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Promoting Colorectal Cancer Screening in Public Health Outreach Campaigns

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Objective: Research on public outreach campaigns is presented.

Background: One study examines the effects of instruction design on adherence to cancer self-screening instructions. A second study examines the effect of persuasive announcements on increasing screening campaign participation.

Method: The first study examined adherence to screening (operationalized as returning results for evaluation) given standard instructions, or one of three other versions: persuasive, human factored, or a combination of the two. The second study investigated combining persuasion with a campaign announcement to increase participation (operationalized as picking up a test kit).

Results: The first study found that among first-time participants, the persuasive and human-factored instructions evoked higher result return rates than did the standard. The second study found that participation was significantly increased by adding persuasion to the campaign announcement.

Conclusion: Enhancing motivation and reducing cognitive barriers increase adherence to test instructions and increase participation.

Application: These are simple, cost-effective strategies that increase adherence to cancer screening in public outreach campaigns, which may reduce cancer-specific mortality.

Keywords: cancer, human factors, colorectal cancer screening, prevention, health

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INTRODUCTION

Colorectal cancer deaths have decreased since the 1990s (Cancer Statistics, 2005), in part because of prevention and the detection of pre-cancerous cells or early detection (American Cancer Society [ACS], 2011). Colorectal cancer is the third most common cancer in the United States (ACS, 2011). Because it develops gradually, its incidence and mortality rates may be lowered by detecting and treating pre-cancerous conditions (e.g., Atkin et al., 2010). The ACS (2011) recommends that adults older than 50 engage in annual screening using a fecal occult blood test (FOBT) or fecal immunochemical test complemented by a flexible sigmoidoscopy or double-contrast barium enema every 5 years, or a colonoscopy every 10 years. The FOBT is a noninvasive take-home test that screens for blood in feces. Complemented by other screening tools, the FOBT is an efficient (Pignone, Saha, Hoerger, & Mandelblatt, 2002) and cost-effective (Wagner, Tunis, Brown, Ching, & Almeida, 1996) way to prevent and detect colorectal cancer. Systematic reviews suggest that, among people aged 45 to 75, colorectal cancer mortality decreases from about 100 out of 10,000 people without screening to about 85 out of 10,000 people with yearly FOBT screening over at least 12 years (Hewitson, Glasziou, Irwig, Towler, & Watson, 2007). The present article presents studies that investigated (a) the role of persuasion and human factors on result card return and (b) the influence of persuasion on increasing participation in a public outreach campaign.

Health information that relies on education alone or threatening disastrous consequences for nonadherence is only marginally effective at changing behavior (Haynes, 1976; Schneider, 2006). The biobehavioral model of persuasion (BMP; Schneider, Rivers, & Lyons, 2009) proposes

that effective messages evoke moderate levels of personal concern *and* enhance recipients' confidence in their ability to carry out procedures or in the procedures themselves. Health messages conveying information alone may trigger little emotional arousal and result in no behavioral reaction (Slovic, Fischhoff, & Lichenstein, 1980). Conversely, strong emotional arousal may thwart behaviors, eliciting defense or avoidance (Averill, 1987; Hovland, Janis, & Kelley, 1953; Schneider et al., 2009). Along with evoking moderate engagement, increasing ability beliefs are important for motivating behavior change (e.g., R. W. Rogers, 1983; Schneider et al., 2009). People will be challenged to address a health issue when they perceive it is personally relevant *and* they can do something to cope with it, whereas they will be threatened if their coping efforts fall short (Schneider et al., 2009). Threatening health information that overpowers efficacy results in disengagement (Taylor, Kemeny, & Aspinwall, 1992), escape avoidance (Folkman, Lazarus, Gruen, Rand, & DeLongis, 1986; Lerman & Schwartz, 1993), decreased message processing, and lower adherence (Schneider et al., 2009). The BMP postulates that moderately concerning, high-efficacy health appeals evoke an optimal balance of challenge, psychological, and behavioral engagement. For FOBT instructions, this means moderately enhancing personal concern about colorectal cancer and enhancing confidence in the ability to perform the procedure should increase adherence.

