THE RELATIONSHIP BETWEEN SOCIAL NETWORK CHARACTERISTICS AND BREAST CANCER SCREENING PRACTICES AMONG EMPLOYED WOMEN[1,2]

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ABSTRACT

This study examined the relationship between social network characteristics and breast cancer screening practices among employed women. We hypothesized that larger social networks, higher levels of support from networks, and stronger social influences to undergo screening would be positively associated with regular utilization of mammograms and clinical breast examinations. Data were collected from women aged 52 and over who were employed in 27 worksites (N = 1,045). Social network characteristics, breast cancer screening practices, and sociodemographic factors were assessed in a self-administered survey. Bivariate analyses revealed that social influences were significantly associated with regular screening; social support was only marginally associated with regular screening; and social network size was not at all associated. In multivariate analyses, only the perception that screening is normative among one's peers was predictive of regular screening. Provider recommendation was the single most potent predictor of regular screening. These findings provide support for the importance of social norms in motivating women to adhere to screening guidelines. In addition, they underscore the potent impact of provider recommendations on women's screening practices.

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INTRODUCTION

Breast cancer is the most common nonskin cancer among women in the U.S., accounting for one-third of all incident cancer cases. In 1998, an estimated 178,700 new cases of breast cancer were diagnosed, and 43,900 women died from the disease (1). Because risk factors for breast cancer are not easily modified, early detection is a critical means of reducing breast cancer mortality (2).

Despite recommendations of major medical organizations for women age 50 and over to have annual or biennial mammograms and annual clinical breast examinations (1,3,4), these early detection methods are underutilized in the U.S. While the rate of screening has increased in recent years (5), data from the 1995 Behavioral Risk Factor Surveillance System reveal that only 62%[3] of women age 50 and over have had a mammogram and clinical breast examination within the previous 2 years (6). Thus, breast cancer screening is not currently being utilized to its fullest potential for mortality reduction (7).

In recent years, a variety of programs have been launched with the goal of promoting compliance with breast cancer screening guidelines. Increasing numbers of programs rely on the dissemination of information through social networks and the provision of social support as strategies for increasing utilization of breast cancer screening tests (8–18). Although it is generally believed that social network interventions involving interactions among peers are an important vehicle for education and outreach (19), few studies have systematically examined the relationship between social network characteristics and breast cancer screening practices. Studies that have examined this issue have generated mixed results, finding evidence supporting (20–28) and not supporting (29–31) a relationship between network characteristics and screening behaviors.

The purpose of this investigation was to examine the impact of social network characteristics on the practice of regular breast cancer screening. We hypothesized that larger social networks, higher levels of support from networks, and stronger social influences to undergo screening would be positively associated

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[3] National median.

with a pattern of participation in regular breast cancer screening. This study contributes to the existing literature on social network characteristics and breast cancer screening in several important ways. First, since mortality reduction requires a regular pattern of screening over time, we examined regular breast cancer screening (including mammography and clinical breast examination) as the dependent variable. The majority of previous studies have focused on recent or ever use of mammography (22–24,26,28,32). Second, in order to better understand the mechanism by which social factors exert their influence, we examined multiple aspects of social networks simultaneously. To date, most of the existing studies have examined the impact of women's perceptions about social network members' attitudes toward screening (20,21,25,27–34), a construct referred to in this article as "social influence." Four studies have described social network size in relation to screening practices (22–24,26), and only one study has examined social support in relation to screening (24). To our knowledge, no previous study has simultaneously examined the influence of network size, social support, and social influence on screening practices to assess their relative salience.

This study focuses on a population that has received relatively little attention in the literature: working women. Nearly 60% of women are currently in the work force (35) and the number of working women is increasing, as is the length of time during which women remain in the work force (35). Employed women may face unique barriers to screening (29). Results from this study will help also guide the development of effective interventions for worksites.

CONCEPTUAL FRAMEWORK

Substantial evidence exists for the relationship between social relationships and physical or psychological well-being (36–40). However, the mechanism by which social networks exert their influence remains poorly understood (38,40,41). One hypothesis is that social support "buffers" the pathogenic effects of stressful events by influencing physiologic processes, thereby reducing the individual's susceptibility to disease (42,43). A second theory, the "main effects model," states that social support affects health independently of stress by influencing health behaviors and use of health care services (43).

