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## False positive mammograms in Europe: do they affect reattendance?

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False positive results from screening mammography are quite common in the United States, with almost half of women receiving at least one false positive result over 10 years of annual screening [1]. In Europe, false positive mammography results are likely less common, as European countries report many fewer abnormal mammogram results and, on the whole, have similar breast cancer detection rates [2–5]. Reasons for lower false positive rates in Europe may include a less litigious environment, having higher quality standards, having the double-viewing of film be more common practice, having higher tolerance for missing breast cancer (false negatives), requiring higher volume for radiologists interpreting mammograms, and radiologists having access to patients' previous screening records [6, 7]. Even with these safeguards, many European women experience false positive mammograms.

### Consequences of false positive mammograms

We now know that false positive mammograms negatively affect women's well-being. Our previous systematic review and our meta-analysis of the long-term psychosocial consequences of false positives found that women who receive false positive mammograms experience more breast cancer-related anxiety, worry, and distress compared with women who receive normal mammogram results [8, 9]. In some studies, these effects on well-being lingered more than a year after cancer had been ruled out [10–12]. Our and others' findings on this topic were one reason the United States Preventive Service Task Force now recommends that most women begin mammography screening at age 50 [13].

The effect of false positive results on attendance at subsequent routine screenings is more complicated. Our meta-analysis of 12 studies found regional differences in attendance at screening after a false positive mammogram [8]. Women from the United States who received false positives were more likely to return for routine screening than those who received normal results. False positives had no effect in studies that took place in European

countries (Great Britain and Norway) although the trend in Europe was toward a slightly lower return rate for women with false positives. Because repeated, periodic screening is essential to reduce breast cancer mortality, it is particularly important to understand whether women who receive false positives are dissuaded from returning for routine testing or whether their brush with the possibility of cancer encouraged further testing.

### New data on reattendance

Since the publication of our meta-analysis that found regional differences in mammography attendance after receiving false positives, European researchers conducted two additional studies. In this issue of the journal, Signeurin and colleagues present a new population-based study of 18,073 women undergoing mammography in the screening program in Isère, France. The authors investigated the effect of false positive mammograms on women's attendance at two subsequent mammograms, comparing women who received normal mammogram results with women who received false positive results. Women in the false-positive group had been recalled for additional imaging evaluation, clinical and radiological follow-up, or biopsy, and were all deemed free of malignancy after this additional workup. They found that women receiving false positives were less likely than their counterparts with normal results to return for screening—73% of women with false positive results attended their next screening, as opposed to 81% of women who received normal results. This difference diminished when the authors looked at attendance at either of two subsequent rounds of mammographic screening—88% among women who received false positives and 91% among women who received normal results. These results need to be interpreted with caution, as women's attendance at mammography screening in Isère was quite low overall (between 23 and 44% during the study period), raising the possibility of missing data on return for mammography.

An earlier study by Andersen et al. [14] investigated mammography attendance in a cohort of 25,303 women in the Copenhagen screening program. The investigators studied attendance at five consecutive rounds of screening and found no effect of false positives on subsequent mammography attendance. These two studies add to our understanding of the consequences of false positives in Europe.

### Updated meta-analysis

Using data from these two new studies, we updated our meta-analysis of mammography attendance after a false positive. Doing so expanded the geographic area studied within Europe and confirmed that mammography attendance in these countries is not associated with previous false positive results (overall European risk ratio (RR) = 0.96, 95% Confidence Interval (CI): 0.93–1.00). As in the original meta-analysis (overall European RR = 0.97, 95% CI: 0.93–1.01), the trend is toward a slightly lower rate of return for women who received false positives compared to their counterparts with normal results. Although the study by Signeurin demonstrated a more dramatic effect of poor attendance after false positives in France, the impact of false positives on mammography attendance in European countries overall appears to remain a small one. With only four European countries represented in this meta-analysis, and with heterogeneity remaining large in the meta-analysis, the effect of false positives may still vary by a characteristic that we are at this point unaware of.

### Types of false positives

Importantly, Signeurin and colleagues compared subsequent mammography attendance rates among women with different levels of diagnostic workup and found no difference in

attendance between groups. Some previous studies suggest that invasive follow-up procedures, such as biopsy, cause stronger effects on women's perceptions of worry and risk compared to less invasive procedures or rescreening [10, 12, 15, 16]. However, these same studies also found that rates of return for regular screening after receipt of false positive results are the same regardless of type of follow-up.

The finding by Signeurin and colleagues that the degree of diagnostic workup is not associated with attendance at subsequent screening, despite the fact that screening attendance was lower among women with false positives in this study, suggests that the experience of a false positive is more than a reaction to the additional procedures being conducted. It is not simply the invasiveness of the test nor the level of suspicion that may affect women who receive false positive results. Perhaps all that matters is that women are told they may have cancer. Women may mentally prepare for this outcome, regardless of subsequent testing, and this in itself may lead to anxiety, worry, and differential attitudes toward returning for their next mammogram.

## Conclusions

The overall estimate for the effects of false-positive mammogram results on screening reattendance remains null for Europe, based on our revised meta-analysis of data from over 340,000 women. However, the estimate was based on data from only four European countries, and the substantial heterogeneity suggests that the effect in different countries may indeed differ in an important way. More research is needed to characterize how the effects of false-positive mammogram results may differ for some countries and even for some women. We previously proposed that access to care may moderate these effects [17], a potential explanation for differences across countries, but this speculation also requires additional research.

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