On the other hand, when medical instructions neglect users' cognitive capacities, they reduce understanding (Davis, Crouch, Wills, Miller, & Abdehou, 1990; Klein & Isaacson, 2003; Klein & Meininger, 2004) and adherence (e.g., Murray et al., 2004; Park & Jones, 1997). For people older than 50, the target population for colorectal cancer screening, adherence can further decrease because of reduced perceptual-cognitive resources (e.g., W. A. Rogers, 1997), limitations of health-specific cognitive abilities (e.g., Morrow, Leirer, & Sheikh, 1988), or reduced ability to read, understand, or remember instructions (Gazmararian et al., 1999). We modified standard FOBT instructions by identifying the minimum set of constraints and procedures required to accurately perform the screening task (cf. Vicente, 1999) and used human factors guidelines to evaluate and redesign the usability of the instructional text to better meet users' cognitive capacities (Hartley, 1994a, 1994b, 1999, 2004).

We used basic and specific levels of analysis to identify the constraints for accurately performing an accurate FOBT. At the basic level, the FOBT requires three subtasks: (a) perform a *specific procedure* to test for blood in the stool, (b) *distinguish* positive from negative results, and (c) *record* and *report* results to a health professional. The specific level is the procedure, which has five steps that were structured into substeps using a state transition diagram analysis (e.g., Lin et al., 1998). This type of flow chart analysis fostered a clearer description of necessary procedures. Then, human factors guidelines were used to enhance readability and understanding (Hartley, 1994a, 1994b, 1999, 2004). Adding to the content and task constraint analysis, this second step included attending to instruction content, organization, presentation, and language (Morrow et al., 2004).

Instruction content should outline essential constraints on task performance (cf. Vicente, 1999) and build working knowledge about required procedures, including information about adherence, storage, and warnings (Morrow et al., 1988; Morrow & Leirer, 1999). The organization of instructions enhances comprehensibility (Kools, Ruiter, van de Wiel, & Kok, 2004; Reid, Kardash, Robinson, & Scholes, 1994). Patients categorize medication information into general identifying information (name, purpose), directions for use (dose, timing, warnings), and possible outcomes and side effects (see Morrow, Carver, Leirer, & Tanke, 2000; Morrow, Leirer, Altieri, & Tanke, 1991). Organizing information accordingly improves recall (Morrow, Leirer, Andrassy, Decker-Tanke, & Stine-Morrow, 1996). Presen-tation factors such as font, type size, contrast, and capitalization help organize information (Hartley, 1994a, 1994b). Wording, sentence, and text structure influence comprehension and cognitive load, especially among older users (Morrow et al., 1988). Using fewer, shorter, and familiar words and sentences makes instructions easier to read and understand, reducing adherence barriers. Reading ease as calculated

with Kincaid, Fishburne, Rogers, and Chissom's (1975) formula (# words/sentence, # syllables/word) should be at the fourth- to fifth-grade reading level (simple wording, clear syntax) to improve patient understanding (Davis et al., 1990; Morrow et al., 1988). Simple, semantically unequivocal icons further improve health literacy, especially in older adults (Morrow et al., 1988). Compared to text, icons decrease study time and inferences (Morrow, Haier, et al., 1998) and focus attention on salient information (Wickens, 1992).

STUDY 1

We adapted standard instructions as currently provided for a do-it-yourself FOBT and created persuasive, human-factored, or combined instructions. The instruction modifications influenced screening intentions in two pilot studies (Feufel, Schneider, & Berkel, 2006), so they were implemented in the public outreach campaign. We hypothesized that modified FOBT instructions would increase result return (i.e., adherence) compared to the standard.

Method

Framework of the study. This study was part of the third annual colorectal cancer awareness and screening campaign held in March 2006. It spanned four Midwestern counties and was collaborative across a television station, the Cancer Prevention Institute (CPI), the ACS, and a grocery–pharmacy chain (27 stores received 7 boxes each with 100 envelopes; 7 additional boxes floated across stores). In February, the station ran daily public service announcements. In March, the stores displayed poster-style announcements. Pharmacists gave envelopes to those who completed a registration card. Envelopes included FOBT, two-page instructions, and a preaddressed, stamped result card. Result cards had identifiers matched to instruction type. Once stuffed, envelopes with different instructions were randomized (25 of each instruction were shuffled) and placed in boxes of 100.

