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Examining the Durability of Colorectal Cancer Screening Awareness and Health Beliefs Among Medically Underserved Patients: Baseline to 12 months Post-Intervention

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Abstract

The current study examines changes in awareness and health beliefs from baseline to 12 months post-intervention following receipt of one of two colorectal cancer (CRC) educational interventions that aimed to promote CRC screening among a racially and ethnically diverse and medically underserved population. Participants ($N = 270$) were enrolled in a randomized controlled trial to increase CRC screening and completed both baseline and 12-month follow-up assessments. Participants were aged 50–75, at average CRC risk, not up-to-date with CRC screening guidelines, and receiving care at one of three community-based clinics. Participants were randomized to receive either a targeted, low-literacy intervention informed by the Preventive Health Model [PHM] (photonovella and DVD plus fecal immunochemical test [FIT]) or a non-targeted intervention (standard educational brochure plus FIT). Changes in CRC awareness and health beliefs from baseline to 12 months were examined both within and between intervention groups using Student's t tests. Participants in both intervention conditions demonstrated an increase in CRC awareness, PHM social influence, and trust in the healthcare system (all p's $< .0001$), with no significant between-group differences. Among those receiving the targeted intervention, there also was an increase in PHM salience ($p < .05$). Among individuals receiving the non-targeted intervention, there was an increase in PHM response efficacy ($p < .01$) and PHM self-efficacy ($p < .0001$). Both CRC screening interventions promoted positive changes in awareness and several health beliefs from baseline to 12 months, suggesting important benefits of CRC education. Regardless of whether education was targeted or non-targeted, providing CRC screening education successfully promoted durable changes in awareness and health beliefs.

Keywords Colorectal cancer screening · Health beliefs · Intervention · Health disparities · Preventive Health Model

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Among both men and women, colorectal cancer (CRC) is the third most common cancer type and second leading cause of cancer death in the USA [1]. With multiple testing options, CRC screening allows for both early detection and prevention of CRC [1]. However, only 63% of age-appropriate adults are up-to-date with CRC screening and multiple CRC screening disparities exist [2]. Demographic factors that have been associated with screening include age, race, insurance status, education, and immigration status [2]. Barriers to screening include lack of knowledge/awareness, lack of provider recommendation, and practical barriers such as transportation and financial considerations, among others [2]. Furthermore, prior studies have demonstrated that awareness and health beliefs play a role in CRC screening behaviors. For example, higher levels of knowledge or awareness [3], self-efficacy [4], and social influence/family support for CRC screening [4] have been associated with greater likelihood of past CRC screening. As such, educational interventions are often used to increase awareness and influence health beliefs to bring about behavior change among those that are currently not up-to-date with CRC screening recommendations [4–6].

Prior interventions have demonstrated that cancer education can change awareness and health beliefs; the typical approach is to assess health beliefs at baseline and immediately following intervention receipt. However, the goal of the current study was to assess the durability of changes in CRC awareness and health beliefs. Thus, the current study examines changes in CRC awareness and health beliefs from baseline to 12 months after receipt of one of two educational interventions (either a low-literacy, targeted or a non-targeted intervention) for promoting CRC screening uptake among medically underserved individuals. As described in a previously published article, the randomized controlled trial upon which the current study is based resulted in an overall FIT uptake of 80.8% within 90 days of intervention with no significant differences between intervention groups [7].The targeted intervention was informed by the Preventive Health Model (PHM) which has been previously utilized to understand CRC screening behavior and features multiple CRC screening-related cognitions and emotions (e.g., perceived susceptibility, self-efficacy, response efficacy, cancer worry) [8]. In addition, the targeted intervention featured multiple components including a DVD and a low-literacy print photonovella booklet. Furthermore, the targeted intervention addressed test-specific barriers and family communication regarding CRC screening, had an engaging storyline, and featured characters that modeled screening behavior [7]. Through these aspects of the storyline, we attempted to engage participants so that their CRC knowledge would improve and that they might find CRC screening personally relevant and achievable. We hypothesized the following: (1) there will be increases in awareness and health beliefs for each of the two intervention groups, and (2) those in the targeted intervention group would experience greater changes in awareness and health beliefs compared to those in the non-targeted intervention group. In order to better understand for whom either intervention had its strongest effect, we explored whether or not the magnitude of change was predicted by any sociodemographic factor.

