Preventive Medicine 123 (2019) 130–137

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

U.S. women's perceived importance of the harms and benefits of mammograms and associations with screening ambivalence: Results from a national survey

Xuanzi Qin[a,*], Rebekah H. Nagler[b], Erika Franklin Fowler[c], Sarah E. Gollust[a]

[a] Division of Health Policy & Management, University of Minnesota School of Public Health, 420 Delaware St. S.E., Minneapolis, MN 55455, USA
[b] University of Minnesota Hubbard School of Journalism and Mass Communication, 111 Murphy Hall, 206 Church St SE, Minneapolis, MN 55455, USA
[c] Department of Government, Wesleyan University, 45 Wyllys Avenue, Middletown, CT 06459, USA

ARTICLE INFO

Keywords:
Breast cancer
Cancer prevention
Mammography screening
Perceptions and attitudes
Ambivalence
Women's health
National survey
Prevention recommendations

ABSTRACT

The American Cancer Society and the U.S. Preventive Task Force recently recommended that women initiate routine breast cancer screening at older ages (45 and 50, respectively) than previously recommended, and both organizations emphasize the importance of weighing the harms of mammograms against the benefits in making informed decisions. However, little is known from national samples about how women perceive the harms and benefits of mammograms, and how these perceptions relate to their attitudes about getting mammograms. To fill this gap, we surveyed a nationally representative sample of 557 U.S. women aged 30–59 about their perceptions of harms and benefits and their attitudinal ambivalence toward mammograms. We found that respondents overall perceived the benefits as more important than harms, but those who were aware of recent recommendations perceived mammogram harms as more important than those who were unaware. Women who had a mammogram within one year perceived the harms as less important and the benefits as more important, compared to those who had not had a mammogram in the past year. Those who perceived the harms as important were more ambivalent about screening than those who perceived harms as less important. We conclude that if the public health goal is to prevent the population harms from overuse of mammograms (e.g., overdiagnosis, false positives), simply providing women with information about harms and benefits may not lead to this outcome, since women are likely to perceive the benefits as more important than harms, and thus make an informed choice to obtain screening.

1. Introduction

There is longstanding expert disagreement about the use of mammography to screen for breast cancer, particularly for women in their 40s. During the 1990s, experts debated both the age at and frequency with which women should be screened (Fletcher et al., 1993; National Institutes of Health Consensus Development Panel, 1997), and in the early 2000s, a Cochrane meta-analysis questioned whether screening should occur at all (Olsen and Gøtzsche, 2001). In 2009, the United States Preventive Services Task Force (USPSTF) triggered substantial controversy by downgrading mammography to a C rating, recommending against routine screening for women aged 40–49 (US Preventive Services Task Force, 2009), and in 2016 it reaffirmed this recommendation (Siu, 2016).

Since the publication of the 2009 USPSTF recommendation, the harms of mammography screening have been gaining attention (Nagler et al., 2019), and there has been increased emphasis on informed decision making for women aged 40–49. Specifically, the USPSTF recommended that average-risk women start routine mammography screening at the age of 50, emphasizing that the decision to start before 50 should be an individual one and take the patient's values regarding harms and benefits into account (US Preventive Services Task Force, 2009). This recommendation was informed by evidence that the benefits of mammograms do not significantly exceed the harms for women aged 40–49 (US Preventive Services Task Force, 2009). In 2016, the USPSTF again noted the potential harms of mammograms (Nelson et al., 2016; Siu, 2016) while also recognizing that "women who place a higher value on the potential benefit than the potential harms may choose to begin biennial screening between the ages of 40 and 49 years (Siu, 2016)." In 2015, the American Cancer Society (ACS) updated its 2003 breast cancer screening guideline, changing the recommended starting age of routine screening from 40 to 45 (Oeffinger et al., 2015).

* Corresponding author.
E-mail address: qinxx118@umn.edu (X. Qin).

https://doi.org/10.1016/j.ypmed.2019.03.023
Received 6 November 2018; Received in revised form 15 February 2019; Accepted 15 March 2019
Available online 16 March 2019
0091-7435/

Although the recommended starting ages are different, both USPSTF and ACS recommend that younger women weigh the potential benefits of mammograms against the possible harms in order to come to an informed decision (Oeffinger et al., 2015; Siu, 2016). Given this strong emphasis on weighing mammogram benefits against harms, it is critical to understand the factors underlying women's values about the benefits and harms of mammograms and how such values contribute to their mammography screening decisions.

Studies published prior to the 2009 USPSTF recommendation showed that women tend to overestimate their risks of breast cancer and the benefits of mammograms (Black et al., 1995; Chamot et al., 2004; Nekhlyudov et al., 2003; Schwartz et al., 2000). Since the 2009 recommendation, studies have shown that women in their 40s mostly were skeptical about or unaware of the updated USPSTF recommendation and the controversy surrounding the recommendation, that women were less aware of or not convinced about the harms of mammograms (Abelson et al., 2018; Allen et al., 2013), and that they still had high intentions to be screened even after being told about changed screening recommendations (Mehta et al., 2018; Nagler et al., 2017b). These studies suggest that women's perceptions of the harms of mammograms and their attitudes about getting a mammogram likely have changed little even after media publicity (Nagler et al., 2019) of changing recommendations and new research about possible harms. However, given that these previous studies used small samples, qualitative methods, or described samples outside the U.S., more work is needed to understand U.S. women's perceptions of the harms and benefits of mammograms and whether such perceptions are related to attitudes about screening.

