trial carried out as part of RACE-FIT, or HCP, as well as a participant number for anonymity.

**Results**

*Participant characteristics*

Fifteen pregnant women took part in this study, nine of whom had been allocated to the intervention group of the RACE-FIT study and therefore had received detailed information about CMV, including how it can affect a child, ways in which CMV is transmitted and the risk reducing behaviours they could adopt to reduce the risk of CMV acquisition in pregnancy (see Box 3). Six participating pregnant women had been allocated to the TAU group of the RACE-FIT study, and therefore did not receive detailed information about CMV, but were aware of the aims of the study and the focus on CMV risk reduction. Five HCPs were also interviewed, all five had been involved with the delivery of the intervention to pregnant women within the RACE-FIT study. All HCPs involved were clinically active midwives or nurses, who had some awareness and involvement with the study and so had watched the film and seen the immediate reaction of women to the film; they were not experts in CMV and were not involved in the design of the educational intervention. Table 1 provides socio-demographic characteristics of the pregnant women of the sample and Table 2 for HCPs.

From participant interviews, themes and subthemes emerged, these can be seen outlined in Table 3.

Theme 1: Knowledge of CMV and risk reduction

**Table 2**  
Participant demographics for healthcare professional participants.

Demographic		HCPs
Gender	Female	5
	Male	0
Age	26–30	2
	31–34	1
	35–40	1
	41–45	0
	46–50	1
Position	Midwife	3
	paediatric Nurse	2
Ethnicity	White	4
	Black/ African/ Caribbean/ Black British	1
Years in UK	Born in UK	8
	5–15 Years	1
	15+ years	0
Education	Undergraduate degree	4
	Masters degree or equivalent	1
Years of experience Mean (sd)		11.40 (8.35)

*Knowledge about CMV is perceived as important, empowering and reassuring*

Pregnant participants in the intervention group expressed surprise that they had not heard of CMV or been told about CMV as part of their antenatal care. Additionally, they were pleased they had been provided with an awareness and knowledge of CMV as part of the study. Participants in the TAU group did not receive detailed information about CMV, but were informed that the study was about CMV. They understood the significance of CMV awareness and viewed the sharing of the information as an important part of antenatal care. Many women felt that it was important they did all they could to reduce the risk of CMV infection to protect their unborn child. Having knowledge about CMV was considered empowering, allowing them to have the information necessary to adapt their behaviour to reduce the risk of CMV infection whilst pregnant.

- “...I remember saying that surely everybody should be given information on that. Just as part of because you were given a lot of information on other things when you’re pregnant that, you know, for example chickenpox can be particularly harmful for pregnant women and things like that. So, it’s a sort of ‘Oh why are we not given information on this?’” (Lily, TAU)
- “I was very pleased with being told about it. Because you know, you want to know everything can affect your children. Then it’s up to you to decide.” (Helena, IG)

*Healthcare professionals trusted as a reliable source of information about CMV*

Pregnant participants indicated that they would have welcomed a conversation about CMV with a HCP, such as a midwife or general professional, to enable them to fully understand the information and the importance of CMV. Women expressed trust in their antenatal care team, and they considered HCPs to be the most reliable source of information about health-related issues.

“I think the most important thing would be for a health professional to actually tell you when you are pregnant... I guess there is like fake news on social media and things that people get scared about which are actually not scientifically proven. I think if it’s part of your plan of care, you would actually listen to it and understand the implications.” (Natalie, IG)

**Table 3**  
Themes and sub-themes emerging from interviews with pregnant women and HCPs.

Themes	Subthemes
Knowledge of CMV and risk reduction	Knowledge about CMV perceived as important, empowering and reassuring Healthcare professionals trusted as a reliable source of information about CMV Barriers to sharing information about CMV by healthcare professionals Opportunity for educational film to overcome barriers to sharing information about CMV
Implementation of risk reduction in antenatal care	Risk reduction rather than prevention Balancing parental caring behaviours and risk reduction behaviours Implementing behavioural change as a partnership

### *Barriers to sharing information about CMV by healthcare professionals*

Participating HCPs were supportive of information about CMV being shared with pregnant women and considered this important, however they identified barriers which discouraged them from routinely sharing information about CMV. A commonly described barrier was the concern of raising anxiety or causing women to feel guilty for not adhering to the risk reduction measures.

“But some just felt they hadn’t changed their practice…… Some mums did feel a bit guilty ….we told them about it and we showed them the video, but oh no, they still hadn’t managed to do it. If my child gets CMV and not that it might be their fault, but that’s sort of a little bit how they felt.” (Kiera, HCP, Paediatric nurse)

A significant barrier to discussing CMV with pregnant women was a lack of time to discuss this as part of their routine care, meaning participating HCPs were not confident they would be able to communicate information about CMV as well as all the information routinely given.

