Comparing tailored and narrative worksite interventions at increasing colonoscopy adherence in adults 50–75: A randomized controlled trial

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ABSTRACT

Research has identified several communication strategies that could increase adherence to colorectal cancer screening recommendations. Two promising strategies are tailoring and narrative-based approaches. Tailoring is the personalization of information based on individual characteristics. Narrative-based approaches use stories about similar others to counter perceived barriers and cultivate self-efficacy. To compare these two approaches, a randomized controlled trial was carried out at 8 work-sites in Indiana. Adults 50–75 ($N = 209$) received one of four messages about colorectal cancer screening: stock, narrative, tailored, tailored narrative. The primary outcome was whether participants filed a colonoscopy claim in the 18 months following the intervention. Individuals receiving narrative messages were 4 times more likely to screen than those not receiving narrative messages. Tailoring did not increase screening behavior overall. However, individuals with higher cancer information overload were 8 times more likely to screen if they received tailored messages. The results suggest that narrative-based approaches are more effective than tailoring at increasing colorectal cancer screening in worksite interventions. Tailoring may be valuable as a strategy for reaching individuals with high overload, perhaps as a follow-up effort to a larger communication campaign.

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Introduction

Colorectal cancer (CRC) is the third most common cancer in men and women, and accounts for almost ten percent of cancer deaths in the United States (Siegel, Naishadham, & Jemal, 2013). These rates have been declining for two decades, due in part to increased utilization of CRC screening (Smith, Brookes, Cokkinides, Saslow, & Brawley, 2013). CRC screening has been advocated for adults aged 50–75 since the early 1980s (Vernon et al., 2011), but adherence is under 60% nationally (Smith et al., 2013). Given the health benefits of CRC screening — and its inclusion as a national public health objective — identifying strategies to increase participation in screening is a priority.

One communication strategy that has increased CRC screening adherence is tailoring (e.g., Manne et al., 2009). Tailoring is the personalization of information based on user characteristics

(Kreuter, Farrell, Olevitch, & Brennan, 2000). Instead of crafting a message for everyone (stock messages) or for a particular group or demographic (targeted messages), tailoring involves the creation of unique messages for each individual (Rimer & Kreuter, 2006). For example, a targeted message might be designed for Hispanic men in general whereas a tailored message would address the attitudes, beliefs, and risk factors of a particular Hispanic man. Thus, tailoring provides information relevant to the individual rather than the group. Meta-analyses have revealed that tailored messages are more effective than untailored messages at increasing adherence to cancer screening recommendations, though the typical effect is small ($r = .08$, 95% CI: .06, .09) and most studies have relied on self-report measures of screening (e.g., Krebs, Prochaska, & Rossi, 2010; Noar, Benac, & Harris, 2007).

An alternative strategy is to use narratives to increase CRC screening adherence (Green, 2006). Narratives are also called stories and include characters and a string of connected events (Kreuter et al., 2007). CRC screening narratives often depict individuals grieving lost loved ones, overcoming challenges,

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benefitting from behaviors, or using services (Dillard, Fagerlin, Dal Cin, Zikmund-Fisher, & Ubel, 2010). Narratives may be effective at changing behavior because people enjoy stories, become absorbed in the plot, and may be less likely to reject (or even notice) counter-attitudinal information (Dal Cin, Zanna, & Fong, 2004; Moyer-Gusé & Nabi, 2010; Slater & Rouner, 2002). Narratives are also effective vehicles for conveying information that is culturally aligned or centered (Larkey & Hecht, 2010). Communication researchers have noted that narratives are a promising strategy for increasing cancer screening participation, and these approaches are being used more frequently in promoting health and wellness (Kreuter et al., 2007).

To compare tailoring and narrative communication strategies, a randomized controlled trial (RCT) was developed and carried out at eight worksites. In the RCT, adults were randomly assigned to receive one of four pamphlets about CRC screening: stock, narrative, tailored, or tailored narrative. In the latter, the pamphlet was personalized to participants' characteristics and included a narrative with a protagonist from the same gender and racial/ethnic demographic. The main outcome of interest in this study was CRC screening behavior. To measure this outcome, insurance claims data were collected 18 months after the intervention for each participant to track CRC screening. Thus, the current study examines the effectiveness of two different strategies (alone and in combination) and utilizes a more objective measure of behavior (insurance claims data) than many previous studies.

CRC screening, tailoring, and narratives

Tailoring

Tailored messages were originally crafted by hand and evaluated via tailored letter interventions or tailored counseling (Kreuter, Strecher, & Glassman, 1999). Innovations in communication technology have facilitated tailoring efforts by replacing hand tailoring with computerized algorithms (e.g., Jensen, King, Carcioppolo, & Davis, 2012). Computerized, algorithmic-based tailoring can provide people with personalized information quickly and makes this approach more sustainable for interventions aimed at large populations.

Meta-analyses have confirmed that tailoring is an effective communication strategy (e.g., Krebs et al., 2010; Noar et al., 2007). Compared to stock messages, tailored messages yield increased behavior change ($r = .07$, 95% CI: .06, .08), including increased cancer screening ($r = .08$, 95% CI: .06, .09). Messages were most effective when they were personalized on four or five factors ($r = .09$, 95% CI: .07, .10) and communicated via a pamphlet or leaflet (as opposed to a letter, manual, or newsletter; $r = .16$, 95% CI: .14, .19).

Previous studies have typically tailored messages to participant demographics (e.g., age, gender, race/ethnicity), stage of change, and constructs from the health belief model, social cognitive theory, extended parallel process model, and the preventive health model (Noar et al., 2007; Tilley et al., 1999). From a mechanism standpoint, experimental research has identified perceived message relevance as a possible mediator of tailoring effects. For example, in a test of ten mediators, Jensen et al. (2012) found that tailored pamphlets were more effective at increasing mammography intentions because they were perceived as more relevant.

