Mammography Screening Practices in Average-Risk Women Aged 40–49 Years in Primary Care: A Comparison of Physician and Nonphysician Providers in Minnesota

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Abstract

Background: Breast cancer screening practices and the influence of clinical guidelines or recommendations are well documented for physicians, but little is known about the screening practices of nonphysician providers (physician assistants and advanced practice registered nurses). The seven breast cancer screening guidelines or recommendations on the use of mammography have the most variation for screening average-risk women 40–49 years of age. Therefore, to better understand the practices of nonphysicians, this study will compare the practices of physicians with nonphysician providers for women 40–49 years of age.

Materials and Methods: Minnesota physicians and nonphysicians were e-mailed an anonymous cross-sectional survey, which asked primary care providers about their mammography screening practices for average-risk women 40–44 and 45–49 years of age and to rate the influence of seven breast cancer screening recommendations on the use of mammography in their practice. Comparisons across providers' demographic and professional characteristics were conducted using chi-squared and Fisher's exact tests, as appropriate, and multivariate logistic regression analyses.

Results: Of the respondents who practiced primary care (193 physicians, 50 physician assistants, and 197 advanced practice registered nurses), 66.7% reported recommending mammography for women at ages 40–44 and 77.2% recommended mammography for women at ages 45–49. Nonphysician providers were more likely to recommend screening in both these age groups ($p < 0.05$). Having a self-identified interest in women's health was associated with more mammography screening in both age groups. The American Cancer Society guideline was endorsed as influential by the most respondents.

Conclusions: Breast cancer screening practices vary between physicians and nonphysician providers for women 40–49 years of age at average risk. Targeted interventions may help reduce practice variation and ensure high-value care.

Keywords: breast cancer, mammography screening, practice patterns, health care providers, cancer screening recommendations

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Introduction

THE INCIDENCE OF breast cancer in 2015 was 124.8 per 100,000 persons and was the most common cancer across all races.¹ Screening mammography is believed to increase the detection of early-stage breast cancer, thereby reducing the rate of advanced cancer detected and thus reducing mortality. However, seven professional organizations have written seven different and conflicting clinical guidelines or recommendations (hereafter, referred to as recommendations) to direct breast cancer screening practices for average-risk women (Table 1).^{2–8} Although there is much consensus on screening women 50–74 years of age, the multiple and changing recommendations vary on when to initiate mammography and the frequency with which to screen women 40–44 and 45–49 years. For example, the American Cancer Society provides the option of starting annual mammography at age 40 and recommends annual mammography initiation by age 45.³ In contrast, the United States Preventive Services Task Force (USPSTF) recommends initiating routine biennial screening at age 50 and for women 40–44 and 45–49 years, the decision to initiate screening should be based on an individual woman's weighing of the potential harms and benefits of mammography screening.² All seven organizations listed in Table 1 agree that there is some benefit to women being screened with mammography in their 40s; however, they differ in their interpretation of the magnitude of the benefits versus the harms. The USPSTF rates the evidence a “C” for their recommendations to screen women 40–44 and 45–49 years of age, indicating there is a benefit, but the benefit is small, and it remains unclear if the harms outweigh the benefits.

Many studies have tried to understand the practice patterns around mammography screening and which recommendations are influential in directing breast cancer screening practices. The most influential recommendations for physicians are those by the American Cancer Society, the American College of Obstetricians and Gynecologists, and the USPSTF.^{9–11} Most primary care physicians value multiple recommendations in their practice,¹⁰ but doctors tend to follow the recommendations of their professional society.⁹ Family and internal medicine physicians whose professional societies endorsed the 2009 USPSTF recommendations have lower rates of screening at ages 40–44 and 45–49 years in

accordance with the USPSTF's recommendations.¹² Gynecologists are significantly more likely to recommend mammography screening at the ages 40–44 and 45–49 years, consistent with the American College of Obstetricians and Gynecology guidelines (which indicate that women in their 40s have the option to begin screening).^{11–15} The gender and level of training of physician providers have also been found to influence mammography prescribing rates before and after the release of 2009 USPSTF recommendations.¹⁶ Patients who had female internists were more likely to complete mammography screening than patients who had a male internist and were more likely to have a mammogram than patients being seen by medical residents of either gender.

