First and second trimester ultrasound in pregnancy: A systematic review and metasynthesis of the views and experiences of pregnant women, partners, and health workers

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Abstract

Background
The World Health Organization (WHO) recommends one ultrasound scan before 24 weeks gestation as part of routine antenatal care (WHO 2016). We explored influences on provision and uptake through views and experiences of pregnant women, partners, and health workers.

Methods
We undertook a systematic review (PROSPERO CRD42021230926). We derived summaries of findings and overarching themes using metasynthesis methods. We searched MEDLINE, CINAHL, PsycINFO, SocIndex, LILACS, and AIM (Nov 25th 2020) for qualitative studies reporting views and experiences of routine ultrasound provision to 24 weeks gestation, with no language or date restriction. After quality assessment, data were logged and analysed in Excel. We assessed confidence in the findings using Grade-CERQual.

Findings
From 7076 hits, we included 80 papers (1994–2020, 23 countries, 16 LICs/MICs, over 1500 participants). We identified 17 review findings, (moderate or high confidence: 14/17), and four themes: sociocultural influences and expectations; the power of visual technology; joy and devastation: consequences of ultrasound findings; the significance of relationship in the ultrasound encounter. Providing or receiving ultrasound was positive for most, reportedly increasing parental-fetal engagement. However, abnormal findings were often shocking.
Some reported changing future reproductive decisions after equivocal results, even when the eventual diagnosis was positive. Attitudes and behaviours of sonographers influenced service user experience. Ultrasound providers expressed concern about making mistakes, recognising their need for education, training, and adequate time with women. Ultrasound sex determination influenced female feticide in some contexts, in others, termination was not socially acceptable. Overuse was noted to reduce clinical antenatal skills as well as the use and uptake of other forms of antenatal care. These factors influenced utility and equity of ultrasound in some settings.

**Conclusion**

Though antenatal ultrasound was largely seen as positive, long-term adverse psychological and reproductive consequences were reported for some. Gender inequity may be reinforced by female feticide following ultrasound in some contexts. Provider attitudes and behaviours, time to engage fully with service users, social norms, access to follow up, and the potential for overuse all need to be considered.

**Introduction**

Antenatal ultrasound is a routine and established component of antenatal care within high-income countries [1]. In low- and middle-income countries ultrasound scanning in pregnancy is more recent [2]. In many of these settings, provision is not universal [3], and it is often restricted to high level and/or private facilities, limiting access for many [2, 4]. In 2016, the World Health Organization first recommended ultrasound as a routine aspect of antenatal care [5]. This recommendation was for one ultrasound scan before 24 weeks gestation, to estimate gestational age, improve detection of fetal anomalies and multiple pregnancies, reduce induction of labour for post-term pregnancy, and improve a woman’s pregnancy experience. Part of the rationale for the establishment of this recommendation within guidelines was to better regulate the use of antenatal ultrasound, and to increase equitable access for pregnant women in low- and middle-income settings.

For many expectant parents, antenatal ultrasound provides a positive experience [6]. Health workers value its use for gestational age estimation, multiple pregnancy identification and assessment of physiological or potentially pathological fetal growth [1]. Identification of fetal anomalies is also an intrinsic part of ultrasound examination in early pregnancy [1]. As imaging has become more sophisticated, there has been increasing potential to identify markers of uncertain significance [7]. This can bring many benefits, but it has also resulted in concerns relating to overdiagnosis as well as the psychological risks for women, birthing people, and partners when the implications of these markers are not clear [8, 9]. Some have expressed eugenic concerns, as ultrasound-identified fetal abnormalities force parents to decide between giving birth to a child with disabilities, or termination [10], while in some social, cultural and religious contexts, termination is not an option [11]. In some social settings, ultrasound sex determination is associated with female feticide [12], and possibly sex distribution skew [13], raising moral, ethical, and gender equity issues.

Because of the rapid technical improvements in first and second trimester ultrasound, and the spread in routine use, the WHO recommended updating of their early ultrasound recommendation. This qualitative systematic review was carried out to inform the update, enabling
the consideration of values and preferences, and acceptability, feasibility, and equity implications, and the opportunity to share insights into successful implementation and service provision. These considerations are integral to implementation of antenatal ultrasound where it is not yet a routine component of antenatal care, as well as the improvement of existing services.

We undertook a rapid scoping search of the existing literature but did not identify any previous systematic reviews of experiences of first and second trimester ultrasound that were suitable to inform WHO guidelines on this subject. There is one previous systematic review on experiences of antenatal ultrasound, but this was published in 2002. It did not include the perspectives of health workers, or studies from low- or middle-income countries [6].

To inform guidelines and practice in the area of first and second trimester ultrasound we aimed to examine the following questions, for maternity service users (including birth companions), health workers, policy makers and funders in all settings:

a. What views, beliefs, concerns and experiences have been reported in relation to routine ultrasound examination in pregnancy?

b. What are the influencing factors associated with appropriate or inappropriate use of routine antenatal ultrasound scanning?

Methods

Search strategy and selection criteria

We undertook a systematic review using thematic synthesis to develop our review findings and analytic themes [14]. The study protocol is registered on PROSPERO (CRD42021230926).

Searches. We undertook searches in Medline (Ovid), CINAHL, PsycINFO, and SocIndex (via EBSCO), and LILACS and AIM (via Global Index Medicus) on Nov 25th and 26th 2020, with no language or date restrictions. Additional relevant papers were identified through searching reference lists and citation searches of included studies. A log was used to record inclusion/exclusion at each stage of selection. One member of the review team (CH) undertook the searches, and de-duplication of results using both automated and manual methods in EndNote.

Inclusion criteria. Our protocol specified searches for qualitative, survey, and mixed-methods studies. For this paper, we report on findings from qualitative studies. We included papers addressing routine use of ultrasound during antenatal care, including to detect fetal viability, gestational age, fetal growth, fetal abnormality, multiple pregnancy, and any other routine application, where this was a standard part of the routine ultrasound offer for the population in the country(ies) where the study was set.

