

An Innovative Strategy to Reach the Underserved for Colorectal Cancer Screening

Katherine Josa Briant · Noah Espinoza · Avigail Galvan · Elizabeth Carosso · Nathan Marchello · Sandra Linde · Wade Copeland · Beti Thompson

Published online: 9 July 2014
© Springer Science+Business Media New York 2014

Abstract Hispanics are an underserved population in terms of colorectal cancer (CRC). CRC is the second leading cause of cancer incidence among Hispanic men and women, and Hispanics have lower screening rates than non-Hispanic whites. The overall purpose of this project was to provide CRC information, education, and fecal occult blood test (FOBT) kits to Hispanics in a rural three-county region of Washington State. We held a series of 47 community health fair events that incorporated the use of a giant inflatable, walk-through colon model with physical depictions of healthy tissue, polyps, and CRC. We used a pre/post-design to look for changes in familiarity with CRC before and after walking through the colon among adults aged 18 and older ($n=947$). McNemar's test analysis indicated significant differences in the distribution of the percentage of correct participant responses to CRC-related questions from pre- to post-test after an educational tour of the colon. Results from logistic regression analysis identified multiple participant characteristics associated with self-reported likelihood of being screened for CRC in 3 months following post-test. We distributed 300 free FOBT kits to be analyzed at no charge to the end user and to attendees aged 50 and older who toured the inflatable colon; 226 FOBT kits (75.3 %) were returned for analysis. The use of the inflatable colon was an innovative way to attract people to learn about CRC and

CRC screening modalities. Furthermore, the response to our distribution of FOBT kits indicates that if given the opportunity for education and access to services, this underserved population will comply with CRC screening.

Keywords Colorectal cancer · Hispanics · Colorectal cancer screening · Fecal occult blood test · FOBT · Education

Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of cancer mortality among men and women in the USA [1]. CRC incidence and mortality trends have shown significant decreases in the past 10 years for both men and women in the USA. This trend, however, is not replicated for the Hispanic population. For both CRC incidence and mortality, rates remain stable. Some of this may be attributed to the lower CRC screening rates of Hispanics. Hispanics are significantly less likely to have a recent CRC screening test than non-Hispanic whites (47 % compared to 62 %, respectively). Among Hispanic subgroups, CRC screening rates are lowest among Mexican-Americans (45.3 %) [2]. The lack of screening is especially problematic in that screening can result in the detection of early stage CRC which often can be treated successfully and result in decreased morbidity and mortality [3]. Further, removal of adenomatous polyps before they become cancerous can reduce CRC incidence and mortality [4].

There are many impediments to CRC screening for Hispanic individuals. An integrative review of barriers to screening identified a number of factors that were associated with low screening levels; these included limited English proficiency, low literacy and educational level, and lack of provider recommendations [5]. The authors of the review concluded that more studies using culturally appropriate and targeted

K. J. Briant (✉) · N. Espinoza · E. Carosso · W. Copeland · B. Thompson
Cancer Prevention Program, Fred Hutchinson Cancer Research Center, 1100 Fairview Avenue North, M3-B232, Seattle, WA 98109, USA
e-mail: kbriant@fhcrc.org

A. Galvan · N. Marchello
Center for Community Health Promotion, Fred Hutchinson Cancer Research Center, 320 North 16th Street, Sunnyside, WA 98944, USA

S. Linde
Sunnyside Community Hospital, 1016 Tacoma Avenue, Sunnyside, WA 98944, USA

approaches to educate Hispanics about CRC screening and studies that foster provider training are needed. A further barrier to CRC screening is rurality; individuals who live in rural settings are less likely to obtain CRC screening than individuals residing in urban settings [6].

One of the 23 Community Network Program Centers (CNPCs) in the USA, the Center for Community Health Promotion (CCHP) of Fred Hutchinson Cancer Research Center (FHCRC), is located in a rural, agricultural area of Washington State. CCHP, with the participation of its community advisory board (CAB), designed and implemented a culturally appropriate educational and behavioral intervention to increase the use of CRC screening by Hispanics. It did so in a strategic manner that was focused on making the most efficient use of existing resources in the region. The approach used by the CCHP is community-based participatory research (CBPR), where a partnership is formed between the community and academic researchers. The CAB participates in the design and implementation of research studies and initiatives that seek to reduce disparities. Further, CCHP staff have developed partnerships with other community organizations to address the disparities in cancer experienced by residents of this rural area.

