

**QUALITY ASSURANCE GUIDELINES FOR BREAST
CANCER SCREENING RADIOLOGY**

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PREFACE

This is the second revision of the NHS Breast Screening Programme (NHSBSP) quality assurance guidelines for radiology. It updates and replaces those published in May 1997 as *Quality Assurance Guidelines for Radiologists* (NHSBSP Publication No 15). As before, these guidelines have been produced by a subgroup of the NHSBSP Radiology Quality Assurance Coordinating Committee and take into account the changes in practice that have prevailed in the NHSBSP since 1997, particularly the increasing involvement of breast clinicians and radiographers as screening mammography film readers. These revised guidelines also take into account the changes in performance that have been achieved in the NHSBSP over the past seven years. They have been the subject of wide consultation within the relevant professional groups working in the breast screening programme.

1. INTRODUCTION

The principal objective of these guidelines remains the general raising of standards of performance in the NHSBSP. The guidelines take into account changes in practice and in the personnel involved, such as the widespread use of double reading and the introduction of non-radiologist (radiographer and breast clinician) film readers. The guidelines are in line with the extensions to the breast screening programme (namely the use of two view mammography at every screen and extension of routine invitations to women up to and including the age of 70 years).

Those involved in screen reading should, by repeated self assessment, audit of practice and continuing education, strive to maintain and improve their skills to ensure that all women attending for mammographic screening receive an excellent service with minimal adverse effects.

The structure of breast screening quality assurance has changed since the publication of the previous guidelines in 1997.¹ In particular, clear lines of responsibility and accountability have been established, and explicit guidance on quality assurance visits now includes detailed assessment of process as well as outcome.² The principles for the organisation of local breast screening programmes have been clarified, including the criteria to enable quality assurance to be carried out.³

The director of breast screening is responsible for ensuring that these guidelines together with the *Clinical Guidelines for Breast Cancer Screening Assessment*⁴ are applied locally and incorporated into local clinical governance protocols and consultant appraisal.

1.1 Organisation of breast screening radiology quality assurance

The Royal College of Radiologists is responsible for professional standards in radiology and also for approving training courses for radiologists.

The Department of Health Advisory Committee on Breast Cancer Screening is responsible for considering issues relating to breast cancer screening and for making recommendations on policies for the practice of screening in England. This committee includes representatives from each of the main professional groups involved in providing the breast screening service together with representatives for Scotland, Wales and Northern Ireland, the director of the NHS Cancer Screening Programmes and representatives from the Cancer Screening Evaluation Unit. A separate advisory committee exists in Scotland.

There is a national coordinating committee for each of the professional groups that is involved in the NHSBSP. The remit of each of these committees is to ensure that the quality of care provided in the NHSBSP is satisfactory as measured against the national quality assurance (QA) minimum standards and current professional practice and knowledge. It is only by meeting these standards for all activities in the screening programme that the NHSBSP can expect to achieve the predicted 25% reduction in mortality from breast cancer that is directly attributable to mammographic screening.⁵

The radiologists' coordinating committee consists of representatives from each of the English QA regions, a representative from Scotland, Wales and Northern Ireland and representation from the national breast screening training centres. The committee may co-opt representatives from other groups as and when appropriate. The principal remits of the radiologists' coordinating committee are to review the standards that radiologists who are working in screening should reasonably be expected to achieve, to examine relevant data to assess screening radiology performance and to make recommendations on changes in standards and radiological practice in the NHSBSP.

Each regional radiology coordinator is appointed by the regional quality assurance director and has a term of office of three years (renewable), and is formally appraised annually by the director. Coordinators are responsible for ensuring that standards are maintained in their region, for bringing appropriate local issues for debate to the national meeting, for canvassing local opinion on national radiological initiatives and for feeding back locally on issues discussed and decided in the national forum.

2. QUALITY STANDARDS

2.1 Introduction

The quality standards in this document are those of the NHSBSP and primarily relate to monitoring at local programme level. They are divided into three separate tables and relate to women aged 50–70 years who are called or recalled for screening as part of the NHSBSP.

Each table has four columns:

- **Objective.** These are the aims of the NHSBSP in its operation in relation to specific quality issues.
- **Criteria.** These are the parameters by which the achievement (or not) of the objective will be measured.
- **Minimum standard.** These figures represent the levels of performance that are the minimum acceptable for any breast screening programme. When the minimum standard is shown as ‘greater than or equal to’, any level of performance below that standard should be investigated by the quality assurance team. When the minimum standard is shown as ‘less than or equal to’, any level of performance above that standard should also be investigated by the quality assurance team.
- **Targets.** In order for the NHSBSP to achieve a reduction in mortality similar to that of the Swedish Two Counties study,⁶ over 50% of programmes in the UK have to achieve the target invasive cancer detection rate (objective 1) and minimum standards for attendance (objective 6) and round length (objective 7). All programmes should aim to achieve these three key standards that define the quantity of the mortality reduction. The other targets are about the quality of the screening process and should be achievable individually by one third of programmes in the NHSBSP.

The data from which to measure a programme’s performance are all derived from national and local statistical returns. It is important to remember that normal variation can play a significant part in performance, particularly when looking at small numbers, so monitoring can and should be undertaken with care and, in many circumstances, aggregated over a number of years. Team results can be used by individuals as evidence to support appraisal and ultimately revalidation.

Performance of individual team members can be lost within a programme’s global results and it is quite feasible for underperformance of an individual to be masked. Screening and assessment is a team process, but each individual is responsible for his or her own training and should ensure that he or she is trained for the tasks to be undertaken and obtains appropriate training for any new tasks or techniques. Additionally, it is the responsibility of every medical and non-medical practitioner providing radiology services to monitor their team and their own performance, reporting problems through their trust’s clinical governance process.

2.2 Core radiological quality standards

These standards, shown in Table 1, relate to cancer detection. Achieving these is fundamental to the aim of the NHSBSP in reducing mortality.

Quality Assurance Guidelines for Breast Cancer Screening Radiology

Table 1 Core radiological quality standards

Objective	Criteria	Minimum standard	Target
1. To maximise the number of cancers detected	a. The rate of invasive cancers detected in eligible women invited and screened	Prevalent screen ≥ 2.7 per 1000 <i>Incident screen ≥ 3.1 per 1000*</i>	Prevalent screen ≥ 3.6 per 1000 <i>Incident screen ≥ 4.2 per 1000*</i>
	b. The rate of cancers detected which are in situ carcinoma	Prevalent screen ≥ 0.4 per 1000 <i>Incident screen ≥ 0.5 per 1000*</i>	
	c. Standardised detection ratio (SDR)	≥ 0.85	≥ 1.0
2. To maximise the number of small invasive cancers detected	The rate of invasive cancers less than 15 mm in diameter detected in eligible women invited and screened	Prevalent screen ≥ 1.5 per 1000 <i>Incident screen ≥ 1.7 per 1000*</i>	Prevalent screen ≥ 2.0 per 1000 <i>Incident screen ≥ 2.3 per 1000*</i>

*Standards shown in italic apply only to programmes in which all women have been fully screened, ie invited for screening from the age of 50 up to and including the age of 70 years.

