Published in final edited form as:
Cancer Nurs. 2012 July ; 35(4): 288–294. doi:10.1097/NCC.0b013e31822e7859.

The Relationship Between Colorectal Cancer Screening Adherence and Knowledge Among Vulnerable Rural Residents of Appalachian Kentucky

Shoshana H. Bardach, MA, **Nancy E. Schoenberg, PhD**, **Steven T. Fleming, PhD**, and **Jennifer Hatcher, RN, PhD**
Department of Behavioral Science, University of Kentucky, Lexington, Kentucky (Mrs. Bardach and Dr. Schoenberg); Department of Epidemiology, University of Kentucky, Lexington, Kentucky (Dr. Fleming); and Department of Nursing, University of Kentucky, Lexington, Kentucky (Dr. Hatcher)

Abstract

Background—Colorectal cancer (CRC) is one of the leading causes of cancer related deaths among residents of rural Appalachia. Rates of guideline-consistent CRC screening in Appalachian Kentucky are suboptimal.

Objective—This study sought to determine the relationship between colorectal cancer screening knowledge, specifically regarding recommended screening intervals, and receipt of screening among residents of rural Appalachian Kentucky.

Methods—Residents of Appalachian Kentucky (n=1096) between the ages of 50 and 76 completed a telephone survey including questions on demographics, health history, and knowledge about colorectal cancer screening between November 20, 2009 and April 22, 2010.

Results—While 67% of respondents indicated receiving screenings according to guidelines, respondents also demonstrated significant knowledge deficiencies about screening recommendations. Nearly half of respondents were unable to identify the recommended screening frequency for any of the colorectal cancer screening modalities. Accuracy about the recommended frequency of screening was positively associated with screening adherence.

Conclusions—Enhanced educational approaches have the potential to increase colorectal cancer screening adherence in this population and reduce cancer mortality in this underserved region.

Implications for practice—Nurses play a critical role in patient education, which ultimately may increase screening rates. To fulfill this role, nurses should incorporate current recommendation about CRC screening into educational sessions. Advanced practices nurses in rural settings should also be aware of the increased vulnerability of their patient population and develop strategies to enhance awareness about CRC and the accompanying screening tests.

Correspondence: Shoshana H. Bardach, MA, Department of Behavioral Science, University of Kentucky, 125 Medical Behavioral Science Building, Lexington, KY 40536-0086, (shbardach@uky.edu).

Introduction

Cancer is the second leading cause of death in the United States and colorectal cancer (CRC) is the second most common cause of cancer-related death.[1] CRC mortality rates in Kentucky are significantly higher (22.0 per 100,000) than national averages (18.8 per 100,000),[2] and rates within the eastern region of Appalachian Kentucky exceed mortality rates in non-Appalachian Kentucky.[3] These mortality rates are alarming, particularly given that CRC is preventable and treatable through prevention efforts including lifestyle modification (e.g., smoking cessation and optimal dietary intake), cancer screening, early detection, and efficacious treatments.[4–5]

The American Cancer Society screening guidelines suggest that beginning at age 50, most patients, should undergo CRC screening. Screening options include annual Fecal Occult Blood Test (FOBT), double contrast barium enema or flexible sigmoidoscopy every 5 years, or colonoscopy every 10 years.[6] Current Behavioral Risk Factor Surveillance System (BRFSS) data indicate that only 36% of respondents in Appalachian Kentucky reported CRC screening consistent with recommended guidelines compared to 47.2% in Kentucky and 53% nationwide.[7–8]

Previous research among Appalachian residents has suggested several key barriers to cancer screening, including limitations in screening knowledge; however, these studies do not link CRC screening with knowledge. Much of the existing Appalachian literature instead focuses on perceptions of barriers to screening, including or knowledge deficiencies, but does not link such barriers to screening adherence.[9–11] Greater knowledge of cancer risk, the benefits of cancer screening, and the likelihood of cancer survival also are positively associated with cancer screening adherence.[12–14]

Interventions to increase screening have focused on educational campaigns emphasizing the value of CRC screening.[15] Research has demonstrated that maximizing the effectiveness of these interventions requires an improved understanding of the relationship between CRC knowledge and the acceptance of screening.[16] Such insights are lacking within rural Appalachian Kentucky, a region well known for its high cancer mortality.[17–18]

Previous research has suggested that knowledge about screening guidelines,[19] and in particular, knowledge about screening intervals increases the likelihood of compliance with guidelines.[12] This study seeks to test the hypothesis that there is a positive relationship between knowledge of CRC screening guidelines and adherence to CRC screening among rural Appalachian residents. These data are part of a larger study exploring predictors of CRC screening adherence in rural Appalachia, focusing specifically on how multiple chronic diseases serve as either barriers to or facilitators of colorectal cancer screening.

