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A pilot evaluation of the efficacy of a couple-tailored print intervention on colorectal cancer screening practices among non-adherent couples

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Abstract

The objective of this study was to evaluate the efficacy of a couple-tailored print intervention on colorectal cancer screening (CRCS), CRCS intentions and on knowledge and attitudes among couples in which neither partner is on schedule with regard to CRCS. A total of 168 married couples with both members non-adherent with CRCS were randomly assigned to receive either a couple-tailored print (CTP) pamphlet accompanied by a generic print pamphlet or a generic print pamphlet only (GP). Couples completed measures of CRCS, intentions, relational perspective on CRCS, discussions about CRCS, spouse support for CRCS, spouse influence strategies, CRC knowledge, perceived CRC risk, and CRCS benefits and barriers. Results indicated there was no significant benefit of CTP versus GP on CRCS, but there was a significant increase in CRCS intentions in CTP compared to GP. There was also a significant increase in relationship perspective on CRCS, a significant increase in husbands' support of their wives' CRCS, and a significant increase in CRCS benefits in CTP. In summary, CTP did not increase CRCS practices but increased intentions and perceived benefits of CRCS as well as improving couples' ability to view CRCS as having benefit for the marital relationship.

Keywords

colorectal cancer screening; behavioral interventions; couple focused interventions

Introduction

Colorectal cancer (CRC) is the second leading cause of cancer deaths in the United States. The American Cancer Society estimated that there were about 141,210 new cases of colorectal cancer diagnosed in 2011 in the US (American Cancer Society [ACS], 2011). Although the death rate has been declining for the past 15 years, this disease caused about 49,380 deaths in 2011 (ACS, 2011). CRC mortality rates can be reduced substantially through screening via fecal occult blood tests (FOBT) and sigmoidoscopy (SIG). While

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uptake rates for colorectal cancer screening (CRCS) have been increasing, participation in screening remains relatively low. Novel approaches for improving CRCS need to be developed and rigorously evaluated.

A number of individually-focused behavioral interventions have been developed for individuals who are not compliant with CRCS (Lipkus et al., 2005; Marcus et al., 2005; Wardle et al., 2003). Although some interventions have reported significant effects upon screening uptake (Myers et al., 1991; Wardle et al., 2003), other interventions have not yielded significant effects (Zapka et al., 2004). One limitation is that individual-level interventions do not take advantage of the social context in which health behavior occurs. The marital relationship is an example of a social context factor that has not been incorporated into intervention efforts. Research has indicated a correspondence between spouses' health practices (Kolonel & Lee, 1981; Wilson, 2002). Although assortative mating and mate selection may contribute to this correspondence, it may also reflect the influence spouses have on each other in terms of health behaviors (Sexton et al., 1987; Wilson, 2002). Indeed, our pilot data suggests that the correspondence between couples' CRCS practices is 65% (Manne, unpublished).

Despite the potential of a couple-focused approach to improving CRCS, there has only been one couple-focused CRCS intervention study published to date. In a non-randomized clinical trial, Van Jaarsveld, Miles, Edwards, and Wardle (2006) sent households invitations to CRCS and evaluated the role of marital status and whether both individuals at the same address were invited to participate. Individuals were sent a questionnaire assessing "interest in bowel screening." Individuals who indicated interest in having a flexible sigmoidoscopy were then randomized to an intervention or control group. People living at the same address with someone of the opposite sex were randomized to the same study arm. In the intervention group, participants were sent a specific appointment time by mail. Married persons who were invited to participate alone either had a partner who was not within the age range (55–64), lived at a different address, or was registered with a different general practitioner who was not participating in the study. Screening attendance was highest among individuals who were married and were invited to participate with their partners (74.8%) compared with individuals who were unmarried and were invited to participate alone (63.4%). There have been limited studies of couple-based interventions for other health behavior changes and these studies have had mixed results. Studies targeting physical activity and nutrition (Burke, Giangiulio, Gillam, Beilin, & Houghton, 2003; El-Bassel et al., 2010) and HIV medication adherence (Remien et al., 2006) among HIV-serodiscordant couples have shown positive effects. Burke and colleagues (2003) found that couples enrolled in a health promotion program reported greater physical activity, decreased their consumption of high-fat foods, and evidenced decreased high density lipoprotein cholesterol compared with a no-treatment control. El-Bassel and colleagues' (2011) couple-focused intervention compared a couple-focused health promotion intervention versus an HIV/STD intervention for HIV-serodiscordant couples and found that the couple-focused intervention improved fruit and vegetable intake, reduced consumption of fatty foods, increased physical activity, increased prostate cancer screening among men, and mammograms among women. Remien et al. (2006) compared a couple-focused intervention focusing on HIV medication adherence among serodiscordant couples, and found that the intervention group evidenced higher adherence to antiretroviral therapy as compared with a control group that did not receive the couples intervention. However, other studies focusing on smoking cessation have not shown positive effects (McBride et al., 2004). While all of these studies are based on the hypothesis that couples can influence one another in positive ways, these studies were not informed by theory regarding how partners influence one another to adopt behavioral changes.