This project began because CRC screening is of high importance to people in the area. Based on findings from two Town Hall Forums conducted by the CCHP in April 2011, community members reported being most concerned about CRC compared to other cancer sites. As part of this CBPR project with the community, we attempted to assist the community in addressing that problem. The purpose of this paper is to describe the implementation and outcomes of an innovative strategy to increase education and participation in the early detection of CRC.

Methods

Setting

The setting for this project is a rural three-county region of Washington State. The counties comprise an area of 7,337 mile² and lie east of the Cascade Mountain range. The area is primarily agricultural and grows fruit and vegetable crops that are distributed throughout the USA. Many of the towns in the area are majority-minority (Hispanic) towns, and overall, the area is 67 % Hispanic [7]. According to data from the Pew Hispanic Center, most of the Hispanic population in Washington State is of Mexican origin (83 %) as opposed to other Latin American countries [8].

Intervention

The Guide to Community Preventive Services recommends interventions such as client reminders, small media, one-on-

one education, and reducing structural barriers as client-oriented interventions to increase CRC screening. To address CRC screening among the Hispanic population, we used a four-pronged approach which combined these strategies: (1) we sought to increase *awareness* of the importance of CRC screening, (2) we *educated the population* about obtaining CRC screening through one-on-one education and small media, (3) we influenced *behavior* and reduced structural barriers by disseminating free FOBT kits to age-eligible (50+) individuals, and (4) we *followed up* on abnormal FOBT results (client reminders). Each approach is described below.

Awareness Our preliminary data from focus groups and small instructional encounters indicated that many Hispanics were unaware of CRC or the need for CRC screening. To foster awareness, we purchased a giant “inflatable colon” to attract people’s interest. This walk-through replica of the human colon is 10 ft high, 12 ft wide, and 20 ft long and contains simulated healthy colon tissue, polyps, early stage CRC, and advanced CRC. Six display signs inside the colon explain the progression of cancer from normal tissue to advanced stage cancer and highlight the importance of screening and early detection of CRC. Signs were created in English and Spanish. The colon was named CASPER (Capture All Suspicious Polyps and Eradicate Rapidly) in a community naming contest and was displayed at 47 community events, including health fairs, throughout communities in the region between March 1 and October 13, 2012.

Education of the Population We used a participatory strategy to educate the population. CCHP promotores (lay health workers) led tours through the inflatable colon, pointing out the progression of CRC. We invited adult community members, 18 years of age and older, who attended community events where the inflatable colon was presented, to complete anonymous pre/post pencil and paper questionnaires in their language of choice (English or Spanish). CCHP promotores were available to help read questionnaires to participants who needed assistance. Participants were given a pre-numbered packet if they were interested in participating. They filled out the pre-questionnaire before entering the colon, handed it to a staff member, and then filled out the post-questionnaire after exiting the colon. When they returned the post-questionnaire, they were given a water bottle as an incentive and were offered printed materials about colorectal cancer.

Behavior To reduce structural barriers, such as reducing time and distance between service delivery and target population, and to increase screening behavior, we purchased 300 FOBT kits and distributed them following a tour of the inflatable colon. On the inflatable colon post-questionnaire, participants were asked if they were 50 years of age or older and if they were interested in receiving a free FOBT kit.

Because this was a population with limited health literacy, the FOBT instructions were recreated using less text and more pictures; they were also translated into Spanish. FOBT kits included a pre-addressed and stamped envelope to a local hospital. Individuals who completed the FOBT kits could return them in the supplied envelope to the local hospital for analysis. Once the local hospital analyzed the FOBT, they provided the results by participant number to the CCHP office; we tracked the completion of the FOBT kits, monitored the outcome (i.e., positive or negative result), and followed up with participants to provide results.

