Women's views on using artificial intelligence in breast cancer screening: A review and qualitative study to guide breast screening services

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ABSTRACT

As breast screening services move towards use of healthcare AI (HCAI) for screen reading, research on public views of HCAI can inform more person-centered implementation. We synthesise reviews of public views of HCAI in general, and review primary studies of women's views of AI in breast screening. People generally appear open to HCAI and its potential benefits, despite a wide range of concerns; similarly, women are open towards AI in breast screening because of the potential benefits, but are concerned about a wide range of risks. Women want radiologists to remain central; oversight, evaluation and performance, care, equity and bias, transparency, and accountability are key issues; women may be less tolerant of AI error than of human error. Using our recent Australian primary study, we illustrate both the value of informing participants before collecting data, and women's views. The 40 screening-age women in this study stipulated four main conditions on breast screening AI implementation: 1) maintaining human control; 2) strong evidence of performance; 3) supporting familiarisation with AI; and 4) providing adequate reasons for introducing AI. Three solutions were offered to support familiarisation: transparency and information; slow and staged implementation; and allowing women to opt-out of AI reading. We provide recommendations to guide both implementation of AI in healthcare and research on public views of HCAI. Breast screening services should be transparent about AI use and share information about breast screening AI with women. Implementation should be slow and staged, providing opt-out options if possible. Screening services should demonstrate strong governance to maintain clinician control, demonstrate excellent AI system performance, assure data protection and bias mitigation, and give good reasons to justify implementation. When these measures are put in place, women are more likely to see HCAI use in breast screening as legitimate and acceptable.

1. Introduction

There has been a recent, rapid increase in research on public views on the use of healthcare artificial intelligence (HCAI), including women's views about the use of AI in breast screening. Engaging communities about the introduction of new technologies is vital, to maintain health system trustworthiness, and support decision-makers to respond to public values and priorities. Breast cancer screening has strong social and cultural significance, especially for women who feel unseen in other parts of the health system [1]; and screening participants generally have a strong positive sentiment towards screening [2,3]. Significant changes to breast screening services have the potential to disrupt this relationship between services and participants, making it important for screening services to understand women's views.

Breast screening was an early use case for disease detection HCAI, due to the availability of a large corpus of high-quality digital data amenable to machine vision techniques. Implementation of AI in breast screening is underway or imminent in many jurisdictions. Delegating screen reading tasks to AI [4] may be a significant enough change to be perceived as disruptive by clinicians and consumers alike. For service users, breast screening AI is just one instance in a larger, and increasingly dominant, public discourse about HCAI and AI in society generally: understanding women's views on breast screening AI thus benefits from attention to the larger context.

To this end, we will.

1. Summarise systematic reviews on public views of HCAI in general;
2. Review primary studies of women's views about breast screening AI;
3. Present findings from a recent qualitative study conducted by our group, illustrating women's views and highlighting the value of supporting participants to understand the technology they are discussing; and
4. draw conclusions for healthcare services, including mammographic screening services, and for researchers in this field.

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2. Systematic reviews on public views about using AI in healthcare

Our strategy for identifying systematic reviews is in Supplement 1. Primary studies of public views on HCAI began emerging in 2017, and systematic reviews in 2021; followed by a further systematic review in 2022, three in 2023 and three in 2024 [5–12]. Primary studies are mostly from Europe and North America [5–12]. This research is largely hypothetical, because it predates HCAI implementation: more work is needed on what people think of application of real AI systems in their own care [6,8]. In this section, we summarise the literature to provide context for women's views on AI in breast screening.

2.1. What are we doing when we study public views of HCAI?

Primary studies are methodologically diverse, from experimental and quantitative methods through to discussion-based methods. In all of these methods research quality is critical, and arguably not always present in fields such as HCAI that are perceived to be highly topical. It is not always clear what participants *understand HCAI to be* when they are asked for their views on the technology, or *why* researchers are asking them for their views. Studies often conclude (unsurprisingly) that patient and public understanding of HCAI is limited [5,6]; for some participants, AI is completely new [8], especially in healthcare [6,8], and there is significant variation in how AI is understood [5], with clear influences from popular media and real-life automated services [6,8,9]. Researchers provide highly varied amounts of information to participants, from nothing, to short definitions, to scenarios, to experience of AI systems, and this variation alters what can be concluded from a study [10]. In particular, studies that provide minimal information can only be studies of what people's views on what they *imagine* HCAI to be. There is also variation in *why* researchers engage with public views at all [10]. Most seek to improve research, innovation, implementation and/or the technology itself; a substantial minority provide no rationale, or advocate use of their findings to educate or, worse, manipulate consumers to make them accept AI [10]. This is a difficult position to justify.

