Susan Williams

CoRIPS Research Grant 147

£5000 awarded

Title: Breast Screen Reader Assessment Strategy (BREAST): UK Collaboration

Principle Aim

The principal aim of the study is to evaluate the performance of mammographer film readers looking for breast cancer on standard mammography images.

Primary research question

Are error types consistent across UK film reading mammographers when diagnosing breast cancer?

Secondary research questions

- Is performance of UK radiography film readers comparable with international practitioners?
- Is performance variation among UK mammographers comparable?

Outcomes

- Accuracy (sensitivity, specificity,) of mammographers
- Error reduction techniques, including suggesting best fit reader 'pairs' for double reading to minimise errors

Theme 1: Reducing missed cancers through error detection

Theme 2: Error correction

Theme 3: Population assessment

Review of literature and identification of current gap in knowledge

Mammography film reading is well established and integrated into breast care teams, and studies have shown that there is a place for this within the breast screening programme[3,4]. There is less evidence examining radiographer mammography reading, and fewer have directly compared radiographer and radiologist reading over the same test set.

Through Breast Screen Reader Assessment Strategy (BREAST), a world-first infrastructure that uses the latest technological innovations; over the last 4-5 years through local and international experts, reasons for mis-diagnoses have been identified and have presented exciting translational solutions.

To date the work has been shown to improve radiologists' performance by a mean value of 34%, an improvement unparalleled by any other innovation in recent years. This unprecedented success has led to engagement by 80% of breast-reading clinicians across all states in Australia and research agreements with

world-leading imaging scientists across Australia, North and South America, Asia and Europe. It is proposed that this study will utilise BREAST to gather evidence of this technology being directly translatable to film reading mammographers and will show evidence of similar performance and improvements. With regard to recording reader performances and errors, previous efforts have tried to achieve these using manual systems, such as PERFORMS in the UK, which has been in existence for over a decade and continues to run[5]. BREAST's advantage is that it enables readers to access the system via the internet and once the case sets are completed, all readings are instantly analysed. The participants are immediately presented with performance values including receiver operating characteristics (ROC & JAFROC), sensitivity, location sensitivity, specificity, true positive, true negative, false positive and false negative scores. In addition a reader-specific image file is instantly generated so that correct and incorrect decisions can be examined in detail on the image.

Whilst mammography film readers are well established in the UK the model is not as well established internationally. Mammography readers have been long been compared to radiologists in the UK but the role is not as well recognised beyond the UK.

Methodology

Data collection will occur during Symposium Mammographicum, a mammography conference held in the UK during Summer 2018 attracting over 1,000 delegates. This method of participant recruitment has been very successful, often with all available data collection appointments over the 2 days pre-booked. This study will provide preliminary data capturing film reading mammographers. Participants will be self-selected by applying to participate in the study.

BREAST is a web-based system created by the University of Sydney and BreastScreen NSW. The system allows readers to diagnose sets of mammographic images in an anonymous and geographically limitless way with each image interaction being instantly and centrally recorded on a cloud server (Figure 1). Since pathology-proven 'truth' is known for each cancer case and image, instant feedback can be given to each participant including any diagnostic errors. Once the case sets are completed, readings are instantly analysed. Participants are immediately presented with performance values including receiver operating characteristic (ROC) and jack-knife alternate free-response receiver operating characteristic (JAFROC) figures of merit, sensitivity, location sensitivity, specificity, true positives, true negatives, false positives and false negatives. In addition a reader-specific image file is instantly generated (Figure 2) so that correct and incorrect decisions on each image can be examined in detail. All data produced are anonymised and stored on a cloud server. They are then downloaded onto a central database for analysis as part of the study.

This project will form a preliminary data collection for film reading mammographers; experience has shown an increase in data collection through targeted participation, such as at a conference. There will be a high volume of suitable candidates attending the two day conference. Participants will be invited to sign up for a session to complete the data set; this will determine the sample size.

