SHORT PAPER PRESENTATIONS

AWARDED WINNER OF BEST SHORT PAPER PRESENTATION

3B.1 The effect of different combinations of open invitations and timed appointments on breast screening attendance: service evaluation of invitation strategies in the NHS breast screening programme

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Background: NHS Breast Screening Programme (BSP) invites women to breast screening via letters. Depending on the service, the initial invitation contains a timed appointment (with the option to change), or an open invitation to make an appointment. Non-attenders receive a reminder that can be 'Timed' or 'Open'. NHS England commissioned a service evaluation to help updating national guidelines by understanding the effect on screening attendance using different combinations of Open/Timed invitations and reminders.
Methods: Seven services invited eligible women using one of four combinations of open/timed invitations and reminders. The primary outcome was attendance within 90-days of first invitation. Subgroups analysis by index of multiple deprivation were carried out.
Findings: 17,965 women (mean age 58 years, IQR: 47-69 years) invited during April-October 2023 were included and followed until the 19th April 2024. Significant differences in attendance were observed between all strategies. Attendance overall increased from 49.1% using Open/Open, to 67.9% using Timed/Timed (Table 1). Attendance following Open/Timed or Timed/Open invitations fell in between these. The same pattern was observed by invitation strategy across all deprivation quintiles. Attendance amongst the most deprived increased by >20% from 41.1% (95%CI 38.2%-44.1%; open/open) to 63.3% (60.6%-66.2%; timed/timed), compared to a 15% increase from 61.4% (57.6%-65.2%) to 78.0% (74.5%-81.4%) for the least deprived.
Conclusion: Sending more timed appointment invitation letters increases attendance at breast screening. This has a larger impact on absolute attendance rates for those living in the most deprived areas, suggesting that it may also help improve health equity.

3B.2 AI tools to estimate volumetric breast density from processed 2D mammograms

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Background: Continuous measures of volumetric breast density (VBD) are of interest in breast cancer epidemiology and risk prediction since they provide quantifiable and physically relevant information. However, estimation of VBD traditionally requires unprocessed mammograms which are not widely available. In this work we train AI models to predict VBD from processed mammograms using data from the OMI-DB mammography database(1). Building on previous studies(2), a novel aspect of this work is that the models are trained on images from each of the three main manufacturers of mammography equipment in the UK, using the most up-to-date data from OMI-DB to achieve superior performance.
Methods: From OMI-DB, paired processed/unprocessed images were obtained. For each manufacturer, four AI models were trained - one for each combination of view (CC or MLO) and density measure (breast volume [BV] or fibroglandular volume [FGV]), such that VBD=FGV/BV. Ground-truth image-level BV and FGV values were obtained using Volpara (Volpara, NZ). Patient-level FGV and VBD were calculated by averaging over all available views. Model performance was evaluated on hold-out test sets via the correlation coefficient.
Results: Patient-level AI output demonstrated good agreement with ground truth values, with correlations>=0.95. AI models tended to underestimate density at high ground-truth values, possibly due to strong image processing.
Conclusions: The developed AI tools show a good agreement with ground-truth volumetric density measures, but importantly do not require access to unprocessed mammograms. These tools may be useful in future studies on breast density where unprocessed images are not available.