2.2. What does the literature show about public views on HCAI?

Patients and the public are mostly open to HCAI [6,7], and support is stronger for: high-performing HCAI systems [6,8], use in low-risk settings [6], use with human oversight [9], equitable access and greater familiarity with the technology [8], and technology trusted by clinicians [8,9]. People's views are influenced by their own experience of technology, and the opinions of family, friends and colleagues [11]. Participants hope that HCAI will improve efficiency [5,6], accuracy, cost, access to health services [6,8], team dynamics, care, reduce burden on the health-care workforce, aid communication with patients, assist clinical workloads [8], and decrease the number of procedures needed [6]. This openness is qualified, however: participants express caution [8,9] and opposition to HCAI [6]; acceptance hinges on perceived benefits outweighing risks [11]. Reasons given for opposition include lack of evidence that HCAI implementation will improve health services [6,8], and concerns about: HCAI accuracy [5–7], data quality used to develop HCAI, leading to bias [6–8], data privacy and/or security [6–8], data governance [8], accountability for HCAI decisions [5,8], under- and over-reporting, worsening inequity, undermining of patient choice, job loss or deskilling of clinicians, fear of healthcare professionals' over-reliance on HCAI [12], technical complexity [11], technical failure or inefficiency, lack of emotion and empathy, and challenges in interpreting or communicating recommendations [6,8]. Participants express concern about how AI may diminish their relationship with health professionals and services [7] and affect human oversight [6], and question whether AI is suited to all healthcare settings and patients [8].

Ensuring patient-centredness is key [8,9] as is retaining clinician control and oversight [5,6,8] and not replacing clinicians [5,6,8,9], in part because holistic human clinical reasoning is highly valued [5]. HCAI's strengths are also perceived as potential weaknesses: e.g. AI systems may perform some tightly-defined tasks more accurately than humans, but are incapable of adapting to slight changes, unexpected situations, or contextual factors [6]. The risk of HCAI predictions being shared with insurance companies is also a concern [12].

Research on public views regarding ethical and regulatory challenges is limited [5,7], and more collaborative work between developers, ethicists, clinicians and patients/publics is needed to ensure that HCAI is human-centered [5,7], and that legal and regulatory issues are addressed [5,8,9]. Prior to implementation, patients and publics expect not only clinical testing and health service preparedness [5], but also public consultation and education [5,6].

3. Review of existing studies of women's views on using AI in breast screening

With this background of public views on HCAI in general, what do we know about women's views of breast screening AI in particular? The search strategy we used to identify this literature is in Supplement 1. We identified seven studies: five from Europe (Italy [13], the Netherlands [14], Sweden [15,16], and Norway [17]), one English study [18], and one Australian study [19]. A summary is in Table 1.

3.1. What methodologies have been used to examine women's views on breast screening AI?

Researchers have used both quantitative [13–15,17], mixed [18], and qualitative [16,19] methods to explore women's views. Quantitative studies recruited women from screening waiting rooms [13], from women receiving a negative screening result [15], from health service staff with snowballing to their friends and relatives [18], via national omnibus panel survey [14], and by distribution to all women eligible for breast screening [17]. Purposive qualitative samples were recruited from the general population [18,19], or from a screening waiting room [16]. Most studies focused on women of eligible screening age [13–15, 19], one ≥18 years [18], and one 16–75 years [14]. Sample sizes for the quantitative studies ranged from 800 to 8355 women [13–15,18], and for qualitative studies 16–50 [16,18,19]. Information was provided to women in a minority of studies [13,19]. Returning to our earlier observations about the quality of research in this field, readers will note highly divergent designs, arguably of different quality and certainly contributing different types of knowledge. A priority for future work is to pursue the best possible design in whatever methods are being used to understand women's views.

3.2. What do studies report about women's views on using AI in breast screening?

Many studies asked women about their self-perceived knowledge of AI, with mixed findings (some studies also reported that respondents had limited understanding of breast screening. [18,19]) Approximately half of both Italian and Norwegian participants said they knew about healthcare AI [13,17]. In Italy, younger women, women with more education, or those attending their first screening considered themselves less knowledgeable [13]; in Sweden, older women tended to self-report limited understanding [15]. Australian women self-reported increase in knowledge about AI after being exposed to information during participation [19].

Broadly speaking, women's views on breast screening AI mirror views expressed about HCAI in general. Women expressed open and positive views [13,16,18,19]; some women saw AI use as inevitable

Table 1
Methods and key findings of studies about women's views on AI in breast screening.

