



Examining gain- and loss-framed messages in a novel breast cancer screening/cardiovascular context: Does framing matter?



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ARTICLE INFO

Keywords:

Message framing
Message testing
Mammogram
Cardiovascular health
Perceived message effectiveness

ABSTRACT

Objective: Digital mammography can reveal not only breast cancer but also breast arterial calcification (BAC), which can indicate potential coronary artery disease. To explore ways to inform women of their BAC status in the context of a standard mammography results letter, we conducted a preliminary study comparing gain- and loss-framed messages to encourage follow-up cardiovascular care.

Methods: U.S. women over age 40 with no heart disease history ($N = 227$) were randomly assigned to view a mammography letter including BAC information in one of seven ways (three gain-framed messages, three loss-framed messages, one comparison message).

Results: Post-test measures indicated no significant differences on BAC knowledge, recall of test results and recommendations, perceived message effectiveness, or behavioral intentions for follow-up.

Conclusion: Despite showing no significant differences between message conditions, results supported the messages' ability to clearly convey BAC information and encourage intention for follow-up cardiovascular care.

Innovation: This experimental study represents the first published report examining the inclusion of BAC screening results within the mammography letter. It also explored the use of message framing in a dual detection-prevention context and suggests that future work should test the effects of including both framing tactics in messages designed to target dual-focus contexts.

1. Introduction

Recent research and clinical practice have shown that mammography is a critical tool not only to detect breast cancer but also to identify risk factors associated with cardiovascular disease. Specifically, mammography can detect the presence of breast arterial calcifications (BAC) [1], which can indicate the presence of coronary artery disease (CAD) [2-4]. Given that heart disease is the number one killer of women in the United States [5] and that women receive less routine preventive cardiology care [6], the opportunity to use BAC detection to identify women at risk for cardiovascular disease is an important and innovative public health opportunity. Because close to 70% of women do adhere to mammography screening guidelines [7] and because cardiovascular disease is often asymptomatic in women [8], using mammography to alert women of their personal cardiovascular risk and to urge them to engage in follow-up care is a potential boon to women's health. However, BAC status is not routinely reported to mammography patients because the clinical focus is primarily on breast cancer

and BAC research is still emerging, and thus very little is known about how to most effectively present BAC information to maximally encourage women to engage in preventive cardiovascular health behaviors. Because BAC provides a context that involves both detection of disease (presence of cardiovascular issues) and prevention of disease (e.g., through changing diet and lifestyle or seeking medical intervention such as statin prescriptions), it offers a novel opportunity to investigate the effects of different health messaging strategies.

Message framing, which highlights the advantages (gains) of adopting a recommended behavior or the disadvantages (losses) of not adopting a recommended behavior, is one of the most studied approaches to message design in the health behavior change literature [9]. Original conceptualizations of framing tactics extending from prospect theory (see Salovey et al., 2002) suggested that gain-framed messages should be more effective in disease prevention contexts (e.g., vaccination), whereas loss-framed messages should be more effective in disease detection contexts (e.g., HIV screening) [10]. However, several meta-analyses [11-13], along with recent empirical

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work that we have done [14,15], have not consistently or conclusively borne out this generalization. Moreover, the distinct categories of disease prevention and detection contexts and corresponding message framing tactics ignore the fact that many health screenings (e.g., colonoscopy) have both prevention and detection goals, just like BAC.

Unfortunately, little work has addressed the use of message framing in a “dual” detection–prevention context. A study reported by Salovey et al. (see Experiment 10, pp. 400–401, [10]) investigated the impact of regulatory focus and message framing on HIV testing among low income, minority women. Results showed that promotion-focused women who saw gain-framed messages were more likely to get tested than those who saw loss-framed messages; there was no statistically significant difference based on message framing among prevention-focused women, although gain-framed messages showed a slight advantage. The authors suggested that the overall effect for gain- over loss-framed messages for this disease detection behavior might be because women were deciding to get tested “to prevent the spread of HIV to partners rather than, necessarily, detect illness in themselves” (p. 401). A follow-up study by Apanovitch and colleagues [16] found that low income, minority women who were relatively certain that they did not have HIV were more likely to get tested if they saw a gain-framed message than a loss-framed message; there was no framing effect for women who were uncertain about their HIV status, although the authors wrote there was “some advantage for the loss-framed message” (p. 60). These two studies demonstrate that the prevention/gain-frame and detection/loss-frame guideline is not as clear cut as one would like in the context of HIV testing, which, like BAC, has dual detection and prevention implications.