2.2.1 Cancer detection rates (objective 1)

Invasive cancers (objectives 1a, 1c)

The criterion used to measure whether the number of cancers detected is being maximised is the rate of invasive cancers detected in women both invited and screened every three years in the 50–70 age group. Micro-invasive disease is excluded. There is a geographical variation in the incidence of breast cancer, with reduced incidence in the north compared with the south, although no significant pattern has emerged which would allow different standards to be set for different parts of the country.

The age of women screened is the major determinant of cancer detection rates. This is corrected for by use of a standardised detection ratio (SDR). This ratio allows easy calculation of confidence intervals and performance over a longer period (usually three years). The SDR for any given screening programme is the ratio of the observed number of cancers to an expected number. Expected numbers of invasive cancers detected for individual screening programmes can be predicted by knowing the numbers and age profiles of those attending and then applying these to the age specific expected detection rates. The minimum standard for each screening service is an SDR of 0.85 for any given year. This standard is the minimum for all screening programmes, regardless of size. Should a programme's performance fall below this level, data for the last three years should be examined. An investigation to establish the reasons for this apparent poor performance will be undertaken subject to the discretion of the QA team. SDR values for short periods of time should always be considered in the context of long term performance.

This minimum standard of ≥ 0.85 has been set to allow for statistical variation in the detection rate. Therefore, all screening programmes regardless of size will be expected to achieve the stated minimum standard. Target populations smaller than the recommended size should not be accepted as an explanation. Programmes that are smaller than the recommended size (9000 invited women screened per annum) can be justified only when there is adherence to national minimum standards.³

The prevalent detection rate assumes that most women attending for a prevalent screen are between the ages of 50 and 52.9 years (average 51.5 years), for whom the underlying incidence of breast cancer is estimated to be 17.3 per 10 000, and the predicted number of cancers detected in women attending for their first screen is 2.1 times the underlying incidence at age 51.5 years (this factor is derived from the cancer detection rate achieved in the Swedish Two Counties study).⁶

The incident detection rate assumes that the majority of women who are attending for an incident screen will be between the ages of 53 and 70.9 years (average 62 years). It is assumed that screening will detect 62% of cancers that are expected to occur over a three year period (based on the performance of the Swedish Two Counties study).⁶

Note: Standards 1a and 1c are for invasive cancers only and exclude in situ carcinoma and in situ carcinoma with microinvasion. The minimum standards for in situ and microinvasive disease detection are in addition to these numbers.

Ductal carcinoma in situ (objective 1b)

The number of in situ carcinoma expected includes ductal carcinoma in situ (DCIS), lobular carcinoma in situ and microinvasive disease. Detection of DCIS at screening, particularly the high grade types, is assumed to be a factor contributing to long term reduction in mortality, but no firm scientific evidence exists to confirm this. The majority of DCIS detected at screening is of the high risk type. It is thought to be good practice to detect and treat DCIS, and for this reason the minimum standard is set at ≥ 0.4 per 1000 for prevalent screens and ≥ 0.5 per 1000 for incident screens. **DCIS numbers include in situ carcinoma and in situ carcinoma with possible or definite microinvasion.** This is based on 10% of the total target cancer detection rate. No target or upper limit has been set because there is evidence that high DCIS detection rates are associated with a high SDR.⁷

2.2.2 *Tumour size (objective 2)*

It should be the aim of any breast screening programme to detect small breast cancers. The criteria for invasive tumours of less than 15 mm in diameter has been included as the primary measure, as there is good scientific evidence that this size represents the prognostic threshold.⁶ For any individual screening programme the number of tumours detected that are less than 15 mm in diameter will give a more reliable measure of performance (confidence limits will be smaller than for the number of tumours 10 mm or less). The expected standard is that 55% of the screen-detected invasive cancers will be less than 15 mm in maximum diameter for both prevalent or incident screens (standard based on analyses of the results of the Swedish Two Counties study).⁶ The minimum standard is 0.85 of the expected standard.

The histological size of invasive carcinoma (fixed specimen) is used when available. When no histology is available, the best available size from mammography, ultrasound or clinical examination (in this order of preference) should be used. Note that those cases of DCIS with possible or definite microinvasion are included with DCIS and not with invasive

cancers. There is concern that histological size may not be accurately recorded when size is recorded as 'less than' as opposed to 'less than or equal to', and pathologists should be discouraged from 'rounding up' histological size measurements.

As well as being related to tumour size, the prognosis of invasive breast cancer is correlated with a number of other factors. Those that should be routinely available include histological lymph node status, histological tumour grade and tumour type. Small size, lymph node negative disease, low histological grade and tumour special type are all associated with better prognosis. The collection of information on the success or otherwise of film readers and those carrying out assessment clinics in detecting tumours with these characteristics is to be encouraged.

Screening programmes should collect on an annual basis details of the histopathology of all screen-detected cancers, including tumour size, type, lymph node status and histological grade for invasive carcinomas and tumour size, type and grade for in situ carcinoma.⁸

2.3 General radiological quality standards

The general radiological quality standards are summarised in Table 2.

2.3.1 Screen reading specificity (objective 3)

The minimum standard for the recall of women for further assessment is less than 10% of women screened (target less than 7%) for their prevalent screen and less than 7% for subsequent screens (target less than 5%). With increasing experience it is expected that the target standards should be easily achieved by most screening programmes. When particularly high cancer detection rates are found, it may not be possible to reduce greatly referral for assessment rates. These targets relate to women aged 50–70 years who are called or recalled for screening as part of the NHSBSP. This is a measure of radiological screen reading specificity. The standards exclude technical recalls.

Film readers involved in mammographic screen reading should also be involved in breast screening assessment, preferably as part of a multidisciplinary assessment team employing the triple approach to diagnosis, as this will ensure that film readers experience first hand the outcome of their screening recalls. The assessment process is enhanced when it includes pretreatment clinical management meetings that provide each member of the team with information on his or her diagnostic accuracy.

To achieve a significant reduction in breast cancer mortality it is of prime importance that small (less than 15 mm diameter) invasive breast cancers are detected; when breast cancer detection rates are lower than predicted and the quality of service is satisfactory, less emphasis should be placed on achieving low recall rates. Recall rates of less than 2% for prevalent attendees are more likely to be associated with low small cancer detection rates.

Positive predictive value (PPV) for recall, particularly when used in a PPV recall diagram, is a powerful audit tool to demonstrate the relationships

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Table 2 General radiological quality standards

Objective	Criteria	Minimum standard	Target
3. To minimise the number of women screened who are referred for further tests*	a. The percentage of women who are referred for assessment	Prevalent screen < 10% <i>Incident screen < 7%[†]</i>	Prevalent screen < 7% <i>Incident screen < 5%[†]</i>
	b. The percentage of women screened who are placed on short-term recall	< 0.5%	≤ 0.25%
4. To ensure that the majority of cancers, both palpable and impalpable, receive a non-operative tissue diagnosis of cancer	The percentage of women who have a non-operative diagnosis of cancer by cytology or needle histology after a maximum of two attempts	≥ 80%	≥ 90%
5. To minimise the number of unnecessary operative procedures	The rate of benign biopsies	Prevalent screen < 3.6 per 1000 <i>Incident screen < 2.0 per 1000[†]</i>	Prevalent screen < 1.8 per 1000 <i>Incident screen < 1.0 per 1000[†]</i>

*Further tests includes all second appointments during which further procedures (including further views and/or clinical examination) beyond those normally undertaken at first appointment are carried out.

