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Third Annual Fecal Occult Blood Testing in Community Health Clinics

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Abstract

Objectives—Our objective was to determine the effectiveness of 3 approaches to encourage completion of fecal occult blood testing (FOBT) in the third year of the intervention.

Methods—Between 2008 and 2011, a quasi-experimental intervention was conducted in 8 predominantly rural Federally Qualified Health Centers. Clinics were randomly assigned to enhanced care (screening recommendation and FOBT kit mailed annually), education (patients additionally received a health literacy appropriate pamphlet and simplified FOBT instructions), or nurse support (same as education but with nurse follow-up). Participants included 206 patients

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Human Subjects Statement

The Louisiana State University Health Sciences Center – Shreveport Institutional Review Board approved this study, IRB # H10-097.

Conflict of Interest Statement

No conflicts are noted by the authors related to the work described.

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with negative FOBTs in years 1 and 2; ages 50–85, 80% female, 70% African American, and 52% had limited health literacy. The main outcome measure was completion of a third annual FOBT.

Results—Third-year FOBT rates were 48% overall, 34.2% enhanced care, 59.6% education, and 47.4% nurse support ($p = .21$), even after adjustment for sex, marital status, and health literacy.

Conclusion—All mailed interventions were similarly effective in sustaining rates of FOBT screening. Post hoc analyses of the results analyzed by health literacy skills found that patients with both limited and adequate health literacy skills were more likely to complete FOBTs when mailed simplified instructions.

Keywords

annual FOBT screening; community clinics; health literacy

Colorectal cancer (CRC) is the third most commonly occurring cancer in the United States (US) with over 136,000 new cases diagnosed and 50,000 deaths in 2014.¹ The American Cancer Society (ACS) estimates that over half of CRC deaths could be prevented by screening.¹ The US Preventive Services Task Force recommends screening for CRC with annual fecal occult blood testing (FOBT), sigmoidoscopy every 5 years (in conjunction with FOBT every 3 years) or colonoscopy every 10 years unless there is a family history or previous cancer indicating a need for more frequent screening.² There is equal mortality reduction across different types of screening assuming perfect adherence.³ Although overall screening rates have increased recently in the US, with Healthy People 2020 reporting 59% of Americans are currently up-to-date on CRC screening, significant disparities persist particularly among low-income adults (48%), those without health insurance (28%), and fewer years of education (44%).⁴ Louisiana, with its high rates of poverty, limited education, and low health literacy, ranks third among states in CRC incidence.⁵ Healthy People 2020 has called for 71% of eligible adults to be up-to-date with current guidelines.⁴ In addition, the National Health Disparities Report emphasizes the importance of reducing disparities in CRC screening, particularly among adults living in inner city and rural areas.⁶

CRC screening with fecal occult blood tests (FOBTs) offers an acceptable, effective, lower-cost screening option for areas of high poverty and rurality where financial and geographic access to colonoscopy is a barrier.^{7–11} To be an effective test for CRC, FOBTs must be performed annually, yet few studies have examined repeat FOBT screening rates over time and results have been disappointing.^{7,12–16} Most studies have found less than 25% of eligible patients completed a second round of FOBT test within 2 years. Only one study, a national Veterans Administration (VA) retrospective analysis, looked at longer term adherence to FOBT (17% and 14% completed tests in years 3 and 4 respectively).¹⁷

Numerous studies have examined barriers and facilitators to CRC screening among patients served in safety net clinics.^{18–20} Limited health literacy is one such barrier – having been linked to low understanding of CRC, negative attitudes towards CRC screening, lower self-efficacy, and less likelihood of CRC screening completion.^{18,21–23}

The National Colorectal Cancer Roundtable highlighted the potential for Federally Qualified Health Centers (FQHCs) to improve CRC screening rates among 22 million individuals with lower socioeconomic status and low health literacy.²⁴ Certain patient-directed interventions (pamphlets, videos, and reminders delivered by clinic-based nurses, medical assistants, or health educators) have shown positive results in increasing initial FOBT screening rates in urban community clinics.^{7,8,25–31} Mailed FOBT kits with reminder letters and telephone calls have been effective in promoting initial and repeat screening in predominantly Spanish-speaking patients in an urban FQHC.³²

We previously reported intermediate-term results for a 3-year FOBT intervention with predominately rural FQHCs in Louisiana. The intervention had 3 strategies that were evaluated. The objective of this report is to determine the effectiveness of the 3 approaches for completion of the third and final year of the intervention. Currently there are no prospective community clinic-based studies on 3-year adherence to FOBT guidelines.