Methods

Procedures and Participants

Study procedures, which were approved by the University of South Florida and Florida Department of Health Institutional Review Boards, have been described in detail previously [7]. Briefly, participants were receiving primary care services at federally qualified health centers or a county health department clinic in the Tampa Bay area [7]. Eligibility criteria included individuals being aged 50–75 years, able to speak, read, and write English (as intervention materials were in English), no personal history of CRC, at average CRC risk, not up-to-date with CRC screening guidelines, and willing to provide at least two forms of contact information and the contact information of a relative not living with them [7]. Following determination of participant eligibility and informed consent, face-to-face baseline interviews were completed by trained research assistants [7]. Next, participants were randomly assigned to either the targeted or non-targeted intervention group [7]. The targeted intervention group received a low-literacy intervention composed of a photonovella booklet and DVD plus fecal immunochemical test (FIT) kit [7]. The FIT kit is one of several CRC screening modalities; to be most beneficial, FIT must be completed annually [1].

The targeted intervention was based upon formative work conducted by the team and was informed by a community advisory board. The DVD and photonovella were locally produced with local actors. To be relatable, characters and storyline were co-created with community input. In addition, the characters portrayed on the DVD and in the photonovella modeled CRC screening behavior by completing a FIT as part of the storyline. Individuals in the targeted intervention group viewed the DVD in the clinic and also received a copy of the DVD to take home. The photonovella provided a print format of the information shared through video and dialog in the DVD, and included the same characters. Individuals in the non-targeted intervention group received a Centers for Disease Control and Prevention brochure plus FIT kit [7]. Thus, all participants (regardless of intervention condition) were provided with a FIT kit, written and verbal instructions for FIT kit collection, received a FIT kit collection demonstration from the research assistant, and were sent home with educational

materials/media for further reference [7]. Follow-up interviews were completed 12 months post-intervention via phone. Participants received $10 and $20 gift cards following completion of the baseline and 12-month follow-up interviews, respectively. Informed consent was obtained from all individual participants included in the study.

Measures

Awareness Twelve items assessed CRC and CRC screening awareness and knowledge [7, 9] with higher scores indicating greater knowledge and awareness. Awareness was assessed at both baseline and follow-up. Baseline Cronbach's alpha for the awareness scale was .60 (Christy, in press).

Preventive Health Model Variables Twenty-six items measured the seven PHM constructs (i.e., salience and coherence, perceived susceptibility, self-efficacy, response efficacy, cancer worry, social influence, and religious beliefs) which were assessed using a 5-point Likert scale ranging from strongly disagree = 1 to strongly agree = 5 [8, 10–12]. Reliability and validity for these subscales have been demonstrated previously [8, 10–12]. The PHM variables were measured during both baseline and follow-up assessments. The salience and coherence subscale measured one's belief that CRC screening was important and made sense in one's life. Baseline Cronbach's alpha was .68 (Christy, in press). The perceived susceptibility subscale assessed one's perceived risk of being diagnosed with CRC. Cronbach's alpha was .83 at baseline (Christy, in press). The self-efficacy subscale measured the belief that one could complete the steps necessary for FIT collection. Baseline Cronbach's alpha was .80 (Christy, in press). The response efficacy subscale measured the belief that CRC screening is beneficial in CRC early detection and prevention. At baseline, Cronbach's alpha was .63 (Christy, in press). The cancer worry subscale measured the degree to which one is worried about having an abnormal CRC screening result. Baseline Cronbach's alpha was .78 (Christy, in press). The social influence subscale assessed the perception that important others (e.g., family members, friends, one's healthcare provider) would want the individual to complete CRC screening and wanting to comply with the support for CRC screening of these important others. Baseline Cronbach's alpha for this subscale was .67 (Christy, in press). The religious beliefs subscale assessed the degree to which one relies upon one's religious beliefs to make health decisions. Cronbach's alpha at baseline was .67 (Christy, in press).

Decisional Conflict The amount of difficulty one had in making decisions about CRC screening was assessed with a 9-item measure adapted from O'Connor [13, 14]. Responses ranged from strongly agree = 1 to strongly disagree = 5 on a 5-point scale, with lower scores indicating less conflict in making a CRC screening decision. Decisional conflict was assessed at both baseline and follow-up. Cronbach's alpha at baseline was .91 (Christy, in press).

