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Enhancing Breast Cancer Screening Efficiency with AI

The integration of artificial intelligence into mammography screening has the potential to revolutionise breast cancer detection by improving efficiency and diagnostic accuracy. The Mammography Screening with Artificial Intelligence (MASAI) trial, a large-scale, randomised controlled study, assessed the impact of AI-supported screening compared with the conventional double-reading approach. Conducted within the Swedish national screening programme, the study evaluated AI's ability to detect cancers, its influence on false-positive rates and its impact on the workload of radiologists. The results demonstrated a notable increase in cancer detection rates while maintaining screening accuracy, highlighting AI's potential to optimise mammography screening.

Improved Cancer Detection with AI

The MASAI trial included 105,934 women who were randomly assigned to either AI-supported screening or standard double reading. The AI system used in the trial played a dual role: triaging mammograms into single or double reading based on AI-generated risk scores and providing detection support by highlighting suspicious areas on the images. The results showed that AI-assisted screening detected 29% more cancers than conventional screening, with a cancer detection rate of 6.4 per 1,000 screened participants in the AI-supported group compared with 5.0 per 1,000 in the control group. This increase was primarily due to a higher detection of small, lymph-node-negative invasive cancers, which are considered more treatable and associated with better patient outcomes.

The AI-supported screening also detected 51% more in situ cancers compared with the standard approach. Importantly, the increase was mainly in high-grade in situ cancers rather than low-grade cases, which are more likely to progress to invasive disease. There was no significant increase in the detection of low-grade in situ cancers, which are often considered to contribute to overdiagnosis and unnecessary treatment. This suggests that AI contributes to detecting clinically relevant cancers without a disproportionate increase in less aggressive cases.

Efficiency Gains and Reduced Radiologist Workload

A key advantage of AI-assisted screening in the MASAI trial was the significant reduction in radiologists' workload. The AI system was designed to categorise mammograms based on risk scores, allowing low- and intermediate-risk cases to undergo single reading while prioritising high-risk cases for double reading. This triaging approach resulted in a 44.2% reduction in the total number of screen readings compared with the standard method, which requires double reading for all cases.

Despite the workload reduction, the AI-supported approach maintained accuracy, with no substantial increase in recall rates or false positives. While the recall rate was slightly higher in the AI group (2.1% compared with 1.9% in the control group), the difference was not statistically significant. Similarly, the false-positive rate remained nearly identical between the two groups, ensuring that AI did not lead to an unnecessary increase in recalls that could cause anxiety for patients. Additionally, the AI-supported screening demonstrated a 19% improvement in the positive predictive value (PPV) of recalls, meaning that recalled cases were more likely to result in a confirmed cancer diagnosis. This suggests that AI can enhance diagnostic efficiency while reducing the burden on radiologists.

Clinical Relevance and Future Considerations

Beyond improving efficiency, the MASAI trial demonstrated AI's ability to detect cancers that are clinically significant. AI-supported screening was particularly effective in identifying aggressive subtypes of breast cancer, including triple-negative and HER2-positive cancers, which often have poorer prognoses. Detecting these cancers at an earlier stage could lead to better treatment outcomes and potentially lower mortality rates. Moreover, AI was able to identify a greater number of invasive cancers while keeping the detection of indolent or low-grade in situ cancers stable, which may help mitigate concerns about overdiagnosis.

The findings also highlight the importance of how AI is integrated into screening workflows. The MASAI trial used AI as a decision-support tool rather than a standalone diagnostic system, allowing radiologists to make final decisions while benefiting from AI-generated risk scores and image markings. This approach helped ensure that the AI system's strengths were maximised while maintaining human oversight to prevent unnecessary recalls or missed diagnoses.

While the study's results are promising, further research is needed to evaluate AI's long-term impact on patient outcomes. The primary endpoint of the MASAI trial—the interval cancer rate—will be assessed after a two-year follow-up period, providing additional insights into whether AI contributes to a reduction in cancers detected between screening rounds. Additionally, the cost-effectiveness of AI integration remains a key consideration, as the financial benefits of reduced radiologist workload must be weighed against the costs associated with AI implementation.

The MASAI trial provides strong evidence that AI can enhance breast cancer screening by increasing cancer detection rates, improving efficiency and reducing radiologists' workload without compromising accuracy. AI-supported screening demonstrated a significant increase in the detection of clinically relevant breast cancers, including aggressive subtypes, while maintaining a stable false-positive rate. The reduction in screen-reading workload further highlights AI's potential to optimise mammography screening processes and alleviate pressure on radiologists.

Further studies will be crucial to refining its integration into screening programmes and evaluating its long-term impact on patient outcomes. The MASAI trial represents a significant step forward in understanding AI's role in breast cancer detection and underscores its potential to improve early diagnosis, enhance healthcare efficiency and ultimately contribute to better treatment outcomes for patients.

Source: The Lancet

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