Methods

Institutional Review Board approval was obtained from the University of Kentucky, after which the University of Kentucky Survey Research Center (SRC) administered the survey between November 20, 2009 and April 22, 2010. Eligible participants were residents of the Appalachian region of Kentucky who were between 50 to 76 years old, an age range generally considered consistent with eligibility for CRC screening recommendations. Trained, experienced, and continuously monitored SRC interviewers conducted surveys with randomly selected households using a modified list-assisted Waksberg-Mitofsky random-digit dialling procedure.[20–21] For each telephone number, up to 15 attempted calls were made. After 15 call attempts or when a respondent declined participation, no further call attempts were made to that number. If respondents indicated that the timing was inconvenient, interviewers attempted up to 10 call-backs. Potential participants were read a

statement about the study purpose and target population and asked for their willingness to continue.

The survey consisted of questions on (1) demographics; (2) burden of disease by the presence of fifteen different chronic conditions; (3) the 4 predominant methods of CRC screening; (4) the barriers and facilitators of CRC screening. Participants were given a brief description of each of 4 predominant types of colorectal cancer screening tests, and asked 3 questions for each test: (1) Have you ever had this test? (2) How long ago did you have this test? (3) How often do the medical guidelines say you should have this test? Participants were asked for reasons why they had or had not been screened.

Statistical Analyses

Data were entered into and analyzed using SAS v9.2. Participants with missing data for age, sex, marital status, education, financial status, health status, or race were excluded from analysis. Consistent with established guidelines,[22] participants were coded as adherent if they conformed to screening guidelines. Participants who had received any of these tests but not within these time frames were labeled as screened but not within guidelines. In order to test for differences between individuals with different levels of screening knowledge, ANOVA was used for continuous data and chi-square tests were used for categorical data. Logistic regression was used to study the association between knowledge accuracy about screening recommendations and adherence to screening recommendations, controlling for age, gender, number of conditions, self-reported health status, subjective financial status, and education. *P* values less than .05 were considered to be significant.

Results

Sample description

Including ineligible participants in both the numerator and the denominator, the response rate was 55%, ((1,182+3,226)/8,019). After excluding participants missing data on the demographic variables indicated, 1096 participants remained. On average, participants were 61 years old, the majority (70.6%) were female, married (62.8%), and White (96.6%). Participants reported an average of 3.3 medical conditions. Over a third of participants (36.4%) reported struggling financially, with almost half of participants (44.9%) feeling they had just enough to get by, and roughly a fifth of the sample (18.7%) feeling that they had more than enough to get by. Nearly 42 percent had more than a high school education, 36.7% had a high school education or a GED, and 21.6% had less than a high school education. See Table 1 for additional sample description.

Screening behaviors and accuracy of knowledge regarding screening frequencies

Contrary to BRFSS data, most study respondents reported having been screened for CRC according to medical guidelines (n=733, 66.9%), an additional 11.1% of the sample (n=122) had been screened previously but not within recommended guidelines, and the remaining 22.0% of the sample had never been screened for CRC. The most common screening test participants reported receiving was colonoscopy (65.8%), followed by FOBT (39.4%), double contrast barium enema (28.7%), and sigmoidoscopy (20.2%). Responses add up to more than 100% because many individuals reported being screened with multiple modalities.

Respondents provided the most accurate responses to questions about the recommended frequency of FOBT (47.9%), followed by double-contrast barium enema (33.0%) and sigmoidoscopy (32.5%), and finally colonoscopy (12.3%). All respondents who did not correctly identify the recommended FOBT frequency suggested a less frequent schedule

than advised. In contrast, for colonoscopy, the majority of respondents (85.5%) incorrectly suggested a more frequent screening schedule. For sigmoidoscopy and double contrast barium enema, 49.4% and 42.5% of respondents, respectively, suggested schedules more frequent than advised.

