Cross-Sectional *versus* Prospective Predictors of Screening Mammography[1]

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Abstract

Data from a population-based longitudinal study were used to compare cross-sectional *versus* prospective predictors of screening mammography. Although the results of the two analyses were not dramatically different, some important differences emerged. More attitudinal variables were related to future behavior compared with past behavior. Using purely cross-sectional data from this study to design an intervention would result in potentially important variables being de-emphasized or omitted, which could have a significant impact on the strength of the intervention. Our findings strongly suggest that it may be unwise to generalize cross-sectionally obtained data to a longitudinal situation.

Introduction

Over the past decade, our understanding of factors related to mammography screening has grown significantly, and certain variables such as a recommendation from a physician, fear of finding cancer, and belief that a mammogram is appropriate only in the presence of symptoms consistently emerge as "predictors" (1–3). Numerous studies have used this knowledge to design interventions to increase mammography use. Many interventions have been successful in increasing mammography screening. For example, Trock *et al.* (4) showed that a multistage intervention aimed at female members and primary care physicians of a health maintenance organization resulted in a significant increase in self-reported mammography screening. Taplin *et al.* (5) found that sending a reminder postcard nearly doubled the odds that female members of a health maintenance organization would get a mammogram within 1 year. On the other hand, many studies fail to find an intervention effect. Bastani *et al.* (6) used a randomized design to test a mail-out intervention to influence knowledge and attitudes and increase mammography screening in a population-based sample of women in Los Angeles. Although both the intervention and control groups showed increased screening at follow-up, the difference between the groups was not statistically significant. Curry *et al.* (7) evaluated the effectiveness of a direct-mail intervention providing either general or personalized risk information and found no differences in rates of screening mammography between the various intervention groups. One possible explanation for the lack of effectiveness of some interventions is that much of the information on "predictors" of screening was based on cross-sectional studies in which the direction of the relationship between attitudes and behavior was unclear (8, 9). Therefore, the interventions may have missed their mark with respect to factors truly predictive of future screening. A clearer understanding of the differences between data obtained correlationally *versus* longitudinally would thus be helpful to researchers in the field. We conducted a population-based longitudinal study on screening mammography use in Los Angeles County and report the results of a cross-sectional *versus* prospective analysis of the data (6).

Subjects and Methods

Subjects were recruited through random-digit dialing of telephone numbers from exchanges that serve Los Angeles County. During April and May 1989, 802 baseline interviews were conducted with English-speaking women ≥40 years of age, with a response rate of 77.6%. The details of subject recruitment, subject characteristics, and the content and results of the baseline interview are described elsewhere (9). After completion of the baseline interview, women were randomly assigned to an intervention (mail-out materials) or a control group. One year after the baseline survey, the original group of 802 women was recontacted by telephone. Completed follow-up interviews were obtained from 78% (n = 626) of the original sample. As reported previously, there was no effect of the intervention, but screening rates improved significantly in both groups (6). This article is limited to women 51 years and older at the time of the baseline who completed both interviews and who reported never having had breast cancer (n = 373). Women 50 years of age and younger were excluded, because they were not eligible for yearly mammography screening in the year prior to baseline. We used variables assessed at baseline to predict having had a screening mammogram 12 months prior to the baseline interview (cross-sectional analysis) and in the 12 months following the baseline interview (prospective analysis). The variables assessed at baseline included demographics, screening history, knowledge, and attitudes. The attitudinal variables were derived from the Adherence Model (10, 11), which is a comprehensive theoretical framework incorporating aspects of the Health Belief Model (12), the Theory of Planned Behavior (13, 14), and other theories of health behavior.

Results

Of the 373 women who were included in the analysis, 167 (44.8%) had obtained a screening mammogram in the 12

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Table 1 Characteristics of women who had obtained a screening mammogram in the 1 year prior to baseline (cross-sectional analysis) and/or during the 1 year after baseline (prospective analysis) (n = 373)

Variable	Sample characteristics (%)	Had screening mammogram			
		1 y prior to baseline		During 12-mo follow-up	
		% screened	χ^2 significance	% screened	χ^2 significance
Age (y)			0.067		0.590
51–59	35	50		56	
60–69	35	48		59	
70+	30	36		53	
Ethnicity			0.815		0.242
White	77	45		58	
Other	23	44		51	
Education			0.328		0.050
<High school	41	41		50	
≥High school	59	47		60	
Income			0.001		0.001
<$20,000	37	30		39	
≥$20,000	63	51		63	
Marital status			0.007		0.002
Married	57	51		63	
Other	43	37		47	
Has health insurance			0.027		0.002
Yes	92	47		59	
No	8	26		29	
Family history			0.107		0.238
Yes	18	54		63	
No	82	43		55	
Knowledge of guidelines			0.001		0.141
Yes	56	53		59	
No	45	36		52	
Concern over radiation			0.007		0.001
High	44	36		44	
Low	56	50		64	
Cost as barrier			0.056		0.001
High	49	39		46	
Low	52	49		66	
Fear of finding cancer			0.101		0.005
High	27	38		44	
Low	73	48		61	
Likelihood of obtaining a mammogram if physician recommended			0.003		0.001
High	77	50		62	
Low	23	31		38	
Perceived efficacy of mammography			0.587		0.196
High	61	46		58	
Low	40	43		51	
Perceived efficacy of early detection			0.449		0.648
High	64	44		56	
Low	36	48		58	
Perceived susceptibility			0.902		0.591
High	39	44		53	
Low	61	43		56	

