"*It's come around way too quickly!*" Can technology help parents provide support during menarche?

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Menarche is an important milestone and time of transition, where children and adolescents need information and support. Parents provide significant support, but barriers such as parents' own lack of confidence and information interfere. Existing technology for menstrual health is not always appropriate or accessible to younger adolescents and children. We ran two studies: Study1, an interview and design study explored how parents support children for menarche, their use of technology for this, and to understand the gaps. Study2 evaluated a design concept based on Study1, to gain further insights. Our findings show that menarche is an emotional time for parents and children; parents provide support and shared sensemaking but there is space for technology in providing scaffolding for parents to provide further support. However, there is a balance between sharing or support and privacy or control that needs to be negotiated between parents and children. We conclude with some reflections.

CCS CONCEPTS • **Human computer interaction (HCI)** • **Empirical studies in HCI** •

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1 INTRODUCTION

Starting one's menstrual cycle, or menarche can be a significant milestone in one's life [13]. However, gathering information and support about this transition can be difficult due to societal and social stigma. Children have reportedly preferred to receive information from parents, especially mothers, at the onset of menarche [30]. Parents may feel responsible for preparing their child for menarche but can feel unsure about providing support and what resources to use. Parents have reported a greater need for awareness and education regarding menstruation to be able to support their children [3], and can have a direct influence on how their child perceives and experiences menstruation [47]. Thus, they should be adequately educated on menstrual practises. Additionally, parents should be informed about the potential harm cultural myths and traditions may have on how children view their menstrual cycle [28]. Finally, to encourage sustainable social change, education needs to be used as a tool for empowerment [11].

For those who menstruate, access to adequate information about menstruation and the management of menstrual symptoms is crucial [11]. Research exploring the experience of menstruation with adolescents in the UK suggests that the internet is an important educational source. Chat forums are found to be a space that

provides peer support and validation of experiences. Although, the participants reported that the internet could also encourage stereotypes about menstruation and therefore be a place of distress [50]. Furthermore, this research highlights that young people want to be educated on menstruation's lived and embodied experience, not just the biological science [50].

This research investigates how technology can support parents with their children – helping parents prepare their children for menarche and managing menstruation, especially in the early stages, and developing an understanding of menstruation together with their child to encourage positive associations and be involved in the child's development. In the first study, 10 individual parents participated in interviews and design activities to explore their experiences when supporting their children with the early stages of menstruation and which tools and technologies they used during this time. The findings from the first study led to the development of user needs and requirements which were compared to existing menstruation apps and contributed to the design of a conceptual app '*POWer*' (Periods for Optimism & Well-being). An evaluation of the conceptual design with eight participants was finally carried out.

This paper provides insights into how technology has the potential to support parents with preparing their child for menarche. Using the results and insights discovered in both studies, recommendations for designing menstruation related technology for children and for their parents to be able to better support them are discussed.

These studies make three contributions to HCI. First, a detailed analysis of data from parents identifies factors and, importantly, values that are important for parents in sharing information with children at the onset of menarche. Second, we expand on the role of technology in improving how information can be shared or communicated between parents and children and what information is important, including a holistic approach at this transitory time of change; we also examine the evolving role of technology as children grow and have different needs for support and information. Finally, we examine aspects of control and power in giving parents varying degrees of access to an intimate part of children's lives. We finish with reflections and design considerations. This work should be extended to include children gaining their individual and shared perspectives (with parents) to empower children with a positive understanding of their bodies at an early age and to further address stigmas associated with menstruation.

2 LITERATURE REVIEW

This section presents an introduction to menarche, what is currently known about parents' role, and finally, existing menstrual health research in HCI. It is important to note that whilst the literature discusses 'women' and 'girls,' this paper includes and aims to support all people who menstruate.

2.1 Menarche & Menstruation

Menarche is often described as a milestone [27]. It refers to the first menstrual period in a child's/adolescent's life [31] and is often used as a signal of biological maturation which can lead to a change in self-identity [41]. The age of onset of menarche varies based on factors such as genetics, ethnicity, socio-economic demographics and individual experiences and can be as early as 8 years [27].

Menarche is a time of transition in the life of the child, or even in some cases a life disruption. As reported by others e.g. [33; 34], life disruptions can lead to a breakdown of the accepted normal, which can be the case as experienced by younger adolescents, especially if they find themselves unprepared for the onset of menarche. As menstrual cycles can vary so much, (e.g., age of onset, duration of period, duration of cycle) understanding what is normal can be difficult in the first place [22]. For example, menstruation occurs on average every 28 days, but this varies vastly between people [31]. The breakdown in normal is usually followed by a process of information seeking and sense-making but lack of access to or absence of reliable information

and trusted support can give rise to misinformation and acceptance of myths [20]. Experienced others can support sense-making by sharing their experiences [36].

2.2 Parental Role in Menstruation

Although the cultural and social significance of starting one's menstrual cycle may vary across different countries, the challenge of coping with new emotions and a changing body is a global phenomenon [42]. A negative perception of menstruation is associated with being unprepared before the onset of menarche, and inadequate guidance on menstrual practises [26]. Feeling positive about menarche and bodily change is critical for well-being, however this does not occur without preparation and insight into what to expect when menstruating [47]. For those who have not been pre-advised and educated on what menstruation will entail are left feeling confused, worried and shocked about their first experience [28].

It has been reported that parents, especially mothers can have influence for providing menstrual related guidance, and information [13; 41]. Similarly, if a child perceives that their parent views menstruating negatively, they are more likely to anticipate a similar negative experience. However, when a parent is open and positive about menstruating the child is likely to view menstruation positively [8].

Knowledge about menstruation is often passed down from parents and caregivers, and the accuracy of information is often based on the parents' education level [1]. Inadequate preparation for menstruation has been linked to illiterate parents and socio-cultural restrictions in providing adolescents with sufficient information to best support themselves [9]. It has been suggested that by passing on misinformation parents can influence whether a child has myth-related fears and confusion about their menstrual cycle [43]. Those approaching menarche and onwards need adequate, accurate and scientific information about menstruation [40]. Therefore, the quality in which parents are informed on menstruation and menstrual practises heavily affects their child. Menstrual health education usually focuses on children or adolescents, and there is little shown on how to support parents to be able to support their children [48].

Research that explores menstruation tends to focus on the menstruator and less so on those responsible for providing support. There is some previous research exploring parental experiences of supporting their children with menstruation, but it has mainly focused on who would be most appropriate to provide menstrual education [13], supporting children with heavy bleeding and other irregular symptoms [3] or how to support children with learning difficulties [7; 51]. Studies have reported that girls preferred to receive support from their mothers over fathers, but some wanted their fathers to be aware of their experiences [30]. However, we find that little is understood about the role parents play or how prepared they are to support their children through this life transition and milestone.

2.3 Menstrual Research in HCI

Though having a menstrual cycle is a common experience, guidance on managing your menstrual cycle and supporting others is lacking. Instead, much taboo, stigma and shame surrounding menstruation still exists [42]. However, there has been much research on menstrual health and management within HCI focusing on improving the menstrual experience. For example, an IoT model of the female reproductive system was developed, integrating gameplay to engage young children and their parents in conversations around menstrual health. The game explores menstrual taboos and educates players on each menstruation phase using visual and audio cues [48]. This research was carried out on children between the ages of 4 to 9 years old; it was suggested that whilst engaging the children in interactivity was effective, this age group may have been too young to understand the content fully. However, including parents could contribute to children having a better understanding.