Participants. A total of 19,683 FOBT kits were available for distribution. A count of remaining postcampaign kits revealed that 16,073 FOBTs were distributed. Participants returned 2,932 result cards (return rate = 18.2%). To control for past behavior (and consequently habits or strong intentions), we examined data for those self-identifying as first-time participants (n = 2,932 – 1,609 = 1,323). This reduced the return rate to 9.1% of the distributed FOBT kits (n = 1,323 out of 16,073 – 1,609 = 14,464). Participants were mostly female (64.8%) and White (89.4%), with 7.1% African American. The mean age was 65 (SD = 12).

Materials: FOBT test. The take-home FOBT (Biomerica, Newport Beach, CA) kit contained a packet with five blood-sensitive *test tissues*, a packet with positive *control powder* to check functioning of test tissues, and a *result card* to record results. In five consecutive steps, tissues are dropped in the toilet with (a) the bowl water alone to check water quality (tissues should not change color), (b) with three consecutive bowel movements to check for blood (blood changes tissue color), and (c) with the positive control powder to ensure the tissues work (powder changes tissue color). After 2 min the tissue either changes color or does not. Participants were to record the results of the steps, note past participation, and mail their results to CPI for evaluation.

Stimuli: Instructions. The factual content and organization were constant across instructions: purpose, procedural summary, warnings, instructions for the steps, and request to mail the results.

Persuasion. The FOBT rationale was reformulated to evoke moderate personal concern. Facts about this health threat were placed early in instructions ("One out of 18 adults will get colon cancer" and "Colon cancer grows without symptoms you can see or feel"), and the FOBT was presented as an efficient response to the threat ("This test can find colon cancer before symptoms occur," "Treatment during early stages is most successful").

Human factors. First, we extracted the general flow of essential tasks, priming users for tasks ahead (*specific procedure* to test for blood in the stool, *distinguishing* positive and negative results, *recording* and *reporting* results; Hartley, 1994a, 1994b, 1999, 2004). Second, we detailed the screening procedure based on a flow chart analysis. Last, we improved readability and comprehensibility by refining information content, organization, presentation, and language.

TABLE 1: Return Rate Statistics for First-Time Participants in the Fecal Occult Blood Test Outreach Campaign

	Standard	Persuasion	Human Factored	Combined	Total
Amount distributed (AD)	3,657	3,653	3,565	3,589	14,464
Sample proportion = AD/total AD (%)	25.3	25.2	24.7	24.8	100.0
Returned result cards (RRC)	291	338	370	324	1,323
Return rate = RRC/AD (%)	8.0	9.3	10.4	9.0	9.1

Combined instructions. We added the persuasive statements to the beginning and end of the human-factored instructions to create the combined version.

Reading indices. The persuasive and standard instructions were identical in reading level: both were at an eighth grade reading level (Kincaid et al., 1975), with a Gunning-Fog Index of 15 years (the minimum age required to understand the text); the Flesch Reading Ease Score (RES) was 62 for the persuasive and 61 for the standard set (numbers closer to 100 denote greater ease). The word count was also similar for the persuasive (n = 1,004) and standard (n = 937) instructions, $\chi^2(1) = 0.49$, *ns*. Compared to the standard, the human-factored instructions had a lower reading level (fifth grade), lower Gunning-Fog Index (12 years), higher RES (79), and significantly reduced word count (n = 523), $\chi^2(1) = 135.36$, $p < .01$. The combined instructions had a similar reading level (fifth grade), Gunning-Fog Index (13 years), RES (78), and word count (n = 523 for human factored vs. n = 581 for combined), $\chi^2(1) = 3.05$, *ns*. In summary, in terms of reading indices, the standard and persuasive versions were similar to each other and the human-factored and combined versions were similar to each other.

