



## Can Australian radiographers assess screening mammograms accurately? First stage results from a four year prospective study



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### ABSTRACT

**Introduction:** Globally, the role of the radiographer is changing; some countries have developed advanced roles with specific scopes of practice. Other countries, like Australia, are in the process of this change. The aim of this research is to assess the diagnostic outcomes reported by the radiographers and compare them to those reported by current screen readers.

**Method:** Six experienced radiographers were invited to participate in a prospective study conducted between 2010 and 2011. They were required to read 2000 mammograms each. Their results were compared with those of the radiologists. Statistical analysis of the results included overall cancer detection rates, recall rates, levels of agreement, kappa, sensitivity, specificity, accuracy, positive predictive value and negative predictive value.

**Results:** A total of 9348 women were included in the study. The percentage of cancers detected by the radiographers ranged from 53% to 100% of the cancers detected by the radiologists. Radiologist recall rate ranged between 3.4% and 5.5% and the radiographers' range was 2.9%–9.8%. Level of agreement of the radiographers with the radiologists ranged from 90 to 96%.

**Conclusion:** The potential for accuracy in screen reading by Australian radiographers is supported by the results of this study. Implementation of formal training is likely to result in an increase in the diagnostic accuracy of radiographers.

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### Introduction

Breast cancer is the most common cancer in women; incidence is increasing due to increased life expectancy and increasing urbanization.<sup>1</sup> In developing countries, the majority of breast cancer is diagnosed at a late stage, whereas in more affluent countries breast cancers tend to be detected much earlier.<sup>2</sup> This early detection is largely due to mass breast screening programs, which, together with improved treatment, is the cornerstone of improved breast cancer outcome and survival.<sup>2</sup>

World-wide studies of the effectiveness of mammography screening have proven to reduce breast cancer mortality by around 20% in screened versus unscreened women across all eligible age

groups; this figure rises to 28% within the target age group of 50–74 years.<sup>3,4</sup> Breast screening programs are complex and resource intensive; the equipment is expensive and specialist staff is required, including radiologists, surgeons, pathologists, radiographers, sonographers, data managers and administration officers.

The core task of a breast screening program is mammographic imaging and assessment. Images need to be high quality, using the most up-to-date equipment available, to enable the early detection of cancers. Radiographers produce the mammograms and assessment of those mammograms is usually performed by radiologists. If an abnormality is detected by the radiologists, that woman will be recalled for further investigation. Breast screening programs aim to maximise the number of cancers detected (sensitivity), while minimising the number of women called back (recall rate). The National Australian Standards (NAS) of BreastScreen Australia (BSA) recommends less than 10% recall rate for initial screens with this reducing to 3–5% for subsequent screens.<sup>5</sup>

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The work of the radiographer is highly repetitive and involves high volume of patient throughput, necessary to support the aims of the screening program. This repetition has both advantages and disadvantages; the obvious disadvantages relate to potential for repetitive strain injuries,<sup>6,7</sup> and the possibility of dissatisfaction with the constancy of tasks which in turn may make retention of staff more difficult.<sup>8</sup> An arguable benefit of constant repetition relates to mammographic critique; radiographers who undertake this work become very familiar with the radiographic presentation of normal breast tissue as this represents the vast majority of mammograms.

Globally, the role of the radiographer is evolving and expanding. This has been in response to a shortage of radiologist reporting and procedural services and also due to experienced radiographers seeking advanced practice roles to further utilise their knowledge. Countries such as USA, UK and other European countries have developed advanced practice roles with specific scopes of practice including mammography.<sup>9–12</sup> Advanced practitioner status in breast imaging in these countries has been established for many years, where trials and research resulted in implementation of roles for screen reading radiographers. In the UK, the highest level in their 'four tier system' are the Consultant Radiographers, who are specialists in their own field, and have the autonomy to undertake procedures and tasks such as screen-reading mammograms; the introduction of Consultant Radiographers demonstrated decreased patient waiting times and continuity of breast services.<sup>13,14</sup> Research into the capabilities of Australian radiographers is relatively new, though there have been some positive preliminary results.<sup>15–20</sup> Australian authors Holt and Pollard,<sup>18</sup> Debono et al.<sup>20</sup> and Moran and Warren-Forward<sup>15,17</sup> have conducted retrospective studies which all demonstrated performance results equivalent to those in other countries. Participant numbers in those studies were small (9–12) and the numbers of mammograms ranged from 50 to 500; the results were similar, showing potential for radiographers to differentiate between normal and abnormal mammograms. This prospective study challenges 6 radiographer participants with a more realistic setting; a large number of mammograms (2000 each) without any bias by the researchers from pre-selected cases.