Only one previous study has assessed patient preferences for receiving BAC results. In that study, we surveyed 419 women presenting for mammography and asked whether they would want to receive BAC test results and, if so, their preferred communication channel to receive the results (from the radiologist by telephone, in the mammogram results letter, from the ordering physician at a follow-up visit, and/or from the ordering physician by telephone) [17]. Results showed that almost all women did want to know their BAC results and that they preferred to receive their BAC results via the mammography results letter. The study did not, however, address *how* such information should be relayed in the letter (e.g., such as whether it should be framed). In fact, no previous research has examined messaging strategies to convey BAC test results or encourage appropriate follow-up. Therefore, in the current preliminary study, we sought to investigate the effect of gain- and loss-framed messages on knowledge of BAC, recall of test results and recommendations, perceived message effectiveness, and behavioral intention for follow-up among women receiving hypothetical BAC screening results.

2. Materials and methods

2.1. Participants and procedure

We recruited women living in the United States who were over age 40, not pregnant, and had no history of heart disease ($N = 227$). A power analysis indicated that to detect a medium between-group effect size, we needed to include at least 224 participants (32 per group) based on Cohen's criteria [18]. Participant recruitment was facilitated by Dynata, a market research firm that maintains panels of 62 million volunteer survey respondents throughout 100 countries. Panelists receive monetary incentives tailored to both the time and effort required for participation and regional preferences. Email invitations were sent to members of Dynata's U.S. panel who met this study's eligibility criteria. We used Qualtrics to facilitate our online survey data collection; participants could fill out the survey on a computer, tablet, or mobile device. After providing informed consent, participants answered demographic questions and questions about personal and family history of mammography, breast cancer, and cardiac disease, as well as perceived susceptibility to cardiac disease. Then they were randomly assigned to one of seven message conditions and presented with the following instructions: “Now we will have you read over a sample letter

that a woman might receive after having her mammogram. Please spend some time reading the entire letter, and then click the arrow at the bottom of the page to proceed to the last set of questions.” Participants then were shown a letter that presented hypothetical cancer screening and BAC results associated with a mammogram. After reading the letter, they were queried on a number of outcome measures. This study received expedited IRB approval from Indiana University.

2.2. Materials

The seven message conditions (three gain-framed message conditions, three loss-framed message conditions, one comparison condition) mimicked an actual mammogram results letter used in clinical practice, although the name of the practice was changed to a hypothetical clinic. For purposes of the study, the results letter indicated no sign of breast cancer but did indicate the presence of BAC. The comparison message served as standard-of-care, presenting basic information about BAC, how radiologists can screen for BAC during mammography, the positive BAC findings, and a recommendation that the woman follow up with a healthcare provider. Three gain-framed message variations added benefits to following up on the BAC findings (i.e., the woman will feel peace of mind, her doctor will have a better chance of diagnosing heart disease early, or she will avoid future potential complications such as heart attack or stroke), whereas three loss-framed message variations added potential negative consequences of not following up on positive BAC findings (i.e., the woman will not feel peace of mind, her doctor will not have a chance of diagnosing heart disease early, or she will not avoid future potential complications such as heart attack or stroke). See Fig. 1 for a description of the comparison and experimental messages and the sample mammogram results letter.

2.3. Outcome measures

Knowledge of BAC was measured by asking nine true/false/I don't know questions about breast arterial calcification that were developed by the study team based on the information presented in the study letter. Four questions were true (e.g., “About 10-15% of women show BAC on their mammograms”) and five were false (e.g., “You would know you have BAC because you'd have chest pain”). Women's correct answers were summed to provide a score for BAC knowledge. On average, women scored 7.26 out of 9 ($SD = 1.67$).

