Diagnostic Imaging Pathways - Breast Screening

Population Covered By The Guidance

This pathway provides guidance on the screening imaging of adult female patients with an average risk of developing breast cancer.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	> 10 mSv

Pathway Diagram

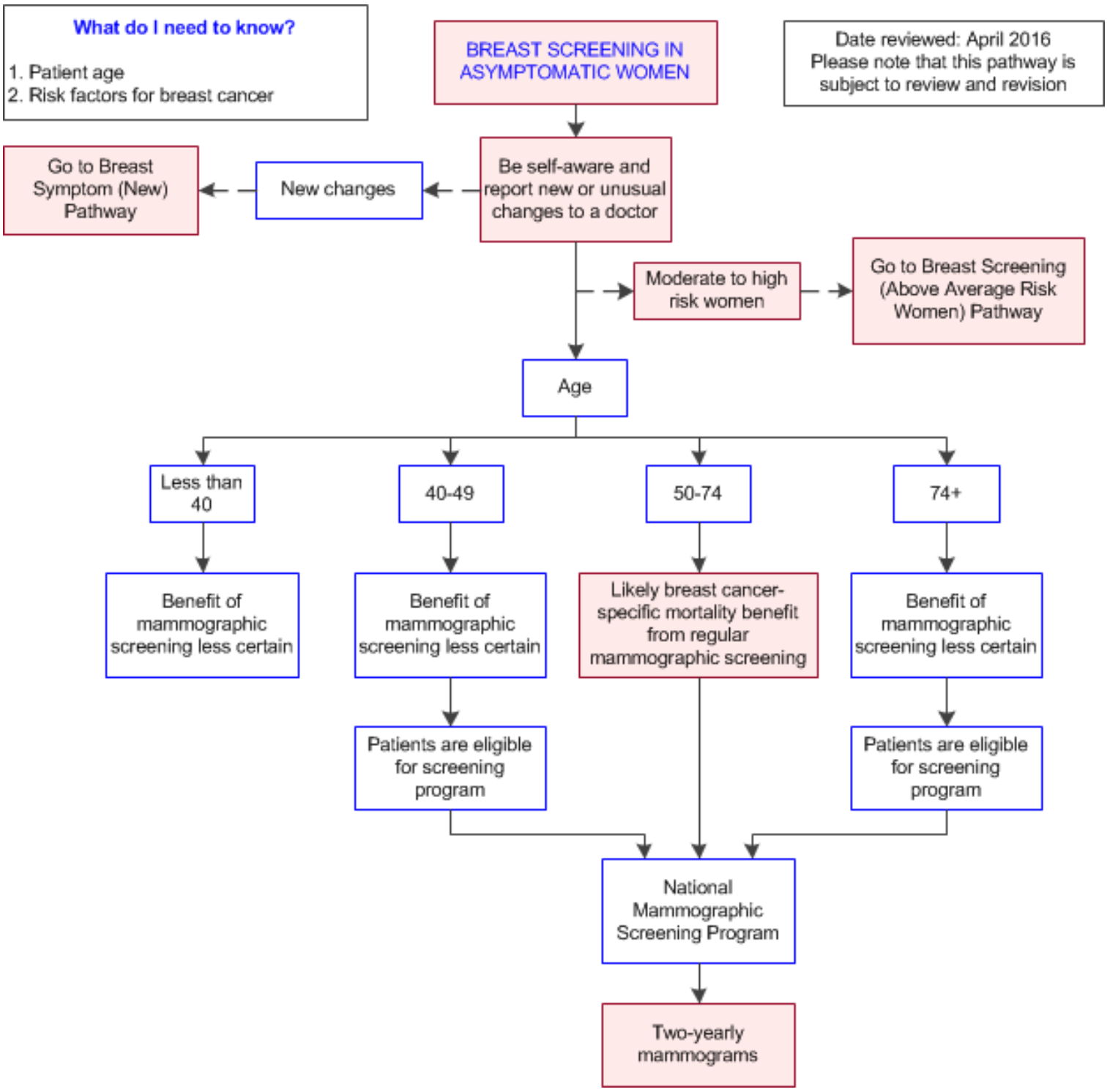


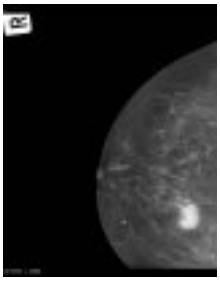
Image Gallery

Note: These images open in a new page

1 **Breast Carcinoma**

Image 1 (Breast Mammography): Stellate lesion with malignant calcification. In addition there is inversion of the nipple and adjacent skin thickening. The features are highly suspicious for an invasive breast carcinoma.

2a



Breast Carcinoma

Image 2a (Mammogram, right breast): A non-calcified 22mm mass is present in the upper inner quadrant of the right breast.

2b

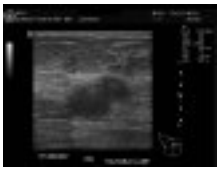


Image 2b (Ultrasound, right breast): Ultrasound of the same lesion showed an ill-defined solid mass with irregular margins, distortion of adjacent stroma and posterior acoustic shadowing, features which are suspicious for malignancy. Biopsy confirmed an invasive ductal carcinoma.

