



The Change in Image-Derived AI-Based Risk Scores to Identify Women at an Increased Likelihood of Breast Cancer

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Introduction

Image based breast cancer risk assessment using AI algorithm has shown to outperform traditional risk models.

Hypothesis

Change in score over time is a useful metric in calculating cancer risk.

Methods

IRB-approved retrospective study analyzed change of risk scores between prior and current DBT mammogram. Sequential cohorts of 514 controls and 52 cancers were analyzed with an AI short-term risk model. The score predicts 1-year absolute breast cancer risk by extracting mammographic features, density, and age to identify women more likely to be diagnosed with breast cancer.

Logistic regression models were used to generate odds ratios (ORs) and 95% confidence intervals (CI) for breast cancer detection. The multivariable model included risk score change, prior risk score, age at prior, and years prior to current. ROC analysis assessed predictive discrimination. Sankey diagrams display risk score changes from prior to current mammogram within cohorts of cancers and controls. Sankey diagram groups were created by quartiles of the range in 1-year absolute risk at prior exam (0.0% to 1.5%) from the overall sample.

Results

AUC for multivariable model with risk score change was 0.88 (95%CI:0.82-0.94) and cancer diagnosis was approximately two times higher (OR=2.1,95%CI:1.7 to 2.5) for every 0.2 unit increase from prior to current. Univariable risk score model AUC was 0.79 (95%CI:0.72-0.87). Within Sankey diagram, 63.5% (n=33) cancers had an increased risk score of at least one quartile from prior to current. 48.7% (19/39) of cancers from the lowest two risk score quartiles (< 0.75%) at prior had an increase into the highest quartile ($\geq 1.125\%$) at current, whereas 3.1% (14/458) of controls increased from lowest two quartiles into highest.

Conclusion

Image-derived AI risk model identifies women with higher likelihood of breast cancer based on risk score change.

Synopsis

An increased likelihood of short-term cancer diagnosis based on changes in risk scores may warrant supplemental screening or clinical interventions.

Figure(s)

Patient Characteristics by Breast Cancer Cohort

Characteristic	Overall (n=566)	Cancer (n=52)	Non Cancer (n=514)
Age (yrs.) at Prior Mammogram			
Mean (SD)	53.8 (8.3)	54.6 (8.8)	53.8 (8.2)
Median [IQR]	54 [47 to 61]	55 [48 to 63]	54 [47 to 61]
Range	36 to 69	36 to 68	39 to 69
Years from Prior to Current Mammogram			
Mean (SD)	1.16 (0.18)	1.39 (0.41)	1.14 (0.12)
Median [IQR]	1.13 [1.03 to 1.24]	1.28 [1.12 to 1.53]	1.12 [1.03 to 1.23]
Range	0.65 to 2.46	0.65 to 2.46	0.89 to 1.69
Prior Risk Score (%)			
Mean (SD)	0.31 (0.34)	0.48 (0.40)	0.30 (0.33)
Median [IQR]	0.17 [0.07 to 0.41]	0.35 [0.15 to 0.73]	0.16 [0.07 to 0.39]
Range	0.00 to 1.49	0.01 to 1.42	0.00 to 1.49
Current Risk Score (%)			
Mean (SD)	0.37 (0.41)	0.98 (0.45)	0.31 (0.36)
Median [IQR]	0.17 [0.07 to 0.51]	1.21 [0.64 to 1.29]	0.14 [0.07 to 0.40]
Range	0.01 to 1.89	0.06 to 1.74	0.01 to 1.89
Risk Score Change (Current - Prior Risk)			
Mean (SD)	0.06 (0.35)	0.50 (0.47)	0.01 (0.31)
Median [IQR]	0.01 [-0.09 to 0.17]	0.45 [0.05 to 0.92]	0.00 [-0.10 to 0.11]
Range	-1.21 to 1.59	-0.17 to 1.59	-1.21 to 1.12

