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Can machine learning predict cardiac risk using mammography?

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Included the paper this Editorial refers to (Ahn et al) in the list of references.

Can machine learning predict cardiac risk using mammography?

Editorial

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The main purpose of breast screening programmes is to decrease mortality from breast cancer through early detection in asymptomatic women. Mammography reduces breast cancer mortality in women aged 50–74 years with smaller reductions in women aged under 50 years.[1] The age and frequency of screening varies by country from annually from the age of 40-70 in the United States to every three years between the ages of 50-70 in the United Kingdom. Artificial intelligence algorithms have recently been developed to detect breast cancer and have been shown to be non-inferior to specialists and superior in cancer detection in combination with radiologists.[2, 3] The age range at which mammography is performed also coincides with the age range when statins might be prescribed for primary prevention if there are 1 or more cardiovascular disease (CVD) risk factors (i.e. dyslipidemia, diabetes, hypertension, or smoking) and an estimated 10-year risk of a cardiovascular event of 10% or greater.[4] Could there be a potential opportunity for opportunistic assessment of cardiovascular risk, as well as asymptomatic cancer, through novel analysis of mammographic images?

Coronary artery calcium (CAC) scoring, as an imaging marker of subclinical atherosclerosis that correlates with total coronary plaque burden, can be used as an adjunct to risk stratification.[5] Although there is uncertainty about how such non-conventional risk factors should guide statin use,[6] there is emerging guidance that supports a more flexible approach to primary prevention where a person's risk of a cardiovascular event may be underestimated.[7] In the accompanying paper (**Ahn et al, 2024**)[8] the authors train a machine learning classifier to predict CAC from routine mammograms in a Korean population. This population is distinctive in having paired CAC and mammograms which is not typically part of a national screening program but provides a valuable dataset for training such models. Here they found that analysis of mammography by their model is comparable to the Framingham risk score (FRS) but potentially better at predicting high CAC (>100). There are plausible features on mammographic images that could implicitly represent cardiovascular risk including breast alveolar calcification and oestrogen-sensitive parenchymal density.[9, 10] Although activation mapping has limitations for explainability, the findings suggest that breast density, fibroglandular patterns and vascular calcifications may influence the classification – although the distribution of reported mammographic calcifications was similar between zero and non-zero CAC groups. It is not known whether these features might change in response to lifestyle risk reduction or lipid lowering therapy.

The study has several limitations, particularly that findings from the Kangbuk Samsung Health Study, which is a longitudinal study of company employees or their relatives who underwent comprehensive annual or biennial screening at two centres, may not generalize to the populations invited for conventional national breast screening programs. Inherent bias as certain ethnicities and lower income groups did not form part of the training set may result in uncertain health inequalities. There are also challenges for training

and evaluating classifiers when there is a strong class imbalance as 90% of women had a CAC of zero. Models may be biased towards the majority class, and the precision-recall tradeoff will be important to assess in the target population. Although similar discrimination to the FRS was reported we do not know how well calibrated the proposed model is.[11] While the code has been shared, the model weights have not, so the findings are not easily reproducible as the source data are not publicly available. There also remain questions on who would take responsibility for management of patients assessed as potentially requiring risk factor review as it would not fall under the primary function of a breast screening service. The use of this algorithm in women who have only consented to breast screening may have implications for insurance risk and could affect uptake.

Although the prevalences of breast cancer and ischemic heart disease in women over 50 are falling,[12] they remain significant causes of morbidity and mortality. Dual assessment of cancer and cardiovascular risk from mammograms could be appealing if it was shown to improve overall outcomes. If AI tools become more widely available for supporting interpretation of screening mammograms this may reduce the technical barriers and costs for applying additional risk stratification algorithms. While the work by **Ahn et al[8]** shows there may be latent features in breast screening images that are predictive of cardiovascular risk, as captured by CAC, the findings are only preliminary. In common with other AI algorithms in radiology, further research on potential clinical and cost effectiveness are needed to inform decision-making on extending the role of mammographic screening beyond its intended use.[13]

Data availability

No data is contained in this work.

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Discolosures

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