Follow-up CCHP promotores followed up with a phone call to participants to let them know their FOBT results. If the results were normal, the screening guidelines were reviewed with the participant and they were encouraged to follow-up with their doctor to discuss future screening. If the results were positive, the CCHP promoter explained that it did not mean that they had cancer, and they advised the participants to follow-up with their doctor to complete further testing. If participants indicated that they did not have a doctor or health insurance, they were referred to the patient navigator at the local hospital for assistance with follow-up. We collaborated with local hospitals, clinics, and the regional Breast, Cervical, and Colon Health Program to generate the list of providers who would provide low-cost or free colonoscopies for any participant in our project who had a positive FOBT result.

The protocol, as well as promotional flyers, participant consent forms, FOBT instructions, and all questionnaires for this intervention, was approved by FHCRC Institutional Review Board.

Study Measure

Pre- and post-tests were administered to measure participants' familiarity with CRC and CRC screening, past screening behavior, likelihood to be screened, access to health care, and likelihood to talk to significant others about CRC before and after walking through the inflatable colon. Demographic variables collected on pre-test included the following: gender, age, education, race/ethnicity, whether they had health insurance, and whether they had a regular health clinic and physician (Table 1).

Awareness of screening was assessed by pre-test responses to yes/no questions where respondents were asked if they ever talked to their doctor about CRC and if their doctor ever recommended they have a FOBT, sigmoidoscopy, or colonoscopy. On the post-test, we asked respondents how likely they were to talk to their doctor about CRC after walking through the inflatable colon.

Familiarity with CRC and screening was assessed by five yes/no questions at pre- and post-test; these questions asked

the respondents if they knew what a colon polyp was, what CRC was, what a cancer screening test was, what the different types of screening tests available for CRC were, and whether patients could survive CRC if it was found early and removed. For intention to be screened, we asked respondents at pre- and post-test how likely it was that they would be screened for CRC. Response categories were "not likely," "somewhat likely," and "very likely." On the pre-test, we also asked respondents if they ever had a FOBT, sigmoidoscopy, or colonoscopy.

Analysis

We examined descriptive statistics of participants using frequencies and proportions. The overall proportion of participants answering correctly for each of the five questions is shown for pre- and post-test by gender, ethnicity, and age in Table 2. McNemar's test for paired binary data [9, 10] was used to determine whether there were significant differences in the distribution of the percentage of correct participant response to questions about CRC and related items (i.e., types of screening, CRC polyps, etc.) from pre- to post-test (complete data not shown).

We also used multiple-logistic regression to identify participant characteristics that were associated with being very likely or somewhat likely to get screened at post-test. In this analysis, very likely and somewhat likely were coded as 1 and not likely as 0. Participant characteristics (Table 3) were coded with the reference group being 0 and the alternative group coded as 1. In the unadjusted models, we estimated odd ratios (ORs) using the following logit formula: $\text{logit}(p) = \beta_0 + \beta_1 x_1$ where p is the probability of being very likely or somewhat likely to get screened. Using the logistic regression model, we estimated the log odds of any self-reported likelihood of getting screened (Y) with only one participant characteristic (x_1). In the adjusted logistic regression models, we simply add more participant characteristics (x_1, x_2, x_3, \dots) to the model to estimate coefficients of Y . Analyses were performed using Stata 12.0 for Microsoft Windows (StataCorp, College Station, TX) and the R programming language [11]. For Table 3, we used a two-step adjustment where, in the first adjustment step, we only included demographic information (age, gender, ethnicity, education) in our model. In the second step, we included the demographic information but also access to care variables (having a regular physician, regular clinic, and insurance). All statistical tests were performed with an alpha set at 0.05 and were two-tailed.