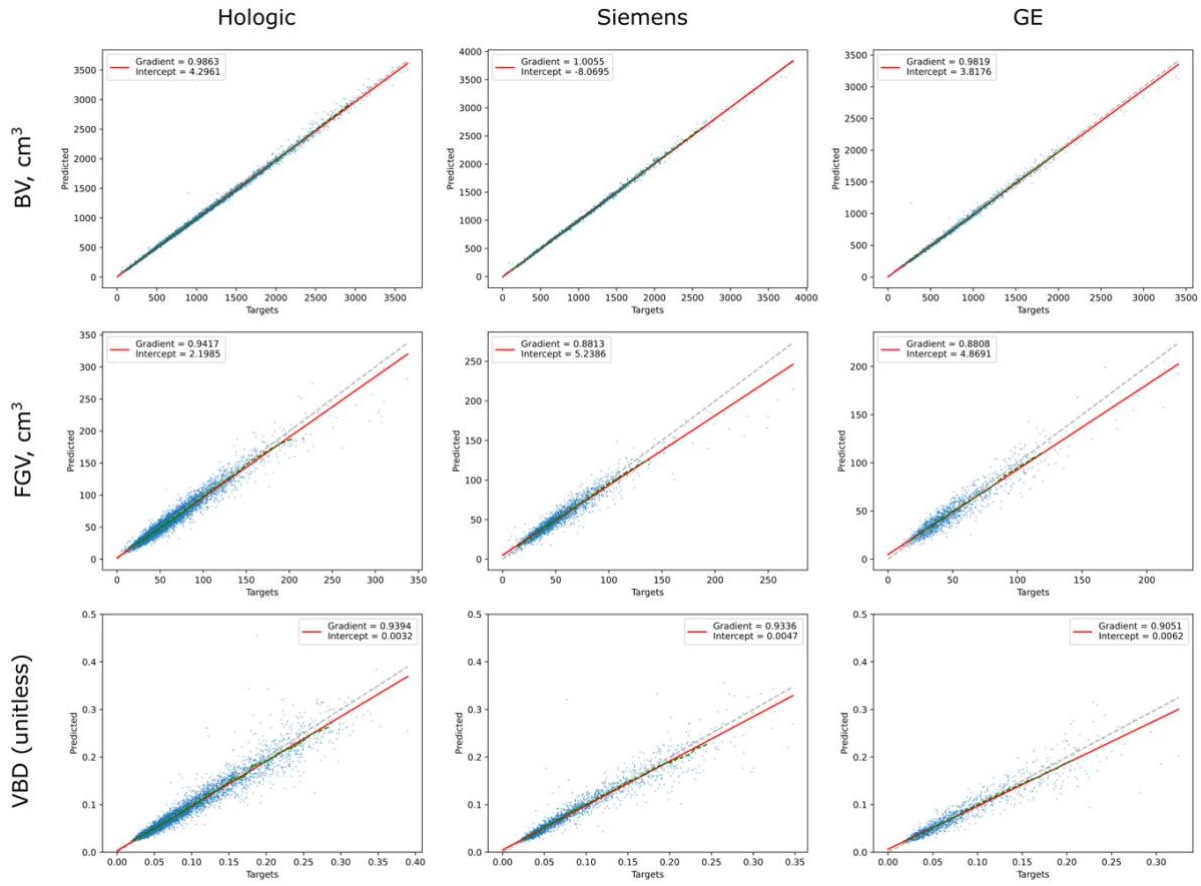

Figure 1: Patient-level AI performance for each of the volumetric measures of interest. BV = breast volume, FGV = fibroglandular volume, VBD = volumetric breast density, defined as the ratio of FGV / BV. Lines-of-best-fit are plotted in red, along with the identity line (dashed grey). Correlation coefficients, as well as fitted parameters for lines-of-best-fit are provided.

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3B.3 Supplementary breast cancer screening in women with dense breasts: Insights from European radiographers and radiologists

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Purpose: This study examines the perspectives of European clinical radiographers and radiologists on the challenges and needs associated with implementing supplementary breast cancer screening for women with dense breasts.
Method: 14 semi-structured online interviews were conducted with European breast screening specialists; 5 radiologists and 9 radiographers—from 8 countries, including the UK, Malta, Italy, the Netherlands, Greece, Finland, Denmark, and Switzerland. The interviews explored participants' professional backgrounds, demographics, and addressed 13 core questions grouped into 5 categories: Supplementary Imaging; Training; Resources and Guidelines; Implementation Challenges; and Women's Perspectives. Data was analysed using the 6 stages of reflexive thematic analysis.
Results: 6 primary themes emerged from the online interviews: (1)experiences with supplementary imaging for dense breasts, (2)training needs for radiographers and radiologists, (3)awareness of imaging guidelines for dense breasts, (4)barriers to implementing supplementary screening, (5)factors influencing successful implementation, and (6)perceptions of women regarding supplementary screening.
Conclusion: Insights from radiographers and radiologists highlighted specific challenges and potential solutions for