In this study, we conducted a pilot study to provide an initial evaluation of a couple-tailored intervention to increase uptake of CRCS among couples in which neither partner is on-schedule with regard to CRCS. Intervention content was based primarily on the Interdependence Model, which is a dyad-level social psychological theory that highlights the interpersonal context of social situations (Lewis, Butterfield, Darbes, & Johnson Brooks, 2004). This model proposes that influences from one's partner are useful when initiating a behavioral change and interventions that attempt to transform the motivation for behavior change to ascribe meaning for the relationship should be more successful than interventions that ascribe meaning for the change for oneself. According to this model, a couple-based intervention should facilitate both greater intentions to change and ultimately greater actual behavior change on the part of the other partner (as well as oneself) by increasing a relational perspective on the health behavior change. A relational perspective would result in attempts to discuss behavioral change and support and influence the other partner (and oneself) to change behavior. In prior work from the baseline data from this sample, we demonstrated the applicability of this model to couples' CRCS intentions (Manne, Etz, Boscarino, & Weinberg, 2011). We have also shown that higher perceived benefits of CRCS and perceived risk for colorectal cancer and fewer perceived barriers to change may influence the adoption of a relational perspective (Manne et al., 2011). Thus, we included benefits, barriers, and risk in our intervention materials.

The goal of the intervention was to improve CRCS uptake and intentions by facilitating a relational perspective on CRC, by increasing the frequency of couples' discussions about CRCS, by increasing each partner's support for the other partner to have CRCS, and by increasing couples' relational perspective on CRCS. CTP was also tailored to individual characteristics (knowledge, risk, benefits, barriers) from the Health Belief Model (Rosenstock, 1990). A number of behavioral interventions have compared the effectiveness of tailored interventions to the effectiveness of generic interventions in improving CRCS uptake, and these studies have concluded that tailored interventions are more effective (Manne, Coups et al., 2009; Myers et al., 2007). We also evaluated the impact of the intervention on partners' knowledge about CRC and their individual attitudes about CRCS, such as decisional balance and perceived CRC risk because information about CRC and CRCS. We included information about CRCS and tailored content about each participant and partner's CRCS benefits and barriers, because knowledge is associated with CRCS (Koo et al., 2010) and tailoring on benefits and barriers has been shown to facilitate screening uptake (Manne, Coups et al., 2009; Marcus et al., 2005). A usual care (generic print) comparison was selected so that the couple-based materials could be compared with usual care that would be provided to individuals to promote CRCS.

In all analyses, we evaluated gender effects. Previous studies have suggested that women adopt caregiving roles in relationships, particularly with health matters (Guberman, Maheu, & Maille, 1992). Women are also more likely to engage in spouse influence to encourage behavioral changes (Umberson, 1992). Research suggests that men are more likely to be influenced to change by their wives than women by their husbands (Westmaas, Wild, & Ferrence, 2002). Thus, we proposed that CTP may be more effective for husbands and that CTP may result in greater increases in wives' relational perspective and wives' support for their husbands' screening.

Method

Participants

Participants were recruited from Knowledge Networks (KN) panel between June and July, 2010. Inclusion criteria were (1) 50 years of age and older; (2) married and living with a partner at the same residence; (3) both partners at average risk for CRC, defined as

asymptomatic, without a personal and family history of CRC or colorectal polyps, inflammatory bowel disease, or a family history of familial adenomatous polyposis, hereditary non-polyposis CRC, or CRC in more than one first degree relative; (4) both partners non-adherent with standard CRC screening recommendations. Non-adherent was defined as no completion of three-card fecal occult blood test in the last 12 months, flexible sigmoidoscopy in the past five years, or routine colonoscopy in the past 10 years by self-report, and; (5) both partners agreed to participate, and; (6) the KN panel member passed the screener to his/her partner if he/she was eligible.

The CONSORT is shown in Figure I. Of the 4801 KN panel members queried for participation, 3711 (77%) completed the screening survey. Of the 3711 completing the screener, 810 were eligible (22%). Of the 810 panel members who were eligible, 489 passed the survey to their partner (60%). Of these 489 panel members who passed the screener to their spouses, 234 spouses were not eligible (48%), leaving 255 eligible couples (7% of total queried). Of the 255 eligible couples, 251 (98.4%) agreed to participate. Of these 251, 61 consented but did not complete any of the survey and 22 consented but did not complete a sufficient amount of the baseline survey to be included in the study. Thus, a total of 168 couples (21% of eligible KN panel members) were randomized.

Of the 168 couples, 80 were randomized to Generic Print condition (GP) and 86 were randomized to the Couple-Tailored Print condition (CTP). One hundred thirty-eight couples completed the follow-up (82%). It should be noted that the completion rate was higher in the GP condition (89%) than the CTP condition (76%).

Comparisons of panel members who passed the screening survey to their spouses with members who did not on available demographic information (age, gender, education, income) were made to assess possible sources of bias in the final sample of participating couples. These analyses indicated one difference: Panel members who passed the information to their spouses reported less income ($t(808) = 2.2, p < .05, M_{\text{passed to spouse}} = 12.1$ (12 = \$50,000–\$59,999) $M_{\text{did not pass to spouse}} = 12.6$ (13 = \$60,000–\$69,999). Comparisons of participants who completed and did not complete the follow-up indicated no significant differences between the two groups with regard to all baseline demographic, knowledge, and attitudinal variables (all p 's $> .12$).

It should be noted that the final sample contained more White individuals (90%) than the KN sample (79.5%) and the US population (81.2%), and the sample had fewer employed individuals (54.5% for husbands, 51.8% for wives) than the KN sample (67.4%) and the US population (67.6%) (Knowledge Networks [KN], 2010).

Procedures

Participants were identified by KN from their KnowledgePanel, an online research panel. KN's panel recruitment methodology uses similar quality standards established by selected random-digit dialing (RDD) surveys. Panel members are randomly recruited by telephone and mail surveys, and households are provided with access to the Internet. KN selects households using RDD or address-based sampling. Households are sent a mailing informing them that they have been selected to participate in KnowledgePanel. Experienced telephone interviewers call for up to 90 days, with at least 10 dial attempts. Once a person is recruited, they are contacted primarily by e-mail. For panel members without internet access, a laptop is custom configured with an email account. KN maintains a technical support line and will provide on-site installation. KN contacts members who do not respond to survey invitations and attempts to restore contact and cooperation. Panel members who have internet access provide KN with their email accounts and their weekly surveys are sent to that account.

