Systematic review: the long-term effects of false-positive mammograms
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CRD summary
This review examined the impact of receiving false-positive mammography results on behaviour, including return for subsequent mammography screening, and well-being in women aged over 40. The authors concluded that there might be differences in whether some women returned for mammography, the occurrence of breast self-examinations, and levels of anxiety compared with women receiving normal results. However, the reliability of these conclusions is not certain given the methodological limitations and poor reporting of the included studies.

Authors' objectives
To assess the long-term effects of false-positive screening mammograms on the behaviour and well-being of women aged 40 years or older.

Searching
MEDLINE, EMBASE, CINAHL, Web of Science, PsycINFO and ERIC were searched to August 2006; the search terms were reported. The references of relevant papers were checked, and authors of identified articles and colleagues were contacted for further unpublished studies. Only studies reported in English were eligible for inclusion.

Study selection
Study designs of evaluations included in the review
Comparative studies were eligible for inclusion in the review.

Specific interventions included in the review
Studies of false-positive results of mammography undertaken during routine screening were eligible for inclusion. False-positive results were defined as abnormal mammogram results that did not result in a cancer diagnosis after subsequent tests in the form of follow-up mammography, ultrasonography, magnetic resonance imaging, fine-needle aspiration, or biopsy. Studies of mammography undertaken because of symptoms or initial screening by clinical breast examination were excluded from the review; studies of hypothetical mammography screening tests were also excluded.

Reference standard test against which the new test was compared
The review did not include any diagnostic accuracy studies that compared the performance of the index test with a reference standard of diagnosis.

Participants included in the review
Studies of women aged 40 years and older who received false-positive results on routine mammography screening were eligible for inclusion. Eligible studies had to compare women receiving false-positive results with women from the same sample who received normal results. Studies that compared women with those who were unscreened, or who were screened in a different setting or at a different time, were excluded from the review. The reported studies included participants from the USA, Canada and Europe.

Outcomes assessed in the review
Studies that reported the principal outcome of return for re-screening within the local recommended period were eligible for inclusion. The secondary outcomes included behaviour, well-being and beliefs, including reported breast self-examinations, anxiety, worry, perceived risk and depression. The outcomes had to be assessed at least 1 month after the ruling out of cancer and be assessed from medical records or patient self-report. Results for women for whom follow-up was early recall for subsequent screening mammography were subsequently excluded from the analysis where possible. Eligible studies reported bivariate statistical analyses, or data which could be re-analysed, although null effects without such analyses or data were also eligible. The included studies were permitted to report data adjusted for covariates provided the main effects were discernible. Two studies that did not report the resolution of abnormal
screening results, as very few abnormal results indicate cancer, were included during the screening process. Inclusion criteria were also modified during the screening process to exclude women whose outcome was not return for further testing but early recall for their next screening mammography.

How were decisions on the relevance of primary studies made?
Two reviewers independently assessed the studies for relevance.

Assessment of study quality
Two reviewers independently assessed the studies for validity. The criteria used to assess validity included study design and use of self-report measures.

Data extraction
Two reviewers independently performed the data extraction and analysis using a standardised form. Data on characteristics that could affect the impact of receiving a false-positive result were extracted. Risk ratios (RRs) were calculated for the outcome of return for mammography screening. Where re-attendance was reported at multiple time points, the time point closest to the recommended screening interval was used.

Methods of synthesis
How were the studies combined?
The studies were combined in a random-effects meta-analysis where appropriate, and synthesised in a narrative form where meta-analysis was not possible. Publication bias was assessed using a funnel plot.

How were differences between studies investigated?
Statistical heterogeneity between studies on the outcome for which a meta-analysis was performed was assessed using the Q statistic. Geographically determined subgroups were employed to account for differences in recommended screening time periods. Differences between studies reporting other outcomes were discussed in the narrative synthesis.

Results of the review
Twenty-three studies with a total of 313,967 participants were included in the review. All but one study used a retrospective or prospective longitudinal cohort design to assess the rate of return for re-screening.

No evidence of publication bias was detected.

Return for next routine screening (12 studies).

Women in the USA who received false positives were more likely to return for routine screening than those who received normal results (RR 1.07, 95% CI: 1.02, 1.12; 5 studies). There was no significant difference in the rate of return in European women (RR 0.97, 95% CI: 0.93, 1.01; 5 studies). Canadian women who received false positives were less likely to return for routine screening than those who received normal results (RR 0.63, 95% CI: 0.50, 0.80; 2 studies).

Breast self-examination (6 studies).

In 3 studies, women with false-positive results reported conducting significantly more self-examinations than women with normal results, in 2 studies there was no difference between the groups, and in 1 study the findings were mixed.

Health care use and symptoms (8 studies).

One study found that women with false-positive results reported similar levels of physician consultations, one found that these women reported higher levels of use of mental health professionals, one found there was no difference between the groups in the number of clinical breast examinations undergone, and one found that health habits were comparable between the two groups. In 1 study women with false-positive results showed significantly more physical
symptoms, in 2 studies there were no differences between the groups, and in 1 study the findings were mixed.

Psychological distress (9 studies).

In 4 studies women with false-positive results showed significantly more symptoms of distress, in 3 studies there was no difference between the groups, and in 2 studies the findings were mixed.

Anxiety (11 studies).

Four studies found that women with false-positive results had significantly higher levels of anxiety than women with normal results, 4 studies found no difference between the groups, and in 3 studies the findings were mixed. Studies that used measures specific to breast cancer showed high levels of this particular aspect of anxiety, although there were no differences in generalised anxiety levels.

Worry, intrusive thoughts and perceived risk (6 studies).

In 4 studies women with false-positive results showed significantly higher levels of worry, in 1 study there was no difference between the results, and in 1 study the findings were mixed. Two studies found that women with false-positives had significantly higher levels of fear of breast cancer than women with normal results, while another study found no difference between the groups. Three studies found that the false-positive group had a significantly greater perceived likelihood of positive future results for breast cancer than women with normal results, while another study found no difference between the groups.

Depression (9 studies).

One study found significantly lower levels of depression in women with false-positive results, 7 studies reported no differences between the groups, and 1 study had mixed results.

Authors' conclusions

Some women with false-positive mammography results might exhibit differences in the rate of return for mammography, occurrence of breast self-examinations, and levels of anxiety compared with women with normal results.

CRD commentary

The review question and the inclusion criteria were fairly clear, although the latter were amended during the selection process. The search was reasonably extensive and the authors reported attempts to locate unpublished studies, thereby reducing the likelihood that relevant studies were not included in the review. However, the fact that only studies reported in English were included might have increased the possibility that relevant studies were excluded. The authors also tested for publication bias using funnel plots, though the validity of these plots is questionable given the small number of included studies. The authors reported using appropriate methods to minimise bias and error in the assessment of study relevance, validity assessment and extraction of data. Few details of the validity assessment and study design were provided, which makes it difficult to assess the robustness of the data.

The authors' decision to employ a meta-analysis for one outcome and a narrative synthesis for the remaining outcomes seemed appropriate, although the poor reporting of patient characteristics, which the authors themselves admit was a weakness of the original study reports, might impact on the value of statistically pooling studies. The authors did, however, attempt to consider some important regional differences between the studies, such as the different recommendations for re-screening periods. The authors' conclusions were therefore based on data that suffered from a number of limitations, which might affect the robustness of the review findings. As such, the conclusions should be interpreted with caution.

Implications of the review for practice and research

Practice: The authors did not state any implications for practice.
Research: The authors stated that further research should examine the impact of how false-positive mammography results affect other outcomes, including trust and health care use.

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