HHS Public Access

Author manuscript

Int J Public Health. Author manuscript; available in PMC 2019 May 18.

Published in final edited form as:

Int J Public Health. 2015 December ; 60(8): 881–890. doi:10.1007/s00038-015-0740-5.

Breast cancer screening in England and the United States – a comparison of provision and utilisation

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Introduction

Screening aims to identify people at an earlier stage in a disease's natural history than if they were to present with symptoms.[1] Mammography screening is widely used for screening to find breast cancer before a lump can be felt. Many consider it appropriate for early detection of breast cancer because of the association between stage at diagnosis (or tumour size) and survival.[2, 3] Despite the wealth of evidence on the subject, the value of mammography screening remains controversial and divisive. There is contention around the ages at which women should be screened, the strength of the mortality benefit evidence, and the extent of the harms including overdiagnosis.

Comparing breast cancer screening across countries within the context of some of the benefits and harms offers the opportunity to improve effectiveness through mutual learning. This paper will describe the provision of breast cancer screening in England and the United States and explore how effective delivery of population-based breast cancer screening can maximise benefits and minimise harms.

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Declarations: None of the authors declared any conflicts of interest.

Research ethics: Not required.

How breast cancer screening services in England and United States are they organised and provided

England

Organisation—The breast cancer screening programme in England is organised at a national level by the National Health Service (NHS). Breast screening services are commissioned against a national service specification[4] by NHS England in collaboration with Public Health England.

The service includes systematic call and recall of eligible women based on their registration with a general practitioner. This is undertaken through the National Health Application Infrastructure Services (NHAIS) call/recall database, more often called the 'Exeter system'. Regular analysis of coverage is undertaken to "identify groups of women who either access breast screening at lower levels, or do not access services at all".[4] The screening takes place at one of 80 Breast Screening Units (BSU) in England. Access to screening and any subsequent diagnosis and treatment is provided at no cost to women screened under the NHS.

National Health Service Recommendation—Women between the ages of 50 and 70 years are eligible for breast cancer screening in England and are systematically invited to be screened every three years. Women over the age of 70 who wish to be screened can request a mammogram at their local unit every three years. The ages are being extended to 47 and 73, as part of a randomized trial.[5]

Younger women who have been identified as being at high risk of developing breast cancer due to either genetic mutations[6] or previous supradiaphragmatic radiotherapy are managed through the same programme. These women can be referred from genetics or oncology services to mammographic and MRI surveillance at appropriate intervals.[7]

Independent review 2012—A review of breast screening by an independent panel was set up in response to the debate about the effectiveness of breast screening and criticism of the information given to women.[8, 9] The panel was commissioned by the National Cancer Director for England and Cancer Research UK to develop an up-to-date assessment of both the benefits and the harms associated with population breast screening programmes. They considered the relative and absolute mortality benefits and balanced these against the harms caused through overdiagnosis. An overdiagnosed breast cancer is a case "diagnosed by screening that would not otherwise have come to attention in the woman's lifetime."[10] The panel concluded that "the UK breast screening programmes confer significant benefit and should continue."[10] This serves to reinforce the provision of breast cancer screening in the UK, while acknowledging that the reduction in breast cancer deaths is at the cost of overdiagnosis in a ratio estimated at three overdiagnoses for each life saved.[10]

USA

Organisation—There is no centrally organised breast cancer screening programme in the United States. Rather than being invited, women can self-refer for screening and are advised

to speak with their doctor to discuss screening appointments.[11] Many insurance plans and providers remind their customers of the services that are available to them, and providers can market mammography directly to the public.

Medicare—Medicare is a government-funded health insurance program that primarily covers people aged over 65 years. Medicare pays for some preventive health care services, including one screening mammogram every 12 months and one clinical breast exam every 24 months.[12] However there may be a charge (deductible and co-pay) if a further diagnostic mammogram or other investigation is required.[12] Supplemental (i.e. private or Medicaid, the insurance for low income patients) insurance often reimburses for these out of pocket costs.

