

Matching Health Messages to Information-Processing Styles: Need for Cognition and Mammography Utilization

Pamela Williams-Piehot, Tamera R. Schneider, Judith Pizarro, Linda Mowad, and Peter Salovey

*Department of Psychology
Yale University*

The use of tailored health communications has become a favored technique for persuading individuals to engage in health behaviors, such as screening mammography. This experiment examined the impact of tailoring persuasive health communications to one aspect of individuals' information-processing styles, that of the need for cognition (NFC), the enjoyment of thinking deeply about issues. To determine whether messages matched to an individual's NFC are more influential than mismatched messages, 602 women who called the Cancer Information Service (CIS) of the National Cancer Institute were asked to participate in an experiment at the end of their service call. They were assigned randomly to receive 1 of 2 phone messages promoting mammography use and a similarly tailored pamphlet 1 month later. Messages matched to an individual's NFC were better at motivating mammography 6 months later among high-NFC women. After controlling for prior mammography utilization, age, worry, intentions, perceived norms, suggestions to get a mammogram, and marital status, the interaction between participant NFC and message type also approached statistical significance. The differential influence of these brief, tailored communications diminished after 12 months, however.

Breast cancer is one of the most common cancers among women. An estimated 203,500 women in the United States developed breast cancer in 2002. It is the second leading cause of cancer death among American women, and, in 2002, about 39,600 women died of this disease (American Cancer Society, 2002). Mammography is generally regarded as the most effective tool for detecting breast cancer

early and preventing cancer mortality. The regular use of mammography is one factor credited with having lowered the mortality rate from breast cancer from 1992 to 1996 (American Cancer Society, 2002). At the time this study was conducted, many of the nation's health organizations recommended that women over the age of 40 obtain a mammogram annually or biannually and that women age 50 and over obtain one annually (Murphy, Lawrence, & Lenhard, 1995). Although the number of women who engaged in regular breast cancer screening rose from 1987 to 1998, only 67% of women ages 40 and older had obtained a mammography within the past 2 years (National Cancer Institute, 2001). One way to motivate more consistent routine mammography screening is to communicate information about it in a manner that is matched, or tailored, to the message recipients' information-processing style.

MESSAGE TAILORING

The technique of message tailoring involves increasing the relevance of a message by customizing it to the informational needs, interests, and concerns of a recipient or a group to which the recipient belongs (Kreuter, Farrell, Olevitch, & Brennan, 2000). There are a variety of ways in which a message can be tailored, including the use of personalized messages (tailored at the individual level) and targeted messages (tailored at the group level). Persuasive messages have been personalized by including recipients' demographic characteristics (e.g., sex, ethnicity) or other identifying characteristics (e.g., the person's name or occupation) in an effort to promote various health behaviors (Schneider et al., 2001). Targeted messages use information about the needs or characteristics of a group to draw its members' attention to the message. For example, Davis, Cummings, Rimer, Sciandra, and Stone (1992) tailored self-help smoking cessation guides specifically to women with young children. Evidence for the effectiveness of tailored messages has accrued for a number of cancer prevention and detection behaviors, including decreasing dietary fat intake (Brug, Glanz, van Assema, Kok, & van Breukelen, 1998; Brug, Steenhuis, van Assema, & De Vries, 1996; Campbell et al., 1994), increasing fruit and vegetable consumption (Brug et al., 1998; but also see Brug et al., 1996; Campbell et al., 1994), promoting smoking cessation (Dijkstra, De Vries, Roijackers, & van Breukelen, 1998; Lipkus, Lyna, & Rimer, 1999; but also see Curry, McBride, Grothaus, Louie, & Wagner, 1995; Dijkstra, De Vries, & Roijackers, 1999), and motivating mammography utilization (Rakowski et al., 1998; Skinner, Strecher, & Hoppers, 1994; but also see Drossaert, Boer, & Seydel, 1996; Rimer et al., 1999).

Beyond personalization and targeting to sociodemographic variables, little research has focused on tailoring to recipients' psychological needs and personality characteristics. Of those studies that have, messages have been tailored most fre-

quently to individuals' stages in the behavioral change process. For example, educational materials tailored to stage of change were more effective in increasing mammography utilization than were standard materials or the receipt of no materials (Rakowski et al., 1998). In addition, due to advances in computer technology over the past decade, expert systems have been used to tailor messages to multiple variables at once. Investigators typically collect responses to baseline questionnaires, medical records, and other sources, input them into a database, and then use computer algorithms to create highly individualized messages (Kreuter, Strecher, & Glassman, 1999). However, because studies have tailored to many variables within the same investigation, it is difficult to evaluate systematically the tailored variable(s) that are most persuasive. An additional yet relatively unexplored way to make the message more personally relevant is to consider individual differences in the meaning of the message and in the meaning of the behavior being advocated. Need for cognition (NFC), "the tendency for an individual to engage in and enjoy thinking" (Cacioppo & Petty, 1982, p. 116), may serve as a suitable variable for this type of tailoring (Rakowski, 1999).