A digital health platform for adolescents called 'Menstrupedia' uses a comic strip to educate and support people about menstrual health. The platform also uses a blog and prompts to engage peer support [49]. This

aimed to reduce the myths, stigma, and taboo surrounding menstruation by informing and encouraging conversation. People can gain information and support from others through openly sharing their experiences. Menstrupedia aimed to inform and educate the community, and such platforms could be useful to encourage and support conversation between children and parents or carers, even though this was not the explicit focus.

Research to evaluate the existing menstruation-related technologies has been conducted and highlights the potential areas for improvement. For example, Epstein [14] carried out an extensive study to review the use of menstrual tracking apps. Whilst results suggested people track their cycles for a wide variety of reasons; these apps were not effective at predicting cycles, limiting the support the apps can provide. Fox et al. (2020) suggest that designers should acknowledge the difference between menstrual tracking and fertility tracking, as a design that only focuses on tracking in relation to fertility can lack inclusivity [17]. Menstrual technologies should support the variety of reasons users track their cycles, such as gaining a sense of menstrual health [17]. For example, non-binary, transgender, and intersex people may experience menstrual-related symptoms such as muscle soreness and headaches and might want to record testosterone levels in the same way current apps consider taking birth control [37].

Research from Epstein (2017) and Fox (2020) highlights that existing menstruation-related technology assumes the user is engaging in sex resulting in pregnancy, which can be inappropriate for younger children. This does not consider the wide range of users such as infertile, single, uninterested in procreation and the LGBTQ+ community. There is no average menstruator; a range of different people can have a menstrual cycle, although much technology can enforce normalised expectations of bodies and gender [3; 6; 44]. Existing tools focus on adult related issues and can be irrelevant for younger adolescents; there is a need for resources and support to engage with the younger population who experience menstruation.

Additionally, the use of apps to assist users with their physical and mental health is a common phenomenon; however, it is important to ensure that these apps are designed without biases and assumptions about self-care [45]. An evaluation of self-care apps found that such apps should be cautious of a negative effect on the user. It highlighted that though said apps are promoted as a tool for information and self-care, they can establish a narrative that oversimplifies distress, which can be harmful to the user [45]. Therefore, when younger adolescents are first learning about menstruation, it can be overwhelming, we need to be sure the appropriate support mechanisms are in place and children are not only reliant on digital tools for information. As mentioned, parents are a common and preferred source of information and support. Yet to our knowledge, these previous works did not explore the role of technology and how it can aid parents in supporting children in this.

2.4 Research Aims and Objectives

Parents play an important role in how their child perceives, is prepared for, and feels supported at menarche. Furthermore, how prepared a child is in their early stages of menstruation can impact the relationship they develop with their menstrual cycle. Therefore, this research explored the following questions from parents' perspective: RQ1: How do parents support their child with menarche and during menstruation, and what are their concerns? RQ2: Do parents use/want to use technology to prepare their child for menstruation? RQ3: How can technology better support parents and children during the early stages of the menstrual cycle? We acknowledge from the outset that we need to identify such needs from children's and adolescents' perspectives as well.

3 ETHICAL CONSIDERATIONS

When designing our studies, we took steps to consider our Ethics carefully to reduce the risk of undue harm to our participants. As menstruation can be a stigmatised topic for some, we ensured all participants were fully aware of the study's aims and the protocol of the data collection through an information sheet. Fully informed

consent was obtained from all participants after they considered the information sheet. We used gender-neutral language in study materials to ensure we did not discriminate against participants. All participants were informed that they could withdraw from the study at any point without giving reasons. The study was ethically approved by the department ethics committee. Due to COVID-19, all activities in this research were held online, so that the health of participants was not compromised.

4 STUDY 1 INTERVIEW STUDY AND DESIGN ACTIVITIES

4.1 Study Design

To address the research questions in 2.4, two studies were carried out. Study1 aimed to address RQ1 and RQ2 and had two parts: (i) one-to-one semi-structured interviews were carried out to gain insights into how parents support their child with the early stages of menstruation and their concerns, as well as which tools and technologies they used (ii) four design activities to understand the needs and requirements of parents in supporting their child with menstruation. The results from Study1 were used to define requirements for a digital technology. These requirements were used to develop a digital conceptual design, which was further evaluated in Study2 to investigate RQ3 (further discussed in Section 7).

4.2 Interview and Design Activities

Figure 1 Example response(Top)- Activity 1: Empathy map, Activity 2: Statements (Bottom) Activity 3: Crazy 8

Participants and materials: 10 participants were recruited using purpose and convenience sampling, through advertising on online forums and social media platforms. The inclusion criteria were to be over 18 years old, a parent, carer, or guardian of a child between the ages of 9-15 years old who has or is expected to have a menstrual cycle. As well as being able to communicate effectively in English, give informed consent, and not be considered a vulnerable person. A £15 voucher was given to each participant to thank them for their participation. Participants were assigned an identifier (P#), which will be used to refer to them. Of 10

participants, three had children who were defined as pre-menstrual, seven had begun their menstrual cycles. Three participants described their relationship as fathers and seven as mothers. Study1 was carried out using Microsoft Teams, and the design activity was conducted using a Miro Board. Participants were required to have a piece of paper and pen for the 'Crazy 8 sketches' task. Both stages of the study were audio-recorded with consent, the files were saved anonymously and transcribed.

Procedure: Firstly, the structure of the study and activities were introduced. The one-to-one semi-structured interview lasted approximately 20-30 minutes, participants discussed their current ways of preparing their child for menstruation, and the emotions they experienced during this time. Participants discussed the information and resources they used to provide their child with menstrual support. Next, participants were guided through the instructions for each activity and allowed to ask questions. The design workshop had four activities, firstly an empathy map that explored what the participants say, do, think, and feel in relation to their child's menstrual cycle. An empathy map was chosen as it can assist with empathising with and understanding user needs [16]. In the second activity participants suggested 'problem' statements' and 'how might we' statements to encourage new ideas and innovative thinking. For the third activity participants were given eight minutes to sketch eight ideas based on their 'how might we' statements, (also known as 'crazy 8 sketches') to generate a wide variety of ideas. Finally, participants reflected on the matters discussed and shared their final ideas. Examples of participant responses are shown in Figure 1.

4.3 Data analysis for Study 1

Each interview was manually transcribed and analysed using an inductive approach through thematic analysis [5]. Initially, the transcription was read multiple times to gain familiarity and then uploaded to a qualitative data analysis software, NVivo. Coding allowed for a deeper understanding of the transcripts and identifying key observations. Affinity mapping enabled codes to be grouped into themes. These themes were then discussed and redefined with the research team. The data was explored to understand what parents did in preparation to support their children and understand the tools and resources they used.

The recordings of the design workshop were re-watched to gain a deeper understanding and to note any insights not captured previously. Next, an affinity diagram was created to group information and identify themes from design activities. A grouped empathy map (e.g., Figure 1) was created to gain insight into the collective user needs to explore common findings from Activity 2 and participants' needs.

5 RESULTS FOR STUDY 1

Our studies revealed participants' experiences, emotions and concerns around the onset of menarche for their children, and the responsibilities they felt during this time, including shared ones. They particularly felt a crucial need to provide substantial support for their child but suggested a lack of confidence in recommending or using existing resources. Furthermore, they wanted to ensure their child felt supported and comfortable in openly communicating about menstruation. Participants also discussed their experiences and expectations in using technology for menstruation related information and support.

5.1 Attitudes and emotions about the onset of menarche in parents and children

Our participants felt that menarche was a time of change and transition. As parents, they spoke about this time as being a milestone and step into adulthood for their children. P9 said, "M*y child is not a baby anymore! She's becoming a woman potentially. it is all quite emotional* ". P10 said, "*It shows me that she is getting mature.*" Thus, this was an emotional and uncertain time for parents who were coming to terms with their own feelings about the changes that their children were going through.

