

Ability of artificial intelligence to reduce the number of interval breast cancer cases: Explorative analysis based on a decade of a Swiss mammography screening program

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BACKGROUND & RESEARCH QUESTION

Background:

- Breast cancer is a leading cause of cancer-related mortality in women globally; early detection through mammography screening programs (MSPs) significantly reduces mortality (1,2).
- Interval breast cancers (IBCs) are diagnosed between regular screenings and are typically more aggressive and associated with worse prognoses than screen-detected cancers (3).
- Artificial intelligence (AI) diagnostic software presents a promising opportunity to improve the sensitivity of breast cancer detection, potentially reducing the incidence of IBCs (4,5).

Research question:

➤ Can an AI diagnostic software potentially reduce the number of IBCs in an MSP?

PATIENTS & METHODS

Patients

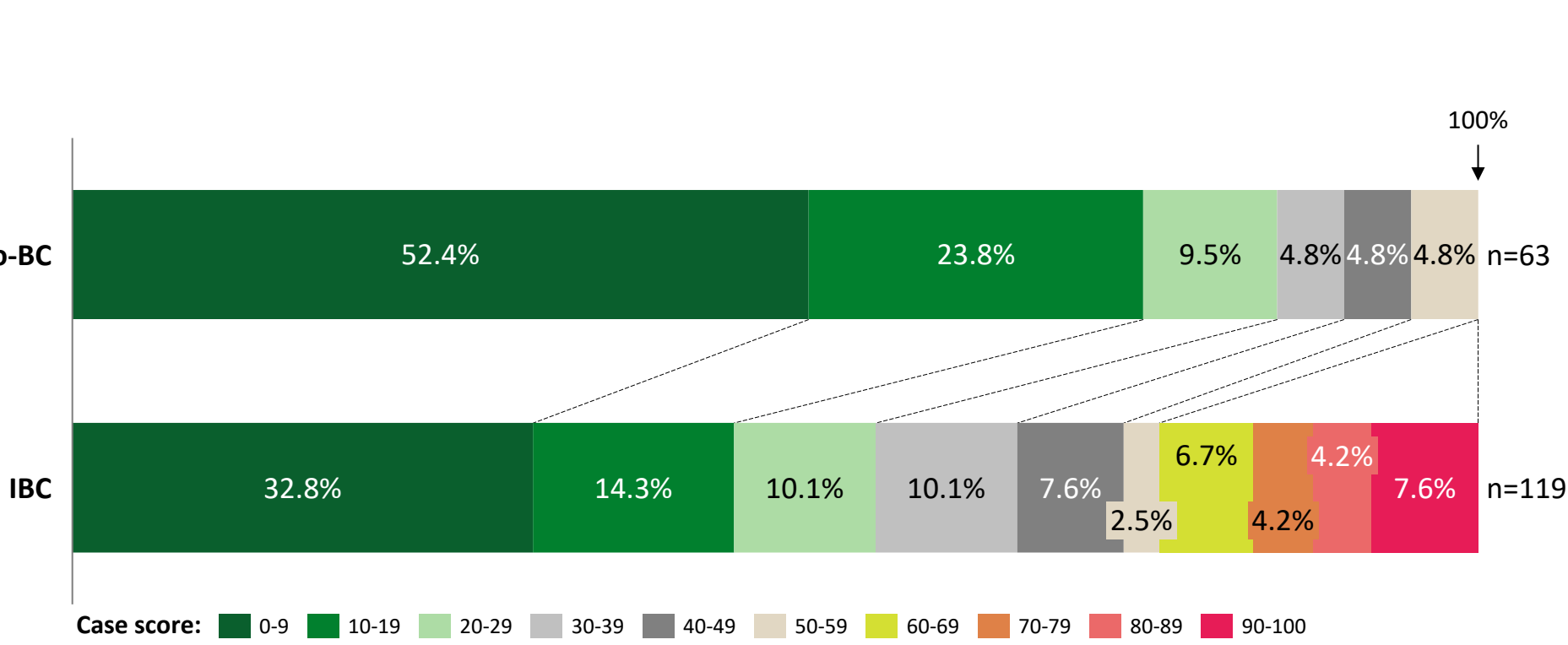
- Data from the "donna" screening program (cantons SG and GR) covering the years 2010 to 2019 and the Cancer Registry of Eastern Switzerland up to 2022 were analyzed. Women with IBC were identified among donna participants who were diagnosed outside the program within two year after the last screening mammogram.
- The anonymized dataset included the screening mammographies of 119 IBC with AI evaluations (242 initially sent but only 119 have been evaluated by the AI diagnostic software due to technical issues), and 63 no breast cancer mammograms (No-BC) which were used for comparison (90 initially sent).
- Data points were excluded from the analyses if the interval carcinoma was a lobular carcinoma in-situ (ICD-O-3: 8520/2)