When surveys are assigned to panel members, they receive notice in their password protected e-mail account that the survey is available. Participants follow the link to the survey and acknowledge reading through the online consent document before proceeding. Surveys are self-administered online and are accessible for 6 weeks. If after 6 weeks a survey was not completed, the participant was considered a passive refuser. For the present study, after the baseline surveys were completed by both partners, couples were randomized. Randomization was done by couple. All participants received intervention materials. Six months after the baseline survey, participants received notice that the follow-up survey was available for completion.

Interventions

Couples were mailed the intervention materials in a single envelope. Inside that envelope were two sealed envelopes labeled with each partner's first and last name. Thus, each partner did not read the other partner's materials unless the partner shared it with them.

Generic print intervention (GP)—Participants received an envelope that contained a cover letter and the generic pamphlet. The letter contained a reference to the pamphlet, asked the participant to read the pamphlet, and reminded the participant that the best way to prevent CRC is by having screening. The Centers for Disease Control and Prevention pamphlet, *“Colorectal Cancer Screening Saves Lives”* (Center for Disease Control [CDC], 2009), was the generic print material. The pamphlet reviewed the basic screening tests, presented the screening guidelines and presented basic information about CRC and was mailed within one week of the baseline survey completion.

Couple-tailored print intervention (CTP)—Participants received an envelope that contained the personalized cover letter and the tailored booklet as well as the CDC pamphlet described above. The letter contained a statement that the pamphlet was prepared for the participant, asked the participant to read the pamphlets and discuss them with their spouse, and reminded him/her that the best way to prevent CRC is by having screening. The tailored booklet was developed by the team based upon the theory guiding the research as well as our prior tailored print used for siblings of patients with CRC (Manne, Coups et al., 2009). Drafts of the print were reviewed during three phone conference calls by the study team. Next, the print was pilot tested by obtaining feedback from ten couples who were not adherent with CRCS recruited from the Geisinger Health System. Geisinger Health System is an integrated health services organization in Pennsylvania recognized for its innovative use of the electronic medical record and an advanced medical home. The system serves more than 2.6 million residents throughout 44 counties. The reason this population was selected is because of the ease of identifying CRCS status of patients, which facilitated locating non-adherent couples.

The tailored booklet had four pages and six pictures. The first page was a cover page which was entitled, “Colorectal Cancer is Preventable for You and Your Spouse!” The introductory section outlined the contents of the booklet and informed the participant that the pamphlet was tailored specifically to their survey. A picture of an age-matched couple was included. Tip #1 outlined the four screening options and what was entailed with each as well as a picture of a polyp. Tip #2 described two reasons it was important to include one's spouse in the screening decision. A message tailored to the level of support for the other spouse's screening was included. The section included a picture of a gender matched patient describing his/her discussion with her husband/his wife about screening and the screening experience (in positive terms). Tip #3 was tailored to the participant's highest ranked barriers and described alternative ways of thinking about the barrier. Barriers rated as “agree” or “strongly agree” were used. The spouse's barriers were also described (based on

the spouses' survey answers). A picture of a couple with a tailored message regarding the relational perspective on screening was included. Tip #4 described five ways to have a positive discussion about screening. A picture of a couple with a message tailored to the level of couple discussion about screening was included (based on the participant's answers). Tip #5 contained a tailored message suggesting the participant speak to his/her partner about screening and suggested that participants and their spouses speak with their physicians about screening. The final message was tailored to whether the couple had discussed screening and suggested that the participant initiate a discussion about CRCS with the spouse if they had not discussed it.

Tailoring was accomplished using a computerized schema based on the subject's answers to questions used for tailoring. There were 15 tailored points in the pamphlet. Examples are provided next. One example was under Tip #2. The sentence stated "You told us that it is somewhat important that Gwendolyn gets a colorectal cancer screening test." "Somewhat" was the participant's answer to the question from the spouse support for screening scale, "How important is it that your spouse get a colorectal cancer screening test?" The answer options were "Not at all/a little bit/somewhat important/very important." In addition, the participant's wife's name was in the sentence. A second example of tailoring was in Tip #3 (benefits and risks). Barriers rated as "agree" or "strongly agree" were selected to be highlighted with counter-arguments for the participants' own barriers. If more than three barriers met this criterion, the top ranked were selected. A third example in Tip #5, "Talk to your doctor about getting screened." The sentence stated "You said you have not/occasionally talked to your spouse about colorectal cancer screening tests. Use this information to start a discussion with Gwendolyn." Another tailored response was, "You said that you have frequently talked to your spouse about colorectal cancer screening tests. Use this information to continue the discussion with Willie" An item on the spouse discussion scale was used for this tailoring point. Samples of the tailored print are available from the first author.

Main outcome measures

Primary outcome: Screening status and CRCS intentions

Screening status—Participants were asked whether they had a CRCS test since the baseline survey, what the screening test was, and the date of the screening test. The variable was defined as either had or did not have screening. Participants who reported a screening test at the follow-up were asked for the name and contact information of the physician who performed the test. Of the 32 CRCS procedures that were reported at follow-up, 22 participants would not give KN permission to contact the physician who performed the test. Of the 10 participants providing permission, three procedures were confirmed, one procedure was not confirmed, two physicians stated they would not provide this information without a written consent, and four physicians would not respond to the request.