3a

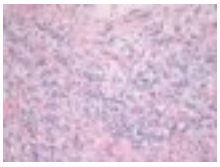
Breast Carcinoma

Image 3a: Mastectomy showing an irregular pale tumour (arrow) with surrounding fibrosis consistent with a breast carcinoma.

3b

Image 3b (H&E, x2.5): Histological section of a moderately differentiated (Grade 2) invasive ductal carcinoma, type not otherwise specified, infiltrating through the breast parenchyma and surrounded by desmoplastic stroma. Occasional poorly formed tubules can be seen at the periphery (arrows).

4



Breast Carcinoma

Image 4 (H&E, x10): Histological section of a typical invasive lobular carcinoma showing the classical alignment of single cells in rows.

Teaching Points

- Screening for women at 'average risk' of breast cancer is dependent on age and should be based on a balance between the benefits and potential harms
- Screening with mammography has been shown to reduce breast cancer specific mortality in women aged 50-74
- Biennial mammography is recommended in this cohort of women

Breast Screening

- Breast cancer is the most common cancer in women worldwide. 1 In Australia, one in eight women will develop breast cancer in their lifetime and it is one of the leading causes of mortality with more than 3000 estimated deaths in 2015. 2,3 Males also develop breast cancer, although it is less common (the risk of a male being diagnosed with breast cancer before 85 years was 1 in 688 in 2008)
- The aim of breast cancer screening is early detection of breast cancer so that prognosis can be improved by early intervention
- Breast screening programs are designed such that the benefits of reduced breast cancer mortality are balanced with the potential harms of screening including false-positives, over-diagnosis and radiation exposure
- Risk factors for breast cancer include but are not limited to 4,5
    - Increasing age
    - Female gender - breast cancer occurs 100 times more frequently in women than in men
    - Family history of breast cancer
    - Inherited genetic mutations such as BRCA1, BRCA2, p53,ATM and PTEN
    - Chest irradiation between the ages of 10 and 30 years
    - White race
    - Obesity
    - Dense breast tissue
    - Early menarche or late menopause
    - Alcohol
    - Smoking
- Several risk prediction models have been developed to calculate a woman's breast cancer risk based on family history and other major risk factors. 6,7 Although a family history of breast cancer is common, only a small percentage of breast cancers will be associated with an inherited genetic mutation. 4 These models are used for risk assessment of individual patients, to decide whether to recommend genetic testing and to predict which patients may benefit from high-risk screening. There are benefits and limitations to each model and calculated risk can vary a great deal according to which model is used. Due to this complexity, stratification of patients by risk should be carried out by health care professionals who specialize in risk assessment. 8,9 One such model is the Familial Risk Assessment-Breast and Ovarian Cancer (FRA-BOC), an online tool which provides an estimation of the risk of developing breast or ovarian cancer, based on family history for unaffected women. The three broad categories of risk are outlined below 10

CATEGORIES OF RISK	FAMILY HISTORY CRITERIA
At or slightly above average risk > 95% of the female population Risk of breast cancer up to age 75 is between 1 in 11 and 1 in 8	• No confirmed family history of breast cancer • One first-degree relative diagnosed with breast cancer at age 50 or older • One second-degree relative diagnosed with breast cancer at any age • Two second-degree relatives on the same side of the family

	diagnosed with breast cancer at age 50 years or older • Two first-degree or second-degree relatives diagnosed with breast cancer at age 50 years or older, but on different sides of the family
Moderately increased risk < 4% of the female population Risk of breast cancer up to age 75 is between 1 in 8 and 1 in 4	• One first-degree relative diagnosed with breast cancer before the age of 50 • Two first-degree relatives, on the same side of the family, diagnosed with breast cancer • Two second-degree relatives, on the same side of the family, diagnosed with breast cancer, at least one before the age of 50 • No additional features of potentially high risk group
Potentially high risk < 1% of the female population Risk of breast cancer up to age 75 is between 1 in 4 and 1 in 2	• Two first-degree or second-degree relatives on one side of the family diagnosed with breast or ovarian cancer plus on or more of the following on the same side of the family ◦ Additional relative(s) with breast or ovarian cancer ◦ Breast cancer diagnosed before the age of 40 ◦ Bilateral breast cancer ◦ Breast and ovarian cancer in the same woman ◦ Jewish ancestry ◦ Breast cancer in a male relative • One first-degree or second-degree relative diagnosed with breast cancer at age 45 or younger plus another first-degree or second-degree relative on the same side of the family with sarcoma (bone/soft tissue) at age 45 or younger

	• Member of family in which the presence of a high risk breast cancer gene mutation had been established • Women who are potentially high risk of ovarian cancer

- This pathway provides guidance regarding breast screening in asymptomatic women who are 'average risk' for breast cancer
- Other broad definitions for women with 'average risk' for breast cancer include women without a personal history of breast cancer, a confirmed or suspected genetic mutation known to increase risk of breast cancer (e.g. BRCA), a history of chest irradiation between the ages of 10 to 30 or women < 20% lifetime risk of breast cancer 1,5