Although the exact mechanism responsible for the tailoring effect is not known, it is generally thought that the personally relevant information communicated in tailored messages is more likely to be attended to and, subsequently, to improve motivation and health behavior change (Kreuter et al., 1999). There is some evidence supporting this rationale: In a number of studies, tailored messages were reportedly better attended to and remembered, and perceived as more relevant and credible, in comparison with standard, nontailored messages (Kreuter et al., 1999; Rimer & Glassman, 1999).

NFC

NFC may moderate the processing of health information. Individuals high and low in NFC tend to derive meaning from persuasive messages in different ways. Individuals high in NFC are motivated to seek information actively and think about and reflect on arguments presented to them (i.e., they cognitively elaborate). They have a tendency to process information systematically, which should carry over to the health domain. Individuals low in NFC tend to be less motivated to employ the cognitive effort required to process the information in health communications systematically. They are more likely to rely on others (e.g., celebrities or experts), cognitive heuristics (i.e., mental shortcuts), or social comparison processes to understand health information presented to them (Cacioppo, Petty, Feinstein, & Jarvis, 1996; Cacioppo, Petty, Kao, & Rodriguez, 1986).

Specific message characteristics may differentially influence individuals high and low in NFC. Individuals with a high NFC are likely most persuaded by strong arguments and counterarguments that are clearly articulated in a direct manner

(Cacioppo et al., 1996). Straightforward facts, details, and statistics are especially persuasive. In contrast, individuals with a low NFC are less sensitive to the actual quality of the arguments but instead can be persuaded by the presence of peripheral message cues. They pay much more attention to the source of the arguments (e.g., a well-known or attractive public figure, or a credible authority), the ease with which they can be processed (e.g., presented pictorially versus verbally), and the mere number of arguments presented (Cacioppo et al., 1996).

OVERVIEW OF THIS EXPERIMENT

Providing individuals with messages tailored to their information-processing style should enhance attention to the message, increase motivation, and thereby influence behavior. The aim of this experiment was to test the hypothesis that messages designed to match one's health information processing style, namely NFC, would be more effective in persuading individuals to obtain a mammogram than mismatched messages. It was expected that a more detailed message would be more influential for individuals high in NFC, and a more succinct message, including celebrity advocacy of mammography, would be more influential for individuals low in NFC. Thus, the design was a two-way factorial: participant NFC (high/low) by message type (tailored to high/low NFC). Mammography use 6 and 12 months later was assessed.

METHOD

Participants

Female callers to the New England office of the Cancer Information Service (CIS), a regionally based service of the National Cancer Institute, served as our study population. At the end of the regular CIS-provided service, women were asked questions to determine their eligibility to participate in the study. To be eligible, women (a) had to have not called the CIS for breast cancer information for themselves; (b) had to have not called the CIS previously during the study period; (c) were at least 41 years of age; (c) were not current cancer patients, waiting for test results to determine cancer status, or taking tamoxifen; and (d) had to have obtained fewer than 50% of the lifetime mammograms they should have had for their age, if following the prevailing guidelines. Seven hundred forty-one women who met all of the eligibility criteria were invited to participate in the study. One hundred thirty-nine (18.8%) women declined this opportunity, leaving a sample of 602 participants. A total of 424 participants completed and returned at least part of the

follow-up questionnaire. Of these, 352 participants could be reached 6 months later and 332 participants 12 months later for behavioral follow-ups.

Procedure

At baseline, eligible and consenting callers answered survey questions on the telephone and were read a randomly assigned message promoting mammography utilization (tailored to high or low NFC) by trained cancer information specialists at the CIS. Within a month, participants received a packet by mail containing a similarly tailored pamphlet (consistent with the type of message delivered over the telephone), a similarly tailored refrigerator magnet, and a survey to complete after reading the pamphlet. Participants who completed and returned at least part of the survey were provided a \$10 compensation.

Brief 6- and 12-month follow-up telephone interviews assessed mammography utilization since baseline. After 6 months, all participants were contacted, and after 12 months, those who had not yet obtained a mammogram at 6 months were re-contacted. Participants reached at either follow-up or both were included cumulatively in the analyses.