Cancer Fatalism The 15-item Powe Fatalism Inventory measured the extent to which a person believes that death is inevitable when cancer is present [15–17]. Participants respond either "yes" or "no" during both the pre- and post-intervention assessments; one point is added for each "yes" response, with higher scores indicating higher levels of fatalism. Cronbach's alpha at baseline was .83 (Christy, in press).

Trust in Healthcare system The 10-item Health Care System Distrust Scale [18] was used to assess opinions of the health care system, hospitals, health insurance companies, and medical research. Response options ranged from strongly disagree = 1 to strongly agree = 5 and higher scores indicate more distrust. Baseline Cronbach's alpha was .80 (Christy, in press).

Perceived Discrimination Eight items assessed experiences of mistreatment in healthcare experiences as well as daily life [19, 20]. During both pre- and post-intervention assessments, participants rated the frequency of experiences with the following options: often = 4, sometimes = 3, rarely = 2, and never = 1. Higher scores indicate greater perception of discrimination. Cronbach's alpha at baseline was .84 (Christy, in press).

Demographics Demographic variables were assessed at baseline and included age, gender, race/ethnicity, marital status, employment status, income, education, insurance status, and receipt of an annual physical exam.

Statistical Analyses

Statistical analyses were conducted using SAS (version 9.4 [TS1M1], 2012, SAS Institute Inc., Cary, NC). Only individuals completing both the baseline and 12-month follow-up interviews were included in analyses. Student's *t* tests were used to examine changes in awareness and health belief scores for each intervention group and to examine differences by intervention group. Spearman correlations were used to explore whether any sociodemographic factors were associated with significant changes in awareness and health beliefs.

Results

Participant Characteristics

Two hundred seventy racially and ethnically diverse participants completed both baseline and 12-month follow-up interviews (65% of the 416 participants who completed baseline interviews). Of the 270 participants completing baseline and follow-up interviews, 137 participants were in the targeted

Table 1 Descriptive statistics for participants completing baseline and 12-month follow-up ($N = 270$)

Variable	Total ($N = 270$) M (SD), range	Targeted intervention group ($N = 137$) M (SD), range	Non-targeted intervention group ($N = 133$) M (SD), range
Age in years	55.64 (3.99), 50–70	55.81 (4.08), 50–66	55.46 (3.91), 50–70
	N (%)	*N* (%)	*N* (%)
Gender			
Male	114 (42)	55 (40)	59 (44)
Female	156 (58)	82 (60)	74 (56)
Race			
White	181 (67)	100 (73)	81 (61)
African American/Black	71 (26)	31 (23)	40 (30)
Other/more than 1 race	18 (7)	6 (4)	12 (9)
Ethnicity			
Hispanic/Latino	27 (10)	13 (9)	14 (11)
Not Hispanic/Latino	243 (90)	124 (91)	119 (89)
Education			
Less than HS/GED	66 (24)	32 (23)	34 (26)
HS/GED	95 (35)	52 (38)	43 (32)
More than HS/GED	109 (40)	53 (39)	56 (42)
Employment status			
Employed	67 (25)	40 (29)	27 (20)
Not employed	203 (75)	97 (71)	106 (80)
Marital status			
Married/partnered	88 (33)	45 (34)	43 (32)
Not married	182 (67)	92 (67)	90 (68)
Health insurance status			
Medicare/Medicaid	26 (10)	16 (12)	10 (8)
Private	14 (5)	8 (6)	6 (5)
Other	120 (44)	55 (40)	65 (49)
None	110 (41)	58 (42)	52 (39)
Income			
Less than $10,000	175 (65)	89 (65)	86 (65)
More than $10,000	84 (31)	42 (31)	42 (32)
I don't know	11 (4)	6 (4)	5 (4)
Receipt of annual physical			
Yes	127 (47)	66 (48)	61 (46)
No	142 (53)	70 (51)	72 (54)

Percentages may not total 100% due to rounding or missingness

M mean, *SD* standard deviation, *HS* high school

group and 133 were in the non-targeted group. Table 1 provides the descriptive statistics for the total group completing the 12-month follow-up interview as well as by intervention group. For the total sample, the average age of participants was 55.64 years (SD = 3.99) and the majority of participants were female (58%) and were White (67%) or Black (26%). Forty-one percent of participants had no health insurance and 65% had a household income of less than $10,000. Of those with health insurance (59% of the total sample), 75% had county health insurance, 16% had Medicaid or Medicare, and 9% had private health insurance.

