



# City Research Online

## City St George's, University of London

**Citation:** Skelton, E., Cromb, D., Smith, A., van Poppel, M., Morland, C., Rutherford, M., Malamateniou, C. & Ayers, S. (2024). "It's not just the medical aspects that are important": A qualitative exploration of first-time parents' experiences of antenatal imaging and their influence on parent-fetal bonding. *Radiography*, 30(1), pp. 288-295. doi: 10.1016/j.radi.2023.11.019

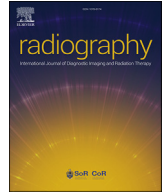
This is the published version of the paper.

This version of the publication may differ from the final published version. To cite this item please consult the publisher's version.

**Permanent repository link:** <https://openaccess.city.ac.uk/id/eprint/31815/>

**Link to published version:** <https://doi.org/10.1016/j.radi.2023.11.019>

**Copyright and Reuse:** Copyright and Moral Rights remain with the author(s) and/or copyright holders. Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, unless otherwise indicated, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way. For full details of reuse please refer to [City Research Online policy](#).



# “It's not just the medical aspects that are important”: A qualitative exploration of first-time parents' experiences of antenatal imaging and their influence on parent-fetal bonding



E. Skelton <sup>a,\*</sup>, D. Cromb <sup>b,c</sup>, A. Smith <sup>c</sup>, M.P.M. van Poppel <sup>b,c</sup>, C. Morland <sup>c</sup>, G. Harrison <sup>a,d</sup>, M. Rutherford <sup>b</sup>, C. Malamateniou <sup>a</sup>, S. Ayers <sup>e</sup>

<sup>a</sup> Division of Radiography and Midwifery, School of Health and Psychological Sciences, City, University of London, EC1V 0HB, UK

<sup>b</sup> Perinatal Imaging and Health, King's College London, SE1 7EH, UK

<sup>c</sup> Guy's & St Thomas' NHS Foundation Trust, London, SE1 7EH, UK

<sup>d</sup> Society and College of Radiographers, London, SE1 2EW, UK

<sup>e</sup> Centre for Maternal and Child Health Research, School of Health and Psychological Sciences City, University of London, EC1V 0HB, UK

## ARTICLE INFO

### Article history:

Received 3 October 2023

Received in revised form

16 November 2023

Accepted 22 November 2023

### Keywords:

Attachment

Bonding

Fetal imaging

MRI

Parent-centred care

Pregnancy

Ultrasound

## ABSTRACT

**Introduction:** Antenatal imaging provides clinical information regarding fetal growth and development. The additional benefit afforded by imaging for expectant parents in developing an emotional connection (bond) to the unborn baby is also acknowledged. However, the relationship between imaging and bonding is not fully understood, particularly where there are differing parental and pregnancy circumstances, for example use of advanced imaging techniques or the prenatal diagnosis of a congenital fetal condition. This study aimed to explore the role of antenatal imaging in enhancing the developing parent-fetal bond in first-time parents.

**Methods:** A descriptive, qualitative methodology was used. Semi-structured telephone interviews were conducted with first-time expectant parents attending a London hospital for clinical ultrasound (n = 20) or research MRI (n = 8) imaging during pregnancy. The sample included parents receiving specialist antenatal care for a diagnosed fetal cardiac condition (n = 8). Thematic analysis was conducted.

**Results:** The analysis generated three themes: 1) Our baby, our scan too; 2) Destination parenthood; and 3) Being in the dark, then finding the light. These themes highlight the important, but transient role of antenatal imaging in enhancing parent-fetal bonding, as well as the differing care needs of expectant parents. The integral role of healthcare professionals in providing a personalised, supportive, imaging experience to facilitate bonding is also reflected.

**Conclusion:** Adopting parent-centred care approaches which involve expectant parents in fetal imaging influences bonding by helping parents to consider the reality of their impending parenthood. Knowledge acquired during scans is used to create an identity for the unborn baby, which parents can develop an emotional connection to.

**Implications for practice:** To optimise the potential for enhanced parent-fetal bonding, care provision in fetal imaging should be tailored to the individual needs of expectant parents.

© 2023 The Authors. Published by Elsevier Ltd on behalf of The College of Radiographers. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

## Introduction

Imaging is integral to antenatal care, providing insights into fetal development to inform clinical management pathways.<sup>1</sup> B-mode

ultrasound is most frequently used, however technological advances enable application of additional techniques like 3 and 4-dimensional ultrasound, and fetal magnetic resonance imaging (MRI). Although fetal MRI is not routine in pregnancy, its value in acquiring highly detailed anatomical information to compliment ultrasound is acknowledged.<sup>2–4</sup>

The psychosocial benefits of antenatal imaging for expectant parents are also reported, and current literature explores the association between imaging and enhanced parent-fetal bonding.<sup>5</sup> The

\* Corresponding author.

E-mail address: [emily.skelton@city.ac.uk](mailto:emily.skelton@city.ac.uk) (E. Skelton).

(E. Skelton)

emotional connection which parents feel towards their unborn child is associated with fetal development<sup>6</sup> and parental well-being.<sup>7</sup> Establishing a quality bond involves developing a new parental identity and building an emotional relationship with the fetus.<sup>8</sup> Fetal imaging is thought to support bonding as it transforms pregnancy from an abstract concept into a reality by providing visual evidence of fetal personhood.<sup>9</sup> Some parents may use fetal imaging to validate and document their new identity in social settings, a behaviour which has been linked to enhanced bonding.<sup>10</sup> It is believed sharing scan images with family and friends involves others in the pregnancy, contributes to the development of a fetal identity, and helps to establish a social network for supporting the new family unit.<sup>11</sup>

