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Transforming Breast Density Measurement with Artificial Intelligence: Population-Level Insights from BreastScreen NSW

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Abstract : Introduction: Breast density is a risk factor for breast cancer, both due to increased fibro glandular tissue that can harbor malignancy and the masking of lesions on mammography. Therefore, evaluation of breast density measurement is useful for risk stratification on an individual and population level. This study investigates the performance of Lunit INSIGHT MMG for automated breast density measurement. We analyze the reliability of Lunit compared to breast radiologists, explore density variations across the BreastScreen NSW population, and examine the impact of breast implants on density measurements. Methods: 15,518 mammograms were utilized for a comparative analysis of intra- and inter-reader reliability between Lunit INSIGHT MMG and breast radiologists. Subsequently, Lunit was used to evaluate 624,113 mammograms for investigation of density variations according to age and birth country, providing insights into diverse population subgroups. Finally, we compared breast density in 4,047 clients with implants to clients without implants, controlling for age and birth country. Results: Inter-reader variability between Lunit and Breast Radiologists weighted kappa coefficient was 0.72 (95%CI 0.71-0.73). Highest breast densities were seen in women with a North-East Asia background, whilst those of Aboriginal background had the lowest density. Across all backgrounds, density was demonstrated to reduce with age, though at different rates according to country of birth. Clients with implants had higher density relative to the age-matched no-implant strata. Conclusion: Lunit INSIGHT MMG demonstrates reasonable inter- and intra-observer reliability for automated breast density measurement. The scale of this study is significantly larger than any previous study assessing breast density due to the ability to process large volumes of data using AI. As a result, it provides valuable insights into population-level density variations. Our findings highlight the influence of age, birth country, and breast implants on density, emphasizing the need for personalized risk assessment and screening approaches. The large-scale and diverse nature of this study enhances the generalisability of our results, offering valuable information for breast cancer screening programs internationally.

Keywords : breast cancer, screening, breast density, artificial intelligence, mammography
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