This paper presents the first stage results from a prospective study conducted between September 2010 and July 2013 investigating the abilities of six BreastScreen radiographers in assessing screening mammograms. The second stage results will discuss the subsequent biennial rescreen outcomes.

The aim of this research was to investigate whether Australian radiographers are able to achieve/maintain equivalent accuracy and recall rates as radiologists while prospectively assessing mammograms.

## Method

Ethics approval was provided by both the University of Newcastle and Hunter New England Area Health (HREC H-352-1206).

The NAS states that each mammogram is required to be "read and reported independently by two or more readers, at least one of whom shall be a radiologist."<sup>5</sup> If both readers recall a case then the woman is recalled; if only one reader recalls a case then the decision to recall is made by reader discussion (consensus) or more usually by a third reader (arbitration). Mammograms are double read with either consensus or arbitration for discordant cases. For the purposes of this paper, the reference standard referred to is defined as the combination outcome of the original readers. The radiographers' results were compared to this reference standard to assess performance criteria.

## Participants

Six experienced radiographers from one BSNW centre were invited to participate in a prospective study. The radiographers were aged between 45 and 65 years and had worked in mammography for a minimum 10 years. Five of these radiographers had previously participated in retrospective studies conducted by the authors, with accuracy rates of 63%–80%.<sup>15,17</sup> As a result of these performances they were selected to be invited to participate in the prospective study. The additional radiographer was the first author, who had been unable to participate in the retrospective studies due to being involved in selecting those images. An in-house training package on image assessment had been made available to the radiographers between the pilot and full retrospective study; no formal training was provided.<sup>19</sup>

BSA uses a synoptic breast imaging reporting system, which recommends that every reported lesion is classified (1–5) in the following way<sup>21</sup>:

1. No significant abnormality
2. Benign findings
3. Indeterminate/equivocal findings (requires further investigation)
4. Suspicious findings of malignancy (requires further investigation, including needle biopsy)
5. Malignant findings (requires further investigation, even if needle biopsy sampling is benign)

The radiographers assessing mammograms in this study were required to firstly make a decision to either 'recall' or 'rescreen'; if it was a recall, they completed a form (created by the authors) for each recalled woman, noting the side, site and type of lesion; they also reported whether they considered the recall to be 'equivocal, suspicious or malignant'. All 'suspicious or malignant' recalls by radiographers that had not been recalled by the radiologists were later reviewed by a senior radiologist. All reads were independent; neither the radiographers nor radiologists were aware of anyone else's results.

As part of this study, the radiographers were required to read 2000 mammograms each, as this number is the annual minimum required for radiologists in BSA as detailed in Appendix P of the NAS.<sup>5</sup> The assessments needed to be conducted outside working hours, to gain access to the equipment; there were 3 reading bays available at different times, using a Sectra digital Picture Archiving System (PACS) with 10 megapixel Barco monitors. This equipment was in the normal screen reading area used by the radiologists, with appropriate lighting and viewing conditions. The radiographers read mammograms that were available at the time they chose to read. Prior images were digitised and available for comparison.

## Resources

The Breast Information System (BIS) provides a program for "trainee radiologist readers". The radiographers accessed this feature and were identified as trainee readers T1 to T6. The BIS reporting system allows for different result options;

- **Return to Routine Re-screen:** When no further imaging is required and the woman is invited back for a re-screen in 2 years. Often simply referred to as a Rescreen.
- **Recall to Assessment:** When the woman is recalled for further investigation and both a reason for the recall (Table 1) and site of lesion is recorded. Often simply referred to as a Recall.

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