The biopsychosocial model of healthcare acknowledges the importance of imaging for providing medical information (biological), facilitating parent-fetal bonding (psychological) and supporting parents' unique experiences of pregnancy (social). This model may be applied to antenatal imaging when considering the interplay between biological, psychological and social factors of scanning, and how these may influence expectant parents' experiences of pregnancy scans.<sup>12</sup> However, it has been criticised for its integration difficulties within healthcare.<sup>13</sup> More complex scan protocols, workforce shortages and high levels of occupational burnout in healthcare professionals (HCPs) makes finding a balance between the biological and psychosocial domains of fetal imaging challenging, especially following the COVID-19 pandemic.<sup>14</sup> Inadequate acknowledgement by HCPs of parents' psychological needs and expectations during fetal imaging can lead to parents' perception of a medico-centric approach to care and subsequent feelings of disempowerment and indifference in the process which may be detrimental to the developing parent-fetal bond.<sup>15</sup> An alternative to the biopsychosocial model is the concept of person-centred care. This shares some similarities in promoting a humanistic approach to involve individuals in their care.<sup>16</sup> Yet, in pregnancy, it must be further adapted to recognise the unique and additional needs of the expectant parent and incorporate the wider family unit.<sup>17</sup>

Parent-centred care is important for improved parental satisfaction and pregnancy outcomes,<sup>18</sup> and its positive influence on parent-fetal bonding. Greater role satisfaction and mitigation of occupational burnout in obstetric sonographers is also reported.<sup>19</sup> However, care may be hindered by organisational challenges and, additionally, there is currently no accepted definition or model in fetal imaging or obstetrics, although recent work seeks to address this.<sup>20</sup> This may be partly due to gaps in knowledge; research into fathers' experiences of antenatal care is limited, despite their increasing involvement in pregnancy and childcare.<sup>21</sup> Furthermore, expectant parents requirements may differ depending on their previous experiences of care. For example, scans in pregnancies following an unexpected outcome may trigger distressing flashbacks for parents,<sup>22</sup> with stress and anxiety noted to be particularly high at the same gestational age to the initial diagnosis.<sup>23</sup> Finally, the effect of new and advancing technologies (e.g., fetal MRI) on parent experiences are yet to be fully evaluated. Imaging acquisition processes of fetal MRI are different to ultrasound, and it has been suggested that expectant parents may not be prepared for loud scanner noises, feelings of claustrophobia, and discomfort when lying still for an extended period.<sup>24</sup> Additional considerations surround parental responses to seeing highly detailed fetal images, particularly if a congenital condition has been diagnosed in the baby.<sup>5</sup>

This study aimed to explore the research question, how does antenatal imaging influence prenatal bonding in first-time expectant parents? A qualitative approach is used to extend current knowledge by providing deeper insight into the role of pregnancy imaging in supporting the developing parent-fetal connection, and further understanding of how this may change with differing parental circumstances and pregnancy outcomes.

## Methods

A descriptive, qualitative methodology was used in this study, located within a pragmatist paradigm. The flexibility of this approach allows the researcher to choose the most appropriate method to address the research question.<sup>25</sup> Semi-structured interviews were conducted to enable in-depth exploration of parental experiences and perceptions of antenatal imaging. Data were analysed using reflexive thematic analysis.<sup>26</sup> The JARS-Qual checklist<sup>27</sup> was used to guide reporting of this study.

### Participants

Convenience sampling was utilised. First-time expectant parents ( $\geq 18$  years) were approached by HCPs during clinical or research imaging appointments at a London hospital. All parents had attended for fetal imaging (clinical ultrasound or research MRI) between 18 and 36 weeks gestation of pregnancy. For some parents, scans were offered as part of the antenatal care pathway in uncomplicated pregnancies.<sup>28</sup> Some parents were receiving specialist care following a fetal diagnosis of congenital heart disease (CHD). These parents were only approached if they were committed to the pregnancy, willing to support research, and their care team believed participation would not be distressing. An information video and written information further detailing the purpose of the study, participation schedule and options for withdrawal were shared with parents who expressed their interest to be involved. Parents were given time to ask questions and consider their participation before providing consent and permission for illustrative quotations to be included in publications through an electronic informed consent form.<sup>29</sup> Based on feedback received during public involvement activities undertaken to inform the methods, no incentives were offered to parents.

### Data collection

Individual interviews were arranged within four weeks of the fetal imaging examination. All were conducted by the lead author via telephone between October 2021–December 2022 because of restrictions around face-to-face research activity during the COVID-19 pandemic.<sup>30</sup> As all interviews were remote, participants could choose the environment they felt most comfortable to talk in, most being at home. No participants were previously known to the research team. A semi-structured interview guide ([Supplementary Material 1](#)) was developed to address the research question based on findings from a systematic review of published literature,<sup>5</sup> and reviewed by parent volunteers and project collaborators (Antenatal Results and Choices, Fathers Reaching Out). The interview guide was piloted with three parent volunteers, resulting in some changes to the question phrasing for improved response clarity (e.g., 'tell me about your experience of the scan' became 'tell me what happened during your scan appointment?'). The interview guide empowered participants to lead the conversation with occasional prompts by the interviewer to maintain alignment with the research question. Sample size was guided by a model of information power.<sup>31</sup> This model identifies five items (aim, specificity, theory, dialogue and analysis) which may inform sample size considerations. For example, the broad aim and exploratory nature of the study to capture experiences across differing case scenarios (including parent type, imaging modality used, routine or specialist antenatal care pathway) suggests a larger sample size is required for adequate information power. Therefore, we aimed to interview approximately 10 parents per scenario.

Member reflections were utilised during the interview (e.g., repeating phrases and checking understanding) and analysis (e.g., review and feedback on themes). This helped to ensure accurate

interpretation and portrayal of participant responses in the final report.<sup>32</sup> Interviews were recorded using an encrypted Dictaphone and transcribed verbatim for qualitative analysis by a professional service. Contracts were in place to conform to data compliance regulations. All transcripts were reviewed for accuracy prior to analysis, and identifying information (e.g., names or specific personal details) was edited to preserve participant anonymity.