Participants shared a range of emotions. Half of the participants were positive about their child starting menarche, and this resonated with their own attitudes and preparedness for this stage in their child's life. *P2:*

"I am not stressed about it. I think it's important that she starts. I'll be happy about it, it's a natural thing." P8: *"I feel positive about it and quite relaxed, pre-emptive I'm definitely ready for it."* Others felt that this was a time of uncertainty and stress for them as parents. P1 said, "I *am feeling anxious around her starting*". Some parents were not prepared for this change in their children because they felt that they were too young. P4 said, *"I feel pity, because she is young, and she doesn't fully understand what she is going through right now.*" In some cases, negative attitudes to menstruation were related to parents' own experiences of menarche and menstruation while some worried that if their child's experience is different to their own, they may not be able to support them. *P5 said, "initially I was anxious and worried because I didn't know what her experience would be, mine have always been quite painful and not a good time so I didn't want the same for her*"

Participants shared their children's attitudes to menstruation. In some cases, these were negative, especially if the child was unprepared. P6 explained, "*At first she was shocked because we weren't expecting her to start so early so maybe I didn't prepare her or hadn't given her enough information.*" Some children felt uncertain about the onset of menarche despite being given information by parents. P1 said, "*... it's the unknown not because it's a bad thing. It's difficult because up until I had the talk with her and told her I had [periods] she had no idea. So, it's not negative but she's nervous about what is going to happen to her.*"

Some parents said that their children were prepared from a young age as they were very open. P5 said, "*She's always been aware of it from quite young, because she used to follow me to the loo and ask questions and I would always tell her, she would call a pad mummy's nappy.*" Others who were open about it, still used code names to discuss when they were talking about menstruation. P8 said, "*I'm open about it, and we have a code name between us, so my son doesn't understand.*" This reflects the mixed attitudes that many have about menstruation. Some parents spoke about how they had to work to change their child's feelings towards menarche and normalise it. P4 said, "*my wife and I we try to change her mind because she viewed it negatively. My wife explained it is a positive thing, it is normal*". Others' children were neutral at this stage, but parents still worried about potential negative attitudes. P2 explained, "*I don't think she quite gets it yet, or fully understands... she's seen me writhing in pain which isn't probably the best association for her, but I think its natural and it's not something she should view negatively.*" The most positive attitude was associated with children who were prepared for menarche. P9 explained, "*they have been well prepared for it. They knew what was coming because school taught them from quite early on.*"

Parents shared that they felt it was their role to provide information and support but sometimes felt unprepared to do this appropriately. They felt anxious about supporting their child especially due to the unpredictability of menarche for individuals. P1: "*[It] comes around way too quickly, did not expect to have this conversation so early. [...] Its normal but she panics and likes to prepare and plan [...] but this isn't something you can plan for. Obviously, I can tell her what to expect but I can't prepare how it will actually feel for her. Will she be regular or not, will she be heavy etc.[...] so I am a bit worried.*"

5.2   Preparation for menarche is a shared endeavour with shared responsibility

Whilst preparing for the onset of menarche in their children, parents focused on the importance of their child feeling prepared. Despite highlighting their feelings of readiness to support their children, they emphasised their children's feelings and their role in supporting them. This would often involve providing children with resources such as books, websites, or videos to support informed discussions and a self-learning experience but finding resources was hard. P10 said, "*We try to give her books so she understands and feels in control. [...] but it is hard to find, we really had to look at lots of books to find one that [...] was good.*"

Parents highlighted that menarche is the onset, not just of the menstrual cycle but all kinds of changes including physical changes (bodily changes, onset of symptoms such as cramps), mental and emotional changes (with hormones and changing feelings), and social changes and wanted resources to address all these changes holistically. Several felt the importance of providing their child with sufficient information to feel confident in handling the physical and emotional changes accompanying puberty. Parents described sharing the learning

experience. P8: "*we sat down and went through [a book], and it's got a lot of information about growing up, body shape and period starting [...] this way she can be pre-emptive and honestly, it's just good to get to know her cycle and be familiar with it. [...] the more you know and the more prepared you are the more you can handle situations around you. There's going to be ups and downs, especially being a teenager is a difficult time [...] and understand that ok, it's a week before my period I'm going to have cravings, I'm going to be upset about things so possibly could I do some exercise?*"

Additionally, many searched for resources that provided insight beyond scientific explanations. Multiple parents discussed the importance of their children having insight into managing their symptoms and the opportunity to explore a variety of treatments for their symptoms. P10 said, "*For example she gets cramps... really bad cramps and we give her pain killers but then it works sometimes you know and then we look online, and we try lots of different foods and exercises but not much helps her.*" They also mentioned advice on lifestyle choices, such as diet, nutrition, and cycle tracking benefits. In being equipped for menarche, parents discussed how they prepared their children for the practical aspects of menarche. P6 mentioned, "*I think it's important that they know how to look after themselves, how to stay clean, which products are comfortable. How to manage mood swings, headaches, and symptoms and to keep a track of it to see if you are regular.*" Parents also worried about how children would cope if the onset of menarche happens in school, especially when children are young. P8 said, "*When she was 8, I showed her the products and where she should go in school if it happens. I talked her through my experience.*"

Most participants treated the gathering of information, tracking the menstrual cycle in the early days for younger children, and solving any problems as their own or a shared responsibility where they were equally involved. Most of them said that their children shared information such as when they started their period, worry about any variations from their normal cycle and other emotions and concerns and parents were there to support them. P4 explained, "*she shares, she tells me that she has started, and it is my responsibility to take care of her and make sure she is feeling ok, when she is feeling pain and uncomfortable, we support her by giving pain killers.*" P5 had a similar experience: "*She often tells me what's going on, initially she was irregular, which is common, but she was concerned so I consoled her and told her not to worry we can go to the Doctor if it doesn't settle down.*" The sentiment of shared responsibility and making sense of the experience with their children was also present in the language where parents spoke of managing symptoms or finding information and making sense of experiences, together with their children rather than simply pointing them to information. Some parents were also more proactive in supporting their children: for example, P9 said, "*I track their cycles for them. I will check with them regularly to see if they have started etc.*"

Some parents discussed that it was key to show their children different menstrual products and offer guidance on which one they might use. Some parents worried how to introduce available sanitary products, whilst others shared what they had done. P4: "*We gave her the sanitary pads and the liners, we showed her different products, and some are better for the environment, some are more expensive, and my wife explained how to use them so my daughter could make a decision.*" They also discussed the associated financial cost of, for example, some educational resources and allowing their child to explore multiple menstrual products. P4: "*My wife looked for some apps to educate my daughter, but you had to pay for a lot of the resources on there, [...] the sanitary products are expensive and then the information to give them to support is also expensive.'*" Also, they suggested that their children should have the ability to compare a wide range of menstrual products to allow for informed decisions and choose the most suitable. P5 explained that they did, "*lots of talking and going through various products with her, she wanted to see how they absorbed stuff, so we used water and I showed her practically how they worked.*" Parents mentioned wanting a trusted interactive tool that could share tutorials for each product, including reusable ones, and health and hygiene guidelines to ensure their children get accurate and impartial information.

