BREAST CANCER SCREENING: THE UK INDEPENDENT REVIEW AND UPDATE ON BREAST SCREENING IN ENGLAND

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Abstract
The National Health Service Breast Screening Program began operations in 1988. Good quality was achieved by the mid-1990s, by which time the program was screening one million women per year. Criticism of the program grew in the first decade of the 21st century. Originally it was alleged lives were not saved, but this moved on to alleging that only a few lives were saved, and that many more were damaged by overdiagnosis. In 2012, an independent review of the breast screening program was commissioned, which concluded that the program saved about 1300 lives per year and should continue. However, for each life saved, three women were diagnosed with cancer who might not otherwise have had such a diagnosis. Following the review, the information leaflet sent to women was revised to take account of the new calculations of benefits and harms. The program is now conducting a major trial of screening of women 47-49 and 71-73 years, involving sending additional invitations at each end of the routine 50-70 year age group. It is also considering the evidence about introduction of tomosynthesis and how to meet the challenge of the retirement of the cohort of staff who were appointed at the start of the program.

The National Health Service (NHS) Breast Screening Program commenced operations in 1988. At the time, the UK had the highest mortality rate in the world from breast cancer, although not the highest incidence rate. There were about 30,000 cases a year and 16,000 deaths. There is no reliable cancer stage data from the time, but the often expressed view was that this poor survival rate was due to British women presenting late.

The Swedish Two Counties trial of breast cancer screening published its results in 1985, showing a 31% fall in mortality among invited women. Following this the Department of Health in the UK commissioned Professor Sir Patrick Forrest to lead a group of experts to examine the evidence and make recommendations. They recommended three yearly screening for women aged 50-64 years. In 2004, this was expanded to women aged 50-70 years inclusive, but otherwise essentially this is the screening program which exists today. It was fully rolled out across England by 1990 and the first, prevalent, round of screening was completed in England in 1993.

It took a number of years for the correct quality to be achieved, but by the end of the 20th century the program was working well. At the same time, mortality from breast cancer was falling dramatically as treatment improved, particularly with the introduction of tamoxifen, and the introduction of the breast screening program had hugely improved the infrastructure and techniques for breast cancer diagnostics for all women in the UK. Studies showed the greatest reduction in mortality was observed in the screened age group, but the effect was not as large as had been hoped for.

Figure 1: Number of women screened annually in the breast screening program, England.
![Figure 1](source: Department of Health and Health and Social Care Information Centre)

Figure 2: Breast cancers detected annually in the breast screening program, England.
![Figure 2](source: Department of Health and Health and Social Care Information Centre)
The NHS Breast Screening program now screens nearly two million women a year and in the last year reported (2012/13) found over 16,000 breast cancers (see figures 1 and 2).

Criticism of breast screening

Criticism of breast screening for not achieving its objective of reducing mortality began in the 21st century. In particular, a paper from the Nordic Cochrane Group published in the Lancet caused a great deal of consternation. As time moved on, it was broadly accepted that there was some reduction in mortality, and the argument shifted to whether this was worth the price in overdiagnosis, but papers continued to appear regularly over the years which criticised mammographic screening and the NHS Breast Screening Program in particular.6,7

Overdiagnosis, that is the diagnosis of disease which would not be clinically relevant in the patient’s lifetime, is a feature of all cancer screening programs. It is felt to be a particular problem in prostate cancer screening, but affects all programs to a certain extent. In breast screening, the diagnosis of a cancer which would never clinically present could lead to a mastectomy (i.e. overtreatment) and the concept of overdiagnosis leads often to a very emotional debate.

The problem is that those breast cancers which will never prove fatal to their host can generally not be distinguished from those that will. The introduction of mammography, whether for screening or investigation of symptoms, has led to a major increase in the proportion of ductal carcinoma in situ being found. But it is recognised that if this is not completely excised, some ductal carcinoma in situ will go on to become invasive and develop, in some women, to become a fatal cancer. Thus, the level of overdiagnosis can only ever be an estimate and to some extent is a function of when the time cut-off for analysis is set. Estimates vary from 1.7% to 54% for women aged 50–59 years, and 7% to 21% for women aged 60–69 years.8

The debate about breast screening continued. While in the UK, the stage moved from the Lancet to the British Medical Journal, it also raged around the world.9,10,11 The information sent to women also became a topic of major discussion, as programs around the world moved to take better account of the concept of an informed choice and giving women information about the potential harms of breast screening, as well as the potential benefits. Many critics of breast screening, however, complained the information was still biased towards persuading women to be screened and that it deceived them about the true position.12

In the UK, new breast screening leaflets were commissioned in summer 2012 by the screening program, but the Department of Health felt something more than this was needed to deal with the criticism. Therefore, together with Cancer Research UK, the Department of Health decided to commission the UK Independent Review of Breast Screening in the autumn of 2012.13 The work on the information was thus put on hold until the independent review reported its findings.

The UK independent review

The review team (the panel) consisted of two statisticians and two breast cancer clinicians, none of whom had ever published on breast cancer screening before. There was a female lay member who was an active patient advocate and the panel was led by Sir Michael Marmot, the Sydney-educated MRC Research Professor of Epidemiology and Public Health at University College, London. The panel embarked on the major task with the secretariat supplied by Cancer Research UK. The panel had a great deal to learn about breast cancer screening. Their reading list runs to 17 pages and would be helpful for anyone embarking on a master’s degree in breast screening. They invited people prominent in the discussion to speak to them and held a discussion group to ascertain more closely the views of women eligible for the screening program.