**Analysis**

Transcribed interviews were imported into NVivo for analysis (v14, QSR International Pty LTD). A 6-step framework was followed utilising a reflexive, inductive approach so that codes and themes could be developed from the data whilst also acknowledging the researcher's reflexivity in generating meaning.<sup>26,33</sup> Following a period of familiarisation with the data, each transcript was individually coded. The initial codes were reviewed collectively and further developed through combining similar codes and generating new codes. The codes were grouped into core themes and named. In keeping with the principles of reflexive thematic analysis, all analyses were conducted by the lead author and only discussed with other authors at the point of finalisation. Further details of the analytical process are provided in [Supplementary Material 2](#).

**Ethics**

Ethical approval was given by the NHS West of Scotland REC 3 (REC reference: 20/WS/0132, date of approval: 12th November 2020) and School of Health and Psychological Sciences REC at City, University of London (REC reference: ETH1920-1680, date of approval: 30th November 2020). Due to the nature of the research, the lead author attended an external training session on sensitive interviewing practices prior to starting data collection. This built on their existing communication skills and professional experience of conducting difficult conversations in the clinical setting. Opportunities to provide further care and support to parents during their participation in the study were also considered in the study design; debriefing was offered immediately following the interview, and an information leaflet with contacts for further support was also shared with all parents by email after the interview. The lead author

also had access to psychological support and debriefing provided by senior members of the research team.

**Positionality**

The lead author is a sonographer with over 12-years clinical experience of obstetric ultrasound, and four years experience of conducting and publishing research in the topic area. The wider authorship team are composed of male and female clinical and academic professionals with substantial experience across domains including medical imaging, midwifery, paediatrics and psychology. All recognise the potential implications and influence of their positions on the research.

**Findings**

Twenty-eight parents were interviewed (18 mothers, 10 fathers). Of these, eight parents attended for fetal MRI. There were eight pregnancies with a known fetal cardiac condition: six had ultrasound and two had fetal MRI ([Table 1](#)). The average interview length was 55 min (range: 39–76 min). Of all parents who gave their consent to be interviewed, none requested withdrawal from the study.

Three themes were developed: 1) Our baby, our scan too; 2) Destination parenthood; and 3) Being in the dark, then finding the light ([Table 2](#)). Collectively, these themes placed fetal imaging as pivotal for expectant parents in developing the emotional connection to their unborn baby, transitioning into new caregiving roles and establishing their new family unit. All parent names used in direct quotations below are pseudonyms that preserve anonymity but maintain authenticity of the process and the human-centric focus of this research.

*Our baby, our scan too*

The duality of antenatal imaging is represented in this theme, highlighting the importance of adopting a parent-centred approach to scans. Expectant parents welcomed the medical focus of scans for providing assurance of fetal development, but also craved the opportunity to engage with their unborn baby on a deeper emotional

**Table 1**  
Participant characteristics – grouped to provide participant information whilst preserving individuals' anonymity.

	Mothers-1 (n = 8)	Mothers-2 (n = 4)	Mothers-3 (n = 4)	Mothers-4 (n = 2)	Fathers-1 (n = 6)	Fathers-2 (n = 2)	Fathers-3 (n = 2)
Modality	Ultrasound	Ultrasound	MRI	MRI	Ultrasound	Ultrasound	MRI
Fetal cardiac condition?	No	Yes	No	Yes	No	Yes	Yes = 1 No = 1
Average GA at scan	20 w 2 d	25 w 4 d	26 w 3 d	33 w 6 d	22 w 1 d	20 w 4 d	31 w 1 d
Average GA at interview	23 w 3 d	29 w 1 d	29 w 4 d	35 w 1 d	26 w 4 d	27 w 1 d	33 w 5 d
Average parental age	32	29	34	25	27	35	31
Ethnicity (self-reported)	White British = 5 Asian British = 1 Latin American = 1 White Jewish = 1	White British = 3 Black Caribbean = 1	White British = 3 European = 1	White British = 2	White British = 5 Mixed ethnic = 1	White British = 2	White British = 2
Education	Undergraduate degree = 3 Postgraduate degree = 5	College = 2 Undergraduate degree = 2	Undergraduate degree = 2 Postgraduate degree = 2	College = 1 Undergraduate degree = 1	College = 2 Undergraduate degree = 2 Postgraduate degree = 2	College = 1 Postgraduate degree = 1	College = 1 Undergraduate degree = 1
Employment status	Full-time = 8	Full-time = 4	Full-time = 4	Full-time = 2	Full-time = 6	Full-time = 2	Full-time = 2
Pseudonyms assigned	Sara Elizabeth Jennifer Stephanie Jessica Alisha Nicole Kayla	Rachel Leah Mia Rebecca	Amanda Lauren Danielle Megan	Abigail Caitlin	Joshua Ryan Andrew Nicholas Rob Christopher	Matthew William	Joseph David