Author-Date-Method	Key findings
Jonmarker et al. (2019) **Country:** Sweden **Design:** Prospective survey **Recruitment:** Survey sent to women 40–74 years (eligible screening age) who received a negative screening result **Sample:**164,444 invited; n = 2196 responded; 1.3 % response rate **Data collection:** Feb. 2018–Mar. 2019	- Respondents divided into two groups: those preferring a computer-only read if the computer is at least as good as the average physician (n = 839) vs those preferring a two-physician read (n = 1357). - Those preferring a computer-only read were more likely to be more highly educated and have higher self-rated understanding of new technology.
Ongena et al. (2021) **Country:** Netherlands **Design and Recruitment**: Analysis of Data from the Longitudinal Internet Studies for the Social Sciences panel survey. **Sample**: Women 16–74 years; n = 922 **Data collection:** Wave Apr. 1, 2020, Wave Dec. 2, 2018.	– 77.8 % agreed with the 'necessity of a human check' when AI was used – those agreeing more likely to value personal interaction in care, not believe AI is efficient, and have less education. - varied responses to AI selecting images for a second (clinician) reading – those agreeing more likely to not value personal interaction, and to believe AI is efficient. - majority unsure whether developers or radiologists should be responsible for errors.
Lennox-Chhugani et al. (2021) **Country:** England **Design:** Survey and focus groups *Survey* **Recruitment:** Invited men and women working in the East Midlands National Health Service, survey also open to their friends and relatives. Invited n = 23,332 staff, but total number of people receiving invitation not clear. **Sample:** n = 4,096, women only *(response rate unclear)* **Data collection:** Dec.2019–Feb. 2020 *Focus groups* **Recruitment:** Purposive samples from the general population of women ≥18 years **Sample:** n = 25 **Data collection:** Jul. 2020	In the survey: - Respondents reported limited understanding of breast screening processes. – 847/4096 women said AI in breast screening would and should happen in future. - Concerns expressed in free text fields included: the reliability and safety of technology; trustworthiness of the technology itself or the systems it is embedded in; fear of over-reliance on AI and job losses; absence of human touch. - Potential benefits expressed included: efficiency, reliability, safety. In the focus groups: Benefits identified: efficiency, reliability, better outcomes, fewer errors, releasing staff for patient care; cost savings; addressing workforce shortages. Main concerns: loss of 'human touch'; governance; bias; privacy.
Pesapane et al. (2023) **Country:** Italy **Design**: Prospective survey/self-report questionnaire **Recruitment:** Distributed to women while they waited for screening. **Sample**: n = 800 *(response rate unclear)* **Data collection**: May–Jun. 2021	- Half (51 %) of respondents reported understanding the use of AI in medicine (women <50, with more education, without screening experience less likely to report understanding). – 88 % agreed that breast screening AI will be useful and secure; 77 % that AI should at least be used as a second reader. – 94 % wanted radiologists to always be responsible for reporting. – 90 % agreed AI could help choosing images for further investigation (women with prior screening experience less likely to agree). – 52 % thought both software developers and radiologists should be responsible for errors.
Carter et al. (2023) **Country:** Australia **Design:** Online discussion groups **Recruitment:** Purposive sample from the general population, women eligible for breast screening (50–74 years) **Sample:** n = 50 **Data collection:** Jun.–Aug. 2021	- Increased self-reported knowledge from information provided during the study - Increase in support for breast screening AI after participating - Overall positive sentiment towards breast screening AI - Testing/monitoring/evaluation and evidence important - Transparency about AI use important - Breast screening program trusted not to introduce AI until it performs better than clinicians. - Human oversight, radiologists reading every mammogram, highly valued - Value of human involvement: unique expertise, 'human touch' and care - Lower tolerance of AI error than of human error - Benefits: efficiency, releasing staff for patient care, cost savings, addressing workforce shortages - Concerns: privacy, deskilling, job losses, communication with patients.
Holen et al. (2024) **Country:** Norway **Design:** Survey **Recruitment:** Survey sent by breast screening service to all women of eligible screening age (50–69) - 84,543 women invited **Sample:** n = 8355; Response rate 9.9 % **Data collection**: Oct.–Dec.2022	- Self-report of little or no knowledge of AI: 39 % in general, 46.8 % in healthcare. – 64 % willing to participate in a study where AI was being used (9.5 % not willing). – 54.9 % willing to participate in a study where AI triages images into risk groups: 13.9 % not willing. – 20.6 % would be confident in a negative finding by AI alone. – 76.6 % of women wanted to know that AI was being used. – 31 % preferred two radiologists to read mammograms, 59 % preferred a radiologist and an AI system, only 0.5 % preferred AI alone. - Self-rated higher knowledge about AI, and higher levels of education, correlated with willingness to participate in AI studies and confidence in AI assessments. - Self-rated lower levels of health inversely correlated with willingness and confidence. - Loss of human interaction, and risk of missed cancers, were most common concerns. - Greater efficiency and greater disease detection more common perceived benefits.
Viberg-Johansson et al. (2024) **Country:** Sweden **Design:** Semi structured interview study **Recruitment:** Purposive samples recruited from a screening waiting room – 63 women invited. **Sample:** 16 women interviewed **Data collection**: Feb. 2023	- Sentiment generally positive. - Human and AI assessment perceived differently: AI was merely a tool, less tolerance for AI error vs human error. - Trust in the healthcare system underpinned confidence in AI. - Evaluation of AI paramount. - Humans should remain central to decision making and care (humans were preferred but AI could complement humans). - False negatives and false positives seen as a trade-off, avoiding false negatives preferred.