Our research hypothesis that characteristics of social networks influence breast cancer screening behaviors is consistent with the main effects model and borrows from several theoretical models. According to Social Cognitive Theory, interactions among social network members provide opportunities for role modeling, observational learning, and positive reinforcement for behavior change. These experiences, in turn, influence expectations regarding the outcome of health behaviors, as well as self-efficacy regarding the behavior (44,45). Following the Theory of Reasoned Action, behavioral intention, the causal determinant of behavior, is a function of individual attitudes and subjective norms regarding the behavior. Subjective norms are determined by perceptions of what social network members think of the behavior and motivation to comply with the expectations of others (46,47). The Health Belief Model states that an individual will engage in a health behavior if she perceives herself to be susceptible to a disease, views the disease to have serious consequences, believes that there are benefits to the behavior, feels that there are few barriers to its performance, and experiences cues to action (48,49).

These theories suggest at least three mechanisms by which social network characteristics may impact breast cancer screening behaviors. First, social network size is likely to be related to exposure to individuals who have had or have been screened for the disease. This exposure may influence awareness about the disease, perceived susceptibility, as well as knowledge about early detection methods; these factors have previously been associated with utilization of mammography (33,50–53). Second, social support from network members, in the form of emotional support (nurturance, empathy), instrumental support (tangible aid or services), or informational support (advice, instruction) (54,55) may influence the ability to overcome emotional, logistical, or financial barriers in accessing and utilizing early detection methods. Numerous studies document negative associations between perceived barriers and screening participation (7,19,50,51,56). Finally, social influence, meaning social network members' attitudes and practices related to breast cancer screening and the individual's desire to gain social approval (46), may affect perceptions about the benefits of screening and reinforcement of screening behaviors.

METHODS

Background

Data for this cross-sectional study were collected from women employed in 27 Massachusetts worksites participating in the Breast and Cervical Cancer Education Project. The Breast and Cervical Cancer Education Project, a 4-year randomized trial funded by the National Cancer Institute, was designed to evaluate the effectiveness of cancer education offered in the workplace. Data from the baseline survey, administered prior to randomization of worksites to treatment condition, formed the basis for the present investigation.

Study Setting and Sample

Worksite selection criteria included the following: a minimum of 30 women employees in each of two age strata (40–52 years, 52 years and over); union representation among some segment of the work force; and location within 1½ hours of the study center. Participating sites included nine public community hospitals or chronic care facilities, nine private community hospitals, six state agencies, two state universities, and one private health organization. Worksites ranged in size from 250 to 2,800 employees.

Women employees aged 40 and over and employed on a permanent basis for 15 hours per week or more were eligible for survey participation. In sites with fewer than 125 eligible employees per age stratum, all women were selected for survey participation. In sites with 125 or more eligible employees per age stratum, stratified random sampling was conducted.

Due to the controversy surrounding routine mammography screening for women between the ages of 40 and 49 (57,58) and to ensure that women included in this study were of the age to which mammography screening guidelines of major medical organizations (1,3,4) have applied for at least 2 years, only data from women aged 52 and over were included in these analyses.

Data Collection

Employees completed a written survey during work time. The survey was administered through interoffice mail or in a small group setting at the worksite. Response rates across the 27 worksites ranged from 59% to 97% (worksite mean = 72%), yielding a sample of 1,368 women aged 52 and over. Women who had a prior history of breast cancer ($n = 67$) and those who provided incomplete information on breast cancer screening history ($n = 256$) were excluded from the analyses, resulting in a sample of 1,045 women.

Measures

At the time of data collection, the National Cancer Institute recommended that women aged 50 and over receive mammograms every 1 to 2 years and a clinical breast examination every year (6). Therefore, for the purposes of this study, regular screening was defined as the receipt of at least two mammograms, the most recent of which was within the past 2 years, with a maximum interval of 2 years between screenings, and receipt of a clinical breast examination within the past year.[4] Items to measure regular screening were taken from the National Cancer Institute's Breast Cancer Screening Consortium studies (61). Screening history was assessed by asking the year of the most recent mammogram and clinical breast exam and year of the mammogram before last. The survey was administered during winter and spring of 1996; therefore, mammograms reported between 1994–1996 were classified as recent or within the past 2 years.