**Table 2**  
Key themes and codes.

Theme	Definition	Codes	Illustrative quotations
Our baby, our scan too	The importance of parent-centred care to balance the medical and psychosocial aspects of fetal imaging	<ul style="list-style-type: none"> <li>• Active participants, not observers</li> <li>• Checking in with baby</li> <li>• Dual-purpose imaging</li> <li>• Feeling cared for</li> <li>• Important moments for imaging</li> <li>• Making it through the MRI scan</li> <li>• More than a diagnosis</li> <li>• Understanding images</li> </ul>	<p>“As [I am] not the parent carrying the child ... this additional visualisation helps you feel even closer to it.” [Ryan]</p> <p>“When they showed me all the pictures, they were showing a parent-to-be their baby for the first time.” [Danielle]</p> <p>“I feel like from the NHS’ point of view, they’re taking it very much from a very pragmatic, biological, practical side. And it’s like well that’s all well and good but actually there’s a huge emotional side to all of this as well.” [Stephanie]</p> <p>“It’s nice to feel that someone cares about you as well. Because of course they’re there for the baby and everything else, they’re also very much making sure that you’re okay as well.” [Rebecca]</p> <p>“She started explaining what she was doing and kept up almost a commentary the whole way through. I feel like I had an understanding of what she was doing.” [Joshua]</p> <p>“My natural instinct is to just try and get out of the [MRI] machine ... I tried to remember logically why I was doing it ... having someone reassuring you and knowing that someone’s there with you, knowing that perhaps you’re gonna have that picture or video at the end, knowing that you’re gonna help, it’s definitely worth it.” [Abigail]</p> <p>“You’re not just looking at it like a case study of a condition, that is your baby, you are looking at your baby.” [Abigail]</p>
Destination parenthood	Fetal imaging as a milestone and influence in the transition to parenthood	<ul style="list-style-type: none"> <li>• Accepting new roles and responsibilities</li> <li>• Building a village</li> <li>• Getting to know you</li> <li>• Keeping a distance</li> <li>• Meeting the milestones</li> <li>• Power of the physical connection</li> </ul>	<p>“When you see it on the scan, it just brings it all home and if makes you confront the reality.” [Rob]</p> <p>“Close family and friends they have really journeyed with us, over the last two to three years, we have shared it [scan photo] with them.” [Alisha]</p> <p>“... even sort of seeing that detail of like little fingers and things like that it really started to feel like a baby, rather than just a sort of idea ... It started to make me feel that the baby had a bit of personality.” [Elizabeth]</p> <p>“Just to see your little boy before he’s actually here, I think that’s a beautiful thing.” [Joseph]</p> <p>“I feel like I kind of held back a little bit sometimes [...] kind of want to make sure they are actually here before you throw yourself into it 100%, but you already are in it anyway regardless as to what you tell yourself.” [Rachel]</p> <p>“I don’t think a day has gone by where we haven’t talked about something to do with the baby [...] whereas I think before the twenty week scan it possibly wasn’t something that came up every single day because it didn’t seem like there was that much to talk about at that point.” [Elizabeth]</p> <p>“Seeing the blood kind of going through the placenta and into the baby [...] seeing that connection and then realising, actually, there is a physical bit where I and baby meet [...] the baby is separate but it’s also very much part of me as well.” [Stephanie]</p>
Being in the dark, then finding the light	The role of fetal imaging in navigating the uncertainties of pregnancy	<ul style="list-style-type: none"> <li>• Against all odds and expectations</li> <li>• Changing expectations</li> <li>• Making the best of the situation</li> <li>• “Normal for us”</li> <li>• Preparing for the worst, hoping for the best</li> <li>• Scanzxiety is real</li> <li>• Taking control</li> <li>• The journey ahead</li> <li>• Trusting the professionals</li> <li>• Unknowns of fetal imaging</li> <li>• Vicarious experiences</li> <li>• When the unexpected happens</li> </ul>	<p>“If we’re talking about numbers, it’s the fact that [the baby] has come about against tremendous odds.” [Nicholas]</p> <p>“It’s quite hard to process having a cardiac baby ... you have an idea of what having a baby should be like to the have your world kinda spun upside down.” [Abigail]</p> <p>“Everyone always wanted to tell you a story about somebody that something bad has happened to, but if you actually think about it, all the people that you know, that have gone through a healthy pregnancy, have given birth at the end to a healthy baby.” [Leah]</p> <p>“Relief ... it’s not the right way of saying it, but it was a relieving moment [...] it very much, sort of, it solidified things, and it made me feel much more relaxed within the pregnancy period.” [Andrew]</p> <p>“I was really reassured by what [the HCP] said around the development of the baby [...] I’m a big worrier on these things and my concern was that we were gonna get the scan and there was gonna be something slightly suboptimal or abnormal and that we were gonna worry.” [David]</p> <p>“We’ve both got the mentality of, we can’t change it so let’s just get on with it. We’re in the best hands possible, the care plan’s in place, we’re lucky cos it’s been picked up ... I actually think I’ve had a really positive outlook.” [Leah]</p> <p>“I wanted to make sure that I was there with my husband to kind of both get the information because I feel like sometimes when you get that information you don’t really process it until afterwards and you both take different information from it.” [Rachel]</p>

level. Parents also expressed their desire to be actively involved in scans. Those who were involved, perceived a better overall experience. This was particularly evident for fathers who experienced challenges in navigating their role as a non-pregnant parent.

*“I think sometimes as a partner when you go to a scan and all the conversation is directed at the pregnant woman then you*

*sometimes feel like a bit of a spare part and, like, you’re not particularly useful in the whole thing.” [David]*

Fathers appreciated being welcomed into the clinical space and being included in conversations with HCPs. Feeling looked after and working with HCPs to understand and interpret fetal images were also important for supporting and including both parents during

scans. They felt empowered when the importance of their new parenting role was acknowledged, experienced joy in seeing the baby, and felt reassured by listening to and watching the fetal heartbeat. This was symbolic of on-going life, even for parents of babies with a cardiac condition. Being made to feel comfortable, receiving a clear explanation of scan findings and having the opportunity to ask questions were characteristics of good care. Fetal MRI scanning was highlighted to be a greater challenge for parents than ultrasound, both physically and psychologically. Mothers developed strategies to help them through the scan, including reminding themselves of the health benefits and counting down the remaining acquisition time with HCPs. Both parents also acknowledged feelings of isolation during fetal MRI; mothers felt alone in the scan room and fathers felt separated from the experience and their partner as they waited in another room. In both modalities, imbalances in parent-centred care delivery were perceived when the parents' needs were overshadowed by hcps' medical focus of the scan.

*"If you tell a patient 'Oh you may have gestational diabetes', unfortunately that this is going to be their take-home message [...] Everything else has been normal, that's what you need to take away from the scan."* [Alisha]

Parents receiving specialist care also appreciated when HCPs did not solely focus on the condition but took time to acknowledge the baby too. This was especially important for parents participating in clinical imaging research projects where a physical condition was being studied. Finding a balance between the medical and psychosocial aspects of scans was crucial to facilitate positive parental experiences of care.