Minimizing Attrition

A number of procedures were used to obtain an adequate return rate of the mail-out surveys and the 6- and 12-month mammography utilization information. If participants had not returned their survey within 1 month, they were mailed a reminder postcard. If they had not returned their surveys within the next month, they were telephoned and offered a new packet of follow-up materials. Finally, if participants had not returned their surveys by the time of the 6- or 12-month follow-up contacts, they were reminded during the call. To reach as many participants as possible for the follow-up phone calls, they were telephoned at different times of the day. If they could not be reached after eight telephone attempts, they were mailed a stamped, preaddressed postcard to record their mammogram status.

Development of the Materials

To develop the messages used in the telephone interview, mailed pamphlet, and refrigerator magnets, we first reviewed web sites, pamphlets, and public statements from the National Cancer Institute, American Cancer Society, and Centers for Disease Control and Prevention. The goal was to acquire standard messages and the most current and scientifically sound cancer information for inclusion in our messages. Then pamphlets were designed utilizing information about the risk factors for breast cancer, the likelihood of developing and dying from cancer, and the use of mammography for early detection of cancer and prevention of cancer mortality.

Next, messages were created that were tailored to high or low NFC. The presentation style of the pamphlet tailored to high NFC was adapted to be most persuasive for such individuals. Therefore, the message emphasized the facts and details related to cancer and mammography utilization and presented the arguments encouraging mammography utilization in a detailed manner. Compared to the other message, the pamphlet tailored to high NFC was longer and contained additional statistics related to mammography use and breast cancer, as well as a table of breast cancer risk by age (as high NFC individuals tend to seek out and enjoy mulling over information). Examples of typical phrases from the pamphlet tailored to high NFC were as follows:

Breast cancer is the most common cancer among women in the United States. The risk for breast cancer increases significantly for women as they grow older. Seventy-five percent of the cases of breast cancer occur in women ages 50 and older. The encouraging news is that, more and more, breast cancer is being detected early, before it has had a chance to spread. It's important for you to know that, as women age, they're more likely to develop breast cancer.

The pamphlet tailored to low NFC presented the information in a way that was thought to be most persuasive for these individuals. Therefore, the message was more succinct and was presented in a simplistic manner, as low-NFC individuals tend to be less motivated to engage in deep processing of information. Although the same essential information was provided as in the other pamphlet, there were fewer details on each subtopic. In addition, the message included celebrity advocacy of mammography, because low NFC individuals are especially influenced by the source of arguments—such as public figures—and other peripheral cues. Photographs of these celebrities were included in the pamphlet for ease of information processing and to draw attention to the source of the arguments. Phrases such as the following were found in the pamphlet:

World-renowned figure skater Peggy Fleming and singer/actress Olivia Newton-John are both breast cancer survivors. Both attribute their survival to early detection. Fleming and Newton-John found their lumps early enough to have them removed, and both remain cancer free. If you get routine mammograms, you'll lower your chance of dying from breast cancer too.

The cancer information specialists at the New England office of the CIS (who collected the baseline data) reviewed and edited the messages, as did the CIS program staff at the National Cancer Institute. Because they interact daily with their callers (the population of interest), the experience of the information specialists made them especially adept at detecting wording and message construction that

might be problematic on the telephone. A pilot study was conducted for 1 week to determine whether changes to the messages, interview items, or study protocol were needed before the start of the actual study.

Measures

Baseline measures. After determining that callers met eligibility criteria and gave their informed consent, participants answered baseline questions. Their *intentions* were measured by asking if they expected to schedule a mammogram when they became due for their next one. Their *perceived risk* was examined by asking if they thought they were likely to get breast cancer in the future. We assessed *worry* by asking if they worried about developing breast cancer. Each of these items was assessed using a 5-point, Likert-type scale ranging from 1 (*definitely no/not at all*) to 5 (*definitely yes/always*).

In addition, NFC was measured using three items from the short-form of the NFC Scale (Cacioppo, Petty, & Kao, 1984), selected for their high factor loadings (Cacioppo & Petty, 1982, Table 3), as in prior studies (e.g., Steward, Schneider, Pizarro, & Salovey, in press). The reliability of these items as a scale was sufficient (Cronbach's $\alpha = .69$). A median split of NFC scores was used to classify participants as high or low in NFC.

Immediate post-message measures. Immediately following the presentation of the phone messages, we asked participants to indicate on a 5-point scale ranging from 1 (*definitely no*) to 5 (*definitely yes*) whether they found the message to be educational and whether their intentions were to schedule a mammogram in the next 12 months (using the baseline intentions 5-point scale).

