

A prospective study to assess the impact and benefits of an artificial intelligence system in double reading for breast cancer screening

Submission date 30/08/2023	Recruitment status No longer recruiting	<input checked="" type="checkbox"/> Prospectively registered <input type="checkbox"/> Protocol
Registration date 29/09/2023	Overall study status Completed	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
Last Edited 04/10/2023	Condition category Cancer	<input type="checkbox"/> Individual participant data <input type="checkbox"/> Record updated in last year

Plain English summary of protocol

Background and study aims

Normally, mammograms (breast X-rays) are looked at by two qualified healthcare professionals (often called 'readers'), to decide if more tests are needed. In this study, a piece of new technology using artificial intelligence (AI) software (known as 'Mia') will also look at some mammograms in the background, in addition to the two readers. The study aims to see how the AI performs when compared to readers, and the impact of introducing AI into breast screening. This will help to understand if AI might help us find more cancers and how humans may interact with AI in the real world.

Who can participate?

Breast screening participants at Leeds Teaching Hospitals aged between 49 and 70 years old who have a standard 4-view mammogram taken of sufficient quality

What does the study involve?

Half of eligible women (1 in 2) will be chosen at random to have their mammogram looked at by the AI, as well as two readers. The other half will have their mammogram looked at by two readers as normal. Breast screening appointments will go ahead as normal. Women will not need to have any extra X-rays, and women will find out their results in the usual way.

What are the possible benefits and risks of participating?

The long history of breast screening shows human readers miss a very small number of breast cancers on mammograms. It is possible a small proportion of women whose cancers may have been missed by human readers will benefit from earlier cancer detection by having AI involved. This is because AI and humans do not analyse mammograms in the same way.

Using AI to look at mammograms could mean that more women are called back for further tests. This may make participants feel anxious about having further tests, but most people who need further tests will not be diagnosed with breast cancer. In the breast screening programme,

about 4 in every 100 women are asked to come back for more tests after screening. Out of these 4 women, 1 will be found to have cancer. The rest will not have cancer and will go back to having screening invitations every three years.

Where is the study run from?

Kheiron Medical Technologies (UK)

When is the study starting and how long is it expected to run for?

April 2022 to August 2024

Who is funding the study?

NHS Accelerated Access Collaborative (AAC) National Institute for Health and Care Research (NIHR) Artificial Intelligence in Health and Care Award (UK)

Who is the main contact?

Dr Annie Ng, annie@kheironmed.com (UK)

Study website

<https://www.kheironmed.com/libra-study>

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Additional identifiers

EudraCT/CTIS number

Nil known

IRAS number

316873

ClinicalTrials.gov number

Nil known

Secondary identifying numbers

KMT014, IRAS 316873, CPMS 53675

Study information

Scientific Title

A prospective study to assess the impact and benefits of an AI system in double reading for breast cancer screening

Acronym

LIBRA: Leeds Investigation of BREast screening AI

Study objectives

This study aims to evaluate mammography intelligent assessment (Mia)'s influence on arbitration and the potential clinical benefit of Mia by involving Mia's opinion as a third independent read in arbitrated breast screening cases.

Ethics approval required

Ethics approval required

Ethics approval(s)

Approved 01/11/2022, South East Scotland Research Ethics Committee 02 (2nd Floor, Waverley Gate, 2-4 Waterloo Place, Edinburgh, EH1 3EG, United Kingdom; +44 (0)131 536 9000; ruth.fraser4@nhslothian.scot.nhs.uk), ref: 22/SS/0077

Study design

Prospective feasibility study

Primary study design

Interventional

Secondary study design

Randomised controlled trial

Study setting(s)

Medical and other records

Study type(s)

Diagnostic

Participant information sheet

Not available in web format, please use contact details to request a participant information sheet.

Health condition(s) or problem(s) studied

Breast cancer

Interventions

This is a single-site prospective feasibility study comparing double reading with Mia (AI software as a medical device) with standard double reading in a local breast screening programme. The study will evaluate Mia's influence on arbitration and the potential clinical benefit of Mia by involving Mia's opinion as a third independent read in arbitrated breast screening cases. 50% of all eligible cases will be randomly assigned to Arm A, and the other 50% to Arm B to encourage the diligent reading of all cases according to the standard of care. Approximately 6876 total screens are expected to be included in the total sample size.