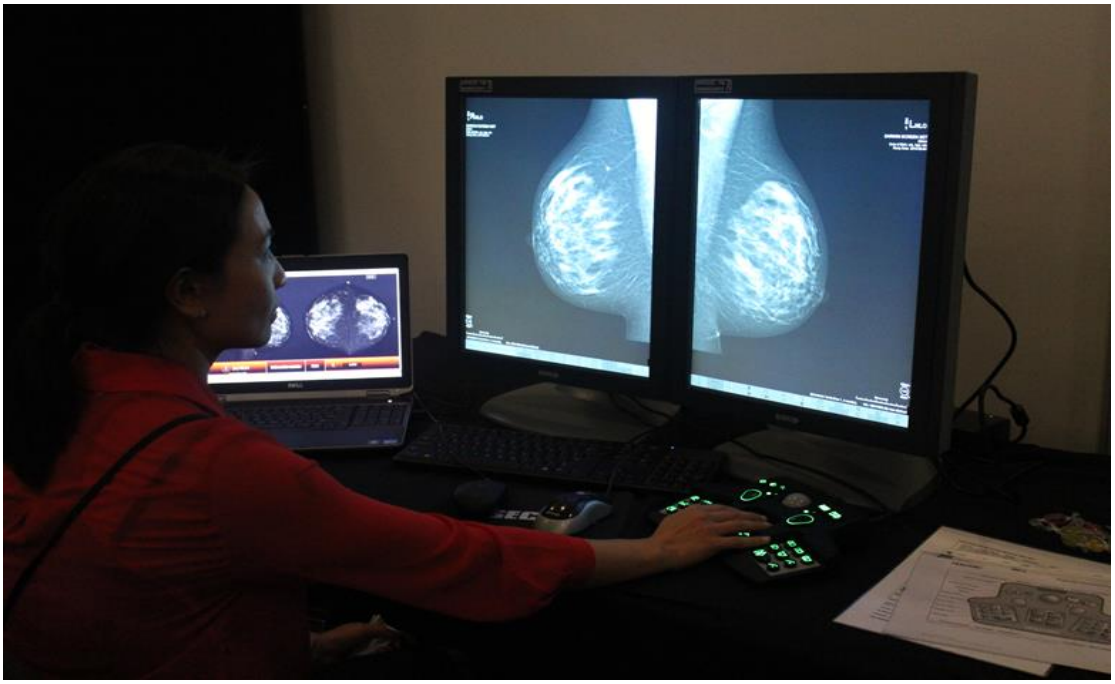

Figure 1. **An individual studying the BREAST test set.**

Figure 2a. **An example of a feedback image presented *after* the radiologist has judged the image. The term "Truth" represents the real location of the image, whereas "Your Selection" represents where the radiologist thought there was a lesion. In this case on the left MLO and left CC projections, the cancer was correctly located, whereas on the right MLO and CC projections the observer failed to locate the cancer.**

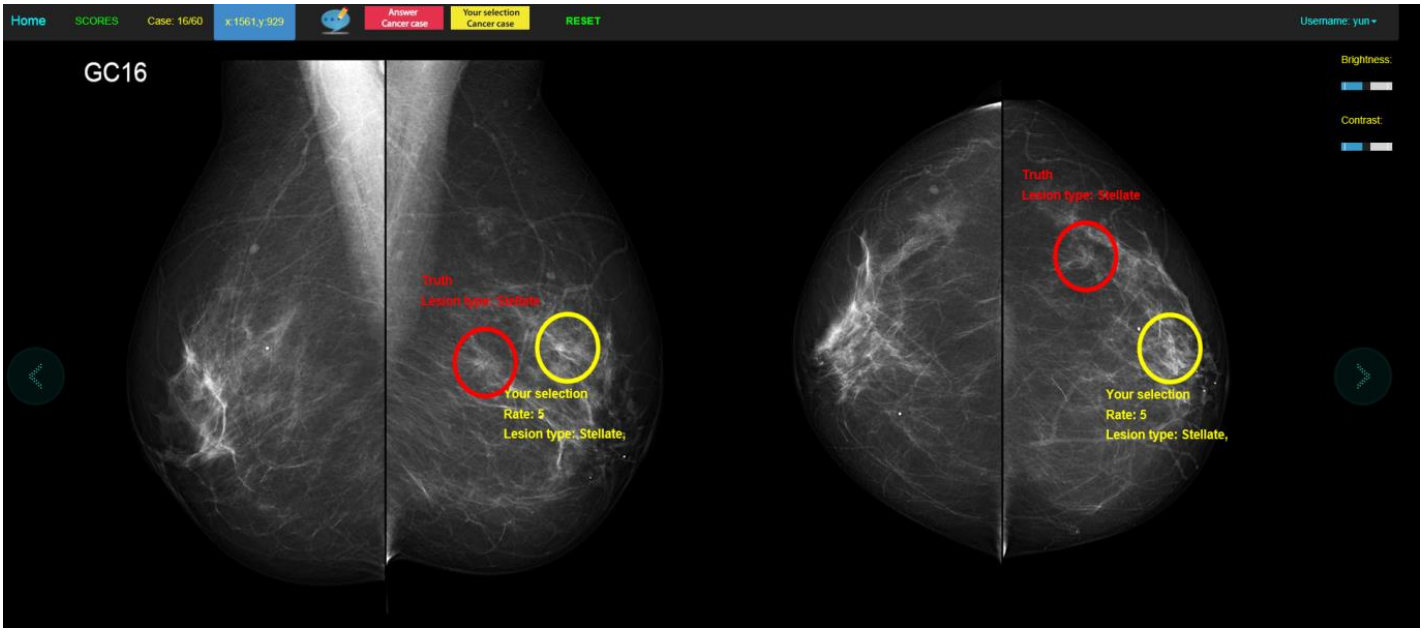

Figure 2b. **In this example on both projections, the lesion has been missed, but the observer has a false positive interaction in a different part of the image.**