Past studies have examined whether tailoring increases CRC screening adherence specifically. Several have found that tailored materials outperform stock materials (e.g., Lairson et al., 2008; Manne et al., 2009; Marcus et al., 2005; Ruffin, Fetters, & Jimbo, 2007; Walsh et al., 2010), whereas others have found no benefit (e.g., Ling et al., 2009; Myers et al., 2007, 2013; Vernon et al., 2011),

or only benefits for particular subgroups (e.g., Rawl et al., 2008). An online intervention assessed the efficacy of a website tailored to match screening type with user preferences with a stock colorectal screening site, finding that participants in the intervention condition were 3.23 times more likely to be screened post-intervention than those in the control condition (Ruffin et al., 2007). Walsh et al. (2010) compared a culturally tailored brochure to increase CRC screening against an individual's usual care, finding that culturally tailored messages resulted in increased adherence. A longitudinal study compared four different message conditions, a single untailored message, a single tailored message, four multiple tailored messages based on a single pretest, and four multiple, retailored messages based on updated information. Results revealed that tailored messages were generally more effective than untailored at increasing CRC screening (Marcus et al., 2005). Most relevant to the present study, Lairson et al. (2008) found that tailored messages performed better than targeted messages, but still viewed targeted postcards as a more cost-effective strategy. The benefit of tailoring CRC screening messages is uncertain and questions have been raised about the value of using other strategies to achieve the same (or greater) effect (e.g., Dillard et al., 2010; Lairson et al., 2008).

Narratives

Humans have been using stories to persuade for thousands of years (Abbott, 2002). Researchers prefer the term narrative, and research on narrative features and effects has become a central component of communication scholarship (Busselle & Bilandzic, 2008; Kreuter et al., 2007). Didactic messages focus on arguments and facts, whereas narratives focus on characters and a string of connected events (Kreuter et al., 2007). In narrative communication situations, receivers may focus on the plot or story rather than the implicit or explicit arguments in the message (Green & Brock, 2000; Slater & Rouner, 2002). As a result, some have argued that narratives "short-circuit" critical message processing and thereby produce persuasive effects equal to or even different from expository messages (Nabi, Moyer-Gusé, & Byrne, 2007, p. 31). If narratives can short-circuit critical message processing, then they may be effective at increasing adherence for individuals or groups that typically avoid or attack CRC screening messages.

Narratives provide communicators with opportunities to depict models engaged in the target behavior or overcoming relevant barriers to action. Modeling can increase self-efficacy and counter perceived barriers to action (Bandura, 2004; Dillard et al., 2010). Narratives can reflect both cultural values and norms (Larkey & Hecht, 2010) as well as provide examples that are more vivid and memorable than real life (Shrum, 2009). For all of these reasons, story-based information may be the underlying framework guiding memory and thus make it easier to recall (Jensen, Bernat, Wilson, & Goonwardene, 2011; Jensen, Carcioppolo, et al., 2011; Schank & Berman, 2002).

Very few studies have examined the impact of narratives on CRC screening adherence. Lipkus, Green, and Marcus (2003) found that narratives increased perceived threat severity and intentions to screen. Likewise, Dillard et al. (2010) observed that narratives reduced perceived barriers and intentions to screen. However, Larkey and Gonzalez (2007) found that culturally-centered narratives and expository messages did not produce statistically different outcomes. Two conclusions can be drawn from the narrative literature. First, narratives seem to impact variables from the health belief model (perceived threat severity, perceived barriers) which suggests those constructs could be mediators. Second, the benefit of using narratives to increase CRC screening is still uncertain.

RCT: tailoring, narratives, and tailored narratives

Based on theory and extant findings, there is reason to believe that CRC screening adherence could be enhanced through the effective use of tailoring or narratives. Communicators could also pursue both strategies by tailoring narratives or using tailoring and narratives at the same time. The impact of tailored narratives could hinge on how the two are combined. For example, a narrative could be tailored so that the main character is similar to the message recipient (henceforth, character tailoring). Alternatively, the narrative could be tailored so that the story focuses on a particular barrier relevant to the recipient (henceforth, plot tailoring). Computerized algorithms also create the possibility that a narrative could include character and plot tailoring (henceforth, comprehensive tailoring). Indeed, one of the challenges to combining tailoring and narrative communication strategies is that there are numerous approaches to consider.

The current study compares four message types: stock (no tailoring, no narrative), narrative (no tailoring, narrative), tailored (tailoring, no narrative), and tailored narrative (tailoring, narrative). The tailored narrative in this study is akin to character tailoring as the main character was altered to match the gender, age, and race/ethnicity of the recipient.

It is hypothesized that tailored messages will be more effective than messages without tailoring (H1) and that this effect will be mediated by perceived message relevance (H2). Narrative messages should be more effective than messages without narratives (H3) and in line with past research this effect will be mediated by variables from the health belief model including perceived barriers (H4a), perceived benefits (H4b), self-efficacy (H4c), perceived threat susceptibility (H4d), and perceived threat severity (H4e). The impact of crossing tailoring and narrative approaches is unknown, so this is posed as a research question (RQ1).

Cancer information overload

Efforts to increase CRC screening adherence should be mindful of the larger communication environment. Survey research has shown that a large number of people seem to exhibit cancer information overload (CIO). For example, approximately 7 in 10 U.S. adults agree that "there are so many recommendations about preventing cancer, it's hard to know which ones to follow" (Arora et al., 2008; Jensen et al., 2013). Individuals with high CIO are overwhelmed by the amount of cancer information in their environment. Accordingly, CIO is a disposition that may be cultivated by communicating cancer information too frequently or in a way that hinders effective processing (Jensen et al., 2013). Available research suggests that CIO is an aversive motivational disposition that triggers other negative cognitions including fatalistic thinking, backlash against health recommendations, and greater perceived barriers to action (Jensen et al., 2013). Identifying communication strategies that are effective with overloaded individuals is a priority given the large number of adults that exhibit this disposition.