5.3 Lack of confidence in finding and recommending appropriate resources for evolving needs

A key concern for parents was the lack of confidence in using existing resources as they were concerned about trustworthiness and credibility of existing information. They explained difficulty finding information as there

was an overwhelming number of resources but a lack of comprehensive, trusted resources. Parents also shared a need to validate their knowledge on menstruation to ensure they could support their children to be better equipped and prepared than themselves. P9 explained, "*I want it to be different for them then when I grew up [..] I was never taught this myself.*" Furthermore, participants stated resources could help initiate the conversations they may not have been entirely comfortable raising themselves. P10 said, "*it's hard to know (whether) what you are reading [online] is accurate [...] it could be a good thing to have all accurate information in one place and maybe she can learn stuff we are not comfortable talking to her about.'*"

Whilst exploring existing resources another concern was the suitability of the information in relation to their children's age and current needs. While parents wanted their children to have a holistic knowledge of their menstrual cycle, they did not think that younger children need to understand all implications of their menstrual cycle in relation to sex and fertility and voiced concerns about the difficulty of finding information on menstruation that did not include fertility and sex. Parents shared that information about fertility or contraception would be more appropriate when their children were older. P1 said, "*I haven't mentioned the whole fertility thing, because she's very young and doesn't need to understand about sex [..] So, I used Google to find a book for her, because I didn't want her to search for herself because there is so much, she can come across on the internet that I don't want her exposed to such as the sex side of things.*" Those with older children (over 12 years old) expressed that their children should be educated adequately on fertility and practising safe sex but were concerned with the spread of misinformation amongst their children's peers. P9 said, "*Especially as they grow up, they probably don't want to talk to their parents as much but also there's so much information online and what their friends could be telling them could be inaccurate or harmful [..] they are becoming young women they should be informed on sexual health and the repercussions, how to protect themselves and be pre-emptive.*" Parents wanted to be sure that accurate information was being acquired. P10 said, "*We question her on what she is learning [...] we think it important she has support and can talk to her friends but sometimes children spread to each other wrong information and that is worrying.*"

Further, whilst parents considered autonomy was important for their children, many pointed out that allowing their children to freely research menstruation online, especially for younger children, was a daunting thought, as they did not want their child to come across incorrect or inappropriate information. P1 said, "*I didn't want her to search for herself because there is so much, she can come across on the internet that I don't want her exposed to [...] there's so much information out there and you don't know what's true.*"

5.4 Open channels of support

Many participants expressed the importance of having open and honest communication, they wanted to ensure their child felt comfortable discussing menstruation and to ask any questions they may have openly with themselves and others. Their concern was for their children to have open communication and to feel comfortable sharing, hoping to reduce the some of the traditional stigmas that surround menstruation that can make it feel like a hidden or taboo topic to discuss. More than half the parents spoke about that they did not want their children to feel shame, or feel embarrassed, such as P1: "*there should not be shame around it*" and encouraged sharing and talking about menstrual experiences. *P7 said, "I create a safe space with my kids and just want them to feel like they can talk to me about anything on this topic. But also confident in themselves and able to express what they are experiencing.*"

Parents mentioned that it was important to them for their child to receive positive messages about menstruation. They shared that they felt the responsibility to ensure their children viewed menstruation as something natural and positive, not something that is shameful or taboo. P9 said, "*We have a lot of conversations about [periods] and I question them about what their friends are saying or anything they might be hearing and if it's anything that might have negative connotations or make them feel bad about their periods, I try to shut it down and push them back into the positive direction.*" Some expressed the ways in which they ensure their child is viewing menstruation as something manageable and positive. P8: "*I explain why the body is changes and its positive and*

amazing.'" Furthermore, some discussed wanting insight into what their children were learning at school about menstruation, as this would help support conversations at home and effectively question their children's understanding of what they are learning. P5 said, *"It was a lot easier during lockdown because we were all sitting around a table and I could hear what her lessons were. Conversation is crucial. The fact that she's happy to come and ask, [...] have open conversations without embarrassing her."*

Many proposed that in addition to themselves and teachers, access to trusted information from healthcare professionals and councillors could be beneficial for their children. They suggested that this could increase their children's confidence in and understanding of menstrual and sexual health, symptom management and understanding their cycles but also normalising the experience. P9 explained, *"They are becoming young women they should be informed on sexual health and the repercussions, how to protect themselves and be pre-emptive. But also, how to manage the symptoms they have if they are suffering from their periods if they could talk to someone at the school or maybe myself. Now they are quite good at managing their cycles and I have two children; one takes it in her stride and the other needs to rest and I think it's important they know that everyone is different and can have a different experience."*

5.5 How parents use and would like to use technology for menstrual support for their children

Many parents shared how they used technology with their children for menstruation-related information and support. Participants felt they wanted their children to use tools for tracking their periods and menstrual cycle and had many motivations for encouraging their child to do so including using phone calendars to track irregular periods. P1 said, "*when she starts, I would like her to have something to use whether it's an app or a paper calendar. When I used an app nine years ago for my fertility you know I was very irregular so none of it really made sense for me.*" Some children already used phone or paper calendars or asked their parents to track for them by sharing dates. P2 felt that technology would be helpful but did not want to give access to technology such as a phone to a young child: "*When she starts, I will probably want her to track the cycle, but I won't be giving her a phone anytime soon, so I'll track it for her until she gets one.*" Parents did not want to use existing apps with their children because they felt they were not age appropriate. P5 said, *"weren't really focused on her age group it was mainly to do with fertility which of course is not relevant at her age."* while some said their children did not like the apps. For example, P9 said her child found *"[the tracking app] was too girly for her"*. Participants also acknowledged that not all children would have access to a smartphone so may not be able to use technology but acknowledged this would be useful for those who had access.

P2 was motivated to encourage tracking by her own experience of health difficulties, *"I have also had fibroids so I would like to see her menstrual health. Mine has always been very heavy and painful, you know as a teenager it was a difficult ordeal and knowing about fibroids could have helped maybe. Tracking it for her will help her be familiar with her health and offer her guidance."* While most parents wanted to support children with their own experience, P4 felt that there was need for more normalised information as well, "*My wife is speaking from experience so I think that it is accurate because she is going through it, but my daughter might not have a similar experience to my wife.*" Reasons for tracking were also pragmatic. P5 said tracking could help, *"so she knows when to carry her pack with her products and to monitor when she's regular."* Some other reasons were also added by P9, *"Just to make sure they have a regular cycle, to ensure there are no health scares or pregnancies in sight.".* As evident here, parents want to know for children's best interests but there is also a potential for harm if they deny the child autonomy and control. Besides tracking, some children used forums (e.g., P4) for emotional support and information. Others used related apps such as meditation ones for stress and relaxation (P9).

Parents felt that technology was already ubiquitous and important in their children's lives and that their children were using apps in other aspects of their lives. At the same time, parents used technology such as apps, for their own menstrual cycles and were showing these to their children. Therefore, it made sense for technology to be leveraged for this purpose as long as it is age appropriate and evolves with their changing needs. P2 said, *"Even homework comes through on google classrooms now. So, I think it makes sense that there is an*

app that focuses entirely on menstrual cycle and specified depending on ages you know... preteens and teens how to deal with it, what different information they need."

