Supplemental Imaging Improves Breast Cancer Early Detection but Remains Underutilized among High-Risk Women

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Introduction

The MERIT (Mammography, Early Detection, Risk Assessment, and Imaging Technologies) cohort, launched at MD Anderson in 2017, integrates clinical, imaging, and blood biomarker data to support personalized cancer risk assessment. To date, 8,124 women have contributed imaging, clinical measures, annual questionnaires, and prospectively collected blood samples for biomarker research.

Participants undergo annual screening for at least five years, with quantitative density metrics and BI-RADS categories generated automatically, and radiology reports incorporated into the study database. Outcomes including recalls, additional imaging, biopsies, and pathology-confirmed cancers are systematically tracked.

While supplemental imaging can improve detection, current risk assessments often fail to identify who truly benefits. Risk-adapted screening strategies are needed to optimize detection and reduce unnecessary procedures.

This analysis evaluates breast cancer detection rates and staging outcomes among women undergoing annual screening mammography with or without supplemental imaging.

Methods and Materials

- Participants grouped by imaging modality: mammography (MG) alone or MG with supplemental imaging (MRI/CEM within 2 years).
- Follow-up calculated from enrollment to last breast imaging or breast cancer diagnosis.
- Cancers classified as DCIS or invasive, with clinically confirmed pathology, stage, and receptor subtype.
- 5-year breast cancer risk estimated using the Gail model, incorporating age, family history, reproductive history, prior biopsies, and atypical hyperplasia[1-2].

Results

Characteristics	Breast Cancer	Control	p-value
Participants[1]	240 (3%)	7884 (97%)	
Age at consent[2]	60 (15)	56 (17)	<0.001[a]
Age at diagnosis[2]	63 (16)	NA	
Body Mass Index[3]	27.8 (5.5)	28.7 (6.6)	0.621[a]
Age at menarche[2]	13 (1)	13 (2)	0.467[a]
Age at first parity[2]	26 (7)	27 (8)	0.902[a]
First-degree relatives with breast cancer[4]	106 (44%)	2135 (27%)	<0.001[b]
Follow-up time[2]	3 (3.6)	4 (3.9)	0.945[a]
Race[4]			0.502[b]
Asian	11 (4.5%)	534 (6.8%)	
African-American	19 (8.3%)	854 (11%)	
White, Non-Hispanic	180 (75%)	5475 (69%)	
White, Hispanic	27 (11%)	904 (11%)	
Hawaiian-American	NA	9 (0.1%)	
Other[5]	3 (1.2%)	108 (1.4%)	
Screening modality[4]			0.731[b]
Mammography (MG)	194 (80%)	6421 (81%)	
Supplemental (MRI/CEM)	46 (20%)	1463 (19%)	
Breast density[4]			0.461[b]
Dense	142 (59%)	4473 (57%)	
Not dense	98 (41%)	3411 (43%)	
Gail 5-year absolute risk[2]	1.9 (2.0)	1.5 (1.1)	<0.001[a]

Table 1. Socio-demographic and clinical characteristics of the MERIT cohort. Over 28,434 person-years of follow-up, 240 breast cancers were diagnosed. Women with cancer had a median follow-up time of 3 years compared to 4 years among women without cancer. Among 1,509 women who underwent supplemental imaging, 46 breast cancers were identified. The median Gail 5-year risk score was significantly higher in the breast cancer participants (1.9) compared to controls (1.5, p <0.001), highlighting its potential utility in distinguishing risk profiles. Additionally, age at consent and family history of breast cancer differed significantly between cancer cases and controls.