Only one study has examined screening practices of nonphysician providers (advanced practice nurses and physician assistants) and found that nonphysicians had significantly higher rates of screening—in excess of the USPSTF recommendations—than primary care physicians, although they had lower rates than gynecologists.¹³ The sample size of nonphysicians was small ($n=46$), thus this study only provided limited information on their practice. Given the large role nonphysicians will play in the future of primary care,^{17,18} having a better understanding of their practice patterns will help target interventions and education. In addition, this knowledge will help public health and health care organizations understand how health care costs and utilization may be affected by the growing nonphysician workforce. The primary aims of this study were therefore to describe health care providers' breast cancer screening practices for average-risk women at the ages of 40–44 and 45–49 years and to compare these practices by professional background (physician, physician assistant, and advanced practice registered nurses), specialty, practice setting, and demographic characteristics. The secondary aim was to identify which professional organizations' recommendations are most influential for physicians and nonphysicians.

Materials and Methods

Study design and sample

The study was reviewed and deemed exempt from oversight by the University of Minnesota's Institutional Review Board. Minnesota primary care and gynecology physicians

TABLE 1. RECOMMENDATIONS FOR BREAST SCREENING MAMMOGRAPHY FOR AVERAGE-RISK WOMEN BREAST

Organization (source)	Age for initiation	40–44	45–49	When to stop screening
U.S. Preventive Services Task ²	50	Individualized assessment	Individualized assessment	75
American Cancer Society ³	Offer at 40, initiate at 45	Annual	Annual	When life expectancy is <10 years
American College of Obstetricians and Gynecologists ⁴	Offer at 40, initiate by 50	Annual or biennial	Annual or biennial	75
American Academy of Family Physicians ⁵	By age 50	Individualized assessment	Individual assessment	Individualized assessment
American College of Radiology ⁶	40	Annual	Annual	Not specified
American College of Physicians ⁷	By age 50	Individualized assessment	Individual assessment	Individualized assessment
National Comprehensive Cancer Network ⁸	40	Annual	Annual	When life expectancy is <10 years

and nonphysician providers (advanced practice registered nurses and physician assistants) were e-mailed a link to an anonymous cross-sectional online survey from June to October 2016. Study data were collected and managed using Research Electronic Data Capture (REDCap) electronic data capture tools hosted by the University of Minnesota.¹⁹

Participants were identified through the Minnesota Board of Medical Practice and the Minnesota Board of Nursing. To be eligible, physicians had to be from the specialties of family medicine, internal medicine, or obstetrics and gynecology. Advanced practice registered nurses were eligible if they were in family practice, adult, gerontology, women's health, or nurse midwifery specialties. All physician assistants were e-mailed a link to the survey, as they are not licensed by subspecialty.

Participation was voluntary and anonymous. Recruitment consisted of sending an initial e-mail inviting participation and up to five reminders. As a participation incentive, participants were entered into a drawing for the chance to receive 1 of 20 \$300 Amazon gift cards.

Measures

Providers' demographic and professional characteristics were requested, including professional background, specialty among physicians and advanced practice registered nurses, gender, race, interest in women's health, practice setting (community or academic), and years in practice.

The survey included 37 multiple-part, multiple-choice questions regarding breast cancer screening recommendations for average-risk and high-risk women; this report includes the results for screening average-risk women only. Some questions were adapted from the validated National Health Survey of Primary Care Physicians' Recommendations and Practice for Breast, Cervical, Colorectal, and Lung Cancer Screening.²⁰ Providers rated the influence of each of the seven recommendations on their screening practices of average-risk women using a 4-point Likert-type scale (very influential, somewhat influential, not influential, not applicable). Providers were asked if they recommended screening with mammography and the frequency of screening (annual or biennial) in the following age groups: 40–44 years, 45–49 years, 50–69 years, and older than 70 years. Providers were also asked to assess their comfort level with providing breast cancer screening recommendations to patients. A copy of the complete survey is provided in Supplementary Data.