Social network size was measured with a subset of items from Berkman's Social Network Index (36). Three items asked the individual to quantify the number of family members, friends, and coworkers with whom they "feel close, can talk to or call on for help." The midpoints of the response categories (none, 1–2, 3–5, 6–9, 10+) were then summed to create a continuous social network size index. Scores could potentially range from 0 to 30, with higher scores indicating larger networks.

Social support provided by network members was assessed with items from the MacArthur Successful Aging Study survey (62). Four items measured perceived availability of general emotional, instrumental, and informational support (e.g. "How often do persons close to you make you feel loved and cared for?"). Three additional items were created to assess perceived availability of support specifically related to breast cancer screening. The first item measured emotional support ("How often are persons close to you willing to listen to you when you need to talk about specific health problems or concerns, such as breast symptoms or mammography?"). The second item measured instrumental support ("How often can you count on persons close to you to help you make and keep medical appointments (such as appointments for mammograms), by doing things such as giving you a ride, or by taking care of other family members while you are away?"). The third item measured informational support ("How often do persons close to you give you advice or information about health problems, such as breast cancer?"). Perceptions regarding support were rated using a 4-point scale (never or no need = 0, rarely = 1, sometimes = 2, frequently = 3). Responses were summed and divided by the total number of items completed to form a composite measure of social support. Possible scores ranged from 0 to 3, with higher scores indicating greater perceived availability of social support (Cronbach's alpha = 0.70).

The social influence construct was composed of three component parts. The first component measured subjective norms regarding mammography (20,30,34), which included the respondent's perception of social network members' approval of mammography ("How does your family or those close to you feel about your having a mammogram?" strongly approve = 2, approve = 1, uncertain = 0, disapprove = −1, strongly disapprove = −2), multiplied by the degree of influence network members' attitudes had on mammography decision-making ("How much does the opinion of your family or persons close to you influence your decision about having a mammogram? very much = 4, somewhat = 3, not very much = 2, not at all = 1). Scores on this component could range from −8 to +8. The second component assessed whether social network members had offered explicit encouragement of mammography screening ("Has a friend, family member, or coworker ever encouraged or advised you to have a mammogram?" yes = 1, no = 0). The third component measured perceived social norms about mammography screening ("Of the women your age whom you know, how many get regular mammograms every 1–2 years?" most = 3, some = 2, a few = 1, none = 0, don't know = 0). Although we had intended to combine the three social influence components in a single index for analytic purposes, the low internal reliability of the index (Cronbach's alpha = 0.36) led us to analyze the social influence components individually.

Analysis

The primary analytic objective was to assess relationships between social network characteristics and breast cancer screening behaviors. Descriptive statistics were assessed to characterize the study sample with respect to sociodemographic characteristics and screening practices. Bivariate associations between sociodemographic characteristics, social network variables, and breast cancer screening practices were examined using logistic regression analysis for categorical variables and analysis of variance for continuous variables. All subjects (N = 1,045) were included in the bivariate analyses in order to maximize the statistical power to identify potential associations. Next, we constructed a taxonomy of logistic regression models to examine relationships between social network characteristics and breast cancer screening practices, while controlling for significant individual level characteristics. In these analyses, cases with missing data on any of the covariates were excluded (n = 163). Included in the multivariate modeling were variables relevant to the study's conceptual framework, regardless of statistical significance, as well as those exhibiting statistical significance at the $p < 0.05$ level. Since the worksite was the unit of enrollment in the larger trial, worksite was included as a random effect in all bivariate and multivariate analyses. Logistic regression coefficients were converted to odds ratios and 95% confidence intervals were calculated.

Goodness-of-fit measures for the multivariate model are provided in the footnote to Table 4. Unfortunately, there is not yet a goodness-of-fit measure for these Generalized Linear Mixed Models. The deviance statistic can sometimes be interpreted as a goodness-of-fit chi-square statistic, but procedures based on deviance statistics are not well-studied in the context of the Generalized Linear Mixed Model. Furthermore, deviance statistics are not helpful for goodness-of-fit statistics when the number of cells in the multidimensional matrix defined by the terms in the model is large relative to the number of observations per cell, as is the case in this study (63).