Screening intentions—A scale developed and used in prior work (Manne et al., 2002; Manne et al., 2003) was used. Participants rated four items about intentions in the next year (on 7-point Likert scales (1 = *not at all likely* to 7 = *extremely likely*). A sample item is "Do you intend to have a colorectal cancer test of any kind in the next year?" Items were summed. Internal consistencies as calculated by Cronbach's alpha were .90 and .93 for husbands and .89 and .93 for wives at Time 1 and 2, respectively.

Secondary outcomes: Relationship factors

Relational perspective—A scale developed specifically for this study was used. We modified the Thinking Beyond Oneself scale adapted from Rakowski and colleagues (1996)

to assess relational perspective on CRCS. A sample item is “I can think of reasons having screening could be beneficial to my spouse”. The adapted scale consisted of the sum of responses on four items which were rated on a Likert scale from *strongly disagree* (1) to *strongly agree* (5). Internal consistencies as calculated by Cronbach’s alpha were .85 and .90 for husbands and .84 and .90 for wives at Time 1 and 2, respectively.

Support for spouse screening—A scale adapted from a prior study (Manne et al., 2002; Manne, Coups et al., 2009) was used. Participants rated how much they supported their spouse having CRCS by rating two items which were rated on a 4 point scale (*Neither unsupportive or supportive* to *extremely supportive*). A sample item is, “To what degree do you support your spouse getting a colorectal cancer screening test?” Internal consistencies as calculated by Cronbach’s alpha were .73 and .77 for husbands and .76 and .81 for wives at Time 1 and 2, respectively.

Discussions with spouse about CRCS—Participants rated how frequently they discussed CRCS with their spouse in the past 6 months on a 4 point scale (*never, once, twice, more than two times*). Participants reported whether or not their spouse had recommended that they get colorectal cancer screening (*Yes/No*). At Time 2, the question specified whether the spouse had made a recommendation during the 6 month period after the participant received the pamphlet.

Spouse influence strategies—A scale adapted from Franks and colleagues (2006) and Lewis and colleagues (2006) assessed communication strategies used with regard to CRCS. Six items assessed the perception that the spouse used supportive strategies in the past month. A sample item is, “Tried to understand your concerns about colorectal cancer screening.” Seven items assessed the perception that the spouse used controlling or unsupportive strategies. A sample item is, “Pressured you to have a colorectal cancer screening test.” Items were rated on a 5-point Likert scale (“*never*” to “*often*”). Participants rated their partner’s behavior. The supportive and unsupportive strategies were combined into a single scale because the item-total correlations were positive and because a factor analysis suggested only a single scale. Internal consistency for the spouse influence strategy scale as calculated by Cronbach’s alpha was .97 and .98 for husbands and .97 and .98 for wives at Time 1 and 2, respectively.

Secondary outcomes: Knowledge and attitudes

Knowledge—We used a scale from our prior work (Manne et al., 2009). Participants completed measures of CRC knowledge (7 items). A sample item is, “Colorectal cancer usually starts as a pre-cancerous growth called a polyp.” Correct answers were summed into a percent total correct.

Perceived risk—Six items used in prior work (Manne et al., 2009) assessed personal CRC risk (percent likelihood of developing CRC, chances compared with individuals the same age, and chances of developing CRC if he/she does not have screening). Items were standardized and the z-scores were averaged. Internal consistencies as calculated by Cronbach’s alpha were .90 and .91 for husbands and .88 and .89 for wives at Time 1 and 2, respectively.

Benefits and barriers of screening—Items were based on Rakowski and colleagues (1996) and our previous work (Manne et al. 2009). The scale consists of ten benefits and 18 barriers rated on a Likert scale from *strongly disagree* (1) to *strongly agree* (5). A sample benefit item is, “Colorectal cancer tests are a part of good health care.” A sample barrier item is, “Current tests for finding colorectal cancer are just not very effective.” Benefits and

barriers were calculated as a sum. Internal consistencies as calculated by Cronbach's alpha for the benefits scale were .92 and .92 for husbands and .89 and .89 for wives at Times 1 and 2, respectively. Alphas for the barriers scale were .89 and .89 for husbands and .85 and .82 for wives at Times 1 and 2, respectively.

Print evaluation

There were two print evaluation measures. The first evaluation measure consisted of five dichotomous items assessing whether they remembered receiving the materials, whether they read the materials, whether they saved the materials, whether they showed the materials to the spouse, and whether the spouse showed it to them. The second evaluation measure consisted of 17 items assessing the degree to which the materials were comprehensible, addressed reasons they may have had for not getting screening, provided ideas about how to talk about CRCS with the spouse, and prompted discussions about CRCS with the spouse. These 17 items were rated on a 6-point scale. For the second scale, the Cronbach's alpha was .91 for men and .96 for women.

Analysis plan

Analyses were conducted using multilevel modeling to account for nonindependence between scores from spouses. In these analyses, couple was the upper-level unit with treatment condition as an upper-level predictor variable, and individual was the lower-level unit with gender as a lower-level predictor. Outcome variables that were categorical in nature (e.g., recalling receiving the pamphlet, having CRCS) were analyzed using a binomial logit multilevel model that compared the relative frequencies for the outcome as a function of condition, gender, and the condition by gender interaction (GENLINMIXED in SPSS version 19). Quantitative outcomes were analyzed using standard multilevel modeling (MIXED in SPSS version 19).

Results

Preliminary analysis

Sample characteristics—Participant characteristics are shown in Table I.

Intervention evaluation—First, using the statistical approach outlined above, we evaluated whether there were differential intervention effects on whether participants recalled receiving the pamphlet, saved the pamphlet, read the pamphlet, showed the pamphlet to their spouses, and whether their spouses showed them the pamphlet. As noted, 30 of the 168 couples did not participate in the follow-up, and so analyses of these variables, which were assessed only at the follow-up, were based on 138 couples.