Included participants were pregnant or postnatal women, families of such women, and related community members, antenatal health workers, managers, funders, or policy makers involved in the receipt, provision, management or funding of routine antenatal ultrasound scanning.

We included all settings (low-, high- and middle-income), and all types of health care design and provision (including public, private and mixed models of provision), and localities (hospital facilities, birth centres, or local communities).

Exclusion criteria. We excluded papers if ultrasound was undertaken for specific indications, for example following IVF procedures, or after women’s reports of reduced fetal movements.

We excluded controlled studies, cohort studies, and epidemiological studies.

Screening. Initial screening by title and abstract was refined through blind screening 100 records in two teams to ensure agreement in the screening process. Uncertainties were discussed amongst the review team, and a further 100 hits were then screened until sufficient
agreement was reached. For full text screening, batches of ten records were screened in each team until sufficient agreement was reached, after which three members of the review team (GM, SC, RM) screened the remaining records independently.

Data extraction and analysis

Studies assessed as eligible for inclusion were quality assessed [15]. Quality assessment was undertaken by GM, SC, RM and KF. SD independently assessed 10% of studies to calibrate the assessments of the teams. Very low-quality studies were logged for transparency but were not included in the analysis.

The authors name, the date, characteristics, and setting of included papers, and the key findings, were logged on the study-specific Excel file. Translation of non-English studies was carried out using Google translate.

Analytic procedure. We initially derived review findings and overarching themes using a thematic synthesis approach [14]. We started by logging themes and findings highlighted by the authors, or, where these were not clear, reviewer generated findings from the quote material and author narratives (GM, SC, RM). As each subsequent paper was coded, themes were generated (GM, KF, SD) and entered iteratively onto a separate worksheet of the study Excel file, resulting in an initial thematic framework. The findings continued to develop as the data from each paper were added. This included looking for what was similar between papers and for what contradicted (‘disconfirmed’) the review findings. All authors involved in the primary analysis (GM, KF, SD), consciously looked for data that would contradict our prior beliefs and views.

Confidence in each finding was assessed using GRADE-CERQual [16]. Review findings were graded using a classification system ranging from ‘high’ to ‘moderate’ to ‘low’ to ‘very low’ confidence. Following CERQual assessment the review findings were grouped into higher order analytic themes and the final framework was agreed by consensus amongst the authors.

Analysis of subgroups or subsets. Findings were logged by country income status (HIC vs LMIC), and by trimester of scan (first, second, or both). Interpretation of the findings and themes includes these subgroups where they can be clearly differentiated in the data.

Reflexive statement. Based on our collective and individual experiences (as midwives, academics, service users, and researchers), we anticipated that the findings of our review would reveal that women and their partners generally look forward to ultrasound but may be unprepared for it to reveal abnormalities; that health workers like to use it as it gives them a sense of certainty in diagnosis; and that policy makers and funders see it as a useful source of revenue and/or of attracting women to use facilities. We maintained awareness of these prior beliefs and their potential impact on our analysis to ensure we were not over-interpreting data that supported our prior beliefs, or over-looking disconfirming data.

Results

Of the 7076 records generated by our search, 181 studies met the initial inclusion criteria to be included in our synthesis. 4656 records were excluded at the initial abstract screening stage, primarily because they were unrelated to the focus of this review. Full text screening excluded 574 studies, primarily because they did not focus on perceptions/experiences of routine ultrasound. Of the 181 studies initially identified as being eligible for inclusion, 80 were qualitative and 98 were quantitative or mixed methods studies. Due to the large number of qualitative papers identified, the decision was made to focus on the qualitative studies, and to analyse the qualitative/mixed methods studies separately. Eighty qualitative papers were therefore included before quality screening, and three more were identified from reference lists of the
included papers. Following quality appraisal, 3 studies were rated D and excluded. Fig 1 outlines the screening and selection process.

Of the 80 studies included in our review, eight were rated A, 52 B, and 20 were rated C. They were published between 1994 and 2020 and were from 23 different countries, with 16 studies from LICs/MICs. They represent the views of over 1500 participants. The majority of papers reported the views of women or women and their partners; 19 reported provider perspectives; seven reported the views of both. There were no eligible studies that included the views of funders or policy makers. Study characteristics and quality appraisal grades are presented in Table 1.

Findings
Our analysis generated 17 review findings, synthesised into four over-arching analytic themes. Three findings represent the views of women and their partners only, three represent the views of healthcare professionals only, and 11 describe findings from both groups. Most were graded moderate or high confidence. The Summary of Findings and CERQual assessment are provided in Table 2.

Sociocultural influences and expectations. For many women, ultrasound was seen as an integral part of pregnancy and an opportunity not to be missed [17–26]. It offered parents the chance to ‘meet’ their baby and receive an image of the scan that they could share with friends and family [21, 25, 27, 28]. Fathers’ attendance was seen as a demonstration of their commitment to their family and to facilitate involvement with the pregnancy [19, 25, 28, 29–34]. For health workers however, these views sometimes conflicted with their role in providing a medical assessment and potential diagnosis [35–37]. It also sometimes conflicted with parent’s autonomy in terms of whether attending ultrasound was seen as a choice, or a decision to be made [17, 18, 21, 22, 38–42]. Some felt that they had not been offered an actual choice due to the routine nature of ultrasound in antenatal care, whilst others felt they should follow the authoritative advice of health professionals to ensure wellbeing of their baby [43–47]. In some contexts, healthcare professionals actively directed women towards ultrasound with the belief that this would inevitably result in better outcomes, and women were seen as irresponsible if they declined the offer of a scan [39, 44, 48–52].