months prior to the baseline interview, and 209 (56.0%) had obtained a screening mammogram during the 12 months following baseline. Bivariate analyses were performed to determine which variables measured at baseline were related to receipt of a screening mammogram during each of these periods. For all bivariate analyses, attitudinal variables were dichotomized based on conceptual categories. For example, the high category for concern over radiation includes "moderate," "somewhat high," and "very high" concern, whereas the low category includes "somewhat low" and "very low" concern. Nonattitudinal variables were categorized as indicated in Table 1.

As Table 1 indicates, six variables were significantly related to having had a screening mammogram 12 months prior to baseline (cross-sectional analysis); women who were married, had health insurance, and had higher levels of income were more likely to have been screened. In addition, knowledge of the screening guidelines, reporting low concern over radiation exposure, and reporting a greater likelihood of complying with a physician's recommendation were also positively related to screening.

With the exception of knowledge of screening guidelines, all of the above variables were also significantly related to having obtained a screening mammogram during the 12-month follow-up (prospective analysis). In addition, two attitudinal variables, concern over cost and fear of finding cancer, were

Table 2 Logistic regression analyses predicting likelihood of having obtained a screening mammogram 1 year prior to baseline (cross-sectional analysis) and/or 1 year after baseline (prospective analysis) (n = 244)

Variable	Had screening mammogram[a]					
	Cross-sectional (1 y prior to baseline)			Prospective (1 y after baseline)		
	B	OR	CI	B	OR	CI
Age				0.05	1.05	1.01–1.08
Income	0.24	1.27	1.07–1.51	0.32	1.38	1.14–1.68
Concern over radiation	−0.55	0.58	0.34–0.98	−1.06	0.35	0.20–0.60
Likelihood of obtaining a mammogram if physician recommends				0.69	2.00	1.05–3.80

[a] OR, odds ratio; CI, confidence interval.

negatively related to outcome. Also, women with higher levels of education were more likely to have obtained a screening mammogram during follow-up.

To multivariately examine the predictors of having obtained a screening mammogram during the year prior to baseline (cross-sectional analysis) and the year following the baseline (prospective analysis), two stepwise logistic regression analyses were performed, using all of the predictor variables reported in Table 1. A standard logistic regression analysis yielded similar results. Variables were entered in their original form (no dichotomization) for these analyses. Table 2 lists the significant variables in the order in which they were selected by the stepwise procedure for both the cross-sectional and prospective analyses.

In the cross-sectional analysis, only two variables emerged as significant: women with higher levels of income and women who reported low concern over radiation were more likely to have obtained a screening mammogram 12 months prior to baseline. The same two variables and the following two additional variables emerged as significant in the prospective analysis: older women were more likely to have obtained a screening mammogram during follow-up, as were women who reported a high likelihood of complying with a physician's recommendation.

Discussion

This study is unique in that a set of variables obtained at one point in time on one group of women were examined as correlational and longitudinal predictors of screening mammography. In this controlled situation, the results of the cross-sectional and prospective analyses were not dramatically different, and variables traditionally found in the literature to be related to screening mammography surfaced as significant in both analyses. The demographic variables of income, marital status, and health insurance were related to screening cross-sectionally and longitudinally. Concern regarding radiation and reported likelihood of obtaining a mammogram if a physician recommended it were also related to screening in both analyses. Similar results have been obtained by Zapka *et al.* (8) and Rimer *et al.* (15) using correlational analyses and Hyman *et al.* (16) and Montano and Taplin (17) using prospective analyses. Age is consistently reported in the literature as a predictor (18–20) but failed to emerge as significant in either of our bivariate analyses.

Despite the overall similarities between our correlational and prospective predictors, some important differences emerged. In general, a larger number of variables were related to future behavior compared with past behavior, and these additional variables tended to be attitudinal as opposed to demographic. Concern over cost and fear of finding cancer were negatively related to future behavior but not to past behavior. The finding that age and income, as opposed to attitudinal variables, were significant in the multivariate analysis is probably due to their correlation with the attitude and belief variables.

The above differences are not of great import in our overall understanding of variables related to screening. They are much more important, however, in situations in which interventions are being designed to influence screening behavior. For example, if we were to use purely cross-sectional data from this study to design an intervention to increase mammography screening, we would conclude that cost and fear of finding cancer are not very important in this group of women. This would be a mistake that could have a significant impact on the strength of the intervention and, consequently, on our ability to show an intervention effect.

Our findings strongly suggest that it may be unwise to generalize from data obtained through cross-sectional studies to longitudinal situations. Further work is needed to clarify which variables are simply explanatory, that is, correlated with mammography screening, and which are truly predictive of behavior that occurs in the future.

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