“In routine care, there is so much to talk about. So much information to give at every point in pregnancy and everything that you are talking about can really impact them. Whereas with CMV the number of babies that are affected is actually quite small…if the mums ask about it or if we do have more time or they know of problems like they know of CMV or they have been affected by it then that is when I will bring it up with them.” (Kiera HCP, Paediatric nurse)

*Participating HCPs were concerned about having defined clinical pathways, adequate follow-up for women or opportunities to screen for pregnant women who were concerned about CMV. Here the salient concern for midwives was not leaving pregnant women anxious, particularly as they were unaware of where women could find out how to prevent CMV transmission to their foetus or indeed test to see if their child had CMV.*

“I think, if we are going to tell women about it, we need there to be a follow-up and midwives need to know where to signpost people and how to refer people if they have got problems because I think again, that will put people off telling women about CMV if they feel there is not a clinical prepare space for them to go down.” (Paige, HCP, Midwife)

“I feel if I tell women about CMV and kind of opening a bit of a can of worms, because then they might want to test and there might not be someone to interpret the test…… If it’s just I’ve kind of made the woman anxious about it…It’s not like Down Syndrome screening where we tell them about it and we have screening. It would be me telling the woman and then just kind of leaving her to get on with it.” (Paige, HCP, Midwife)

### *Opportunity for educational film to overcome barriers to sharing information about CMV*

The educational film about CMV has been designed to be used alongside routine antenatal care. HCPs participating in our study suggested that the short film produced as part of the RACE-FIT project included a good introduction to CMV and clear guidelines to pregnant women on how they might reduce risk of CMV in pregnancy. Participating HCPs suggested that the film had the potential to empower pregnant women to reduce the risks of acquiring CMV during pregnancy. They expressed that they themselves felt they would be more prepared to answer pregnant women’s questions about CMV after watching the film themselves.

“It just raised a bit more awareness about CMV amongst us which is good. So just a bit more knowledge and then awareness which would help us kind of direct women if they asked us about CMV or if we chose to speak about it, which has a bit more to talk about.” (Shannon, HCP, Midwife)

“To know it from the off like it can be kind of like a virus like CMV they say no—at least give them some information on it. That was quite nice to actually be able to tell them about something that can have an impact on life or their baby’s life if they were parents and get the congenital CMV.” (Natasha, HCP, Midwife)

### *THEME 2: Implementation of risk reduction education in antenatal care*

#### *Risk reduction rather than prevention*

Participating pregnant women and HCPs favoured messages about CMV being framed in such a way that encourages women to modify their behaviours to reduce the risk of CMV, rather than to prevent CMV. Pregnant women expressed an inability to completely control the risk of CMV when trying to implement preventive measures but felt that making small changes to reduce risk, was an achievable goal.

“I think the main thing was just around how… you can’t possibly avoid all contact with bodily fluids, especially when your child is really ill. Um, so, yeah, you can take precautions, but you cannot… you can’t stop them sneezing in your face, so, you know, dribbling on your pillow or, you know. There’re certain things that you can’t prevent.” (Fiona, IG)

Participating HCPs also expressed that a focus on risk reduction, rather than prevention, may reduce anxiety about CMV for pregnant women, providing some reassurance to mothers and empowering them to take some steps towards changing behaviours that exposes them to saliva and urine.

“To highlight more that what we are trying to do is just reduce the risk. We can never take it all away, the risk. Every little helps as it were. Even one less kiss or one less share of

the spoon helps the risks go down. ... just a bit more encouraging to mums that we are just reducing rather than eliminating.” (Kiera, HCP, Paediatric nurse)

#### *Balancing parental caring behaviours and risk reduction behaviours*

One clear concern for pregnant women was the potential impact of the CMV risk reduction behaviours on their other children. It was evident that pregnant participants with children were concerned about finding a balance between reducing the risk of catching CMV, passing CMV on to their unborn baby and demonstrating parental love and care towards their older child, by kissing a child on the lips and sharing food with them.

“I think she would have been confused about why I wasn’t eating with her. I think she would have probably been quite upset if I wasn’t kissing her in the same way. But then, maybe that’s my perception, because I was pregnant and you are already worried about what’s it going to be like when the sibling arrived.” (Camilla, TAU)

Pregnant women in the intervention group made active attempts to reduce sharing food with their children, but did experience challenges in sustaining this.