RESULTS

Sociodemographic characteristics and indicators of health care access among the study sample are presented in Table 1. Respondents ranged in age from 52 to 79, with a median age of 58 years. Seventy-three percent (n = 764) of the sample were between the ages of 52 and 59, 25% were between the ages of 60 and 69 (n = 265), and only 2% were age 70 or over (n = 16). Since the vast majority of women (98%) were between the ages of 52 and 68,

[4] We did not consider regular practice of breast self-examination in our definition of regular screening, due to controversy regarding its efficacy (59,60) and to key differences between breast self-examination and the other screening modalities (i.e. mammography and clinical breast examination require access to the health care system).

TABLE 1
Characteristics of Study Sample, Breast and Cervical Cancer Education Project (N = 1,045)

Characteristic	No.	(%)*
Age		
52–59	683	(65)
60+	362	(35)
Missing	0	
Education		
HS or Less	300	(30)
Post HS/Some College	287	(29)
College	170	(17)
Graduate School	234	(24)
Missing	54	
Job Category		
Craft, labor, maintenance, service	57	(6)
Clerical, administrative support, sales	276	(28)
Technical, paraprofessional	62	(6)
Professional, clinical, managerial or administrative	554	(56)
Other	48	(5)
Missing	48	
Household Income		
<$29,999	216	(22)
$30,000–$49,999	323	(33)
>$50,000	430	(44)
Missing	76	
Marital Status		
Married/Living as married	557	(54)
Other	468	(46)
Missing	20	
Race/Ethnicity		
White/Anglo	896	(88)
Other/Hispanic	121	(12)
Missing	28	
Primary Language		
English	974	(96)
Other	42	(4)
Missing	29	
Usual Source of Care		
Yes	998	(96)
No	44	(4)
Missing	3	
Provider Recommendation		
Yes	898	(87)
No	135	(13)
Missing	12	
Family History		
Yes	137	(14)
No	876	(86)
Missing	32	
Self-Rated Health Status		
Excellent	259	(25)
Very Good	395	(38)
Good	308	(30)
Fair	66	(6)
Poor	9	(1)
Missing	8	
Pattern of Regular Breast Cancer Screening		
Yes	654	(63)
No	391	(37)

* Percentages are based on nonmissing cases.

the age variable was dichotomized (52–59, 60+) for analysis. Multiple educational levels were represented, reflecting the range of respondents' occupations. Due to the small percentage (6%) of women who had less than a high school education (n = 66) and to the relatively high level of education in this sample, those with less than a high school education were combined with those who had a high school education but no more schooling (n = 234) for analysis. More than three-quarters of respondents reported household incomes of $30,000 or more. The majority were White, non-Hispanic and spoke English as a primary language. Most women had a usual source of health care and had received recommendations from their providers to have a mammogram.

Rates of regular screening across the 27 worksites ranged from 45%–81%, with an average of 63% across all worksites. The difference among the rates was not statistically significant (p = 0.08) by a chi-square test with 26 degrees of freedom. The intraclass correlation of regular screening rates in the participating worksites was negligible (r = 0.0007). Despite the low intraclass correlation and lack of statistical significance, the worksite was included as a random effect in all bivariate and multivariate analyses, because it was a design effect.

Regular screening by selected characteristics is presented in Table 2. Women who reported a pattern of regular screening were more likely to report higher annual household income levels, English as their primary language, a usual source of care, receipt of a provider recommendation to have a mammogram, and a positive family history of breast cancer than women who did not undergo regular screening. Screening status was unrelated to age, education, job category, marital status, race/ethnicity, or self-rated health status.

Correlations among the social network variables were modest (social support and social influence r = 0.34; social support and social network = 0.25; social network and social influence = 0.22; $p < .0001$ for all). Bivariate associations between regular screening and social network variables are shown in Table 3. There was little difference in the size of social networks among women who were regularly screened and those who were not. Women with higher levels of social support were more likely to have a history of regular screening than those with lower levels of social support, though this difference was not statistically significant (p = 0.06). Those who perceived that social network members approved of screening (subjective norms) and those who believed that most women their age undergo regular screening (social norms) were more likely to have been screened. Women whose social network members explicitly encouraged them to have a mammogram were less likely to have a history of regular screening than women whose family members or friends did not encourage mammography.