Insurance based in younger women—Women under the age of 65 can access breast cancer screening with the costs covered as part of their insurance. Many states require that "private insurance companies, Medicaid, and public employee health plans provide coverage and reimbursement for specific health services and procedures."[13] As at September 2014 the only state without a law ensuring that private health plans cover or offer coverage for screening mammograms is Utah.[13]

Medicaid and National Breast and Cervical Cancer Early Detection Program—Medicaid is a government-run health program for families and individuals with low income. All state Medicaid programs cover screening mammograms.[13] The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) also provides free or low-cost mammograms to low-income women with little or no health insurance. Costs of treatment are covered through Medicaid for those women diagnosed with cancer through the Centers for Disease Control and Prevention's (CDC's) National Breast and Cervical Cancer Early Detection Program.[14]

Introduction of the Affordable Care Act—The introduction of the Affordable Care Act will likely increase access to mammography in the United States by reducing of the number of uninsured women, the expansion of Medicaid, and elimination of cost-sharing.[14, 15]

Recommendations—There are a number of recommendations regarding breast cancer screening in the United States. The American Cancer Society, the American College of Radiology, and the American Congress of Obstetricians and Gynecologists recommend annual mammography beginning at age 40.[16, 17, 18] The National Cancer Institute recommends that women age 40 or older have screening mammograms every one to two years.[19]

In 2009, the United States Preventive Services Task Force (USPSTF) updated their recommendations on breast cancer screening. Their 2002 recommendation had been for screening mammography every one to two years for women aged 40 and older.[20] The updated guidelines recommended biennial screening between 50 and 74 years, and recommended against routine screening mammography in women aged 40 to 49 years.[21]

Critics attacked the "expertise, motivations, and independence of the scientists and clinician experts"[22] as well as their reliance on mathematical models rather than outcomes data.[23]

Publication of these recommendations coincided with the announcement of President Obama's healthcare reforms and were perceived as the onset of rationing among some groups.[24, 25] As a result of the debate, the second part of the recommendation was revised to state that the "decision to start regular, biennial screening mammography before the age of 50 years should be an individual one and take patient context into account, including the patient's values regarding specific benefits and harms."[21]

The effect of competing authoritative voices is uncertain, but it may impede the development of coordinated and effective screening programs.[26] Physicians and clinical groups, within the same provider organisation, could recommend different testing regimes to their patients depending on which guidelines they choose to follow. One study found that the screening mammography rate decreased by 4.3% in 2010, the year after the USPSTF recommendations were issued.[27] Surveys suggested, however, that the USPSTF breast cancer screening recommendation had not been widely adopted[28] and did not affect screening patterns.[29]

Evidence suggests mammography has more risks than benefits for women in their forties of average risk.[30] Women of this age are less likely to benefit because disease grows faster before menopause[31] and the cancer is more difficult to detect in denser breasts, which are most prevalent in premenopausal women.[32] Despite evidence against routine screening for this group, almost half of American women in their forties have a mammogram each year.[28] This highlights how recommendations regarding screening access and the resulting behaviours of providers and individuals are based on values rather than evidence. It is worth considering the extent to which the acquisition of these values within American society is influenced by the industry that depends for its commercial success on these demands.[1] To Americans, it may seem that collectivist societies deny women the right to breast screening under the age of 50 "for financial reasons or, at best, for paternalistic reasons to protect the majority from harm."[1] Raffle and Gray question whether the American medical profession is "humouring demand for their own financial ends" or "members of a can-do society" determined to tackle disease with all of the powers at their disposal.[1]

There is now tension between the public health success of creating awareness and fostering uptake of mammography screening in the United States over the past several decades, with emerging evidence of population-wide breast cancer screening in an era of advanced technology. This evidence is interpreted and applied heterogeneously, creating a varied landscape of guidelines, recommendations, values, and beliefs.

Quality assurance, performance, and incentives

England

The NHS Breast Screening Programme (NHSBSP) is coordinated at a national level by the NHS Cancer Screening Programmes, now part of new statutory body Public Health England which began operating on 1st April 2013. This coordination includes developing standards and measures to assess the programme's performance and outcomes. The regional Quality Assurance Reference Centres (QARCs) continuously monitor performance against these measures and conduct detailed audits, as well as organising the multidisciplinary quality

assurance visits that are carried out at each site at least once every three years. They also have a service development role in providing specialist expertise through the staff team and a network of professional leads in each clinical area. The emphasis on quality optimises cancer detection whilst minimizing the number of false positives, and burden of further assessment on the NHS.