Changes in Awareness and Health Beliefs by Intervention Group

Changes in awareness and health beliefs from pre-intervention to post-intervention are displayed in Table 2. There were no significant differences in changes in awareness or health

Table 2 Changes in awareness and health belief measures from baseline to 12-month post-intervention

Variable	Targeted intervention group		Non-targeted intervention group		Group comparison
	Mean (SD)	*p* value	Mean (SD)	*p* value	*p* value
Awareness	1.34 (1.74)	*< .0001*	1.39 (1.95)	*< .0001*	.81
PHM-perceived salience	0.36 (2.11)	*.0446*	0.22 (2.26)	.27	.58
PHM-perceived susceptibility	0.06 (3.44)	.84	0.36 (3.34)	.22	.46
PHM response efficacy	0.10 (1.57)	.45	0.42 (1.57)	*.0025*	.10
PHM cancer worry	0.08 (3.13)	.77	− 0.33 (3.04)	.21	.28
PHM social influence	1.69 (3.90)	*< .0001*	1.23 (3.91)	*.0004*	.33
PHM religious beliefs	0.47 (4.81)	.26	− 0.02 (4.74)	.97	.41
PHM self-efficacy	0.28 (3.12)	.30	0.89 (2.38)	*< .0001*	.07
Decisional conflict	− 0.05 (5.79)	.92	0.43 (6.55)	.45	.52
Cancer fatalism	0.22 (2.89)	.38	0.33 (2.40)	.11	.73
Trust in healthcare system	6.48 (6.07)	*< .0001*	5.44 (6.55)	*< .0001*	.18
Perceived discrimination	− 0.73 (4.80)	.08	0.02 (4.08)	.97	.17

Statistically significant *p*-values are indicated by italics

SD standard deviation, *PHM* Preventive Health Model

beliefs between the two intervention groups. However, there were significant within group differences. Among individuals in the targeted intervention group, significant positive mean changes were found for awareness, PHM salience and coherence, PHM social influence, and trust in healthcare system. Among individuals in the non-targeted intervention group, significant positive mean changes were found in awareness, PHM response efficacy, PHM social influence, PHM self-efficacy, and trust in healthcare system.

Exploring Predictors of Change

Spearman correlations were used to assess associations between sociodemographic factors (Table 1) and positive change in awareness and health beliefs. Among those receiving the targeted intervention ($N = 137$), increases in awareness were associated with being employed ($r_s = .17$, $p = .04$) and with not having an annual physical ($r_s = .20$; $p = .02$). Among those receiving the non-targeted intervention ($N = 133$), (1) increases in awareness were associated with younger age ($r_s = .20$, $p = .03$) and with not having an annual physical ($r_s = .26$; $p < .01$); and (2) positive changes in PHM social influence were associated with being married ($r_s = .23$, $p = .01$).

Discussion

Whereas many intervention studies measure health beliefs at baseline and immediately following intervention receipt, the current study sought to understand durability of changes in CRC awareness and health beliefs at 12 months post-intervention. Changes were seen in CRC awareness and multiple health beliefs among participants in both CRC screening educational intervention groups. For example, both interventions demonstrated changes in CRC awareness, PHM social influence, and trust in healthcare system scores; specifically, individuals in both intervention groups had improved CRC awareness, increases in social influence, and increased levels of trust in the healthcare system. In addition, the targeted intervention also had a unique positive effect on PHM salience and coherence. The non-targeted intervention had unique positive influence on PHM self-efficacy and PHM response efficacy.

We hypothesized that the targeted intervention would result in greater changes from baseline to 12-month follow-up compared to the non-targeted intervention; however, contrary to our hypothesis, there were no substantive between-group differences. Although the targeted materials were based on extensive formative research, pretesting, and informed by input from a community advisory board, it may be that the content and storyline of the targeted materials were no more compelling than those of the standard brochure. This finding is similar to another targeted CRC intervention in which there were no pre- or post-intervention group differences in CRC knowledge, attitudes, self-efficacy, or intentions [21]. In a different study featuring a decision aid, participants receiving a culturally targeted decision aid demonstrated improved knowledge of CRC and less decisional conflict compared to a control group [22]. However, there were no group differences for attitudes, perceived norms, or screening intentions [22].