Results from logistic regression analyses are presented in Table 4. Because cases with missing values (n = 163) are excluded from the multivariate analyses presented in Table 4, odds ratios (controlled only for worksite cluster) are again presented for each variable. Comparison of the results in Table 2 (for the full sample) and those in Table 4 (for the reduced sample) reveal that the reduction in sample size did not materially affect estimates of the odds ratios.

The multivariate model (Table 4) includes the social network variables from the theoretical framework and covariates that demonstrated bivariate associations at the 5% significance level. In this model, neither social support nor subjective norms regarding mammography significantly contributed to the prediction of regular screening. The odds of having a history of regular screening were 50% lower among women who reported encouragement by a social network member to have a mammogram (OR = 0.51; 95% CI = 0.37, 0.71), compared with women who had received no encouragement. The odds of regular screening were 30% greater among those who perceived mammography to be a common

TABLE 2

Participation in Regular Breast Cancer Screening by Selected Characteristics, Breast and Cervical Cancer Education Project (N = 1,045)

Characteristic	Pattern of Regular Screening No.	(%)*	No Pattern of Regular Screening No.	(%)*	OR**	95% CI
Age						
52–59	435	(64)	248	(36)	1.14	(0.87–1.48)
60+	219	(61)	143	(39)	1.00	
Education						
HS or Less	171	(57)	129	(43)	1.00	
Post HS/Some College	187	(65)	100	(35)	1.41	(1.01–1.97)
College	106	(62)	64	(38)	1.25	(0.85–1.85)
Graduate School	153	(65)	81	(35)	1.34	(0.94–1.93)
Job Category						
Craft, labor, maintenance, service	37	(65)	20	(35)	1.00	
Clerical, administrative support, sales	172	(62)	104	(38)	0.87	(0.48–1.60)
Technical, paraprofessional	37	(60)	25	(40)	0.80	(0.38–1.68)
Professional, clinical, managerial or administrative	356	(64)	198	(36)	0.96	(0.54–1.70)
Other	25	(52)	23	(48)	0.60	(0.27–1.33)
Household Income						
<$29,999	118	(55)	98	(45)	1.00	
$30,000–$49,999	196	(61)	127	(39)	1.28	(0.90–1.81)
>$50,000	291	(68)	139	(32)	1.71	(1.22–2.40)
Marital Status						
Married/Living as married	362	(65)	195	(35)	1.00	
Other	282	(60)	186	(40)	0.82	(0.64–1.06)
Race/Ethnicity						
White/Anglo	566	(63)	330	(37)	1.07	(0.72–1.61)
Other/Hispanic	75	(62)	46	(38)	1.00	
Primary Language						
English	619	(64)	355	(37)	1.00	
Other	20	(48)	22	(52)	0.51	(0.27–0.95)
Usual Source of Care						
Yes	635	(64)	363	(36)	2.52	(1.36–4.66)
No	18	(41)	26	(59)	1.00	
Provider Recommendation						
Yes	616	(69)	282	(31)	6.50	(4.30–9.84)
No	34	(25)	101	(75)	1.00	
Family History						
Yes	103	(75)	34	(25)	1.92	(1.27–2.89)
No	535	(61)	341	(39)	1.00	
Self-Rated Health Status						
Excellent	165	(64)	94	(36)	1.09	(0.78–1.51)
Very Good	252	(64)	143	(36)	1.13	(0.84–1.51)
Good/Fair/Poor	235	(61)	148	(39)	1.0	

* Percentages based on nonmissing cases.

** Mixed effect model logistic regression, controlling for worksite as a random effect.

TABLE 3

Mean and Standard Error of Social Network Index, Social Support Index, and Social Influence Components for Total Sample and by Participation in Regular Breast Cancer Screening, Breast and Cervical Cancer Education Project

Variable	Total Sample Mean	Pattern of Regular Screening Mean	S.E.	No Pattern of Regular Screening Mean	S.E.	p-value*
Social Network Index (n = 1,026)	11.04	11.19	0.27	10.82	0.33	0.35
Social Support Index (n = 1,019)	1.90	1.93	0.03	1.86	0.03	0.06
Social Influence Components						
Subjective Norms (n = 1,034)	3.27	3.48	0.11	2.91	0.14	0.001
Social Network Member Encouraged Mammography (n = 1,034)	0.47**	0.44**	0.02	0.52**	0.03	0.007
Social Norms (n = 1,043)	1.96	2.12	0.06	1.72	0.07	0.0001

* Mixed model analysis of variance, controlling for worksite as a random effect.