The first finding related to a reduction in mortality. The panel concluded that a relative risk reduction of 20% was “the most reasonable estimate of the effect of the current UK screening programs on breast cancer mortality”. The panel based this on randomised control trials (RCTs) and not observational studies, which they did not find particularly helpful. They noted considerable uncertainties in calculating the level of mortality reduction, but also noted that the findings of the observational studies were in the same direction as the trials.

Absolute mortality benefit was the next issue to be addressed. Using their own figure of 20% relative reduction in risk and calculating the benefit for women up to the age of 79 years (approximately 10 years after screening finished), the panel estimated that there was one breast cancer death prevented for approximately 250 women invited to breast screening. This contrasted with the range of one in 2000 used by some prominent critics of the program and translates into about 1300 lives a year saved by UK breast screening programs.

The issue of estimating the extent of overdiagnosis raised many difficulties. Once again the panel examined both RCT data and observational data. In the case of the latter, the most commonly used method to estimate overdiagnosis was examination of time trends in incidence rates of breast cancer for different age groups over the period that population screening was introduced. The panel however, commenting that estimates of overdiagnosis using this method varied from 0% to 36%, concluded that this method could give no reliable estimate of the extent of overdiagnosis and fell back on RCT data. Using RCT data, they estimated that “...the frequency of overdiagnosis was of the order of 11% from a population perspective, and about 19% from the perspective of a woman invited to screening...”. Importantly, they also pointed out that a diagnosis of DCIS did not equate to an overdiagnosed case. Overall, the messaging resulting from this was that for every life saved, there were three diagnoses of breast cancer that might not otherwise have occurred. On balance, the panel concluded that the UK breast screening programs conferred significant benefit and should continue.
The report was published 29 October 2012 in full with an executive summary. A paper was also published in the *Lancet*. Predictably there was extensive coverage in the press the following day. Headlines talked of ‘needless cancer therapy’ (*Daily Mail*). However, while there has been concern that falling participation rates might be attributed to falling confidence in the test, research has not yet shown any direct effect of the review on breast screening participation.

**Next steps for the NHS Breast Screening Program**

With the independent review concluded, attention once more turned to the information sent to women with their invitation for screening. An independent research team from King’s College, University of London, had been commissioned to do the work and relied on the new calculations about harms and benefits for the content of the leaflet. However, finding the best methods of communicating the issues proved difficult for an audience which include every woman over 50 years of age in the country. A number of ways to convey the information were tested out in opinion polls and with a citizens’ jury. These steps in the process were all documented and the reports can be found online. Peer reviewed publications have been accepted and will appear shortly. The new leaflet was released in September 2013. There is a commitment by the Department of Health to evaluate it, but this has not yet taken place.

The major development in the NHS Breast Screening Program through this period has been the instigation of what will be the largest trial in the history of breast cancer screening. The extension of the breast screening program from 50-70 to 47-73 years was announced in 2007. This is being implemented as a cluster-randomised controlled trial of an additional screening invitation for women about to enter the routine age group, those aged 47-49 years, and an additional invitation at the end of routine screening, at the age of 71-73 years. The end points are death from breast cancer by the age of 60 years for the younger group, and death from breast cancer by the age of 80 for the older group. The trial will also be able to look at the issues of overdiagnosis and overtreatment in women, which were not specifically considered in the original breast screening trials which were instituted over 30 years ago.

The major technical issue currently facing the NHS Breast Screening Program is the evaluation of breast tomosynthesis. Digital breast tomosynthesis (DBT) uses multiple thin reconstructed slices to produce a 3D image and thus aims to avoid the problems of the 2D conventional image with overlapping tissues. It is to minimise overlapping tissues that compression is used, and this will still be needed. Overlapping tissues can mean small cancers are obscured behind normal tissue, or conversely that normal tissues superimposed one on another, can give the impression of an abnormality and lead to a false positive recall. Thus DBT has the potential to improve both the sensitivity and specificity of mammography. There has been a large trial examining its use for assessment of screen detected abnormalities and now the debate is moving on to the use of DBT for screening. Taking account of already published trials and observed data from both Europe and North America, is there a need for another trial focusing on whether to incorporate DBT in the initial screen or not? One factor which has always been a challenge for the screening program, although its manifestation has varied, is the need to develop and maintain sufficient and sufficiently skilled staff. When the screening program started, mammography was a rare skill in the NHS. Training radiographers to carry out the technique and radiologists to interpret the films consumed a great amount of energy and effort in the early years. Many new consultant posts were created at that time. Once this phase was over, increasing numbers of staff were needed to cope with the expanding eligible population. This expansion was caused by baby boomers hitting 50 and also by the slightly later expansion of the screening age group, adding two more screening rounds to the program. Training of radiographers to report films and to undertake biopsies in the assessment clinics relieved the radiologist staff of some of the pressure. Assistant practitioners were trained to take mammograms in order to release radiographers for these duties. Now another phase is coming upon the program, and that is the retirement of many of those people who were new consultants at the start and have been the leaders of the program through its first 25 years. It is not yet clear where their replacements will be found.

Some challenges remain the same as when the screening program commenced. Acceptance and participation rates need constant attention, and breast screening is still more likely to attract the affluent than the deprived. The biggest challenge of all however, remains - to make breast cancer a curable disease by integrating early detection with ongoing improvements in treatment.

**References**

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