To fill this gap, we used a nationally representative survey to examine U.S. women's perceptions of the harms and benefits of mammograms as well as the association between their perceptions of harms and benefits and their attitudes about getting a mammogram. Specifically, we examined attitudinal ambivalence, "a psychological state of conflict" (Priester and Petty, 1996, p. 432) in which people hold both positive and negative (i.e., mixed) evaluations of a given object or behavior at the same time (here, mammography screening) (Priester and Petty, 1996; Thompson et al., 1995). Previous work has demonstrated that one consequence of exposure to information about mammograms could be greater ambivalence about mammograms (Nagler et al., 2018b). Since experiencing attitudinal ambivalence could contribute to health behaviors (including information seeking or delays in decision-making) (Conner et al., 2002; van Harreveld et al., 2015), ambivalence is an important outcome relevant to women's mammogram-related decisions.

2. Methods

2.1. Data and sample

Study participants were women aged 30–59 (N = 557) who received a survey module on mammogram benefits and harms as part of a longer survey on public opinion about cancer-related issues, which was fielded by the survey research firm GfK between May 24 and June 6, 2016. We included women below the target age range for considering mammogram decisions (i.e., younger than 40) because these are the women who professional societies recommend make individualized decisions about mammogram initiation when they age into their 40s, and thus understanding the factors that may shape their attitudes, including their ambivalence about screening, is an important priority. GfK maintains a probability-based nationally-representative panel of about 55,000 U.S. adults aged 18 and over (called KnowledgePanel). Eligible participants were randomly selected, and 51% of them completed the survey. GfK used demographic benchmark distributions of 30- to 59-year-olds in the U.S. population from the March 2015 data of the Current Population Survey (CPS) to create sample weights for each respondent so that estimates are nationally representative. This study was determined to be exempt from review by the Institutional Review Board at the University of Minnesota.

2.2. Measures

2.2.1. Dependent variables

2.2.1.1. Perceived importance of the harms and benefits of mammograms. Survey participants rated the importance of 7 harms and 4 benefits from 1 to 5 ("not important," "slightly important," "moderately important," "important" and "very important"). The 7 harms included overdiagnosis, false-positive results, anxiety and stress due to false-positive results, unnecessary surgeries and/or medications, costs to women, costs to the health system, and increased cancer risk due to radiation. The 4 benefits included early detection of cancer, saving lives, early treatment of cancer, and providing peace of mind by finding no cancer. Detailed information about the 7 harms and 4 benefits in this national survey is reported in Appendix. Exploratory factor analyses indicated a single latent factor for the 7 harms and another for the 4 benefits (Cronbach alpha for benefits = 0.94; Cronbach alpha for harms = 0.93). Consequently, we constructed two continuous variables, the perceived importance of harms and the perceived importance of benefits, by averaging across the 7 harms and across the 4 benefits.

2.2.1.2. Women's ambivalent attitudes about getting a mammogram. Attitudinal ambivalence about mammograms was assessed by the single item "I have mixed feelings about getting a mammogram," for which participants selected a response on a 5-point Likert scale ("strongly disagree," "disagree," "neither agree nor disagree," "agree" and "strongly agree"). Similar items have been used in previous research to measure attitudinal ambivalence about health behaviors (Chang, 2013; Han et al., 2014), including about mammograms (Nagler et al., 2018a). We treated this variable as continuous in our analyses.

2.2.2. Independent variables

2.2.2.1. Awareness of the new recommendations. The survey did not ask directly about whether a participant was aware of the updated USPSTF or ACS screening recommendations, given concerns about the accuracy of such self-reports. Instead, we used three items to assess women's possible awareness of these new recommendations, as shown in Fig. 1. Participants were asked if they had heard that women at average risk for breast cancer should get mammograms, and, if so, they were asked at what age women should start getting mammograms and if they heard of starting ages other than the one they specified. Women who identified a recommended age of either 45 or 50 are likely to have heard information consistent with the new ACS guideline or USPSTF recommendation. In addition, women who chose age 40 but noted they had either heard of other ages or were unsure of other ages were also classified as at least potentially aware of information consistent with the new recommendations. We categorized women who identified only age 40 as the recommended age for routine screening and who did not identify any other ages at which women might initiate screening as only knowing the old recommendations. Those who had not heard or did not know that women should get mammograms, those who did not know a certain screening starting age, or those who answered ages younger than 40 as starting ages were classified as having low awareness of screening. We also conducted a sensitivity analysis by categorizing women who chose age 40 but were unsure of other ages as knowing only the old recommendations; the results were unchanged.