The NHSBSP collect and validate detailed comparative performance statistics on all breast screening units. These are analysed and published by Health and Social Care Information Centre.[33] Measures include the percentage of invited women who attend and indicators of screening quality, for example recall for assessment and cancer detection rates. There are also detailed national clinical standards for all professional groups. The regional QARCs ensure that screening providers "meet national programme standards, or have plans in place to meet them."[4]

Standards are set at both "minimum" and "achievable" levels. Performance below a minimum standard would be investigated by a Quality Assurance team. The standards relate to the quantity of the mortality reduction by measuring attendance, the rate recall for further assessment, of invasive cancer detection, and maintenance of screening interval ("round length"). Aspirational levels would need to be achieved by 50% of units for the programme "to achieve a reduction in mortality similar to that in the Swedish two county trial."[34]

The observed number of invasive cancers detected is compared to the expected number by applying criteria from the Swedish two county trial.[35] This is expressed as a ratio (standardized detection ratio) and used as a yardstick of performance.[33]

Centres for training of staff involved in the provision of breast cancer screening are regional. A number of accreditation systems are in place for the differing professionals involved in the screening process. These include accreditation of readers,[36] pathologists,[37] and laboratories.[38] The Royal College of Radiologists is responsible for professional standards and training in radiology, while standards for radiographers are specified by the Society and College of Radiographers.

The NHS Quality and Outcomes Framework (QOF) is an incentive scheme for primary care practices in the UK, rewarding them for how well they care for patients.[39] It covers a range of clinical and organisational indicators, including four indicators relating to the national programme of screening for cervical cancer. Screening for breast cancer is not part of this framework, and as such, there are no additional financial incentives for primary care providers to encourage breast screening amongst their patients. However screening coverage in each practice is monitored by regional commissioners.[40]

USA

Under the Mammography Quality Standards Act (MQSA, 1992), all U.S. facilities that perform mammography must be certified by the Food and Drug Administration (FDA) regarding training for personnel mammography technique.[41] Inspections are undertaken by the FDA which certifies and accredits facilities based on judgments about compliance with the MQSA.

The MQSA requires that all mammography facilities be accredited. This is undertaken by the American College of Radiology's Mammography Accreditation Program. The program provides peer review and feedback on "staff qualifications, equipment, quality control, quality assurance, image quality and radiation dose"[42] but is not independent of the profession.

Primary care providers have a central role in inviting women for screening in the United States; the relationships between them and their patients are important. There are professional, reputational, and financial incentives for primary care physicians to refer their patients for breast cancer screening. Aspects of primary care provider performance are measured using the Healthcare Effectiveness Data and Information Set (HEDIS) from the National Committee for Quality Assurance (NCQA). These are linked to each physician and service and are of interest to the insurers and employers; high performance may give the opportunity to access insurance plan networks. The percentage of women aged 50 to 74 years who had a mammogram in the previous 24 months is a 2014 HEDIS measure.

Accountable Care Organizations (ACOs) are groups of doctors, hospitals, and other health care providers, who aim to give coordinated high quality care to their patients and share the savings that they achieve.[43] The percentage of women who had a screening mammogram is one of the measures used to judge the performance of the ACOs.[44] These measures give incentives for the local systems to maximize the number of women accessing breast cancer screening in their patient population.

Comparing utilisation of services and performance

As of 31 March 2013, 77% of English women aged 53–70 had been screened in the previous 3 years.[33] Screening rates differed between regions, and was significantly lower in London. The programme explains that this is because the population here is "harder to reach due to its diverse and mobile nature."[45]

Between 72.4%[46] and 79.7%[47] of American women aged 50 to 74 self-reported having been screened for breast cancer in the previous two years (2010 interviews). These rates differed significantly by race, ethnicity and insurance status. Of women in this age group with no health insurance, between 38.2%[46] and 50.4%[47] reported having a mammogram within the previous two years. 14.9% of women aged 45 to 64 years reported being uninsured at time of interview (2012 interview).[48]

When comparing screening rates between the two countries it is important to note that data from England is calculated from recorded activity, while in U.S. it is estimated within regions or health plans or based on self-reported behaviours from national surveys. Women are known to over-report having had a recent mammogram.[49]

Access to mammography is high in the United States despite there being no population-based programme. This is due to the characteristics of the health system including fee-for-service reimbursement, insurer performance incentives, medical malpractice liability, and increasing access to subsidised services.