Abbreviations: SD = Standard Deviation, IQR = 25th to 75th percentile

Figure 1. Patient Characteristics by Breast Cancer Cohort

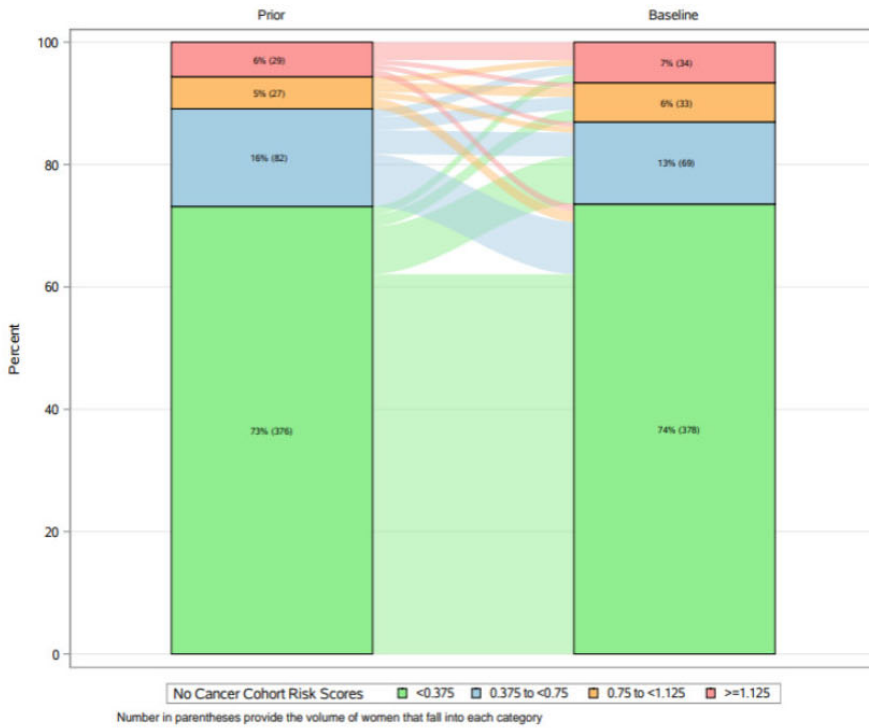
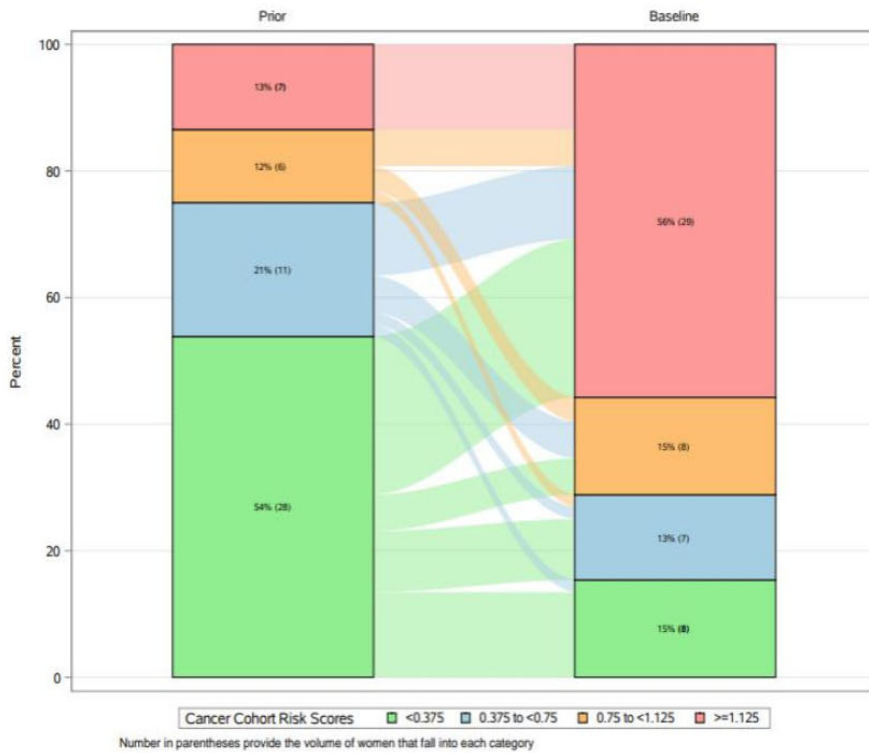


Figure 2. Sankey Diagrams for Cancer and Non Cancer Cohort Risk Scores

Keywords

Artificial Intelligence / Machine Learning; Emerging Technologies; Imaging Research