Follow-up packet measures. Participants evaluated the tailored pamphlets. One item served as a manipulation check and asked "how *challenging* was the brochure in terms of making you think a lot?" (This question was repeated at the 6- and 12-month follow-up telephone interviews.) Two items assessed how believable and interesting the pamphlets were. Four items measured emotional reactions to the pamphlets, specifically assessing feelings of reassurance, hopefulness, discouragement, and anxiety. All items were rated using 5-point response scales. In addition, we assessed perceived norms by asking participants to rate whether the women that they know best get regular mammograms every year, using a scale from 1 (*none*) to 5 (*all*). A dichotomous measure (0 = *yes*, 1 = *no*) asked whether a health care worker suggested that they get a mammogram in the next 12 months. Demographic variables, including marital status, health insurance status, education, and ethnicity also were assessed in the follow-up packet.

Analysis Plan

First we examined the demographic characteristics of participants. Next we conducted a series of analyses of variance to check for group differences at baseline and in message evaluations and in the impact of the message manipulations. Then we assessed the association of preintervention variables with mammography utilization and examined mammography utilization overall by message type and by NFC using chi-square tests. Finally, mammography utilization at 6 and 12 months as a function of matching message type to individual differences in NFC was assessed in separate logistic regression models for each follow-up. Only individuals for whom we had complete data (i.e., those who returned the mail-out survey) were included in analyses examining mammography utilization.

RESULTS

Description of the Sample

The average age of the participants was 58 ($SD = 12$; range = 41 to 88). Ninety-two percent of them were White, 3% African American, 1% Hispanic, 1% Asian or Pacific Islander, and 3% from other ethnic groups. Although not many participants had attended graduate school (18%), 24% were college graduates, 28% had attended some college, and 25% were high school graduates. Only 4% reported that they only had attended some high school, and 1% only had attended grade school. Most participants had health management organization coverage or private medical insurance (60%), or a combination of health management organization coverage and Medicare (11%). Only 19% received Medicare exclusively, 2% received Medicaid, and 8% reported having no medical insurance. The majority of the women were married (61%), 17% separated or divorced, 14% widowed, 7% never married, and 1% other. Married women were more likely to get a mammogram after 6 months than were women of other marital statuses. No other demographic variables were significantly associated with mammography utilization.

NFC scores ranged from 3 to 15 ($M = 10.40$, $SD = 2.76$), with $M = 12.65$ ($SD = 1.51$) for the high-NFC group and $M = 8.23$ ($SD = 1.79$) for the low-NFC group. There were no differences in NFC between the women assigned to the two message conditions, as expected (i.e., message type was effectively randomized across participant NFC). Overall, participants were only slightly worried about developing breast cancer ($M = 2.25$, $SD = 1.03$), and they felt they were not likely to develop breast cancer ($M = 2.53$, $SD = 0.74$). They expected that they would get a mammogram at their next due date ($M = 4.30$, $SD = 1.05$). There were no differences in worry, perceived risk, or intentions between the two message conditions, between participants high or low in NFC, or in their interaction.

Evaluations of the Messages

Differences in evaluations of the messages by message type and NFC groups can be found in Table 1. All participants found the telephone message, delivered by the CIS information specialists, to be educational. Participants hearing the message tailored to high NFC reported that the message was as educational as did those hearing the message tailored to low NFC, $F(1, 597) = 0.07, ns$. Similarly, there were no differences between the message type groups in their evaluations of the believability or interestingness of the mailed pamphlet. Surprisingly, there were no differences in how challenging the message groups rated the pamphlets to be, as measured on the follow-up questionnaire and during the 12-month follow-up interview. However, at the 6-month follow-up interview, those who read the pamphlet tailored to high NFC remembered the pamphlet as being more challenging in terms of making them think than those who read the pamphlet tailored to low NFC, $F(1, 600) = 4.19, p < .05$.

The messages elicited different emotional reactions. Participants who read the pamphlet tailored to low NFC felt more reassured, $F(1, 415) = 5.20, p < .05$; more hopeful, $F(1, 413) = 4.77, p < .05$; and less discouraged, $F(1, 411) = 9.87, p < .01$, than those who read the pamphlet tailored to high NFC. There were no differences in anxiety elicited by the pamphlets. Overall, it appears that the lack of details about breast cancer and mammography included in the pamphlet tailored to low NFC made it less emotionally overwhelming and more reassuring than the pamphlet tailored to high NFC.

Individuals high and low in NFC differed in their evaluations of the telephone and pamphlet messages. Participants with a low NFC found the information in the phone message to be more educational than did high-NFC participants, $F(1, 592) = 7.02, p < .01$. Low-NFC participants rated the pamphlets as more reassuring than high-NFC participants, $F(1, 411) = 7.43, p < .01$. Finally, those low in NFC felt more hopeful after reading the pamphlets than did those high in NFC, $F(1, 409) = 4.63, p < .05$. There were no significant interactions of NFC classification by message type on participants' evaluations of the messages.