** Mean equals the percent who responded that a social network member had recommended mammography.

practice among their peers (OR = 1.29; 95% CI = 1.10, 1.52), compared with those who did not know the screening practices of their peers or those who believed screening was not a common practice. Notably, the odds of having a pattern of regular screening were nearly six times greater among women whose health care provider had encouraged or advised screening (OR = 5.90; 95% CI = 3.70, 9.42), compared with those whose provider had not recommended mammography. Those with a family history of breast cancer were also more likely to undergo regular screening (OR = 1.64; 95% CI = 1.03, 2.62).

DISCUSSION

Public health interventions increasingly rely on the provision of social support and the dissemination of information through existing social networks as a means of promoting breast cancer screening. Although previous studies have assessed associations between various social network characteristics and screening, this paper reports the first systematic investigation of the relationship between regular screening and multiple network characteristics. As such, these results provide insights into the mechanisms by which social factors exert their influence and offer guidance for future intervention efforts.

We found that women who perceived regular mammography screening to be a common practice among their peers were more likely to be screened. The influence of social norms on breast cancer screening practices has received little attention in the literature. We identified only one other study that examined the relationship between knowledge of similar-aged peers' screening practices and mammography utilization; in it women who had never had a mammogram were more likely to report that they did not know how many other women obtained mammograms (32).

In bivariate analyses, we found that women who believed that social network members approved of screening were more likely to have a history of regular screening than women who did not share this perception. Two other studies have found that subjective norms, or the attitudes of significant others toward mammography, influence mammography screening practices (20,21). However, both of these studies included provider recommendation to have a mammogram as a component of subjective norms. We did not include provider recommendation as part of subjective norms, as this was not consistent with our conceptual definition of social

TABLE 4

Odds Ratios (and 95% Confidence Intervals) for Logistic Regression Analysis of Participation in Regular Breast Cancer Screening, Breast and Cervical Cancer Education Project*

Variable	Unadjusted		Multivariate Model+⊕	
	OR	(95% CI)	OR	(95% CI)
Social Network Index±	1.07	(0.93, 1.21)		
Social Support Index±	1.12	(0.98, 1.29)	1.03	(0.88, 1.21)
Subjective Norms±	1.25	(1.08–1.44)	1.13	(0.95–1.33)
Social Network Member Encouraged Mammography				
No	1.00		1.00	
Yes	0.72	(0.55–0.95)	0.51	(0.37–0.71)
Social Norms±	1.39	(1.21–1.60)	1.29	(1.10–1.52)
Household Income				
<$29.9K	1.00		1.0	
$30K–$49.9K	1.18	(0.81, 1.72)	1.10	(0.73, 1.66)
>$50K	1.56	(1.09, 2.24)	1.38	(0.93, 2.05)
Primary Language				
English	1.00		1.00	
Other	0.49	(0.24, 0.97)	0.68	(0.32, 1.46)
Usual Source of Care				
No	1.00		1.00	
Yes	2.64	(1.37, 5.10)	1.50	(0.71, 3.17)
Provider Recommendation				
No	1.00		1.00	
Yes	6.78	(4.35, 10.57)	5.90	(3.70, 9.42)
Family History				
No	1.00		1.00	
Yes	1.88	(1.22, 2.91)	1.64	(1.03, 2.62)

* Models include women with complete data on all variables (n = 882).
± Per one standard deviation increase in the index.
+ Adjusted for social support, subjective norms, social network member encouragement of mammography, social norms, household income, primary language, usual source of care, provider recommendation, family history, and worksite.
⊕ Goodness-of-fit for multivariate model. Deviance = 1018.16. Df = 871. Extra-dispersion scale = 0.998.

network. In this study, after controlling for provider recommendation, the impact of subjective norms was no longer evident.

