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REVIEW ARTICLE

MRI screening for breast cancer in women at high risk; is the Australian breast MRI screening access program addressing the needs of women at high risk of breast cancer?

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Abstract

Breast magnetic resonance imaging (MRI) screening of women under 50 years old at high familial risk of breast cancer was given interim funding by Medicare in 2009 on the basis that a review would be undertaken. An updated literature review has been undertaken by the Medical Services Advisory Committee but there has been no assessment of the quality of the screening or other screening outcomes. This review examines the evidence basis of breast MRI screening and how this fits within an Australian context with the purpose of informing future modifications to the provision of Medicare-funded breast MRI screening in Australia. Issues discussed will include selection of high-risk women, the options for MRI screening frequency and measuring the outcomes of screening.

Introduction

Around 1 in 800[1] women in the Australian population are estimated to have an inherited mutation in a cancer predisposition gene, and significantly more with a strong family history but no known familial mutation, are at high risk of breast (and other) cancer(s). Women at high risk of breast cancer, with or without a known genetic mutation, have multiple strategies available to them for managing their elevated cancer risk. Risk-management options include bilateral mastectomy, risk-reducing medication and screening programs which comprise of clinical assessment and mammography +/− breast magnetic resonance imaging (MRI). Although it is the most sensitive imaging technique for cancer detection[2–9] (Figs. 1–4), breast MRI can only be included if a woman meets the Medicare Benefits Schedule (MBS) criteria for access to this test or decides to pay for this imaging herself. MRI is almost always combined with mammography to maximise the detection of breast malignancy otherwise some cancers will be missed.

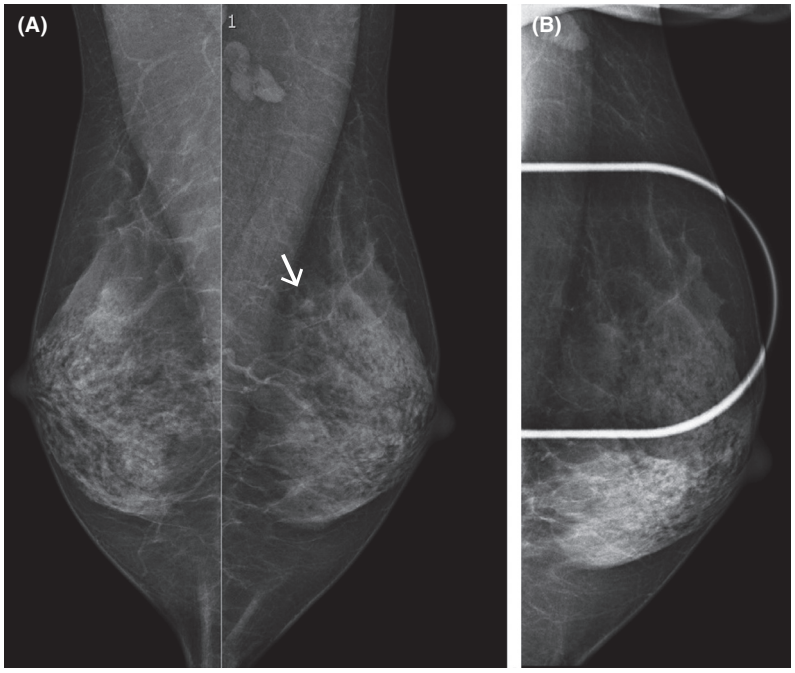

Figure 1. (A) Bilateral oblique mammograms (B) coned compression view left breast axillary projection. This 49-year-female with a strong family history of breast cancer was undergoing high-risk imaging surveillance with annual mammography and MRI studies. Her initial screening contrast enhanced MRI was normal. Nine months later a possible small mass (↓) was noted in the upper left breast on screening mammography (A). This resolved on the coned compression view (B). An extended CC view (not shown) was unremarkable.

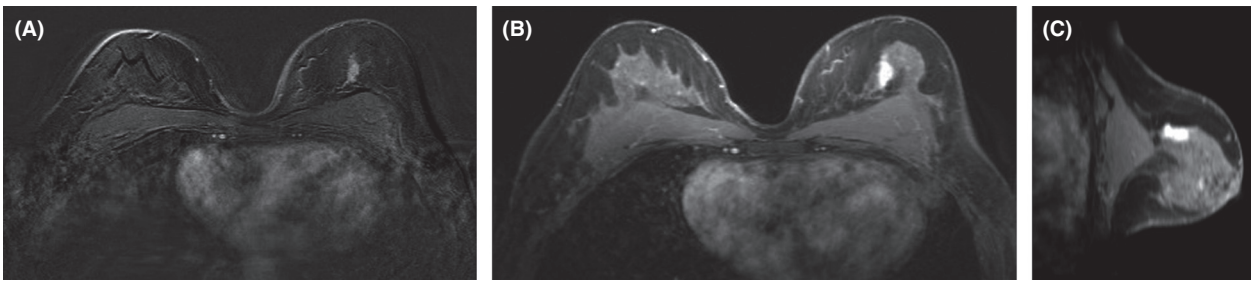

Figure 2. Routine screening breast MRI 2 weeks later: (A) axial T1-weighted subtraction 90 sec post contrast, (B) axial and (C) sagittal 3D T1 fat saturated images 270 sec post contrast. At 11 o'clock in the upper inner quadrant of the left breast there is a segmental area of non-mass enhancement measuring 23 × 23 × 11 mm. Even in retrospect, this was mammographically occult.