Intentions

The type of message that was delivered did not influence intentions. Participants who heard the telephone message tailored to high NFC ($M = 4.24, SD = 1.18$) had similar intentions to get a mammogram in the next 12 months as those who heard the message tailored to low NFC ($M = 4.37, SD = 1.05$); $F(1, 569) = 1.92, ns$. There were also no differences in intentions due to NFC, and the interaction between NFC and message type was not significant. Examining changes in intentions over time using a repeated measures analysis of variance revealed a change in intentions due to message type, $F(1, 565) = 3.78, p = .05$. A pairwise comparison indicated

TABLE 1
Main Effects in Message Ratings Due to Message Type and Individual NFC

| | <i>Message Type (Tailored to NFC)</i> | | | | | <i>Individual NFC</i> | | | | |
|-----------------------------|---------------------------------------|-----------|--------------|-----------|----------|-----------------------|-----------|--------------|-----------|----------|
| | <i>High M</i> | <i>SD</i> | <i>Low M</i> | <i>SD</i> | <i>F</i> | <i>High M</i> | <i>SD</i> | <i>Low M</i> | <i>SD</i> | <i>F</i> |
| Phone message rating | | | | | | | | | | |
| Educational | 4.57 | 0.94 | 4.55 | 1.00 | 0.07 | 4.45 | 1.09 | 4.66 | 0.83 | 7.02** |
| Pamphlet ratings | | | | | | | | | | |
| Believable | 4.24 | 0.69 | 4.18 | 0.66 | 0.82 | 4.21 | 0.73 | 4.21 | 0.62 | 0.00 |
| Interesting | 3.72 | 0.80 | 3.68 | 0.85 | 0.36 | 3.64 | 0.82 | 3.75 | 0.83 | 1.86 |
| Challenging (packet) | 3.09 | 1.11 | 2.94 | 1.06 | 1.99 | 2.93 | 1.17 | 3.11 | 1.04 | 2.72 |
| Challenging (6-month call) | 2.93 | 3.00 | 2.45 | 2.74 | 4.19* | 2.69 | 2.88 | 2.68 | 2.90 | 0.00 |
| Challenging (12-month call) | 1.54 | 2.48 | 1.40 | 2.27 | 0.52 | 1.43 | 2.27 | 1.49 | 2.48 | 0.10 |
| Emotional reactions | | | | | | | | | | |
| Reassured | 2.98 | 1.02 | 3.21 | 0.99 | 5.20* | 2.98 | 1.03 | 3.24 | 0.96 | 7.43** |
| Hopeful | 3.16 | 0.92 | 3.36 | 1.02 | 4.77* | 3.16 | 1.01 | 3.37 | 0.93 | 4.63* |
| Discouraged | 1.59 | 0.88 | 1.34 | 0.72 | 9.87** | 1.49 | 0.86 | 1.42 | 0.74 | 0.77 |
| Anxious | 2.08 | 1.05 | 2.00 | 1.08 | 0.63 | 2.04 | 1.07 | 2.04 | 1.06 | 0.00 |

Note. NFC = need for cognition. Degrees of freedom may vary due to some missing data but are usually (1, 415) for message type and (1, 411) for individual NFC.

* $p < .05$. ** $p < .01$.

that the telephone message tailored to low NFC had a greater impact on intentions over time compared to the telephone message tailored to high NFC, $t(289) = 2.05$, $p < .05$.

Mammography Utilization

Among those participants with complete data records, the overall reported mammography rate after 6 months was 35.4%.¹ After 6 months, the message tailored to high NFC was somewhat more effective at encouraging mammography utilization than was the message tailored to low NFC (38.6% vs. 32.7%). Individuals low in NFC were somewhat more likely to report obtaining a mammogram than those high in NFC (37.3% vs. 34.3%). Figure 1 shows the self-reported mammogram rates stratified by NFC and message type for the 6-month time point. Individuals high in NFC and who were exposed to the message tailored to high NFC were most likely to report obtaining mammograms (39.3%). Individuals high in NFC who received a mismatched message tailored to low NFC were least likely to report receiving mammograms (29.1%). Individuals low in NFC who heard the message tailored to high NFC (37.9%) and individuals low in NFC who heard the message tailored to low NFC (36.6%) reported similar rates of mammography use. Overall, it appeared that the message-matching hypothesis was confirmed among individuals high in NFC. However, low-NFC individuals did not differ much in their reported mammography use depending on message condition.