effective implementation of supplementary screening. Key challenges include patient-related factors and workforce limitations. Proposed solutions, such as integrating Artificial Intelligence, investing in specialised training, and enhancing resources, could help overcome these barriers. Future research and international collaboration are considered essential to optimise and implement these strategies across different healthcare settings effectively.

3B.4 Impact of mammography image quality on AI-based breast cancer risk prediction

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Introduction: Retrospective studies have suggested better discrimination by AI-driven image-based breast cancer risk models than traditional methods.[1] However, published findings indicate image-based risk scores can vary between screenings, even among disease-free patients.[2] This study aims to test the sensitivity of an existing image-based risk model to clinical image quality as a potential source of variation.
Methods: Breast cancer risk was retrospectively predicted using 4-view screening mammograms from the OPTIMAM database[3] for clients aged 47-73 using the Mirai model.[4] Only cases with repeated imaging due to breast positioning (RP) deficiencies or image blur (RB) were included. Mammogram characteristics, including breast density, compression pressure, and positioning quality, were assessed using Volpara Imaging Software (v3.4). Risk scores were compared between studies with the original 4-views and the same exams, with poor quality views replaced by repeats.
Results: The study included 1617 RP cases and 656 RB cases, with most (94%) having just 1 or 2 repeated views. The RP group's mean change in risk was not significant, but 343 cases (22.5%) showed a >10% change in 5-year risk when repeat views were used. For RB, a small mean increase in 5-year risk (0.18, $p<0.05$) was observed. Using a 1.67% 5-year risk threshold, 130 RP cases (8.5%) changed risk categorization. In the RB group, 70 cases (10.8%) changed risk category.
Conclusion: Image quality can significantly impact image-based risk scores. Guidelines and models may be best developed considering multiple studies over time to differentiate changes in scores tracking early onset disease versus image quality variations.

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3B.5 Energy consumption assessment of mammography machines: Advancing green radiology

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Background: Green radiology promotes sustainable practices to mitigate environmental impact. However, there is a lack of operational energy data for mammography machines. Understanding the carbon footprint of mammographic imaging is crucial for optimizing its use and advancing healthcare sustainability.
M&M: This study prospectively collected energy data from 169 mammogram examinations conducted with two different machines: Machine 2 (Senographe Pristina, GE Healthcare) and Machine 3 (Selenia Dimension, Hologic) over 5 days from 4th to 8th/11-2024. Wireless current transformers were connected to each machine's power supply to measure energy consumption at one-minute intervals. A comparative analysis was performed to evaluate energy efficiency between the two machines.
Results: The average daily energy consumption was 9.1 kWh for Mammo 2 and 7.6 kWh for Mammo 3. The average net energy per scan was 41 Wh for Mammo 2 and 90 Wh for Mammo 3, while the average gross energy per scan was 500 Wh for Mammo 2 and 406 Wh for Mammo 3. The average gross energy cost per scan was 14.8 pence for Mammo 2 and 10.3 pence for Mammo 3. Although Mammo 2 uses less energy per scan, its idle time consumption results in a higher overall average energy usage.
Conclusion: This study highlights significant energy consumption differences between the two mammography machines. It emphasizes the need to switch off machines during idle periods and be mindful of out of hours energy use, as mammogram machine may still consume power. Collaborating with manufacturers can optimize energy use and reduce the carbon footprint.