Parents welcomed the idea of having a resource for themselves and their children to check the validity of acquired information, as some felt their children may not be comfortable discussing everything with them and teachers. They suggested that apps could have a parental profile to explore the available resources and ensure their child is getting the appropriate information. However, an app for children should include guidance for parents on the content of the information and those who may not use technology often. Once they can see what their children are exposed to, parents shared that they could supplement the information on the app with in-person support. P5 said, *"young people [...] are constantly on their phones, especially if it had an information guide for parents to inform [parents] of what the child is learning but also on how to use the app."* P9 added, *"an app could be useful if it asked questions and was personalised to their age group. They could also ask it questions to self-educate and be exposed to a variety of experiences (...) if the information is monitored could be useful."*

Parents felt that their children should have access to holistic menstrual information and have a place to fact check information they come across. P2 said, *"I think it makes sense that there is an app that focuses entirely on menstrual cycle and specified depending on ages you know, apps probably are a good way to do this and probably a good way to correct information from their friends."* Some also expressed that technology that would incorporate interactive learning and access to resources which encourages their child's self- learning experience would be useful. P9 said, *"They need to ask questions to educate themselves and you know maybe be exposed to a variety of experiences, because sometimes children will ask questions but often you don't know what's going through their mind. I think a safe space where they can self-teach and be interactive, kids like apps and if the information is monitored it could be useful for them"*

6 DESIGN REQUIREMENTS

The findings from Study 1 provided insights into not just the needs of parents but also the values to support a positive menarche/menstruation experience and attitude in their children, which should be taken into consideration when designing for aiding parents in providing support. The final theme of the findings section (section 5.5), explicitly addressed our third research question, i.e. how can technology better support parents and children during the early stages of the menstrual cycle? Our participants discussed their desire for access to reliable information around menstrual health, products, symptom management and cycle tracking that was age appropriate for their children. Parents also wanted to ensure that their children received both holistic and scientific information. As well as feeling comfortable in communicating their experience. These findings lead to the development of the user requirements (see Table 1).

Using Study 1 data, we created two personas to establish realistic representations of users, and help to generate empathy during design ideation [16]. The features identified in the personas highlighted key findings from the study and were used to evaluate the conceptual design, which is an app. We chose an app as during Study 1 apps were the most frequently discussed digital product. Participants felt that an app could be seamlessly incorporated into daily life and easily accessible for parents and children. Further, the use of apps to support menstrual tracking is already widely adopted.

6.1 User Requirements

The findings from the interview and design activities were grouped using an affinity diagram to establish user requirements. A cross comparison (Table 1) shows how several existing menstrual apps support the needs identified in Study1. These Apps were chosen based on the most downloaded menstrual apps on the Google Play Store, but the analysis suggests that besides tracking, existing apps did not meet other requirements.

User Requirement		Menstruation Apps						
		Flo	Period Tracker	Magic Girl	My Calendar	Clue	Ovia	Eve
Reliable Information	Credible Source of Information	/	X	X	X	/	/	X
	Free access to educational information	/	X	X	X	/	/	X
	Management advice	~	X	X	X	~	X	X
	Peer support	/	X	/	X	X	/	/
	Diet and nutrition advice	~	~	X	X	X	X	X
Holistic Information	Access to medical professionals	~	X	X	X	~	X	X
	Advice on mental health	~	X	X	X	~	/	X
	Information on related health conditions	/	X	X	X	~	/	X
Child Friendly	Personalise information (age appropriate)	X	X	/	X	X	X	X
	Simple language	/	/	/	/	X	/	/
	Inclusive (not gender specific)	X	X	X	X	/	/	X
Cycle Tracking	Tools to track	/	/	/	/	/	/	/
	Promote benefits of tracking outside of fertility	X	X	X	X	~	X	X
Menstrual Products	Comparison of wide variety	~	X	X	X	X	X	X
	How-to tutorials	X	X	/	X	X	X	X
Communication	Data sharing	X	/	/	/	/	X	~
	Conversation support	X	X	X	X	X	X	X

Table 1 User requirements compared against existing menstrual Apps. '/' = requirement met, 'X' = requirement not met. ~ = paid subscription required for requirement to be met.

6.2 Conceptual Design

The conceptual design was referred to as *POWer* (Periods for Optimism and Wellbeing) and aimed to explore and visualise identified needs based on ideas generated from Study1, existing menstrual apps, and the established user requirements (see Table 1). The initial design concept was created using pen and paper (Figure 2), followed by a digital prototype using Figma. *POWer's* purpose is to provide users with various relevant information required to manage their menstrual cycles effectively. Users can learn about menstruation and related changes, manage their symptoms and ask questions from other users or healthcare professionals. *POWer* has separate but linked accounts for a parent and child, allowing parents with young children to monitor activity.
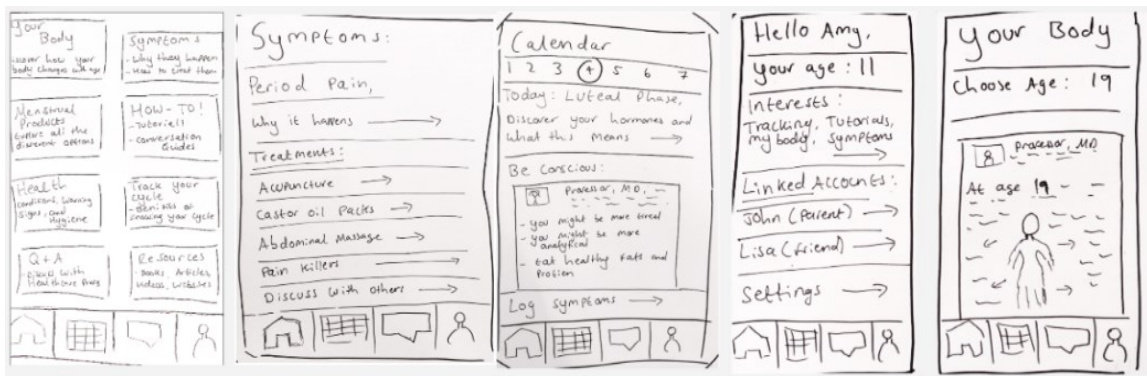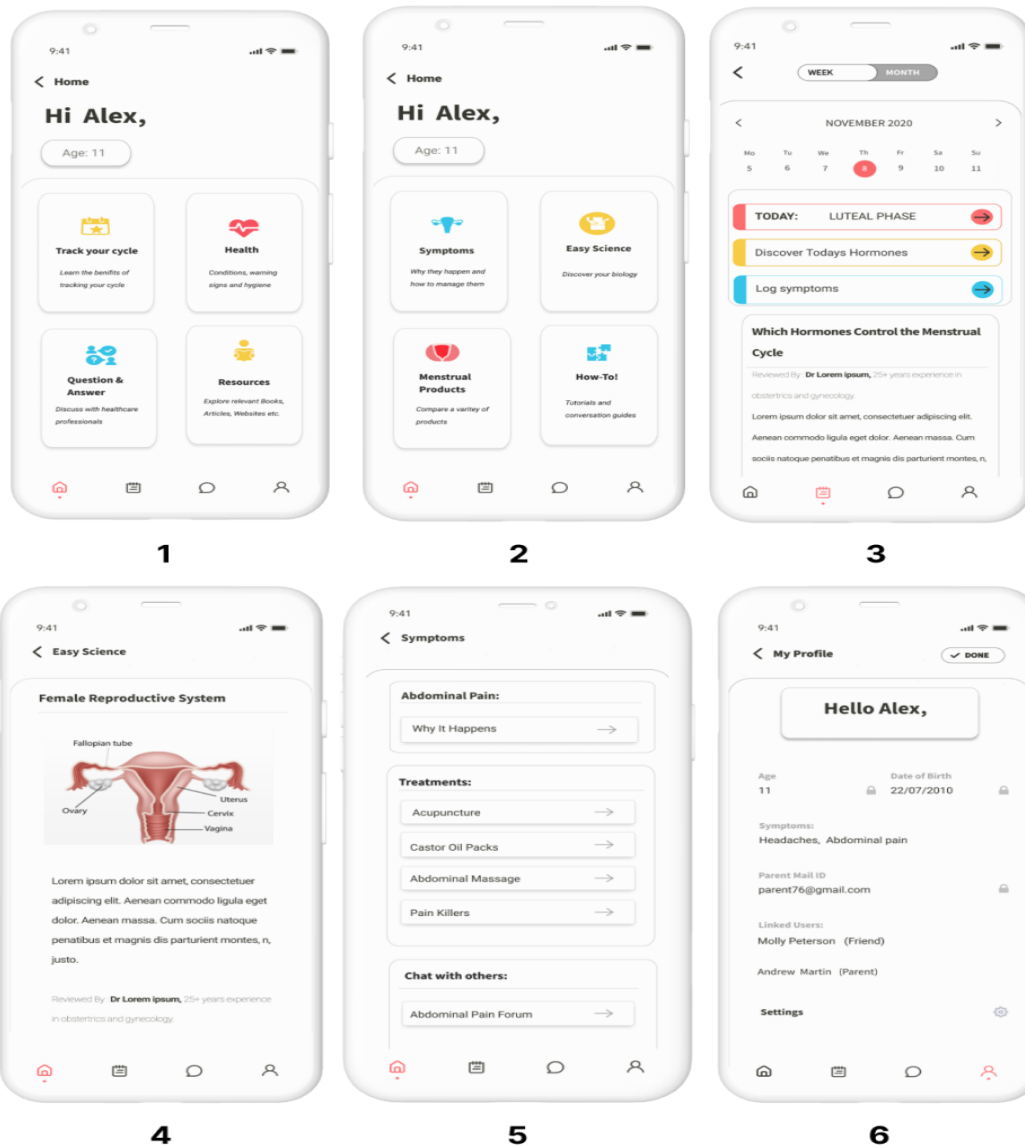