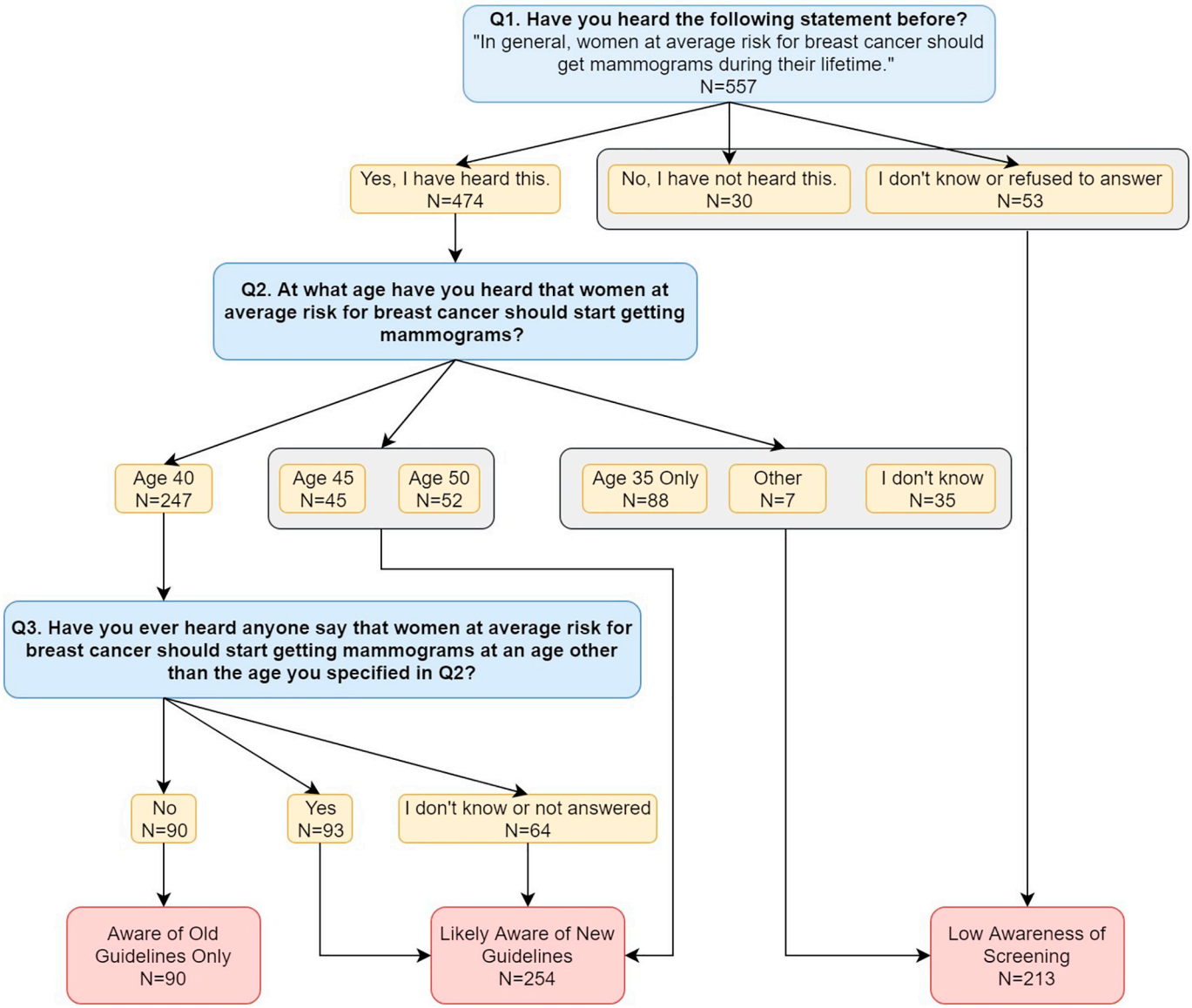


Fig. 1. Flowchart of creating the awareness of the new recommendations variable.

2.2.2.2. Mammography screening history. We asked participants if they had ever had a mammogram, and, if so, when, to create a three-category mammography screening history variable: (1) never had a mammogram, (2) had the most recent mammogram one year ago or less, and (3) had the most recent mammogram more than one year ago.

2.2.2.3. Breast cancer history. We asked participants whether they had ever been diagnosed with breast cancer and whether a close family member had ever been diagnosed with breast cancer (responses were "yes" or "no").

2.2.2.4. Demographic characteristics. Demographic variables included in the analyses are age (30–39, 40–49 and 50–59), race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic other race, Hispanic, and non-Hispanic multiple races), metropolitan statistical area (MSA) (vs. non-metropolitan area), insurance coverage (had insurance coverage from any source vs. no insurance coverage), income, and education. Income was grouped into five levels: less than $25,000; $25,000–$49,999; $50,000–$74,999; $75,000–$99,999; or $100,000 or more. Education levels were less than high school, high school graduate, some college, college, and graduate degree.

2.3. Statistical analyses

We used ordinary least square (OLS) regression to investigate whether women determined to be aware of the newer recommendations (i.e., to initiate screening at age 45 or 50) perceived the importance of mammogram harms and benefits differently than those who were only aware of recommendations that suggested screening initiation at age 40, controlling for mammogram history, breast cancer history, and demographic variables. We also tested whether the relationship between awareness of the new recommendations and perceptions of the harms and benefits of mammograms was moderated by age or mammogram history, by estimating regression models with an

Table 1
Characteristics of the study participants (N = 557).

	Mean (SD) or percent
Ambivalent attitudes about getting a mammogram (measured as continuous variable, range 1–5)	2.4 (1.2)
Ambivalent attitudes about getting a mammogram (measured as categorical variable)[a]	
Strongly disagree	25.3%
Disagree	33.0%
Neither agree nor disagree	19.9%
Agree	16.0%
Strongly agree	4.9%
Perceived importance of the harms of mammograms (mean and SD)	3.2 (1.1)
Perceived importance of the benefits of mammograms (mean and SD)	4.3 (0.9)
Awareness of new breast cancer recommendations	
Low awareness of screening	38.2%
Aware of old guidelines only	16.2%
Likely aware of new guidelines	45.6%
Mammography screening history[b]	
Never had a mammogram	30.9%
Had a mammogram within one year	42.2%
Had a mammogram more than one year ago	26.4%
Breast cancer history, self	3.1%
Breast cancer history, close family member	14.2%
Age	
30–39	26.2%
40–49	28.9%
50–59	44.9%
Education	
Less than high school	12.4%
High school graduate	24.8%
Some college	15.8%
College	32.5%
Graduate degree	14.5%
Race	
White, non-Hispanic	70.2%
Black, non-Hispanic	10.6%
Other, non-Hispanic	5.2%
Hispanic	10.4%
2+ races, non-Hispanic	3.6%
Income	
$0–24,999	21.4%
$25,000–49,999	15.6%
$50,000–74,999	18.7%
$75,000–99,999	13.5%
$100,000+	30.9%
Lives in a metropolitan statistical area	82.9%
Has insurance coverage	91.6%

[a] Percentages do not add up to 100% because 0.9% (n = 5) of respondents were missing for this measure.