[†]Standards shown in italic apply only to programmes in which all women have been fully screened, ie invited for screening from the age of 50 up to and including the age of 70 years.

between sensitivity and specificity, and can be used to suggest ways to improve performance.

2.3.2 Short-term recall (objective 3b)

This standard applies to women who are recalled for screening assessment at an interval less than the normal screening interval (currently three years) after a previous screen and attendance for assessment. It is not acceptable practice to place women on short-term recall without first explaining the reason(s) why in person and offering appropriate counselling. This means that all women on short-term recall should have previously attended for assessment. Short-term recall should not be used as a routine outcome following assessment. Every effort should be made to obtain a definitive diagnosis at initial assessment and short-term recall should only be employed in exceptional circumstances and with fully informed consent, as it is associated with significant anxiety (J Austoker, personal correspondence). No more than one short-term recall outcome should be used per woman per normal (three year) screening cycle. Women on short-term recall should normally return to an assessment clinic where they can be informed of the results of any further imaging or other investigations without delay. Short-term recall of women to a routine screening session should not be used as the outcome as further management cannot usually be discussed directly with them. Short-term recall at an interval of less than one year should be exceptional as it is unlikely to be helpful in the diagnostic process.

A family history of breast cancer, other factors associated with significant increased risk of breast cancer (e.g. atypical ductal hyperplasia) or a history of previous breast cancer, however diagnosed, should not be used as an indication for more frequent screening within the NHSBSP. If continued surveillance of women in any of these categories is required

according to local policy then separate arrangements and records must be kept as part of the local symptomatic breast service.

2.3.3 Non-operative diagnosis (objective 4)

A non-operative diagnosis of malignancy is highly desirable as it allows for informed pretreatment counselling of the patient and facilitates one stage treatment. The minimum standard is that at least 80% of cancers should be diagnosed non-operatively. The target is 90%. This should be achieved by most units that are given appropriate equipment. This standard applies to all carcinomas (invasive and in situ) and applies to diagnoses made by fine needle aspiration cytology and/or core biopsy/mammotomy. Only definitive diagnoses of malignancy (C5 or B5) should be included; open surgical biopsy is not included.

Repeated attendances for assessment or needle biopsy during a single screening episode are likely to be associated with unnecessary anxiety. A definitive diagnosis should be achieved in the minimum number of assessment visits wherever possible and women should not have to make more than two visits for interventional procedures.

Standards for non-operative diagnosis adequacy and miss rates are defined in *Guidelines for Non-operative Diagnostic Procedures and Reporting in Breast Cancer Screening*.⁹ These standards are summarised in Table 3.

2.3.4 Benign biopsies (objective 5)

Surgical open biopsies are carried out specifically for the purpose of establishing a diagnosis.¹⁰ The definition excludes needle biopsy and diagnostic vacuum assisted mammotomy. Therapeutic excision biopsy of known benign lesions, which is undertaken at the woman's/surgeon's request, are also excluded. In order to minimise unnecessary surgery, the number of open surgical biopsies (performed as a result of screening) that prove to be benign should be as small as possible. Wherever possible a definitive diagnosis should be obtained by non-operative techniques, thereby avoiding the need for surgical excision. Some benign biopsies are inevitable when imaging, clinical or cytological/histological features or the woman's choice necessitate formal surgical excision to obtain a definitive diagnosis.

Table 3 Non-operative diagnostic procedures

Objective	Criteria	Minimum standard	Target
To achieve optimum aspiration technique and minimise the number of repeat needle biopsy procedures	Inadequate rate of fine needle aspiration cytology (FNAC) from solid lesions	< 25%	< 15%
To maximise the non-operative diagnosis rate and minimise the number of repeat needle biopsy procedures	Inadequate rate of FNAC from cancers	< 10%	< 5%
To maximise the non-operative diagnosis rate and minimise the number of repeat needle biopsy procedures	Miss rate on core biopsy (B1 + B2) from cancers	< 15%	< 10%

- 2.4 Service quality standards** The service quality standards are summarised in Table 4.
- 2.4.1 Attendance rates (objective 6)* The predicted reduction in mortality from breast cancer of 25% for the NHSBSP assumes a minimum attendance for screening of 70% of eligible women. This target relates to women aged 50–70 years who are called or recalled for screening as part of the national programme. The higher the level of attendance achieved, the more likelihood there is of achieving a significant reduction in mortality from breast cancer in the target age group.
- 2.4.2 Rescreening interval (objective 7)* The long-term effectiveness of the screening programme is dependent on women in the target age group continuing to be screened at regular

Table 4 Service quality standards

Objective	Criteria	Minimum standard	Target	
6. To maximise the number of eligible women who attend for screening	The percentage of eligible women who attend for screening	≥70% of invited women to attend for screening	80%	
7. To ensure that women are recalled for screening at appropriate intervals	The percentage of eligible women whose first offered appointment is within 36 months of their previous screen	≥90%	100%	
8. To minimise anxiety for women who are awaiting the results of screening	The percentage of women who are sent their result within two weeks	≥90%	100%	
9. To minimise the interval from the screening mammogram to assessment	The percentage of women who attend an assessment centre within three weeks of attendance for the screening mammogram	≥90%	100%	
10. To minimise diagnostic delay for women who are diagnosed non-operatively	Proportion of women for whom the time interval between non-operative biopsy and result is one week or less	≥90%	100%	
11. To achieve optimum image quality (film/screen mammography only, excludes digital mammography)	a. High contrast spatial resolution	≥12 lp/mm		
	b. Minimal detectable contrast (approximately)	5–6 mm detail	≤1.2%	≤0.8%
		0.5 mm detail	≤5%	≤3%
		0.25 mm detail	≤8%	≤5%
c. Aim film density	1.5–1.9			
12. To limit radiation dose	Mean glandular dose per film to standard breast using a grid	≤2.5 mGy		

intervals. Currently, the screening interval is 36 months. Women should be sent an appointment to reattend which is not more than 36 months from the date of their previous attendance.

2.4.3 *Timely processes (objectives 8–10)*

Screening can be stressful for women and it is appropriate that all stages of the process are undertaken in a timely fashion.

Having cytology or core biopsy causes particular anxiety and a quality service would be expected to inform women of the results of these procedures without significant delay. Ideally, women should be informed of any results in person; when results are given by telephone, these should be confirmed in writing.

2.4.4 *Image quality (objective 11)*

Although the regular monitoring of image quality is the responsibility of the radiographic team and medical physics services, there is clear evidence relating film quality to cancer detection and for this reason the film reader should demand the highest quality while maintaining dose at a reasonable level.¹¹

3. STANDARDS FOR WORKING PRACTICE

3.1 Radiologists' responsibilities

A radiologist involved in breast cancer screening has the following responsibilities.