SHORT PAPER PRESENTATIONS

6B.1 CONTrast Enhanced breaSt Tomosynthesis (CONTEST) in patients suspected of having breast cancer: a prospective comparison with digital mammography and breast MRI

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Background and aim: Digital breast tomosynthesis (DBT) improves visibility of malignant structural features compared to digital mammography (DM). In the screening setting, the increase in cancer detection rates is 20-30% and recall rates are reduced. 1 Contrast-enhanced mammography (CEM) yields functional information on breast lesion vascularity. CEM has greater diagnostic accuracy than DM, comparable to MRI, with sensitivities over 90%2-4. This study seeks to identify any improvement in diagnostic performance of CEM combined with DBT (CE-DBT) compared to DM and MRI.
Methods: In this multi-centre, paired-comparison imaging study, female patients aged 18-70 years with clinical suspicion of breast cancer had CE-DBT and breast MRI in addition to standard care ultrasound and biopsy. Radiological findings were compared to the gold standard of histopathology.
Results: 87 participants were recruited; 80 completed the study, of whom 69 had cancer. DBT and CEM had greater sensitivity than DM when separately compared. CEM alone showed better specificity than DM, but specificity was worse for DBT. When DBT was added to CEM (=CE-DBT), specificity fell with no change in sensitivity. CEM and CE-DBT each showed higher accuracy rates than DM (table 1). MRI showed higher sensitivity than DM or DBT, but lower than CEM or CE-DBT. MRI specificity was lower than CE-DBT, both separately and in combination (table 2). Differences in accuracy were not statistically significant.
Conclusions: Consistent with published data CEM showed comparable accuracy to MRI. Adding DBT to CEM did not improve accuracy.

	Sens. (%)	Spec. (%)	PPV (%)	NPV (%)	Accuracy (%)	ANOVA
DM	88.4	81.8	96.8	52.9	87.5	
DBT	94.2	63.6	94.2	46.7	85.7	p=0.62
CEM	100.0	72.7	95.8	100.0	96.3	p=0.06
CE-DBT	100.0	63.6	94.5	100.0	95.0	p=0.11

Table 1: Diagnostic accuracy of digital mammography vs CE-DBT

	Sens. (%)	Spec. (%)	PPV (%)	NPV (%)	Accuracy (%)	ANOVA
MRI	98.5	54.6	93.1	85.7	92.4	-
DBT	94.2	63.6	94.2	46.7	85.7	p=1.00
CEM	100.0	72.7	95.8	100.0	96.3	p=0.14
CE-DBT	100.0	63.6	94.5	100.0	95.0	p=0.24

Table 2: Diagnostic accuracy of breast MRI vs CE-DBT

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SHORT PAPER PRESENTATIONS

6B.2 Breast mainstream genomics clinic and the impact on patient's surgical management - Teaching Hospital experience

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Background: Mainstreaming genomics integrates genomic testing into cancer care, allowing teams to directly order tests per the National Genomic Test Directory. The Breast Mainstream Genomics Clinic was piloted at Leeds Teaching Hospitals Trust (LTHT) in 2020 and this evaluation aims to assess the impact of genomic testing on the surgical management of breast cancer patients and unit workload.
Methods: Retrospective analysis of patients seen in the Breast Mainstream Genomics Clinic at LTHT from November 2020 to October 2023. Patient medical records were reviewed for cancer diagnosis, family history, genetic test results, treatment plans, and follow-up data.
Results: Between November'20 and October'23, 278 breast cancer patients were tested according to R208: Inherited Breast Cancer and Ovarian Cancer directive. Of these, 41 patients (18 BRCA1, 13 BRCA2, 4 PALB2, 2 ATM, 3 CHEK2, 1 RAD51D) tested positive. During this period, the testing criteria expanded to include patients diagnosed with breast cancer at age <40, increasing the number of eligible patients while maintaining a stable mutation detection rate of 15-20%. For high-risk genes (BRCA1, BRCA2, PALB2), between Nov'20–Oct'21: 100% underwent breast risk-reducing surgery (BRRS), 50% opted for bilateral salpingo-oophorectomy (BSO); Nov'21–Oct'22: 90% opted for BRRS, 40% BSO, and Nov'22–Oct'23: 39% underwent BRRS, 17% opted for BSO (some patients remain pending genetic testing/treatment).
Conclusion: Genetic testing significantly impacts surgical decisions in breast cancer care, enabling personalized treatment plans and improved patient outcomes. However, it also increases the unit's workload, creating higher demands for workforce, theatre capacity, and reconstructive options to meet the increasing demand.