Evaluation of test result cards. Two months postcampaign, CPI provided a database with identifiers from returned result cards, demographics, and prior participation.

Results

Data from the returned result cards (n = 2,932) were matched with a database containing the total number of envelopes distributed (N = 16,073). Then, the data set was split to include only first-time participants (45%; n = 2,932 – 1,609 = 1,323 out of 14,464). (Past participation for nonreturners is an unknown. Given the returned results, one could assume that 45% were first-timers, and although we might have reduced our denominators for subsequent analysis, it was a more conservative test not to.) Table 1 shows that the standard instructions yielded the lowest return rate with about 80 returned results cards for every 1,000 FOBTs distributed (291 of 3,657). A simultaneous logistic regression tested the effect of the new instructions relative to the standard on result card return. For every 1,000 cards distributed, persuasion resulted in about 13 additional returned result cards, *Wald*(1) = 3.89, $p < .05$, the human-factored instructions in about 24 additional returned result cards, *Wald*(1) = 12.66, $p < .001$, and the combined in about 10 additional returned results cards, *Wald*(1) = 2.67, $p = .10$.

Discussion

These findings demonstrate that persuasion and human factors principles can significantly increase the number of returned test results compared to the standard instructions currently in use. Specifically, for every 1,000 participants randomly given the standard, those randomly given persuasive instructions had a 16% (13/80) increase, and those randomly given human-factored instructions had a 30% (24/80) increase in result return. Extrapolating to the total FOBT kits distributed (N = 14,464; which includes both first-time and repeat participants), the persuasive instructions would have resulted in 188 and the human-factored in 347 more returned results

than the standard. There was a tendency for those receiving the combined instructions to have a higher rate of result return, but it did not reach significance.

The present analysis focused on individuals who were new to the campaign, a small subset of campaign participants. By registering for the colorectal cancer campaign and picking up a FOBT kit, people demonstrate some intention to take the test. Once first-time users take this initial step, the results of the present study suggest that either persuasive or human-factored instructions increase adherence, and their combination tends to increase adherence. One important goal of public health outreach campaigns is to get new audiences interested in taking that first step. Study 2 examined whether adding persuasive components to the campaign in-store advertisement would increase new participation in the campaign.

STUDY 2

Even with research-based recommendations from reputable organizations such as the ACS, there remains a challenge to involve the public in cancer prevention and early detection behaviors. Whereas Study 1 examined the influence of instruction design on the return rates of FOBT results and related research shows that instructions can increase the accuracy with which participants conduct the test and report their results (Feufel, Schneider, & Berkel, 2010), Study 2 examined increasing participation in a colorectal cancer outreach campaign (and included the same campaign partners and general procedure as Study 1). We added a persuasive message to the standard campaign poster advertisement placed at store entrances and near pharmacies. We expected that stores randomly selected to receive a persuasive message to accompany their in-store advertisement would yield higher participation rates than stores randomly selected to include only the in-store advertisement (i.e., without the persuasive message).

Method

Participants. A total of 10,184 people who filled out registration cards at pharmacy counters received an envelope containing the FOBT, instructions, and an ACS pamphlet. The human-factored instructions were provided in all envelopes given their maximal effect on return rate (see Study 1) and accuracy (see Feufel et al., 2010). Participants provided their name, address, date of birth, sex, and ethnic background (e.g., White, Black, or Hispanic) on registration cards.

Stimuli. A brief persuasive message was developed for posting beneath the in-store poster campaign advertisements, which were displayed in the month of March (colorectal cancer awareness month). Two posters were to be displayed at each store (n = 30), one near the entrance and one near the pharmacy. Half of the stores were randomly selected to receive the persuasive message, which was the same width as the poster and contained poster-complementary lettering so it would stand out. The message stated, "YOU may have colon CANCER but not know it, once you notice symptoms a cure is difficult. This test can help BEFORE you have SYMPTOMS. EARLY DETECTION is KEY to successful treatment."