1. To ensure that he or she acquires and maintains a comprehensive knowledge of breast disease and the necessary skills to conduct the full diagnostic process, including:
 - reading and interpretation of mammograms
 - use of ultrasound and its application to breast assessment
 - assessment of suspected abnormalities
 - performing fine needle aspirations, wide bore needle biopsies and localisation by palpation, ultrasound and x-ray (stereotactic control).

This will involve attendance at the Royal College of Radiologists (RCR) approved breast screening training courses and subsequently regular reading of appropriate articles/journals and attendance at scientific meetings that include breast imaging. The RCR Breast Group curriculum for subspecialty training in breast imaging is given in Appendix 1. The screening radiologist is expected to participate in the college's continuing medical education (CME) credit scheme and ensure continuing accreditation by the college. It is suggested that at least 25% of a screening radiologist's CME time should be spent specifically in breast screening education (12.5 hours per year at present). Recommendations for CME are given in Appendix 2. A list of NHSBSP national training centres is given in Appendix 3.

2. To oversee and give advice on radiographic work and standards.
3. To participate actively in and encourage the concept of breast screening as a multidisciplinary team activity. This will involve liaising routinely and regularly with pathologists, cytologists, breast clinicians, surgeons, radiographers, breast care nurses and physicists. It may also involve clinical and medical oncologists, geneticists, plastic surgeons, consultants in public health medicine and cancer registry staff.
4. To participate actively in and encourage formal audit of performance of the programme and individuals. This will require radiologists to agree to the audit of all aspects of their work in breast screening and comparison with their peers and to demonstrate a willingness to alter their practice if the need is indicated by the outcomes. This may imply in a few cases that retraining is required (eg by secondment to a Royal College of Radiologists accredited training centre). This audit should include the regular review of NHSBSP objectives:
 - to maximise the number of carcinomas detected in the screened population
 - to maximise the number of small carcinomas detected
 - to minimise the number of women recalled for assessment
 - to minimise the number of interval cancers, particularly

false negative cases, and to encourage surgeons to request mammography when a carcinoma is detected so as to minimise the number of unclassifiable cases

- to minimise the number of unnecessary excision biopsies (ie biopsies in benign cases).

Besides auditing the above professional work, it should be recognised that audit will also include the timeliness of the various activities against prescribed limits. The audit will compare the local programme's performance against other programmes in the region and nation. An individual's performance may be monitored against others in that programme, region and nation. To ensure long term participation and commitment to audit of performance, audit information should not identify the individual radiologist without prior permission.

Radiologists working in the breast screening programme should ideally be associated with the local symptomatic breast imaging service and involved in the imaging of patients with symptomatic breast problems. This will maintain and develop the radiologist's skills and represents the best use of expertise. It will ensure that quality standards for symptomatic services will equate with those of the NHSBSP.

3.2 Working practices for film readers

To achieve the quality standards, each film reader should:

- undertake a minimum of 5000 screening and/or symptomatic cases per year
- attend multidisciplinary clinical management meetings
- participate in an approved radiology performance QA scheme for mammography.

Film readers involved in breast cancer screening are encouraged to participate in the voluntary PERFORMS™ self assessment programme administered by the Applied Vision Research Unit at the University of Derby.

In addition, each radiologist should:

- be employed for a minimum of three programmed activities dedicated to direct clinical care in breast imaging
- comply with the requirements for training as outlined above and for CME as prescribed by the appropriate Royal College or equivalent
- be involved with assessment as well as basic screening
- be experienced in the use and interpretation of mammographic and breast ultrasound procedures
- have access to pathology follow-up data
- have access to surgical follow-up data.

It is also recommended that the screening radiologist should:

- be involved with symptomatic breast work
- have skills in clinical examination of the breast
- have undertaken training in communications and 'breaking bad news'.

The expertise of radiologists who satisfy these criteria should also, as stated above, wherever possible be directly involved in providing the local symptomatic breast imaging service. Professional standards for screening and symptomatic breast imaging prepared by the RCR Breast Group are set out in *Guidance on Screening and Symptomatic Breast Imaging*.¹²

3.3 Facilities for screen reading

Mammography film readers should ensure that facilities for screen reading are suitable for the purpose. Equipment should include adequate access to a film multiviewer sited in an environment with appropriate lighting which is suitable for uninterrupted screen reading. A magnifying glass or other magnifying device should be used routinely when viewing screening mammograms. When resources allow, double reading of mammograms by two film readers is preferred.

Previous mammograms should be available to film readers at the time of screen reading. For incident examinations, the previous and, or at least penultimate, screening mammograms should be mounted on the viewer to allow direct comparison by the reader. It is the responsibility of the film reader to decide whether or not it is necessary to obtain previous mammograms held at another unit. When previous films are required, the original, rather than copy films, should be obtained whenever possible. Within the NHSBSP no charge should be made for the transfer of patient information from one unit to another. A reasonable fee, to cover administration and carriage, for the transfer of films from elsewhere within the NHS may be expected. Radiologists should establish reciprocal links between the NHSBSP and the private sector to encourage free flow of relevant radiological data.

A system should also be in place to alert the film reader at the time of screen reading to relevant clinical signs or symptoms noted by the radiographer or reported by the woman at the time of the screening attendance (see *Information and Advice for Health Professionals in Breast Screening*).¹³ It is the responsibility of the film reader to assess the significance of these breast symptoms or signs and to ensure that appropriate further assessment of these women takes place.

When possible, previous screening mammograms should also be available to the radiographic practitioner at the time of performing subsequent screening examinations. This allows the radiographic practitioner to tailor the examination and obtain images of optimal quality.

The radiologist is responsible along with the director of screening for ensuring that:

- mechanisms are in place to record accurately the results of screen reading
- the results are conveyed to the woman in writing in a timely manner (within three weeks of screening attendance, and ideally within two weeks)
- the primary care teams are kept informed
- any further assessment required is instigated without delay and within the required time scales.

4. INTERVAL CANCERS

4.1 Interval cancer data

Interval cancers are defined as breast cancers diagnosed in the interval between scheduled screening episodes in women screened and are issued with a normal screening result. They are inevitable in any screening programme but their numbers should be kept to a minimum. A high proportion of interval cancers will reduce the likelihood of achieving a reduction in mortality in the population that is being offered screening. As the number of interval cancers occurring in individual screening programmes each year is relatively small, analysis of interval cancer data should preferably take place on a regional basis. An individual screening programme's interval cancer data are likely to be meaningful only when several years' data are available. However, individual screening programmes should continue actively to participate in the collection and collation of interval cancer data. Interval cancer data should be examined together with other screening data such as invasive cancer detection rates and SDRs when considering the performance of a breast screening programme.

Audit of the proportions of interval cancers, screen-detected breast cancers and cancers of the other classifications outlined below will assist in the evaluation of the NHSBSP and its achievements in the longer term. Estimates could be made of overall programme sensitivity and possibly areas that would merit further attention could be identified.

Expected interval cancer rates for the target screening age group of 50–70 years are shown in Table 5.

