the cumulative rate at first but at the end a not statistically significant 8% higher incidence in the former invited group. In other trials almost no excess incidence was shown when the control group was invited, which is to be interpreted as similar rates of over-diagnosis in both groups.[14]

Exclusion of prevalent cases

We found a reduced, but remaining, excess incidence after exclusion of prevalent cases (the first two screening rounds). This shows that the excess incidence is not just related to prevalent cases in a population exposed to screening. Two screening rounds correspond to four years, and the average lead time has been estimated to be two to four years depending on age.[11 12] Most of the prevalent cases in the invited group and their corresponding controls should therefore have been accounted for.

Factors influencing over-diagnosis

Attendance rates for screening decrease with age, as shown in both the Malmö mammographic screening trial and in the subsequent service screening programme.[15 16] On the other hand, women who had been screened in the Malmö trial were more likely to attend the service screening programme[16] and probably also to undergo mammography after screening had ended. Furthermore, mammography of asymptomatic women outside the trial in the control groups may lead to underestimation of over-diagnosis.

It is widely agreed that screening using mammography can reduce mortality in breast cancer. The rate of over-diagnosis is another issue to be considered in the discussion on implications of breast cancer screening.

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What is already known on this topic

Rates of over-diagnosis in screening for breast cancer have been estimated at 5% to 50%

Evidence from randomised controlled trials is lacking

What this study adds

Over-diagnosis of breast cancer was 10% in women randomised to screening at age 55-69 years compared with an unscreened control group

Calculations are based on direct observations of follow-up 15 years after the end of a randomised controlled trial

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Commentary: Over-diagnosis in breast cancer screening

Henrik Møller, Elizabeth Davies

The article by Zackrisson et al is an important follow-up study of diagnosis of breast cancer in women in the Malmö mammographic screening trial.[1]

In 2002 the International Agency for Research on Cancer concluded that population mammographic screening for women aged 50-69 years reduces the mortality from breast cancer by about one third.[2] But screening can also lead to over-diagnosis and over-treatment.[3]

Over-diagnosis arises from two distinct phenomena: anticipation of diagnoses and excess diagnoses. Anticipation is the earlier diagnosis of cancers that would otherwise have become symptomatic and presented later: this phenomenon is both expected and desirable.

Excess diagnosis relates to cases detected through screening that would otherwise never have presented. A few may be false positive histological diagnoses, and some will arise when women are diagnosed by screening but then die shortly afterwards from other unrelated causes. Screening may also detect slow growing cancers that would not become symptomatic within the normal life expectancy.

When a new cohort of women first attends mammographic screening their incidence of breast cancer increases substantially compared with that of an unscreened cohort, owing to both anticipation and excess cases. During subsequent screens the incidence remains around 30% higher than before screening.[4]

King's College London, Thames Cancer Registry, London SE1 3QD
Henrik Møller *professor*
Elizabeth Davies *senior lecturer*
Correspondence to: H Møller henrik.moller@kcl.ac.uk

Excess cases are more important here because anticipation will relate only to new tumours that have become detectable since the previous screen. Finally, when screening ceases at around age 64-69, the incidence returns to a lower than expected rate.

The most informative analysis in Zackrisson et al's study is the comparison of the cumulative incidence of breast cancer in the screened and the non-screened groups of women born between 1908 and 1922 and randomised between 1976 and 1978.[1] This is a mature cohort with follow-up to 2001 when about 60% of the women had died. The main finding is a 10% increase in the lifetime occurrence of breast cancer (including cancer in situ) in the screened group.

The study's low statistical power precludes an exact estimate of over-diagnosis (95% confidence limits around the 10% estimate are 1% and 18%). Because some women randomised to screening were not screened and some women in the control group were, the intention to screen analysis leads to somewhat conservative estimates of over-diagnosis and of the reduction in breast cancer mortality (around 17%).

To put these numbers into perspective, let us for simplicity assume that they are both correct. In a population where the lifetime risk of breast cancer is 8% and the lifetime risk of dying from breast cancer from age 50 onwards is 2.5%, screening 250 women may prevent about one death from breast cancer. Screening would, however, also lead to the over-diagnosis of two cases. The woman whose death from breast cancer is prevented receives all the important benefit, whereas the two over-diagnosed women pay part of the price by becoming breast cancer patients and undergoing treatment. We cannot predict, however, which three women these will be.

The trouble is that although we can easily calculate these or alternative numbers based on different sets of data and assumptions, we cannot determine who the three women are. Ideally we should try to identify prognostic factors to distinguish the over-diagnosed cases and reduce the aggressiveness of their treatment. The first step towards this is to appreciate the reality of over-diagnosis and its likely magnitude. Zackrisson et al's study should inspire similar estimations of over-diagnosis in other populations, not only for breast cancer but also for colorectal cancer, prostate cancer, and other cancers, where organised screening or other diagnostic tests are being introduced.

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Effectiveness of educational interventions in improving detection and management of dementia in primary care: cluster randomised controlled study

Murna Downs, Stephen Turner, Michelle Bryans, Jane Wilcock, John Keady, Enid Levin, Ronan O'Carroll, Kate Howie, Steve Iliffe

Editorial by England

Bradford Dementia Group, Division of Dementia Studies, School of Health Studies, University of Bradford, Bradford BD5 OBB
Murna Downs *professor in dementia studies*
Dental Health Services Research Unit, Dundee University, Dundee
Stephen Turner *senior researcher*

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Abstract

Objective To test the effectiveness of educational interventions in improving detection rates and management of dementia in primary care.
Design Unblinded, cluster randomised before and after controlled study.
Setting General practices in the United Kingdom (central Scotland and London) between 1999 and 2002.
Interventions Three educational interventions: an electronic tutorial carried on a CD Rom; decision support software built into the electronic medical record; and practice based workshops.
Participants 36 practices participated in the study. Eight practices were randomly assigned to the electronic tutorial; eight to decision support software; 10 to practice based workshops; and 10 to control. Electronic and manual searches yielded 450 valid and usable medical records.
Main outcome measures Rates of detection of dementia and the extent to which medical records showed evidence of improved concordance with guidelines regarding diagnosis and management of dementia.
Results Decision support software (P = 0.01) and practice based workshops (P = 0.01) both significantly improved rates of detection compared with control. There were no significant differences by intervention in the measures of concordance with guidelines.
Conclusions Decision support systems and practice based workshops are effective educational approaches in improving detection rates in dementia.

Introduction

Inadequate detection of dementia in primary care and poor management have been documented nationally and internationally. People with dementia and their

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