Results

In 7 months of intervention, approximately 3,500–4,000 people walked through the inflatable colon; 958 completed

Table 1 Participant demographic characteristics

Characteristic	NHW ^a (116), <i>n</i> (%)	Hispanic ^a (718), <i>n</i> (%)	Total ^b (947), <i>n</i> (%)
Gender			
Female	87 (75.0)	550 (76.6)	718 (76.6)
Male	29 (25.0)	163 (22.7)	220 (23.4)
Age			
<30	23 (21.1)	142 (21.7)	182 (21.1)
30–39	23 (21.1)	187 (28.6)	236 (27.3)
40–49	13 (11.9)	160 (24.5)	193 (22.3)
50+	50 (45.9)	165 (25.2)	253 (29.3)
Education level			
8th grade or less	4 (3.5)	273 (38.1)	282 (30.0)
9th–12th grade (no diploma)	4 (3.5)	145 (20.3)	158 (16.9)
HS diploma or GED	18 (15.7)	127 (17.7)	172 (18.3)
Some college or higher	89 (77.4)	171 (23.9)	327 (34.8)
Regular health clinic			
Yes	91 (79.8)	519 (73.2)	704 (75.6)
No	23 (20.2)	190 (26.8)	227 (24.4)
Regular physician			
Yes	87 (77.7)	406 (57.3)	577 (62.2)
No	25 (22.3)	302 (42.7)	351 (37.8)
Health-care plan/insurance			
Private	56 (49.1)	123 (17.4)	206 (22.2)
Basic health plan	17 (14.9)	85 (12.1)	115 (12.4)
Medicare	4 (3.5)	29 (4.1)	40 (4.3)
Medicaid, coupons, VA, IHS	4 (3.5)	60 (8.5)	85 (9.2)
None	24 (21.1)	371 (52.6)	425 (45.8)
Other	0 (0)	21 (2.9)	23 (2.4)
Multiple	9 (7.9)	17 (2.4)	34 (3.7)

^a Does not include missing responses

^b Includes individuals who did not self-identify as Hispanic or non-Hispanic white (Black, 3; Native American, 73; Asian/Pacific Islander, 3; and others, 27); does not include missing responses

pre-test and 947 completed both pre- and post-test questionnaires. Those 947 sets of pre/post-tests were used for the current analysis. Characteristics of the 947 participants are presented in Table 1. The majority of participants were Hispanic (76.4 %, *n*=718) and female (76.6 %, *n*=718). Of the four age categories, the majority of participants were 50 years old or older (29.3 %, *n*=253). Approximately

half of the participants had less than a high school education (46.9 %, *n*=440).

We examined familiarity with CRC for all participants as well as familiarity specific to those who were 50 years of age and older (see Table 2). There was little awareness on CRC screening at pre-test. There was a significant change in familiarity with CRC, from “no” (incorrect) at pre-test to “yes”

Table 2 Pre- and post-test familiarity by gender, ethnicity, and age

Familiarity questions (% responding correctly)	Female		Male		NHW		Hispanics		<50		50+	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Knows what a colon polyp is	28.6	85.9 ^a	26.9	83.9 ^a	71.6	97.4 ^a	19.1	82.7 ^a	24.2	86.8 ^a	37.6	82.5 ^a
Knows what colon cancer is	34.8	85.7 ^a	38.6	84.6 ^a	62.9	96.5 ^a	30.1	82.6 ^a	34.4	87.3 ^a	41.7	80.2 ^a
Knows what CRC screening test is	31.4	84.0 ^a	28.8	83.7 ^a	67.0	94.7 ^a	22.4	81.2 ^a	28.4	85.5 ^a	38.4	80.4 ^a
Knows types of CRC screening tests	14.2	78.6 ^a	9.6	76.8 ^a	24.1	86.1 ^a	10.5	76.3 ^a	10.1	79.5 ^a	20.4	73.2 ^a
Survival of CRC is possible with early detection	76.7	90.7 ^a	81.4	91.7 ^a	80.7	97.4 ^a	76.2	89.8 ^a	77.3	92.2 ^a	80.7	87.7

^a Difference in the distribution of percentage of correct answers at pre- and post-test is significantly different at level $p < 0.01$, based on McNemar's test for paired binary data and the complete table of correct percentage and incorrect percentage at the pre- and post-test visits (data not shown)

Table 3 Post-test self-reported likelihood of intent to be screened for CRC by demographic