[b] Percentages do not add up to 100% because 0.5% (n = 3) of respondents were missing for this measure.

interaction term between awareness of the new recommendations and mammogram history and one between awareness and age group. Second, we used OLS regression to examine the association between women's perceptions of the importance of mammogram benefits and harms and women's ambivalent attitudes about getting a mammogram, controlling for awareness of the new recommendations, mammogram history, breast cancer history, and demographic variables. We used ordered logit regression to conduct sensitivity analyses by treating the ambivalent attitude measure as an ordered 5-category variable.

3. Results

Table 1 describes the study participants (N = 557). Almost 5% strongly agreed and 16% agreed that they had mixed feelings about getting a mammogram. The average score of ambivalence about mammograms was 2.4 (95% CI: 2.3–2.5). Participants' mean perceptions of the importance of the harms of mammograms and the benefits of mammograms were 3.2 (95% CI: 3.1–3.3) and 4.3 (95% CI: 4.3–4.4), respectively, indicating that on average participants perceived the benefits to be more important. Forty-six percent of women were determined to be aware of the new ACS or USPSTF recommendations. While 31% of women had never had a mammogram, 42% reported one in the past year and 26.4% reported having one more than one year ago.

Table 2 shows the results from the OLS regressions examining factors associated with women's perceived importance of the harms and benefits of mammograms. The coefficients displayed represent the difference in perceived importance of mammogram harms or benefits in the specified group, as compared to the reference group. Women who were aware of the new mammography screening recommendations perceived the harms as more important than did women who were only aware of previous recommendations for screening initiation at age 40. Women who had a mammogram within the past year perceived the harms of mammograms as less important and the benefits as more important compared to those who never had a mammogram. Women who reported a breast cancer diagnosis perceived the harms of mammograms as less important than did women without any breast cancer history. Women aged 30–39 perceived harms as more important than did women aged 40–49. Black women perceived both harms and benefits as more important than did white women. Hispanic women saw harms as more important than did white women. Women with incomes above $100,000 perceived the harms of mammograms as less important and the benefits as more important compared to those whose incomes were under $25,000. Women with incomes between $25,000 and $49,999 and above $75,000 saw the benefits as more important than women whose incomes were below $25,000. Women in metropolitan areas considered harms to be more important than did those in non-metropolitan areas.

The relationship between awareness of recommendations and perceptions of harms and benefits was consistent regardless of participants' mammogram history or age group; none of the interaction terms were statistically significant.

Table 3 shows the results from the regression model examining the factors associated with having ambivalent attitudes (i.e., mixed feelings) about getting a mammogram. The estimated coefficient represents the difference in ambivalence toward mammograms (i.e., higher values signify greater ambivalence, or more agreement that they had mixed feelings) in the specified group, as compared to the reference group. The more women perceived harms as important, the greater ambivalence they reported. The more women perceived benefits as important, the less ambivalence they reported. Women who had previous mammograms reported less ambivalence about getting a mammogram than did women who never had a mammogram. The more recently a woman had a mammogram, the less ambivalence she reported. Women with insurance coverage reported less ambivalence than did women without insurance coverage.

4. Discussion

Given that both ACS and USPSTF recommendations suggest that women consider their personal perspectives on the harms and benefits of mammograms in making decisions regarding screening initiation and frequency, this study was designed to examine the factors that are associated with women's perceptions of mammogram harms and benefits, as well as whether those perceptions are associated with attitudinal ambivalence about mammograms. We found that women overall perceived the benefits of mammograms as much more important than the harms. However, those who were likely aware of the new ACS and/or USPSTF recommendations perceived the harms of mammograms as more personally important. We also found women who had ever had a mammogram were less ambivalent about mammograms than were those who had not, and those who perceived harms as more important were more ambivalent, while those who perceived benefits as more

Table 2
Factors associated with women's perceptions of the harms and benefits of mammograms.