Table II presents the relevant cell frequencies and percentages. Analyses indicated that participants recalled receiving the pamphlet significantly more in CTP relative to GP, $F(1,270) = 6.93, p = .009$, such that 79.7% of participants recalled receiving the information in CTP but only 65.2% recalled receiving the information in GP. Likewise, CTP participants were more likely to report having saved the pamphlets, $F(1,193) = 11.48, p = .001$, with 55.2% of CTP participants saving it but only 30.4% of GP participants saving it. There were no significant gender differences or gender by condition interactions for these variables. Across condition and gender, 89.9% of participants reported reading the pamphlet(s), and there were no significant main effects or interactions for this variable. Similarly, 79.7% reported showing the pamphlet(s) to their spouse with no significant main effects or interactions.

Second, using the analysis approach outlined above, we evaluated whether the intervention had an effect on the 17-item print evaluation. There were no significant differences across the groups (Treatment main effect $F(1,93) = 1.43, p = .234$; Gender main effect, $F(1,74) = .41, p = .524$; Treatment by Gender interaction $F(1,74) = .93, p = .339$). Across both conditions, the average evaluation of the pamphlets was positive ($M = 75.41, SD = 15.07$ on a scale that could range from 17 to 103). The average positive evaluation was between “somewhat agree” and “moderately agree.”

Intervention effects on CRCS practices and intentions

Multilevel modeling, treating couple as the upper-level unit and using a binomial logit model, was used to test whether treatment condition, gender, and the interaction of Treatment by Gender predicted whether the 276 participants who completed the Time 2 survey underwent CRCS. The frequencies for this outcome are in Table III. Across gender and treatment condition, CRCS uptake was relatively low, with only 11.6 % (32 out of 276) undergoing tests. There was no evidence of treatment condition, gender, or condition by gender differences (Treatment main effect, $F(1,272) = .26, p = .613$; Gender main effect, $F(1,272) = .53, p = .467$; Treatment by Gender interaction $F(1,272) = .11, p = .735$).

Table III presents the results for CRCS intentions. Because this variable was measured both before and after the intervention, in this analysis time was also a factor in our multilevel model. Thus, we tested a three-factor factorial model with gender and time as lower-level predictors and treatment condition as an upper-level predictor. In this analysis (and all other analyses including time as a factor), because MLM uses all available data in its estimates, data from all participants, including those who did not participate in the follow-up, were used in the estimates of Time 1 effects but not the Time 2 effects. We conducted a second set of all analyses dropping the 30 couples from Time 1 as well as Time 2 and results were virtually identical.

Analyses predicting intentions showed both a significant main effect of time, $F(1,138) = 6.74, p = .01$, and a significant time by condition interaction, $F(1,138) = 8.14, p = .005$, with no moderation by gender. In the CTP condition there was a significant increase in intentions from Time 1 to Time 2, $F(1,69) = 13.37, p < .001$ (Time 1: $M = 11.78, SD = 6.21$, Time 2: $M = 13.80, SD = 7.28$). In contrast there was no evidence of change in GP condition, $F(1,69) = .01, p = .912$ (Time 1: $M = 12.35, SD = 6.81$, Time 2: $M = 12.64, SD = 7.17$).

Intervention effects on individual knowledge and attitudes

Table III also presents descriptive information on the secondary outcomes. The same three-factor factorial multilevel model was used. CRC knowledge showed a significant effect of time, $F(1,156) = 25.18, p < .001$, such that knowledge was significantly higher at Time 2 ($M = 84.85, SD = 23.02$) than at Time 1 ($M = 74.01, SD = 29.04$). There was also a significant main effect of gender, $F(1,152) = 6.04, p = .015$, indicating that women ($M = 81.21, SD = 25.79$) knew significantly more on average than men ($M = 76.56, SD = 28.06$). There were no differences as a function of condition, nor were any of the interactions significant. Both GP and CTP were effective in increasing knowledge.

CRCS benefits showed a main effect of time, $F(1,143) = 8.11, p < .005$, such that participants perceived more benefits at Time 2 ($M = 3.68, SD = 0.66$) relative to Time 1 ($M = 3.59, SD = .56$) as well as a significant condition by time by gender interaction, $F(1,151) = 3.9, p = .05$. Simple interaction analyses showed that there were no differences as a function of time, $F(1,72) = .44, p = .51$, gender, $F(1,80) = .003, p = .95$, or the time by gender interaction, $F(1,74) = .22, p = .64$, in the GP condition. In contrast, both the time main effect, $F(1,71) = 10.64, p = .002$, and the time by gender interaction, $F(1,75) = 6.21, p$

$= .015$, were significant for the couples who received the CTP. Follow-up tests and the means indicate that, although men and women increased in perceived benefits after CTP, women's increase was greater than men's. We also examined barriers as a function of time, condition, and gender, and the only statistically significant effect was the main effect of time such that barriers were lower at Time 2 ($M = 2.68$, $SD = .56$) than at Time 1 ($M = 2.8$, $SD = .54$).

Finally, although there were no significant main effects for perceived CRC risk, there was a significant condition by time interaction, $F(1,145) = 4.27$, $p = .041$. There was a non-significant increase in perceived risk in CTP, $F(1,71) = 1.98$, $p = .164$, Time 1 $M = -.00$, $SD = .78$, Time 2 $M = .09$, $SD = .89$ and a non-significant *decrease* in perceived risk in GP, $F(1,74) = 2.27$, $p = .136$ (Time 1: $M = -.00$, $SD = .83$; Time 2: $M = -.09$, $SD = .75$).