Respondents demonstrated significant knowledge deficiencies about screening guidelines. Nearly half (541, 49.4%) of respondents provided inaccurate responses regarding the suggested screening frequency for all 4 modalities. In support of the hypothesis, accuracy about the recommended frequency of screening was positively associated with screening adherence. The degree of accuracy was also associated with number of chronic medical conditions; those with the least knowledge about screening guidelines tended to have a greater number of medical conditions than those with the most knowledge about screening frequencies. In addition, those with lower knowledge accuracy tended to have poorer health, greater financial difficulty, and less education than those who were more accurate about suggested screening frequencies. See Table 3 for additional details.

Logistic Regression Analysis

Analysis of receiver operating curves suggests that the model utilized had good overall fit, c=.67. Logistic regression results also supported the hypothesis that knowledge was positively associated with screening adherence. As compared to individuals who were not knowledgeable about any recommended screening frequency, those who were accurate about 2 or more screening test guidelines had twice the odds of being adherent to screening, controlling for age, numbers of conditions, sex, education, perceived financial status, and subjective health status. Thus, these results indicate that knowledge accuracy regarding screening frequency is associated with screening adherence, even when controlling for other variables in the model. See table 4 for details.

Of the 363 individuals not screened within guidelines, (241 had never been screened and 122 had been screened previously but not within guidelines), 43.0% provided reasons for non-adherence that can be categorized as lacking awareness. Such reasons included having never thought about CRC, not realizing screening was needed, not thinking CRC was important, or not believing oneself to be at risk. These awareness-related reasons for not being screened were not associated with any demographic variables.

Discussion

Over two-thirds (66.9%) of study participants reported adhering to CRC screening recommendations, an unanticipated result given the CDC's finding that just over one-third of Appalachian Kentuckians are guideline adherent. Although participants were most likely to report receiving colonoscopy than any other screening modality, only 12.3% accurately reported the recommended screening frequency. Inaccurate information about recommended screening frequencies were pervasive, with only 15.9% of respondents able to identify the correct screening frequency for two of the screening options and nearly half of all respondents unable to identify the recommended frequency for any test. Prior research has shown similar knowledge deficits among rural Appalachian women regarding breast cancer and guidelines regarding screening timing; these knowledge deficits were evident even among well-educated women.[9] The knowledge deficiencies identified in the present study warrant attention since the study hypothesis was supported; that is, having fewer accurate responses was associated with a lower likelihood of being screened within guidelines.

Those with fewer medical conditions, those in better health, and those with higher socioeconomic status (SES, consisting of income and education) were more likely to respond accurately about screening recommendations. The association between higher SES

and greater CRC knowledge and likelihood of screening is consistent with prior research.[23–24] The finding that fewer medical conditions are associated with greater knowledge about CRC screening has not been reported extensively. This association, at first glance, seems to present a paradox since those with fewer conditions also had a lower level of CRC screening adherence. It is plausible that individuals with higher SES may have greater health knowledge and resources, resulting in fewer conditions, and presumably fewer health encounters; and such encounters probably are a stronger predictor of screening adherence than knowledge. This explanation is consistent with patient reports that a provider recommendation is the strongest predictor of screening adherence.[25–26] This study's findings support this possibility as the number of self-reported medical conditions was independently associated with adherence, whereas finances and education were not associated with adherence.

These findings suggest that when trying to improve adherence, it is important to consider the relationship between the number of medical conditions and contact with health care providers. Research has demonstrated that older adults in poorer health had higher rates of FOBT;[27] this may suggest that greater health needs result in increased contact with providers and consequently more opportunities for discussions related to screening. These findings also suggest that although it is beneficial for individuals to have fewer chronic conditions, they may run the risk of inadequate exposure to health care providers who direct patients toward screening.

After controlling for other salient factors (sex, age, number of conditions, education, financial status, subjective health), knowledge about frequency of screening recommendations remained a significant predictor of screening adherence. These results may even suggest a dose-response relationship between knowledge and screening, with a greater degree of knowledge associated with higher odds of screening adherence.

Conclusions

The findings from this study suggest that, given the strong association between knowledge and screening adherence, enhanced educational approaches may be useful in increasing CRC screening adherence. A substantial percentage of respondents also offered knowledge-related reasons for why they were not screened. Thus, while individuals are not always able to identify the role that knowledge plays in their screening decisions, significant knowledge deficiencies do seem to be associated with lower screening adherence rates.