[18]. More positive views were associated with higher levels of educational attainment, age effects were inconsistent [13–15,18]. Women wanted to know that testing, monitoring and evaluation of AI systems was rigorous [16,18,19], and wanted to be informed that AI was being used [17]. Human oversight was highly valued [14,19], and sometimes thought to mitigate concerns [18]. Women generally wanted radiologists to continue reading every mammogram, with AI in a support role only [13–16,19], potentially as a second reader [13,14], but not as a stand-alone reader [14,17]. Although a minority of technophilic women may prefer an effective AI over two physicians [15], most endorse 'the necessity of a human check' [14]. In qualitative studies, women strongly endorsed the central role of unique human expertise, believing clinicians and AItogether would improve system performance, and that only humans could provide a 'human touch' and care to women in such vulnerable circumstances [18,19]. Women may be less tolerant of AI error than of human error in mammography [16]. Although subgroup analyses have been used to determine what demographic characteristics might explain willingness to accept AIin breast screening, this has not yielded clear insights [13,14].

Women were sometimes unsure of the benefits of AI in breast screening, but named: improved efficiency and performance, more time for staff to work with patients, cost savings, and addressing workforce shortages [18]. Women's concerns included: AI performance, systems being ready for AI, dependency on AI [18], AI governance (including equity issues) [18], bias [18], losing human involvement [18], data privacy [18,19], legal issues (such as accountability) [13], deskilling [16], job losses, communication with patients [19], and inconsistency/deterioration in AI performance [16]. Reported views regarding who should be accountable for AI decisions varied widely [13,14], with authors noting the need to develop clear lines of accountability [13,14].

In summary, in breast screening as in healthcare AI in general, women are concerned about AI system performance and retaining the centrality of clinicians; oversight and accountability are key issues.

4. Understanding women's reasoning

On this background, we now report on a qualitative Australian study focused on women's reasoning about the use of AI in breast screening, to provide illustration of what matters most to women and why.

4.1. Study design

This study used dialogue group methodology, which invites participants to make normative judgments about scenarios, provide reasons, and potentially change their views. We aimed to recruit eight dialogue groups with a total of 40 diverse women of screening age (50–74 years): 4 groups who had screened in the last 4 years, 4 who had not. Women were recruited purposively from the general population via a market research organisation using social media posts and random digit dialling.

To support informed participation in dialogue groups we shared three 5-10-min videos with participants over six days and asked them to post comments on a secure research bulletin board. The videos explained: AI, including its uses; screening and breast screening, including current and potential workflows; and evidence on AI performance (as of 2022) in each workflow. Data collection was completed in September–October 2022. This design provided women with three key elements: 1) high quality and accessible information; 2) time to engage with information; and 3) opportunity to interact with one another. The videos were designed as a low-burden, high-value way for women to increase their understanding before participating in a discussion group. In the 90-min discussion groups, participants weighed up multiple

factors in their decision-making, and sometimes struggled to choose a preferred workflow; decision making was sometimes assisted by a recap of the evidence or hearing other women's views. The methodology allowed researchers to understand nuances in women's views, to a greater extent than most AI research with consumers.

To understand the impact of information exposure and discussion, women completed a questionnaire on their (self-perceived) knowledge and attitudes towards AI, including in Australian breast screening programs (see Supplement 2), at three time points: before and after the bulletin boards, and after their dialogue group. There was <100 % response to the questionnaires at each time point; figures reflect the proportion of total respondents at each time point.

4.2. Respondent characteristics

We recruited a sample of 40 women who were diverse in educational opportunity, employment status and place of birth, but skewed towards younger age and non-urban location of residence (Supplement 3).