Characteristic	Intention to be screened for CRC (Y/N)		
	Unadjusted OR (95 % CI)	Adjusted ^a OR (95 % CI)	Adjusted ^b OR (95 % CI)
Female	1.00	1.00	1.00
Male	0.94 (0.65–1.36)	0.87 (0.56–1.37)	0.84 (0.53–1.36)
Less than 50 years of age	1.00	1.00	1.00
50+ years of age	<i>1.76 (1.19–2.62)</i>	<i>2.27 (1.40–3.68)</i>	<i>1.99 (1.20–3.32)</i>
NHW	1.00	1.00	1.00
Hispanics	<i>3.76 (2.46–5.76)</i>	<i>3.68 (2.23–6.06)</i>	<i>4.25 (2.47–7.32)</i>
≥HS graduate	1.00	1.00	1.00
<HS graduate	<i>2.08 (1.49–2.90)</i>	1.22 (0.81–1.85)	1.21 (0.78–1.87)
Never screened	1.00	1.00	1.00
Ever screened	1.53 (0.94–2.52)	1.46 (0.75–2.83)	1.18 (0.58–2.41)
No regular physician	1.00	1.00	1.00
Regular physician	<i>2.12 (1.25–3.62)</i>	<i>1.93 (1.03–3.63)</i>	<i>1.96 (1.03–3.74)</i>
No regular clinic	1.00	1.00	1.00
Regular clinic	0.93 (0.64–1.35)	0.78 (0.50–1.23)	0.75 (0.47–1.20)
No health insurance	1.00	1.00	1.00
Health insurance	0.78 (0.56–1.08)	1.00 (0.67–1.51)	1.05 (0.69–1.59)

Values shown in italicized font were found to be associated with intent to screen for CRC with a significance level of 0.05

^a Adjusted for age, ethnicity, gender, and education

^b Adjusted for age, ethnicity, gender, education, regular physician, regular health clinic, and insurance status

(correct) at post-test for all questions asked. When examining familiarity with CRC among those aged 50 and older, the significant relationships prevailed for all but one question (Do you think most patients survive CRC if it is found early and removed?). This is likely due to a large proportion of correct answers on the pre-test.

Only 15.6 % of respondents had ever talked to their physician about CRC, and only 16.8 % of respondents reported that their physician had ever recommended that they have any kind of CRC screening test (data not shown in tables). Respondents were able to identify CRC screening methodologies at the post-test; something that was only sporadically done on the pre-test. Uniformly, the change in familiarity was significant at the 0.01 level for all questions, except for one when examined among participants 50 and older (see Table 2). We observed an increase in participants' intention to be screened. The proportions of respondents who shifted from not likely to somewhat likely or very likely increased significantly for all ages (data not shown in tables).

In Table 3, we present unadjusted and adjusted odds ratios for participant characteristics associated with post-test likelihood intention to be screened. In the unadjusted model, being 50 years or older (OR=1.76; 1.19–2.62), ethnicity (OR=3.76; 2.46–5.76), education (OR=2.08; 1.49–2.90), and having a regular physician (OR=2.12; 1.25–3.62) were associated with intention to have a CRC screening test after walking through

the inflatable colon. In the partially adjusted model, being 50 years or older (OR=2.27; 1.40–3.68), ethnicity (OR=3.68; 2.23–6.06), and having a regular physician (OR=1.93; 1.03–3.63) were associated with intention to be screened. These associations remained in the fully adjusted models for each of the same categories, although with slightly different estimates (see Table 3).

Of the 300 FOBT kits distributed to participants, 226 (75.3 %) were returned. Of the 226 returned kits, six were read as abnormal and one was determined to be unreadable (data not shown in tables).

Discussion

In this study, we demonstrated that Hispanics who learn about CRC can be encouraged to take action toward CRC screening. Using a giant inflatable colon to foster awareness about CRC, approximately 3,500–4,000 individuals received CRC information between March and October of 2012 in three rural counties of WA State. These counties have high Hispanic population proportions. As a result of touring the inflatable colon, familiarity with CRC improved significantly as did intention to obtain screening. We supplemented this intervention by providing free FOBT kits to a sample of participants who toured the inflatable colon.