The model of information overload posits that people become overwhelmed with information when it cannot be efficiently categorized (Jensen, Bernat, et al., 2011; Jensen, Carcioppolo, et al., 2011). In this case, categorization information includes cues about importance, certainty, and/or relevance (Jensen, Bernat, et al., 2011; Jensen, Carcioppolo, et al., 2011). Without categorization information the already strained processing capabilities of the human brain react by shutting down, lashing out, and/or rejecting new information (Lang, 2006). Tailored messages may be more effective because they increase the perceived relevance of the information (Jensen et al., 2012). In other words, tailored information is categorized as relevant. Accordingly, we examine whether tailoring is more effective for individuals with high CIO (RQ2).

Narratives may diffuse counter-attitudinal thinking (Dal Cin et al., 2004; Nabi et al., 2007), which has the potential to reduce negative cognitions triggered by CIO. For example, an individual with high CIO could become engrossed in a compelling story about a person fighting cancer − momentarily shutting down fatalistic thinking or backlash − and thus be susceptible to influence delivered through the narrative (Slater & Rouner, 2002). Consistent with this idea, past research in the context of mammography suggested that narrative messages might be more influential than expository messages with lower education audiences and those who distrust cancer information (Kreuter et al., 2010). In light of this research, we examine whether narratives are more effective for individuals with high CIO (RQ3).

Method

Study design

A 2 (stock vs. tailored) × 2 (no narrative vs. narrative) message intervention was carried out in eight Indiana worksites (six hospitals and two manufacturing plants). Participants completed a pretest on a computer (Time 1) and then were randomly assigned by the computer to one of four intervention conditions: stock (no narrative, no tailoring), narrative (narrative, no tailoring), tailored (no narrative, tailored), or tailored narrative (narrative, tailored). The message intervention was delivered immediately after finishing the pretest. The message intervention appeared on the computer and was also printed off and given to the participant as a take home pamphlet.

Three months after initial participation and information reception, participants completed a posttest assessing involvement with the intervention (Time 2). Two years after viewing the intervention materials, eighteen months of insurance claims data were pulled for all participants (Time 3). The insurance claim data tracked whether the participant had filed a claim for colonoscopy during that time span (the main outcome). Participants received $25 for completing the study ($15 at Time 1 and $10 at Time 2). The study protocol was approved and monitored by an institutional research board at Purdue University.

The Time 1 data informed the tailoring of health messages for participants in the tailored conditions. Demographics, dispositions, and past behavior were also assessed. The Time 2 data tracked enduring change in key psychographic variables (e.g., health belief model constructs) and perceptions of the health materials. Health materials are often evaluated immediately after exposure, but this is potentially problematic for two, somewhat conflicting, reasons: (1) it provides participants with minimal time to examine intervention materials, and (2) even if they do examine everything, the immediate posttest assessment fails to assess the enduring impact of message interventions on attitudes, beliefs, and perceptions. Thus, the posttest was delayed three months to allow participants to review the materials at their own pace and to track enduring change. Likewise, claims data were culled years after exposure as it can take considerable time to schedule, complete, and file a colonoscopy claim. There is a six month lag on most insurance data, so only eighteen months are available two years post-intervention.

Participants

Adults ($N = 209$) were recruited from one of eight worksites (six hospitals and two manufacturing plants) via their human resource representatives. Healthcare and manufacturing workers were the focus of the intervention as they have lower rates of colonoscopy screening compared to the general population (Vidal et al., 2009). HR representatives at each respective site sent out recruitment

emails to employees who were 50–75 years of age and behind on their CRC screening (based on insurance claims data). Colonoscopy is recommended every ten years for individuals 50–75 (Smith et al., 2013). Fig. 1 shows recruitment attrition by condition and phase. More women dropped out ($n = 42$) than men ($n = 37$). Individuals dropping out of the study did not differ in terms of age, stage of change, or on any of the tailored variables (e.g., curability). Of the 288 participants that started the study, approximately 27% ($n = 79$) were lost to follow-up. Participants were lost to follow-up because they did not respond to the Time 2 survey ($n = 18$) or refused to provide their claims data at Time 3. Concerning the latter, all participants consented to share their claims data before participating in the Time 1 survey; however, per IRB guidelines, participants had to reconfirm their consent before the data was culled at Time 3. Most of the attrition ($n = 61$) was a byproduct of this double consent process.

The mean age of participants in the current sample was 55.56 ($SD = 4.24$) with a range of 50–71. Most participants were female (71.8%) and Caucasian (97.1%). Education was distributed as follows: high school degree (27.3%), some college (8.6%), associate degree (19.1%), bachelor degree or higher (45.0%). In terms of household income, approximately 18.7% of the sample earned below the U.S. average ($51,000/year). Sixty-seven percent of the participants reported receiving colonoscopy in the past, a slightly higher proportion than reported statewide (between 59.3% and 63.5%; Centers for Disease Control & Prevention, 2010).

Intervention

Participants were randomly assigned to one of four conditions: stock, narrative, tailored, or tailored narrative. All participants received intervention materials in two ways: as a web message delivered immediately after completing the baseline survey and as a take home pamphlet. The web message and pamphlet were identical. Participants were provided with the message in two formats to increase exposure to the intervention and because pamphlets yield larger tailoring effects (Noar et al., 2007) and provide lower literacy participants with take home materials they can navigate at their own pace (Jensen, 2012). Materials for all four conditions were refined via 8 focus groups with 46 adults between the ages of 50 and 75 recruited from Indiana hospitals not participating in the study. All of the focus group participants were employees of the hospitals. Based on the focus group research, the pamphlet layout and design were altered to include more white space, imagery, and the color blue (instead of green). Blue is the official color of CRC awareness month. From a message standpoint, two narratives were dropped (as participants felt they were unrealistic), one was refined (to include a visit with a doctor), and four of the messages designed to reduce perceived barriers were modified. For example, the message designed to reduce concerns about pain was modified to include a sentence about sedation. The transit message was modified so that people were encouraged to call their provider to talk about options (the original message noted specific shuttle services that were available). Information about the affordability of fecal occult blood tests (FOBT) was added to the cost message, and the time to do an FOBT (5 min) was added to the time message.