Implications for practice

Nurses at all levels of practice routinely provide recommendations for preventive care to patients.[28] In light of their increased contact with patients, nurses are ideally situated to provide information that will increase knowledge regarding CRC screening guidelines. One approach to reducing the knowledge deficiencies identified in this study may be enhanced CRC screening counseling, especially among those primary care providers, including NPs and physicians, who are most accessible to their patients. Providers in rural Appalachia, only one third of whom report recommending screening to their patients, may assume that their patients have limited interest in CRC screening tests or may lack the means to obtain screening and consequently may be reluctant to advocate for screening.[29] Mammogram research suggests that many patients indicate a willingness to engage in screening, but identify the lack of a provider referral as a key reason why they do not get cancer screening.[27, 30–31] Providers have a valuable opportunity during routine examinations to reinforce and/or clarify screening guidelines, rectifying knowledge limitations, thereby increasing awareness and possibly screening adherence.[32] Unfortunately, while nurses

recognize the need to be involved in cancer prevention and detection, their current rate of delivery of cancer prevention practices remains low.[33]

Nurses in primary care roles should base recommendations on a combination of best practice and current guidelines. Recent research indicates that nurses recognize the need for and would like additional training related to cancer prevention and detection.[34–35] Continuing education programs designed specifically for nurses should emphasize evidence-based cancer-screening guidelines and their translation into clinical practice. A review of such guidelines would aid clinicians in sorting out any ambiguity in the guidelines.[36]

A careful examination of the unique considerations of rural Appalachian adults also will provide insight into what methods work best to increase understanding and awareness of CRC and screening recommendations among this population. Research indicates that cultural practices and beliefs, particularly in relation to communication norms and expectations, influence the processing of knowledge acquisitions regarding CRC screening.[37–38] Future research should therefore focus on enhancing providers' abilities to offer culturally sensitive interventions to increase knowledge of CRC and thereby improve screening uptake. Another promising approach to promote screening is to identify and educate opinion leaders, leveraging the strong social networks within rural communities, creating a community demand for screening.[39–41] These individuals can also be trained as lay health advisers or patient navigators, and their familiarity with the local community will increase their ability to address patient barriers to screening.[42–45] This is a particularly promising approach given the nursing and other provider shortages endemic in rural areas.[46]

Study limitations and strengths

These results must be interpreted with some caution. First, generalizability is limited by the possibility that respondents may differ from non-respondents. Although this sample's race/ethnicity reflects the predominance of Whites in Appalachian, such homogeneity limits generalizability.[47] Additionally, the sample was disproportionately female. Second, since this project was meant to explore CRC among vulnerable Appalachian residents, the results may not be generalizable to other rural populations. Third, there is potential for retrospective memory biases or social-desirability responses due to self-report. These potential biases may explain the unexpected finding that most participants reported being screened according to guidelines. In addition, many respondents did not answer questions about their knowledge of medical guidelines and it is unclear whether this reflects uncertainty about guidelines or omissions in survey delivery or response recording. Finally, this study focused on a single proxy for knowledge, screening intervals.

Despite these limitations, this study helps elucidate the relationship between knowledge and screening among rural Appalachian residents. The current study evaluated behavioral outcomes and the reasons for those behaviors, rather than focusing solely on barriers and asking respondents to imagine what they would do if the barriers were removed. In conclusion, the insights gained from this study, stressing the importance of knowledge in predicting CRC screening adherence, can be used to inform future efforts to increase CRC screening and reduce cancer mortality in this underserved region. Nurses are positioned to play a pivotal role in promoting screening and reducing cancer mortality.

Acknowledgments

Conflicts of Interest:

Support for this research was provided by the grant "Increasing Colorectal Cancer Screening for Patients with Multiple Morbidities" (National Institutes of Health/ National Cancer Institute. R21CA129881-01, PI: Schoenberg).