Recall of test results and recommendations for follow-up was assessed by asking what the letter said about BAC results (positive [correct answer], negative, or unsure) and whether the letter recommended making a follow-up appointment (for BAC only [correct answer], for breast cancer only, for BAC and breast cancer, or no follow-up recommended). The majority of women accurately recalled both the test result (75.8%) and the follow-up recommendation (78.3%).

Perceived message effectiveness (PME) was measured using four items based on previous, validated work [19]. On a Likert scale (1 = *strongly disagree* to 5 = *strongly agree*), participants reported the extent to which the message (a) made them think about their cardiovascular health, (b) increased their concern about their cardiovascular health, (c) made them feel like they could do something to protect their cardiovascular health, and (d) would convince them to see a healthcare provider about their cardiovascular health. On average, women scored 3.97 ($SD = 0.89$), and the scale showed strong reliability ($\alpha = 0.94$).

Behavioral intention to follow up on BAC results was measured by asking women to imagine that they received this letter and to then indicate (a) how likely they would be to see a healthcare provider about their cardiovascular health in the next six months (1 = *very unlikely* to 5 = *very likely*) and (b) how likely they would be to change their health behaviors in some way (e.g., diet and exercise) to improve their cardiovascular health in the next six months (1 = *very unlikely* to 5 = *very likely*). Mean scores on these two items were 4.21 ($SD = 1.08$) and 3.90 ($SD = 1.00$), respectively.