METHODS

Theoretical Framework

The Health Belief Model (HBM), Social Cognitive Theory (SCT), and Health Learning Capacity, an evidence-based framework, guided the framing of the intervention to address beliefs, self-efficacy, understanding and action to complete FOBT screening annually.^{33–35} SCT recognizes the need to overcome barriers related to patients (limited knowledge, beliefs, self-efficacy), the health system (need to come to the clinic to receive a test and recommendation to repeat annually), and the environment (screening location, transportation, and cost) to mitigate their impact on CRC screening. Health Learning Capacity and SCT, which recognize the need to enhance patients' understanding and ability to take action to overcome barriers to obtain and adequately complete the test annually, guided our development of materials and educational approach. Our intervention clearly gives benefits of annual screening and understandable, actionable instructions to complete the test independently at home in addition to annual prompting to sustain screening beliefs and behavior. The Health Learning Capacity Framework influenced design of an intervention that minimized the cognitive load required to obtain an FOBT, understand and problem solve completion of the test, and improve the self-efficacy needed to complete the test annually.

A 3-arm, quasi-experimental (ie, based on randomization of sites, not patients within sites), comparative effectiveness evaluation was conducted among 3 FQHC networks in predominantly rural areas of Louisiana between May 2008 and August 2011. The study team determined that randomizing patients within a FQHC network was not an optimal study design, because of the diffuse nature of interventions and concern of communication among patients who belonged in a network FQHC that shared providers and staff. The target population included 5 FQHC networks in predominantly rural north Louisiana. Three FQHC parent networks participated in this study, the other 2 network FQHCs were already involved in cancer screening programs at the time. The study statistician generated the allocation of parent network to arm by using computer generated random numbers. At the time of randomization, each participating FQHC parent network was affiliated with multiple clinics

that were assigned to the same study arm as its parent network. This resulted in 2 clinics in the enhanced care arm, 2 in the educational strategy arm, and 3 in the nurse support arm. After the first year of the study, one additional clinic was enrolled in the enhanced care arm due to limited patient recruitment in this arm.

The 3 study arms included: (1) an enhanced version of usual care where patients waiting for a scheduled appointment with their provider received a recommendation for CRC screening by a clinic-based research assistant (RA) and an FOBT kit with a stamped envelope addressed to the clinic; (2) a health literacy-informed educational intervention where patients received enhanced care plus a clinic-based RA provided brief education with a health literacy informed pamphlet and video, simplified FOBT instructions and demonstrated how to do the test using teach back to confirm patient understanding;³⁶ and (3) a nurse strategy where patients received enhanced care and a designated clinic-based study nurse provided the health literacy informed education and telephone follow-up using motivational interviewing.³⁷

Participants were recruited through a multistep process. First, while taking participants' vital signs, a medical assistant at each clinic identified potentially eligible participants by the age listed in their chart (between 50–85 years of age). Participants aged 76–85 were included at the request of clinic directors even though this extends beyond American Cancer Society (ACS) recommend screening age limit of 50 to 75. Further eligibility included: (1) being English-speaking; (2) not requiring screening at an earlier age according to ACS guidelines;¹ (3) not being up-to-date with US Preventive Services Task Force² CRC screening recommendations; and (4) medical staff believing patients not too ill to be interviewed. All participants were consented by a research assistant (RA) prior to data collection.

Years 2 and 3 differed from year 1 as interventions in the 2 out-years were designed to promote repeat FOBT completion without the need of a clinic visit. Participants were mailed study materials rather than receiving these materials in-person. None of the clinics had an Electronic Health Record (EHR) System during the time of the study.

Enhanced care arm—Twelve months after participants returned the year 2 FOBT, a centralized RA at the academic medical center mailed a letter from the participant's clinic to remind eligible participants that it was time for their annual FOBT and that a kit would be mailed the following week. The RA mailed the FOBT kit and a stamped envelope addressed to the clinic. Participants returned FOBTs to the clinic by mail. Regular clinic protocol was followed for positive test results and if diagnostic testing was needed.

Health literacy-informed education arm—The enhanced care protocol was followed but participants were mailed an FOBT with *simplified* instructions and a health literacy appropriate pamphlet. Tracking and follow-up were the same as in the enhanced care arm.

Nurse support arm—The enhanced care protocol was followed, but *the nurse* mailed participants the same *simplified* materials as those in the education arm. If participants did not return their FOBT, the nurse called within 2 weeks and again in one month to problem-solve barriers and motivate them to complete the test. The nurse recorded and tracked

results. If results were positive, the nurse called participants to discuss results, facilitate appointments with their primary care provider, and if indicated, schedule participants for a diagnostic colonoscopy.

The primary outcome for the third year of the intervention was completion of a third annual FOBT within 12–18 months of the second year negative FOBT. Screening results were documented by the clinic nurse (enhanced care and education arms) or study nurse (nurse support arm).