	Perceived importance of the harms			Perceived importance of the benefits		
	Coeff	SE	p-Value	Coeff	SE	p-Value
Awareness of new breast cancer guidelines						
Low awareness of screening	0.15	0.14	0.27	−0.19	0.11	0.10
Aware of old guidelines only	Ref					
Likely aware of new guidelines	0.33	0.13	0.01	−0.06	0.11	0.60
Mammography screening history						
Never had a mammogram	Ref			Ref		
Had a mammogram within one year	−0.36	0.15	0.02	0.25	0.12	0.04
Had a mammogram more than one year ago	−0.01	0.15	0.95	−0.18	0.12	0.15
Breast cancer history, self	−0.78	0.27	0.00	−0.14	0.22	0.53
Breast cancer history, close family member	0.10	0.14	0.48	−0.01	0.11	0.90
Age group						
30–39	−0.30	0.14	0.04	−0.08	0.12	0.49
40–49	Ref					
50–59	0.00	0.12	1.00	0.14	0.10	0.14
Education						
Less than high school	Ref			Ref		
High school graduate	0.06	0.18	0.75	−0.05	0.15	0.76
Some college	−0.12	0.19	0.53	0.08	0.16	0.61
College	−0.10	0.18	0.58	−0.16	0.15	0.30
Graduate degree	−0.35	0.21	0.10	−0.30	0.17	0.09
Race						
White, non-Hispanic	Ref			Ref		
Black, non-Hispanic	0.36	0.15	0.02	0.36	0.12	0.00
Other, non-Hispanic	0.20	0.19	0.29	−0.15	0.16	0.34
Hispanic	0.31	0.13	0.02	0.09	0.11	0.43
2+ races, non-Hispanic	0.07	0.42	0.86	0.10	0.34	0.77
Income						
$0–24,999	Ref			Ref		
$25,000–49,999	−0.11	0.17	0.50	0.29	0.14	0.04
$50,000–74,999	−0.09	0.17	0.61	0.27	0.14	0.06
$75,000–99,999	0.04	0.18	0.81	0.56	0.15	0.00
$100,000+	−0.50	0.17	0.00	0.47	0.14	0.00
Lives in a metropolitan statistical area	0.31	0.14	0.03	−0.16	0.12	0.16
Has insurance coverage	−0.16	0.19	0.40	0.06	0.16	0.71
Constant	3.27	0.30	0.00	4.16	0.24	0.00

Note: table entries display ordinary least squares linear regression coefficients, standard errors, and p-values from two-sided tests. Ref = reference category.

important were less ambivalent. A recent study of Canadian women similarly found evidence that mammogram history is a strong predictor of attitudes about harms and benefits: women who had not been screened were significantly less likely to overstate benefits and more likely to acknowledge harms such as overscreening and stress or anxiety (Abelson et al., 2018).

The current study contributes to the evidence base on women's response to recent screening recommendation changes. Past research generally has shown mixed results on whether providers' recommendations (Corbelli et al., 2014; Fedewa et al., 2016; Haas et al., 2016; Radhakrishnan et al., 2017) or patients' behaviors (Block et al., 2013; Howard and Adams, 2012; Pace et al., 2013; Qin et al., 2017; Wang et al., 2014; Wharam et al., 2015) have changed following the 2009 USPSTF recommendation. Our research points to a potential role for attitudinal ambivalence in shaping women's behaviors. Research has shown that ambivalence about a health behavior can moderate the relationship between attitudes about the behavior and behavioral intentions, such that favorable attitudes about a behavior only predict behavior change when ambivalence toward the behavior is low (Conner et al., 2002). Research also suggests that one way people respond to the feeling of ambivalence is delaying decision-making about the health behavior in question (van Harreveld et al., 2015). While we were not able to examine this hypothesis in the present study using cross-sectional data, future research should test whether disseminating mammogram information contributes to changes in mammography screening (Qin et al., 2017; Wang et al., 2014; Wharam et al., 2015), possibly through attitudinal changes such as perceptions of harms and ambivalence about mammograms.

4.1. Limitations

As just noted, an important limitation of this cross-sectional study is that we were not able to establish causal relationships between awareness of recommendations and perceived importance of mammogram harms and benefits, nor can we establish the causal relationship between perceptions of harms/benefits and ambivalence toward mammograms. Given women's longstanding lack of awareness of the harms of mammograms (Kiviniemi and Hay, 2012; Nagler et al., 2017a; Yu et al., 2017), the positive association between the awareness of the new recommendations and the perceived importance of harms may indicate that exposure to recommendations increased women's perceptions of the importance of harms. However, this relationship could be bi-directional: women who perceive harms of mammograms as important may be more attune to this information in the media and thus more aware of recommendation changes. Since we did not follow the same women over time, we could not examine their decisions to initiate or maintain routine mammograms. Further research is thus needed to establish causal relationships and explore alternative explanations

Table 3
Factors associated with women's ambivalent attitudes about getting a mammogram.

	Mixed feelings about getting a mammogram		
	Coeff	SE	p-Value
Perceived importance of the harms of mammograms	0.29	0.04	0.00
Perceived importance of the benefits of mammograms	−0.38	0.05	0.00
Awareness of the USPSTF breast cancer recommendation			
Low awareness of screening	−0.21	0.13	0.10
Aware of old guidelines only	Ref		
Likely aware of new guidelines	−0.14	0.12	0.25
Mammography screening history			
Never had a mammogram	Ref		
Had a mammogram within one year	−1.08	0.14	0.00
Had a mammogram more than one year ago	−0.86	0.13	0.00
Breast cancer history, self	−0.22	0.25	0.37
Breast cancer history, close family member	−0.19	0.13	0.12
Age group			
30–39	−0.50	0.13	0.00
40–49	Ref		
50–59	−0.02	0.11	0.84
Education			
Less than high school	Ref		
High school graduate	−0.18	0.17	0.27
Some college	−0.16	0.18	0.38
College	−0.24	0.17	0.15
Graduate degree	−0.28	0.19	0.16
Race			
White, non-Hispanic	Ref		
Black, non-Hispanic	−0.19	0.14	0.17
Other, non-Hispanic	−0.19	0.17	0.26
Hispanic	0.22	0.12	0.08
2+ races, non-Hispanic	0.37	0.38	0.34
Income			
$0–24,999	Ref		
$25,000–49,999	0.22	0.16	0.16
$50,000–74,999	0.08	0.16	0.62
$75,000–99,999	0.11	0.17	0.53
$100,000+	0.11	0.16	0.50
Lives in metropolitan statistical area	0.10	0.13	0.45
Has insurance coverage	−0.40	0.18	0.02
Constant	4.50	0.35	0.00

Note: table entries display ordinary least squares linear regression coefficients, standard errors, and p-values from two-sided tests. Ref = reference category.

about the contribution of women's attitudes and beliefs to changes in mammogram use that have been observed in other studies (Qin et al., 2017; Wang et al., 2014; Wharam et al., 2015).