Breast Awareness

- Although breast self-examination has been promoted for many years as a screening method to diagnose breast cancer at an early stage, studies have shown that self-detection does not reduce breast cancer-specific mortality 30 and self-examination is no longer routinely recommended 1
- However, more than half of breast cancers are diagnosed after investigation of a breast change found by the woman or by her doctor 31 hence women are recommended to be aware of the normal look and feel of her breasts and report new or unusual changes to the doctor 31
- No one method for women to use when checking their breasts is recommended over another 31

Mammography Screening Program

- Mammography screening has been shown to be associated with a statistically significant reduction in breast cancer mortality in multiple high quality studies 11,12
- In one meta-analysis of 11 randomized control trials with 13 years of follow-up, there was an estimated 20% reduction in breast cancer mortality in women invited for screening compared with women not offered screening 11
- Reduction in breast cancer mortality is greatest for women between 60-69 years (RR 0.69, 95% CI: 0.57-0.83) 13
- Around 75% of all breast cancers occur in women over the age of 50 14
- The benefit of screening women younger than 50 is less certain 1,12,13
- BreastScreen Australia therefore invites women aged 50-74 for 2 yearly mammograms, with women aged 40-49 or 75 and over also eligible to attend if they wish 14
- For every 1000 women who are screened every two years through BreastScreen Australia (over 25 years), around 8 deaths will be prevented 3
- Routine imaging for women younger than 40 is not recommended 14
- If an abnormality is found on initial screening mammography, it is further investigated by one or more of the following methods, collectively known as then triple test. Not all patients will require all three tests to be performed 15,16
    - Clinical assessment
    - Imaging: repeat mammography including special views or sonography

- Tissue sampling: core biopsy preferred over FNA as it provides better sensitivity and specificity for non-palpable and palpable lesions 17,18,19

Mammography

- The two main types of mammography are film (also analogue, film screen) mammography and digital mammography
- In film mammography, x-rays are transmitted through the breast tissue to create an image that is displayed directly on film. Digital mammography uses digital receptors which absorb x-rays transmitted through breast tissue and once recorded, can be displayed electronically by using computer image-processing techniques
- Digital mammography has largely replaced film as the primary test to screen women for breast cancer in Australia. 20 The advantages of digital mammography over film mammography are 21
    - The ability to post-process the image by changing contrast and magnification
    - Greater contrast resolution
    - Lower average radiation dose
    - The ability to store and send images electronically
- There are two main types of digital imaging systems which represent advancing, improving technology; computed radiography (CR) where a cassette-based removable detector is inserted into an external reading device to generate an image and direct radiography (DR) where the image is transmitted directly to the radiologist's workstation
- Full-field digital mammography is a DR technique which has a reported cancer detection rate that is greater than film and CR. 12,22,23 It is significantly more accurate than film in young women aged less than 50 years, women with dense breasts and premenopausal and peri-menopausal women 24 and is the most common mammography technique used in Australia
- Standard mammography involves two views: cranio-caudal and medio-lateral oblique 25
- The diagnostic accuracy of mammography is enhanced through the use of magnification views (magnified, coned compression views), which visualise only a small area of breast tissue but gives better contrast resolution and spatial detail
- Standardised reporting systems such as the Breast Imaging Reporting and Data System (BI-RADS) by the American College of Radiology have been developed to improve communication between physicians 26
- Although useful in predicting the presence of malignancy and widely adopted in clinical practice in USA and Europe, 25,27 BI-RADS use is less common in Australia 28
- The standardised reporting system currently in use in Australia requires a description of the following characteristics
    - Location
    - Size
    - Mass lesions - shape, margins, associated calcifications
    - Asymmetric density
    - Significant calcification- distribution, shape
    - Architectural distortion
- The mammographic findings + / - ultrasound findings are then classified into one of five categories according to level of suspicion of malignancy 28
    1. No significant abnormality
    2. Benign findings
    3. Indeterminate / equivocal findings
    4. Suspicious findings of malignancy
    5. Malignant findings
- Mammography is not as sensitive in detecting abnormal lesions in dense breast tissue and for this

reason and because it does not involve exposure to ionising radiation, ultrasound is preferred over mammography in women younger than 35 28

- One of the potential harms of breast screening is over-diagnosis, that is, detection of cancer through screening that would not have led to symptomatic breast cancer throughout a woman's life if not detected by screening. 29 This has the potential to lead to unnecessary investigations and overtreatment. The likelihood of overdiagnosis has been estimated from randomized clinical trials to be about 19% however it is uncertain how accurate this number may be. 11 In Australia, for every 1000 women who are screened from age 50 to 74 through BreastScreen (over 25 years) around 8 will have breast cancers that are treated and may not have become life threatening 2
- False-positive findings are another potential harm. The 10 year cumulative probability of a false-positive mammogram is reported to be 7% with annual and 4.8% with biennial screening 1
- The radiation exposure and hence risk of malignancy secondary to mammography is believed to be low 12

References

Date of literature search: April 2016

The search methodology is available on request. Email

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

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