Intervention effects on relationship factors

Descriptive information is shown in Table III. There was evidence that relational perspective increased over time, $F(1,144) = 6.90$, $p = .01$ (Time 1: $M = 14.46$, $SD = 2.95$; Time 2 $M = 14.99$, $SD = 3.33$). This main effect was qualified by a three-way interaction between gender, time, and condition, $F(1,151) = 5.92$, $p = .016$. In the GP condition there were no differences as a function of time or gender. However, in the CTP condition, the simple main effect of time was significant, $F(1,71) = 4.73$, $p = .033$, showing an average increase over time in adopting a relationship perspective in CTP (see Table III). In addition, there was a significant time by gender interaction in the CTP condition, $F(1,77) = 5.34$, $p = .024$. Analyses separately by gender showed that although women did not show an increase over time, $F(1,70) = .46$, $p = .50$, men showed a substantial increase, $F(1,73) = 8.72$, $p = .004$.

Spouse influence showed only gender and time main effects. For gender, the main effect, $F(1,168) = 6.54$, $p = .011$, showed that men ($M = 1.96$, $SD = 1.09$) reported that their spouses influenced them more than did women ($M = 1.82$, $SD = 1.00$). The time main effect, $F(1,155) = 14.45$, $p < .001$, showed that there was more spousal influence at Time 2 ($M = 2.08$, $SD = 1.12$) relative to Time 1 ($M = 1.74$, $SD = .96$).

When asked specifically whether the participant supported their spouse having CRCS, there were significant main effects of time and gender, as well as a significant 3-way interaction.

The main effect of time, $F(1,145) = 7.08$, $p = .009$, showed that participants were more supportive of their spouse getting tested at Time 2 ($M = 5.57$, $SD = 1.81$) relative to Time 1 ($M = 5.32$, $SD = 1.82$). The main effect of gender, $F(1,162) = 4.34$, $p = .039$, indicated that wives reported being significantly more supportive of their husbands ($M = 5.55$, $SD = 1.80$), relative to husbands' support of their wives ($M = 5.32$, $SD = 1.83$). The three-way interaction, $F(1,152) = 4.76$, $p = .031$, qualified these main effects. This interaction was driven by opposite gender patterns for the two conditions. In CTP, wives did not change significantly over time, $F(1,72) = .38$, $p = .537$ (see Table III), but husbands in CTP increased significantly over time in support for their wives' CRCS, $F(1,73) = 6.17$, $p = .015$. In contrast, in GP, husbands did not change over time, $F(1,73) = .25$, $p = .618$, but the wives increased over time, $F(1,73) = 4.62$, $p = .04$.

Means and standard deviations for whether participants discussed CRCS with their spouse are also in Table III. The only significant effect was that for time, $F(1,145) = 35.16$, $p < .001$. In both conditions, participants reported discussing CRCS with their spouse significantly more at Time 2 ($M = 2.21$, $SD = 1.03$) than at Time 1 ($M = 1.69$, $SD = 1.01$).

Finally, MLM using the binomial logit model was used to test whether there were differences in the frequency of spouse recommendations that the other partner have CRCS

as a function of treatment condition, gender, and time. The only significant effects were the main effect for time, $F(1,525) = 21.15, p < .001$, and the main effect for gender, $F(1, 525) = 32.74, p < .001$. The effect of time showed that a significantly higher percentage reported that their spouse had recommended that they have CRCS at Time 2 ($N_{\text{yes}} = 73, \% = 36.9$) than at Time 1 ($N_{\text{yes}} = 68, \% = 20.3$). The effect for gender showed that husbands were significantly more likely to report that their wives recommended CRCS ($N_{\text{yes}} = 96, \% = 36.0$) than wives ($N_{\text{yes}} = 45, \% = 16.9$). Contrary to expectations, there was no interaction between gender, time, and condition.

Discussion

This pilot intervention study suggested that the CTP intervention encouraging a relational perspective on screening showed promise when compared to a GP intervention. Although CRCS uptake was low across both conditions and there was not a significant difference between the CTP's effect on CRCS when it was compared to GP, CTP participants reported higher CRCS intentions and perceived more CRCS benefits. CTP participants were also more likely to remember receiving the pamphlets and were more likely to save the pamphlets suggesting the CTP was more salient. CTP showed some evidence of increasing a relational perspective, but both interventions improved couples' support for their partner's screening and facilitated couples' discussions.

Although we reported a significant increase in CRCS intentions in CTP, our findings did not indicate significant effects for either intervention on CRCS uptake. The screening rate of 11.6% is lower than that reported for other behavioral interventions which have reported screening rates between 25% (Philip, DuHamel, & Jandorf, 2010) and 70% (Gimeno-Garcia, Quitero, Nicolas-Perez, Parra-Blanco, & Jimenez-Sosa, 2009). Our rate of uptake is also lower than figures reported in literature reviews, which have reported an average rate of 50% (Vernon et al., 2011). Our finding is particularly surprising because both interventions increased the likelihood that couples discussed CRCS. There are several potential reasons for the low uptake. First, we targeted couples in which neither partner was on schedule with regard to CRCS. This population is likely more resistant to screening than the general population. Second, the CTP was not as intensive as other behavioral interventions to improve CRCS in terms of its focus on individual attitudes about CRCS. The CTP had standard information and contained some barriers counseling (i.e., other ways of thinking about CRCS) but there was no personalized information about perceived risk, level of knowledge, or stage of change, which has been included in other interventions (Marcus et al., 2005; Myers et al., 2007). Rather, the main emphasis was on recognizing the benefits of having screening for the relationship and on initiating discussions with one's spouse about CRCS. Third, it is possible that our approach, which was primarily based on the Interdependence Theory (whose goal is to facilitate a relationship perspective), did not address other important steps towards having a screening test. Having colorectal screening is a multi-step process which includes finding a physician to perform the test, arranging insurance coverage for the test, rearranging one's work schedule for the test, possibly undergoing preparation for the test, and arranging for time off from work. Although couples discussed screening, we do not know if they made a plan for how and when they would get screened, and we do not know whether their discussions were constructive in nature. Other approaches, such as collaborative implementation intentions, could be incorporated to increase the likelihood that the increased intentions and couples' discussions about CRCS resulted in behavior change (Prestwich et al., 2012). Fourth, it is possible that the KN population was less motivated to make behavioral changes. A review of the literature revealed only three published behavioral intervention studies conducted with a KN sample (Davis, Blitstein, Evans, & Kamyah, 2010; Evans et al., 2009; Fong & Luttmer, 2009). Thus, KN panels may not be as motivated to alter their behavior as the general population of