4.3. Information increased women's self-perceived knowledge

Across the three time points, women's self-perceived knowledge steadily increased (Fig. 1), demonstrating that small amounts of information can increase women's confidence in their own understanding and ability to engage meaningfully in discussions.

5. What mattered most to women when considering the use of AI in breast screening?

We found, consistent with the literature, that women commonly responded: yes I'm open to the development of AI in breast screening, but on conditions. Women supported AI implementation in hope of greater accuracy, speed, and accessibility of breast screening services, and were open to AI as a potential solution to workforce shortages:

Look, I'm all for it, especially finding out how behind we are when it comes to the number of specialist hours it takes. If AI can cut into that time and get more of the scans processed. As long as it's done accurately, I'm all for it … But I think there's a long way to go before people show any type of genuine faith in the AI. (DG6)

However, acceptance was not always enthusiastic: it was also recognition of the inevitable, sometimes disappointing, automation across industries:

… AI has the capacity to learn and continually improve, and I see that as being fantastic, but it does go to some of the bigger questions about is the safety of the human beings here at the root of the question or are we jumping to let's go AI 'cause we haven't got much choice. (DG7)

On this background of (sometimes grudging) acceptance, women sought to impose conditions on AI implementation in four key areas.

1. human control and decision making;
2. real world evidence and accuracy;
3. supporting familiarisation; and
4. providing adequate reasons for introducing AI.

As shown above, the first two conditions dominate the literature on public views. The second two are less common in the literature, but highly relevant to this context, and elicited by our study design. We explore them in turn below.
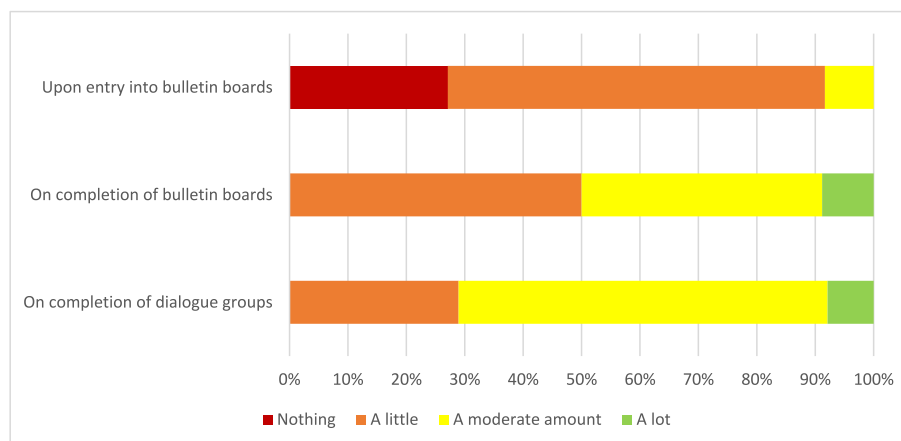
Fig. 1. Questionnaire responses: How much do you know about artificial intelligence.?.

5.1. Condition one: human control and decision making is preserved

As in previous studies, women emphasised that human attributes brought rigour to screen-reading processes and outcomes. This included research skills, professional experience, empathy, intuition, and flexibility. Women were greatly reassured by having multiple radiologists working independently.

> So knowing that it's the two people have looked at them, and there's been an arbitrator and then, if you are recalled, then there's a fairly good chance that there's an abnormality given how much attention that's had already. But I actually didn't realise there was an arbitrator and I must say, having learned that, I felt quite reassured that any cancer I may have is less likely to be missed. (DG3)

Women expected clinicians to continue reading mammograms, oversee AI decisions and maintain control; for women who thought accountability was important, humans—and not AI systems—could be held accountable, and this was critical. All women, whatever their sentiment towards breast screening AI, wanted radiologists to remain central.

> Yes. And this is really stupid, but if anything does go wrong, who do we blame? We can't … put it towards a robot. We can, but what's going to happen then, you know what I mean? (DG2)

> I have a lot of confidence in AI. I don't think it should be the ultimate judge, but I have the sense that at some point it might be able to pick up more than humans do. I wouldn't want to relinquish control and I would like to have humans kind of vet anything that it came up with, but I think, ultimately, it would save on mundane kind of labour, the tedious part and free up doctors from doing that as long as there was participation. Yeah, I just think that AI might end up picking up things that humans miss. (DG4)

Retaining human control required ongoing investment in the radiology workforce, maintaining those skills and knowledge, including their role in training and discovery:

> … I think it's really important to remember that the specialists don't just look at x-rays, they also teach the upcoming students, and they have a lot of other roles and if we tend to get rid of specialists maybe for this, we're going to have more shortages in all other areas as well and includes education. (DG8)

Skilled radiologists provided access to human explanation, which

was highly valued:

> If that specialist knows how to read it, they can explain it a lot better to a person rather than AI can't explain it … a specialist can explain it still in human terms. (DG1)

5.1.1. Condition two: real world evidence shows improved accuracy prior to implementation

Consistent with the broader literature, accuracy was critically important, regardless of women's overall sentiment towards AI. Women thought the evidence summaries provided did not suggest implementation should be imminent.