The stock message was based on existing CRC screening materials obtained from the American Cancer Society, National Cancer Institute, and local public health departments. The pamphlet provided information about CRC risk factors, screening options, and benefits of screening. It also included a section on the development of CRC (for the stock pamphlet, see online Appendix 1).

The narrative message was identical to the stock message except that the development of CRC section contained a story. For the tailored narrative condition, the story was tailored to participants'
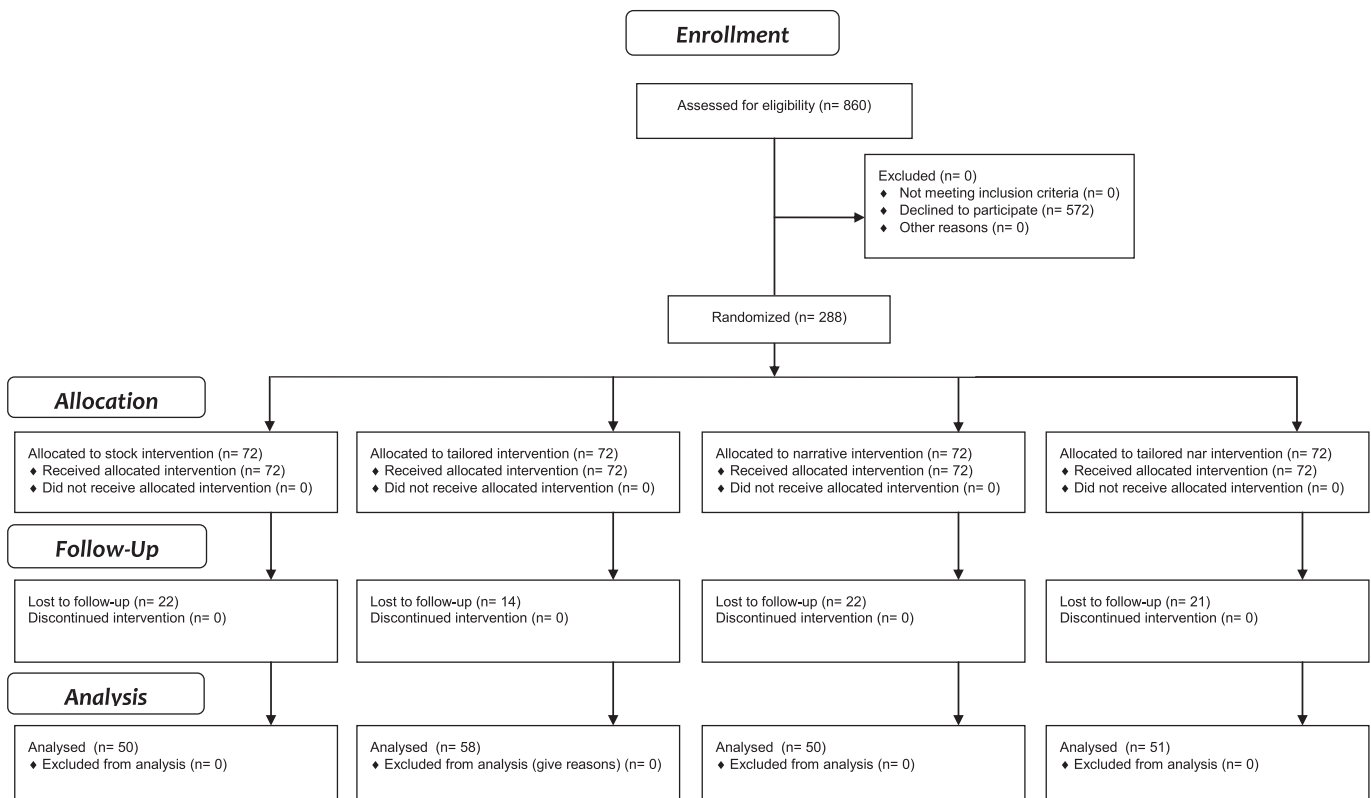

Fig. 1. Recruitment diagram.

gender and race/ethnicity. Accordingly, the narrative condition had to contain a narrative that was not tailored. The research team created several narratives that were ambiguous concerning gender and race/ethnicity. Of those, the most popular was a story about a fictional person called "Pat." Pat provided a gender-neutral name for the narrative, which was confirmed through focus group discussions where participants used the descriptor him and her with similar frequency (for the stock pamphlet, see online Appendix 2).

The tailored message used information from the baseline survey to personalize both the web message and the pamphlet (for the tailored pamphlet, see online Appendix 3). The tailored pamphlet in the appendix includes notations to reveal where information was personalized. The tailored message was personalized on 9 factors: age (notated as "A" on the pamphlet), gender (B), self-efficacy (C), response efficacy (C), curability (D), cancer worry (D), perceived barriers (E), perceived benefits (G), and stage of change (F). The pamphlets have abundant white space because the tailored conditions needed to have room for varied amounts of information. For example, in the tailored condition a person received a minimum of 3 messages about perceived barriers (the panel marked with an E) but they could receive up to 8 messages if they expressed concern about every possible barrier. This was done to minimize information overload. Participants only received minimal information unless they specifically expressed concerns about a barrier.

The tailored narrative message was identical to the tailoring message except that participants received a narrative that was tailored to their gender (male, female), age (50–60; 61+), and race/ethnicity (white, black, Hispanic, and other). Other narratives were used for participants that reported Asian/Pacific Islander, Native American/American Indian, or mixed racial/ethnic heritage. Sixteen narratives were created for the study. A sample tailored narrative pamphlet is provided in online Appendix 4.