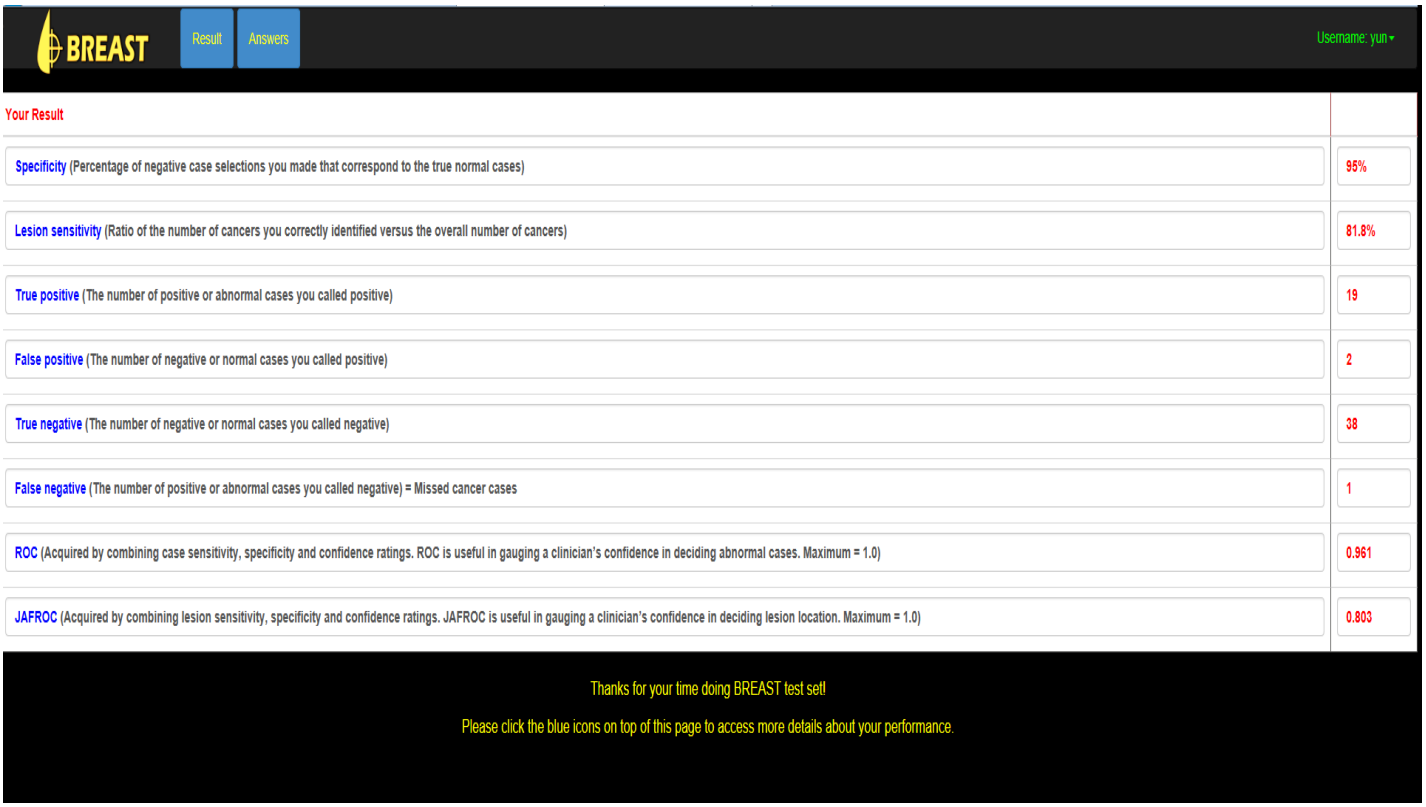

Figure 3. **A screenshot of the type of information instantly available to the reader once he or she has completed the test set.**

BREAST has been used for multiple studies[6,7,8] and is well established in the collection and analysis of quality data used to improve performance and evaluate innovative and new techniques.

Patients were involved in the construction and development of the wider research project and we will reach out to patient groups in the U.K. to explore other areas.

Potential impact

The evidence this study generates will support the promotion of mammographer film readers as experts on an international platform. An introduction to mammography reading for aspiring or interested advanced practitioner radiographers will also act as a 'recruitment drive' by raising awareness of role extension within breast imaging.

Dissemination Strategy

The findings will be presented at Symposium Mammographicum in 2020, as an award associated with the conference; it is hoped that the conference will support an oral presentation. This would be an excellent forum in which to share the findings as it is a well-attended conference, dedicated to breast imaging and has a high international attendance. A poster presentation at Symposium in 2020 would be ideal, but as there is a two year gap between conferences an abstract will be submitted to UKRCO 2019. We also aim to publish the results in a peer reviewed journal (Radiography).

Any interested participants are encouraged to register for the 2018 Symposium Mammographicum http://sympmamm.org.uk/ **and will find details for registration to this study on the symposium site in due course.**

References

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