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6B.3 Radiofrequency identification (RFID) tag localisation of non-palpable breast lesions: A systematic review and meta-analysis

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Introduction: Breast cancer screening has increased the detection of non-palpable breast lesions in recent years. Pre-operative localisation of these lesions has traditionally been performed by wire-guided localisation (WGL). Radiofrequency Identification (RFID) tag localisation provides a less-invasive alternative. We aim to assess the clinical utility, efficacy, and safety of RFID tag localisation compared to wire-localisation of non-palpable breast lesions.
Methods: A systematic review and meta-analysis was performed in accordance with PRISMA guidelines. Studies reporting on outcomes post-RFID tag localisation, and comparing outcomes post-RFID tag localisation and WGL were included. Positive margins and re-excision rates post-RFID tag localisation was estimated using meta-analyses of proportions. Further meta-analyses compared margin positivity and re-excision rates between RFID tag localisation and WGL. Random effects models were used for all analyses, with a P-value of <0.05 considered significant.
Results: 19 studies with 3,324 patients were qualitatively assessed. In patients who underwent RFID tag localisation, the pooled rate of positive margins was 12% (95% CI, 10-15%, P = 0.0074), and pooled re-excision rate was 13% (95% CI, 10-16), P = 0.0043), in 14 and 16 studies respectively. RFID localisation was associated with a significantly lower rate of positive margins than WGL, (OR 0.71, 95%CI, 0.54-0.95, P = 0.02). However, no difference was observed in re-excision rate, (OR 1.13, 95%CI, 0.88, 1.45, P = 0.35).
Conclusion: RFID tag localisation provides an effective alternative to WGL and may be of benefit in select patients. Randomised trials are required to better elucidate its potential benefit over WGL and other less-invasive techniques.

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SHORT PAPER PRESENTATIONS

6B.4 Mammographic predictors of cancer recurrence after breast conservation and adjuvant endocrine therapy: Initial results of the MEDICI study

Sarah Savaridas[1,12], Kulsam Ali[1], Sue Astley[3], Andrew Evans[7], Mark Halling-Brown[4], Andrea Marshall[2], Dr Sarah Vinnicombe[5], Patsy Whelehan[6], Sonya Drummond[12], Raja Ebsim[3], Nuala Healy[8], Andrew Joiner[4], Elizabeth Muscat[11], Jonathon Nash[13], Adam Perrett[3], Ashwini Sharma[9], Marianna Telesca[10], Violet Warwick[14], Janet Dunn[2]

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Background: Adjuvant endocrine therapy (AET) resistance affects many ER+ve patients1,2. Emerging evidence suggests mammographic density (MD) may represent an imaging biomarker whereby decreasing MD is associated with lower risk of recurrence and breast cancer specific death3-7. We investigate whether reduction in MD after 1 and/or 3yrs is associated with breast cancer specific survival (BCSS) or metastasis free survival (MFS).

Methods: A retrospective cohort study was generated from a Mammo-50 trial [ISRCTN48534559] subset. Participants taking AET (cases) and controls were included. MD was assessed using a 0-100% visual analogue scale (VAS), readers scoring contralateral mammograms at diagnosis, 1yr and 3yrs post-surgery. Decrease in MD was defined as a change ≥10% from baseline.