In 2009 the Australian Government funded breast MRI for 'the diagnosis of breast cancer in asymptomatic women with a high risk of developing breast cancer when used as part of an organised surveillance program.' The eligibility criteria for screening provide for an annual breast MRI for women under 50 years with a known mutation predisposing to breast cancer (BC) or those women who fit the 'National Breast and Ovarian Cancer Centre (NBOCC) Category 3' risk (estimated to approximate to >25% lifetime risk),[1] plus a follow up MRI 6 months later if needed. The MBS-funded item was introduced with a proviso that a review would be undertaken. Only an updated literature review has occurred and there are no official plans by Medicare to undertake a review of the performance and/or outcomes of breast MRI screening.

We have sparse data on the outcomes of breast MRI screening in these younger women at high familial breast cancer risk in Australia as they do not fit within any current population breast screening programme and outcomes such as sensitivity, specificity and interval cancer rates are not routinely or consistently recorded. Data from international breast MRI screening studies (not out-of-trial, or 'real-life', MRI screening

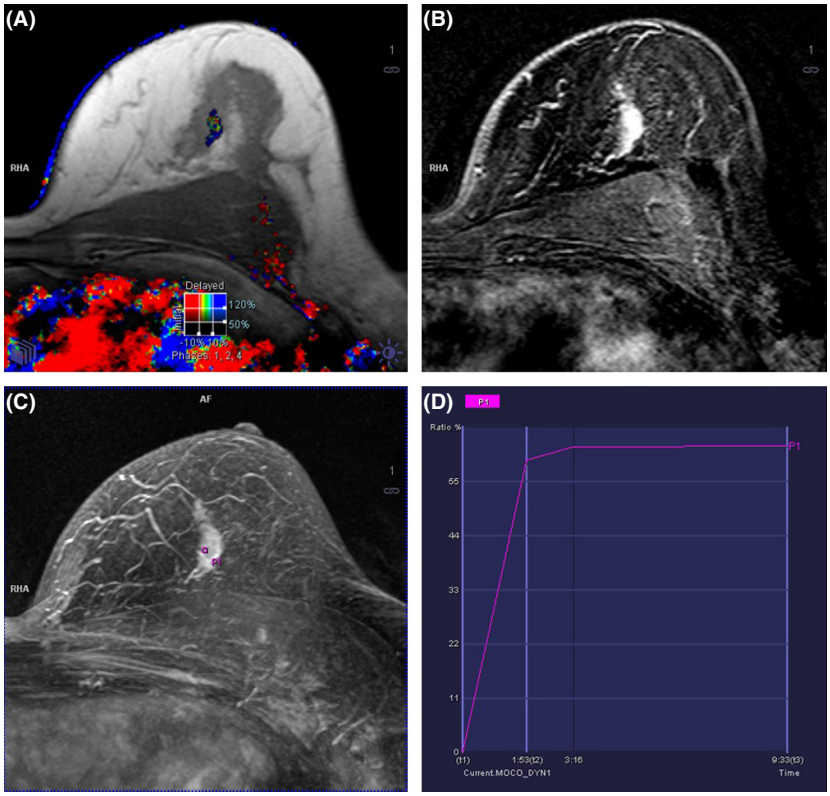

Figure 3. Composite enlarged images of left breast: (A) colour coded enhancement map; (B) initial T1-weighted contrast enhanced subtraction; (C) 3D maximum intensity projection; and (D) kinetic curve. Two regions of interest (ROIs) have been placed within the non-mass enhancement. A type 2 curve is present with medium initial rise followed by plateau in the delayed phase.

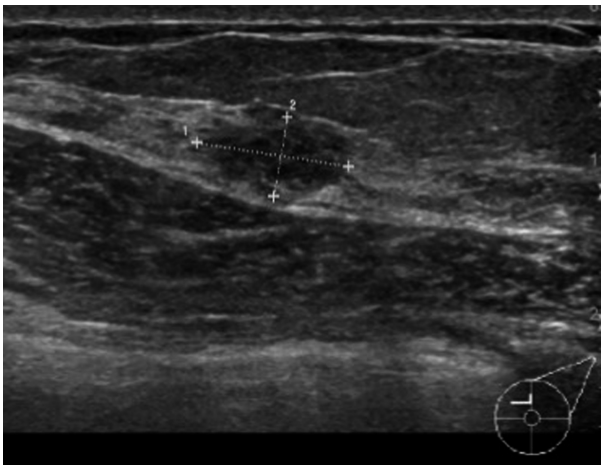

Figure 4. Targeted ultrasound of the left breast. A focal area of heterogeneous echogenicity 10 × 23 × 5 mm corresponding with the MRI finding is present in the upper inner quadrant. Ultrasound guided core biopsy showed high-grade DCIS. Patient elected to have bilateral mastectomy.

environments) suggest that these outcome parameters are at least comparable to population mammographic screening programs of women >50 years.[2–9] Although there is some evidence for down staging of MRI-detected tumours both in terms of tumour size and lymph node status at diagnosis, any improvement in breast cancer-specific survival data is yet to be seen.[2–9]

Developing a breast cancer risk management plan with an individual woman at high risk can be complex, depending on their level of risk, availability of resources, personal preference and the current limits of scientific knowledge. Any or a combination of these factors can provide barriers to appropriate care of women with a high lifetime risk of breast cancer.