‘Yes I’m sure it is (optional) but I think everybody else does it . . . well maybe not . . . but anyway I wouldn’t miss it.’ (Sweden) [25]

‘I don’t know if it is good or bad. They provide it for us so we use it.’ (Australia) [46]

‘The ones that choose not to are far more informed than the ones that choose to–because you have to go against the system.’ (Australia) [50]

In some low-income settings, access to ultrasound was limited due to lack of staff and other resources, as well as the costs incurred for women and the distance they would have to travel to attend appointments [53–56]. Some midwives in these contexts expressed the desire for training in the use of ultrasound, so that they could make decisions when other staff were not available [55, 57]. There were varying beliefs in relation to the safety of ultrasound as well as the diagnosis that could be made through its use [19, 34, 41, 49, 52, 58]. In some contexts, social and religious beliefs influenced the utility of a diagnosis if the only solution to a finding of fetal abnormality was termination [44, 59–61].

‘She [pregnant woman] didn’t go for ultrasound even though she was told to do so, she refused because of the cost.’ (Tanzania) [54]
Fig 1. Screening and selection process.

* Reasons for exclusion: not experiences of ultrasound; not antenatal ultrasound; does not fit method criteria; unable to obtain full text; indistinguishable ultrasound data; limited ultrasound data

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Table 1. Characteristics and quality rating of included studies.

| First author | Date | Country | Resource setting | Participants | Sample size | Scan trimester | Study design/methods | Quality rating |
|--------------|------|---------|------------------|--------------|-------------|----------------|----------------------|---------------|
| Ahman        | 2010 | Sweden  | HIC              | Women        | 11          | Second         | Naturalistic inquiry, in-depth interviews | A-            |
| Baillie      | 2000 | UK      | HIC              | Women        | 24          | Second         | Interpretative phenomenological analysis, semi-structured interviews | B+            |
| Bashour      | 2005 | Syria   | LMIC             | Women        | 30          | General        | Qualitative, semi-structured interviews | C             |
| Carolan      | 2009 | Canada  | HIC              | Women        | 10          | Second and third | Constructivist grounded theory | B-            |
| Ekelin       | 2004 | Sweden  | HIC              | Women (22) and partners (22) | 44          | Second         | Grounded theory, interviews | B+            |
| Larsson      | 2010 | Sweden  | HIC              | Women (5) and partners (4) | 9           | Second         | Grounded theory, interviews | B+            |
| Lou          | 2017 | Denmark | HIC              | Women        | 20          | First          | Ethnography, semi-structured interviews | B+            |
| Mitchell     | 2004 | Canada  | HIC              | Women        | 42          | Second         | Qualitative, semi-structured interviews | B-            |
| Molander     | 2010 | Sweden  | HIC              | Women        | 10          | First and second | Qualitative descriptive, interviews | B+            |
| Thorpe       | 1993 | UK      | HIC              | Women        | 42          | General        | Qualitative, interviews | C-            |
| Barr         | 2013 | UK      | HIC              | Women (17), partners (5), health workers (22) | 44          | First          | Qualitative, focus groups | B-            |
| Walsh        | 2014 | USA     | HIC              | Partners     | 22          | Second         | Qualitative, observation and semi-structured interviews | A-            |
| Ahman        | 2012 | Sweden  | HIC              | Fathers      | 17          | Second         | Naturalistic inquiry, in-depth interviews | B+            |
| Dheensa      | 2013 | UK      | HIC              | Women (6) and partners (12) | 18          | General        | Grounded theory, semi structured | B             |
| Dheensa      | 2015 | UK      | HIC              | Fathers      | 12          | General        | Grounded theory, in-depth, semi-structured interviews | B-            |
| Draper       | 2002 | UK      | HIC              | Fathers      | 18          | Second         | Ethnography, interviews | C             |
| Pereira Silva Cardoso | 2018 | Brazil | UMIC             | Women        | 11          | Second and third | Qualitative descriptive, semi-structured interviews | B+            |
| Williams     | 2005 | UK      | HIC              | Women        | 15          | First          | Qualitative, semi-structured in-depth interviews | B             |
| Edvardsson   | 2018 | Norway  | HIC              | Obstetricians | 20          | General        | Qualitative, in-depth interviews | B             |
| Hadirce      | 2020 | UK      | HIC              | Sonographers | 14          | General        | Qualitative, semi-structured interviews | B-            |
| Schwennesen  | 2012 | Denmark | HIC              | Sonographers | 7           | First          | Ethnography, semi-structured interviews | C             |
| Ahman        | 2015 | Sweden  | HIC              | Obstetricians | 11          | General        | Qualitative, interviews | A-            |
| Ahman        | 2019 | Norway  | HIC              | Midwives     | 24          | General        | Qualitative, focus groups and interviews | B             |
| Edvardsson   | 2016 | Sweden  | HIC              | Midwives     | 25          | General        | Exploratory qualitative, focus groups | B-            |
| Firth        | 2011 | Tanzania | LIC             | Women        | 25          | General        | Descriptive, semi-structured and structured interviews | C             |
| Ockleford    | 2003 | UK      | HIC              | Women        | 41          | Second         | Qualitative, semi-structured interviews | B-            |
| Georges      | 1996 | Greece  | HIC              | Women (26) and health workers (16) | 42          | General        | Ethnography, interviews, and observation | C-            |
| Harris       | 2008 | UK      | HIC              | Women        | 34          | General        | Qualitative, interviews | C+            |
| Jones        | 2020 | Kenya   | LMIC             | Women        | 50          | First and second | Qualitative, in-depth semi-structured interviews | B             |
| Liamputtong  | 2002 | Australia | HIC             | Women        | 67          | General        | Ethnography, in-depth interviews | B+            |
| Øyen         | 2016 | Norway  | HIC              | Women        | 8           | General        | Phenomenology, interviews | B             |