Measures

Time 1

For the baseline survey, most of the questions had dichotomized response options (yes, no) to facilitate tailoring. For instance, participants responded yes or no to a perceived barrier question asking whether they had concerns about the cost of the test or lack of insurance coverage (McQueen, Tiro, & Vernon, 2008). Participants were asked about past colonoscopy adherence ($0 = no past colonoscopies, 1 = past colonoscopy$) and the month/date/year of the colonoscopy (to calculate whether they were up to date). Only one participant had a personal history of colon cancer (they were removed from the study), but several had an immediate family member with a personal history ($0 = no family history, 1 = family$

history). Past research has shown that having a conversation with a physician about colonoscopy is a strong predictor of behavior (Beydoun & Beydoun, 2008), thus participants were asked, "Have you ever discussed colorectal cancer screening with your doctor?" ($0 = no, 1 = yes$; Griffith, Fichter, Fowler, Lewis, & Pignone, 2008). Participants also completed questions assessing age, gender, self-efficacy (measured using a scale from McQueen et al., 2008), response efficacy (Tiro, Vernon, Hyslop, & Myers, 2005), curability (Myers et al., 1994), cancer worry (Jensen, Bernat, Davis, & Yale, 2010), perceived barriers (McQueen et al., 2008), perceived benefits (McQueen et al., 2008), and stage of change (Vernon et al., 2011). Percent of participants needing tailoring on each of these variables is presented in Table 1.

Cancer information overload was measured using an 8-item battery assessing feelings about the overwhelming quantity of cancer information. Four response options (*strongly disagree* to *strongly agree*) were provided for each item (i.e., higher scores for greater overload). The scale demonstrated excellent reliability ($M = 2.37, SD = .77, \alpha = .87$). Psychometric details for this scale are reported elsewhere (Jensen et al., 2013).

Time 2

Involvement with the health intervention was assessed in two ways: time spent with the materials and elaboration about colon cancer after exposure. Time with the health materials was assessed with a 4-point item ($1 =$ spent very little time with the materials, $4 =$ spent a lot of time reviewing the materials; $M = 2.50, SD = .60$). Elaboration was measured using 3 items, "I have been thinking about colon cancer screening, " "Colon cancer has been on my mind, " and "I have seriously considered getting screened for colon cancer" that were assessed on 5-point scales ranging from *not at all* to *a lot* ($M = 2.78, SD = 1.25, \alpha = .94$). In addition to involvement questions, participants completed non-dichotomized measures for self-efficacy, response efficacy, curability, cancer worry, perceived benefits, perceived barriers, and perceived susceptibility (Tiro et al., 2005) and severity (Witte, Cameron, McKeon, & Berkowitz, 1996). Threat susceptibility and severity are components of the health belief model (Glanz & Bishop, 2012) and logical mediator variables as tailoring information on other factors (e.g., age, gender) could impact perceived threat. Participants also completed a four-item measure of perceived message relevance. The perceived message relevance scale was based on a 2-item measure that had demonstrated moderate reliability ($\alpha = .79$; Jensen et al., 2012). Two additional items were added in an effort to increase the reliability of the measure: "The pamphlet was primarily general information that wasn't applicable to me" and "The pamphlet was not customized at all." The original 2-item version of the measure

Table 1
Time 1 and Time 2 perceptions.

	Barriers	Benefits	Self-efficacy	Resp. efficacy	Curability	Worry − Severity	Worry − Frequency	Threat severity	Threat suscept.	Message relevance
Time 1 survey										
% Need Tailored	44.8%	36.1%	43.5%	10.5%	6.2%	79.4%	51.7%	–	–	–
Time 2 survey										
Mean	1.58	3.41	3.67	3.96	3.29	3.26	1.39	4.38	2.75	3.40
SD	.50	.56	.51	1.16	.87	1.53	.85	.87	4.38	.51
Alpha	.74	.85	.95	.91	–	.86	.82	.87	.84	.63
Scale Points	4	4	4	5	4	7	7	5	5	5

Note. Participant perceptions at Time 1 and Time 2. At Time 1 participants provided dichotomized responses (yes, no) to facilitate tailoring. Percent (%) need tailored indicates the percent of participants that needed tailored messages on that perception. At Time 2 participants were asked the same items again and responded using traditional Likert scales. Means, standard deviations, alphas, and the number of scale points are provided for Time 2 measures. Higher scores indicate increased perception of the construct being measured (e.g., higher barriers score equates to greater perceived barriers, and higher curability score equates to greater perceived curability). Threat severity, threat susceptibility, and message relevance do not have Time 1 scores because they were not tailored features (i.e., no message targeted these feeling directly). They are included here because tailoring is thought to impact these variables (e.g., tailoring to perceived barriers could increase perceived message relevance).

demonstrated low reliability ($\alpha = .62$). The full 4-item measure was slightly better but still low ($\alpha = .63$). Means, standard deviations, alphas, and scale points for all Time 2 measures can be found in Table 1.

Time 3

The research team contacted HR representatives at each worksite two years after the intervention. All participants had consented to share insurance claims data with the research team prior to completing the pretest. The HR representatives confirmed employee participation, consent, and then pulled 18 months of claims data for each participant. The claims data tracked four CRC cancer screening activities including colonoscopies, double barium enemas, sigmoidoscopy, and fecal occult blood tests (FOBTs). Of the 209 participants, 24 filed a screening claim (17 colonoscopies, 7 FOBTs) in the 18 months following the intervention (11.5%, see Table 2). No participant filed a claim for sigmoidoscopy or double-contrast barium enema. Thus, the analysis will focus on three outcomes: Colonoscopy claims, FOBT claims, and any CRC cancer screening claims (i.e., Colonoscopy and FOBT claims combined).

Analysis

For those who completed all three phases of the study, 3% ($n = 7$) had missing data that was replaced using expectation maximization (Schafer & Olsen, 1998). Participants were missing less than 2% of their data (as a result of skipped or missed questions).

Hierarchical logistic regression was utilized to test whether the experimental conditions predicted CRC cancer screening (H1, H3), and whether there were significant interactions among the experimental conditions and CIO (RQ1–3). For the hierarchical logistic regression, screening behavior was the dependent variable (did not screen $= 0$, did screen $= 1$), and the other variables were blocked as follows: worksite (hospital $= 0$, manufacturing $= 1$), past colonoscopy screening behavior, prior conversations with doctors about colonoscopy, family history of CRC, demographics (age, gender, education, and worksite), and involvement with the intervention (time w/pamphlet and elaboration) entered in Block 1, CIO

Table 2
Number of participants filing a screening claim by condition.