[1]Number of total participants (%), [2]Median Years (IQR), [3]Mean (SD)
[4]Number of total participants (%) within each group [5]Other is Native American or race unknown; [a]Wilcoxon rank-sum test [b]Chi-squared test

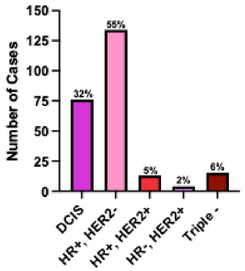


Figure 1. Distribution of Breast Cancer Subtypes. DCIS accounted for 32% of cases (MG 61, MRI 14). Among invasive cancers, HR+/HER2– was most common (55%; 116 MG, 22 MRI/CEM), followed by HR+/HER2+ (5%; 9 MG, 4 MRI/CEM), HR–/HER2+ (2%; 3 MG, 1 MRI/CEM), and triple-negative (6%; 11 MG, 3 MRI/CEM).

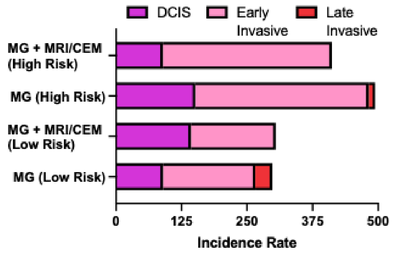


Figure 2. Incidence Rate of Breast Cancer Outcomes by Screening Modality and Gail Risk Group. Supplemental MRI/CEM screening increased detection of DCIS and early invasive cancers across both low and high risk women (DCIS: 143 vs 90 for low, 90 vs 151 for high; Early invasive: 161 vs 176 for low, 322 vs 331 for high), with no late invasive cancers observed in women receiving MRI/CEM, highlighting its potential to detect cancers earlier.

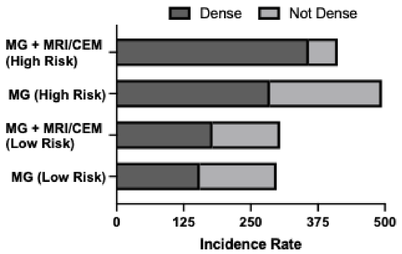


Figure 3. Incidence Rate of Breast Density by Screening Modality and Gail Risk Group. High-risk women with dense breasts had the highest incidence (286 with MG and 358 with MG+MRI/CEM), yet many continued to receive MG only screening. This pattern highlights a clear underuse of supplemental imaging in the population with the greatest observed risk.

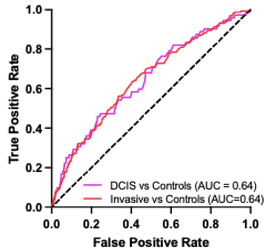


Figure 4. ROC Curves for Gail 5-year Absolute Risk Score Comparing DCIS and Invasive cases versus Controls. Gail 5-year risk score demonstrated an AUC of 0.64 for differentiating women with DCIS or invasive breast cancer from controls, highlighting its ability to capture elevated risk in both.

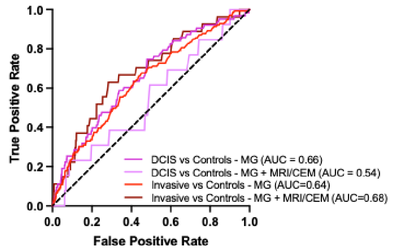


Figure 5. ROC Curves for Gail 5-year Absolute Risk Score by Screening Modality. The AUCs were 0.66 for MG-DCIS, 0.64 for MG-invasive, 0.54 for MRI/CEM-DCIS, and 0.68 for MRI/CEM-invasive, indicating modest discriminatory performance across modalities, with slightly higher accuracy for invasive cancers detected by MRI/CEM.

Conclusions

- No late-stage cancers were observed in the supplemental MRI/CEM group, compared with 11 advanced cases in the mammography-only group, highlighting a potential benefit for earlier detection.
- Supplemental imaging increased detection of DCIS and early invasive breast cancers.
- High-risk women with dense breasts, despite the highest incidence, were often screened with mammography alone, demonstrating underuse of supplemental imaging.

Discussion

These findings support the need for personalized, risk-aligned screening strategies that integrate both breast density and formal risk assessment to improve early detection of clinically significant breast cancer.

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