*"When you're put in a big machine and it's all very technical and just research, research, research [...] I'm not a lab rat, my baby's not a lab rat, so it's quite nice to just bring the human side of it, you know, they understand you're still a parent..."* [Abigail]

#### Destination parenthood

Fetal imaging represented a milestone in the pregnancy journey and transition to parenthood. Scans provided expectant parents with a metaphorical compass to provide future direction for the pregnancy, and prompted many new caregiving behaviours. Collectively, these behaviours reflected individuals' acceptance of, and adjustment to their new parental roles, varying from recognisable "nesting" traits (e.g., buying things) to more subtle psychological tasks such as sharing news of the pregnancy with family and friends and building a social support network. Parents described delaying these behaviours until after the scan, wanting to feel fully reassured of the continuing pregnancy before fully committing.

*"I was really hesitant with telling people [...] because I was like you know, anything can happen. Maybe we'll have the second scan and maybe it won't be okay?"* [Danielle]

However, the influence of fetal imaging on the creation of a new parental identity and simultaneously developing parent-fetal bond was transient and time-sensitive. Scan images provided early proof of fetal presence in the absence of later-manifesting physical cues like a visible pregnancy bump. Many parents felt closer to their baby following scans, although were not always able to articulate exactly why this was. Some referred to a greater sense of "knowing baby", attributed to the recognition of personal or familial characteristics identified on scan images. However, parents' connection was not to the images themselves, but to the individual they were creating in their minds based on knowledge acquired from scans. Following scans, parents' visions of their baby rapidly shifted from a generic entity existing in the womb to their imagined child. At later

gestations though, the superior influence of fetal imaging on bonding was replaced by a greater sense of connection through fetal movements.

*"I literally feel everything all the time. I feel like that really connects me with the baby more than seeing the images."* [Lauren]

#### Being in the dark, then finding the light

Fetal imaging was transformational for first-time expectant parents as it provided an opportunity to resolve uncertainties they had encountered during pregnancy. Scans facilitated a shift from the unknown to the known, helping to inform parents about the progression of the pregnancy. Much of the uncertainty was centred around parents' fear of receiving unexpected news from the scan. This "scanxiety" was felt by all parents in the sense that pregnancy is never guaranteed, though was experienced most strongly in those influenced by previous complicated pregnancies or vicarious experience of pregnancy complications shared by family and friends.

*"One of my sisters had a really bad experience [...] and so that has kind of coloured my expectations of how difficult it can be and what can go wrong..."* [Rob]

In moments of uncertainty, parents sought to exert some control over the situation. For some, this meant actively searching for and arming themselves with information. For others, it meant simply deciding to put their faith in the HCPs and "go with the flow". Parents who received a fetal cardiac diagnosis experienced an additional transformation; one which required them to rapidly adjust their expectations of pregnancy and parenthood and adapt to a new reality. After receiving news of a diagnosis, parents described initial reactions of shock, confusion and grief for the previously imagined child. With the support of their HCPs, they described a move from uncertainty to empowerment and acceptance of their baby's diagnosis. This was achieved by adopting a positive mindset and embracing the further opportunities afforded by specialist clinical care, including learning more about their baby through fetal MRI.

*"As strange as it is to say, it's quite lucky in a way to be able to have seen that. It's such an incredible view of your baby and it's just quite an incredible experience."* [Joseph]

## Discussion

Consistent with previous literature,<sup>5</sup> antenatal imaging was perceived by this group of parents to have a positive effect on bonding. The findings from this study suggest that first-time expectant parents utilised fetal imaging examinations to support two important processes for bonding; establishing a new parental identity and developing a connection to the unborn baby.<sup>8</sup> Both were informed by knowledge created and acquired during scans, although the superior influence of fetal imaging over other pregnancy milestones was time-sensitive.

Parents' use of fetal imaging to validate and explore their changing identities was observed, although fathers felt more uncertain in their role. Traditional and anthropological views of parenting associate caregiving tasks with mothers and play-based, interactional learning with fathers,<sup>34,35</sup> and whilst acts of maternal caregiving may begin during (and even before) pregnancy, the paternal role may be less well-defined until the baby's birth.<sup>36</sup> Pregnancy is a psychologically challenging time for fathers who, in the absence of any physical cues, experience pregnancy through their partner.<sup>37</sup> Consequently, many consider their primary role is in providing support and companionship for their pregnant partner,<sup>38</sup> which may draw focus away from developing their emotional

connection to the fetus. This may explain previously observed differences in measured bonding scores between mothers and fathers.<sup>39–41</sup> Research highlights fathers' participation in the scan experience and visualising fetal movement as more impactful than viewing images,<sup>42</sup> and fathers' exclusion from antenatal care and subsequent negative impact on their parental role has been previously discussed.<sup>43</sup> However, consistent with existing literature,<sup>44–46</sup> fathers in this study identified how HCPs created opportunities for involvement. As fathers may experience greater challenges in adjusting to their new parental identity than mothers, early involvement helps support their transition and prevent disengagement from the pregnancy.<sup>47</sup>

Whilst many expectant parents consider fetal imaging to be a source of reassurance for fetal health, it also caused parental anxiety.<sup>48</sup> In this analysis, many parents spoke of their concerns of receiving unexpected news about fetal development prior to the scan, regardless of whether they had previous experience of pregnancy complications or not. Indeed, research suggests that anxiety levels in parents peak immediately before fetal imaging.<sup>49</sup> Historically, it was believed that strong pre-occupation with concerns about fetal health may impair development of the parent-fetal bond as less time is spent fantasising about the future child.<sup>50</sup> For some parents, previous experience of loss may make it more difficult to navigate feelings of closeness to a new baby whilst grieving for the first baby.<sup>51</sup> The importance of identifying previous psychological trauma in expectant parents to inform sensitive care delivery is therefore highlighted.<sup>22</sup>