(Continued)
| First author       | Date  | Country | Resource setting | Participants                          | Sample size | Scan trimester | Study design/methods | Quality rating |
|--------------------|-------|---------|------------------|---------------------------------------|-------------|----------------|-----------------------|----------------|
| Gammeltoft        | 2007  | Vietnam | LMIC             | Women (116) and health workers (23)   | 139         | General        | Mixed methods, interviews, and observation | C              |
| Gammeltoft        | 2007  | Vietnam | LMIC             | Women                                | 32          | General        | Phenomenology, in depth interviews | C              |
| Edvardsson        | 2015  | Australia| HIC             | Midwives                             | 37          | General        | Qualitative, focus groups      | C+             |
| Sandelowski       | 1994  | USA     | HIC              | Women                                | 62          | General        | Qualitative, interviews          | C-             |
| Tsiannakas        | 2002  | Australia| LMIC            | Women                                | 15          | General        | Qualitative, in-depth interviews | B+             |
| Ahman             | 2016  | Tanzania| LIC              | Physicians                           | 16          | General        | Qualitative, interviews          | B+             |
| Ahman             | 2018  | Tibet    | LIC              | Midwives                             | 31          | General        | Qualitative, focus groups        | B+             |
| Holmclund         | 2017  | Rwanda   | LIC              | Midwives                             | 23          | General        | Qualitative, focus groups        | B+             |
| Scott             | 2020  | India    | LMIC             | Health workers                       | 30          | General        | Qualitative, in-depth interviews | A-             |
| Vesel             | 2019  | Kenya    | LIC              | Health workers                       | 32          | General        | Qualitative, In-depth interviews and focus group discussions | B              |
| Terni             | 2011  | USA      | HIC              | Women                                | 25          | General        | Ethnography, interviews          | B+             |
| Gitsels           | 2015  | Holland  | HIC              | Women                                | 12          | General        | Qualitative, interviews          | C              |
| Lewando-Hundt     | 2001  | Israel   | HIC              | Women (16) and health workers (20)    | 36          | Second         | Qualitative, in-depth interviews | C              |
| Rice              | 1999  | Australia| HIC              | Women                                | 30          | Second         | Qualitative, interviews and observation | C-            |
| Gottfredsson      | 2009  | Iceland  | HIC              | Women (10) and partners (10)          | 20          | First          | Qualitative, semi-structured interviews | B-            |
| Ledward           | 2017  | UK       | HIC              | Women                                | 6           | Second and third | Grounded theory, semi-structured interviews | C+            |
| Doering           | 2015  | New Zealand| HIC           | Women                                | 13          | Second         | Qualitative descriptive, interviews | B-            |
| Kristjansdottir   | 2014  | Iceland  | HIC              | Women                                | 14          | First          | Phenomenology, semi-structured interviews | B+            |
| Hawthorne         | 2009  | Australia| HIC              | Women                                | 20          | First          | Hermeneut phenomenology, semi-structured interviews | B-            |
| Larsson           | 2009  | Sweden   | HIC              | Women (5) and partners (4)            | 9           | Second         | Grounded theory, interviews       | B+            |
| Ekelin            | 2016  | Sweden   | HIC              | Women (10) and partners (6)           | 16          | Second         | Qualitative, interviews          | B-             |
| Gomes             | 2007  | Brazil   | UMIC             | Women                                | 3           | General        | Qualitative, questionnaire and interviews | C-            |
| Mabuuke           | 2011  | Uganda   | LIC              | Women (50) and health workers (30)    | 80          | General        | Qualitative exploratory, semi-structured interviews | C              |
| Bhagat            | 2012  | India    | MIC              | Women (26) and girls (16)             | 42          | General        | Ethnography, focus groups        | C              |
| Ranji             | 2012  | Sweden   | HIC              | Women (9) and partners (9)            | 18          | Second         | Qualitative exploratory, in-depth interviews | B-            |
| Denny             | 2014  | UK       | HIC              | Women                                | 7           | Second and third | Qualitative, semi-structured interviews | B-            |
| Gomes             | 2007  | Brazil   | UMIC             | Women                                | 3           | General        | Collective case study, semi-structured interviews | C              |
| Edvardsson        | 2014  | Australia| HIC              | Obstetricians                        | 14          | General        | Qualitative, semi-structured interviews | A-            |
| Edvardsson        | 2015  | Vietnam  | LMIC             | Obstetricians                        | 17          | General        | Qualitative, semi-structured interviews | B+            |
| Edvardsson        | 2016  | Rwanda   | LIC              | Physicians                           | 19          | General        | Exploratory qualitative, semi-structured interviews | B              |
| Dykes             | 2001  | Sweden   | HIC              | Women                                | 12          | Second         | Grounded theory, in-depth interviews | B              |
| Gagnon            | 2020  | Canada   | Women            | Women                                | 25          | General        | Qualitative, interviews          | A              |
| Walsh             | 2020  | USA      | HIC              | Women (22), partners (20), sonographers (7) | 49 | Second | Qualitative, observation | B              |

(Continued)
"We perceive that it is not out our job, but our wish as midwives is to be able to perform ultrasound so that we can play a role in the mother’s care and make decisions without necessarily waiting for the availability of the doctor." (Rwanda) [55]

"In our society it would be too late to do anything about that because the woman is not allowed, according to our religion, to have an abortion. Hence there is no point in doing tests during pregnancy. It’s only a waste of time, money and effort." (Israel) [60]

For some, beliefs about what was important to know during pregnancy, the value placed on ultrasound, and the impact of a diagnosis, appeared to be influenced by the vicarious experiences of friends, family and community members [17, 19, 28, 62, 63]. Information about the provision and nature of the ultrasound assessment appeared to also be mediated through community members in some cases, rather than healthcare professionals [29, 64, 65]. This extended to support after the scan which was often provided by friends and family [66–68].