Second, all surveys, and online surveys in particular, have some limitations. While only 51% of those eligible completed this survey, the risk of selection bias is reduced since the survey invitation to KnowledgePanel members did not identify the specific topic of the survey (only that they were eligible to participate in a new survey) and at the start of the online survey they were told only that it was a survey about "your experiences learning about health issues in the media." Thus, it is unlikely that those who chose to answer the survey were particularly knowledgeable (or not) about the mammogram content of the survey module in a way that might bias the responses. Further, all results apply GfK weights which adjust the sample for both non-response bias as well as population representativeness. While all respondents by definition took the survey online, when GfK recruits participants into KnowledgePanel they provide Internet access to those that do not have it, reducing concerns about selection bias based on Internet accessibility.

Third, despite our efforts to measure awareness of new recommendations without directly asking, in order to minimize reporting bias, there could still be error in our awareness measure. For instance, some respondents may just have simply guessed at what age women should start mammograms (not based on any knowledge of recommendations); or those who identified age 40 as starting age and indicated that they were aware of other ages might have been thinking of ages younger than 40 (and thus would be unlikely to be aware of the recent recommendations to initiate screening later), which would have been a misclassification. However, such a measurement error would apply to a very small percentage of the sample and would be unlikely to affect the overall results.

5. Conclusion

Our findings contribute to an understanding of how information that emphasizes the limitations of mammograms could shape women's understanding about and attitudes toward mammograms. Specifically, consistent with a recent Canadian study (Abelson et al., 2018), we found that mammography screening history is strongly associated with both women's perceptions about the harms and benefits of mammograms and their screening ambivalence, with those women who have already initiated routine screening believing harms to be less important, and having less ambivalence about getting screened. This suggests that women may be more open to information about the limitations of mammograms prior to initiating routine screening. However, mammogram screening history did not moderate the relationship between awareness of recommendations and perceptions of harms or benefits, suggesting that awareness of recommendations could shape women's values about mammogram harms regardless of screening history.

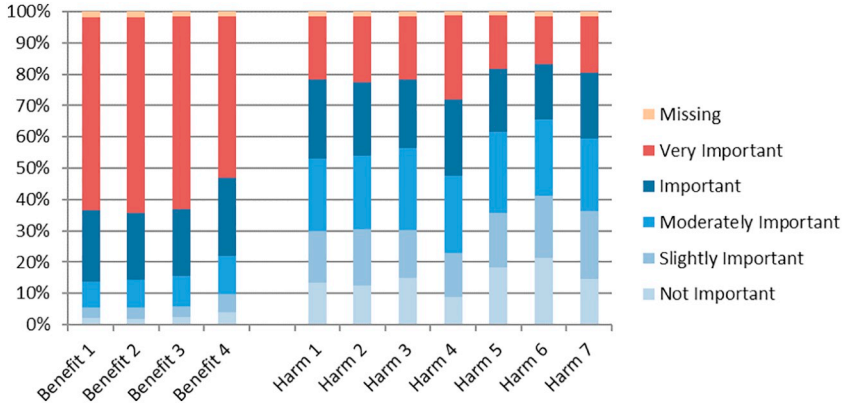
Our findings also pose questions about the role of information in shaping informed decision-making. As noted in the introduction, both the ACS and USPSTF stress that women should incorporate their own values with regard to the harms and benefits of mammograms and apply them to make individualized screening decisions. Our findings reveal that when women were provided with information about both the harms and benefits of mammograms (as they were in this study), they perceived the benefits as much more important compared to harms, and that these importance weightings contributed to their ambivalence toward screening. If the public health goal is to reduce the population harms from overuse of mammograms (e.g., overdiagnosis, false positives), simply providing women with information about harms and benefits may not lead to this outcome, since women are likely to perceive the benefits as more personally important than the harms—thus weighing them more highly—and make an informed choice to obtain screening. As others have noted, to influence population-level screening patterns, clinicians and health communicators alike must consider the role of persuasive framing tactics in messages about cancer screening (versus providing simple information about both harms and benefits) (Traeger, 2018), as well as how to incorporate and address the salient emotional and cultural context that for many decades has surrounded women's perceptions of mammograms (Johansson and Brodersen, 2015). These issues pose critical health communication challenges for researchers and clinicians alike to address in the future.

Funding source

This work was supported by the American Cancer Society [grant numbers RSG-14-166-01-CPPB].

Appendix A

Detailed information about the 7 harms and 4 benefits.



Benefit 1: Mammograms can find cancer early, sometimes before cancer symptoms begin.

Benefit 2: Mammograms can save lives.

Benefit 3: Mammograms can lead to earlier treatment of breast cancer.

Benefit 4: Mammograms can provide peace of mind by finding that you do not have breast cancer.

Harm 1: Some breast cancers that are found by mammograms are so slow-growing that they would not have caused any health problems for women in their lifetime.

Harm 2: Mammograms can find something that looks like cancer but turns out eventually not to be cancer. This is called a “false-positive” or “false alarm.”