Table 5 Expected interval cancer rates

	0–24 months	25–36 months
Number of invasive cancers per 1000 women screened	1.2	1.4

4.2 Review of interval cancers

4.2.1 Principles

The importance of radiological review and classification of interval cancers in a breast cancer screening programme has been recognised particularly because of the educational benefit of this process to screening film readers. By viewing cases in which the mammograms show very subtle changes of malignancy, film readers have been able to improve their skills in detecting small breast cancers. The review protocol recognises the need for consistency and objectivity in the review process. However, because the review and classification process involves opinions on cases from individual film readers, it will not be possible to develop a process yielding entirely consistent results among all programmes and regions.

4.2.2 Aims of review

The aims of the review protocol are:

- to ensure that there is a standard process for the review of previous mammograms, which will ensure that radiologists and film readers continue to learn from interval cancer film review

- to provide helpful and understandable information to those women with a diagnosis of breast cancer who request results of audit of their previous films.

4.3 Information flow

4.3.1 *Identifying interval cancers*

Interval breast cancer cases may be identified from a number of sources. These will include symptomatic breast clinics, pathology laboratories and eventually the cancer registry. When a breast cancer case is identified in a woman aged 50–74 years in a hospital with a breast screening unit, the clinician treating the woman should ensure that the director of breast screening is informed. The director is then responsible for informing the regional quality assurance reference centre (QARC). When the hospital that is treating the woman for breast cancer does not have a screening unit, the clinician treating the woman should inform the QARC directly. Patients with interval breast cancers may also be identified through liaison between the QARC and the local cancer registry. Identifying details to be passed to the screening unit or QARC might include:

- name
- date of birth
- address
- GP/practice details
- NHS number.

4.3.2 *QARC actions*

Once the QARC has received the identifying details of a patient diagnosed with breast cancer, they should check the patient's NHSBSP history and confirm the identification of interval cancers. They should then classify the cases into the following categories:

- interval cancer (between screens)
- cancer in a non-attender (never accepted invitation)
- cancer in a 'lapsed attender' (more than three years since last screen and since reinvited or over invitation age)
- cancer in an uninvited woman (woman who has never been invited).

The QARC should inform the appropriate screening programme of those patients with breast cancer that are interval cases and which therefore require radiological review. The screening programme should also be given details of the woman's diagnosis, including the details of the treating clinician.

4.4 Review process

Once notified of a woman's details, the breast screening programme should request the symptomatic mammograms and carry out radiological review in order to classify the previous screening mammograms (Figure 1).

- **Category 1: normal/benign.** Normal or benign mammographic features
- **Category 2: uncertain.** A feature is seen with hindsight on the screening mammogram that is difficult to perceive or does not clearly

have either benign or malignant features. All screening film readers may have difficulties with perception or interpretation of such subtle mammographic appearances, eg asymmetric soft tissue density, parenchymal distortion

- **Category 3: suspicious features.** An abnormality is seen on the mammogram that has features suspicious of malignancy, eg pleomorphic microcalcification, spiculate mass.

The review process will be carried out at a local level in the screening programme and should involve a minimum of two film readers. For screening programmes with one film reader, a film reader from another programme should be invited to take part in the review. If there is disagreement regarding the classification of a case between the two film readers, arbitration will be sought from a third reader. Some regions or programmes may choose to undertake a further review process involving more than two readers for educational purposes.

The previous screening films should be initially reviewed by each reader independently without sight of the mammograms taken at diagnosis if these are available. It is not necessary to mix normal cases with the screening films to be reviewed. The presence of any abnormal mammographic sign/feature is recorded and the radiology level of suspicion for malignancy is indicated using the three point classification scale. Following initial review, the diagnostic films should be reviewed in order to verify that any subtle or suspicious signs that are detected on the screening films correspond to the site of the confirmed breast cancer on the diagnostic films. If there are no mammograms available from the time of diagnosis, there can be no certainty that any abnormality on the screening films corresponds to the cancer and the case should be designated 'unclassifiable'.

Once the cases have been reviewed, the breast screening programme should inform the QARC. The unit that screened the woman should retain the named patient data in order to discuss the findings of the review with the woman at a later date if she so wishes.

4.4.1 *False negative assessment cases*

For cases when a woman has been recalled following screening and has undergone assessment for an abnormality that is shown to correspond to the breast cancer, the case should be reviewed within a multidisciplinary forum. These should be separately reported to the QARC in aggregated reports as a subcategory of interval cancer.

4.4.2 *QA review*

Interval cancer films together with the results of the review process will be reviewed by the regional QA radiologist during a QA visit to ensure that the interval cancer review process is being carried out appropriately.

4.5 **Disclosure**

Further detailed guidance on the psychological and medicolegal aspects of the audit of interval cancers and the disclosure of results is in preparation.¹⁴