"I needed help to sort out all my feelings and questions, my husband was a great support to me, but I would have liked to talk to my midwife." (Iceland) [65]

Finding out the fetal sex was important for respondents in a range of contexts, in terms of imaging their future baby, and practical planning [28, 45, 48, 68–70]. However, in some circumstances, this knowledge had negative consequences [30, 71]. As reported by both health workers and community members, this was particularly (but not only) apparent in cultures
Experiences of first and second trimester ultrasound in pregnancy

Table 2. Summary of Findings and CERQual assessment.

| Finding | Supporting studies | Methodological limitations | Adequacy of data | Coherence | Relevance | CERQual assessment | Comments |
|---------|--------------------|---------------------------|------------------|-----------|------------|-------------------|----------|
| Parents | Ultrasound is generally viewed as an integral part of pregnancy and support for their partner is expected. | Ahman 2010, Sweden (A); Ahman 2012, Sweden (B); Ahman 2019, Norway (B); Bashour 2005, Syria (C); Carolan 2009, Canada (C); Harris 2008, England (C); Bashour 2005, Syria (C); Carolan 2009, Canada (C); Harris 2008, England (C). | Minor concerns about the methodological limitations of 5/23 studies contributing to the review finding. | Few or minor concerns about adequacy of data in the findings is supported by rich data from a number of studies. | Minor concerns about coherence and relevance of data are consistent and supported by information from women and healthcare workers. | High | Grading only applicable to HCs |
| Parents | The role of ultrasound as a routine and expected part of pregnancy is imposed on decision making and autonomy. | Ahman 2010, Sweden (A); Ahman 2012, Sweden (B); Ahman 2019, Norway (B); Bashour 2005, Syria (C); Carolan 2009, Canada (C); Harris 2008, England (C); Bashour 2005, Syria (C); Carolan 2009, Canada (C); Harris 2008, England (C). | Minor concerns about the methodological limitations of 5/23 studies contributing to the review finding. | Few or minor concerns about adequacy of data in the findings is supported by rich data from a number of studies. | Minor concerns about coherence and relevance of data are consistent and supported by information from women and healthcare workers. | High | Grading only applicable to HCs |
| Health workers | Providers sometimes found it difficult to reconcile their role as a clinician working in an environment assessing risk, with parents’ expectations of the scan viewed as an exciting event. | Ahman 2010, Sweden (A); Ahman 2012, Sweden (B); Ahman 2019, Norway (B); Bashour 2005, Syria (C); Carolan 2009, Canada (C); Harris 2008, England (C); Bashour 2005, Syria (C); Carolan 2009, Canada (C); Harris 2008, England (C). | Minor concerns about the methodological limitations of 5/23 studies contributing to the review finding. | Few or minor concerns about adequacy of data in the findings is supported by rich data from a number of studies. | Minor concerns about coherence and relevance of data are consistent and supported by information from women and healthcare workers. | High | Grading only applicable to HCs |

(Continued)
Findings | CERQual assessment

| Findings | CERQual assessment |
|---|---|
| Parents: Fears around potential for harming the unborn baby, stories of misdiagnosis and false alarms, and religious and social beliefs with respect to the morals and timing of pregnancy termination for fetal abnormality may influence whether ultrasound is acceptable or believed by women and their partner. Some women may misunderstand the nature of the diagnosis that can be made through ultrasound. | Moderate concerns around adequacy of data as the finding is supported by relatively rich data from women and health workers in variety of different settings and contexts. |
| Health workers: In some contexts, there were societal misunderstandings about how ultrasound was performed and them the baby. Some felt the power of the technology was overemphasized in society impaired. | Moderate concern about coherence as the finding is supported by relatively rich data from women and health workers in variety of different settings and contexts. |
| Parents: | Moderate concern about adequacy of data as the finding is supported by relatively rich data from women and health workers in variety of different settings and contexts. |
| Fears around potential for harming the unborn baby, stories of misdiagnosis and false alarms, and religious and social beliefs with respect to the morals and timing of pregnancy termination for fetal abnormality may influence whether ultrasound is acceptable or believed by women and their partner. Some women may misunderstand the nature of the diagnosis that can be made through ultrasound. | Moderate concerns around adequacy of data as the finding is supported by relatively rich data from women and health workers in variety of different settings and contexts. |
| Health workers: In some contexts, there were societal misunderstandings about how ultrasound was performed and them the baby. Some felt the power of the technology was overemphasized in society impaired. | Moderate concern about coherence as the finding is supported by relatively rich data from women and health workers in variety of different settings and contexts. |
Ultrasound findings can generate complex ethical and moral dilemmas, including the potential for conflict between the wellbeing of mother and fetus. Ultrasound findings may also trigger anxiety and distress among expectant parents, particularly when they are not prepared for the potential implications. Providers should be mindful of these potential impacts and offer support and guidance to expectant parents to help them navigate these challenging situations.

Providers can play a critical role in communicating ultrasound findings effectively and supporting expectant parents in making informed decisions. This may involve providing clear and concise information about the ultrasound findings, addressing any concerns or anxieties they may have, and offering resources and support as needed. Providers should also be prepared to address any potential ethical or moral dilemmas that may arise in the course of their work.

Medical practitioners, health workers, and service users should be encouraged to engage in ongoing professional development and education to stay informed about the latest research and best practices in ultrasound and other diagnostic imaging modalities. This will help them provide high-quality care and support to their patients and ensure that the benefits of ultrasound are realized while minimizing any potential risks or harms.