To test the hypothesis that appropriately matched messages would be more persuasive than mismatched messages after controlling for baseline engagement in mammography and other variables that correlated with mammography use—that a message tailored to high NFC would be most effective when presented to a individual with a high NFC, and a message tailored to low NFC would be most effective when presented to an individual low in NFC—we conducted a logistic regression analysis in which we included the message type by NFC interaction term. In addition, preintervention variables significantly associated with mammography utilization at 6 months were controlled for. As shown in Table 2, these variables included intentions, prior mammography use, perceived norms, worry about breast cancer, health care provider suggestions to get a mammogram within the past year, and marital status (1 = *not currently married*, 2 = *currently married*). In addition, age was included in the analysis to control for age-related differences in prior mammography use. In the first step, we entered all of these control variables. Message type and individual NFC were entered in the second step as main effects, and the third step included their interaction (Message Type \times Individual NFC). As shown in Table 3, the final model revealed a marginally significant improvement

¹Among all participants reached at the 6-month follow-up regardless of whether their records were complete, 20.9% reported that they had obtained a mammogram.

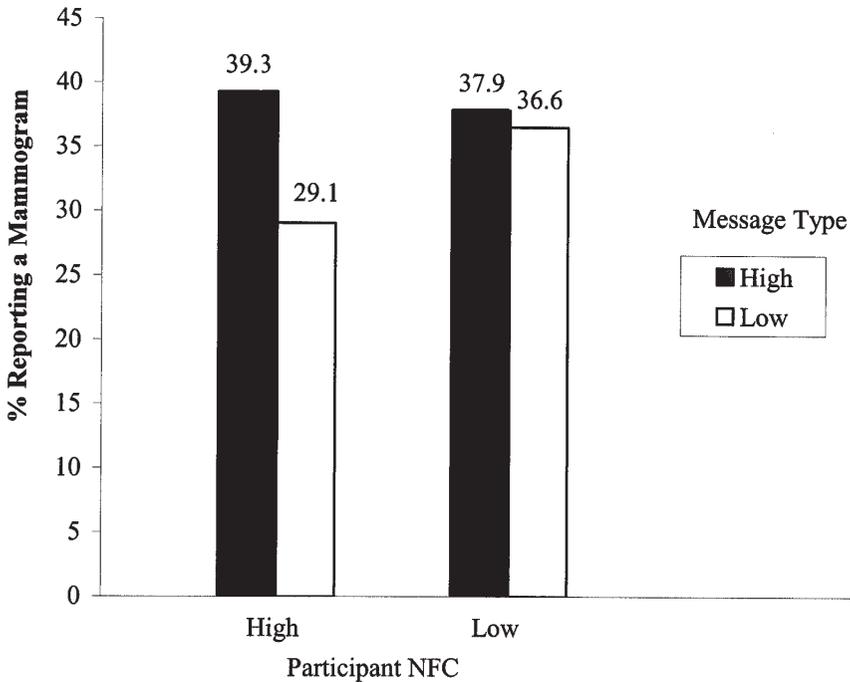


FIGURE 1 Percentage of women who reported obtaining a mammogram 6 months after the message, by participant NFC and message type (tailored to high or low NFC).

due to the addition of the interaction term to the regression model (Δ Wald $\chi^2 = 3.18, p = .07$). Based on the calculated odds ratio, when the message matched the women’s NFC, they were 2.77 times more likely to report getting a mammogram than when it was mismatched.

At the 12-month follow-up, 51.9% of participants with complete data records reported that they had obtained a mammogram.² Again, the message tailored to high NFC was somewhat more effective at encouraging mammography utilization than was the message tailored to low NFC (54.7% vs. 50.0%), and individuals with a low NFC were somewhat more likely to obtain a mammogram than those with a high NFC (56.9% vs. 48.3%). However, by the 12-month follow-up, the interaction of message type and NFC systematically did not affect mammography utilization. A logistic regression analysis conducted on the 12-month data indicated no significant effects of message type, NFC, or their interaction on mammography utilization.

²After 12 months, 55.6% of all participants regardless of whether their records were complete reported that they had obtained a mammogram.