Contrary to our expectations, explicit encouragement to undergo mammography by social network members was negatively associated with regular screening. Lerman et al. (33) similarly found that a mammography recommendation by a friend or family member was negatively associated with screening. These findings suggest that women who are most reluctant to participate in screening are those who are offered the most encouragement by network members. Alternatively, it may be that encouragement actually deters screening behaviors, insofar as it may be viewed as nagging. We believe that the former explanation of this finding is most likely. In analyses presented elsewhere (64), we found that encouragement by social network members to have a mammogram was positively associated with the intention to have a future mammogram among women who had not yet established a regular pattern of screening.

In these analyses, social network size was not strongly associated with regular screening, although other studies have noted association between these variables (23,24,26). Possible explanations for the lack of congruency with previous study findings is our conceptualization of the dependent variable (which consisted of mammography plus clinical breast examination) and the fact that our sample consisted of women with relatively high levels of income and education. The finding that social support was unrelated to screening history is consistent with Kang and colleagues' (24) results that found neither emotional nor instrumental support were associated with utilization of mammograms or clinical breast examinations.

We also found that provider recommendation was the single most powerful predictor of regular screening, as noted by previous studies (33,52,56,65,66). Provider recommendation may act as an intermediary between subjective norms and screening behaviors, in that social network members' approval may prompt discussions of screening with one's provider. Alternatively, a provider recommendation may stimulate discussion about screening with members of one's social network, resulting in greater perceived subjective norms supporting the behavior. Unfortunately, our cross-sectional data do not allow exploration of the temporal relationship between these variables.

Prior to discussing the implications of these findings for intervention efforts, limitations of this study must be noted. Generalizability is limited due to the characteristics of the study sample. These women were employed in health care settings and state agencies, were predominately White, spoke English as their primary language, and tended to have high levels of income and education (67). The cross-sectional nature of these data does not allow causal inferences to be made regarding the temporal relationship between social network characteristics and screening practices and does not permit us to assess the nature of the relationship between provider recommendation and subjective norms. Like previous studies, we rely on self-reported mammography history. While published studies demonstrate that mammography self-reports are fairly accurate (68–71), women tend to underestimate the time since their last screening exam. In this study, breast cancer screening practices were collected on a self-administered questionnaire, which is less subject to bias due to the provision of socially desirable responses than face-to-face or telephone interviews (72).

Finally, this data set lacked data on the month in which mammograms were received. By classifying any mammogram that took place 25–30 months prior to the survey as "within the past 2 years," it is likely that the prevalence of adherence to guidelines is overestimated. It is unlikely, however, that any misclassification would produce a false association between social influence and screening practices.

Despite these limitations, this study can provide guidance for the development of interventions designed to promote use of early detection methods for breast cancer. While the effect of social factors on screening behaviors is small in epidemiologic terms, we believe that these findings have practical significance for public health initiatives, since social influences are factors to which the entire population is exposed and are potentially modifiable.

As proposed by Social Cognitive Theory and the Theory of Reasoned Action, our findings suggest that interventions involving interactions between social network members could play an important role in increasing screening participation, providing opportunities for role modeling, positive reinforcement, and establishment of social norms. Examples of social modeling interventions include those which employ role models recruited from the target community who display the desired behaviors (73–75). Mass media campaigns that depict screening as a normative practice have also been used to positively influence social norms regarding screening (76). In addition, these findings suggest that interventions should be targeted toward existing social groupings, such as

families and friend networks. Because of the existence of established social networks and channels for communication, worksites represent an important setting for such efforts. The Breast and Cervical Cancer Education Project is currently testing a workplace intervention model in which women employees are trained to educate their coworkers about the importance of early detection. These "peer health advisors" lead small group education sessions and conduct one-to-one outreach and worksite-wide campaigns to promote screening utilization.

Given the strong association between provider recommendation and regular screening, intervention efforts should include strategies aimed at increasing provider referrals for screening. Providers clearly act as gatekeepers to screening procedures and may influence perceptions regarding the social acceptability of screening behaviors. Regardless of the mechanism of action, prior studies show that physician reminder systems (77–79) and provider education (80–82) can be effective in promoting women's participation in screening. Interventions targeting providers should therefore be included as components of comprehensive programs.

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