“I definitely did, initially changed and didn’t share food. It was hard to do that all the time, because she was only two and so trying to get her to eat she would often share food with me and I didn’t want to keep on pushing it away, because we were trying to get her to eat. I did try and I was more aware that I shouldn’t be sharing food or eating a bit that she’d bitten or anything like that.” (Kate, IG)

In contrast, pregnant women who had not watched the CMV intervention but were aware of the potential risk of sharing food and drink with their children, seemed to weigh the risk of contracting CMV against the negative impact of insufficient food intake for their older children.

“I didn’t drink from her cup anyway. I still helped her eat her dinner just to get her to eat. You make decisions based on risk, don’t you. I would rather she ate.” (Camilla, TAU)

Most participants exposed to the intervention found adaption of behaviours fairly straightforward and were able to develop a new routine and ‘norm’. It seemed that incorporating changes into their daily routine and family ‘norm’, creating new habits which initiated and maintain changes in behaviour.

“I didn’t find any of them difficult to change, because I kind of developed my own mantra of you have got to do this and keep the unborn safe. It was an internal conversation that I had repeatedly until it became second nature. At first, it was difficult to not kiss my eldest on the lips, because that is just what I was used to and that’s all about practice and just family norms... I think the difficulty was just changing my routine... Usually the child doesn’t finish your food and you finish their plate because you don’t want to waste food .... It was just changing your mindset to incorporate the recommendations.... It’s breaking the habit essentially, that is the hardest thing and that would basically remove the tag line.... It wasn’t hard to do. It was just once I’d created a memory stamp of where I’ve got to do this because then it was easy.” (Chloe, IG)

#### *Implementing behavioural change as a partnership*

Pregnant women in the intervention group stressed the importance of involving partners in implementing behavioural changes. Participants recalled the support they received from their partners, and expressed that their partner’s support had an important

role in reassuring them and helping them to adhere to behavioural changes.

“Pretty supportive... He would just help kind of divert the interaction between him and my son and I if he was upset that I wasn’t sharing my drink or snack or whatever it was. He would just help out in those sorts of ways.” (Nicole, IG)

Others would have wanted more involvement from their partners, but it was harder to engage them in risk reducing behaviours.

“I told my partner. That’s it. Yes. I think he probably didn’t pay much attention to be honest. .... Well, I think, maybe, maybe if I showed him it [the film], he might have paid more attention.” (Fiona, IG)

Pregnant women’s partners have a significant role in reassuring and facilitating the implementation and adherence to behavioural changes. This could also be especially important considering the establishment of a new family ‘norm’ and routine, and what this can do for women’s motivation to adhere to preventive measures and maintain them throughout their pregnancy.

## **Discussion**

This qualitative study sought to explore the perspectives of participating pregnant women and HCPs towards receiving and providing CMV education in pregnancy, so that barriers and facilitators towards incorporating CMV in routine antenatal care could be better understood. CMV infection is not routinely included as part of antenatal education in the UK, however pregnant women in our study who were introduced to CMV felt strongly that information about CMV - and ways to reduce the risk of CMV during pregnancy - should be provided to all pregnant women. In contrast, HCP who were familiar with the CMV antenatal education and had assisted with the trial were largely accepting of CMV education for pregnant women, however expressed some concerns about increasing anxiety in pregnant women, particularly as they felt that not have a clear clinical pathway or a screening programme for concerned pregnant women. Pregnant women suggested that presenting information on behavioural changes required for CMV should be presented as risk reduction methods rather than complete prevention and this would make behavioural changes required more achievable, obtainable, and realistic. Additionally, support of partners was described as essential to implementing and sustaining change family environment.

Our findings are in line with previous research that have highlighted that CMV is not routinely included in antenatal education and most pregnant women felt frustrated and annoyed that they haven’t been given the chance to implement changes to reduce risk of congenital CMV for their unborn child (e.g. Vandrevalla et al., 2019; Wood, 2017; ComRes, 2014) and there was a unanimous agreement that they wanted information about CMV to be provided to them by HCPs, particularly midwives, as their most trusted resource in antenatal education (McArdle et al., 2015; Grimes et al., 2014; Lavender et al., 1999). This contrasts with the views expressed by HCPs who assisted with showing pregnant women the film that midwives often lacked adequate time to provide CMV education within routine care. There is therefore a need for provision of information about CMV in an accessible and acceptable way, that does not require a significant time investment for individual counselling in busy antenatal clinics.