TABLE 2
Correlations Among Variables Associated With Obtaining a Mammogram 6
Months After Receiving the Message

| | <i>Baseline Intentions</i> | <i>Prior Mamm. Use</i> | <i>Age</i> | <i>Perceived Norms</i> | <i>Baseline Worry</i> | <i>HCP Suggest</i> | <i>Marital Status</i> | <i>Message Type</i> |
|---------------------|--------------------------------|----------------------------|------------|----------------------------|---------------------------|------------------------|---------------------------|-------------------------|
| Baseline intentions | — | | | | | | | |
| Prior mamm. use | .37** | — | | | | | | |
| Age | .02 | .59** | — | | | | | |
| Perceived norms | .28** | .28** | .13* | — | | | | |
| Baseline worry | .16** | -.01 | -.16** | .02 | — | | | |
| HCP suggest | .12* | .00 | -.04 | .08 | .02 | — | | |
| Marital status | .00 | -.07 | -.12* | .14** | .05 | .08 | — | |
| Message type | .02 | .00 | -.02 | .05 | -.07 | .02 | .05 | — |
| Individual NFC | -.05 | -.03 | -.07 | .06 | .06 | .11* | .04 | .00 |
| Obtained mamm. | .22** | .11* | -.02 | .17** | .13* | .21** | .12* | .06 |

Note. HCP = health care provider; NFC = need for cognition; Mamm. = mammogram. These are Pearson correlations, except for those with HCP suggest, marital status, message type, individual NFC, and obtained mamm., which are point-biserial correlations.

* $p < .05$. ** $p < .01$, two-tailed.

DISCUSSION

In this field experiment, we aimed to encourage regular mammography utilization with messages tailored to recipients' information-processing styles. We examined the effect of messages matched to an individual's NFC, the tendency to engage actively in and enjoy effortful cognitive activities. The findings from this experiment support, to some extent, the hypothesis that messages tailored to individual NFC tend to be better at persuading mammography utilization than mismatched messages 6 months, but not 12 months, later, particularly among women high in NFC. The 6-month findings are in accordance with studies that have utilized messages tailored to psychological needs and personality characteristics in an effort to increase mammography utilization (Rakowski et al., 1998; Skinner et al., 1994). Other studies that failed to find significant effects for tailoring to psychological variables were conducted mostly using samples of women who were more adherent to mammography-screening guidelines, in comparison with this underutilizing sample (Drossaert et al., 1996; Rimer et al., 1999).

From the findings, it is clear that the pamphlet tailored to low NFC did not provide the motivation that the high-NFC group needed. The mismatched message tailored to low NFC was markedly less effective for the high-NFC group than was the message tailored to high NFC. However, the extra facts and details in the pamphlet tailored to high NFC were about as effective for the low-NFC group as was

TABLE 3
 Hierarchical Logistic Regression Analysis Predicting Obtaining a
 Mammogram by 6-Month Follow-Up

| Predictor | <i>b</i> | <i>SE</i> | <i>Odds Ratio</i> | <i>95% CI</i> | <i>Model $\Delta\chi^2$</i> | <i>Model <i>p</i></i> |
|--------------------------------|----------|-----------|-------------------|---------------|--|-----------------------|
| Step 1 | | | | | | |
| Baseline intentions | 0.36 | 0.19 | 1.43* | 0.99–2.07 | | |
| Baseline worry | 0.24 | 0.14 | 1.27 | 0.97–1.68 | | |
| Age | –0.01 | 0.02 | 0.99 | 0.96–1.03 | | |
| Prior mammography use | 0.05 | 0.05 | 1.05 | 0.96–1.15 | | |
| Perceived norms | 0.28 | 0.18 | 1.32 | 0.94–1.87 | | |
| HCP suggestion | 0.81 | 0.28 | 2.25** | 1.29–3.94 | | |
| Marital status | 0.42 | 0.30 | 1.52 | 0.84–2.75 | 35.38 | .0001 |
| Step 2 | | | | | | |
| Baseline intentions | 0.36 | 0.19 | 1.43* | 0.99–2.07 | | |
| Baseline worry | 0.27 | 0.14 | 1.31* | 0.99–1.73 | | |
| Age | –0.01 | 0.02 | 0.99 | 0.96–1.03 | | |
| Prior mammography use | 0.04 | 0.05 | 1.05 | 0.96–1.14 | | |
| Perceived norms | 0.27 | 0.18 | 1.31 | 0.92–1.87 | | |
| HCP suggestion | 0.85 | 0.29 | 2.34** | 1.33–4.12 | | |
| Marital status | 0.44 | 0.30 | 1.54 | 0.85–2.79 | | |
| MT | 0.25 | 0.29 | 1.28 | 0.73–2.25 | | |
| NFC | –0.43 | 0.29 | 0.65 | 0.37–1.14 | 3.13 | .21 |
| Step 3 | | | | | | |
| Baseline intentions | 0.34 | 0.19 | 1.41* | 0.97–2.03 | | |
| Baseline worry | 0.28 | 0.14 | 1.32* | 0.99–1.75 | | |
| Age | –0.01 | 0.02 | 0.99 | 0.96–1.03 | | |
| Prior mammography use | 0.05 | 0.05 | 1.05 | 0.96–1.15 | | |
| Perceived norms | 0.30 | 0.18 | 1.35 | 0.95–1.93 | | |
| HCP suggestion | 0.84 | 0.29 | 2.32** | 1.32–4.08 | | |
| Marital status | 0.44 | 0.30 | 1.55 | 0.85–2.81 | | |
| MT | 0.76 | 0.41 | 2.14* | 0.96–4.76 | | |
| NFC | 0.07 | 0.40 | 1.07 | 0.49–2.32 | | |
| Interaction of MT \times NFC | 1.02 | 0.58 | 2.77* | 0.90–8.55 | 3.18 | .07 |