References

1. Centers for Disease Control and Prevention. [Accessed July 19, 2010] Colorectal cancer: The importance of prevention and early detection. 2010. http://www.cdc.gov/colorectalcancer/publications/fact_sheets.htm
2. U.S. Cancer Statistics Working Group. United States cancer statistics: 1999–2006 incidence and mortality web-based report. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute. 2010. http://apps.nccd.cdc.gov/uscs/statevsnational.aspx
3. Kentucky Cancer Registry. Age-adjusted cancer mortality rates in Kentucky. 2010. http://cancer-rates.info/ky/index_mort.php
4. American Cancer Society. Colorectal Cancer. 2011. http://documents.cancer.org/107.00/107.00.pdf
5. Scherubl H. Rectal carcinoids are on the rise: early detection by screening endoscopy. Endoscopy. 2009 Feb; 41(2):162–165. [PubMed: 19214898]
6. American Cancer Society. [Accessed July 14, 2010] American Cancer Society Guidelines for the Early Detection of Cancer. 2010. http://www.cancer.org/Healthy/FindCancerEarly/CancerScreeningGuidelines/american-cancer-society-guidelines-for-the-early-detection-of-cancer
7. Hughes E, McCracken M, Roberts H, et al. Surveillance for certain health behaviors among states and selected local areas --- Behavioral Risk Factor Surveillance System, United States, 2004. MMWR: Morbidity and Mortality Weekly Report. 2006; 55(SS07):1–124. http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5507a1.htm?s_cid=ss5507a1_x. [PubMed: 16410759]
8. Kentucky Department for Public Health and Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System survey data. Frankfort, KY: Cabinet for Health and Family Services, Kentucky Department for Public Health; 2002.
9. Leslie N, Deiriggi P, Gross S, DuRant M, Smith C, Veshnesky J. Knowledge, attitudes, and practices surrounding breast cancer screening in educated Appalachian women. Oncology Nursing Forum. 2003; 30(4):659–667. [PubMed: 12861325]
10. Schoenberg N, Hopenhayn C, Christian A, Knight E, Rubio A. An in-depth and updated perspective on determinants of cervical cancer screening among central Appalachian women. Journal of Women and Health. 2006; 42(2):89–105.
11. Royse D, Dignan M. Appalachian knowledge of cancer and screening intentions. J Cancer Educ. 2009; 24(4):357–362. [PubMed: 19838899]
12. Nelson W, Moser RP, Gaffey A, Waldron W. Adherence to cervical cancer screening guidelines for U.S. women aged 25–64: data from the 2005 Health Information National Trends Survey (HINTS). J Womens Health (Larchmt). 2009 Nov; 18(11):1759–1768. [PubMed: 19951209]
13. Lee EE, Fogg L, Menon U. Knowledge and beliefs related to cervical cancer and screening among Korean American women. West J Nurs Res. 2008 Dec; 30(8):960–974. [PubMed: 18539883]
14. Graves K, Huerta E, Cullen J, et al. Perceived risk of breast cancer among Latinas attending community clinics: risk comprehension and relationship with mammography adherence. Cancer Causes and Control. 2008; 19(10):1373–1382. [PubMed: 18704716]
15. Davis RE, Armstrong DK, Dignan M, Norling GR, Redmond J. Evaluation of educational materials on colorectal cancer screening in Appalachian Kentucky. Preventing Chronic Disease. 2006 Apr.3(2):A43. [PubMed: 16539784]
16. Philip EJ, DuHamel K, Jandorf L. Evaluating the impact of an educational intervention to increase CRC screening rates in the African American community: a preliminary study. Cancer Causes Control. 2010 Oct; 21(10):1685–1691. [PubMed: 20535541]
17. Hutson SP, Dorgan KA, Phillips AN, Behringer B. The mountains hold things in: The use of community research review work groups to address cancer disparities in Appalachia. Oncology Nursing Forum. 2007 Nov; 34(6):1133–1139. [PubMed: 18024340]
18. Center for Disease Control and Prevention. Cancer death rates--Appalachia, 1994–1998. MMWR: Morbidity and Mortality Weekly Report. 2002 Jun 21; 51(24):527–529. [PubMed: 12088143]