Statistical analyses

Data analysis was limited to respondents who reported providing primary care to women. Providers' demographic and professional characteristics were summarized using descriptive statistics. This analysis focused on providers' self-reported adherence to breast cancer screening recommendations for younger women (40–44 and 45–49 years), given greater consensus among recommendations for women in their 50s and 60s. Comparisons of practices across providers' demographic and professional characteristics were conducted using chi-squared and Fisher's exact tests, when appropriate, and multivariate logistic regression analyses were conducted. The multivariate logistic regression models included provider's professional background (physician/physician assistant or advanced practice registered

TABLE 2. PROVIDER CHARACTERISTICS AND DEMOGRAPHICS, *N*=456

<i>Characteristic</i>	<i>n</i>	<i>%</i>
Professional background		
Physician	193	43.9
Physician assistant	50	11.4
Advanced practice registered nurse	197	44.8
Missing	16	
Physician or physician assistant specialty		
Internal medicine/Adult or gerontological health	50	20.8
Family medicine/family practice	172	71.7
Gynecology	15	6.3
Other (geriatrics, nephrology, oncology)	3	1.3
Missing	3	
Advanced practice registered nurse specialty		
Adult/gerontological health	26	13.5
Family practice	98	50.8
Nurse midwifery	25	13.0
Women's health	31	16.1
Other ^a	13	6.7
Missing	4	
Specialized interest in women's health		
No	238	54.1
Yes	202	45.9
Missing	16	
Years of experience		
<5	68	15.6
6–10	50	11.5
11–15	64	14.7
16–20	85	19.5
>20	169	38
Missing	20	
Practice setting		
Academic	66	15.2
Community	369	84.8
Missing	21	
Gender		
Male	119	27.2
Female	316	72.2
Other	3	0.7
Missing	18	
Race/ethnicity		
Non-Hispanic White	395	90.4
Non-Hispanic Black	4	0.9
American Indian/Alaska Native	2	0.5
Asian	15	3.4
Native Hawaiian/Other Pacific Islander	1	0.2
Hispanic	9	2.1
Other	11	2.5
Missing	19	

^aBreast clinic, Certified Registered Nurse Anesthetists, human immunodeficiency virus, Internal medicine, Pain, Preventive Medicine, Preventive/Occupational/Aerospace medicine, Psychiatry.

nurse), interest in women's health (yes/no), years of experience (<5 years/6–10 years/11–15 years/16–20 years/>20 years), practice setting (academic/community), and gender (male/female). Odds ratios (OR) and 95% confidence intervals (CI) are presented. Data were analyzed using SAS version 9.4 (SAS Institute, Cary, NC) and *p*<0.05 were considered statistically significant.

TABLE 3. UNIVARIATE ANALYSIS OF CLINICAL VARIABLES ASSOCIATED WITH MAMMOGRAPHY SCREENING RECOMMENDATIONS AMONG WOMEN 40–44 AND 45–49 YEARS OF AGE

Characteristic	Age 40–44					Age 45–49				
	No		Yes		p	No		Yes		p
	n	%	n	%		n	%	n	%	
Professional background					0.001					0.02
Physician	83	43.0	110	57.0		56	29.0	137	71.0	
Physician assistant	14	28.0	36	72.0		11	22.0	39	78.0	
Advanced practice registered nurse	51	25.9	146	74.1		34	17.3	163	82.7	
Specialty (among physicians)					0.13					0.22
Internal medicine/Adult or gerontological health	25	52.1	23	47.9		18	37.5	30	62.5	
Family medicine/Family practice	53	42.4	72	57.6		34	27.2	91	72.8	
Gynecology	3	20.0	12	80.0		2	13.3	13	86.7	
Other	1	50.0	1	50.0		1	50.0	1	50.0	
Specialized interest in women's health					0.006					0.007
No	93	39.1	145	60.9		66	27.7	172	72.3	
Yes	54	26.7	148	73.3		34	16.8	168	83.2	
Years of experience					0.17					0.13
<5	16	23.5	52	76.5		16	23.5	52	76.5	
6–10	16	32.0	34	68.0		11	22.0	39	78.0	
11–15	19	29.7	45	70.3		9	14.1	55	85.9	
16–20	27	31.8	58	68.2		15	17.7	70	82.4	
>20	67	39.6	102	60.4		48	28.4	121	71.6	
Practice setting					0.51					0.17
Academic	24	36.4	42	63.6		19	28.8	47	71.2	
Community	119	32.3	250	67.8		78	21.1	291	78.9	
Gender					<0.0001					0.002
Male	61	51.3	58	48.7		41	34.5	78	65.6	
Female	85	26.9	231	73.1		60	19.0	256	81.0	
Other	1	33.3	2	66.7		0	0.0	3	100.0	