Table 2. (Continued)

| Findings | CERQual assessment |
|----------|-------------------|
| Provider | Moderate |
| Patients | High |
| Patients | High |
| Patients | Moderate |
| Patients | High |
| Patients | High |
| Patients | High |
| Patients | High |
| Patients | High |
| Patients | High |

Experiences of first and second trimester ultrasound in pregnancy
For health workers, uncertainties in interpreting the ultrasound image can lead to fear of under/over diagnosis. Low

Health workers:

Providers were sometimes left with feelings of uncertainty if the image was perceived to be ambiguous and feelings around coherence as well as potential relevance in the context of not detecting what is there and seeing things that aren’t really there.” (Ahman 2019, Norway)

Health workers:

“that would be the sad side of medicine isn’t it so that the image or pressure or not to use anything. That has never been absoluted” (Edvardsson 2014, Australia)

Parents, 9 Studies: Ahman 2015, Sweden (A-); Ahman 2018, Norway (B); Barr 2013, England (B-); Gameltoft & Nguyen 2007(c) Vietnam (B-); Larsson 2009, Sweden (B+); Oscarsson 2015, Sweden (B+); Stephenson 2016, Australia (B); Stephenson 2016, Australia (B); Williams 2008, UK (C)

Finding: Fewer concerns about the methodology limitations of 4/7 studies contributing to the review finding

More concerns about adequacy of data in methodology limitations of 3/23 studies contributing to the review finding

More concern about coherence as a criticism in few of the findings (in conclusion) in sections of studies contributing to the review finding

No or minor concerns about coherence as a criticism in few of the findings (in conclusion) in sections of studies contributing to the review finding

Moderate concerns about relevance of service in most of the studies, as there are relatively little data from LMICs

Low Finding: downgraded because of limited data from LMICs and a lack of relevance across studies

Experiences of first and second trimester ultrasound in pregnancy

Table 2. (Continued)

(Continued)
### Table 2. (Continued)

| Findings | CERQual assessment |
|----------|--------------------|

#### The Impact of Staff Attitudes, Behaviours and Communication Skills on Women and Families

| Parents | Women and their partners want health workers to welcome them to the antenatal appointment, and to provide information about the results. In some contexts, women noted that health care providers only told the information they needed. Women were highly sensitive to verbal, non-verbal cues from service providers during the scan. Long silences and being excluded from communication, or not being effective in communication were anxiety-provoking for many. In contrast, being welcomed and engaged in the scanning process, and being provided with coherent and timely information during and after the scan, had a positive impact on the experience, even if it resulted in an adverse diagnosis. | Minor concerns about the methodology of 1/12 studies contributing to the review finding. |
|----------|-------------------|----------------------|
| Health workers | In unclear or mixed communication as a significant but challenging aspect of their role. They highlighted the need for more time during consultations to establish a rapport with parents with differing expectations, and to foster empathetic and compassionate care when needed. This involves professional, non-directive conversation, and facilitating parental engagement with the fetus whilst simultaneously looking for anomalies. A challenging role, with a need for training and emotional support. | Minor concerns about the methodology of 1/12 studies contributing to the review finding. |
| Health workers | Providers expressed satisfaction in their ability to guide prospective parents through their prenatal and postnatal care. Most providers also reported offering support during difficult conversations. However, they also discussed the difficulty of maintaining professional and supportive demeanor whilst also dealing with their own emotions. A few also talked about their sense of responsibility, due to a lack of literature on professional and emotional preparation. The conflicting roles meant a lack of time to form relationships and communicate results, a lack of adequate training in the communication of abnormal results and the need for a more effective approach to their engagement with service users. | Minor concerns about the methodology of 1/12 studies contributing to the review finding. |

* = first trimester ultrasound scan; ** = second trimester scan

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where there is a preference for male babies. In these contexts, the disclosure of female fetal sex through ultrasound could result in feticide [19, 53, 71, 72]. To avoid this potential outcome there was a policy of non-disclosure relating to fetal sex to avoid this outcome [19, 53, 54, 71, 72].

‘USG is done to know the sex of the child and then abortion is done if its female child.’ (India) [71]

There is this stigma between girls and boys, in some communities they want to know if it’s a boy or a girl so that they may be able to either prevent the pregnancy from going on.’ (Tanzania) [53]

‘...via USG people can know about sex of the baby and can get the girl child aborted.’ (India) [71]

The power of visual technology. For most respondents, ultrasound was seen as central to antenatal care. Women generally trusted it as a valued technology that could provide confirmation of their pregnancy and reassurance of fetal wellbeing [19, 28, 30, 43, 64, 66, 73]. For providers, it was an important tool, particularly for the detection and management of complications [39, 43, 53, 57, 74–76]. However, some respondents reported that a reliance on ultrasound results in the potential for overuse, and consequent neglect of other forms of antenatal care [19, 53, 74]. Some participants felt compelled towards ultrasound to visualise their baby and for reassurance [19, 31, 43, 47, 61]. For some women and healthcare professionals, ultrasound held greater value than other forms of antenatal assessment. The overuse of ultrasound was felt to result in reduced clinical skills and the potential to miss complications that were not picked up through this form of assessment [38, 43, 48, 55, 74].

‘The scan is very necessary; there is no point in visiting the doctor without seeing the fetus and knowing how well it is doing. You would not benefit at all!’ (Syria) [19]

‘Initially, I can say it came as an extra tool without really knowing why I have to do this. But, through getting used to the tools and doing it regularly, I came to get used to it and think right now I can say it is something we feel like we cannot do without.’ (Kenya) [57]

‘I think that in Vietnam nowadays, obstetric ultrasound is the most important investigation to monitor the pregnancy. Some other investigations like blood test, urine test also have importance but they cannot be compared to the obstetric ultrasound.’ (Vietnam) [75]

‘I think it’s a very useful tool, I think we’re getting to the situation where many people can do nothing without an ultrasound, so those clinical skills have gone to a large extent.’ (Australia) [74]