19. Wall KM, Rocha GM, Salinas-Martinez AM, Baraniuk S, Day RS. Modifiable barriers to cervical cancer screening adherence among working women in Mexico. J Womens Health (Larchmt). 2010 Jul; 19(7):1263–1270. [PubMed: 20509792]
20. Brick JM, Waksberg J, Kulp D, Starer A. Bias in list-assisted telephone samples. Public Opinion Quarterly. 1995; 59(2):218–235.
21. Casady RJ, Lepkowski JM. Stratified telephone survey designs. Survey Methodology. 1993; 19:103–113.
22. U.S. Preventive Services Task Force. Screening for Colorectal Cancer: U.S. Preventive Services Task Force Recommendation Statement. AHRQ Publication 08-05124-EF-3. 2008. http://www.ahrq.gov/clinic/uspstf08/colocancer/colors.htm
23. Klabunde CN, Schenck AP, Davis WW. Barriers to colorectal cancer screening among Medicare consumers. Am J Prev Med. 2006 Apr; 30(4):313–319. [PubMed: 16530618]
24. Wilkinson AV, Vasudevan V, Honn SE, Spitz MR, Chamberlain RM. Sociodemographic characteristics, health beliefs, and the accuracy of cancer knowledge. J Cancer Educ. 2009; 24(1): 58–64. [PubMed: 19259867]
25. Klabunde CN, Vernon SW, Nadel MR, Breen N, Seeff LC, Brown ML. Barriers to Colorectal Cancer Screening: A Comparison of Reports From Primary Care Physicians and Average-Risk Adults. Medical Care. 2005; 43(9):939–944. [PubMed: 16116360]
26. Greiner KA, Engelman KK, Hall MA, Ellerbeck EF. Barriers to colorectal cancer screening in rural primary care. Preventive Medicine. 2004; 38(3):269–275. [PubMed: 14766108]
27. Grindel CG, Brown L, Caplan L, Blumenthal D. The effect of breast cancer screening messages on knowledge, attitudes, perceived risk, and mammography screening of African American women in the rural South. Oncol Nurs Forum. 2004 Jul; 31(4):801–808. [PubMed: 15252434]
28. Tompkins TH, Belza B, Brown M-A. Nurse practitioner practice patterns for exercise counseling. Journal of the American Academy of Nurse Practitioners. 2009; 21(2):79–86. [PubMed: 19228245]
29. Shell R, Tudiver F. Barriers to cancer screening by rural Appalachian primary care providers. The Journal of Rural Health. 2004; 20(4):368–373. [PubMed: 15551854]
30. Gierisch JM, O'Neill SC, Rimer BK, DeFrank JT, Bowling JM, Skinner CS. Factors associated with annual-interval mammography for women in their 40s. Cancer Epidemiology. 2009; 33(1): 72–78. [PubMed: 19481879]
31. Garbers S, Chiasson MA. Breast cancer screening and health behaviors among African American and Caribbean Women in New York City. J Health Care Poor Underserved. 2006 Feb; 17(1):37–46. [PubMed: 16520506]
32. Carcaise-Edinboro P, Bradley CJ. Influence of Patient-Provider Communication on Colorectal Cancer Screening. Medical Care. 2008; 46(7):738–745. 710.1097/MLR.1090b1013e318178935a. [PubMed: 18580394]
33. Furfaro T, Bernaix L, Schmidt C, Clement J. Nurse practitioners' knowledge and practice regarding malignant melanoma assessment and counseling. Journal of the American Academy of Nurse Practitioners. 2008; 20(7):367–375. [PubMed: 18638176]
34. Patton LL, Ashe TE, Elter JR, Southerland JH, Strauss RP. Adequacy of training in oral cancer prevention and screening as self-assessed by physicians, nurse practitioners, and dental health professionals. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006; 102(6):758–764.
35. Edwards QT, Maradiegue A, Seibert D, Saunders-Goldson S, Humphreys S. Breast cancer risk elements and nurse practitioners' knowledge, use, and perceived comfort level of breast cancer risk assessment. Journal of the American Academy of Nurse Practitioners. 2009; 21(5):270–277. [PubMed: 19432911]
36. Lawvere S, Mahoney MC, Symons AB, Englert JJ, Klein SB, Mirand AL. Approaches to Breast Cancer Screening Among Nurse Practitioners. Journal of the American Academy of Nurse Practitioners. 2004; 16(1):38–43. [PubMed: 15008037]
37. Ge G, Burke N, Somkin CP, Pasick R. Considering culture in physician-- patient communication during colorectal cancer screening. Qual Health Res. 2009 Jun; 19(6):778–789. [PubMed: 19363141]

38. Cameron KA, Francis L, Wolf MS, Baker DW, Makoul G. Investigating Hispanic/Latino perceptions about colorectal cancer screening: A community-based approach to effective message design. Patient Education and Counseling. 2007; 68(2):145–152. [PubMed: 17517486]

39. English KC, Fairbanks J, Finster CE, Rafelito A, Luna J, Kennedy M. A socioecological approach to improving mammography rates in a tribal community. Health Education & Behavior. 2008 Jun; 35(3):396–409. [PubMed: 17114330]

40. Valente TW, Pumpuang P. Identifying Opinion Leaders to Promote Behavior Change. Health Education & Behavior. 2007 Dec 1; 34(6):881–896. 2007. [PubMed: 17602096]

