



The diagnostic accuracy of radiographers assessing screening mammograms: A systematic review



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ABSTRACT

This systematic review aims to evaluate the literature on the performance of radiographers in assessment of screening mammograms compared with radiologists. Measurable performance criteria were essential as well as a gold standard with which to compare both performance, and outcomes by means of biopsy reports or consequent negative screenings. The level of training of the radiographers in mammogram assessment was also documented. The majority of the literature demonstrated that the performance statistics of radiographers are equivalent to that of radiologist readers. Although formal training of radiographers demonstrates improved sensitivity, results of all performance data suggest no statistical difference at the 95% level between trained or untrained radiographers and radiologists.

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Introduction

Breast cancer is the top cancer in women both in the developed and the developing world.¹ It is estimated that worldwide over 508,000 women died in 2011 due to breast cancer. Incidence rates vary greatly worldwide from 19.3 per 100,000 women in Eastern Africa to 89.7 per 100,000 women in Western Europe (all ages); incidence is rising due to increased life expectancy, more urbanization and adoption of western lifestyles.¹ Survival rates vary from more than 80% in North America, Sweden and Japan to below 40% in low socio-economic countries. Low survival rates in less developed countries can be explained by a lack of early detection programs, which results in women presenting with late-stage disease, as well as a lack of treatment facilities.²

There is no clear answer as to the cause of breast cancer and currently no means for preventing the disease; modifiable risk factors include a healthy diet, sufficient physical activity and control of weight and alcohol intake.³ Clinical diagnostic mammography is utilised in cases where symptoms are present, and usually requires a radiologist to be present to diagnose the images

immediately; often other tests are undertaken on the same day to reach a diagnosis. Mass breast screening programs are aimed at detecting asymptomatic breast cancer in a targeted age-related female population; large numbers of women are screened with mammography and their images are assessed for any abnormalities, which may necessitate those women to return to the screening centre for further tests. Detection of unsuspected breast cancer has proved effective, allowing for early intervention and treatment. Mammography screening is very costly and is feasible (and cost-effective) only in countries with good health infrastructure that can afford a long-term population-based screening program.¹

The risk of breast cancer has been found to increase with age, and screening mammography is known to be effective in reducing breast cancer deaths in women over 50 years of age. Screening mammography is less accurate in younger women because their breast tissue is often denser than in older women and cancer detection is likely to be less accurate³; however this is changing due to the introduction of digital mammography.⁴

Breast cancer is the most common cancer in Australian women, with the incidence of invasive breast cancer remaining fairly steady over the last decade at approximately 280 per 100,000 women between 50 and 69 years old; incidence of ductal carcinoma in situ (DCIS) is approximately 45 per 100,000.⁵ Mortality from breast cancer in Australia has decreased in that same age

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group from 68 per 100,000 women in 1991 (when BreastScreen Australia (BSA) commenced) to 44 per 100,000 women in 2011. The BSA program utilises the skills of radiologists to assess the mammogram films, which are required to be read by at least two different readers.⁶

In 2011–2012, more than 1.4 million women in the (then) target age group of 50–69 had a screening mammogram with BSA. In 2015 the target age was extended to age 74, and although participation in BSA has been fairly constant at approximately 55%, it is estimated that the actual numbers of women will increase by at least 20% by 2020.⁶ The number of radiologists is not increasing sufficiently to keep up with population growth, ageing population and extra workload. Fewer radiologists are choosing to specialise in the area of breast cancer screening due to the high risk of litigation, and perceptions that it is an uninteresting field, too stressful, and is not as lucrative as other specialties.⁷

Assessment of mammograms is a highly specialized area; the detection of abnormalities on breast images is difficult because of the subtlety of changes in breast tissue. Screening programs utilise qualified radiographers to produce high quality mammograms every day. Some have many years of experience of critiquing images, and may be proficient at detecting abnormalities. Making use of some of the experienced radiographers in this specialty, to be trained to interpret screening mammograms makes sense.