Condition	Not tailored freq. (% within)	Tailored freq. (% within)	Total freq. (% within)	N
Any screening test				
No Narrative	3 (6.0%)	5 (8.6%)	8 (7.4%)	108
Narrative	8 (16.0%)	8 (16.0%)	16 (15.8%)	101
Total	11 (11.0%)	13 (12.0%)		
N	100	109		
Colonoscopy				
No Narrative	2 (4.0%)	2 (3.4%)	4 (3.7%)	108
Narrative	5 (10.0%)	8 (15.7%)	13 (12.9%)	101
Total	7 (7.0%)	10 (9.2%)		
N	100	109		
FOBT				
No Narrative	1 (2.0%)	3 (5.2%)	4 (3.7%)	108
Narrative	3 (6.0%)	0 (0.0%)	3 (3.0%)	101
Total	4 (4.0%)	3 (2.8%)		
N	100	109		

Note. Table presents raw counts and percent within (in parentheses). Number of participants that filed a claim with their insurance after the intervention. Insurance claims data was monitored for 18 months. All participants in the study had insurance from their employer. 'Any screening test' is the combined category (colonoscopy or FOBT). Twenty four participants filed a claim following the intervention (17 colonoscopies, 7 FOBTs). Sample sizes for individual cells are as follows: stock = 50, narrative = 50, tailored = 58, tailored narrative = 51.

in Block 2, tailoring and narrative conditions in Block 3, and interactions between tailoring, narrative, and CIO in Block 4. This analysis is designed to test whether the experimental factors predict variance above and beyond known predictors (Block 1) and the moderator variable (Block 2). It also tests whether interactions (Block 4) significantly enhance prediction compared to the direct effects of the experimental factors (Block 3).

G*Power was utilized to calculate achieved power (Faul, Erdfelder, Buchner, & Lang, 2009). Meta-analyses of tailoring research have found a small, but significant effect ($r = .07$), which is slightly larger for cancer screening interventions ($r = .08$; Krebs et al., 2010; Noar et al., 2007). Power analysis calculations for logistic regression require effect size to be entered as an odds ratio; therefore, the 'r' was converted to a Cohen's d ($d = .161$), which was then translated to an odds ratio (OR $= 1.339$; see Borenstein, Hedges, Higgins, & Rothstein, 2009). With a sample size of 209, the design had modest power (.66) to detect an effect of that size (Faul et al., 2009). For comparison purposes, the design had strong power (.99) to detect a medium effect (OR $= 2.477$; Cohen, 1988).

PROCESS was utilized to test for mediation and moderated mediation (H2, H4a–H4e). PROCESS is a conditional process modeling program that utilizes an ordinary least squares- or logistic-based path analytical framework to test for both direct and indirect effects (Hayes, 2012; Preacher, Rucker, & Hayes, 2007). Moderated mediation analysis (Model 8 in PROCESS) was carried out with screening behavior as the outcome, tailoring as the predictor, narrative as the moderator, and all covariates from the previous analysis. Ten mediator variables were examined including perceived barriers, perceived benefits, self-efficacy, response efficacy, curability, cancer worry frequency and severity, perceived message relevance, and perceived severity and susceptibility. Interactions were probed using procedures outlined in Hayes and Matthes (2009).

Results

Three hierarchical logistic regressions were utilized to evaluate the effectiveness of tailored and narrative message approaches. The regression was not significant for FOBT claims, *Cox & Snell $R^2 = .09$, -2 Log Likelihood $= 41.86$, $\chi^2 = 19.18$, df $= 15$, $p = .206$*, and it was only significant at the second block for the combined category, *Cox & Snell $R^2 = .07$, -2 Log Likelihood $= 133.05$, $\chi^2 = 4.26$, df $= 1$, $p = .039$*. Individuals with greater CIO were less likely to file a CRC cancer screening claim, $b = -.70$, SE $= .35$, Wald $= 4.03$, $p = .045$, OR $= .499$.

For colonoscopy, the hierarchical regression was significant at all four blocks (see Table 3). Past screening and elaboration positively predicted screening. CIO was negatively related to screening such that those with greater overload were less likely to screen. Participants who viewed a narrative (tailored or not) were four times as likely to screen (support for H3). Tailoring did not predict screening (no support for H1); however, there was a significant interaction between tailoring and CIO. The interaction was probed at three points (the mean and +/− one standard deviation). Tailoring was not related to colonoscopy screening for those with CIO scores one standard deviation below the mean ($b = -.41$, SE $= .68$, $z = -.60$, $p = .55$) or at the mean ($b = 1.18$, SE $= .79$, $z = 1.49$, $p = .14$). It was significantly related to colonoscopy for those with CIO scores one standard deviation above the mean ($b = 2.76$, SE $= 1.43$, $z = 1.93$, $p = .05$). In other words, tailoring was effective at increasing screening behavior for those with higher overload. There was no significant narrative $\times$ CIO interaction.

Moderated mediation analysis was utilized to test indirect effects (e.g., whether perceived benefits mediated the significant relationship between narrative condition and colonoscopy

Table 3
Logistic regression predicting colonoscopy screening.