Procedure. At the end of the campaign, researchers visited each store, retrieving remaining registration cards to discern the number of packets still available and whether advertisements were hung (with or without any accompanying message). When campaign posters were not displayed, the researchers queried pharmacists on their recollection of the poster–message display. Of those queried, only one pharmacist at a store assigned to the persuasive accompaniment was unsure about whether the message was displayed. Pharmacists at stores that were not assigned to receive a persuasive message to accompany their poster correctly stated that the in-store advertisement was all that was displayed to advertise the campaign.

Results

Stores that did not receive a persuasive message (n = 15) turned in 4,434 completed registration cards, whereas those stores randomly selected to also post the accompanying (i.e., persuasive) message (n = 15) turned in 5,750. This difference of 1,316 registration cards and thus distributed FOBT kits seems large. A binomial test for proportion analysis was significant, $p < .001$, showing that a persuasive in-store message increased distribution to 56%

(# distributed across stores with persuasive messages/total distributed = 5,750/10,184), compared to 44% (# distributed across stores without persuasive messages/total distributed = 4,434/10,184). A simple persuasive message increased participation in a public health outreach campaign by 30% (1,316/4,434).

Discussion

This study examined whether a persuasive message would increase public participation in a cancer screening outreach campaign. We found that a persuasive message added to in-store advertisements did significantly increase participation by 30% (1,316) additional test kits compared with the standard advertisement (4,434). When considering the magnitude of participation in public health outreach campaigns, this is statistically and practically significant. One limitation of this study is that registration cards did not query whether participants were newcomers or whether they had participated in past years' campaigns. Regardless, the persuasive message significantly increased participation (i.e., picking up test kits) in the campaign in those stores randomly assigned to such a message.

GENERAL DISCUSSION

Colorectal cancer is a leading cause of U.S. cancer-related deaths (Cancer Statistics, 2005) and may be prevented by detecting and treating precursors or cured if detected early with screening tests such as the FOBT (e.g., Hewitson et al., 2007). Recent strategies to increase adherence to FOBT procedures focused on financial barriers to test taking (e.g., Freedman & Mitchell, 1994), the effects of financial incentives (Kane, Johnson, Town, & Butler, 2004), mailing of test kits (Mahon, 1995), or improved FOBT accessibility (e.g., Goldberg et al., 2004). Compared to these strategies, the present studies point to simple and cost-effective alternatives, which may be of particular interest given financial pressures in the U.S. public health system.

The results of these studies demonstrate that providing users with persuasive and human-factored instructions and using persuasion to motivate participation can facilitate the goals of public outreach campaigns. Specifically, the first study demonstrated that persuasion and human-factored instructions can improve adherence to return FOBT results for evaluation, compared to the standard instructions currently provided. This result is encouraging because these instruction design changes are simple and cost-effective. Furthermore, unlike the clearly reorganized human-factored instructions, our systematic manipulation of persuasion (a few additional sentences) had to compete with features inherited from the lengthy, difficult to read, and poorly organized standard instructions. The results of the first study suggest the effectiveness of the manipulations suggested by the BMP (Schneider et al., 2009). However, when combined, the persuasion and human-factored instructions only marginally increased result return. An expanded persuasion manipulation (beyond two sentences) may help the combined instructions.

Studies investigating the effects of human-factored instructions report that they are preferred (Klein & Meininger, 2004; Morrow et al., 1988; Morrow, Leirer, & Altieri, 1995), more understandable (Eustace, Johnson, & Gault, 1982; Morrell, Park, & Poon, 1989), and easier to memorize (Morrow et al., 1991, 1996), compared to a standard. Researchers have also suggested that apart from financial, educational, and psychosocial measures, applying human factors may play a role in increasing patient adherence (e.g., Boyle & Chambers, 2000; McDonald, Garg, & Haynes, 2002; Morrow et al., 2004; Murray et al., 2004; Park & Jones, 1997). To our knowledge, this is one of the first field studies to demonstrate a relationship between human factors and behavioral adherence to a medical procedure. The present findings provide strong recommendations for designing instructions that are preferred, are user-friendly, and more importantly increase adherence to medical do-it-yourself procedures.