Results

The survey was e-mailed to 10,392 eligible licensed providers in Minnesota: 3,800 physicians, 2,132 physician assistants, 4,000 nurse practitioners, and 460 nurse midwives. A total of 805 providers completed the survey for a response rate of 7.7%. After excluding 349 respondents who indicated they did not provide primary care to women, the final sample included 456 respondents. Characteristics of the respondents are given in Table 2. Most of the respondents were women, nonphysicians, and practiced in community settings.

Screening practices for women at 40–44 years

Two-thirds of providers ($N=304$; 66.7%) reported recommending mammography for women at age 40–44; among those, 174 (57.4%) recommended annual mammography and 126 (41.6%) recommended biennial mammography. In univariate analyses (Table 3), physician assistants and advanced practice registered nurses recommended mammography in this age group significantly more often than physicians ($p=0.001$). Providers who self-identified as specializing in women's health ($p=0.0006$) and female providers ($p<0.0001$) were significantly more likely to recommend screening. Specialty (among physicians), years of experience, and practice setting were not associated with mammography recommendations. In the multivariate analysis, nonphysicians (OR=1.84, 95% CI=1.10–3.08, $p=0.02$) and those who reported specializing in women's

health (OR=1.63, 95% CI=1.06–2.50, $p=0.03$) remained significantly more likely to recommend mammography for women in this age group.

Screening practices for women at age 45–49

A total of 352 (77.2%) providers recommended mammography for women 45–49 years. Among those, 204 (58.5%) recommended annual screening and 140 (40.1%) recommended biennial screening. Similar to findings for women 40–44 years of age, physician assistants and advanced practice registered nurses ($p=0.02$), those who specialize in women's health ($p=0.0007$), and female providers ($p=0.002$) were more likely to recommend mammography in women 45–49 years in univariate analyses (Table 3). In the multivariate analysis, only nonphysicians (OR=1.98, 95% CI=1.06–3.69, $p=0.03$) and those who reported specializing in women's health (OR=1.75, 95% CI=1.07–2.88, $p=0.03$) remained significantly more likely to recommend mammography for women in this age group.

Influence of professional organizations' recommendations

Providers were asked which of the seven recommendations were influential in guiding their practice of screening with mammography (Table 4). The American Cancer Society's breast cancer screening recommendations for average-risk women were endorsed as influential by most respondents,

TABLE 4. ALL PROVIDERS RESPONSE TO THE QUESTION, IN YOUR CLINICAL PRACTICE, HOW INFLUENTIAL ARE BREAST CANCER SCREENING GUIDELINES FOR AVERAGE-RISK WOMEN FROM THE FOLLOWING ORGANIZATIONS?

Guideline	Response options					
	Very influential		Somewhat influential		Not influential	
	n	%	n	%	n	%
U.S. Preventive Services Task Force	215	47.8	187	41.6	33	7.3
American Cancer Society	230	51.1	189	42.0	20	4.4
American College of Obstetricians and Gynecologists	186	41.5	183	40.9	53	11.8
American Academy of Family Physicians	126	28.1	194	43.2	74	16.5
American College of Radiology	74	16.5	173	38.5	111	24.7
American College of Physicians	48	10.7	181	40.5	104	23.3
National Comprehensive Cancer Network	25	5.6	122	27.4	116	26.0
Other ^a	11	4.0	30	11.0	68	24.9
					164	60.1