Technical performance: Sensitivity and specificity

Smith-Bindman et al analysed nearly 5 million mammograms in order to compare the performance of mammography screening in the USA and the UK. They estimated that over a 20 year period of screening, the "percentage of women who would be recalled for additional testing was nearly threefold higher in the USA."[50] Another study estimated that almost half (49%) of women aged 40–69 years in the United States will have at least one false-positive mammogram after ten screens.[51] Smith-Bindman et al found that despite the differing regimes, "no substantial differences in the rates of detection of large cancers" were observed.[50] A higher number of small invasive and *in situ* cancers were found in the USA.[50] Since this study the NHSBSP has converted to digital mammography and cancer detection rates have increased further.[33]

Other studies of screening performance have similar findings when comparing American and European systems. Elmore et al found that North American screening programs "appear to interpret a higher percentage of mammograms as abnormal than programs from other countries without evident benefit in the yield of cancers detected".[52] Hofvind et al highlighted "higher sensitivity and specificity" in Norway compared to Vermont.[53] The experience of having a false-positive screening mammogram can result in avoidable and harmful procedures, cause psychological distress, reduce the likelihood that women will return for their next round of screening,[54] and is costly as a result of additional appointments and testing.[51]

Reasons for differing performance

In their international comparison, Youlden et al found "the coordination of activities across the entire pathway", including monitoring of clinical quality, was essential for screening programme to attain quality outcomes.[55]

Smith-Bindman et al considered that the successes of the NHS programme relative to the American system is primarily as a result of this "centralized programme of continuous quality improvement."[50] The NHSBSP in England has controls to guard against overinvestigation and overtreatment. These include monitored standards for maximum positive rates, recall rates, and intervention rates.

Making comparison with prior images significantly reduces false-positive findings.[56, 57, 58] BSUs in England always have access to prior images. In the USA a woman would need to return to the same provider in order for these comparisons to be made consistently.

Radiological reading procedures

Double vs single reading

In the English NHS system, reading of mammograms by two film readers is mandatory.[34] In the United States, single reading, increasingly with CAD, is the norm.[54, 59] There is evidence that double reading with arbitration increases detection rate and decreases recall rate.[53, 60, 61]

Interpretive volume

Studies have shown an association between increased volume and lower recall.[62, 63] NHS readers must "undertake a minimum of 5,000 screening and/or symptomatic cases per year"[34]. In the USA, the Mammography Quality Standards Act requires that the interpreting physicians interpret at least 960 mammographic examinations every two years.[64] This relatively low number was "chosen with the intent of maximizing access."[65] As part of their examination of high health care costs in the United States, The Commonwealth Fund compared the availability of imaging devices in a selection of Organisation for Economic Co-operation and Development (OECD) countries. They report that there were 9.0 mammograph devices per million population in the UK (2009) and 40.2 per million in the United States (2008).[66]

Cultural differences - litigation

The differences in the way that the English and American systems are organised and quality assured account for some of the variations in performance. In addition, cultural differences should be considered.

Units in England that responded to a 2002 NHS Breast Screening Programme survey highlighted fear of litigation as a possible explanation for the vacancies in radiologist posts.[67] Courts in England have awarded compensation to patients who had received false negative cervical screening results,[68] however these incidences are very rare.