For many women and healthcare professionals, the power of the ultrasound image was significant [32, 32, 43, 50, 54, 66, 73, 75–77]. Some women appeared to lack trust that they were pregnant until they were able to visualise the image of their baby [21, 25, 44, 52, 68, 72, 78]. The capacity for visualisation was particularly valued by fathers and other parents [21, 28, 61, 78]. The scan image offered the chance to visualise the future together as family. For some, it represented an opportunity to construct their child’s future personality and characteristics [32, 21, 73, 79]. However, this sense of connection also complicated decisions around termination of pregnancy [18, 30, 34, 68].
Before I found out I was pregnant I’d always said if I knew I was having a handicapped baby, I’d have a termination, but then when I went for the very first scan and saw the baby moving about and saw his heart beating, I thought afterwards I don’t know whether I could do it now, because he’s alive, it’s a person.’ (England) [18]

Some providers were concerned that the clarity of the ultrasound image meant that all complications should be visible and identified [39]. Some feared the potential for consequences for both the mother, and for their professional security, if abnormalities were missed [36, 39, 76]. In some LMIC contexts, concerns were also expressed about the lack of appropriate training and the potential for this to result in missed complications or misdiagnosis [38, 39, 76, 80]. Some respondents described professional and moral dilemmas around prioritising either mother or fetus in their clinical assessments [35, 40, 81, 82], as well ethical concerns when parents made decisions that did not fit with personal or professional beliefs [55, 80, 82]. Some also expressed concern that women would go to any lengths to protect the wellbeing of their baby, even when this was to their own detriment [38, 75, 81].

‘No special training on ultrasound, that’s the limitation, that’s why you can sometimes miss some complications if I find something I am not understanding.’ (Rwanda) [76]

‘I have never met an expectant mother who has hesitated to expose herself to something that might be harmful to her health as long as it benefits the fetus.’ (Sweden) [38]

**Both joy and devastation; consequences of ultrasound findings.** The scan appointment was a source of great excitement, joy and relief for many couples, providing a chance to bond with their baby, whilst also instilling a sense of responsibility, particularly amongst fathers and other co-parents [19, 21, 32, 41, 45, 68, 77, 83]. For some, it also offered the potential for choice and the opportunity to plan when complications were detected [22, 68, 84, 85]. However, for many, the identification of abnormalities was completely unexpected [17, 18, 20, 24, 65, 69, 73, 80, 86–88]. Some reported deep shock and distress on hearing this news [17, 65, 67, 69, 73, 86–89]. Both service users and healthcare professionals reflected on how this shock could be compounded by couples’ expectations that the scan appointment is a happy event that would provide confirmation of wellbeing [24, 36, 65, 83]. The difficulty in getting the balance right in preparing couples for potential consequences of the scan was also discussed by healthcare professionals. Some felt that they lacked time to do this, amongst all the other issues to be discussed in an appointment, and they struggled to get the balance between discussing risk and maintaining a sense of normality prior to the scan [27, 37, 90].

‘We were so naive. We thought we were going to see the baby and get a nice photo.’ (Canada) [24]

“It was a shock like this, because what we expect is that it will be everything perfect” (Brazil) [69]

‘You come to find out the sex of the baby and have the bomb dropped on you.’ (USA) [87]

Uncertain findings that could, but may not, indicate abnormality, were particularly difficult for many couples, resulting in feelings of having lost their pregnancy, and a shift to a new
tentative, risky state [18, 20, 29, 91]. Some women reported detaching themselves from their pregnancy and/or baby while also experiencing constant worry in relation to their baby’s well-being [17, 18, 22]. This state persisted into the long term for some, even after a follow-up diagnosis that all was well [18, 20, 91]. In some cases, this concern persisted even into infancy, with, at the extreme, the decision not to pursue previously planned future pregnancies [18, 20, 91]. Some health professionals were acutely aware of the impact of uncertain findings on parents, resulting in dilemmas around whether these should be disclosed [36, 74, 81]. Parents were also conflicted about the benefits versus the harms of disclosing these findings [17, 29]. Some expressed regret in retrospect about the negative impact on their pregnancy [20, 87, 65, 67].

‘Because of this I wouldn’t have a third child . . . I’m not putting myself through this stress again ever, and I would have gone on to have a third one. We’re stopping at two.’ (England) [18]

‘The more you see sometimes the more uncertain things get. And you can ruin a pregnancy quite a bit like that. So I’m not sure whether it’s always good.’ (Australia) [74]

The significance of relationship in the ultrasound encounter. Women and partners expressed a desire for scan providers to recognise the unique nature of the scan experience for them, to make them feel welcome, and to provide information and the opportunity to ask questions [21, 22, 25, 76, 65, 88]. Their actual experiences ranged from health workers being cold, disinterested, and lacking time to provide information, to those who were warm and engaging, and actively fostered questions and interest in the scan [18, 19, 22, 72, 80, 92]. In some contexts, women reported that they were unable to ask questions and that their experience was completely in the hands of the healthcare professional [19, 92]. Some women and their partners reported being completely excluded from their scan experience, unable to see the image of their baby, and left in silence to guess through body language what might be happening [18, 19, 22, 87].

‘He was staring for a long time at the screen. You see he is very good. He keeps looking [she waves as if she is reading from a book], and he keeps explaining. He told me about the amniotic fluid. My previous doctor was different. She does the scan very quickly and tells you: ‘Hey stand up . . . you have nothing’ and that’s all. I tell you, I felt the difference between those two doctors.’ (Syria) [19]

For some health workers supporting women through difficult findings was a rewarding aspect of their role; but they expressed the desire for more training in the communication of abnormal results, as well as more professional support to confirm findings [36, 37, 93–95]. A lack of time to form relationships and properly communicate results meant that some providers felt the need to distance themselves, in order to protect their own emotions and to enable them to perform consecutive scans within a limited time period [36, 90, 95].

