Appendix A

The incremental cost of the intervention comprised two components. The first component was the additional personnel time associated with a decrease in efficiency of the intervention. The second cost component was the increased utilization of personnel, machines and supplies associated with a higher rate of false-positives in the intervention group compared to standard radiology practice. (Barton, Morley et al. 2004) We added both cost components to obtain the total cost of the radiology intervention.

Inefficiency-related costs

We developed a model to estimate the relative inefficiency of the intervention, using data on each site on each day that study recruiters were enrolling patients between October 1999 and October 2000. Data from a total of 435 site-days were collected, and included women with normal and abnormal (i.e. true-positives and false-positive) mammograms. Sources and type of data included:

- Study recruitment files that tracked the number of women scheduled for mammograms at each site for each day and who actually appeared for their appointments
- Information supplied by the technologist that indicated whether women had their mammograms read by the radiologist before they left the office
- The group-wide radiology database that provided information on the daily volume of all radiology procedures at each site

An outcome variable was created for the number of “equivalent screening mammograms” taken per hour. It was developed based on the number of mammograms taken during scheduled recruiting hours at each site daily, including both screening and diagnostic mammograms. We estimated that diagnostic mammograms took 1.5 times longer than a screening mammogram (personal communication, Philip Arena, MD, December 17, 1998); furthermore, data gathered for the determination of eligibility suggested that 60% of women ineligible for the study were symptomatic and underwent diagnostic mammograms. (Walter, Lindquist et al. 2004) To estimate the "equivalent number of screening mammograms" taken during recruitment hours, we multiplied the number of diagnostic mammograms taken at each site daily by 1.5 and added this to all other screening mammograms taken during recruitment hours.

The proportion of screening mammograms read daily in immediate setting at each site was also calculated. This was entered into the model as a dichotomous variable allowing for the comparison of the number of screening mammograms taken per hour when radiologists read at least 30% of mammograms immediately compared to reading fewer than 30% immediately. We selected the 30% cut-off for base-case analysis from the 75th percentile of immediate reading. It also seemed reasonable after inspecting the association between quartile of immediate reading and number of screening mammograms graphically and by testing for linear effects.

The model also included variables for daily volume of non-mammography work, the number of hours of observation/recruiting on each date, and dummy variables to allow for site fixed effects.

The outcome variable was log-transformed due to heteroskedasticity of residuals in the linear regression model. The resulting model estimates the percentage change in the number of screening mammograms when radiologists read a minimum proportion of screening mammograms in the immediate setting compared to batch setting, adjusted for the factors listed above.

The results of the multivariable model suggested that the intervention was associated with a 9% [$\pm$ 3.2%] decrease in the number of screening mammograms taken per hour. For the base case analysis, we assumed that the intervention was associated with a 9% increase in personnel time. To estimate the additional cost associated with personnel time for the intervention, we took 9% of the $24.60 Medicare 2000 Direct Practice Expense File reimbursement for intra-service clinical staff for bilateral views. From this calculation, we estimated that the inefficiency –related cost of the intervention was $2.22 per screening mammogram, and we attributed that amount to each woman who received the intervention.

Increased utilization associated with the intervention

The rate of false-positive mammograms was 22.8% in the intervention group (867 of 3802) compared to 18.5% for the control group (875 of 4741). (Barton, Morley et al. 2004) We compared the actual number of false-positives in the intervention group to the number expected if the rate were the same as the usual care group. We estimated there were approximately 163 excess false-positives in the intervention group leading to 163 extra mammographic views. The additional cost associated with increased utilization was calculated as the number of excess views (n = 163) multiplied by the estimated cost of an extra view from the Medicare practice expense files ($50.87) divided by the total number of women in the intervention group (n = 3802). We calculated the additional cost per woman was $2.18.

Total cost of the intervention

We estimated the base-case total cost of the intervention as the sum of the inefficiency-related ($2.22) and increased utilization costs ($2.18), for a total cost of $4.40.

References

Barton, M. B., D. S. Morley, et al. (2004). "Decreasing women's anxieties after abnormal mammograms: a controlled trial." J Natl Cancer Inst **96**(7): 529-538.

Walter, L. C., K. Lindquist, et al. (2004). "Relationship between health status and use of screening mammography and Papanicolaou smears among women older than 70 years of age." Ann Intern Med **140**(9): 681-688.