The inflatable colon generated a great deal of attention and interest. Installed at community events such as outdoor health fairs throughout the region, the inflatable colon could be seen from great distances and attendees were eager to see it. The inflatable colon was the source of a number of local news stories and received coverage by newspapers and radio stations.

As a result of the inflatable colon tours, CRC became a conversational topic among many residents of the community. This is supported by the change in responses from pre- to post-test about the likelihood of talking to significant others about CRC (data not shown). In addition, CCHP staff received an increase in the number of requests from organizations who had heard about the inflatable colon, or seen it at a community event, and were interested in bringing it to their local community.

The change in familiarity was impressive; however, in itself, it does not speak to behavior change. Nevertheless, the response rate to the distribution of free FOBT kits was surprising, especially among minority populations such as Hispanics who are often noted as facing barriers to screening [5, 12–15]. Other studies have distributed free FOBT kits through mail [16–18], clinic visits [19–23], community retail stores [24, 25], and pharmacies [26, 27]. None experienced response rates as high as those seen in this study. Direct mailing yielded anywhere from 28 to 48 % participation rate, while clinic visits yielded between 48 and 69 %. FOBT return rates for studies that distributed kits via community retail stores and pharmacies were lower (17.6 to 20 %).

The associations with ever having been screened for CRC were noteworthy. Ever screened was associated with age, ethnicity, having a physician, having a clinic, and having health insurance. The lack of access to a regular physician, clinic, or health insurance is a structural barrier faced by many Hispanics [5, 28, 29]. Although the association of these barriers with intention to be screened was limited to having a regular physician, we were unable to follow up and verify the screening behavior of the majority of those who intended to be screened.

We attribute the success of the response to our FOBT screening to a number of factors. First, we increased the awareness of the problem in the area. A trip through the inflatable colon showed individuals that polyps that are not removed can develop into CRC and that advanced CRC can metastasize to other parts of the body. Other studies also have found that increasing awareness is important in generating action [30–33]. Second, the provision of the FOBT and its analysis were free, preventing a major burden of screening that is cost. The safety-net clinics that provide free or reduced cost screening often require the completion of documents and that the resident provide proof of income and/or citizenship status. Finally, as a result of this and other CBPR projects, we have long-term, trusting relationships in this area with community-based organizations and community members,

which facilitates recruitment and participation in this type of educational intervention.

Limitations

This study has some limitations. We did not conduct a formal count of people who walked through the inflatable colon at every event. Although we have information on intention to be screened, questionnaires were anonymous; thus, we cannot determine what percentage of respondents aged 50 and older followed up by obtaining CRC screening after walking through the inflatable colon. It was expected that after touring through the inflatable colon, participants would have increased awareness of CRC. The pre/post-questionnaire responses show each participant's increased familiarity with CRC but are not an indicator of their ability to retain the information. The FOBT kit was only distributed to a sample of participant and thus cannot be generalized to the entire population. Further research is needed to associate follow-up with CRC screening after touring the inflatable colon.

Conclusions

The use of an inflatable walk-through colon appears to be an innovative way to attract people to learn about CRC and CRC screening modalities. There were significant changes in participants' familiarity with CRC and likelihood to get screened. Furthermore, the response to our distribution of FOBT kits indicates that if given the opportunity for education and access to services, this population will comply with CRC screening. This is especially important for racial and ethnic minority populations and people of low socioeconomic status who typically lack health insurance, or are underinsured, and therefore find it difficult to obtain even basic health care services.

Acknowledgments We would like to thank all the participants who agreed to take part in this study as well as our community partners who hosted the inflatable colon. We would also like to thank all the promoters who were involved in leading tours through the inflatable colon. This project was supported by grant numbers 5U54CA153502 and 3P30CA015704-37S5 from the National Cancer Institute (NCI). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NCI or the National Institutes of Health.

Ethical Standards This project has been approved by the Fred Hutchinson Cancer Research Center Institutional Review Board Office and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. All participants gave their informed consent prior to their inclusion in the study.

