# Screening participants attitudes to the introduction of AI in breast screening

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## Abstract

A shortage of radiologists is increasingly putting the UK breast cancer screening under strain. One possible partial solution is the use of Artificial Intelligence (AI) in a screening context to meet this future need. Significant strides have been made in advancing the possible use of Artificial Intelligence in breast cancer screening, mostly using retrospective studies. However, little is known about breast cancer screening population views on the use of AI in interpreting breast screening mammograms.

We conducted a survey assessing the views and attitudes of breast screening participants regarding the use of AI in breast cancer screening, by presenting them with a number of scenarios detailing the possible clinical use of AI clinically. Overall there was high levels of acceptance of AI in the assessment of breast cancer screening mammograms, particularly where there remained a human screen reader assessing images. However, in scenarios where human readers were replaced showed no overall acceptance. We assessed participants self-assessed understanding/knowledge of AI. Interestingly, increasing levels of self-assessed understanding of AI correlated with higher levels of acceptance of its use clinically.
Letter to the Editor

Screening participants’ attitudes to the introduction of artificial intelligence in breast screening

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A shortage of radiologists is increasingly putting UK breast cancer screening under strain \(^1\), and with more breast radiologists retiring than new radiologists being appointed/trained \(^2\) this burden is set to increase. One possible partial solution is the use of artificial intelligence (AI) in breast screening mammogram interpretation to meet this future need. Various groups have demonstrated the potential use of AI in retrospective studies although few have demonstrated its utility, in situ, in large prospective randomised control trials \(^3\)-\(^5\), the conventional way of demonstrating clinical and operational utility.

The next step in this technology’s evolution is to determine how best to implement it. Should AI replace all human readers, partially replace them, or operate as a reader assistant/companion? Population screening relies on the test (and its interpretation) being acceptable to those participating \(^6\). However, little is known about the views of the breast cancer screening population on the use of AI in interpreting breast screening mammograms. Data published recently from a Dutch survey of women aged 16-75 does demonstrate overall good acceptance of AI especially when used alongside human screen readers \(^7\).

In October 2020, using a standardized paper questionnaire, we sought to obtain NHS Grampian screening participants’ views on the use of AI in interpreting breast screening mammograms, with the aim of designing a prospective study agreeable to the screening population. The questionnaire was designed with help from social scientists and reviewed by University of Aberdeen ethics committee. Its execution was aided by a local charity/patient group and tested for clarity in a similar population to our sample. The complete questionnaire is available in the supplementary material and on our study website (https://icaird.com/about/public-engagement).

After describing the current UK system of dual reader screening followed by arbitration reading if required, we posed four different AI scenarios and asked participants whether they approved or objected; 364 consecutive screening participants were offered the questionnaire, and 187 (51\%) returned completed responses. Responses to the four key questions can be seen in Figure 1. We tested the differences in approval/objection for
those that expressed a preference (not neutral) using a Chi-squared approach. Participants significantly approved of the introduction of AI for three out of the four scenarios presented. These scenarios involve both AI and human readers to varying degrees. Of these three scenarios, AI as a reader companion (Scenario 4) and AI replacing one human reader (Scenario 1) met with the most approval, while AI as a triage tool (Scenario 3) met with less approval. On average, participants neither approved nor disapproved of the boldest option (Scenario 2), the complete replacement of human readers. In addition to the scenarios, we asked participants their age; perceived knowledge of AI; and if they had a family history of breast cancer. Those with greater self-assessed knowledge of AI were more likely to approve of its introduction. Family history of breast cancer showed no association with AI approval. Age had a weak positive association with approval for Scenario 3, AI as a triage tool.

The gains of each scenario are yet to be quantified; however, it is clear from these results that most of the screening population approves of (or does not object to) the introduction of AI techniques for breast screening. This approval is larger in a subsample who have some self-perceived knowledge or understanding of AI. It is our understanding that these are the first published data demonstrating the effect that perceived understanding of AI has on the likelihood of acceptance of AI within breast cancer screening mammography. However, the level of perceived understanding may be a function of other factors such as education or socioeconomic status. For this reason, the generalisability of our finding may be limited to similar populations. Taken together, the more potentially disruptive the AI scenario (i.e. less human involvement), the lower the level of approval. This is to be expected with the service and the population entering an exciting but uncertain phase, until in-situ knowledge and confidence are gained with AI tools. The more acceptable scenarios may well be stepping stones to a bolder use of AI with potentially more service gains in the future.

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also like to thank the participants and staff at the breast screening unit in NHS Grampian.

References

1. Gulland A. Staff shortages are putting UK breast cancer screening survey finds. *BMJ* 2016; 353: i2350.


Figure 1. The acceptability of different strategies for the introduction of AI into a dual reporting breast screening service.

[Figure – can be reproduced in greyscale for print issue, no color charge]
Scenario 1: AI as a partial replacement

Instead of two specialists examining your mammograms, a specialist and the AI examine your mammograms. If they disagree, a different specialist will make the final decision.

Scenario 3: AI as triage

The AI examines your mammograms – if the scan is very likely to be normal you are not invited back for further investigation. If the AI is unsure or the image appears abnormal a human specialist will also review your image.
Scenario 2: AI as a complete replacement
The AI examines your mammograms without input from specialists and decides if you are invited back for further investigation.

Scenario 4: AI as a reporting companion
All mammograms continue to be examined by specialists as is the current practice. They have access to an AI to help them make their decision.
Breast screening participants’ views on artificial intelligence for breast cancer screening

We would like to find out your views on the use of artificial intelligence for breast cancer screening.

Taking part is voluntary and your responses will be completely confidential. None of the health care professionals involved in your care will know whether or not you have responded. If you have any questions about this survey, you can contact Dr Clarisse de Vries at: telephone xxxxxxxxx, email xxxxxxxxx.

In the future, an artificial intelligence (AI) computer program could examine a person’s breast X-ray images (mammograms).

Currently, two specialists examine a person’s mammograms. They both give their opinion on whether the person should be invited back for additional exams. If they disagree with each other, a third specialist decides.

Below are a few scenarios on the use of AI in breast screening. Please circle the opinion that most closely reflects your views.

1. **Instead of two specialists examining your mammograms, a specialist and the AI examine your mammograms. If they disagree, a different specialist will make the final decision**

   | Strongly Object | Object | Neutral | Approve | Strongly Approve |

2. **The AI examines your mammograms without input from specialists and decides if you are invited back for further investigation**

   | Strongly Object | Object | Neutral | Approve | Strongly Approve |

Please turn over to complete
3. The AI examines your mammograms – if the scan is very likely to be normal you are not invited back for further investigation. If the AI is unsure or the image appears abnormal a human specialist will also review your image.

   | Strongly Object | Object | Neutral | Approve | Strongly Approve |

4. All mammograms continue to be examined by specialists as is the current practice. They have access to an AI to help them make their decision.

   | Strongly Object | Object | Neutral | Approve | Strongly Approve |

5. If the use of an AI would lead to faster screening results, would you be more likely to object to or approve of any of the above scenarios?

   | More likely to Object | No influence | More likely to Approve |

Please tell us about yourself by answering the following questions.

6. How old are you?

   | 50-54 | 55-59 | 60-64 | 65-70 | Older than 70 |

7. Do you have a family history of breast cancer?

   | Yes | No |

8. Is this your first breast screening visit?

   | Yes | No |

9. My understanding of artificial intelligence is:

   | Very Poor | Poor | Average | Good | Excellent |

Thank you very much for your time.