	B (SE)	Wald	Odds ratio	Cox & Snell R^2
Block 1				.09*
Age	−.11 (.07)	2.34	.90	
Gender	.79 (.81)	.93	2.20	
Education	.18 (.24)	.56	.07	
Worksite	−.63 (.76)	.69	.53	
Prior Colonoscopy	−2.64 (1.10)	5.75*	.07	
Family History	−1.34 (1.11)	1.46	.26	
Talk to Physician	.79 (.71)	1.23	2.20	
Time w/Pamphlet	−.12 (.49)	.06	.88	
Elaboration	.49 (.23)	4.55*	1.63	
Block 2				.12*
CIO	−1.02 (.45)	5.25*	.36	
Block 3				.14*
Tailoring	.17 (.61)	.08	1.19	
Narrative	1.57 (.68)	5.29*	4.81	
Block 4				.16*
Tailoring × Narrative	.79 (1.42)	.31	2.20	
Narrative × CIO	−.82 (1.06)	.59	.44	
Tailoring × CIO	2.10 (1.06)	3.94*	8.17	

Note. Hierarchical logistic regression predicting colonoscopy screening. Compared to the stock condition, the narrative conditions yielded a clinically significant absolute increase of 8.9% in colonoscopy screening. Compared to non-narrative conditions, the narrative conditions yielded a clinically significant absolute increase of 9.2% in colonoscopy screening. *p < .05.
Coding of dichotomous variables.
Gender: Male = 0, Female = 1.
Worksite: Manufacturing = 0, Hospital = 1.
Prior Colonoscopy: no past colonoscopies = 0, past colonoscopy = 1.
Family History: no family history = 0, family history = 1.
Talk to Physician: no = 0, yes = 1.
Tailoring: no tailoring = 0, tailoring = 1.
Narrative: no narrative = 0, narrative = 1.

screening). No significant indirect relationships were found. In other words, there was no support for H2 and H4a–4e.

Tailoring was marginally related to perceived benefits, $b = -.20$, SE = .10, $t = -1.96$, $p = .05$, and perceived message relevance, $b = .18$, SE = .10, $t = 1.78$, $p = .08$. Those in the tailored conditions perceived fewer benefits to CRC screening, even though participants indicated the message had greater personal relevance. Two significant tailoring × narrative interactions were found: perceived barriers ($b = .25$, SE = .14, $t = 1.78$, $p = .08$) and perceived message relevance ($b = -.30$, SE = .14, $t = -2.10$, $p = .04$). Tailoring decreased perceived barriers for those in the narrative condition ($b = -.21$, SE = .10, $t = -2.18$, $p = .03$) but not in the no narrative condition ($b = .01$, SE = .10, $t = .08$, $p = .94$). Tailoring was perceived as more relevant for those in the no narrative condition ($b = .19$, SE = .10, $t = 1.92$, $p = .06$) compared to the narrative condition ($b = -.12$, SE = .10, $t = -1.13$, $p = .26$).

Given the significant interaction between tailoring and CIO, a follow-up moderated mediation model was tested with tailoring as the predictor, CIO as the moderator, and narrative included as a covariate (with all other covariates). Once again, no significant indirect relationships were found.

Discussion

Researchers from a number of fields have examined strategies for increasing CRC screening adherence. These efforts have yet to identify a cost-effective strategy that consistently increases screening adherence. Vernon et al. (2011) noted this following the failure of another randomized controlled trial:

To date, as a research community, we have yet to identify an intervention approach for CRC screening that is consistently more effective than usual care or minimal cues despite using the

best available theoretical evidence and state-of-the-science methods. (p. 297)

The current study identified a promising direction for future research as narratives proved to be effective at increasing colonoscopy screening. Individuals who received narratives were 4 times more likely to screen over an 18 month span. This is an also an encouraging finding as narratives may be more cost effective than tailoring.

Future research should continue to explore the persuasive potential of narratives in CRC screening efforts. Identifying features of narratives that increase impact is a priority (Kreuter et al., 2007; Winterbottom, Bekker, Conner, & Mooney, 2008). For example, Larkey and Gonzalez (2007) found that culturally aligned narratives increased intentions to engage in cancer prevention. Dillard et al. (2010) found using narratives to correct forecasting errors significantly reduced perceived barriers to CRC screening, and also increased intentions to screen. In the current study, tailored narratives also reduced perceived barriers; thus, narratives might be especially effective at countering perceived barriers to adherence. Relatedly, it is possible that certain story types will resonate more with particular subgroups. Researchers should construct a taxonomy of CRC screening stories and then evaluate the efficacy of those stories with target populations. Similar research has been conducted in the context of mammography by evaluating the impact of survivor narratives (Kreuter et al., 2010).

Narratives were more effective in this study, but the mechanism of effect is unclear. Ten mediator variables were examined, and none of them explained the relationship between exposure to narratives and CRC screening behavior. Narrative research has identified several narrative-specific constructs that should be examined in the future. Narrative transportation is how much people get lost in a story; it is a logical mediator of narrative impact (Green & Brock, 2000). Narrative believability captures story completeness, consistency, plausibility, and coverage (Yale, 2013). Stories that are perceived as more believable should resonate with audiences and yield more impact on decisions. Finally, character identification is how much audience members empathize with particular characters in the story (Busselle & Bilandzic, 2008). Greater identification should translate to narrative effect.

The results of this trial are somewhat concerning as well. Narrative communication has significant potential to be selective and misleading. Stories can represent the typical case, but they can also depict relatively unusual events and make that occurrence seem normative. Research on exemplification theory has found the latter to be true in that people tend to perceive stories as exemplars − representative cases − even when provided with contradictory statistical information (Zillmann, 2006). For instance, while some narratives utilized in this study addressed barriers (e.g., the preparation for a colonoscopy), none depicted or discussed potentially negative side effects of CRC screening (e.g., a perforated colon). Moreover, several of the narratives depicted people having colonoscopies that found cancer. This is potentially misleading, as the typical colonoscopy finds nothing or precancerous polyps. Other information in the pamphlet hedged this situation by noting that colonoscopies often find precancerous polyps (rather than cancer), but exemplification theory posits that the story would likely trump the didactic information (Zillmann, 2006). Further research on the ethical utilization of narrative communication is warranted especially if this strategy continues to prove effective.

Tailoring did not significantly increase CRC cancer screening in the current study. However, power was modest (.66) to detect the relatively small effect reported by past meta-analyses of tailored cancer screening intervention ($r = .08$, 95% CI: .06, .09). Moreover,

the obtained effect (OR = 1.19 is the equivalent of r = .05) falls just outside the 95% confidence interval suggested by meta-analytic data. Combined, these results suggest the tailoring intervention may have yielded an effect in line with past research.