^aOther stated guidelines by participants: American College of Nurse-Midwives, Canadian Medical Guidelines, Cochrane, Consumer Reports, ICSI, Mayo Clinic, National Institute for Health and Care Excellence, SAGE, Executive Care Network, ICSI, Institute for Clinical Systems Improvement.

with 93.1% of providers stating this set of recommendations was either very or somewhat influential, followed by the USPSTF (89.4%) and the American College of Obstetricians and Gynecologists' recommendations (82.4%). The influence of the professional organization varied significantly by provider type (all $p < 0.01$), with the exception of the American Society of Clinical Oncology recommendations. The three most influential recommendations for physicians were from the American Cancer Society, USPSTF, and American Family Physicians (Fig. 1), whereas the recommendations of the American Cancer Society, USPSTF, and American College of Obstetricians and Gynecologists were identified as the most influential for physician assistants (Fig. 2) and advanced practice registered nurses (Fig. 3).

Discussion

This study first aimed to examine whether mammography screening practices for average-risk women 40–44 and 45–49 years of age differed between nonphysician and physician primary care providers in Minnesota and whether there were other demographic characteristics influencing screening practices. We found that nonphysician providers (nurse practitioners, nurse midwives, and physician assistants) reported recommending mammography more frequently for women in these age groups than physicians. Our findings are consistent with the study by Haas et al.¹³ who compared physician and nonphysician screening practices relative to the USPSTF recommendations in four clinical networks in northeastern United States. Because Haas et al. did not report the results by age group or professional background, we are not able to directly compare study results. Our study added to the knowledge on nonphysician practice by using a much larger sample of nonphysicians and by providing results by professional background. Both studies imply a trend whereby suggesting nonphysicians recommend screening women in their 40s more frequently than physicians. Although it is unknown why nonphysicians screen more practice patterns of nonphysicians in primary care have shown a strong health promotion focus, as exemplified in a study showing non-physicians provided 30%–40% more health education and counseling to patients than primary care physicians.²¹

Having a self-identified interest in women's health was consistently related to significantly more screening. In a study by Corbelli et al.,¹⁵ the internist and family medicine physicians who had a self-identified interest in women's health were not more likely to screen in excess of the USPSTF recommendations. The results of our study were different possibly because we did not limit self-identified interest in women's health to internist and family medicine physicians. Therefore, those who identified as having an interest in women's health also included advanced practice nurses, physician assistants, and gynecologists.

In fulfillment of the second aim, our study is the first to report which professional organizations' recommendations (or guidelines) were influential for nonphysicians as a subgroup and provides insight into which recommendations were influencing their breast cancer screening practices. In this study, the practice patterns of providers were not compared against one particular professional organization's recommendations. Rather, we examined which professional organizations' recommendations were being used by provider groups.

FIG. 1. Physician responses to the question: In your clinical practice, how influential are breast cancer screening guidelines for average-risk women from the following organizations?

Advanced practice nurses, physician assistants, and physicians did vary in which professional organization's recommendations they indicated were influential in their practice. The three organizations (American Cancer Society, USPSTF, and American College of Obstetricians and Gynecologists) that were identified as the most influential for nonphysicians are consistent with previous research on the most influential recommendations for physicians.⁹⁻¹¹ The American Family Physicians was one of the top 3 influential recommendations

for physicians, in place of the American College of Obstetricians and Gynecologists. Given that providers tend to be influenced by professional organizations in their specialty,⁹ the relatively small number of gynecologists in our sample may explain why the American College of Obstetricians and Gynecologists' recommendations were rated lower.

Clinical practice recommendations are not the only factor influencing screening practices. For example, Haas et al.¹³ found that 75.7% of providers recommended mammography

FIG. 2. Physician assistant responses to the question: In your clinical practice, how influential are breast cancer screening guidelines for average-risk women from the following organizations?