41. Baron RC, Rimer BK, Breslow RA, et al. Client-Directed Interventions to Increase Community Demand for Breast, Cervical, and Colorectal Cancer Screening: A Systematic Review. American Journal of Preventive Medicine. 2008; 35(Supplement 1)(1):S34–S55. [PubMed: 18541187]

42. Percac-Lima S, Grant R, Green A, et al. A Culturally Tailored Navigator Program for Colorectal Cancer Screening in a Community Health Center: A Randomized, Controlled Trial. Journal of General Internal Medicine. 2009; 24(2):211–217. [PubMed: 19067085]

43. Plescia M, Groblewski M, Chavis L. A Lay Health Advisor Program to Promote Community Capacity and Change Among Change Agents. Health Promotion Practice. 2008 Oct 1; 9(4):434–439. 2008. [PubMed: 17105806]

44. Yu, M-y; Lixin, Song; Seetoo, A.; Cuijuan, Cai; Smith, G.; Oakley, D. Culturally Competent Training Program: A Key to Training Lay Health Advisors for Promoting Breast Cancer Screening. Health Education & Behavior. 2007 Dec 1; 34(6):928–941. 2007. [PubMed: 17965228]

45. Nguyen TT, Le G, Nguyen T, et al. Breast Cancer Screening Among Vietnamese Americans: A Randomized Controlled Trial of Lay Health Worker Outreach. American Journal of Preventive Medicine. 2009; 37(4):306–313. [PubMed: 19765502]

46. Dudley G. Nursing shortage in rural America: a tragedy not yet fully acknowledged? Osteopathic Family Physician. 2009; 1(1):12–17.

47. Appalachian Regional Commission. Socioeconomic overview of the Appalachian Region. 2010. http://www.arc.gov/appalachian_region/SocioeconomicOverviewoftheAppalachianRegion.asp

Table 1

Sample Description[a]

Characteristics	All Respondents (n=1096)	Screening Adherence		
		Screened Within Guidelines (n=733)	Screened Not Within Guidelines (n=122)	Never Screened (n=241)
Age, mean (SD)[b]	61.2 (7.2)	62.0 (7.2)	61.1 (6.2)	58.7 (7.1)
Number of conditions, mean (SD)[b]	3.3 (2.2)	3.6 (2.3)	3.3 (2.1)	2.6 (1.9)
Sex, No. (%)				
Male	322 (29.4)	212 (28.9)	33 (27.1)	77 (32.0)
Female	774 (70.6)	521 (71.1)	89 (73.0)	164 (68.1)
Marital Status, No. (%)				
Married/partnered	688 (62.8)	465 (63.4)	78 (63.9)	145 (60.2)
Separated/Divorced	169 (15.4)	111 (15.1)	20 (16.4)	38 (15.8)
Widowed	161 (14.7)	111 (15.1)	15 (12.3)	35 (14.5)
Single, never married	75 (6.8)	44 (6.0)	9 (7.4)	22 (9.1)
Other	3 (0.3)	2 (0.3)	0	1 (0.4)
Education, No. (%)[c]				
<High School	237 (21.6)	152 (20.7)	22 (18.0)	63 (26.1)
High School/GED	402 (36.7)	252 (34.4)	47 (38.5)	103 (42.7)
>High School	457 (41.7)	329 (44.9)	53 (43.4)	75 (31.1)
Perceived Financial Status, No. (%)[d]				
More than enough	205 (18.7)	150 (20.5)	17 (13.9)	38 (15.7)
Just enough	492 (44.9)	333 (45.4)	62 (50.8)	97 (40.3)
Struggle to get by	399 (36.4)	250 (34.1)	43 (35.3)	106 (44.0)
Current Health Status, No. (%)				
Excellent/Very Good/Good	620 (56.6)	417 (56.9)	71 (58.2)	132 (54.8)
Fair/ Poor	476 (43.4)	316 (43.1)	51 (40.8)	109 (45.2)
Race, No. (%)				
White	1059 (96.6)	716 (97.7)	118 (96.7)	225 (93.4)
Non-White	37 (3.4)	16 (2.3)	4 (3.3)	16 (6.6)

[a] Percentages may not add up to 100% due to rounding

[b] p<.0001

[c] p=.0043

[d] p=.028

Table 2

Screening Behaviors and Responses[a]