Figure 2 Initial sketches of design concept.

Figure 3 Screens of the Concept design, POWer. (1) Examples of menstrual products and How-to Tutorials. (2) Resources and Health Information. (3) Tracking your cycle. (4) Easy Science. (5) Symptoms (6) Parents Profile

The digital prototype of POWer was used as a probe to gain an in-depth understanding of how parents might use an app to prepare their child for menstruation. It was designed to be a central point of information, support and communication for children and their parents. In addition to including a wide variety of age-appropriate menstrual related information, POWer aimed for a holistic approach to menstrual education. For example, by providing the ability to track one's menstrual cycles to understand what is happening in each phase and the associated changes in their body (for example, in their reproductive system), allowing them to learn about which hormones are rising or falling and how this may affect their symptoms. It also provides insight into how to manage symptoms and includes examples of different menstrual products available (Figure 3), as well as how they work. Interactive resources such as the Easy Science screen include interactive diagrams (to enable the user to interact with a diagram of the reproductive system), video explanations, and written text. The variety of information types was intended to keep the attention of children. POWer enables users to log

symptoms daily to discover patterns in their cycles and explore the science behind their experiences. Users can ask questions from other users or healthcare professionals through a forum. POWer allows separate but linked accounts for a parent and child, allowing parents with young children to monitor their activity. Parents had the option of having full control over their child's activity in early years to understand how they felt about such a feature. Parents could monitor what the child accessed and could give the child permission to dissolve control, allowing complete privacy.

As mentioned, the specifications for and development of the Conceptual Design POWer was based on the interview findings in Study 1. However, there was a need to evaluate the concept to investigate whether this tool fulfilled the needs and requirements of parents supporting their children through menstruation.

7 STUDY 2: EVALUATION OF CONCEPTUAL DESIGN

We evaluated our data based conceptual design with users of menstruation apps, This study further addressed our third research question of how can technology better support parents and children during the early stages of the menstrual cycle.

7.1 Method for Study 2

Participants and Materials: Eight participants were recruited using purposive (selective) sampling and offered £10 amazon voucher to say thank you for participating. For anonymity, participants are assigned a number (P#) which will be used to refer to participants. Of eight participants, two had children who were defined as pre-menstrual, four had begun their menstrual cycles and two participants were not parents but had experience with menstruation tracking and apps. Including both parents of children who were pre-menstrual as well as parents whose children had begun their cycles was key to understanding their needs before the event of menarche, as well as understanding parents needs where menarche had occurred. Having this diversity in our participant pool enabled us to understand what parents wished they had access to as well as what parents would like for support. The two participants who were not parents were HCI researchers. Their unique perspective and experience were helpful in evaluating the conceptual design. The study took on average 30 minutes. The evaluation interview was carried out using Microsoft Teams, each session was audio recorded for further analysis. The digital prototype of *POWer* was shared with participants*.* Participants were given an information sheet explaining the purpose of the research and background information.

Procedure: Participants were given a brief overview about the session and the opportunity to ask questions. They were reminded of their right to withdraw anytime and gave informed consent. They were instructed to open the link to *POWer*. Participants shared their screen whilst exploring the prototype and expressed their initial thoughts. Next, they asked the following for each page: What are your thoughts about this? Do you think this feature would be useful? What do you like/dislike? What is missing – would you add or improve or change anything? Participants then reflected on the concept and asked the same questions about the entire concept.

Analysis: The data collected during interviews was analysed by revisiting audio recordings for familiarity, followed by transcribing the interviews and making note of any additional insights identified. This analysis process led to five main themes, including benefits of interactive learning of their own cycle, the need for centralised information as *POWer,* meeting support needs and the importance of privacy.

8 RESULTS FOR STUDY 2

Participants were interested and engaged with the app and positive about the design concept and the need for a resource like *POWer.* They particularly liked the comprehensiveness of trusted and integrated information. They enjoyed the idea of exploring bodily changes through different stages of their cycle, to allow for a more holistic understanding. They suggested different ideas based on the prototype.

8.1 Interactive learning of their own cycle for a holistic understanding and health

Parents liked the focused learning about the menstrual cycle and associated changes happening in the body and otherwise, such as tracking menstrual cycles whilst learning about the effects of hormone fluctuations and symptoms, for children to gain an in depth understanding and help them have a sense of control as well as addressing the negative aspects of their cycle. P1 explained, *"I think this can be quite a stressful time for children and my daughter has a lot of questions, like 'how will I know when the next one will be?' because she knows I'm irregular. ...kids these days want to be more in control, and this would help them."*

Parents also felt that there were so many aspects for children and adults to understand the multidimensional quality of periods, contextualise the changes, and see the cyclical patterns to better understand their health and emotions. P5 said, *"I think just in terms of tracking and understanding symptoms it's helpful to monitor and understand patterns. One thing that's amazing is [...] being able to understand their hormones. I was surprised how much it affected her, and it would be helpful to put this information into context, if she's being particularly emotional. I could see where her hormones were at and not belittle her experience".* Some shared such information would be helpful for themselves and their child. P4 said, "*there's so much I'm clueless about in terms of what each week means so this would be very helpful for me and my daughter*".