Although parents of babies diagnosed with a cardiac condition acknowledged their altered experience of pregnancy imaging compared to others, this did not seem to affect their feelings of connection to their baby. Whilst research is limited in this field, studies have attempted to observe quantifiable differences in measures of parent-fetal bonding between pregnancies with a fetal condition and uncomplicated pregnancies. However, the findings are often conflicting and vary depending on the type and severity of the anomaly.<sup>52</sup> Fetal imaging offers parents the opportunity to visualise a physical condition, which may be beneficial to support clinical explanations and parents' understanding of a diagnosis.<sup>53</sup> A study exploring fetal MRI in suspected brain conditions reported parents found these images empowering in enhancing their own conceptualisations of the fetal identity, and helpful in challenging an often negative, medicalised view of the pregnancy.<sup>54</sup> Rather than the fetal condition itself being a predictor for bonding, it may be argued that the potentially detrimental impact of the condition on the parental pregnancy experience may be more influential. For example, if multiple specialist care appointments are perceived as burdensome, this may contribute to a negative experience of pregnancy.<sup>55</sup> Interactions with HCPs may also affect how parents cope with unexpected news, with experiences of poor communication contributing to increased psychological distress.<sup>56</sup> Expectant parents therefore need clear, empathetic and consistent communication to feel adequately supported and satisfied with their care experience.<sup>15</sup>

### *Implications for practice*

The findings from this study suggest that in fetal imaging, there is no “one size fits all” approach to parent-centred care. In supporting psychosocial factors of imaging, the dual role of HCPs as skilled professionals and communicators is acknowledged.<sup>57</sup> Literature reports the positive effect of an “imaging consultation” for reduced maternal anxiety and enhanced bonding.<sup>58,59</sup> This approach focuses on quality communication between HCPs and parents to improve clinical knowledge of the scan procedure,

and promote parent-fetal interaction during the examination to assist with recognition and understanding of the fetus.<sup>60</sup> The importance of good communication to support parents is of particular importance in prenatal diagnosis.<sup>56</sup> Additional recommendations for parent-centred care in fetal imaging developed from the study findings are also informed by literature<sup>5</sup> and models of person-centred care in antenatal domains.<sup>20</sup> These include: providing adequate and accessible information to support decision-making; respecting parent choices and autonomy; responding to parental psychological and emotional needs; acknowledging the importance of social relationships during pregnancy; and establishing a collaborative alliance between HCPs and parents for best outcomes.

Trustworthiness of this study is supported in several ways.<sup>61</sup> Triangulation of field notes and analytical memos aided theme development by adding depth to interview transcripts.<sup>62</sup> Member reflections from participants were also utilised to improve confirmability.<sup>32</sup> As reflexive thematic analysis is conducted independently, the personal influence of the researcher over the findings is acknowledged. Practising reflexivity and including a detailed report of the analytical process provided transparency for others to understand the researcher's position in the analysis.<sup>63</sup> Still, this study is not without limitations. The broad scope of the research question did not facilitate in-depth exploration of the experiences of different parent groups included in the sample (e.g., fathers, specialist care, fetal MRI). Whilst principles of information power were adopted to inform the sample size,<sup>31</sup> it may be argued that the dataset would benefit from expansion, particularly for fathers and parents who had fetal MRI, as recruitment of these participants was limited by ongoing disruption in the aftermath of the COVID-19 pandemic. Purposive sampling may also be advantageous to include better representation of minority sociodemographic characteristics.

### **Conclusion**

As fetal imaging is fundamental to antenatal care, it is critical for HCPs to understand the psychological importance it holds for expectant parents in connecting with their unborn baby. This study suggests it is not only fetal images which parents value for bonding, but the interactions with HCPs during the examination that help to shape fetal personhood, validate new parental identities, and provide reassurance of parents' emotional investment in the pregnancy. The provision of parent-centred care to address parents' differing psychosocial needs is essential for improved experiences of care and bonding. Whilst this study provides some recommendations for practice, further research is required to better understand imaging experiences in various parent groups (e.g., other ethnicities, same-sex couples, different fetal conditions) and develop a comprehensive framework for care, inclusive of all parents and their needs beyond the clinical aspect of fetal imaging.

### **Authors' contributions**

**ES:** Conceptualisation, Methodology, Formal analysis, Investigation, Writing – Original draft, Writing – Review & Editing, Funding acquisition, Project administration; **DC:** Resources, Validation, Writing – Review & Editing; **AS:** Resources, Writing – Review & Editing; **MvP:** Resources, Writing – Review & Editing; **CMo:** Resources, Writing – Review & Editing; **GH:** Writing – Review & Editing; **MR:** Resources, Writing – Review & Editing, Supervision; **CMa:** Conceptualisation, Methodology, Writing – Review & Editing, Funding acquisition, Supervision; **SA:** Conceptualisation, Methodology, Writing – Review & Editing, Supervision.

## Ethics approval

This study was granted approval from the NHS West of Scotland REC 3 (reference: 20/WS/0132, approval date 12th November 2020) and School of Health and Psychological Sciences REC at City, University of London (reference: ETH1920-1680, approval date: 30th November 2020). All participants gave informed consent prior to their interview, which included permission to use anonymised quotations for research presentation and publication.

## Data availability

There are ethical restrictions on public sharing of this study's dataset because of limited anonymity. However, a minimum dataset will be made available on reasonable request to the institutional research ethics committee ([researchethics@city.ac.uk](mailto:researchethics@city.ac.uk)).

## Competing interests

None.

## Acknowledgements

The authors would like to thank all parents who participated in this study. We are also grateful to parent volunteers, MS and PG, who kindly reviewed the manuscript and offered reflections on the findings. Thanks are also extended to ARC, Fathers Reaching out, and parent volunteers for reviewing the study protocol and questionnaire. Imogen Desforges and Chidinma Iheanuetuoguojeiofor are also acknowledged for their support in identifying prospective participants. This work was funded by the College of Radiographers' Doctoral Fellowship Award (DF017) and the School of Health and Psychological Sciences at City, University of London. Funding from the City Radiography Research Fund has been instrumental for dissemination. The funders were not involved in the design, analysis, or writing of this manuscript.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.radi.2023.11.019>.