	FOBT, No. (%)	Colonscopy, No. (%)	Sigmoidoscopy, No. (%)	Double-contrast Barium Enema, No. (%)
Ever Had Test?				
Yes	431 (39.4)	718 (65.8)	218 (20.2)	306 (28.7)
No	663 (60.6)	374 (34.3)	861 (79.8)	762 (71.4)
How long ago did you get this test?[b]				
Within past year	**135 (32.0)**	**228 (31.8)**	**52 (24.8)**	**42 (14.1)**
Within past 2 years	70 (16.6)	**154 (21.5)**	**29 (13.8)**	**25 (8.4)**
Within past 3 years	36 (8.5)	**89 (12.4)**	**21 (10.0)**	**17 (5.7)**
Within past 5 years	73 (17.3)	**132 (18.4)**	**26 (12.4)**	**32 (10.7)**
Within past 10 years	48 (11.4)	**72 (10.1)**	26 (12.4)	46 (15.4)
10+ years ago	60 (14.2)	41 (5.7)	56 (26.7)	136 (45.6)
How often do medical guidelines suggest this test?[c]	n=710	n=865	n=535	n=473
Every year	**340 (47.9)**	160 (18.5)	124 (23.2)	92 (19.5)
Every two years	129 (18.2)	122 (14.1)	85 (15.9)	64 (13.5)
Every three years	51 (7.2)	93 (10.8)	55 (10.3)	45 (9.5)
Every four or five years	117 (16.5)	365 (42.2)	**174 (32.5)**	**156 (33.0)**
Every six to ten years	29 (4.1)	**106 (12.3)**	49 (9.2)	47 (9.9)
Never	44 (6.2)	19 (2.2)	48 (9.0)	69 (14.6)

[a] Numbers may differ from totals due to survey skip patterns and missing data; Percentages may not add up to 100% due to rounding

[b] Responses within medical guidelines are bolded

[c] Correct response is bolded

Table 3

Accuracy of Knowledge Regarding Screening Frequencies[a]

	Accurate responses for screening guidelines			
	0 (n=541)	**1 (n=381)**	**2+ (n=174)**	***P* Value**
Adherence, No. (%)				<.001
Screened within guidelines	335 (61.9)	268 (70.3)	130 (74.7)	
Screened, not within guidelines	56 (10.4)	46 (12.1)	20 (11.5)	
Never screened	150 (27.6)	67 (17.6)	24 (13.8)	
Number of conditions, mean (SD)	3.5 (2.2)	3.2 (2.3)	2.8 (2.1)	<.001
Gender, No. (%)				.03
Male	174 (32.2)	93 (24.4)	55 (31.6)	
Female	367 (67.8)	288 (75.6)	119 (68.4)	
Health, No. (%)				.002
Excellent/ Very Good/Good	284 (52.3)	218 (57.2)	118 (67.8)	
Fair/ Poor	257 (47.5)	163 (42.8)	56 (32.2)	
Financial Status, No. (%)				<.001
More than enough	80 (14.7)	68 (17.9)	57 (32.8)	
Just enough	249 (45.9)	170 (44.6)	73 (42.0)	
Struggle to get by	212 (39.2)	143 (37.5)	44 (25.3)	
Education, No. (%)				<.001
<High School	143 (26.4)	78 (20.5)	16 (9.2)	
High School/GED	188 (34.8)	152 (39.9)	62 (35.6)	
>High School	210 (38.8)	151 (39.6)	96 (55.2)	

[a]Numbers may differ from totals due to missing data; Percentages may not add up to 100% due to rounding

Table 4

Logistic Regression Model Determining Factors Associated with Adherence to Screening Recommendations

	Adherence to Screening Recommendations OR (95% CI)[a]
Knowledge Accuracy (# accurate responses)	
0	Reference
1	1.6 (1.2, 2.1)
2+[b]	2.0 (1.3, 2.9)
Age[c]	1.0 (1.0, 1.1)
Number of conditions[c]	1.2 (1.1, 1.3)
Sex	
Male	1.0 (0.8, 1.4)
Female	Reference
Education	
<High School	0.6 (0.4, 0.9)
High School/GED	0.7 (0.5, 0.9)
>High School	Reference
Perceived Financial Status	
More than enough	1.6 (1.0, 2.4)
Just enough	1.2 (0.9, 1.7)
Struggle to get by	Reference
Current Health Status	
Excellent/Very Good/ Good	1.1 (0.8, 1.5)
Fair/Poor	Reference

[a] Adjusted for other variables in the model; Abbreviations: CI, confidence interval; OR, odds ratio

[b] p=.02

[c] p<.001