

## EDITORIAL

# The benefits and harms of mammographic screening for breast cancer: building the evidence base using service screening programmes

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Many countries provide mammographic screening for breast cancer as part of regional or national public health policy, and some programmes have been in place for several years. Mammographic screening was implemented after results from large randomized controlled trials showed that regular screening led to a significant reduction in breast cancer mortality.<sup>1</sup>

We have long been in an era of ‘evidence-based medicine’, and it is not unusual for a single clinical trial of a new intervention, based on several hundred patients, to change routine practice without much criticism. Yet despite the evidence from six trials of mammography from three different countries (about 212,000 women in total), doubts have been raised over whether such screening is worthwhile and questions posed about the magnitude of the benefit in relation to potential harms.<sup>2,3</sup> It is difficult to think of any other large-scale public health intervention for which there is significant supporting evidence, but where uncertainty is claimed by some over its effectiveness.

Nevertheless, it is valid to consider that the randomized trials were conducted in the 1980–1990s, and that there have since been technological changes and improvements in the screening process. Cancer detection rates, breast cancer mortality, overdiagnosis (women with breast cancer found through screening who otherwise would not have been identified in their lifetime) and false-positive results (women with abnormal mammograms who do not have breast cancer) are all important and variable aspects that should be examined over time.

In this special supplement of the *Journal of Medical Screening*, the EUROSCREEN Working Group and their colleagues, who have substantial experience in breast cancer screening research and service delivery, have produced a set of seminal articles. They are based on a systematic assessment of established service screening programmes and observational studies within Europe, using a series of literature reviews with careful statistical analyses.

Giordano *et al.*<sup>4</sup> use the European Network for Information on Cancer (EUNICE), a web-based data warehouse, to summarize screening activity within 18 EU countries. While half the programmes have acceptable uptake (>70% of invited women who are screened), there is wide geographical variation with much room for improvement.

Two articles discuss details of two different study designs for estimating the impact of screening on breast cancer mortality.<sup>5,6</sup> Examining trends in breast cancer mortality over time (before and after the introduction of screening)

appears, at first, to be a reasonable approach. However, Moss *et al.*<sup>5</sup> explain why this method will underestimate the effect on mortality attributable to screening, because breast cancers diagnosed before the start of screening or below the lower age limit for screening are usually included. Njor *et al.*<sup>6</sup> review incidence-based mortality (IBM) studies, in which only breast cancer deaths occurring in women who have been invited for screening are included, and the importance of considering lead-time bias and having sufficiently long follow-up are outlined.

Three articles each focus on the benefit or harms of screening.<sup>7–9</sup> Broeders *et al.*<sup>7</sup> collate evidence from three types of study designs (trend, IBM and case-control studies), to obtain best estimates of the reduction in breast cancer mortality due to screening. Hofvind *et al.*<sup>8</sup> use observational studies to estimate the risk of having a screen-positive result, and a biopsy, among women without breast cancer, with supporting evidence from the EUNICE database. Puliti *et al.*<sup>9</sup> indicate that the over-diagnosis rate (the proportion of women with overdiagnosed cancers) is likely to be 10% at most, and importantly that high estimates of overdiagnosis reported by others are due to not fully allowing for baseline breast cancer risk and/or lead time. The main findings from these three review articles are then used in a ‘balance sheet’, summarizing the benefit and harms in a form that is easily interpreted.<sup>10</sup> To complement these articles, Giordano *et al.*<sup>11</sup> discuss the best ways to communicate the scientific evidence to women and health professionals.

Reviews have previously been published on mammography screening, and it is reasonable to ask what more the supplement reviews add. First, there has probably not before been such a comprehensive assessment of service screening, which can also be used to complement or update evidence from the randomized trials. The criticisms of mammographic screening have helped to encourage researchers to look more closely at the outcomes from service screening. Second, the authors of the articles make clear the importance of using appropriate statistical methodology to design and analyse observational studies of mammography, in order to avoid inaccurate results and false conclusions. When this is achieved, the estimates of reduction in breast cancer mortality are entirely consistent with those from the randomized controlled trials, even though they are based on completely independent data collected in recent times. Also, that estimates of the overdiagnosis rate are much less than previously postulated.<sup>12</sup> Third, the clearly explained balance between the benefit and potential

harms to be used by women and health professionals (based on scientific evidence) is vital for maintaining the success of ongoing programmes and to help to establish new ones. What these papers tell us is that the time has come to move away from relying solely on the older randomized trials of mammographic screening for the evidence-base, and to use data regularly collected and monitored from service screening programmes, with proper statistical analyses in addition to the results from the randomized trials. The authors of these articles set a precedent for how this could be done effectively.

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