individuals that participate in research. Finally, it is possible that our tailoring points did not match participants' actual reasons for not having screening. Previous studies have suggested that the goodness of fit of tailored materials is associated with their efficacy (Kreuter et al., 2000).

Some of our findings were consistent with the Interdependence Model. CTP participants, and men in particular, were more likely to adopt a relational perspective than GP participants, and CTP husbands were more likely to report that they supported their wives having screening than husbands in GP. One possible explanation consistent with the theory is that the CTP materials emphasized the importance of talking about CRCS as a way of maintaining the couple's health and the importance of supporting the other spouse's screening, whereas the GP materials did not address these topics. These findings indicate that the material addressing some dyadic constructs was differentially affected by the CTP. However, other findings were not consistent with the model. Both interventions increased discussions about CRCS and increased the likelihood that spouses recommended CRCS to one another. These results suggest that simply sending both partners general print information about CRCS prompted them to discuss screening with one another and that the couple-tailored approach was not needed to spur such discussions.

Along with changing relational perspectives, CTP increased participants' perceptions of CRCS benefits. These findings are consistent with other research evaluating the impact of tailored interventions on perceived CRCS benefits (Manne, Coups et al., 2009; Philip et al., 2010). The CTP contained personalized barriers counseling for the highest nominated barriers, which was probably responsible for the increase in positive attitudes about CRCS. The fact that CTP increased risk perceptions is also consistent with the content of CTP which stated that the participant was at increased risk because s/he was not on schedule with regard to CRCS and is consistent with the results of other behavioral intervention studies (Wardle et al., 2003). It is surprising that there was a reduction (although non significant) in perceived risk in the GP group. It is not clear why the GP had this effect. Both interventions increased knowledge about CRC which is consistent with previous behavioral intervention studies (Morales, Rao, Livaudais, J., & Thompson, 2012). This finding is probably due to the fact that the GP contained basic information about CRC and CRCS procedures.

There were gender differences in intervention effects, but they were not in the predicted directions. First, we proposed that CTP would result in a higher screening uptake and higher screening intentions among husbands, and this was not the case. Second, we predicted that CTP would result in greater increases in wives' relational perspective and wives' support for their husbands' screening when compared with husbands in CTP and all participants in GP. This was not the case. In contrast, in the CTP condition husbands reported an increase in relational perspective, not wives, and again no changes were noted in the GP. Moreover, husbands in CTP reported increased support for their wives' CRCS at follow-up whereas husbands in GP did not report changes in support for their spouse's CRCS at follow up. A possible explanation for this finding is that husbands initially reported lower levels of support for their wives' screening pre-intervention, and they may have been more sensitive to personalized information suggesting their level of support was low and they may have been more responsive to suggestions that they increase their spousal support. As noted above, wives were more supportive of their husbands getting CRCS at baseline, and husbands were more likely to report that their wives suggested CRCS and that their wives engaged in influence strategies. Thus, before receiving the interventions, wives were more supportive of their spouses having CRCS than husbands. Previous studies have suggested that wives engage in more influence strategies than husbands (Lewis et al., 2004).

Limitations

First, there were a relatively large number of KN panel members who did not pass the survey screener on to their spouse (40%). It is difficult to compare participation rates with the other couple-focused CRCS intervention study (Van Jaarsveld et al., 2006) because their study included non-married individuals, had a different recruitment methodology which asked KN panel members to pass the survey on to their partner, and their study did not screen both partners for non-adherence with CRCS. However, if one compares rates, the reported rate of passing the survey to one's partner in our study (60%) was similar to the participation rate reported by Van Jaarsveld and colleagues (64%). It is possible that those panel members who did not pass the survey screener to their spouse had less positive attitudes about CRCS, lower relational perspective on screening, less support for their spouse's screening, and more marital dissatisfaction, thus biasing the sample towards those who were more interested in CRCS. The sample was comprised of more White individuals than the KN Panel and this may have resulted in a sample that was more interested in CRCS and/or interested in discussing screening with their spouse. We were not able to obtain data on the interest in CRCS among those panel members or partners who did not participate, and thus we cannot conclude whether bias was present.