FIG. 3. Advanced practice registered nurses responses to the question: In your clinical practice, how influential are breast cancer screening guidelines for average-risk women from the following organizations?

in excess of USPSTF recommendations, despite these same providers reporting the USPSTF as the most influential recommendation. Those providers reported high patient demand as the reason for screening practices. The recommendations from the American Cancer Society, USPSTF, and American College of Obstetricians and Gynecologists recommend initiating routine screening at age 45 or 50 years, but most (66.7%) providers in this study recommended screening women at ages 40–44 years. Although recommending screening at ages 40–44 years is consistent with the American College of Radiology recommendations, the providers reported the American College of Radiology's recommendations as the fifth most influential. More research is needed to better understand how patient demand and other factors are influencing breast cancer screening and how these factors may differ between physicians and nonphysicians.

Despite the differences across recommendations, all emphasize a shared and informed decision-making process to determine when to initiate screening for an individual patient. Yu et al.²² found that patients have a better understanding of the benefits of mammography than the harms, and they suggest there may be a lack of balanced information offered by providers, media, and professional organizations. Because the current survey was only of providers, more research is needed to better understand how patients of different types of providers are involved in decision-making.

Limitations

Although this was a large cross-sectional study of a diverse group of providers, the study has several limitations. First, the response rate was low. It should be noted, however, that the response rate was calculated using the number of surveys

we sent out and the number returned; in contrast, many studies use the number actually received by the participant to calculate the response rate, resulting in a higher rate and limiting comparison with our study.²³ Because we sent surveys by e-mail, we were not able to calculate how many were actually opened and received by participants. Although low response rates are thought to bias results and limit generalizability, there is evidence that there is less response bias among physicians than the public. Furthermore, the response rate of this survey is similar to other studies of physicians.¹⁴ For example, Yasmeen et al.¹⁴ reported in their national study of providers about mammography screening a response rate <10%. They found no difference between those who responded to the first invitation and those who responded to the second and third invitations, suggesting limited differences between responders and nonresponders (*i.e.*, low response bias). Response bias to surveys was also found to be minimal in a study of pediatricians, even when response rates were the lowest.²⁴ This project's resources restricted the survey to e-mail and did not allow for individual monetary incentives, which partly explains the low response rate.^{23,25,26} Increasing demands on health care providers could also explain why response rates to surveys are declining over time.²⁴ Because of the overrepresentation of providers with an interest in women's health, the results may be an overestimation of mammography screening practices. There was also a small number of gynecologists in our sample, which restricted our ability to compare the practice patterns of gynecologists with other physicians and nonphysicians.

Second, this study was conducted in a single state (Minnesota) and therefore may not be generalizable to all health care providers in the United States. In an analysis of the National Ambulatory Medical Care Survey, geographic location was not found to influence the recommendations for

mammography by physicians.²⁷ However, slight regional differences have been found in actual mammography rates by region for women 40–49 years following the 2009 USPSTF update, with decreasing rates observed in the West.²⁸ Income, insurance status, health literacy, and previous screening have been identified as having strong associations with mammography screening rates.^{29,30}

The responses are self-reported data on providers' practices. Therefore, the survey was not able to capture providers' actual clinical decisions. Providers may be answering the questions with what they believe to be desired clinical practice instead of what they are actually doing. The survey does not tell us if the patient follows through with the provider's recommendation to have or not have a mammogram. Despite these limitations, this study expands current knowledge by uniquely identifying reported screening practices in nonphysician providers, a growing segment of primary care providers.

Conclusions

As the future of health care includes an increasing number of nonphysicians providing primary care, it is important to understand their breast cancer screening practice patterns. In the context of multiple conflicting recommendations attempting to direct mammography screening for average-risk women, advanced practice nurses and physician assistants were more likely than physicians to recommend mammography for women 40–44 and 45–49 years of age. Having a self-identified interest in women's health was also associated with more mammography screening among women. Recommendations from American Cancer Society, USPSTF, and the American College of Obstetricians and Gynecologists were the most influential breast cancer screening recommendations for nonphysicians. These results can inform targeted interventions to help reduce practice variation and ensure high-value care. More research is needed to understand what is driving these practice patterns and the extent to which informed decision-making is taking place between providers and patients.

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No competing financial interests exist.

Supplementary Material

Supplementary Data

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