The aim of this article is to present a review regarding the important issues surrounding MRI breast screening that remain in Australia. We will highlight the areas of controversy that provide challenges in daily clinical practice and the limitations of the available evidence in support of breast MRI screening.

Defining Breast Cancer Risk

The first challenge to the evidence-based management of women at high risk of breast cancer is the inconsistency in the medical literature regarding the definition of 'high

risk'. Traditionally 'high risk' in the Australian context has been defined as a ≥25% lifetime risk[1] whereas, in contrast, some international screening studies have considered high risk to be ≥20%.[9] Breast cancer risk for the purposes of cancer screening or prevention research and/or clinical practice, has tended to be considered as either an inherited form of risk (genetic or 'familial' risk) category or a personal risk factor-based risk category focused on the presence or absence of personal breast cancer risk or protective factors and the incorporation of familial risk factors in the latter category is highly variable in its detail.

There are a number of methods or risk calculators available to determine genetic or 'familial risk'.[10,11] Historically risk has been calculated by Claus tables,[12] which provide an estimate of breast cancer risk based on a woman's current age and the number, and ages of onset, of breast cancers in close relatives. These tables are based on empiric observational data and make limited assumptions about the genetic basis of the family history and therefore of cancer risk in close relatives. They are easy to apply in the clinical setting but have limitations to their use including reduced utility in paternally inherited risk and in small sized families, and lack of integration of family structure and other personal breast cancer risk factors.

A commonly used personal risk factor-based risk calculator that does take into account a range of risk factors is the Breast Cancer Risk Assessment Tool (BCRAT, previously known as the Gail model).[13] The BCRAT includes demographics such as age and race, family history, presence of benign breast disease and certain hormonal factors. It was initially derived from a Caucasian population undergoing routine mammographic screening but has been updated and is calibrated for women of African,[14] Pacific Islander and Asian descent.[15] Its strength lies in that it takes into account more factors than just family history. However, it does not discriminate between levels of genetic risk as accurately as some of the other calculators. The family history included is limited to the first generation and age of cancer diagnosis is not included and therefore is best suited to women who approximate to the general population and is not well suited to women who have a strong family history of breast cancer.

Recently, more comprehensive risk calculators have been developed for women with a suspected genetic or familial breast cancer risk, such as the Tyrer–Cuzick model[16] (IBIS Breast Cancer Risk Evaluation Tool) and Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm (BOADICEA)[17] tools. Both models have a more sophisticated approach to determining genetic risk than Claus tables or BCRAT but also include risk factors other than family history. They vary in the fine details regarding the method and weight of incorporation of personal risk factors (such as age of menarche) and tumour pathology features to the estimate of breast cancer risk, and in their overall ease of use. BOADICEA has a more complex user interface and is currently more suited to the genetics clinic environment rather than being designed for daily use in other clinical settings where these women are most often managed – that is surveillance breast clinics, specialists' rooms or general practice. In contrast, the IBIS tool was developed from risk factor data derived from women participating in the IBIS breast cancer prevention studies and includes multiple non-genetic risk factors such as biomorphic markers and benign breast disease. It is administered as a single Web page data collection form and is generally more well-suited to a busy clinical setting that BOADICEA. Family history is a major component of the IBIS tool risk calculation but it uses more broad familial risk categories than BOADICEA and therefore may not gradate genetic risk as well as BOADICEA.

As the selection and use of risk calculators is a relatively complex undertaking and can be perceived as time-consuming for a busy clinical practice, in 2006 the Medical Services Advisory Committee (MSAC) advised the use of NBOCC Category 3 (as described in Table 1) as the definition of high risk for the purposes of determining eligibility for MRI screening. While this category is designed to capture women who have >25% lifetime risk of breast cancer, it is still a broad category and risks including women with significantly lower lifetime risks (especially if they have large families with multiple female relatives) and also excluding women with >25% lifetime risk, often as a result of a paternal inheritance pattern of risk or having a small family with few at-risk female relatives.

Internationally, criteria for inclusion in breast MRI clinical screening programs and/or research studies for

Table 1. National Breast and Ovarian Cancer Centre (NBOCC) Category 3 criteria.

Breast or ovarian cancer in at least 3 relatives on one side of the family, or breast or ovarian cancer in at least 2 relatives and one of the following
• Bilateral breast cancer
• Breast cancer diagnosed under 40 years old
• Ovarian cancer diagnosed under 50 years old
• Breast and ovarian cancer in one individual
• Male breast cancer
• Ashkenazi Jewish heritage
• An additional relative with breast cancer
or breast cancer diagnosed under 45 years plus a relative with sarcoma diagnosed under 45 years old

high-risk women vary with respect to level of risk and model of risk used. Ozanne[18] demonstrated using three commonly used risk prediction models that there was minimal agreement for which individual women were at high risk. In that study, a retrospective analysis of 10,000 women who received mammographic screening was performed. The lifetime risk of developing breast cancer using the BRCAPRO, Claus, and Tyrer–Cuzick calculators was then calculated and eligibility for breast MRI screening was defined as a lifetime risk ≥20%. The percentage of women found to be eligible for MRI screening by the Tyrer–Cuzick model was 5.6%, by BRCAPRO was 0.4% and by the Claus model was 0.9%. Only 0.2% of the study population was eligible by all three risk models.

Women at High Risk of Developing Breast Cancer for Reasons Other Than High Genetic or Familial Risk

As well as women at high genetic or familial risk of breast cancer, other groups of women can also be recognised as having a significant lifetime risk of developing breast cancer. However, whether or not any of these groups would benefit from the addition of routine breast MRI screening is poorly studied, if at all.