> … all of this is can only really be premised on substituting AI for a human being when the AI is good enough to do no worse than the human being. And I don't think you're there, you're at that point at all … (DG3)

Women wanted to see trials and examples of successful implementation; some emphasised they did not want to *be* the trial. Radiologists were proven by experience: AI had not yet "proven itself".

> At this stage, we don't know how well AI is going to work … So we've seen friends and family have scans and get found by specialists … so we have faith in the human side of it at this point … the AI is untried … our experience is that we've seen specialists pass the test, prove themselves, but not AI. (DG6)

5.1.2. Condition three: women have time to get informed and familiar with AI

Women emphasised the need to have time to become familiar with a new technology. Some women imagined AI as science-fiction or of the future; a technology promised but unachieved, unattainable in the real world. Some women—almost all aged 50-69—explained this view as generational, as shown in the exchange between two women below:

> Participant 1: It's just that it's not advanced enough. I mean, hey, I've watched Star Trek. I know AI's way of the future. It's just too new at the moment. You know what I mean? But in 20 years' time, people are going to say, can you believe that the, these people argued about this? They had no say. But I think that's what everything comes to medically. I mean, all the advancements we've had over generation after generation, of course, an AI's going to be it

eventually. The people will just be way more accepting of it because that's what they're going to know.

Participant 2: … And we're – I think we're from a pretty similar generation as women. And we are from the lost in space era where you put your washing in washing machine and came out folded, and they had systems and all of that was meant to be happening by now. So lots of trying in a concentrated time, but not everything has happened. So we still have that reservation of yes, you can dream that. You can see that's possible. And if you're an entrepreneur or researcher or an inventor, you might have more faith in it. But maybe we are slightly more real. We know what – my washing machine washes and wrings. It doesn't fold. (DG6)

Women worried that the unfamiliarity of AI would be too confronting, causing a change in how participants felt about breast screening services, perhaps driving disengagement, as shown in this exchange:

Participant: … remember most people who get their breast screens are just ordinary, everyday humans. We're not scientists and all that sort of stuff. And let's just say one of the ladies has just turned 50, so the majority of people are older. So science and things like that are probably scarier as to many of our older generation. So, I don't know, I just think don't try and force it because it'll backfire and people just won't bother to do it.

Moderator: Yeah. Right. And just so I'm really clear, what would be forcing it look like? What is it that you think needs to be avoided there?

Participant: Just telling them that this is the way it is, we're not going to have doctors do this anymore, we're going to have a machine do it. People will be like, "Well why bother?" (D4)

5.1.3. Women offered three solutions to mitigate disengagement and support familiarity

A novel finding in this study were three solutions women offered in response to the problem of unfamiliarity.

First, breast screening services needed to be transparent about the role of AI and its performance, benefits and risks. This was a common final message participants had for policymakers. The information we provided, and discussion, increased women's willingness to support the idea of breast screening AI, demonstrating that women can reimagine AI as a result of respectful information sharing (see Fig. 2).

The *second solution* was slow and staged implementation of AI so that screening services had time to demonstrate that AI is trustworthy.

Participant: … any new procedure you need to have that trust, whether it's AI or whether it's any a vaccine or anything, you need to have that longitudinal build-up of trust. (DG4)

Third, some hoped that women may be able to opt in or out of AI reading in breast screening: choice would enable gradual implementation and time to develop familiarity, as shown in the exchange below between one participant and the moderator.

Participant: And if they really want that person, they can go through a specialist and have them read it. That would still be an option, wouldn't it?

Moderator: … So whatever's offered in the public screening program is what people can access.

Participant: But surely they would still make that a viable option for those that were against the AI, wouldn't they?

Moderator: That's an interesting idea. So you're thinking that there should be options in the system?

Participant: I think so.

Moderator: And what makes you feel that that's so important to have options built in?