Radiographer reporting has been undertaken in other countries for close to three decades. Van den Biggelaar et al. published a systematic review in 2007 of six studies conducted in the U.K and U.S.A, between 1987 and 1996; all these studies indicated that reading by radiographers could help to increase cancer detection.⁸ That systematic review is now nearly 10 years old; since its publication, there have been other authors in other countries reporting on this issue and technological changes within breast screening, which include digital mammograms and image assessment on Picture Archive and Communication Systems (PACS), warranting (the authors believe) a new systematic review of literature on this topic.

Surveys undertaken by Price and Masurier^{9,10} highlighted changes in the scope of practice for radiographers working in the National Health Service (NHS) across the United Kingdom; there are currently many radiographers performing tasks that historically have been solely the domain of radiologists. The NHS Breast Screen Program implemented New Ways of Working (NWoW) in December 2003; two of the aims of this model were to “create new roles based on skills and experience rather than profession” and “to improve recruitment and retention of staff”.¹¹

Any change or progression in a profession is driven by many different factors; formal education, professional recognition, skill shortages, the need for service improvements and economics to name a few. Globally, the role of the radiographer is changing, as a result of necessity where there has been a shortage of services and also due to experienced radiographers wanting to rise above their usual scope of practice and to be able to utilise their knowledge within their chosen profession.¹²

It is hoped that radiographer reporting within the BreastScreen setting, as the focus of this review paper, will be introduced within Australia in order to both safeguard against any future radiologist shortage and to encourage recruitment and retention of skilled mammography radiographers. The authors are reviewing radiographer contributions to reporting practices in other countries; how the radiographers perform in comparison to the gold standard, how extra training impacts on their performance, what methods and conditions are utilised. A summary of the global evidence of radiographer capabilities in the art of image interpretation may provide evidence for the way forward for Australian radiographers.

Review question/objective

The primary objective of this review was to summarise and synthesise evidence to answer the question: “Can radiographers assess screening mammograms as accurately as radiologists?”

Specifically, the objectives are to compare the sensitivity, specificity, and diagnostic accuracy of radiographers with the current ‘gold standard’ or best practice performance measures.

A secondary question arose as the study commenced: “What impact does training have on the performance of radiographers in mammogram image interpretation?”

Methodology

Types of participants

This review examines only studies that include radiographer participants, with or without specific training in image interpretation. Radiologists provide the gold standard (best practice) used by the authors to compare performance measures.

Types of studies

All papers were required to be original research studies of quality of performance assessments in the screening setting.

Search strategy

The search strategy aimed to find published studies. The databases searched included Medline (Ovid SP), EMBASE, Scopus, Cinahl and the Cochrane Library. Key words used in the searches were modified as required for each database and derivatives of all words were used. The terms used included: mammography, mammo*, breast screen, breast x-ray, mass screen, radiologic technologist, radiographer, radiog*, radiologist, radiol*, medical radiation scientist, radiology personnel, sensitivity and specificity, image interpretation, image assessment, diagnostic accuracy, gold standard, performance, clinical competence, predictive value. The reference list of all identified reports and articles were searched for additional studies.

Inclusion criteria

Quantitative studies that examine the diagnostic outcomes of radiographers were included for consideration. The review reports measurable results on all or some of the following: sensitivity, specificity, accuracy, PPV, recall rate of radiographers and the gold standard. Only studies published in English were considered for inclusion. Studies published from 1980 were considered for inclusion in this review, as radiographer reporting services were introduced in the UK during that decade.¹³

Exclusion criteria

Conference abstracts, case studies, editorial comments, systematic reviews and narrative reviews were all excluded from this review. The review of the database searches excluded further studies, due to non-relevant results (eg effect of CAD on readers’ results¹⁴) or an outcome of no interest in this review (eg cost effects of additional double reading by radiographers¹⁵).

Study and data selection

The papers resulting from the literature search were independently assessed by two reviewers, who considered the title, abstract and keywords before making a decision about the suitability of that study. If a decision could not be reached using those criteria, the full text was reviewed.

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