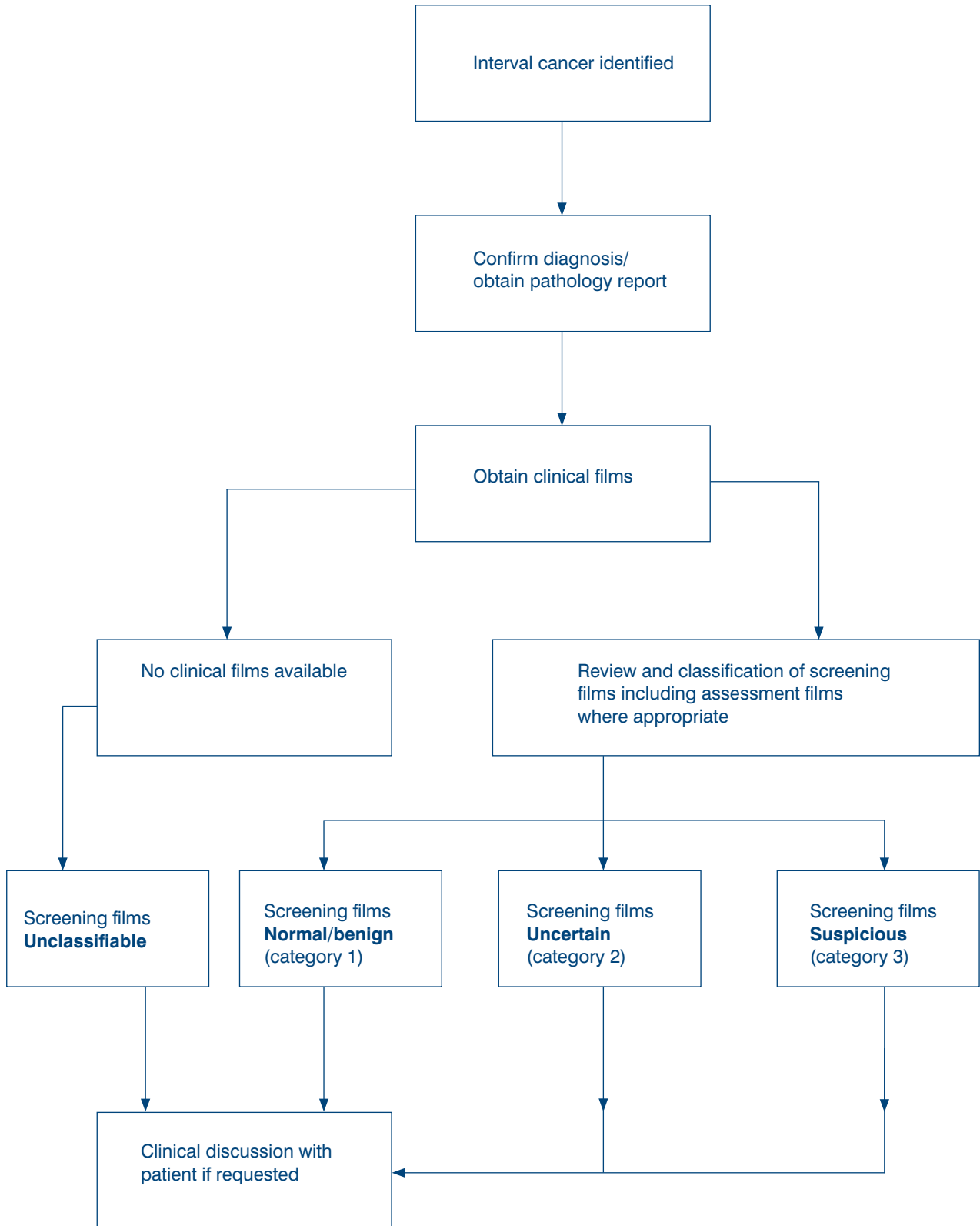


Figure 1 Interval cancers: review of screening mammograms.

5. BREAST SCREENING TRIALS AND RESEARCH

- 5.1 Research programmes** Many research programmes are under way nationally and internationally on different aspects of breast cancer screening, diagnosis and treatment. Further information and a list of these trials can be found at www.cancer-portfolio.org. Funding for research in breast cancer in the UK is currently coordinated by Cancer Research UK and the Medical Research Council (MRC). Recent and current trials are summarised below.
- 5.2 Radiologist's role** Despite being currently the most sensitive test available for the early detection of breast cancer, mammography has a number of well documented shortcomings. To address these, it is important that radiologists working in breast cancer screening encourage, support and, where possible, participate in research aimed at improving the effectiveness of early detection by screening to reduce breast cancer mortality.
- The radiologist has an important role to play in research into improving basic screening techniques and subsequent assessment diagnostic processes.
- 5.3 Recent and current UK trials**
- 5.3.1 Frequency trial** This trial was designed to compare the efficacy of annual screening with three yearly screening carried out in the NHSBSP. The published report concluded that shortening the screening interval in the age group of 50–62 years is predicted to have a relatively small effect on breast cancer mortality.¹⁵ It was felt that other improvements to the screening programme could be targeted more productively on areas other than the screening interval.
- 5.3.2 One versus two view mammography trial** This trial has been completed and the results published.¹⁶ Implementation of two view mammography for the prevalent round became mandatory in 1995. Two view screening has now commenced for all rounds as part of the NHSBSP screening extension. All units should have been compliant by the end of 2003.
- 5.3.3 Age trial** This is an MRC/Department of Health (DOH) funded trial. This prospective randomised control trial aims to study the value of annual mammographic screening of women starting at the age of 40–41 years on the mortality from breast cancer. In total, 54 000 women have been recruited into the intervention arm of the trial. Two views are used for the first screen and single view thereafter. A total of 107 000 women who have been recruited to the control arm have not been invited for screening as part of the trial. Cumulative breast cancer mortality rates will be compared in the intervention and control arms. Although recruitment has fallen just short of the target of 195 000 women, the trial retains an acceptable 73% power to detect a 20% breast cancer mortality reduction at a 10 year follow-up. An analysis of surrogate outcome measures has

been conducted and will be submitted for publication. Further papers on screening, pathology and radiology results from the trial will also be submitted. Trial coordinator: Iyamide Thomas (iyamide@icr.ac.uk).

5.3.4 *Magnetic Resonance Imaging for Breast Screening (MARIBS)*

The MARIBS study started in 1997 to examine the sensitivity and specificity of magnetic resonance imaging (MRI) in comparison with mammography as a screening modality for young women at high genetic risk of breast cancer. Women under the age of 50 years who are either tested mutation carriers for the *BRCA1*, *BRCA2* or *p53* genes or at least at a 50% risk of being gene carriers owing to a known family mutation or family history of breast and/or ovarian cancer (or Li–Fraumeni syndrome) were recruited at 22 genetics clinics around the UK. The recruits were then offered annual mammograms and MRI scans at their local centre. Recruitment to the study closed in March 2003. Project coordinator: Linda Pointon (linda.pointon@icr.ac.uk).

5.3.5 *Million Women Study*

This is a national survey into hormone replacement therapy (HRT) usage and its possible effects in women who are invited for breast screening. Funded by Cancer Research UK, it started collecting data through a self administered questionnaire in June 1996. Papers on the design of the study and patterns of use of HRT have so far been published. A major publication on breast cancer and hormone replacement therapy in the Million Women Study was published in 2003.¹⁷ The study concluded that the use of HRT is associated with an increased risk of incident and fatal breast cancer. The effect on incident cancer is substantially greater for oestrogen–progestogen combinations than for other types of HRT. The study is also looking at the effect of HRT and other factors on the specificity and sensitivity of screening, and two subsequent papers have been published.^{18,19} Principal investigator: Professor Valerie Beral.

5.3.6 *Vacuum assisted biopsy*

The first meeting of the UK users of vacuum assisted biopsy took place in October 2002. A multicentre study on the effectiveness of the device has been carried out and will be published in 2005. Guidelines for the use of vacuum assisted biopsy as part of breast screening assessment are now included in the updated guidelines for breast screening assessment.⁴

5.3.7 *Computer aided detection (CAD)*

The use of CAD is being evaluated by a group at St George's Hospital and City University, London, funded through Health Technology Assessment (HTA). Initial findings with the R2 Image Checker using archive mammograms and 50 film readers did not reveal any significant improvement in cancer detection overall.²⁰ This appears to be due to the number of false prompts. A further study funded by the NHSBSP has looked at R2 version 5 in routine clinical practice.²¹ This showed a small increase in the sensitivity with CAD (2%), a larger increase with double reading (8%), increased recalls with CAD (5.2%) and that overall single reading with CAD takes more time than double reading.

5.3.8 *Sloane project*

This prospective audit of DCIS, funded by the NHSBSP in memory of Professor John Sloane, commenced in April 2003. It aims to accurately document the radiological, clinical and pathological findings in screen detected DCIS. All screening units have been invited to participate in collecting relevant data. Project coordinator: Karen Clements (karen.clements@wmciu.nhs.uk); tel. 0121 4158190.

5.3.9 *International Breast Cancer Intervention Study (IBIS-II)*

IBIS-II is a randomised double blind control trial divided into two studies. The Cancer Research UK Department of Epidemiology, Statistics and Mathematics is coordinating the trial. One study is investigating the effect of anastrozole as a chemopreventive agent in postmenopausal women at increased risk of breast cancer (anastrozole versus placebo in a double blind randomised control trial). Women with a medium to high risk owing to family history or benign breast conditions are eligible. The other study is comparing the effectiveness of tamoxifen with anastrozole in women who have been diagnosed with ER or PgR positive DCIS within the last six months (tamoxifen versus anastrozole in a double blind, double dummy trial). The study is recruiting at present and will continue for five treatment-years. There are over 20 countries participating in the study and an anticipated 50 centres. All trial activities will be conducted electronically.