‘It’s the responsibility of being alone in such a small place, I’m the only one looking . . . I miss a colleague, so I could say “Could you take a look with me, let’s discuss this together.”’ (Norway) [95]

‘You’ve got to protect yourself, you’ve got to . . . not harden your heart, but you do have to protect yourself and not get too emotionally involved, because otherwise you wouldn’t survive very long in our job.’ (England) [36]
Discussion

In 2019, the WHO maternal and perinatal health steering group prioritised updating their early ultrasound scan recommendations [5]. This systematic review informs the subsequent recommendations and will inform living guideline updates of this recommendation [96]. The potential drivers for appropriate or inappropriate use of ultrasound were captured in the four study themes.

In line with other studies [6], the experience of providing or receiving ultrasound was generally seen as positive in our analysis [21, 25, 34, 38, 39, 41, 97], generating high demand for scans [19, 39, 43, 49, 50, 55, 64, 74], but the consequences of adverse findings was sometimes devastating [18, 20, 50, 65, 67, 73, 74, 87]. Importantly, in this review, we found that even when an initial concern was later ruled out, there were very significant long-term adverse consequences for some service users [17, 18, 20, 67, 91]. Respondents also reported overuse, with implications for the provision of other antenatal assessments and potential loss of clinical skills [19, 38, 48, 53, 55, 74, 82]. This reinforces previously published survey data from a range of settings [98–100].

Provider attitudes and behaviours were influential in the service user experience [18, 19, 21, 22, 72, 86, 88], as were local social norms [18, 21, 25, 34, 41, 52, 58, 60, 61] and access to follow up investigations and support [21, 22, 67, 86, 87]. Providers reported concerns around missing important features of the scan [38, 39, 75, 96], and a lack of sufficient time and training to appropriately carry out ultrasound assessments [36, 38, 76, 90, 95].

Previous survey research has found mixed evidence about the impact of ultrasound screening on maternal anxiety [101]. Our data suggest possible drivers for the varying perceptions of ultrasound screening. The power of the visual in making the fetus ‘real’ is evident in our analysis [21, 23, 28, 32, 35, 43, 44, 50, 73], reinforcing the validity of concepts of what has been termed the ‘tentative pregnancy’, in which women put their sense of being pregnant on hold until they have visual evidence of the fetus, and of its wellbeing [102]. Our data show that visual markers with unknown provenance or meaning can be unsettling for health workers as well as for service users [17, 18, 20, 38, 50, 74, 81]. The value of diagnosing abnormality was less clear in contexts where termination was not an option [58, 60, 61]. The critical, ethical and equity issue of female feticide reported in some settings underpins growing concerns about sex selection, linked to a much lower female-male sex ratio than would be expected in some countries [13, 68, 69, 103].

Our findings raise questions about the utility of ultrasound in pregnancy as a screening tool in settings where the implications of features on the scans are not always understood by practitioners or service users [100, 104–107], and/or if there are no effective follow up, treatment, or solution to some ultrasound findings [108–110]. They raise concerns about the use of ultrasound as a deliberate ‘draw’ to bring women into antenatal care, if the consequence is overuse by undertrained staff, without time to undertake the scan effectively, including provision of tailored information and psychosocial support where needed; and without effective, affordable, equitable referral pathways.

The strengths of this review include the comprehensive search that was not restricted by language or date, and the inclusion of 80 qualitative studies covering countries from most regions of the world. Fourteen of the 17 review findings were assessed as high or moderate confidence evidence using the GRADE CERQual approach [16]. We have included the experiences and perspectives of women and their partners, as well as health workers, from low-, middle- and high-income countries. Limitations include that we were unable to distinguish between first and second trimester ultrasound in our findings, as the findings were not clearly separated, or they were similar in both trimesters. We were also unable to include the views of
policy makers or funders, as our search did not retrieve any eligible studies that included this perspective. Furthermore, many of the findings relate to identification and diagnosis of abnormality, rather than to assessment of gestational age, fetal growth, or multiple pregnancy. The majority of studies in our review are from high-income countries, which was anticipated, but the inclusion of more studies from low-income settings may have provided further implications for the use of ultrasound services in this context. Thirteen of the included studies were from the CROss-Country Ultrasound Study (CROCUS). However, these studies explored the views of both providers and service users, from a number of different low-, middle-, and high-income countries.

This review offers a critical insight into how countries can introduce and maintain optimal routine antenatal ultrasound services. The findings reinforce the psychological and emotional benefits of such services from the point of view of most women and their partners, and the clinical benefits as perceived by service providers. However, there are implications for implementation in settings where antenatal ultrasound is not yet a routine component of antenatal care, and improvements that can be made in other settings where use of this technology is already established. In all settings, and particularly those with restricted resources, adequate education and training in both the use of obstetric ultrasound and in positive interactions with service users is essential, as well the allowance of sufficient time to undertake the scan effectively and with attention to the needs of the parents. Mitigation against overuse is important, to ensure that the use of ultrasound is appropriately balanced with the provision of expert clinical antenatal care. The potential for, and consequences of fetal sex disclosure must also be considered, especially in contexts where there is sociocultural bias towards male sex. Improvements can be made in all settings to ensure that women and their partners make autonomous informed decisions relating to the uptake of antenatal ultrasound; that they are adequately involved during the scanning procedure; and that information relating to the results is provided in a timely and supportive manner.

Future research should consider the ways in which ultrasound might be implemented to ensure equity of access, follow up, and longer term social and psychological support where this is needed, so that the positive aspects are maintained, while limiting the potential for overuse and for adverse impacts. There is a need to determine what is necessary and optimal to disclose with regard to markers of unclear significance and to consider how couples can be optimally supported through uncertain findings, and through to future reproductive decision making. Consideration should be given to the whole maternity and health care system into which ultrasound is introduced. Research into the use of portable ultrasound may be relevant for all settings, but particularly within LMICs, where this may be a requirement for rural and remote provision of ultrasound. This would require the ability to produce scan images of sufficient quality, as well as consideration of the findings of this review.

Supporting information

S1 Checklist. PRISMA 2020 checklist.
(PDF)

S1 Table. Search strategy.
(PDF)

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