Parents proposed that a feature that explained why hormones fluctuate, and symptoms occur could be useful to allow children to gain a deeper understanding of their bodies. This would help them understand the science and tackle misinformation and stigma. P7 explained, "*She has symptoms, and she asks me about it and my only explanation is 'oh your period is coming', I can't explain the science of it or what's happening in her body. I can only pass on the ancestorial information, like the symptoms that have been passed on for generations, there was no questioning or asking why, you just accepted it as it was.*" P2 added, "*This would allow children to have a greater awareness of their body and that's great.*"

All parents were positive about the cycle tracking feature, and how it was not focused on fertility and did not dictate to children that their body's purpose is to make babies. However, some suggested that ovulation should not be overlooked as children need to be aware of it, and older adolescents should learn about fertility. P2 said, "*I think it would be important to know when they're ovulating as it can cause pain and it does have side effects, but I like that this app isn't all about fertility and being a baby making machine.*"

Some also discussed having accurate information in simple terms was useful for their children, but also made it easy for them to refresh themselves on information when necessary. P1 said, *"I think it's important for it to be simple language, as a child you need it in a simple format but also parents need to be refreshed with the information."* P2 suggested that it would be useful to have *"a definition of each scientific word, and maybe the option to highlight or pin something that is interesting."*

In terms of information presentation in the app to aid learning, many participants responded positively to interactive information describing it as a more enjoyable experience than reading a large body of text. P2 said, "*I think the whole concept of having interactive information is interesting, because often it's just paragraph after paragraph which gets boring [..] it's better to click on something and be able to interact with the information."* The opportunity to receive information in a variety of ways such as, interactive diagrams and videos was found to be useful as it would hold the attention of a variety of users. Similarly, to the design interview participants discussed the importance of having accessible adequate information about menstruation. P3 said; *"I like that its simple [...] videos are also useful to explain what's going on, this would be helpful for visual and audio learners who don't want to read a long body of text."*

8.2 Information is POWer

Some mentioned the ease of accessing a variety of different information in one place, they discussed the struggle of researching different websites for hours to find an answer with no certainty that the information they were reading was trustworthy or correct. P2 said, *"...sometimes when I google treatments, the websites are so*

overwhelming with different information so it's nice to have it all in one place." The comprehensiveness of information extended to the practical information available, as parents responded positively to the opportunity of exploring a wide range of menstrual products, as they were yet to find a resource that compared products effectively. Parents also discussed how not knowing the correct way to use a menstrual product can be daunting, and how this lack of knowledge can hold them back from exploring different products or be embarrassing for their children to try to find out. P4 explained, *"I like that there's tutorials on how to use each product, it took me ages to figure out how to use a tampon, I'm still clueless with a menstrual cup and my daughter is going to have to go through the same confusion."* Also, they discussed how important it is to discover some menstrual products. P1: *"The current information out there doesn't talk about new stuff, cups etc. reusable tampons. I think comparing products is important because for years I used tampons and I would get cramps. Then when I stopped using them, I stopped getting cramps."*

Most liked the idea of having an app such as *POWer* as a useful tool for children to refer to it as new questions and intrigue arises, as well as to refresh their memory on information they previously found interesting. P3 said, *"I like that it's educational and can be a constant reminder because as much as you learn about your menstruation it's easy to forget. It's difficult to know off the top of my head when progesterone is high, how am I supposed to remember?"* Participants suggested that children would be able to use an app such as this one long-term and as a refresher. P1: *"I think it's really good that it's an app because a lot of kids are using phones and it's not like a book where they can misplace or lose it. It's something they can refer to throughout life and have a digital record of their cycles as they grow up."*

8.3 Meeting needs for support

Participants liked the idea of a supportive chat forum, as they thought hearing about the experience of others was valuable, especially for figuring out what is normal and when to be concerned. But also, to know about more information and ideas. P2 said, *"I really like the idea of chatting about it and having forums because it's important to read about other people's experiences. I have had instances where something has happened, or I've experienced a symptom and I'm not sure if its normal or not."*

They also valued peer support that a chat feature like the one in *POWer* prototype demonstrated for children to communicate openly with each other, and to address taboos and stigma. P1 said, *"I like the fact that there's the option for friends, I think it's important they talk to their friends to avoid taboos and stigmas. My generation never use to talk about it with each other, so I think this is good."* But for this, parents felt that chat forums should be monitored especially with young children and adolescents as the users. and that such forums should be checked to avoid the spread of misinformation. P2 said, *"I think it's important to monitor the information discussed in the chat section and regulate for false information."*

Many also discussed how giving children access to information by trusted healthcare professionals or educators was beneficial, as it would allow them to be well informed on when to be concerned and if they need to seek help. P4 said, *"I think an app like this could be helpful in those situations because it will help them to know when they should be going to the doctor."*

8.4 Privacy and control

POWer also helped users to think about privacy concerns as menstruation can be a very intimate time and participants suggested that children might not want to share everything with their parents. Participants discussed that children might require privacy to be able to learn effectively, as they could be reserved when using the app due to being embarrassed about what their parents might see. P3 explained, *"I think parents having full insight into their child's menstrual cycle and being able to monitor what they are doing on this app could be invasive for the child. I think for secondary school children it might be nice for them to have some privacy, especially if they have questions, they don't want their parents to see. They might benefit from having the power to take control of their*

femineity and not be monitored.". P5 echoed this thought and further stated, *"Whilst we do talk openly, I think they would want to keep some of these things private and personal, and I would want them to."* Having a balance of being able to respect their child's privacy, giving them autonomy and being able to support them was a concern for parents of older children.

9 DISCUSSION

This research explored how parents support their children for early stages of menstruation and if technology can support them in bridging the gaps. Our first interview study suggested that parents and children need support at this time in terms of understanding, information, and their own emotions. Parents often need to prepare but are not always sure how to effectively support their children by giving them a holistic understanding of the changes they are going through. They lack confidence in the validity of existing information and resources about menstruation and their ability to find and communicate this knowledge. They struggle to find age-appropriate resources and open channels of communication and support.

These findings led to the design of a conceptual app called *POWer* (Periods for Optimism & Well-being) which provides a central point for a wide variety of menstrual related information, menstrual tracking with insight into body changes. As well as hormone fluctuations and symptom management, and access to healthcare professionals and social support. Using *POWer* as a conceptual design, a second study was carried out with eight participants to further understand how they would use such a technology. Participants mostly discussed the importance of gaining a holistic understanding of one's cycle and hormones, the benefits of having a central point of a wide range of information and ensuring the children feel supported. However, privacy concerns for the children were raised as menstruation is an intimate and private process, and children might not feel comfortable with their parents monitoring their activity. Thus, the second study allowed for further insight into how technology can support parents with preparing their child for the early stages of menstruation. Using the insights gained in this research, suggestions for designing menstruation related technologies for parents and their children are discussed.

9.1 The need for *POWer*

The first study we ran showed that parents felt emotional and often unsupported and their ability and confidence in supporting their children is based on their own experiences. In the case of fathers, they can feel helpless and unsure of how to support their children because of the lack of experience and often information. Parents need to understand how to communicate information to their children and for this they need to prepare. However, they also need to understand what their children know and understand. This is for two reasons: to support and supplement the information children already have but also to combat misinformation. Often parents may even be unsure of when to start telling their children about menstruation and what information is appropriate for their age and understanding.

One vital consideration that emerges in this situation is that of control, who has it and how it is shared. For children and younger adolescents, parents want to be aware of and more in control of their children's access to information about menstruation, especially when they are unsure of the source (e.g., online). There is also a potential of shared learning and rediscovery of the connection between a menstrual cycle and their bodies for parents and children. The dynamic of sharing control in younger adolescents and children stems from practical reasons. Such as, not necessarily having a personal device for menstrual information and tracking. However, this control needs to shift subtly until it fully resides with growing adolescents as they grow in autonomy and power over their bodies and needs. This is important in older adolescents as research finds that too much parental control can be associated with more online risks [19], as well as encourage more controlling forms of parenting where children may be forced to share aspects they do not want to [29]. Some parents expressed concern that even though they shared information about menstruation and spoke openly, it may be intrusive

to have shared control over an app about such an intimate aspect of their child's life. In this, we agree with researchers who are pushing for a shift towards supportive family structures that encourage autonomy, learning, and involvement in negotiating control and rules for appropriate technology use, rather than relying on parental control or authoritarian parenting strategies. (e.g.,[21; 23]). This aligns with other research that reports on tensions around privacy and control as well as parental anxieties around technology use between parents and adolescents that can interfere with family dynamics and lead to conflict [4; 10; 12].