An active dissent approach will be used where the sample obtained is more likely to be representative of a real-world screening population and a better evaluation of the behavioural impact and benefits that Mia may have in real-world deployments in double reading. Potential participants will have multiple opportunities to learn about the study, including thorough materials that have been designed in collaboration with PPI Advisors, and will have the option to opt out of participation.

In Arm A, Mia's outputs will be shared with the human readers as part of the arbitration process. In Arm B, Mia will not analyse cases until after the positive evidence collection period is complete and these cases will be handled in a retrospective analysis. As such, Mia's outputs for control arm cases will not be available to human readers as part of the arbitration process during the study.

The following procedures will be applied for Arm A:

1. All cases will continue to be read according to the site's routine double-reading workflow. Therefore, human Readers R1 and R2 will read all cases as normal
2. Human Readers R1 and R2 will always be blinded to Mia's opinion in the study
3. Opinions for R1, R2 and Mia on eligible cases will be compared
4. When R1, R2 and Mia all agree to not recall a case, this is taken as the final recall decision and follows the routine screening pathway. Where R1, R2 and Mia all agree to recall a case, consensus arbitration takes place. When there is a disagreement between any of the readers, where any but not all of the readers (R1, R2, or Mia) decide to call back a case, discordant arbitration takes place.
5. All cases to be arbitrated will continue to be arbitrated according to the site's local standard operating practice and will include R1, R2 and Mia opinions
6. After arbitration, the recall or no recall decision will follow the site's standard pathway.

As illustrated by the sequence of events in the intervention arm, there is no change to the participant's visit in terms of how they receive their mammogram and their general appointment. No further visits or interventions/procedures are required.

Intervention Type

Device

Pharmaceutical study type(s)

Not Applicable

Phase

Not Applicable

Drug/device/biological/vaccine name(s)

Mammography intelligent assessment (Mia)

Primary outcome measure

The absolute and relative differences in consensus between arbitration and Mia will be compared between Arm A and Arm B using readers' opinions at the end of recruitment

Secondary outcome measures

All secondary outcome measures will be measured at the end of recruitment. Measurements including consensus, discordance rate, recall rate, arbitration rate, and proportion of cases/cancers in different scenarios will use reader opinions to calculate. Measurements including cancer detection rate, sensitivity, specificity, and positive predictive value will use reader opinions and cancer follow-up information to calculate.

1. Clinical metrics including recall rate, cancer detection rate, sensitivity, specificity, and positive predictive value will be measured for each reader
2. Discordance rate between Mia and Reader 1 to quantify potential workload saving
3. Proportion of cases and cancers in different scenarios in Arm A
4. Consensus between arbitration and each reader per scenario and across all scenarios in Arm A
5. Recall rate and cancer detection rate of arbitration per scenario in Arm A
6. Potential to reduce recall rate and increase cancer detection rate in specific scenarios in Arm A
7. Measurement comparisons between Arm A and Arm B, measuring the proportion of cases and cancers in different scenarios and consensus between arbitration and each reader in different scenarios

8. Measurements and comparisons between simulated double reading in Arm A to Arm B, measuring recall rate, arbitration rate, cancer detection rate, sensitivity, specificity, and positive predictive value
9. Simulations of the 'extra reader' workflow, measuring recall rate, cancer detection rate, sensitivity, specificity, and positive predictive value, to understand potential clinical benefits

Overall study start date

08/04/2022

Completion date

31/08/2024

Eligibility

Key inclusion criteria

1. Participants routinely invited or self-referred for breast screening
2. Participants identified as female
3. Participants for whom a 2D FFDM standard four-view mammography examination was acquired

Participant type(s)

Service user

Age group

Mixed

Lower age limit

49 Years

Upper age limit

70 Years

Sex

Female

Target number of participants

1320 arbitrated cases (estimated to result in about 6876 participants)

Key exclusion criteria

1. Patients with cosmetic breast implants
2. Very high risk patients, including genetic abnormalities etc.
3. Patients who have actively dissented from participation in the study
4. Cases marked as technical recall

Date of first enrolment

31/10/2023

Date of final enrolment

29/02/2024

Locations

Countries of recruitment

England

United Kingdom

Study participating centre

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Sponsor type

Industry

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Funder(s)

Funder type

Government

Funder Name

NHS AAC NIHR AI in Health and Social Care Award

Results and Publications

Publication and dissemination plan

Planned publication in a high-impact peer-reviewed journal

Intention to publish date

31/08/2025

Individual participant data (IPD) sharing plan

The data-sharing plans for the current study are unknown and will be made available at a later date.

IPD sharing plan summary

Data sharing statement to be made available at a later date