Women treated with chest irradiation prior to age 30 years are at particularly high risk of developing breast cancer,[19] and this risk can approximate to that associated with a *BRCA1* or *BRCA2* mutations in some cases. A number of published guidelines (including the American Cancer Society,[20] NCCN[21] and The UK National Breast Cancer Screening Programme[22]) recommend breast MRI screening for women who received therapeutic chest irradiation; combined with mammography this has been found to have a sensitivity of 94%.[23] However, after their recent literature review the MSAC in Australia have decided that the evidence is not yet clear enough to expand the eligibility criteria for Medicare-funded breast MRI screening to include women who received therapeutic chest irradiation for lymphoma as young women.

It is also recognised that women with a prior history of a range of benign breast lesions have a significant increased breast cancer risk.[24] For example women with atypical ductal hyperplasia have been found to have a relative risk of 4.24.[25] For women diagnosed with lobular carcinoma in situ (LCIS) the risk is similar in magnitude to women with a *BRCA* 1 or 2 mutation.[26] It is not known if the addition of breast MRI to mammographic and or ultrasound screening improves outcomes for women with LCIS.

Women with mammographically dense breasts are another subgroup with an increased risk of breast cancer, an effect which is compounded by the fact increased breast density reduces the sensitivity of mammography for detecting breast cancers.[27–33] In 2014, in the United States Congress a bill has been introduced that makes reporting of breast density on mammograms mandatory and has variably been introduced into State legislation across the United States.[34] A recent study[35] reviewing the addition of ultrasound in women with high mammographic density found that the risks did not outweigh the benefits, however, some novel mammographic techniques such as digital tomosynthesis or molecular imaging are currently being investigated in these women as useful adjuncts to mammography.[36–40]

Breast MRI Screening Frequency and Scheduling

For women at high genetic or familial risk, the optimal breast cancer screening frequency is still to be determined. If left too long then there is the risk of interval cancers, but if screening is too frequent then cost effectiveness is reduced. Most clinicians recommend starting screening at 25–30 years or 10 years before the youngest relative developed breast cancer. The current Australian Medicare scheme only provides a rebate for breast MRI screening in women under 50, but clearly for some this arbitrary age limit may not be applicable as evidenced by a recently published meta-analysis of the data for BRCA mutation carriers over 50.[41]

Another area of uncertainty is the scheduling of breast MRI screening with mammography with some guidelines advising concurrent imaging and others alternating breast MRI with mammography every 6 months.[42,43] The attraction of an alternating approach is the possibility of minimising the occurrence of interval cancers (Figs. 5 and 6), but that assumes that both tests are sensitive in detecting breast cancer and it is clear that mammography is much less sensitive than MRI in detecting invasive breast cancer. Furthermore, the practical considerations of scheduling a menstruation-based test and alternating this with another test on a frequent basis, in women with busy professional and family lives, are important and certainly can be challenging and potentially risk compromising screening frequencies. Recently published data suggests that routine mammography in the setting of breast MRI screening may be superfluous. Traditionally mammograms were included in the screening schedule with MRI as initial MRI screening studies suggested mammograms remained the preferred screening test for detecting DCIS.[44] More contemporary breast MRI screening studies performed on the background of more extensive prior experience with breast MRI screening have demonstrated that MRI sensitivity is directly proportional

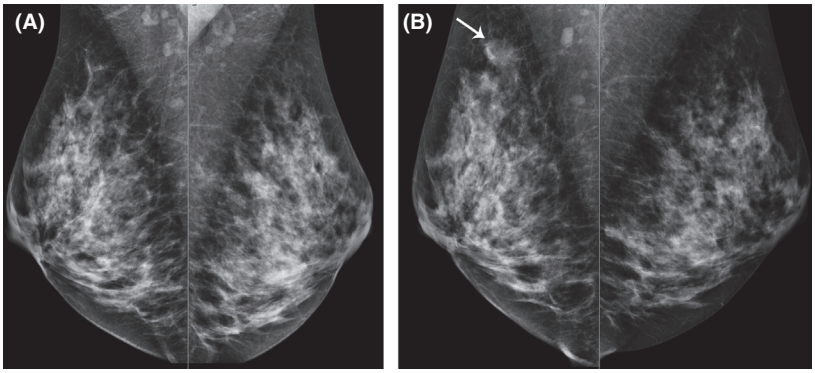

Figure 5. Bilateral oblique mammograms: (A) 2013 and (B) 2014. This 36-year-old BRCA 1 mutation carrier presented with a palpable mass in the upper outer quadrant of the right breast 9 months after a normal screening mammogram (A). MRI at this time was also normal. The repeat mammogram (B) shows a 25 mm poorly defined area of asymmetric density containing pleomorphic microcalcifications (arrow). A normal sized but dense lymph node is also noted in the right axilla.