Further information is given on the trial website (www.ibis-trials.org) or contact the team leader, Clare O'Neill (oneill@cancer.org.uk).

5.3.10 *Family history screening*

A nationally coordinated study has been set up to look at the evaluation of mammographic surveillance services in women under 50 years who have a family history of breast cancer. This initiative aims to collect information on high and moderate risk women who are seen within a clinic setting. Risk criteria have been defined and screening will be carried out annually for five years on women aged 40–45 years at entry. This will be carried out through symptomatic and family history clinics. The coordination of this study is funded by the HTA programme. Study coordinator: Susan Thomas (susan.thomas@velindre-tr.wales.nhs.uk).

REFERENCES

1. *Quality Assurance Guidelines for Radiologists*. NHS Breast Screening Programme, 1997 (NHSBSP Publication No 15).
2. *Guidelines on Quality Assurance Visits*. NHS Cancer Screening Programmes, 2000 (NHSBSP Publication No 40, 2nd edn).
3. *Organising a Breast Screening Programme*. NHS Cancer Screening Programmes, 2002 (NHSBSP Publication No 52).
4. *Clinical Guidelines for Breast Cancer Screening Assessment*. NHS Cancer Screening Programmes, 2005 (NHSBSP Publication No 49, 2nd edn).
5. Blanks RG, Moss SM, McGahan CE et al. Effect of NHS Breast Cancer Screening Programme on mortality from breast cancer in England and Wales, 1990–98: comparison of observed with predicted mortality. *British Medical Journal*, 2000, 321: 665–669.
6. Tabar L, Fagerberg G, Duffy SW et al. Update of the Two-County Program of Mammographic Screening for Breast Cancer. *Radiologic Clinics of North America*, 1992, 30: 187–210.
7. Evans AJ, Blanks RG. Should breast screening programmes limit their detection of ductal carcinoma in situ? *Clinical Radiology*, 2002, 57: 128–132.
8. *Guidelines for Breast Pathology Services*. NHS Breast Screening Programme, 1997 (NHSBSP Publication No 2) (being revised).
9. *Guidelines for Non-operative Diagnostic Procedures and Reporting in Breast Cancer Screening*. NHS Cancer Screening Programmes, 2001 (NHSBSP Publication No 50).
10. *Quality Assurance Guidelines for Surgeons in Breast Cancer Screening*. NHS Cancer Screening Programmes, 2003 (NHSBSP Publication No 20, 3rd edn).
11. Young KC, Wallis MG, Ramsdale ML. Mammographic film density and detection of small breast cancers. *Clinical Radiology*, 1994, 49: 461–465.
12. *Guidance on Screening and Symptomatic Breast Imaging (2nd edn)*. Royal College of Radiologists, 2003.
13. *Information and Advice for Health Professionals in Breast Screening*. NHS Cancer Screening Programmes, 2002 (NHSBSP Publication No 53).
14. *Guidelines of the Audit of Interval Cancers and Disclosure of Results*. NHS Cancer Screening Programmes (in preparation).
15. United Kingdom Co-ordinating Committee on Cancer Research. The frequency of breast cancer screening: results from the UKCCCR Randomised Trial. *European Journal of Cancer*, 2002, 38: 1458–1464.
16. Wald NJ, Murphy P, Major P et al. UKCCCR multicentre randomised controlled trial of one and two view mammography in breast cancer screening. *British Medical Journal*, 1995, 311: 1189–1193.
17. Beral V, Million Women Study Collaborators. Breast cancer and hormone-replacement therapy in the Million Women Study. *Lancet*, 2003, 362: 419–427.
18. Banks E, Reeves G, Beral V et al. Impact of use of hormone replacement therapy on false positive recall in the NHS Breast Screening programme; results from the Million Women Study. *British Medical Journal*, 2004, 328: 1291–1292.
19. Banks E, Reeves G, Beral V et al. Influence of personal characteristics of individual women on sensitivity and specificity of mammography in the Million Women Study: cohort study. *British Medical Journal*, 2004, 329: 477.
20. Taylor C, Champness J, Reddy M et al. Reproducibility of prompts in computer-aided detection (CAD) of breast cancer. *Clinical Radiology*, 2003, 59: 733–738.
21. Taylor P, Champness J, Given-Wilson R et al. An evaluation of the impact of computer-based prompts on screen readers' interpretation of mammograms. *British Journal of Radiology*, 2004, 77: 21–27.

APPENDIX 1: SUBSPECIALTY TRAINING – BREAST IMAGING EUROPEAN GUIDELINES AND SYLLABUS

Introduction

This section includes guidance on training for radiologists. Professionals who are not radiologists but who undertake radiological procedures such as film reading should follow the same guidance but may wish to refer to their own specialist professional groups for details of specific training and educational needs.

The aim of subspecialty training in breast imaging is to prepare a radiologist for a career in which a significant portion of his or her time will be devoted to breast imaging and/or breast cancer screening with mammography. Such individuals will be expected to provide and promote breast imaging and interventional methods, as well as new imaging breast cancer screening procedures.

The aims of establishing a curriculum for subspecialty training in breast radiology is to ensure:

- an in-depth understanding of breast disease with particular knowledge of the nature of breast cancer in all its guises
- a clear understanding of the role of imaging in the early diagnosis of breast cancer
- development of the necessary clinical and management skills to enable radiologists to become an integral part of a multidisciplinary breast team in symptomatic and/or population screening settings.

Expertise and facilities

Training must be undertaken in a team with access to full clinical service in radiology, general surgery/gynaecology and pathology. If possible, oncology, radiotherapy, plastic surgery, social and preventive medicine should also be offered.

Training should be supervised by a radiologist with extensive experience in breast imaging and breast cancer screening methods (eg reporting a minimum of 5000 screening and/or symptomatic cases per year). The training department(s) should fulfil EU guidelines and must have mammography, ultrasonography and interventional equipment, including stereotaxic and ultrasonically guided biopsy systems. Trainees should also have access to breast MRI, nuclear medicine and acquire knowledge of breast cancer screening. Trainees must also have access to a radiological library containing senology and radiology textbooks and journals, and must have access to a film library.

Practical training

Trainees will have obtained a basic knowledge of breast diagnosis in their initial training. The training outlined below will extend this into the practical role.

Those clinical radiologists who wish to devote essentially all of their time as specialists/consultants in breast imaging should undertake 12

months or its equivalent of subspecialty training. Those who wish to practise breast imaging as one of a mixture of activities would normally expect to undertake six months' training.

Trainees will acquire an extensive knowledge of the pathology and epidemiology of breast diseases, both female and male, and of primary, local recurrence and distant disease. They should have at least a basic knowledge of the treatment of breast disease by surgery, radiotherapy and chemotherapy and be aware of the diagnostic needs of their surgical, radiotherapy and oncology colleagues. It would therefore be helpful for trainees to spend time in breast clinics, operating theatres, and radiotherapy and oncology departments. Trainees must also develop skills in the use and interpretation of imaging modalities used in the diagnosis and treatment of distant spread of disease, eg plain radiographs, ultrasound, computerised tomography (CT), MRI and nuclear medicine. They will receive training in communication with patients and colleagues and 'breaking bad news'.