Second, CRCS data were self-report and we were unable to obtain permission from many participants to confirm CRCS, either at the time of eligibility screening or at the follow-up. Although self-report of CRCS has been shown to be valid (Manne, Coups et al., 2009; Matthews et al., 2005), our findings would have been stronger if KN would have been able to obtain permission from more participants to confirm CRCS. Third, the spouse influence scale, which contained both positive and negative influence strategies, was only one scale, with negative strategies (e.g., pressure) correlating highly with the item total. This was an interesting finding as previous studies on spouse influence strategies have assessed negative and positive influences separately and have reported converse associations with behavioral outcomes (Fekete, Stephens, Duley, & Greene, 2006; Lewis & Butterfield, 2005; Lewis et al., 2004; Tucker & Anders, 2001). Future studies should evaluate the spouse support and influence scales more thoroughly. Fourth, and possibly most importantly, we did not show effects on CRCS uptake. Although screening intentions were significantly increased and intention is a known correlate of CRCS behavior (Myers et al., 1991), the fact that we did not show an impact on CRCS suggests that a more intensive intervention may be indicated. Finally, the CTP materials were not as tailored on as many couple-level variables as they could have been. We included materials that were tailored to the level of support for one's spouse's screening, the perceived benefits of screening for the partner, and the benefits of talking about screening for the relationship. However, CTP might have had a stronger effect on CRCS if the benefits to the relationship were emphasized more strongly, or if we tailored on other variables such as their communication style or the reasons that they have not discussed screening. Future couple-based interventions may benefit from manipulating the level of couple-level messages included in the materials.

Conclusions

This study provides evidence that a couple-tailored approach may prove to be a beneficial way to motivate CRCS and points towards potential mechanisms for this treatment's effects. This study adds to the developing literature on dyadic interventions (Gilbert et al., 2010, Wu et al., 2010) by suggesting that a dyadic theory-based intervention that targets spouse support and encourages a relational perspective may also prove efficacious.

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Figure I.
Study flow chart

Table I

Descriptive information on the study sample

	<u>Husbands</u>	<u>Wives</u>
Variable	M(SD)	M(SD)
Mean Age (SD)	60.1(7.6)	58.6(7.3)
Race/Ethnicity		
Caucasian	151(89.9)	154(91.7)
Black, non-Hispanic	9(5.4)	8(4.8)
Other, non-Hispanic	5(3.0)	4(2.4)
Hispanic	2(1.2)	2(1.2)
2 races, non-Hispanic	1(0.6)	0(0.0)
Education		
Less than high school	20(11.9)	14(8.3)
High school	58(34.5)	72(42.9)
Some college	56(33.3)	52(31.0)
Bachelor degree or graduate school	34(20.2)	30(17.9)
Employment status		
Full Time	78(46.5)	58(34.5)
Part time	13(7.7)	29(17.3)
Retired/does not work outside home	57(33.9)	57(33.9)
Unemployed	19(11.3)	23(13.7)
Missing	1(0.6)	1(0.6)
Has Medical Insurance	138(82.1)	141(83.9)

Note. SD = Standard Deviation

Table II

Descriptive information on treatment effects for intervention evaluation

Variable	Couple Tailored Print				Generic Print			
	Husbands		Wives		Husbands		Wives	
	Yes	%	Yes	%	Yes	%	Yes	%
Recalled receiving pamphlet (s)	51	77.3	55	82.1	48	67.6	44	62.9
Saved pamphlet (s)	25	49.0	33	61.1	13	27.1	15	34.1
Read pamphlet (s)	46	90.2	55	100.0	40	83.3	37	84.1
Showed spouse pamphlet (s)	42	82.4	46	85.2	34	70.8	35	79.5

Descriptive information for treatment effects

Table III

Variable	Couple-Tailored Print				Generic Print			
	Husbands		Wives		Husbands		Wives	
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
CRCS procedure	<i>N</i> %	0 7.2	10 7.2	0 0	7 5.1	0 0	8 5.8	7 5.1
Screening Intention	<i>M(SD)</i>	12.07(6.56)	13.90(7.07)	11.49(5.87)	13.70(7.54)	13.21(6.92)	11.89(7.25)	11.23(6.61)
CRC Knowledge	<i>M(SD)</i>	70.64(30.11)	84.60(24.16)	75.95(26.96)	89.05(17.05)	72.92(30.16)	80.52(24.16)	85.45(25.19)
Perceived Benefits	<i>M(SD)</i>	3.62(0.50)	3.73(0.26)	3.52(0.57)	3.77(0.61)	3.60(0.60)	3.63(0.70)	3.62(0.73)
Perceived Barriers	<i>M(SD)</i>	2.78(0.52)	2.56(0.53)	2.77(0.53)	2.59(0.66)	2.81(0.52)	2.78(0.48)	2.74(0.55)
Perceived Risk	<i>M(SD)</i>	0.03(0.81)	0.12(0.93)	-0.03(0.75)	0.06(0.86)	-0.03 (0.83)	-0.13 (0.73)	-0.06 (0.77)
Relational Perspective	<i>M(SD)</i>	14.12(3.20)	15.27(3.12)	14.70(2.69)	14.96(3.08)	14.44(2.58)	14.56(3.42)	15.18(3.66)
Influence Strategies	<i>M(SD)</i>	1.86(1.03)	2.29(1.19)	1.72(.91)	2.16(1.03)	1.82(.99)	1.95(1.12)	1.93(1.12)
Support Spouse's CRCS	<i>M(SD)</i>	5.18(1.92)	5.70(1.71)	5.58(1.78)	5.67(1.81)	5.21(1.83)	5.25(1.82)	5.69(1.90)
Discuss CRCS with Spouse	<i>M(SD)</i>	1.82(1.09)	2.27(1.02)	1.84(1.08)	2.34(1.05)	1.53(.86)	2.11(.98)	2.14(1.09)
Spouse Recommend CRCS	<i>N - Yes</i>	28	23	7	16	23	22	17
	<i>% - Yes</i>	31.8	45.1	8.0	29.1	28.7	45.8	27.3

Note. CRC = Colorectal Cancer; CRCS = Colorectal Cancer Screening