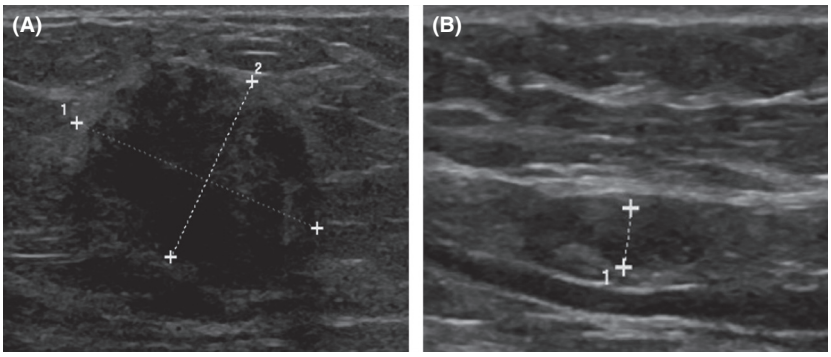

Figure 6. Ultrasound images. (A) Right breast: there is an irregular hypoechoic mass corresponding with the palpable and mammographic lesion and measuring 20 × 15 mm in the upper outer quadrant. (B) Right axilla: an abnormal lymph node with focal cortical thickening (4 mm) is noted. Ultrasound guided core biopsy: grade 3 invasive ductal carcinoma, ER, PR and HER2 receptor negative. FNA of the node was positive for metastasis. Patient underwent wide local excision and axillary clearance, egg harvesting to preserve fertility followed by chemotherapy and bilateral mastectomy with immediate reconstruction.

to increasing grade of DCIS (whereas mammographic sensitivity is inversely proportional)[45] but with increasing reader experience it is also more sensitive overall than mammography.[46–49] A recent study[50] of 559 women found that despite two cases of DCIS being found by mammography alone, there was no improvement in sensitivity with the addition of mammography (or ultrasound).

Performance of Breast MRI Screening in High-Risk Women

The point of screening is to reduce mortality from the disease of interest by early detection. Certain principles need to apply for this to be successful. First, the screening population needs to be strictly defined and there needs to be a scientific body of evidence proving that the screening of choice is effective. Second, a set of agreed quality assurance criteria and performance measures against which outcomes can be audited and benchmarked are necessary to ensure that effectiveness is maintained.

Breast MRI screening in Australia for women at high genetic or familial risk fulfils some of these criteria Unfortunately, the population defined as eligible for screening in Australia differs from most other countries which use a risk calculator derived lifetime risk score as previously discussed. A comparison between these guidelines can be seen in Table 2. Unlike organised mammographic screening in Australia, there are no Australian national quality performance indicators for MRI screening, and no co-ordinated data collection or regular formal quality assurance audit occur. This is especially important with MRI screening as imaging findings can be subtle (Figs. 7–10) and false positives are not uncommon.[2–9]

Table 2. MRI screening guidelines and studies.

Guideline	Calculated risk of breast cancer	Methods used to assess breast cancer risk	Recommendations
American Cancer Society[20]	>20% lifetime	'Claus tables' or 'similar'. Recommends against Gail model	Women who are at high risk for breast cancer should get an MRI and a mammogram every year. Screening with MRI and mammograms should begin at age 30 years and continue for as long as a woman is in good health. But because the evidence is limited about the best age at which to start screening, this decision should be based on shared decisionmaking between patients and their health care providers, taking into account personal circumstances and preferences
National Comprehensive Cancer Network[21]	Not specified	Family history categories or presence of a mutation in a breast cancer predisposition gene	Age 25–29 annual breast MRI screening (preferred) or mammography if MRI not available; or individualized based on earliest age of onset in family. >30–75 year annual mammogram and breast MRI screening. >75 years management should be considered on an individual basis
NICE[71]	>30% risk of carrying a mutation in a cancer predisposition gene	BOADICEA or Manchester model	30–49 years old with (a) a BRCA mutation or (b) who have not had genetic testing but have a greater than 30% probability of being a BRCA carrier; 50–69 years if (a) or (b) and a dense mammographic pattern; 20–69 years if known TP53 mutation
Cancer Australia (2010)[1]	>25% risk of breast cancer to age 75	Family history categories	Annual breast imaging with mammography, MRI or ultrasound from advised to begin screening at a younger age, and at more frequent intervals, than those at population risk
MRI screening studies			
Ontario[53]	≥25% lifetime risk	BOADICEA or IBIS	
Kriege et al.[2]	>15% lifetime risk	Claus tables	
MARIBS[5]	Annual risk of breast cancer of at least 0.9%	Family history categories	
Kuhl[55]	>20% lifetime risk	Criteria for high familial risk as defined by the Consortium on Familial Breast and Ovarian Cancer of the German Cancer Aid	

The addition of breast MRI screening to mammography in the management of high-risk women results in significantly increased sensitivity (up to 94%[5,51]) compared to 40% for mammography alone, an increase in the proportion of node-negative cancers diagnosed compared to mammography alone (70–83%[5]) as well as a projected 25% mortality benefit,[52] which provides high-risk women with a reasonable alternative risk-management strategy to surgery (bilateral mastectomy). However the relevant literature on which MBS funding was based,[2,5,8,9,53–59] comprised of non-randomised cohort studies with significant heterogeneity of inclusion criteria and definition of outcome measures. In addition although there are abundant data that MRI screening improves screening outcomes such as the cancer detection rate, there is no evidence yet that it improves survival from the disease. Given the use of cohort study design, researchers have not been able to fully address concerns about the potential for oversensitivity-, lead time bias and overdiagnosis with breast MRI screening. A randomised, controlled trial of mammography alone versus an MRI-based strategy is now highly unlikely in this high-risk population to address many of these issues. This is due to a lack of clinical equipoise in managing these patients with mammography alone as well as the lack of appetite of high-risk women to be randomised to mammography alone.