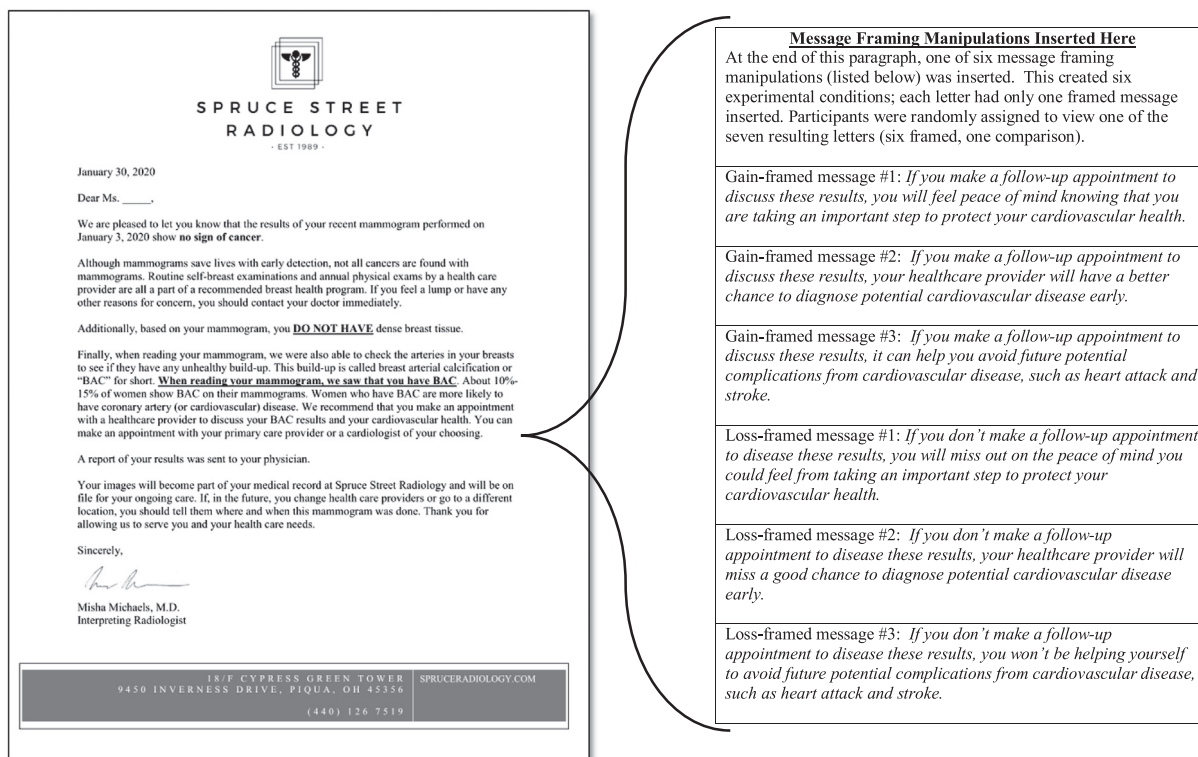


Fig. 1. Mammogram result letters with message framing manipulations. Comparison condition version of letter with no message framing manipulation (below). Note. There were seven total message conditions: one comparison message (the letter as it appears above), and six experimental conditions (described in the table beside the letter).

3. Results

The average age of women in the sample was 60.62 years ($SD = 10.70$), and 91% of the sample was white. The sample was well educated, with 12% having had some college, 34% having earned a bachelor's degree, and 30% having attended graduate school; 23% of respondents chose not to answer this question, however. Almost all of the women (92%) had previously had a mammogram. Demographic factors did not significantly differ by message condition assignment (all $ps > 0.05$).

To test for differences across the seven conditions, we ran one-way analyses of variance for continuous variables and chi-square analyses for categorical variables. Results indicated no significant differences across the seven message conditions for any of the outcome variables: knowledge, $F(6, 220) = 1.11, p = .36$; recall of BAC test results, $\chi^2 = 5.56, p = .47$ or recall of the recommendation to make a follow-up appointment, $\chi^2 = 3.00, p = .81$; PME, $F(6, 217) = 0.48, p = .83$; and intention to see a healthcare provider in the next six months, $F(6, 220) = 0.28, p = .95$ or intention to change health behaviors to improve cardiovascular health, $F(6, 219) = 1.12, p = .36$.

Because there were no significant differences between any of the seven conditions, we recoded group assignment to determine whether there were any differences among three groups (i.e., gain framing messages grouped together versus loss framing messages grouped together versus the comparison condition). Results indicated no significant differences

across knowledge, $F(2, 226) = 2.32, p = .11$; recall of BAC test results, $\chi^2 = 6.94, p = .14$ or recall of recommendation for making a follow-up appointment, $\chi^2 = 1.95, p = .93$; PME, $F(2, 223) = 0.78, p = .46$; and intention to see a healthcare provider in the next six months, $F(2, 226) = 0.50, p = .61$ or intention to change health behaviors to improve cardiovascular health, $F(2, 225) = 2.62, p = .08$]. See Table 1 for mean responses across the three groups.

4. Discussion and conclusion

4.1. Discussion

The purpose of this study was to investigate the effect of gain- and loss-framed messages informing women that their mammogram had revealed the presence of breast arterial calcification on outcome variables related to (a) BAC knowledge, (b) recall of test results and recommendations, (c) perceived message effectiveness (PME), and (d) behavioral intentions for follow-up. This study represents the first published experiment using mammogram result letters to communicate BAC findings and assess these outcome variables. Results revealed two primary findings.

First, regardless of message condition, participants scored relatively highly on BAC-related post-test measures. Means were greater than 4.0 on the 5-point scale measuring intention to see a healthcare provider, and the majority of women across conditions scored highly on BAC knowledge

Table 1
Mean post-test outcome scores by group (comparison, gain framed, loss framed).

Group	BAC Knowledge Score (SD)	Test Result Recall % Correct	Follow-up Recommendation Recall % Correct	PME M (SD)	Intention to Follow Up with Provider M (SD)	Intention to Improve Cardio Health M (SD)
Comparison	7.81 (1.55)	72%	77%	3.92 (0.96)	4.11 (1.24)	3.69 (0.99)
Gain-Framed	7.16 (1.66)	80%	77%	3.91 (0.84)	4.16 (1.02)	3.82 (0.97)
Loss-Framed	7.15 (1.69)	74%	81%	4.06 (0.93)	4.29 (1.07)	4.08 (1.01)

Note. BAC = breast arterial calcification. PME = perceived message effectiveness.

and correctly recalled health information in the results letter. The average score for PME was also relatively high (3.97 on a 5-point scale). Therefore, in addition to women's expressed *preference* for BAC results to be communicated in the mammogram letter [17], the findings from this study suggest that mammogram letters may also be an *effective* way to communicate BAC screening results and to encourage women to take steps to protect their heart health, at least in terms of following the recommendation to see a healthcare provider for follow-up discussion of BAC. Women's mean score for intending to change their cardiovascular health behaviors, although above the scale midpoint, was not as high as intention to see a provider. Because the letter did not explicitly make this recommendation, this result is not surprising.