Raffle and Gray propose that because American individuals are responsible for the costs of their care, "the law is used as a means of seeking finance in a way that substitutes in effect for the safety net of the welfare state"[1] A study concluded that heightened concern amongst American radiologists about medical malpractice legal action "may be a key reason that recall rates are higher in the United States than in other countries".[69] As Cassels noted, American physicians tend to be punished "for sins of omission, not sins of commission."[70] The enthusiastic promotion of cancer screening may be responsible for unrealistic expectations of screening,[68] and make it difficult for defendant radiologists to prevail in a malpractice lawsuit.[71]

Schwartz et al found that public enthusiasm for cancer screening "is not dampened by false-positive test results or the possibility that testing could lead to unnecessary treatment".[72] It may be that in the United States if there is any "potential for health improvement for an individual, then that potential should be realized" no matter "how many resources would be needed and no matter if some women are harmed."[1]

Discussion and conclusions

The English National Health Service is more efficient in detecting breast cancer through screening than the American system. A combination of organisational factors including rigorous quality assurance and stringent radiological reading procedures help to reduce the number of false-positive results – the American system is less effective in minimising these harms. Cultural factors, in particular the threat of litigation, influence the heightened recall rates in the United States. The additional abnormalities that the American mammograms

reveal are mostly small invasive and *in situ* cancers, with the potential to lead to more overdiagnosis and overtreatment. Values, influenced by commercial interest, may take precedence over evidence in the development of recommendations about screening. The complex and contradictory landscape of guidelines result in younger American women being routinely screened; they are less likely to benefit and more likely to be harmed.

The differences of the two screening systems should be considered in the wider context of efforts to improve women's health. Reductions in breast cancer mortality may be more as a result of other factors including advances in treatment than screening programmes.[73, 74]

Estimated age-standardised breast cancer incidence and mortality are higher in the UK (incidence 89.1 per 100,000; mortality 18.6 per 100,000) than the USA (incidence 76.0 per 100,000; mortality 14.7 per 100,000).[75] Women are diagnosed at a similar stage in the UK, but survival is lower than women with the same stage of disease in other countries.[76, 77]. Some of the excess breast cancer deaths in England may be a result of poor symptom awareness, leading to late diagnosis in frail women.[77, 78] A range of other factors influence England's relatively poor survival rates including delays in diagnosis and treatment, treatment variation, and co-morbidity, particularly in older people.[79]

Population-based approaches to breast cancer screening in the United States could learn from European programmes, including the English one. Emphasis should be on reducing false-positive recall rates while maintaining appropriate cancer detection. Despite a well-functioning screening programme, breast cancer mortality is higher in England than the United States. The NHS could supplement existing efforts[79, 80, 81] to understand and improve comparatively poor survival and mortality through improving symptom awareness and learning from other systems, including the United States.

Funding acknowledgement:

This work has come about as a result of an award from Care Quality Commission to Joseph Williams (lead author) who took up a short term post at The Dartmouth Institute for Health Policy and Clinical Practice.

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Table 1

Summary of recommendations for breast cancer screening in the England and the USA

	England – NHS	USA				
		USPSTF	American Cancer Society	American College of Radiology	American Congress of Obstetricians and Gynecologists	National Cancer Institute
Age	50 – 70	50 – 74	40+	40+	40+	40+
Screening interval	3 years	2 years	Annual	Annual	Annual	1 – 2 years

Table 2 –

Coverage and performance of breast cancer screening in the England and the USA

	Coverage of eligible population		Recall rates		Cancers detected among 1,000 women screened for 20 years[~]			Mammography devices per million population[@]
			First screening mammogram	Subsequent screens	All	Large invasive[#]	DCIS	
England	76.4%[*]		7.6%[$]	2.9%[$]	43.0	8.7	8.3	9.0
USA	72.4%[^]	79.7%[+]	13.3%[&]	8.0%[&]	55.1	8.1	12.3	40.2

[*] Previous 3 years (as at 31/03/2013) Age 53–70 (HSCIC)

[^] Previous 2 years at time of survey (National Health Interview Survey) 2010, age 50–74

[+] Previous 2 years at time of survey (Behavioral Risk Factor Surveillance System) 2010, age 50–74

[$] 2012–13

[&] Smith-Bindman et al, 2005

[~] Modeled from four years of data, Smith-Bindman et al, 2005

[#] Larger than 2cm

[@] Commonwealth Fund (UK 2009, USA 2008)