Harm 3: Women who receive positive mammogram results, even if it turns out eventually they do not have cancer, may feel anxious and stressed.

Harm 4: Some breast cancers found by mammograms are treated with potentially-risky surgeries or medications that would not have needed such treatment after all.

Harm 5: Mammograms can lead to increased costs to women because of follow-up tests and procedures.

Harm 6: Mammograms can lead to increased costs to the health care system because of follow-up tests and procedures.

Harm 7: Mammograms, like all X-rays, expose women to very small doses of radiation which could increase risk for cancer.

References

Abelson, J., Tripp, L., Brouwers, M.C., Pond, G., Sussman, J., 2018. Uncertain times: a survey of Canadian women's perspectives toward mammography screening. Prev. Med. 112, 209–215.

Allen, J.D., Bluethmann, S.M., Sheets, M., Opdyke, K.M., Gates-Ferris, K., Hurlbert, M., Harden, E., 2013. Women's responses to changes in U.S. preventive task force's mammography screening guidelines: results of focus groups with ethnically diverse women. BMC Public Health 13, 1169. https://doi.org/10.1186/1471-2458-13-1169.

Black, W.C., Nease Jr., R.F., Tosteson, A.N., 1995. Perceptions of breast cancer risk and screening effectiveness in women younger than 50 years of age. J. Natl. Cancer Inst. 87, 720–731.

Block, L.D., Jarlenski, M.P., Wu, A.W., Bennett, W.L., 2013. Mammography use among women ages 40–49 after the 2009 US Preventive Services Task Force recommendation. J. Gen. Intern. Med. 1–7.

Chamot, E., Charvet, A., Perneger, T.V., 2004. Women's preferences for doctor's involvement in decisions about mammography screening. Med. Decis. Mak. 24, 379–385. https://doi.org/10.1177/0272989X04267011.

Chang, C., 2013. Men's and women's responses to two-sided health news coverage: a moderated mediation model. J. Health Commun. 18, 1326–1344.

Conner, M., Sparks, P., Povey, R., James, R., Shepherd, R., Armitage, C.J., 2002. Moderator effects of attitudinal ambivalence on attitude–behaviour relationships. Eur. J. Soc. Psychol. 32, 705–718.

Corbelli, J., Borrero, S., Bonnema, R., McNamara, M., Kraemer, K., Rubio, D., Karpov, I., McNeil, M., 2014. Physician adherence to US Preventive Services Task Force mammography guidelines. Womens Health Issues 24, e313–e319.

Fedewa, S.A., de Moor, J.S., Ward, E.M., DeSantis, C.E., Sauer, A.G., Smith, R.A., Jemal, A., 2016. Mammography use and physician recommendation after the 2009 US Preventive Services Task Force breast cancer screening recommendations. Am. J. Prev. Med. 50, e123–e131.

Fletcher, S.W., Black, W., Harris, R., Rimer, B.K., Shapiro, S., 1993. Report of the international workshop on screening for breast cancer. J. Natl. Cancer Inst. 85, 1644–1656.

Haas, J.S., Sprague, B.L., Klabunde, C.N., Tosteson, A.N.A., Chen, J.S., Bitton, A., Beaber, E.F., Onega, T., Kim, J.J., MacLean, C.D., Harris, K., Yamartino, P., Howe, K., Pearson, L., Feldman, S., Brawarsky, P., Schapira, M.M., PROSPR (Population-based Research Optimizing Screening through Personalized Regimens) Consortium, 2016. Provider attitudes and screening practices following changes in breast and cervical cancer screening guidelines. J. Gen. Intern. Med. 31, 52–59. https://doi.org/10.1007/s11606-015-3449-5.

Han, P.K., Williams, A.E., Haskins, A., Gutheil, C., Lucas, F.L., Klein, W.M., Mazor, K.M., 2014. Individual differences in aversion to ambiguity regarding medical tests and treatments: association with cancer screening cognitions. Cancer Epidemiol. Prev. Biomark. 23, 2916–2923.

Howard, D.H., Adams, E.K., 2012. Mammography rates after the 2009 US Preventive Services Task Force breast cancer screening recommendation. Prev. Med. 55, 485–487. https://doi.org/10.1016/j.ypmed.2012.09.012.

Johansson, M., Brodersen, J., 2015. Informed choice in screening needs more than information. Lancet 385, 1597–1599.

Kiviniemi, M.T., Hay, J.L., 2012. Awareness of the 2009 US Preventive Services Task Force recommended changes in mammography screening guidelines, accuracy of awareness, sources of knowledge about recommendations, and attitudes about updated screening guidelines in women ages 40–49 and 50+. BMC Public Health 12, 899. https://doi.org/10.1186/1471-2458-12-899.

Mehta, J.M., MacLaughlin, K.L., Millstine, D.M., Faubion, S.S., Wallace, M.R., Shah, A.A., Fields, H.E., Ruddy, B.E., Bryan, M.J., Patel, B., Temkit, M. hamed, Buras, M.R., Golafshar, M.A., Kling, J.M., 2018. Breast cancer screening: women's attitudes and beliefs in light of updated United States Preventive Services Task Force and American Cancer Society guidelines. J. Women's Health. https://doi.org/10.1089/jwh.2017.6885.

Nagler, R.H., Fowler, E.F., Gollust, S.E., 2017a. Women's awareness of and responses to messages about breast cancer overdiagnosis and overtreatment: results from a 2016 national survey. Med. Care 55, 879–885.