The persuasion and human factors benefits are unlikely to be constrained by this campaign or area of cancer. The benefit of human factors guidelines for streamlining and clarifying health information was documented above. Past research has also demonstrated that persuasive message design influences a variety of behaviors such as

obtaining mammograms (Williams-Piehota, Schneider, Pizarro, Mowad, & Salovey, 2003, 2004) and cervical cancer screenings (Rivers, Salovey, Pizarro, Pizarro, & Schneider, 2005) and reduced smoking (Schneider, Salovey, Pallonen, et al., 2001). Furthermore, these benefits of persuasive as compared to merely informative messages extend to medically underserved populations (Schneider, 2006; Schneider, Salovey, Apanovitch, et al., 2001).

These experiments had several limitations linked to doing field research with the public outreach campaign, the population, and the population's social economic status. First, the outcome for the first study was the return of results. It was not possible to collect other variables that might indicate why approximately 83% of the participants who picked up an FOBT did not return their results (perhaps they were comfortable with their own evaluation or did not want external evaluation). They are likely a mixture of those who did not take the FOBT and those who did not return their results. However, the return rate of Study 1 was the highest since the campaign's inception (CPI, 2005). Future research could include a sampling of participants to query reasons for and against adherence. Second, the participants in both studies were homogenous (White, middle class) as in past years and were likely financially homogenous as well. This may be partly the result of the clientele served by the campaign stores and pharmacies or self-selection (not motivated to fill out a registration card). Future research could examine instruction design and and persuasive advertisement in less motivated participants, across social strata, and in different ethnic populations. If useful, these measures may complement socioeconomic and culturally adequate strategies to promote colorectal cancer prevention to minorities and at-risk populations (Schneider, 2006; also see Powe, 2002; Rex, Rawl, Rabeneck, Rex, & Hamilton, 2004). A limitation for Study 2 was that recipients may have been motivated to request the FOBT kit because of media advertising received outside of stores–pharmacies. However, by randomly assigning stores to a message, we are confident that our results are reliable and that persuasion can effectively increase participation in public outreach campaigns.

Building on the first study, the second demonstrated that public participation in a cancer screening campaign could be increased with a brief persuasive message. Message development was guided by the BMP (Schneider et al., 2009) and aimed to evoke challenge (i.e., low arousal, high efficacy). Future research should better test the BMP by investigating challenging versus threatening messages. Threat messages evoke high arousal and low efficacy and should reduce adherence. Though the persuasive components may have increased personal involvement with the health issue of colorectal cancer and increased personal belief efficacy of the FOBT test, these mediators were not investigated. However, prior research suggests that personal concern and efficacy beliefs are important mediators of behavior change (Schneider et al., 2009). Follow-up research can help to clarify the mechanisms that lead to behavior change.

As an initial field study examining the effect of instructions on medical adherence, this research shows that instructions designed from persuasion theory and human factors guidelines effectively increase adherence to FOBT instructions in test takers. Other strategies have focused on financial barriers (e.g., Freedman & Mitchell, 1994), financial incentives (Kane et al., 2004), and improved FOBT accessibility (e.g., Goldberg et al., 2004). Comparatively, the present research points to simple and cost-effective ways to increase adherence to medical procedures among those motivated enough to obtain a screening kit. Mitigating poor motivational or cognitive barriers to FOBT adherence may facilitate screening adherence, lead to early detection of cancer or precancerous cells, and ultimately reduce treatment costs and cancer-specific mortality.

CONCLUSION

Promoting FOBT screening and thus prevention and early detection behaviors may address some of the human and financial costs of colorectal cancer. Improving test-taking instruction design with persuasion and human factors enhancements increased result return adherence compared to standard instructions. These results speak to the predictive validity of the BMP and add naturalistic evidence to the human factors research base with respect to medical adherence

in particular. These enhancements are simple and cost-effective strategies to increase FOBT rates, could be implemented on a large scale, and would be efficient additions to decrease cancer-specific mortality rates.

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KEY POINTS

- Health care instructions should be better designed to promote public health.
- Two studies show that human factors and persuasion can effectively increase adherence.
- Thoughtful instruction design is simple, is cost-effective, and promotes the public health.

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