Methods

- Descriptive statistics and visualizations (i.e., horizontal bar charts, scatterplot diagram, line chart).
- ProFound AI® (iCAD Inc.) is a commercially available AI diagnostic software for 2D FFDM that provides two key outputs per mammogram:
 - Case score (numeric from 0-100): Reflects the degree of confidence that the case contains a cancer compared to the training database.
 - Risk category (categorical: low, general, moderate, high; and numerical score): Reflects the risk of being detected with breast cancer within the next two years after a normal mammogram based on age, regional incidence data and numerous mammographic features.

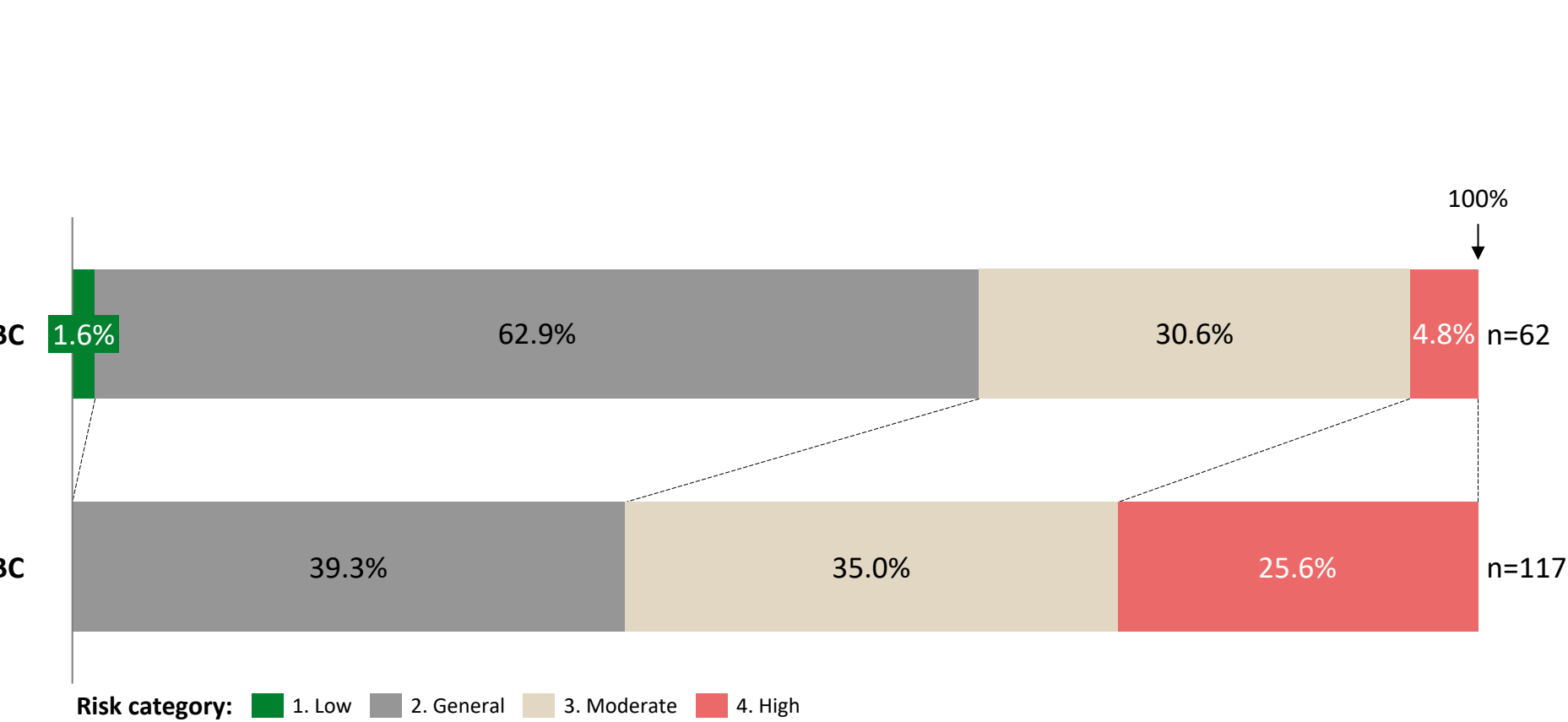
RESULTS

Case score distribution



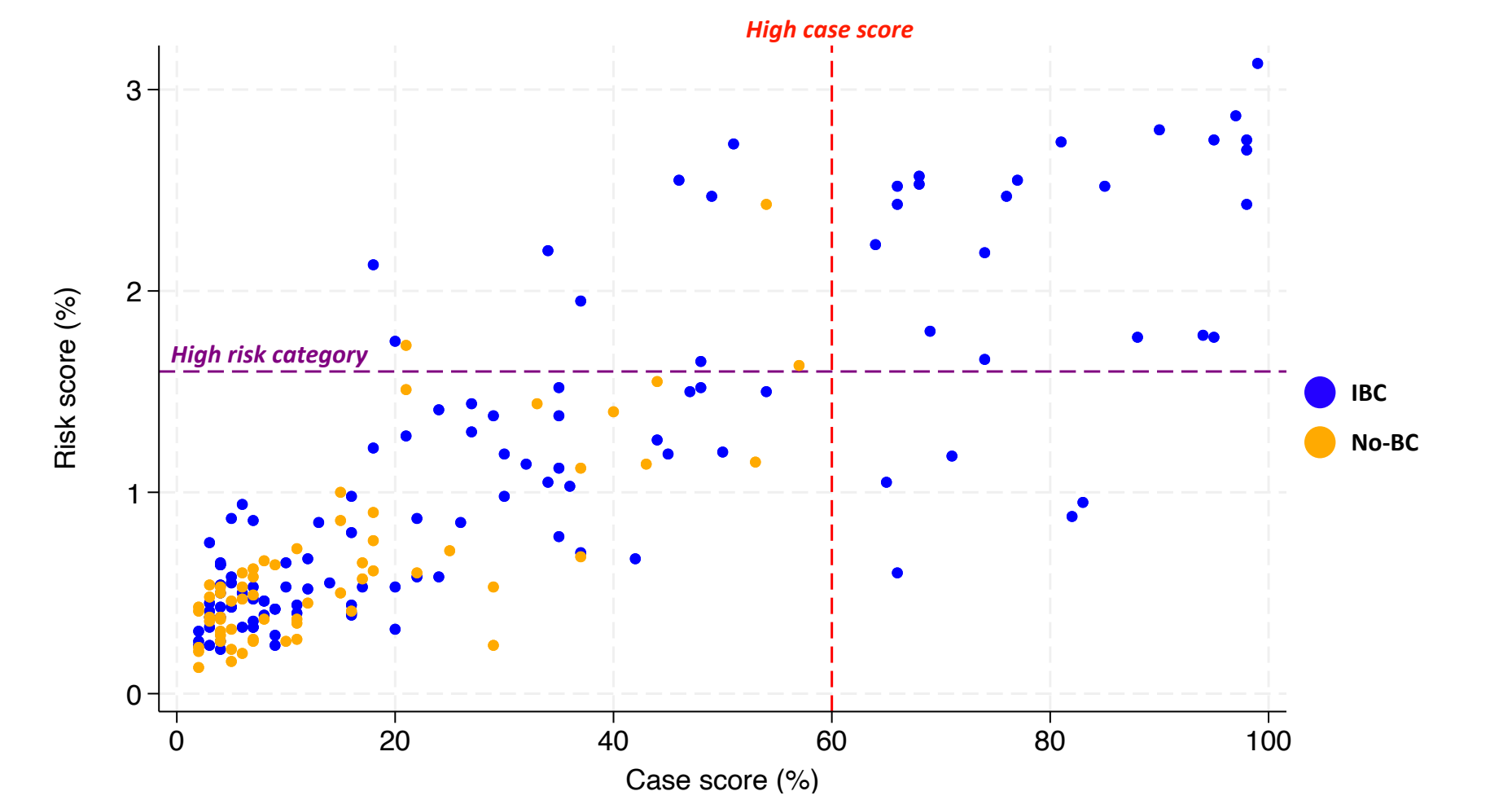
➤ IBCs with higher case scores

Risk category distribution



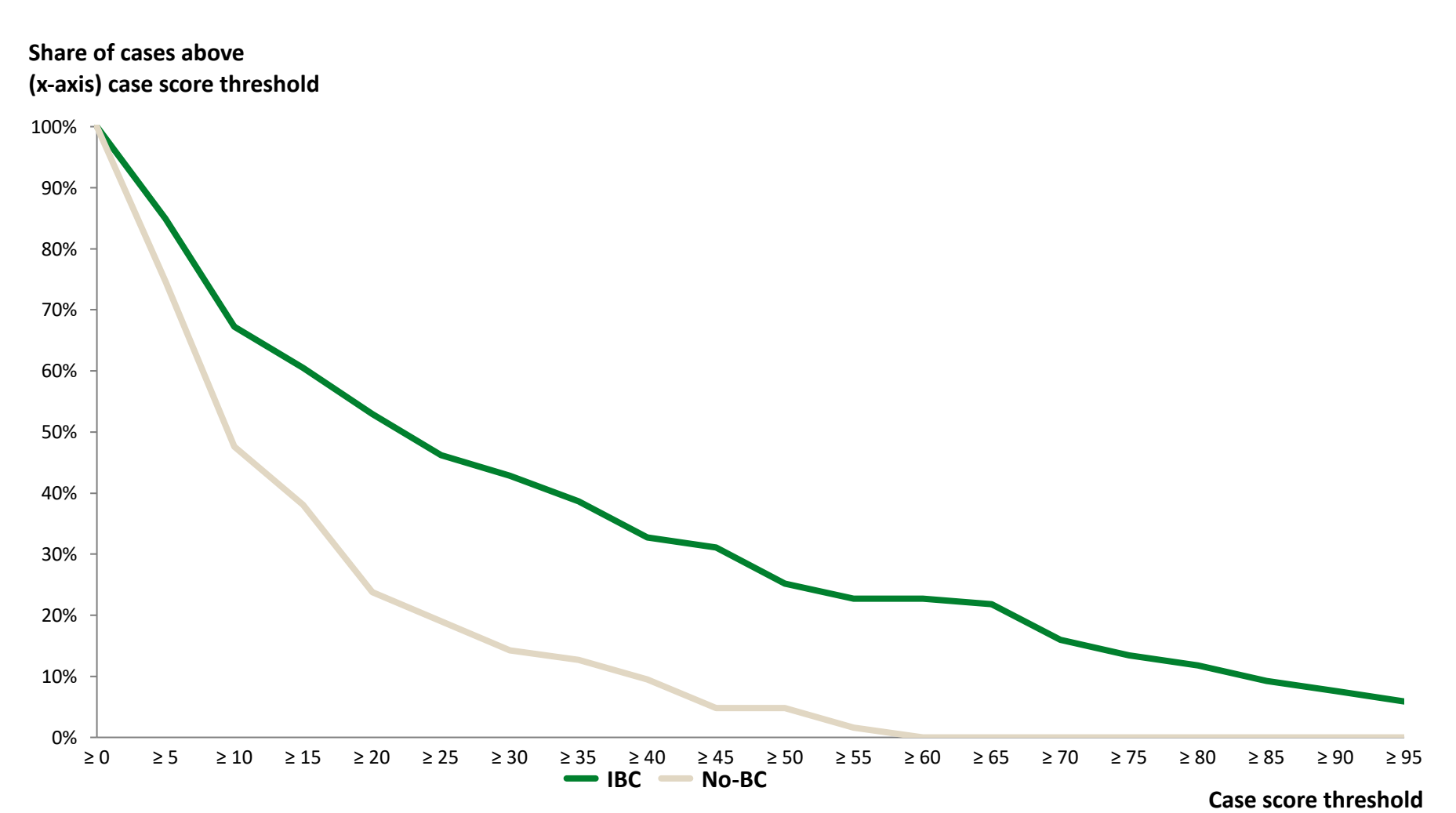