## References

- National Institute for Health and Care Excellence. *CG62 Antenatal care for uncomplicated pregnancies*. NICE; 2019. <https://www.nice.org.uk/guidance/cg62>.
- Pasupathy D, Denbow M, Rutherford M. (on behalf of the Royal College of Obstetricians and Gynaecologists). The combined use of ultrasound and fetal magnetic resonance imaging for a comprehensive fetal neurological assessment in fetal congenital cardiac defects: scientific Impact Paper No. 60. *BJOG An Int J Obstet Gynaecol* 2019;**126**:e142–51.
- Davidson JR, Uus A, Matthew J, Egloff AM, Deprez M, Yardley I, et al. Fetal body MRI and its application to fetal and neonatal treatment: an illustrative review. *Lancet Child Adolesc Health* 2021;**5**:447–58.
- Fileva N, Severino M, Tortora D, Ramaglia A, Paladini D, Rossi A. Second trimester fetal MRI of the brain: through the ground glass. *J Clin Ultrasound* 2023;**51**:283–99.
- Skelton E, Webb R, Malamateniou C, Rutherford M, Ayers S. The impact of antenatal imaging on parent experience and prenatal attachment: a systematic review. *J Reprod Infant Psychol* 2022;**00**:1–23.
- Branjerdporn G, Meredith P, Strong J, Garcia J. Associations between maternal-foetal attachment and infant developmental outcomes: a systematic review. *Matern Child Health J* 2017;**21**:540–53.
- Kluny R, Dillard DM. *Prenatal bonding: the importance of connecting with body and baby*. INC; 2022. <https://doi.org/10.1016/B978-0-12-818309-0.00008-3>.
- Doan H, Zimmerman A. Prenatal attachment: a developmental model. *Int J Prenat Perinat Psychol Med* 2008;**20**:20–8.
- Borg Cunen N, Jomeen J, Poat A, Borg Xuereb R. 'A small person that we made' - parental conceptualisation of the unborn child: a constructivist grounded theory. *Midwifery* 2022;**104**:103198.
- Harpel T. Pregnant women sharing pregnancy-related information on Facebook: web-based survey study. *J Med Internet Res* 2018;**20**:e115.
- Chalklen C, Anderson H. Mothering on facebook: exploring the privacy/openness paradox. *Soc Media Soc* 2017;**3**. <https://doi.org/10.1177/2056305117707187>.
- Lehman BJ, David DM, Gruber JA. Rethinking the biopsychosocial model of health: understanding health as a dynamic system. *Soc Personal Psychol Compass* 2017;**11**:1–17.
- Smith RC. Making the biopsychosocial model more scientific—its general and specific models. *Soc Sci Med* 2021;**272**:113568.
- Skelton E, Harrison G, Rutherford M, Ayers S, Malamateniou C. UK obstetric sonographers' experiences of the COVID-19 pandemic: burnout, role satisfaction and impact on clinical practice. *Ultrasound* 2023;**31**:12–22.
- Jackson P, Power-Walsh S, Dennehy R, O'Donoghue K. Fetal anomaly: experiences of women and their partners. *Prenat Diagn* 2023. <https://doi.org/10.1002/pd.6311>.
- Santana MJ, Manalili K, Jolley RJ, Zelinsky S, Quan H, Lu M. How to practice person-centred care: a conceptual framework. *Health Expect* 2018;**21**:429–40.
- Brady S, Lee N, Gibbons K, Bogossian F. Woman-centred care: an integrative review of the empirical literature. *Int J Nurs Stud* 2019;**94**:107–19.
- Park M, Giap TTT, Lee M, Jeong H, Jeong M, Go Y. Patient- and family-centered care interventions for improving the quality of health care: a review of systematic reviews. *Int J Nurs Stud* 2018;**87**:69–83.
- Skelton E, Smith A, Harrison G, Rutherford M, Ayers S, Malamateniou C. "It has been the most difficult time in my career": a qualitative exploration of UK obstetric sonographers' experiences during the COVID-19 pandemic. *Radiography* 2023;**29**:582–9.
- Dong K, Jameel B, Gagliardi AR. How is patient-centred care conceptualized in obstetrical health? comparison of themes from concept analyses in obstetrical health- and patient-centred care. *Health Expect* 2022;**25**:823–39.
- Chin R, Hall P, Daiches A. Fathers' experiences of their transition to fatherhood: a metasynthesis. *J Reprod Infant Psychol* 2011;**29**:4–18.
- O'Leary J. The trauma of ultrasound during a pregnancy following perinatal loss. *J Loss Trauma* 2005;**10**:183–204.
- Beauquier-Maccotta B, Shulz J, De Wailly D, Meriot EM, Soubieux MJ, Ouss L, et al. Prenatal attachment, anxiety and grief during subsequent pregnancy after medical termination of pregnancy. Attachment to which child? *J Gynecol Obstet Hum Reprod* 2022;**51**. <https://doi.org/10.1016/j.jogoh.2022.102353>.
- Leithner K, Pömbacher S, Assem-Hilger E, Krampfl E, Ponocny-Seliger E, Prayer D. Psychological reactions in women undergoing fetal magnetic resonance imaging. *Obstet Gynecol* 2008;**111**:396–402.
- Yardley L, Bishop FL. Using mixed methods in health research: benefits and challenges. *Br J Health Psychol* 2015;**20**:1–4.
- Braun V, Clarke V. *Thematic analysis: a practical guide*. 1st ed. London: SAGE Publications; 2022.
- Levitt H, Bamberg M, Creswell J, Frost D, Josselson R, Suárez-Orozco C. Journal article reporting standards for qualitative primary, qualitative meta-analytic, and mixed methods research in psychology: the APA publications and communications board task force report. *Am Psychol* 2018;**73**:24–46.
- NHS Fetal Anomaly Screening Programme. *NHS Fetal anomaly screening programme handbook*. 2021. <https://phscreening.blog.gov.uk/2021/07/23/new-fasp-handbook/>.
- Skelton E, Drey N, Rutherford M, Ayers S, Malamateniou C. Electronic consenting for conducting research remotely: a review of current practice and key recommendations for using e-consenting. *Int J Med Inf* 2020;**143**:104271.
- Kroenke K, Bair MJ, Sachs GA. Continuing research during a crisis. *J Gen Intern Med* 2021;**36**:1086–8.
- Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: guided by information power. *Qual Health Res* 2016;**26**:1753–60.
- Tracy SJ. Qualitative quality: eight 'big-tent' criteria for excellent qualitative research. *Qual Inq* 2010;**16**:837–51.
- Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101.
- Deutsch FM. Equally shared parenting. *Curr Dir Psychol Sci* 2001;**10**:25–8.
- Machin AJ. Mind the Gap: the expectation and reality of involved fatherhood. *Fathering* 2015;**13**:36–59.
- Condon J. What about dad?: psychosocial and mental health issues for new fathers. *Aust Fam Physician* 2006;**35**:690–2.
- Fenwick J, Bayes S, Johansson M. A qualitative investigation into the pregnancy experiences and childbirth expectations of Australian fathers-to-be. *Sex Reprod Healthc* 2012;**3**:3–9.
- Lagarto A, Duaso MJ. Fathers' experiences of fetal attachment: a qualitative study. *Infant Ment Health J* 2022;**43**:328–39.
- Condon JT. The assessment of antenatal emotional attachment: development of a questionnaire instrument. *Br J Med Psychol* 1993;**66**:167–83.
- Kaur S, Sagar N. Comparative study to assess the maternal and paternal fetal attachment among the expectant mothers and fathers. *Int J Reprod Contraception, Obstet Gynecol* 2017;**6**:3134.
- Skelton E, Smith A, Harrison G, Rutherford M, Ayers S, Malamateniou C. The effect of the COVID-19 pandemic on UK parent experience of pregnancy ultrasound scans and parent-fetal bonding: a mixed methods analysis. *PLoS One* 2023;**18**:e0286578.