Another barrier that health care professionals experience in including CMV as part of antenatal education, is their own lack of knowledge and awareness of CMV (Cordier et al., 2012; Wizman et al., 2016). Unsurprisingly, these concerns are often translated into an overall lack of self-belief in their own abilities to support pregnant mothers in relation to CMV awareness as well

as advice on behavioural changes (Sanders et al., 2016). In order for midwives to feel equipped and empowered to provide information about CMV to pregnant women, they need to have access to such knowledge themselves. Evidence based digital antenatal educational films such as those developed by our RACE-FIT project or the e-learning training about CMV developed by the Royal College of Midwives (RCM) (<https://www.ilearn.rcm.org.uk/enrol/index.php?id=150>) has the potential to empower midwives to be able to answer women's questions about CMV with increased confidence.

The reluctance of midwives to include CMV in routine antenatal education arises from concerns that this could lead to an increase in anxiety for pregnant women, as there is no routinely recommended treatment for CMV in pregnancy or licensed vaccines available to prevent CMV. Similar concerns are also often found in other areas of antenatal care, such as advice relating to weight gain during pregnancy (Smith et al., 2012; Schmied et al., 2011), in which midwives show a similar reluctance to have discussions with patients due to concerns about framing the information in a way which is upsetting for their patients, and the overall emotive impact that knowledge might have. However, our findings show that pregnant women are unanimously keen to be equipped with knowledge about CMV and are motivated to reduce risks of CMV to their unborn child. Findings like those of (Olander et al., 2014) as well as (Karatary et al., 2010) emphasise the importance in employing psychological health concepts, such as self-efficacy (one's own intrinsic belief that they can successfully carry out a behaviour) into antenatal care. Their results suggested applying these concepts was an effective method to achieve and maintain successful behavioural change. Often, much responsibility for sharing information is placed upon HCPs, but in line with the concepts of empowerment and self-efficacy, by giving women the tools and knowledge to modify behaviours, they may feel more in control to then initiate and maintain the changes throughout pregnancy. Hughes et al. (2017) supports this within CMV research, by finding that an increase in self-efficacy led to an increased uptake of CMV risk reduction behaviours. It is clear that knowledge is powerful; it allows women to be autonomous and have control over their own CMV risk reduction.

Our study has highlighted that behaviour-change messages about CMV should be framed as 'reduction' as opposed to 'prevention', with pregnant women acknowledging that complete prevention was unattainable. This is an important consideration for antenatal care professionals when discussing CMV with pregnant women, especially as this was something pregnant women felt made the measures more realistic and achievable for them. In line with the previously mentioned, approaching CMV in this way may increase pregnant women's self-efficacy to thus initiate and maintain these behaviour changes. Additionally, CMV risk reduction measures should also be framed using positive messaging, as positively-framed messages leads to more positive perception of effectiveness and motivate behaviour rather than negatively-framed messages (Akl et al., 2011; Marsh et al., 2014; Weir et al., 2010).

Our study has also highlighted the importance of involving partners and families in antenatal education on CMV, specifically in helping the partner to enact the behaviours required to reduce risk of CMV themselves and support and encourage their pregnant partner to do so. Other studies have highlighted that midwives often did not include partners in antenatal conversations, for example, about alcohol advice (Van der Wulp et al., 2013) but research does endorse the involvement of social support and partners (Torkan et al., 2018; Appleton and Pharoah, 1998) for successful behavioural change. As highlighted within this research, pregnant women discuss how implementing changes as a partnership such as reducing kissing their child on the lips and both imple-

menting and encouraging first to share, made the changes much easier to implement.

Although the study was limited to 15 pregnant women and 5 HCPs who had been involved in the trial, it provided rich data to highlight the experiences of participating in a CMV digital, antenatal intervention. The aim of qualitative research is not to reach generalisable findings, but to enable a richer understanding of the participants' experiences of the phenomena under investigation. The lack of ethnic diversity, male/paternal perspective and also engaging with midwives unfamiliar with CMV is an area that warrants further investigation.

## Conclusions

cCMV is a significant public health challenge, with lifelong implications for affected children and their families. It is therefore vital that the information routinely provided to pregnant women includes discussion of CMV, the most common congenital infection, along with advice about how risks can be reduced and that midwives receive the training they need to be empowered to provide this aspect of antenatal care. Until such time as we have a licensed vaccine, it is imperative that we take action to reduce the risk of acquiring infection in pregnancy to reduce congenital infection and the associated life-long consequences of hearing loss and neurodevelopmental delay experienced by around a quarter of infants and children congenitally infected with CMV.

## Declaration of Competing Interest

The authors declare that they have no competing interests.

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## Ethical approval

The study was approved by the NHS Health Research Authority and South-Central Oxford Research Ethics Committee (16/SC/0683).

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## Clinical trial registry

Clinicaltrials.gov: NCT03511274.

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