Exploratory analyses of associations between sociodemographic factors and changes in awareness and

health beliefs revealed that among those receiving the targeted intervention, those who were employed, and those who did not have an annual physical exam were more likely to demonstrate increases in awareness 12 months post-intervention. Among those in the comparison group, individuals who were younger and those who did not have an annual physical exam were more likely to demonstrate improved awareness 12 months post-intervention. In addition, individuals in the comparison group who were married were more likely to report increases in social influence 12 months post-intervention. These findings may assist in further targeting future CRC screening interventions for these individuals.

The current study has a number of implications for future research in cancer education. First, despite the formative work in the development of the targeted materials, it may be that the content and storyline of the targeted materials were no more compelling than those of the standard brochure among this ethnically and racially diverse and medically underserved population. Future studies might need to further explore the dynamics of health beliefs, norms, culture, and everyday situational factors that shape how people believe, think, and ultimately, act on CRC screening. For example, with regard to culturally targeted interventions, three frameworks have been suggested to better centralize culture in the study of social determinants of health and risk messaging [23]. These include the following: (1) combining targeting plus tailoring features in health communications; (2) applying the PEN-3 cultural model to accentuate the three domains of cultural identity, relationships and expectations, and cultural empowerment as a cultural-sensitive approach to health communication; and (3) integrating a culture-centered approach that puts into play community voices and emphasizes the interaction between the structure and agency [23]. The combination of approaches may further help to reveal subtle and deep ways in which behaviors are influenced by culture.

As screening with FIT must be completed annually [1], it remains to be seen whether durable changes in CRC awareness and health beliefs such as those found in the current study may facilitate subsequent *repeat* screening. Our team is currently developing a study which will examine these changes long-term over multiple CRC screening opportunities. In examining relationships between changes in awareness and health belief over multiple time periods, we may be better able to disentangle whether beliefs as well as access were contributing factors that influenced behavioral change. In addition, in both groups, individuals not having an annual physical exam were more likely to have increased awareness of CRC screening following the intervention. This finding suggests that those who may not have regular preventive care are likely to benefit from exposure to CRC education materials. Thus, future CRC screening education studies might consider moving out of the clinic setting and engaging individuals who may not have access to preventive healthcare. Furthermore, although it has been suggested that trust be measured to better understand CRC screening (specifically among African Americans), trust, and more specifically, changes in trust are not commonly measured in CRC screening intervention trials [24]. Thus, it is difficult to compare our results on this construct and to know whether prior CRC screening interventions have resulted in changes in trust in the healthcare system. Therefore, future studies should consider the measurement of trust over multiple time periods. However, it may be helpful to measure specific aspects of trust that might be related to CRC screening behaviors (e.g., trust in one's provider, trust in the provider's medical group, trust in providers in general). Finally, changes in trust in the healthcare system and social influence might have been simply due to the provision of any education materials or being enrolled in a RCT which provided additional time, attention, and interaction with the research coordinator (e.g., FIT instructions/demonstration) and receipt of a free FIT kit.

Study limitations and strengths should be acknowledged. Regarding limitations, generalizability is a potential limitation as the study enrolled individuals from a limited geographic area who were non-adherent to CRC screening guidelines and were willing to participate in an RCT to promote CRC screening. In addition, although we can confirm that individuals in the targeted intervention watched the DVD as they did so in the clinic, we cannot confirm that the written study materials in either intervention arm were actually read/utilized. Study strengths include the ethnically and racially diverse sample and the measurement of changes in awareness and health beliefs, including the construct of trust, over a long-term period (12 months post-intervention).

Conclusions

Both CRC screening educational interventions produced change in awareness and several health beliefs from baseline to 12 months post-intervention, suggesting comparable benefits. Indeed, there were no significant between-group differences. Both targeted and non-targeted CRC education materials may effectively produce durable changes in awareness and health beliefs. In the current study, the type of CRC education (targeted vs. not-targeted) may have mattered less than simply providing CRC education, as both interventions improved awareness and changed multiple health beliefs. Thus, we continue to affirm that education matters and contributes toward addressing health disparities in our communities.

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Compliance with Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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