42. Harpel TS, Barras KG. The impact of ultrasound on prenatal attachment among disembodied and embodied knowers. *J Fam Issues* 2018;**39**:1523–44.
43. Salzmänn-Eriksson M, Eriksson H. Fathers sharing about early parental support in health-care - virtual discussions on an Internet forum. *Health Soc Care Community* 2013;**21**:381–90.
44. Finnbogadóttir H, Svalenius EC, Persson EK. Expectant first-time fathers' experiences of pregnancy. *Midwifery* 2003;**19**:96–105.
45. Widarsson M, Engström G, Tydén T, Lundberg P, Hammar LM. 'Paddling upstream': fathers' involvement during pregnancy as described by expectant fathers and mothers. *J Clin Nurs* 2015;**24**:1059–68.
46. Hodgson S, Painter J, Kilby L, Hirst J. The experiences of first-time fathers in perinatal services: present but invisible. *Healthcare* 2021;**9**:1–12.
47. Genesoni L, Tallandini MA. Men's psychological transition to fatherhood: an analysis of the literature. 1989–2008. *Birth* 2009;**36**:305–18.
48. Pilnick A, Zayts O. 'It's just a likelihood': uncertainty as topic and resource in conveying 'positive' results in an antenatal screening clinic. *Symb Interact* 2014;**37**:187–208.
49. Businelli C, Bembich S, Vecchiet C, Cortivo C, Norcio A, Risso MF, et al. The psychological burden of routine prenatal ultrasound on women's state anxiety across the three trimesters of pregnancy. *Eur J Obstet Gynecol Reprod Biol* 2021;**256**:281–6.
50. Leifer M. Pregnancy. *Signs J Women Cult Soc* 1980;**5**:754–65.
51. O'Leary J. Grief and its impact on prenatal attachment in the subsequent pregnancy. *Arch Womens Ment Health* 2004;**7**:7–18.
52. Tesson S, Butow PN, Marshall K, Fonagy P, Kasparian NA. Parent-child bonding and attachment during pregnancy and early childhood following congenital heart disease diagnosis. *Health Psychol Rev* 2022;**16**:378–411.
53. Lalor JG, Devane D, Begley CM. Unexpected diagnosis of fetal abnormality: women's encounters with caregivers. *Birth* 2007;**34**:80–8.
54. Lie M, Graham R, Robson SC, Griffiths PD. "He looks gorgeous" – iuMR images and the transforming of foetal and parental identities. *Social Health Illness* 2019;**41**:360–77.
55. Kucharska M. Selected predictors of maternal-fetal attachment in pregnancies with congenital disorders, other complications, and in healthy pregnancies. *Health Psychol Rep* 2021;**9**:193–206.
56. Kratovil AL, Julion WA. Health-care provider communication with expectant parents during a prenatal diagnosis: an integrative review. *J Perinatol* 2017;**37**:2–12.
57. Brasseur L. Sonographers' complex communication during the obstetric sonogram exam: an interview study. *J Tech Writ Commun* 2012;**42**:3–19.
58. Boukydis CFZ, Treadwell MC, Delaney-Black V, Boyes K, King M, Robinson T, et al. Women's responses to ultrasound examinations during routine screens in an obstetric clinic. *J Ultrasound Med* 2006;**25**:721–8.
59. Masroor I, Ahmed H, Ajmal F. Impact of prenatal ultrasound consultation on maternal anxiety. *J Dow Univ Heal Sci* 2008;**2**:16–20.
60. Pulliainen H, Niela-Vilén H, Ekholm E, Ahlqvist-Björkroth S. Experiences of interactive ultrasound examination among women at risk of preterm birth: a qualitative study. *BMC Pregnancy Childbirth* 2019;**19**:338.
61. Braun V, Clarke V. Toward good practice in thematic analysis : avoiding common problems and be (com) ing a knowing researcher. *Int J Transgender Heal* 2022;**0**:1–6.
62. Varpio L, Ajjawi R, Monrouxe LV, O'Brien BC, Rees CE. Shedding the cobra effect: problematising thematic emergence, triangulation, saturation and member checking. *Med Educ* 2017;**51**:40–50.
63. Murphy FJ, Yelder J. Establishing rigour in qualitative radiography research. *Radiography* 2010;**16**:62–7.