Participant: Going back to what I originally said about the older people who just have no concept of AI whatsoever or against it, are not comfortable with it, you can't just throw them in at the deep end. There's got to be some sort of leeway for them. You know what I mean? (DG6)

5.1.4. Condition four: reasons for change outweigh the costs

This condition shows how nuanced and thoughtful women were about the challenge of AI implementation. We presented a premise that AI was intended to address a shortage of radiologists. Some women were sceptical, saying it was more likely cost-cutting, or implementing AI simply because it was available. Others accepted the workforce shortages but said other solutions should be considered – such as workforce development.

Participant: … my concern mostly with AI is that people buy a package and expect it to answer every question because you've
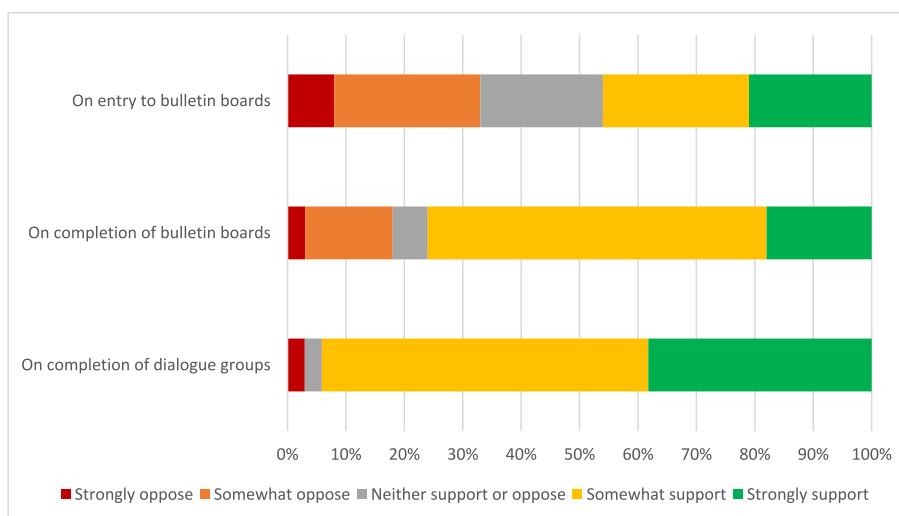

Fig. 2. Questionnaire responses: How much do you support or oppose the use of AI to read mammograms in breast screening programs.?.

invested so much in it, and then you're not factoring that different conditions, different this, different that, which may play a role in it … [AI is] just one set up, it just becomes we're so focused on that as being the answer, we don't temper either way that there could be another – could be – we have to double check ourselves always. That's an important area that you can't just play with people's lives. (DG8)

Even when women accepted AI as a viable solution to workforce shortages, they opposed job loss or automation for the sake of it: they wanted sound reasons for change. For some women, AI was only justifiable if it was necessary to keep screening services functioning, as shown in this exchange:

Participant 3: The human factors. There's no jobs for these people anymore. What kind of – I don't know. There's job shortages and things everywhere. Why do we have to cut out people just for computers? I mean, on a really real level, I hate going to [the supermarket] and having to do your own shopping. We've got things like that now. What about jobs for the young kids? Young kids work [in supermarkets] after school and stuff like that. Now we are cutting out. I don't know. That's actually human …

Participant 4: But there's also the wasting of human resources and the wasting of intelligence, it's not tapped yet. So the – just because AI may be better than humans in the future, humans could still be better than AI too. There is the potential of every human to develop beyond that. (DG6)

Participant: So I think what my concern would be that we are using AI to replace so many humans already, it's like where do we draw the line? And I think for something that is so important to us women, yeah, I think that I would probably [be] really disappointed if we did get to a stage where AI took over this area entirely … (DG2)

Women imagined numerous potential downsides of introducing AI: false positives putting pressure on health systems and burdening women with long travel times to follow-up, false negatives, automation bias, reduced participation. They also imagined numerous potential benefits: both likely (e.g. improved speed and accuracy of results, reduced pressure on workforce) and unlikely (e.g. wider target age, better access in less urban areas of Australia). Some women explicitly advocated for all benefits and losses to be evaluated, and that there should be evidence of net benefit for participants and for radiologists before introduction, as shown in the exchange below:

Participant: I think the last thing we need is to make anything worse, like in a hospital or some things like that. Of course, like somebody else said, they're already run off their feet, understaffed, time poor, and to muck around with an AI that's not completely accurate, is just going to make – slow processes down.

Moderator: Yeah. I guess you're right. If there's more recalls, then that's additional burden on the system.

Participant: Yeah, yeah. And the nurses and the doctors, who are already run off their feet …

Moderator: So there's already some women that will be called back for more tests, who actually don't have cancer, for example, like there's some level of unnecessary recalls in the system already. So am I right in thinking that you don't think we should implement AI if it makes that any worse, is that right?