Until now this article has considered women at high genetic or familial risk as a single homogeneous group, but in reality within this group there is a range of level of personal risk and it is likely that the utility of addition of

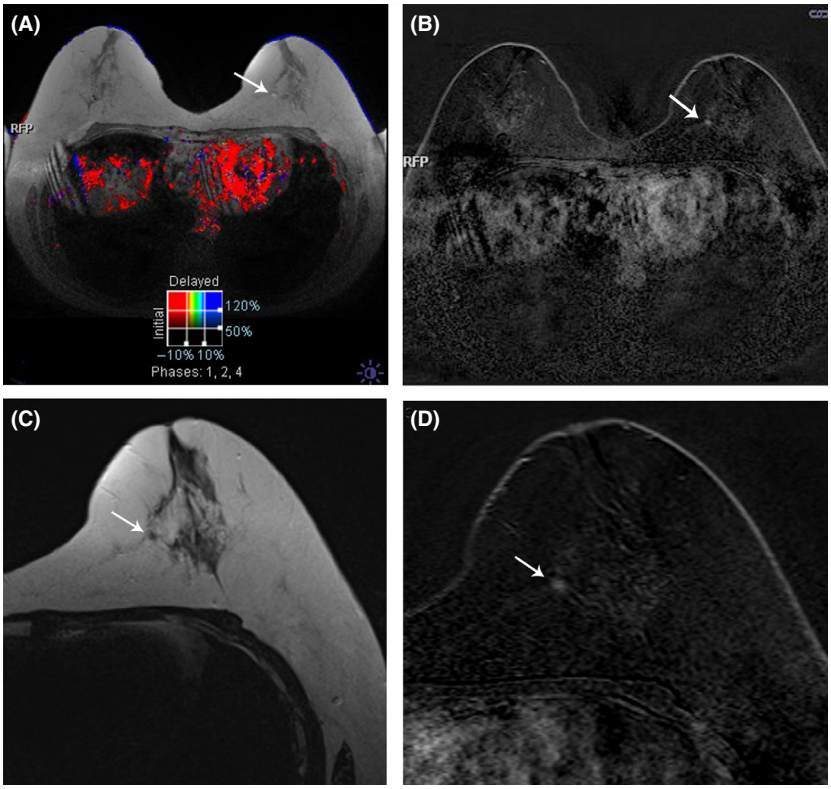

Figure 7. Thirty six-year-old woman with past history of mantle radiotherapy for Hodgkins disease at the age of 13. There was also a family history of breast cancer in two first degree relatives (bilateral in one). Contrast-enhanced MRI: (A) colour map first post-contrast T1-weighted sequence; (B) first post-contrast subtraction; (C) enlarged T2-weighted image of left breast; and (D) enlarged first post-contrast T1-weighted subtraction image. A 5 mm enhancing focus is noted in the lower inner quadrant of the left breast (arrow) too small to characterise, but not showing worrying kinetics on the colour map. The lesion was not visible on a targeted ultrasound scan and the mammogram at this time (Fig. 9A) was normal. A repeat MRI in 3–6 months was recommended to assess stability.

MRI to a screening program will vary with level of risk. The benefit of the addition of breast MRI screening for women at risk is most equivocal for women with no known mutation in a cancer predisposition gene. Six major studies[2,5,9,53–55] included women without known mutations and were recruited on the basis of their breast cancer family history. The most recent of these studies[53] is potentially the most informative due to the increased experience of their radiologists in the interpreting of breast MRIs compared with older studies, as well as inclusion criteria that use the more discriminating breast cancer risk calculators (lifetime risk ≥25% using BOADICEA or IBIS). The cancer detection rate of MRI with mammography in patients with a mutation was 30.8/1000 initial screening examinations as opposed to 6.9/1000 initial screening examinations in those without; this difference was statistically significant. To put some context around these figures, in Australia, the population-based mammographic screening program, Breastscreen, detected 10.4 cancers/1000 initial screening examinations;[60] this figure includes all women aged 50–69 years, so is a composite of women at a range of personal cancer risks. The rate of 6.9/1000 was observed in younger women than those attending Breastscreen (over half were younger than 50 years at the time of screening).[53]

A specific area of uncertainty unique to Australia is the heterogeneity of practice caused by the interpretation of the MBS descriptor with respect to a woman's eligibility for breast MRI screening. Specifically, whether currently asymptomatic high-risk women who have a personal history of breast cancer are eligible for ongoing breast MRI screening once their breast cancer treatment is complete. Some screening studies included this population of women – for example three[9,53,55] of the six previously discussed studies included this group which made up 9.9, 27.9 and 30.8% of the study population, respectively, and thus it can be argued there is an evidence base for this practice.

An important question is whether the published breast MRI studies are relevant to the Australian population and in particular to the women eligible for breast MRI