Second, this preliminary study suggests that neither gain nor loss framing is necessarily more effective in promoting cardiovascular health behavior among women whose mammograms identify BAC. Although there were no differences across message conditions on the outcome measures, a null finding in an experimental study such as this still provides important knowledge [20], both in terms of both practical application and theoretical implications. Because neither gain nor loss framing provided any added advantage, it seems reasonable to recommend that practitioners simply extend standard mammography letter content, describing the presence of BAC and including a direct recommendation to follow up with a healthcare provider (i.e., the comparison condition here). However, in terms of theory development and advancing communication science, additional research is warranted to explore whether a message that includes *both* gain- and loss-framing in this *dual* detection–prevention context would be more effective than a standard letter in encouraging follow-up behavior among women who test positive for BAC. In other words, because BAC screening represents both a detection and a prevention behavior, it may be that including both gain- and loss-framed messages within the same letter could yield significant improvements in outcome variables.

Despite strengths of this study, such as testing multiple instantiations of gain and loss framed messages and enhancing external validity through modeling the stimulus letters on a practice-based mammography/BAC screening letter, there are limitations to acknowledge. First, there was lack of diversity in terms of race, with more than 90% of the sample being white. Also, the use of an online survey panel may have introduced sampling bias. In addition, although there were approximately 35 participants per condition, the sample may not have been large enough to detect small effect sizes. To address these limitations, future research on the most effective way to present BAC screening results with a larger, more diverse and nationally representative sample is warranted, especially considering that even small effect sizes can make clinically significant impacts on population health. Finally, we presented participants with a hypothetical test result. Future research in clinical settings is needed to determine the generalizability of the results and to enhance ecological validity.

4.2. Innovation

This pilot message testing experiment demonstrated that the mammogram results letter may be an effective and innovative way to communicate BAC results and potentially improve preventive cardiovascular care for women. As new developments in biomedical science and clinical care emerge, such as the ability for mammograms to detect BAC and for BAC to serve as an important screening modality for women's cardiovascular health, social and behavioral scientists have an obligation to explore innovative ways to communicate with patients about these new clinical tools. If BAC screening is to be effectively integrated into clinical care in the future, incorporating the BAC results within the mammogram results letter appears to be a viable approach. However, more research is needed to test this approach within a clinical context to ensure patient understanding and behavioral follow-up. Implementation work also is needed to ensure that the process of including BAC results within the mammogram letter considers the larger systems within which this communication practice would be integrated, such as healthcare policy, organizational workflow, and

underserved communities for whom screening follow-up is already low [21,22]. Attending to these issues will be imperative to ensure that patient follow-up care for both breast cancer screening and BAC screening can be achieved.

4.3. Conclusions

This study sought not only to test the effectiveness of communicating BAC results within a mammography letter but also to extend the message framing literature by comparing gain- and loss-framed messages in the context of cardiovascular screening. Although scores on outcome variables were high, suggesting that these messages would be effective in increasing BAC knowledge and prompting women to take steps to protect their heart health, we found no differences across the gain- and loss-framed message conditions. One interpretation of this finding is that message framing is unnecessary in a dual detection–prevention health behavior context. However, we believe that additional research should test whether including both gain- and loss-framed messaging in the same letter leads to improvement in outcome variables. With population-based screening behaviors like these, every ounce of prevention can turn into many pounds of cure.

Funding details

This work was supported by the National Cancer Institute [grant R01 CA251754]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute.

Disclosure statement

The authors have no conflicts of interest to disclose relevant to this work.

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