Results: VAS data from 1364 cases and 367 controls were included. Median MD was approximately 30% for cases and controls at all time-points; 20% showed decreased MD at 1yr and 21% at 3yr, with no difference between groups (table 1). Of the AET group, 23 died from breast cancer and 33 developed metastases during follow-up (median 8.7yrs post-surgery). The 5-year breast cancer specific survival (BCSS) rate was 99.6%(95%CI:97.4-99.9) vs 98.3%(95%CI:97.2-98.9) for those with vs without a ≥10% reduction in MD at 1yr, p=0.35. On 3yr MD assessment, BCSS was 99.3%(95%CI:97.2-99.8) vs 98.4%(95%CI:97.4-99.0), p=0.35.

The 5-year metastasis free survival (MFS) rate for those with a ≥10% reduction in MD at 1 yr was 94.2%(90.7-96.4) vs 93.6%(92.0-95.0) and 3yr MD assessment 92.6%(88.8-95.1) vs 94.1%(92.5-95.4); p=0.47 (1yr), p=0.13 (3yrs).

Conclusion: Reduction in MD had no significant effect on BCSS or MFS.

Table 1:

Mammographic density (MD) VAS	Hormone therapy	Control	p
Baseline			
Median (IQR)	27 (13-47)	29 (12-47)	p=0.98
≤10	267 (20%)	82 (22%)	
>10 ≤ 25	377 (28%)	83 (23%)	
>25 ≤ 50	435 (32%)	125 (34%)	
>50 ≤ 75	223 (16%)	57 (16%)	
>75	62 (4%)	20 (5%)	
Year 1			
Median (IQR)	29 (14-50)	30 (14-49)	p=0.83
≤10	250 (18%)	69 (19%)	
>10 ≤ 25	356 (26%)	82 (22%)	
>25 ≤ 50	552 (41%)	163 (45%)	
>50 ≤ 75	155 (11%)	38 (10%)	
>75	50 (4%)	15 (4%)	
Missing	1	0	
Year 3			
Median (IQR)	27 (13-48)	29 (13-46)	p=0.88
≤10	259 (19%)	75 (20%)	

>10 ≤ 25	373 (28%)	89 (24%)	
>25 ≤ 50	437 (32%)	132 (36%)	
>50 ≤ 75	235 (17%)	53 (15%)	
>75	55 (4%)	18 (5%)	
Missing	5	0	
Reduction in MD ≥ 10% at 1 year	277 (20%)	75 (20%)	p=0.46
Reduction in MD ≥ 10% at 3 years	288 (21%)	77 (21%)	p=0.73

Table 2: Breast Cancer Specific Survival

	n	No. events	% event free	% (95% CI) breast cancer specific survival at 2 years	5 years
Reduction In MD at 1 year	HR=0.56 (95% CI 0.17-1.88), p=0.35				
10% or more reduction	277	3	98.9	100 (100-100)	99.6 (97.4 -99.9)
Less than 10% reduction	1086	20	98.2	99.4 (98.8-99.8)	98.3 (97.2-98.9)
Reduction In MD at year 3	HR=0.54 (95% CI 0.16-1.83), p=0.32				
10% or more reduction	288	3	99.0	100 (100-100)	99.3 (97.2 -99.8)
Less than 10% reduction	1071	19	98.2	99.5 (98.9-99.8)	98.4 (97.4-99.0)

Table 3: Metastasis free survival

	n	No. events	% event free	% (95% CI) metastasis free specific survival at 2 years	5 years
Reduction In MD at 1 year	HR=1.19 (95% CI 0.74-1.90), p=0.47				
10% or more reduction	277	23	91.7	97.8 (95.2-99.0)	94.2 (90.7 -96.4)
Less than 10% reduction	1086	75	93.1	98.5 (97.6-99.1)	93.6 (92.0-95.0)
Reduction In MD at year 3	HR=1.41 (95% CI 0.91-2.21), p=0.13				
10% or more reduction	288	27	90.6	97.9 (95.4-99.1)	92.6 (88.8 -95.1)
Less than 10% reduction	1071	70	93.5	98.6 (97.7-99.2)	94.1 (92.5-95.4)

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