They must obtain extensive experience in all of the diagnostic procedures listed in the syllabus and will be expected to be familiar with the current breast imaging literature, from both standard textbooks and original articles.

As audit is an integral part of the process of breast imaging, particularly screening, the trainee will have ready access to data to analyse the proficiency of his or her activities. Additionally, the trainee will be expected to complete a focused audit and develop an understanding of the process of interval cancer review.

Trainees should participate in research and should be encouraged to pursue a project up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, should be acquired.

Trainees must attend regular multidisciplinary conferences.

Theoretical training

Trainees should attend 40 hours of theoretical training in the form of locally delivered tutorials and specialist breast imaging courses as well as national and international breast imaging and breast screening conferences, such as those of the European Society of Breast Imaging (EUSOBI) and the European Congress of Radiology (ECR).

Syllabus

A. Clinical training

- Ability to undertake physical examination of the breast and associated structures.
- Knowledge of the clinical findings associated with normal, benign and malignant tissue.
- Knowledge of the risks of breast disease associated with family history, hormone replacement therapy, etc.
- Knowledge of breast surgery, treatment and reconstruction and how these might influence imaging appearances.

- B. Radiation protection*
- Knowledge and understanding of the current legislation governing the use of ionising radiation and of the responsibilities as defined in national and European legislation.
 - Knowledge and understanding of the need to minimise the radiation dose received by the patient/client.
 - Knowledge and understanding of the risk–benefit analysis associated with breast screening using ionising radiation compared with other techniques, eg ultrasound, MRI.

C. Physics

For all imaging modalities:

- knowledge and understanding of the physics of image production and how alteration of machine parameters affect the image
- knowledge and understanding of image recording and display systems, and how alterations in machine parameters affect the image
- knowledge and understanding of quality assurance programmes and the impact that image quality has on clinical performance
- knowledge of artefacts, limitations of resolution and contrast.

D. Anatomy and pathology

- Knowledge and understanding of normal embryology, physiology and anatomy of the breast and associated structures; in particular changes due to age, lactation, hormonal status, surgery, radiotherapy, etc.
- Knowledge and understanding of normal physiology, pathology and pathophysiology of breasts and associated structures, including synchronous and metachronous disease.
- Knowledge and understanding of benign and malignant diseases of the breast and associated structures, and how these processes manifest both clinically and on imaging.
- Knowledge of the spread of breast carcinoma and the pathology in other organs.

E. Imaging techniques

Understanding of the principles of all imaging methods, including:

- relative indications and contraindications
- complications
- recognition of artefacts
- normal appearances, normal variations, benign and malignant processes, including primary, local recurrence and distant spread
- limitations of individual techniques, examinations, sequences/views and the complementary nature of other techniques and the role of each technique in the investigation of breast disease
- knowledge and understanding of how imaging findings influence decisions by others, eg surgeons, pathologists, oncologists, etc.

The imaging methods are:

1. mammography including additional and special views
2. ultrasound
3. MRI
4. nuclear medicine.

- F. Interventional techniques*
- Understanding of the principles of all of the interventional procedures, including:
- relative indications and contraindications
 - complications
 - advantages and disadvantages
 - limitations of individual examinations and the complementary nature of other techniques, and the role of each technique in the investigation of breast disease
 - knowledge and understanding of how biopsy and interventional techniques influence decisions and treatment planning by others, eg surgeons, pathologists, oncologists, etc.
- The interventional procedures are:
1. cyst aspiration
 2. FNAC (free hand and/or image guided)
 3. mechanical and vacuum assisted core biopsy (free hand and/or image guided)
 4. image guided localisation
 5. abscess management
 6. MRI guided focused ultrasound and any other new techniques.
- G. Communication*
- Knowledge and understanding of the importance of effective communication with both the patient and the members of the multidisciplinary team.
 - Knowledge and understanding of the principles of breaking bad news and the psychosocial consequences of doing this badly.
- H. Team working*
- Knowledge of roles and responsibilities of other members of the breast imaging team, eg clerical officers, radiographers, nurses, support staff, secretaries, etc.
 - Knowledge of roles and responsibilities of other members of the multidisciplinary team.
 - Knowledge and understanding of how imaging findings influence decisions by others, eg surgeons, pathologists, oncologists, etc.
- I. Breast screening*
- Knowledge and understanding of the aims, objectives and principles of population breast screening.
 - Knowledge and understanding of the risks and benefits of screening to the population and the individual, including those related to age factors, family history and HRT.
 - Knowledge and understanding of the objectives and principles of quality assurance.
 - Understanding of the principles and techniques used in audit and research, including the value of clinical trials and basic biostatistics.
 - Knowledge and understanding of legal liability and processes.
- J. Practical training*
- The trainee must obtain substantial experience in all of the clinical, imaging and interventional techniques that are listed above. The minimum experience per month of training is:

- interpretation of screening mammograms, 300 cases
- interpretation of symptomatic cases including ultrasound, 80 cases
- experience of image guided procedures, 20 cases.

Acknowledgements

The contributions of Matthew Wallis and the European Society of Breast Imaging in developing the training guidelines and syllabus are gratefully acknowledged.

APPENDIX 2: CONTINUING MEDICAL EDUCATION

Radiologists working in breast screening should ensure that their knowledge and skills are up to date by:

- participation in PERFORMS or an equivalent assessment of film interpretation
- acquiring at least 25% of CME points in breast radiology
- involvement of audit and interval cancer review
- development of new skills to address new technology challenges, eg MRI and MRI guided biopsy.

The national training centres have a continuing role with regard to:

- training of new entrants into the specialty
- organising refresher courses
- individual tuition for radiologists with a specific problem
- reacting to the training needs that are identified by the various professional QA groups.

The contact addresses of the NHSBSP training centres are provided in Appendix 3.

All training centre activities that are relevant to radiologists should be registered with the Royal College of Radiologists and attract the appropriate CME points.

APPENDIX 3: NHSBSP TRAINING CENTRES

Nottingham National Breast Screening Training Centre
Blamey Education Centre
Nottingham Breast Institute
City Hospital
Hucknall Road
Nottingham
NG5 1PB

Tel. 0115 969 1689
www.ncht.org.uk/breastinstitute/
email: nibecenquiries@ncht.trent.nhs.uk

Manchester National Breast Screening Training Centre
Nightingale Centre
Withington Hospital
Manchester
M20 0PT

Tel. 0161 611 3089

Jarvis National Breast Screening Training Centre
Stoughton Road
Guildford
GU1 1LJ

Tel. 01483 783260

South East London National Breast Screening Training Centre
King's College Hospital
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Camberwell
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Tel. 020 7346 3870

St George's Hospital National Breast Screening Training Centre
Duchess of Kent Breast Screening Unit
St George's Hospital
205 Blackshaw Road
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Tel. 020 8725 1534
www.nationaltrainingcentre.org.uk