➤ IBCs with higher risk categories

Distribution along case and risk score



➤ Only IBCs with high case and risk score

Share of cases per case score threshold



➤ The higher the case score, the greater the IBC share

Potentially avoidable IBC cases

Interval breast cancer (IBC) group						No-BC group	
	N	Proportion	Consensus conferences	Further investigations	Potentially avoidable IBC with AI	N	Proportion
Overall							
All	119	100.0%	26.1%	13.4%	n.a.	63	100.0%
Case scores							
≥ 95	7	5.90%	57.10%	42.90%	3 (2.5%)	0	0.00%
≥ 90	9	7.60%	44.40%	33.30%	5 (4.2%)	0	0.00%
≥ 85	11	9.20%	36.40%	27.30%	7 (5.9%)	0	0.00%
≥ 80	14	11.80%	42.90%	28.60%	8 (6.7%)	0	0.00%
≥ 75	16	13.40%	43.80%	31.30%	9 (7.6%)	0	0.00%
≥ 70	19	16.00%	47.40%	31.60%	10 (8.4%)	0	0.00%
≥ 65	26	21.80%	57.70%	30.80%	11 (9.2%)	0	0.00%
≥ 60	27	22.70%	55.60%	29.60%	12 (10.1%)	0	0.00%
≥ 55	27	22.70%	55.60%	29.60%	12 (10.1%)	1	1.60%
≥ 50	30	25.20%	56.70%	33.30%	13 (10.9%)	3	4.80%
≥ 45	37	31.10%	51.40%	29.70%	18 (15.1%)	3	4.80%
≥ 40	39	32.80%	48.70%	28.20%	20 (16.8%)	6	9.50%
≥ 35	46	38.70%	43.50%	23.90%	26 (21.8%)	8	12.70%
≥ 30	51	42.90%	41.20%	23.50%	30 (25.2%)	9	14.30%
≥ 25	55	46.20%	41.80%	21.80%	32 (26.9%)	12	19.00%
≥ 20	63	52.90%	41.30%	22.20%	37 (31.1%)	15	23.80%
≥ 15	72	60.50%	36.10%	19.40%	46 (38.7%)	24	38.10%
≥ 10	80	67.20%	33.80%	18.80%	53 (44.5%)	30	47.60%
≥ 5	101	84.90%	29.70%	15.80%	71 (59.7%)	47	74.60%

➤ Some IBCs with high case score and no cons. conf.

DISCUSSION & CONCLUSION

- The results showed that the AI diagnostic software tended to highlight IBC cases effectively with higher case scores and risk categories compared to the No-BC mammograms. This highlights its general ability to detect abnormalities in IBC mammograms and is consistent with previous findings from other AI diagnostic tools (6,7).
- Further, the results indicate that lowering the case score threshold increases the number of IBC cases flagged for consensus conferences, but also raises the share of No-BC cases. Optimizing the threshold is critical to maximize breast cancer detection while minimizing false positives to prevent radiologist overload and unnecessary alarm for women.
- Overall, the results outline that AI diagnostic software can potentially reduce the number of IBCs in an MSP. Specifically, 10.1% of IBC received a very high case score (≥ 60) and did not get discussed during a consensus conference, while there were no false positives in the No-BC group. Next, more data including screen-detected cancers will be analyzed.

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