We recognise that this research is incomplete. Nevertheless, it addresses parents' concerns, and it is imperative to include the voices of children and adolescents who menstruate. Further, we propose that this is an area where technology can serve to open dialogue and negotiate boundaries, respecting the values of children and adults in the relationship [35]. Whilst this time affects both adults and children, parents are the primary supporters in the home at such a time of change, eventually the child must have autonomy and control to decide what is important to reveal and conceal. The advantages of sharing are many, thus there is an interesting space here for how we can design for the evolution of control and autonomy in intimate spaces.

9.2 Designing for a Holistic Approach to Menstruation- related Technology

Our research shows that users value a holistic insight into what is happening to and in their bodies during menstruation, to educate children with respect to their own experiences and increase understanding. Similarly, learning about how to manage symptoms was considered an important aspect as this could allow for a greater sense of control of one's body. Therefore, there is a need for menstrual-related technologies to provide the user with more support and insight into how to handle menstruation. Research carried out on UK adolescents found that participants wanted to be informed on how to deal with hormonal changes, menstrual symptoms as well as the lived and embodied experience of menstruation. The participants asserted that they wanted to know more than just the science behind why they menstruate [50]. Research by Eschler et al. has shown that existing tracking apps are insufficient at providing satisfactory information on menstrual literacy, thereby supporting our findings on the need for tools to be able to inform and support [15].

As supported by Epstein (2017) [14], menstrual-related technologies should focus on the variety of reasons people track their cycles. For example, to gain insight into one's menstrual health, to prepare for menstruation and understand their body. As highlighted by Epstein, whilst people track symptoms directly related to their menstrual cycle, they also like to track their cycle's impact on their physical and mental health. Therefore, it is apparent that menstrual-related technology should support the variety of ways users want to understand their menstrual cycle.

9.3 Providing Credible and Age-appropriate Information with Technology.

The findings from this study suggest that parents require confidence in the resources and information they use to educate and prepare their children for menstruation. During the design activities participants often mentioned healthcare professionals as a credible source of information. Therefore, providing both parents and children with access to healthcare professionals that specialise in menstruation, or information that has been approved by said healthcare professionals could be a potential design solution. As research has suggested the effectiveness of digital health interventions for the self-management of a condition, is dependent on a combination of educational content and interactions with healthcare professionals [32]. This would allow parents to validate the information they are passing on to their children and feel confident that their children can safely fact check information they are learning about menstruation.

In addition, children should be provided with types of information that is dependent on their age. For example, as shown in this research, children over the age of 12 years old should learn about fertility and practising safe sex however, children that are around 9 years old are considered too young to be informed of such things. Therefore, designs should consider personalisation depending on the differing needs of those from

different age groups. As suggested by Homewood (2018) it is important to design for different stages the body can go through [24]. Similarly, it is essential to design for personalisation as there is no such thing as an average user [2]. Menstruation technologies must avoid reinforcing a normalised body [17].

Furthermore, participants indicate that they want to provide their children with information that was engaging. For example, resources and information that are interactive, use simple language and avoid scientific jargon. Research such as, the 'Menstrual maze' has been effective in using interactive learning in the form of gameplay to engage with children, they found that children responded well to playful engagement when being educated [48]. Therefore, designs might want to consider implementing interactivity when educating children on menstruation.

9.4 Technology to Encourage Peer Support and Open Communication.

Furthermore, participants responded well to the chat feature in *POWer* as they stated it would encourage peer support amongst children. The parents suggested that encouraging open communication amongst peers can lessen the shame and taboos experienced surrounding menstruation. This notion is supported by 'Help Pinky' [25] which proposes that increasing peer support and collaboration can reduce stigma. Additionally, Plan International UK (2018) research states that adolescents use online forums to interact with peers and openly discuss menstruation to resist traditional norms about menstruation [50].

Similarly, peer support plays an important role when managing a health condition; people often seek out the experience of others when trying to make sense of a health condition [18; 36; 38]. Finding common ground with others concerning understanding one's health condition can lead to a greater sense of control [39]. Users tend to look for similarities in others' experiences to understand what is normal. Comparing an experience to others' can help users validate their experiences and accept or question what they consider normal[18; 38]. Thus, designs of menstrual-related technologies should encourage peer support and open communication. However, chat forums for children need to be regulated and monitored. [18; 36; 38].

Limitations: This research was carried out whilst the pandemic of COVID-19 was present, therefore there were restrictions in place which inhibited in person research. Consequently, both studies were conducted online which could have impacted the interviewer's ability to build a strong rapport with participants. Something that may have been important when discussing a sensitive topic, such as their child's menstruation [46]. Moreover, most participants were pushed outside of their comfort zone in this research, as they did not have a background in design. Therefore, they had no familiarity with the design activities in Study 1 or the process of a concept evaluation in Study 2. The most important limitation here is that this study is conducted only from a parental viewpoint and the children's perspective is needed to validate it.

10 CONCLUSIONS AND FUTURE WORK

In conclusion, this paper explored technology-mediated support for parents to prepare their children for early stages of menstruation. Note that while we refer to parents in this paper and the studies included parents, these findings can be extended to carers and guardians of children at this stage. We found that parents want a central resource with credible and age- appropriate information for their children. They place importance on a holistic approach to menstrual education and want their children to understand their menstrual cycles, to allow for a sense of control and lastly to ensure their children have open communication and support. Our studies make important contributions to HCI, as we identify factors and importantly values that are important for parents in sharing information with children at the onset of menarche. We expand on the role of technology within improving how information can be shared or communicated, and what information is important to include a holistic approach to this transitory time of change; we also examine the evolving role of technology as children grow and have different needs for support and information. Finally, we examine aspects of control and power in giving parents varying degrees of access to an intimate part of their children's lives. This work

should be extended to include children gaining their individual and shared perspectives (with parents), it has the potential to destigmatise and empower children with an understanding of their bodies from an early age. The paper also contributed design suggestions in the form of a conceptual app design *POWer,* to provide insight into how technology can support the needs of parents identified in this research.

Future research could explore the experience of children who are in their early stages of menstruation. Whilst we present initial findings on how technology can be utilised to help parents support their children with menarche and their menstrual cycles, we understand there is still much to be done in this field. Much work focuses on the person experiencing menstruation, and rightly so, we also call on future research to explore how to support the community around menstruation. Through holistic research in this area, we can explore how to better support people as well as reduce the existing stigma around menstruation. Future research could explore the experience of children between the ages of 9-15 years old in their early stages of menstruation. What information and resources they are using, whether their needs differ from what has been highlighted in this research, as well as how much influence and control they would like their parents to have. Likewise, this research did not explicitly explore the experience and needs of LGBTQ+ children and their parents, or in families where care for children is divided amongst adults in non-shared spaces. Future work can also add value by exploring the impact of variation in parents' needs and requirements based on aspects such as gender or cultural background. Furthermore, future work could involve further developing the conceptual app design POWer through rounds of iteration and user testing to evaluate its usability including accessibility features. To implement features such as personalisation and to explore the longitudinal effects of providing users with insight into how to deal with their menstruation. There is also space to explore the needs from such age-appropriate resources for parents of children who do not menstruate, to increase awareness and understanding of menstruation from an early age. Lastly, as the conceptual technology described in this research is in the field of digital health interventions, the feasibility should be explored. As the design directions suggest for a large involvement of specialised healthcare professionals and heavily monitored information to ensure children's credibility and safety.

11 REFERENCES

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