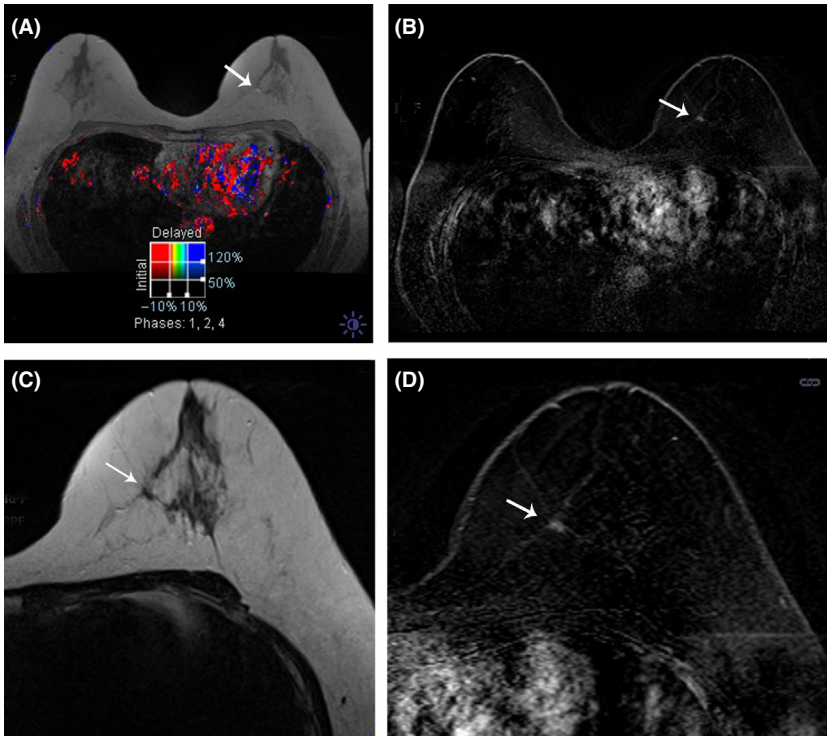

Figure 8. Follow-up MRI 6 months later: (A) colour map first post-contrast T1-weighted image; (B) first post-contrast subtraction; (C) enlarged T2-weighted image of left breast; and (D) enlarged first post-contrast T1-weighted subtraction image. The previously noted focus of enhancement in the lower inner quadrant of the left breast (arrow) was thought to be unchanged. Routine annual follow-up MRI was recommended. In retrospect, this focus has irregular margins and shape and is slightly larger.

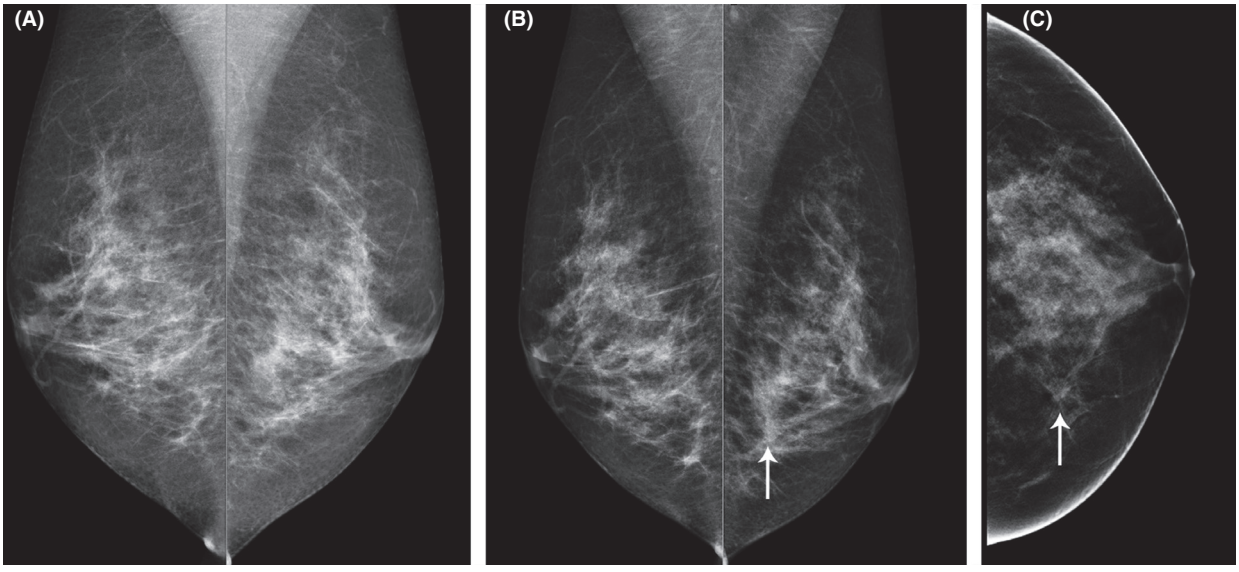

Figure 9. Left oblique mammograms: (A) prior study in 2013; (B) routine surveillance study 15 months later, 8 months after the MRI study shown in Figure 8; and (C) tomosynthesis left breast CC projection. A stellate mass (arrow) is now visible in the lower inner quadrant of in the left breast. Clinical examination was normal.

screening in Australia. There is always concern that trial data is not directly comparable to results seen when translated into the non-trial setting in general and, in particular, when translated to the specific Australian context. The published data comes from tightly controlled screening studies outside of Australia and the Australian

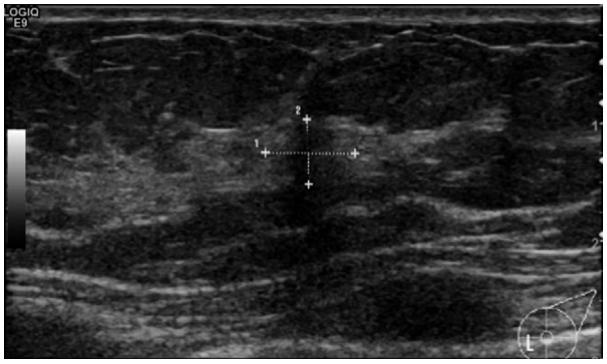

Figure 10. Targeted ultrasound left breast. A 7 mm irregularly shaped, ill-defined hypoechoic mass is present in the lower inner quadrant at the eight-thirty o'clock position. This corresponds to the lesion shown on the mammogram and is likely to represent the lesion shown on the earlier MRI examinations. Ultrasound guided core biopsy: grade 2 infiltrating ductal carcinoma. Patient chose to undergo bilateral mastectomies with immediate reconstruction.

breast MRI screening activity is not run through an organised program – but reliant on the right patient being referred to a breast specialist and their interpretation of the patient's eligibility for MRI screening according to the MBS criteria.