One limitation of existing tailoring research is that there may be insufficient ancillary research to create effective messages. Tailored messages will only be effective if they can counter the attitudinal/belief deficits identified in the baseline survey. If a person has limited self-efficacy to engage in CRC screening, then he/she needs to receive messages that will increase his/her efficacy. Perhaps the self-efficacy deficit stems from concerns about how to get to an appointment, which might be countered by providing additional information about available transportation to CRC screening locations. However, providing information that appears to counter an attitude/belief does not necessarily equate to change. Participants in the current study were provided with information of this sort and it did not consistently alter their attitudes/beliefs. Others have reported similar problems (Vernon et al., 2011), but there are examples of tailored messages having significant impact upon relevant attitudes/beliefs (Jerant et al., 2007). Taken as a whole, there is still a great deal to learn about crafting messages to influence variables such as self-efficacy, response-efficacy, perceived threat, and so on. As researchers make progress on these fronts it is possible that tailoring will prove more effective as well.

The direct effect of tailoring was not significant, but the strategy was successful at increasing CRC screening for participants with high CIO. This finding will need to be replicated and weighed against concerns about cost-effectiveness. That is, the tailoring × CIO interaction was largely exploratory in the current study. The findings are intriguing and logical, yet uncertain, barring further validation. Furthermore, it is possible that tailoring is beneficial for high CIO individuals, but the time and monetary costs of delivering tailored messages may offset this benefit. For example, Lairson et al. (2008) found that tailoring was more effective than targeting; however, they ultimately advocated targeted postcards as the preferred strategy because tailoring proved too time consuming and expensive. Still, there is reason for optimism as individuals with higher CIO were 8 times more likely to screen if they received tailored messages. At the very least, this suggests that tailoring might be a useful follow-up approach for subsets of individuals who exhibit signs of CIO or who are not responding to other strategies. Relatedly, there was no significant narrative × CIO interaction, possibly because no such interaction exists. Of course, it is also possible that the narratives in this study failed to produce significant transportation (a possible mechanism for this effect) or that the study sample was insufficiently overloaded (or too educated) to exhibit such an effect.

Tailored narratives were not more effective than non-tailored narratives, however, the trend was in the expected direction (i.e., tailored narratives more effective) and the tailoring × narrative interaction yielded a moderate, but non-significant effect size (OR = 2.20 is the equivalent of r = .21). It is possible that a design with more power will reveal a significant effect for tailored narratives, or that other forms/degrees of tailoring will prove effective. The current study examined character tailoring with main characters matched to the recipients' gender, age, and race/ethnicity. However, tailoring and targeting exist on a personalization continuum, and additional personalization of the character may have increased the impact of the tailored narrative manipulation. Alternatively, plot tailoring may be a more effective strategy for tailored narratives. Tailoring stories to recipients' barriers, benefits, or self-efficacy could increase relevant attitudes/beliefs and therefore behavior. Additional research on tailored narratives will identify whether there is an optimal form/degree of story tailoring. One note of caution: computerized algorithms make it possible to tailor narratives on numerous dimensions (i.e., comprehensive tailoring). Comprehensive tailoring might be optimal, but past research has suggested that tailored messages are most effective when adapted to 4–5 constructs (Noar et al., 2007) and highly personalized stories could be viewed as manipulative and thus trigger psychological reactance (Rains, 2013).

No strategy was effective at increasing FOBT utilization. The intervention did discuss and advocate CRC screening in general, and specifically addressed FOBT. FOBT was not the focus of any narrative, though several did mention it. In light of the findings, researchers should examine whether a narrative or tailored intervention focused exclusively on FOBT yields significant effects. It is also possible that the intervention would have been more effective at increasing FOBT utilization if the research team had provided participants with free or low cost home screening kits. Interventions providing FOBT kits to patients during annual influenza vaccinations (the FLU-FOBT approach) have yielded increased screening (Walsh, Gildengrorin, Green, Jenkins, & Potter, 2012).

The current study was limited in several ways. First, the sample was relatively small, insured, and predominantly female. Findings may not generalize to other populations, notably those without insurance. Second, all participants were recruited from eight worksites (six hospitals and two manufacturing plants). Third, the tailoring intervention did not influence most of the variables that were tailored (e.g., self-efficacy). Past tailoring studies in the context of CRC screening have reported similar problems (e.g., Vernon et al., 2011). This could indicate that the tailoring intervention was ineffective, that tailoring does not significantly impact these variables, or that tailoring effects on cognitions dissipate relatively quickly. In the current study, researchers should also consider the possibility that assessing impact of the tailoring intervention 3 months after exposure to the messages could have muted or diluted the effect. Ideally, a future intervention will measure mediators immediately after exposure to the message and at multiple points in time thereafter (e.g., 2 weeks, 1 month, 3 months) so researchers have a better understanding of the duration of tailoring effects (for a related discussion, see Krebs et al., 2010). Fourth, the obtained screening rates were lower than past studies; for instance, previous CRC screening interventions have reported screening rates of about 20–30% over a 12 month span (e.g., Vernon et al., 2011). However, most studies are clinical interventions or worksite interventions with in house/onsite medical staff (Tilley et al., 1999). Worksite interventions that require participants to schedule their own screening at an offsite location may have additional barriers. Fifth, participants were asked about prior CRC screening conversations with healthcare providers, but the question was answered at a time point removed from when the conversations might have occurred, raising the likelihood that recall bias affected responses. Further, the item did not include a time frame, so participants may have struggled to answer the question accurately without a clear referent (see Griffith et al., 2008). Finally, approximately one-quarter of the participants were lost to follow-up. Most of these participants were lost as they did not complete the second consent form allowing us to pull their claims data at Time 3. Not surprisingly, participants lost to attrition were virtually identical to those who stayed in the study, as the attrition was likely unrelated to the content of the intervention.

In an RCT, narratives outperformed tailored messages at increasing CRC screening. Those exposed to narratives were four times more likely to screen for CRC. These findings suggest that communication researchers should continue to examine the impact of narratives, especially in the context of CRC screening. If the findings here replicate, then tailoring may be a valuable follow-up strategy to reach individuals with high cancer information overload.

Acknowledgments

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2013.12.003.

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