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

References

- American Cancer Society (2013) Cancer Facts & Figures 2013. American Cancer Society, Atlanta. Available at: <http://www.cancer.org/acs/groups/content/@epidemiologysurveillance/documents/document/acspc-036845.pdf>. Accessed 30 June 2014
- American Cancer Society (2012) Cancer Facts & Figures for Hispanics/Latinos 2012–2014. American Cancer Society, Atlanta. Available at: <http://www.cancer.org/acs/groups/content/@epidemiologysurveillance/documents/document/acspc-034778.pdf>. Accessed 30 June 2014
- Howlander N, Noone AM, Krapcho M, Garshell J, Neyman N, Altekruse SF, Kosary CL et al (2012) SEER Cancer Statistics Review (CSR) 1975–2010. National Cancer Institute, Bethesda
- Edwards BK, Ward E, Kohler BA, Eheman C, Zauberg AG, Anderson RN, Jemal A et al (2010) Annual report to the nation on the status of cancer, 1975–2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. *Cancer* 116(3):544–573. doi:10.1002/cncr.24760
- Wang J, Moehring J, Stuhr S, Krug M (2013) Barriers to colorectal cancer screening in Hispanics in the United States: an integrative review. *Appl Nurs Res* 26(4):218–224. doi:10.1016/j.apnr.2013.08.005
- Fan L, Mohile S, Zhang N, Fiscella K, Noyes K (2012) Self-reported cancer screening among elderly Medicare beneficiaries: a rural-urban comparison. *J Rural Health* 28(3):312–319. doi:10.1111/j.1748-0361.2012.00405.x
- American Fact Finder (2010) 2010 census data. <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>. Accessed 4 Mar 2012
- Pew Research Center (2011) Demographic profile of Hispanics in Washington, 2011. <http://www.pewhispanic.org/states/state/wa/>. Accessed 5 Mar 2014
- Agresti A (2013) Categorical data analysis, 3rd edn. Wiley, Hoboken
- Fay MP (2010) Two-sided exact tests and matching confidence intervals for discrete data. *R Journal* 2(1):53–58
- R Development Core Team (2014) R: a language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <http://www.R-project.org/>
- Jandorf L, Ellison J, Villagra C, Winkel G, Varela A, Quintero-Canetti Z, Castillo A, Thélémaque L, King S, DuHamel K (2010) Understanding the barriers and facilitators of colorectal cancer screening among low income immigrant Hispanics. *J Immigr Minor Health* 12(4):462–469. doi:10.1007/s10903-009-9274-3
- Jerant AF, Fenton JJ, Franks P (2008) Determinants of racial/ethnic colorectal cancer screening disparities. *Arch Intern Med* 168(12):1317–1324. doi:10.1001/archinte.168.12.1317
- Morales EA, Rao SP, Livaudais JC, Thompson B (2012) Improving knowledge and screening for colorectal cancer among Hispanics: overcoming barriers through a PROMOTORA-led home-based educational intervention. *J Cancer Educ* 27(3):533–539. doi:10.1007/s13187-012-0357-9
- Shokar NK, Carlson CA, Weller SC (2008) Factors associated with racial/ethnic differences in colorectal cancer screening. *J Am Board Fam Med* 21(5):414–426. doi:10.3122/jabfm.2008.05.070266
- Frederiksen BL, Jorgensen T, Brasso K, Holten I, Osler M (2010) Socioeconomic position and participation in colorectal cancer screening. *Br J Cancer* 103(10):1496–1501. doi:10.1038/sj.bjc.6605962
- Goldberg D, Schiff GD, McNutt R, Furumoto-Dawson A, Hammerman M, Hoffman A (2004) Mailings timed to patients' appointments: a controlled trial of fecal occult blood test cards. *Am J Prev Med* 26(5):431–435. doi:10.1016/j.amepre.2004.02.009