Measuring Breast MRI Screening Outcomes

Useful measures for assessing screening outcomes include the cancer detection rate, median size of invasive cancer, percentage of node-negative invasive cancers, percentage of invasive cancer ≤10 mm or DCIS, percentage of stage 0 or 1 cancer, recall rate, positive predictive value, sensitivity and specificity. The breast MRI screening studies performed to date do not report their outcomes against all of these indicators or choose one uniform outcome and thus it is difficult to compare outcomes across studies. Further increasing the difficulty in the interpretation of this data is that different studies may use the same indicator but use different ways of expressing its value. For example both Rjinsberger et al.[54] and Chiarelli et al.[53] use the outcome 'cancer detection rate' but the former define it per 1000 women years and the latter use per 1000 initial screening examinations. Other outcomes can be difficult to interpret because the absolute number of events is low, for example the interval cancer rate has not been shown to be statistically significant between MRI and non-MRI screened groups but due to the small numbers of events it is not clear whether the interval cancer rate is truly not different between MRI and non-MRI screened groups. There is no agreed measure of outcomes of breast MRI screening in Australia and no facility in place to collect and/or monitor outcomes data, unlike the mandated measures evaluating the performance of Breastscreen.

Cost-Effectiveness of MRI Screening

Models of cost-effectiveness of incorporating breast MRI in screening schedules for high-risk women have supported the use of breast MRI screening in this group.[52,61–64] However, only three[52,62,64] used data that included women without mutations and only two of these[39,51] analysed their data separately from known mutation carriers. Both the Dutch[52] (15–50% lifetime risk) and the American[64] (≥25% life time risk) cost-effectiveness modelling studies found the most cost effective screening in non-mutation carriers would be staggered biennial MRI scans and mammograms. The relevance of these cost-effectiveness data to an Australian setting remains unknown as costs can differ significantly between countries and the data on which they are based were derived from studies undertaken in the early 2000s when breast MRI, and experience with it, was in its infancy and may now be outdated if the results from Kuhl et al are more representative of current practice and outcomes. We do know from a study of an Australian screening initiative run via a Familial Cancer Centre in Melbourne encompassing the years 2006–2009[65] that there is a significant financial and temporal burden in running an MRI Screening program in Australia. However, the costs may have changed since this time period. Additionally, increased staff experience over this time may now have ameliorated some of the issues described.

The additional benefit of MRI screening to routine mammography-based screening schedules appear to be greatest in women with the highest breast cancer risks and therefore restricting breast MR screening to this group should maximise the cost-effectiveness of breast MRI screening for healthcare systems. Just as important as cost-effectiveness are the negative consequences women can experience as a result of the screening. These include anxiety related both to the test and/or its results, inconvenience, discomfort and financial and other costs to the woman (such as travel, missing work, the costs of seeing a breast surgeon or other specialist(s)). Scans that are ultimately designated as false positive are particularly distressing as the woman undergoes the distress of a biopsy that was never needed and has to deal with the psychological consequences of anticipating a potential cancer diagnosis.

The number of women without a known mutation in a cancer predisposition gene accessing breast MRI screening in Australia and their screening outcomes are of great interest given that the cost-effectiveness of screening is

highly dependent on the overall cancer detection rate. In one American study,[66] there was a significant an increase in Breast MRI use from 2000 to 2011 from 6.5/10,000 women to 104.8/10,000 of which 57.6% were for screening or surveillance. However, only 21% of these patients met local guidelines for screening and only 48.4% of women with documented genetic mutations were receiving MRI screening.

Other Screening Outcomes of Interest

In the 'quality of healthcare' literature six dimensions of care are defined. These are consumer participation, equitable access, effectiveness, efficiency, appropriateness and safety of care. The potential drawbacks of the high cost and oversensitivity of breast MRI screening are clear and are accentuated if inappropriate women (i.e., those not at high enough risk) are screened. It is essential that screening outcomes are investigated within different types of hospitals and different States to ensure they are equivalent. Furthermore, the use of additional investigations post-MRI should be carefully measured as the psychological effects of false-positive tests in women undergoing screening are well documented.[67–69] High false positive rates also challenge the cost-effectiveness equation for breast MRI screening for healthcare providers. While estimates of these items were addressed in the original screening studies, it is important to investigate whether cancer detection rates, false-positive rates, additional health care utilisation costs are different outside of the trial setting in order to inform the true cost-effectiveness of this intervention in the real-life setting.

Conclusions

The Screening Framework published by The Australian Population Health Development Principal Committee[70] maintains that 'there is an ethical obligation to maximise benefits and minimise harm; and the overall benefits should outweigh any harms that result from screening'. Clearly there is the potential that at present that a group of women in Australia is being over screened by breast MRI and other groups of high risk women are being denied breast MRI screening as their familial risk cannot be captured adequately using the current method incorporated within the MBS descriptor. Thus there is an urgent need to review both the performance of MRI Screening in Australia as well as the eligibility criteria for this test, to ensure that first, we do no harm.

Conflict of Interest

The authors declare no conflict of interest.

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