Participant: Yeah. Like how scary to get a recall in the first place. But if it's going to make that worse, like, yeah, that's not good.

Moderator: Okay. Yep. And do you think that AI would need to make things better than they are now, or just the same as they are now?

Participant: Better.

Moderator: … can you tell me about that just a little bit, why would we want the AI to make things better, rather than stay the same?

Participant: Well, that's the point of technology, to move forward and make things quicker, easier for humans, more accurate, like just everything faster. (DG5)

This study demonstrates that, given brief, accessible information in a respectful way, women are willing to accept use of AI in breast screening if four key conditions are met. The data above illustrate how nuanced women's considerations are. Using AI to read mammograms in public breast screening is a significant change to a service that women value and trust [1]. Dialogue groups enabled us to witness the complexity of women's evaluations, and the importance of women's expectations and values when making these policy decisions.

6. Discussion

Research on public views on the use of HCAI is a relatively new, growing field. We summarised existing systematic reviews on views of HCAI in general, reviewed primary studies of womens' views of breast screening AI, and presented detailed analysis from a qualitative study to illustrate women's nuanced reasoning.

6.1. How can health services meet patient and public expectations about HCAI?

AI is an increasing focus in public discourse, so patients and communities will become increasingly aware of HCAI. Health services must be able to demonstrate robust governance, accountability, and consumer and community engagement *ahead* of implementation. Existing health governance processes require adaptation to address challenges raised by AI. This will require collaboration between service users, clinicians, health service managers, ethicists, regulators, developers and others.

Reviews of the literature suggest patients and communities will be open to the use of HCAI, but only under certain conditions. Health services must have good evidence of excellent technical performance, and that the benefits of HCAI use, including relevant health outcomes, outweigh the potential risks and harms. Health services must create conditions that sustain the autonomy, skills and control of clinicians and consumers, retain human capabilities (e.g. empathy, nuanced interpretation and communication), assure data quality and governance, and prevent HCAI systems from worsening bias and inequity.

6.2. How can breast screening services meet women's expectations about breast screening AI?

Women's expectations of breast screening AI mirror general public expectations of HCAI. Our review of seven primary studies provides guidance for breast screening services. Screening services should tell women that screen-reading AI is being used. Most women are likely to be open to AI use, but only under certain conditions. Strong governance and lines of accountability are critical. Screening services must ensure human oversight, skills and care are retained, that rigorous testing, monitoring and evaluation assures AI system performance, data are protected, and plans made to prevent AI-driven bias and inequity. The actions taken to achieve these goals should be communicated to women.

As in all research on public views, women in our primary study called for robust evidence of system performance, and retaining humans at the centre. Our findings also include novel recommendations for breast screening services. Breast screening services can support women to adapt to the idea of their mammograms being read by AI systems in three ways: 1) Be transparent about the role of AI and its performance, benefits and risks; 2) Use a slow and staged approach to implementation, to allow time to demonstrate AI systems are trustworthy; 3) Consider an opt out option, at least at first. We showed that small amounts of

accessible information—as simple as an online video—can help women feel more confident to engage with the idea of AI reading their mammograms, and that women have nuanced, complex views on breast screening AI. Women expect decision-makers to have equally considered and nuanced views, to explain how the benefits outweigh the downsides, and to give good reasons for implementing AI technology.

6.3. Research quality and purpose matters

This review also suggests ways forward for research on public views of HCAI. More studies of what people who are naïve to HCAI think about it, in a general sense, will not advance the field. Also, researchers should not aim to determine how to 'make people trust' HCAI. Instead, studies should give participants opportunities to learn about the detail of specific applications of HCAI, consider risks, benefits and their own values, and form considered views. There are multiple dimensions of HCAI that shape the views of patients and the public: researchers should focus on understanding which dimensions are most important, unpacking the diversity of views, and determining how these can be reflected in implementation.

7. Conclusion

Effective and high-quality research with both the general public and screening participants is critically important for the future of breast screening AI. This review offers guidance for breast screening services looking to implement AI-based systems to support mammographic screen reading. We look forward to this field continuing to grow and strengthen in quality, actively supporting women to answer questions that matter for decision-makers to shape the future of implementation.

CRediT authorship contribution statement

Stacy M. Carter: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Diana Popic:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation. **M. Luke Marinovich:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization. **Lucy Carolan:** Writing – review & editing, Project administration, Investigation. **Nehmat Houssami:** Writing – review & editing, Methodology, Funding acquisition, Conceptualization.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.breast.2024.103783.

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