- Segnan N, Senore C, Andreoni B, Arrigoni A, Bisanti L, Cardelli A, Castiglione G et al (2005) Randomized trial of different screening strategies for colorectal cancer: patient response and detection rates. *J Natl Cancer Inst* 97(5):347–357. doi:10.1093/jnci/dji050
- Dwyer DM, Groves C, Hopkins A, Keelaghan E, Shebl FM, Andrews B, Bienia M, Steinberger E (2012) Experience of a public health colorectal cancer testing program in Maryland. *Public Health Rep* 127(3):330–339
- Potter MB, Phengrasamy L, Hudes ES, McPhee SJ, Walsh JME (2009) Offering annual fecal occult blood tests at annual flu shot clinics increases colorectal cancer screening rates. *Ann Fam Med* 7(1):17–23. doi:10.1370/afm.934
- Potter MB, Walsh JME, Yu TM, Gildengorin G, Green LW, McPhee SJ (2011) The effectiveness of the FLU–FOBT program in primary care: a randomized trial. *Am J Prev Med* 41(1):9–16
- Tu SP, Taylor V, Yasui Y, Chun A, Yip MP, Acorda E, Li L, Bastani R (2006) Promoting culturally appropriate colorectal cancer screening through a health educator. *Cancer* 107(5):959–966. doi:10.1002/cncr.22091
- Walsh JME, Gildengorin G, Green LW, Jenkins J, Potter MB (2012) The FLU-FOBT program in community clinics: durable benefits of a randomized controlled trial. *Health Educ Res* 27(5):886–894. doi:10.1093/her/cys063
- Gellert K, Braun KL, Morris R, Starkey V (2006) The 'Ohana Day Project: a community approach to increasing cancer screening. *Prev Chronic Dis* 3(3):A99
- Wallace SP (2012) Measuring outcomes & selecting effective interventions to advance the National Prevention Strategy. In *Gerontologist*. Oxford University Press, Cary
- Feufel MA, Schneider TR, Berkel HJ (2010) A field test of the effects of instruction design on colorectal cancer self-screening accuracy. *Health Educ Res* 25(5):709–723. doi:10.1093/her/cyq015
- Parente F, Marino B, DeVecchi N, Moretti R (2009) Faecal occult blood test-based screening programme with high compliance for colonoscopy has a strong clinical impact on colorectal cancer. *Br J Surg* 96(5):533–540. doi:10.1002/bjs.6568
- Ahmed NU, Pelletier V, Winter K, Albatineh AN (2013) Factors explaining racial/ethnic disparities in rates of physician recommendation for colorectal cancer screening. *Am J Public Health* 103(7):e91–e99. doi:10.2105/ajph.2012.301034
- Liss DT, Baker DW (2014) Understanding current racial/ethnic disparities in colorectal cancer screening in the United States: the contribution of socioeconomic status and access to care. *Am J Prev Med* 46(3):228–236. doi:10.1016/j.amepre.2013.10.023
- Byrd TL, Wilson KM, Smith JL, Coronado G, Vernon SW, Fernandez-Esquer ME, Thompson B, Ortiz M, Lairson D, Fernandez ME (2013) AMIGAS: a multicity, multicomponent cervical cancer prevention trial among Mexican American women. *Cancer* 119(7):1365–1372. doi:10.1002/cncr.27926
- Duggan C, Coronado G, Martinez J, Byrd TL, Carosso E, Lopez C, Benavides M, Thompson B (2012) Cervical cancer screening and adherence to follow-up among Hispanic women study protocol: a randomized controlled trial to increase the uptake of cervical cancer screening in Hispanic women. *BMC Cancer* 12(1):1–6. doi:10.1186/1471-2407-12-170
- Smith RA, Cokkinides V, Brawley OW (2009) Cancer screening in the United States, 2009: a review of current American Cancer Society guidelines and issues in cancer screening. *CA Cancer J Clin* 59(1):27–41. doi:10.3322/caac.20008
- Redwood D, Provost E, Asay E, Ferguson J, Muller J (2013) Giant inflatable colon and community knowledge, intention, and social support for colorectal cancer screening. *Prev Chronic Dis* 10:E40. doi:10.5888/pcd10.120192