Note. HCP = Health care provider; MT = message type; NFC = need for cognition.

* $p < .08$. ** $p < .01$.

the pamphlet tailored to low NFC. Perhaps the pamphlet tailored to low NFC would have been more effective for the low-NFC group if that group were lower in its NFC. We may have been comparing a medium NFC group and a high NFC group in this sample. Some support for this argument is provided by an examination of the 6-month, self-reported mammogram rates stratified by message type and NFC based only on the upper and lower tertiles, instead of a median split on NFC. Reported mammography utilization rates for high-NFC individuals remained the same as in the sample divided at the median, as did the rates for low-NFC individuals who heard the message tailored to high NFC. However,

low-NFC individuals who heard the matched message tailored to low NFC were somewhat more likely to report mammography use (39.3%) than their counterparts who heard the mismatched message tailored to high NFC (37.9%). Even with the lower power resulting from deleting a third of the participants from the analysis, the addition of the message type and NFC interaction to the regression model provided an improvement in fit that approached conventional levels of statistical significance (Δ Wald $\chi^2 = 2.75, p = .10$). These findings suggest that the support for the message-matching hypothesis may have been stronger for the low-NFC group if they had been even lower, on average, in their NFC.

It is somewhat disappointing that matched messages did not significantly influence mammography utilization at the 12-month follow-up. However, this is not entirely surprising. This was a minimal intervention: Participants were exposed only to a brief tailored message over the telephone and one tailored pamphlet over the course of the 12 months. It seems reasonable that the effect of such a limited intervention would fade over time.

As with all research, this field experiment has limitations. First, the sample was comprised of mostly White, relatively educated women. Because there was homogeneity in their demographic characteristics, the findings may not generalize to other ethnic and demographic groups. In addition, these women were looking for cancer-related information when they called the CIS. The tailoring technique used in this study may be differently effective with other groups of individuals who are less concerned about or less motivated to seek out cancer information. Despite a financial incentive and multiple attempts to reach participants, the retention rate in this study was not optimal. Participants may have been less committed because there was no face-to-face contact with them; all contact was made over the telephone or through the mail. It is also important to keep in mind that many of these women were under stress, often dealing with sick or dying relatives (e.g., spouses, children, siblings).

We need to investigate further that the message-tailoring manipulation used here did not inadvertently alter other aspects of the messages. From our assessments of the participants' evaluations of the messages, it appears that the messages were not perceived as being different in terms of how credible, educational, or interesting they were. However, we expected that the messages tailored to high NFC would be perceived as more challenging than the messages tailored to low NFC, and this difference, seen clearly at the 6-month follow-up, was not significant after 12 months. There were some differences as well in emotional reactions to the messages; the message tailored to low NFC was perceived as more reassuring, more hopeful, and less discouraging, for example. Investigators need to take care in tailoring studies not to confound these manipulations in unintended ways.

Even with these considerations, the findings add to the body of research suggesting that message tailoring may be an effective technique for encouraging cancer prevention and detection behaviors in at least some individuals (cf. Wil-

liams-Piehot, Schneider, Pizarro, Mowad, & Salovey, 2002). The women in this study were selected because they were underutilizing mammography, and although some of them remained underutilizers, the intervention had an impact on others. Future researchers need to investigate the mechanisms underlying the effectiveness of tailoring. Although the Elaboration Likelihood Model (Petty & Cacioppo, 1986) and other dual-process models of attitude change provide one feasible explanation (Rimer & Glassman, 1999), researchers have yet to explore cognitive processing systematically. Rothman and Schwartz (1998) found some support experimentally for the notion that personally relevant information is processed more systematically (i.e., using a central route to persuasion). However, their findings also suggest that persuasion is complex: We need to take into account individuals' prior experience with a domain of judgment or decision making. Knowledge of the mechanisms producing these effects will help researchers and practitioners to craft especially effective tailored messages.

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