Nagler, R.H., Lueck, J.A., Gray, L.S., 2017b. Awareness of and reactions to mammography controversy among immigrant women. Health Expect. 20, 638–647.

Nagler, R.H., Yzer, M.C., Rothman, A.J., 2018a. Effects of media exposure to conflicting information about mammography: results from a population-based survey experiment. Ann. Behav. Med. Publ. Soc. Behav. Med. https://doi.org/10.1093/abm/kay098.

Nagler, R.H., Yzer, M.C., Rothman, A.J., 2018b. Effects of media exposure to conflicting information about mammography: results from a population-based survey experiment. Ann. Behav. Med. https://doi.org/10.1093/abm/kay098.

Nagler, R.H., Fowler, E.F., Marino, N.M., Mentzer, K.M., Gollust, S.E., 2019. The evolution of mammography controversy in the news media: a content analysis of four publicized screening recommendations, 2009 to 2016. Womens Health Issues 29, 87–95. https://doi.org/10.1016/j.whi.2018.09.005.

National Institutes of Health Consensus Development Panel, 1997. National Institutes of Health Consensus Development Conference statement: breast cancer screening for women ages 40–49, January 21–23, 1997. J. Natl. Cancer Inst. 89, 960–965.

Nekhlyudov, L., Ross-Degnan, D., Fletcher, S.W., 2003. Beliefs and expectations of women under 50 years old regarding screening mammography: a qualitative study. J. Gen.

Intern. Med. 18, 182–189.
Nelson, H.D., Pappas, M., Cantor, A., Griffin, J., Daeges, M., Humphrey, L., 2016. Harms of breast cancer screening: systematic review to update the 2009 U.S. Preventive Services Task Force recommendation. Ann. Intern. Med. https://doi.org/10.7326/M15-0970. N/A, N/A-N/A.
Oeffinger, K.C., Fontham, E.H., Etzioni, R., et al., 2015. Breast cancer screening for women at average risk: 2015 guideline update from the American Cancer Society. JAMA 314, 1599–1614. https://doi.org/10.1001/jama.2015.12783.
Olsen, O., Gøtzsche, P.C., 2001. Cochrane review on screening for breast cancer with mammography. Lancet 358, 1340–1342.
Pace, L.E., He, Y., Keating, N.L., 2013. Trends in mammography screening rates after publication of the 2009 US Preventive Services Task Force recommendations. Cancer 119, 2518–2523. https://doi.org/10.1002/cncr.28105.
Priester, J.R., Petty, R.E., 1996. The gradual threshold model of ambivalence: relating the positive and negative bases of attitudes to subjective ambivalence. J. Pers. Soc. Psychol. 71, 431–449. https://doi.org/10.1037/0022-3514.71.3.431.
Qin, X., Tangka, F.K., Guy, G.P., Howard, D.H., 2017. Mammography rates after the 2009 revision to the United States Preventive Services Task Force breast cancer screening recommendation. Cancer Causes Control 28, 41–48.
Radhakrishnan, A., Nowak, S.A., Parker, A.M., Visvanathan, K., Pollack, C.E., 2017. Physician breast cancer screening recommendations following guideline changes: results of a national survey. JAMA Intern. Med. 177, 877–878.
Schwartz, L.M., Woloshin, S., Sox, H.C., Fischhoff, B., Welch, H.G., 2000. US women's attitudes to false positive mammography results and detection of ductal carcinoma in situ: cross sectional survey. BMJ 320, 1635–1640.
Siu, A.L., 2016. Screening for breast cancer: US Preventive Services Task Force recommendation statement. Ann. Intern. Med. 164, 279–296.
Thompson, M.M., Zanna, M.P., Griffin, D.W., 1995. Let's not be indifferent about (attitudinal) ambivalence. In: Attitude Strength: Antecedents and Consequences, Ohio State University Series on Attitudes and Persuasion. vol. 4. Lawrence Erlbaum Associates, Inc, Hillsdale, NJ, US, pp. 361–386.
Traeger, A.C., 2018. Persuading the public that less is more. BMJ 362, k2956.
US Preventive Services Task Force, 2009. Screening for breast cancer: U.S. Preventive Services Task Force recommendation statement. Ann. Intern. Med. 151, 716–726. W-236. https://doi.org/10.7326/0003-4819-151-10-200911170-00008.
van Harreveld, F., Nohlen, H.U., Schneider, I.K., 2015. The ABC of ambivalence: affective, behavioral, and cognitive consequences of attitudinal conflict. In: Advances in Experimental Social Psychology. Elsevier, pp. 285–324.
Wang, A.T., Fan, J., Van Houten, H.K., Tilburt, J.C., Stout, N.K., Montori, V.M., Shah, N.D., 2014. Impact of the 2009 US Preventive Services Task Force guidelines on screening mammography rates on women in their 40s. PLoS One 9, e91399. https://doi.org/10.1371/journal.pone.0091399.
Wharam, J.F., Landon, B., Zhang, F., Xu, X., Soumerai, S., Ross-Degnan, D., 2015. Mammography rates 3 years after the 2009 US Preventive Services Task Force guidelines changes. J. Clin. Oncol. 33, 1067–1074. https://doi.org/10.1200/JCO.2014.56.9848.
Yu, J., Nagler, R.H., Fowler, E.F., Kerlikowske, K., Gollust, S.E., 2017. Women's awareness and perceived importance of the harms and benefits of mammography screening: results from a 2016 national survey. JAMA Intern. Med. 177, 1381–1382.