Study Instruments

The study interview included demographic and CRC screening items from validated questionnaires used previously by the authors.³⁸ A detailed description of the survey, which was written on a 4th grade level and administered orally at enrollment, has been reported previously.³⁸ Health literacy was assessed using the Rapid Estimate of Adult Literacy in Medicine (REALM).³⁹ Raw REALM scores (0–66) can be converted into reading grade levels. A score of 60 or below is estimated to be a reading level of 8th grade or below, which is widely considered a marker for limited health literacy.³⁹

Summary of Intermediate-term Results

We have reported intermediate-term results for a 3-year FOBT intervention focusing on CRC screening of low income, uninsured populations receiving medical care at FQHCs in Louisiana. First-year FOBT completion rates among 961 eligible participants improved from 3% prior to the intervention to 39% with enhanced care, 57% with an intervention that included health literacy informed educational tools, and 61% with the educational tools and additional nurse support ($p < .012$).¹⁵ In year 2, among 461 participants from the study population who completed the initial FOBT and had a negative result, 38% in the enhanced care arm completed a second annual FOBT, 33% in the health literacy education arm, and 59% in the nurse arm with study nurse telephone support ($p < .0003$).¹⁵

Analysis

The denominator for third-year analyses was 206 participants completing a second-year negative FOBT. To examine whether participants in study arms differed on baseline characteristics, generalized estimating equations accounting for clustering by clinic was used. Screening ratios were defined as the ratio of third annual FOBT completion rates between 2 arms. Both screening ratios and pairwise tests for FOBT completion were calculated using generalized estimating equations which accounted for data dependencies (clustering) incurred by the hierarchical design of participants within clinics. Multivariate analyses adjusted for those baseline variables found to be significant across arms, namely sex, marital status, and health literacy level. *Post hoc* analyses consisted of comparisons among the 3 intervention arms within each of the 2 health literacy strata (limited, adequate) using the same statistical methods. Due to small sample sizes within health literacy categories, analyses by health literacy were only adjusted for clustering by clinic. The interaction test was used to compare differences in screening rates across arms between health literacy categories. Data analysis was completed in 2014. Statistical analysis was done using SAS statistical software.⁴⁰

RESULTS

At enrollment (Figure 1), 1055 participants were identified as meeting age criteria; of these, 33 (3.1%) refused to participate and 61 (5.8%) were ineligible because they were up-to-date on CRC screening. A total of 961 participants were consented and enrolled, with a determined cooperation rate of 91.1%. This paper focuses on 206 participants who had negative FOBT results in years 1 and 2 of the study.

Characteristics of participants eligible for the third and final year of the annual FOBT screening intervention are compared among arms in Table 1. The majority were female (80%) and African Americans (70%). Over half (52%) had limited health literacy (ie, reading at 8th grade level). There were significant differences across arms for race/ethnicity, marital status, and health literacy.

Of participants with negative FOBT results in years 1 and 2, 48% completed the third consecutive annual FOBT. Third-year FOBT rates were 34.2% in the enhanced care arm, 59.6% in the health literacy informed education arm, and 47.4% in the nurse support arm ($p = .21$) (Table 2). After adjusting for age, race, sex, and health literacy, FOBT screening rates were not statistically different among the 3 study arms ($p = .21$). In the enhanced care group, the sample size (38) and the screening rate (34%) allowed for a power of 80% (2-tailed Type I error rate of 5%) to detect a screening rate of 65% in the education arm ($N = 52$) and 62% in the nurse support arm ($N = 116$).

Post hoc analyses identified significant differences in FOBT screening rates within adequate- and limited-health literacy arms. Participants with limited health literacy had screening rates of 39.1% with enhanced care, 76.9% with education, and 44.4% with nurse support ($p = .007$) with the health literacy informed education arm having significantly higher rates than the nurse arm ($p = .006$, screening ratio = 1.75, 95% CI 1.17 – 2.59) or the enhanced care arm ($p = .01$, screening ratio = 1.96, 95% CI 1.18 – 3.27). Participants with adequate health literacy skills had FOBT screening rates of 26.7% with enhanced care, 53.9% with education, and 52.2% with nurse support ($p = .002$). Among these participants, the education arm ($p = .015$, screening ratio = 2.34, 95% CI 1.18 – 4.65) and the nurse arm ($p = .036$, screening ratio = 2.07, 95% CI 1.05 – 4.11) had significantly higher rates of FOBT testing than the enhanced care arm.

DISCUSSION

No prior prospective study in the US has identified sustained improvements in FOBT screening rates in community clinics over 3 years. In our study of predominately rural participants receiving care at Louisiana FQHCs, approximately half (48%) of those with negative FOBT tests in years 1 and 2, completed FOBT screening in the third and final year of this intervention. FOBT screening rates were similar among the 3 arms and overall 10-fold higher compared to baseline pre-intervention FOBT screening rates of 1% to 3% reported by clinic databases. Of note, a nurse telephone follow-up call to persons who had not returned their third annual FOBT did not improve completion rates for the final year of the study.

In the first year of our study 53% of participants completed an FOBT – 39% in the enhanced care arm, 57% in the health literacy education arm, and 61% with the educational tools and additional nurse support.⁴¹ Participants enrolled in the 2 arms receiving HBM, SCT, and Health Learning Capacity theory-based health literacy strategies both had comparable rates of initial screening to the 59% Healthy People 2020 reported of the overall population.⁴ This is noteworthy because all participants were low income, and over half had low health literacy and lived in rural areas – groups less likely to be up-to-date with CRC screening according to Healthy People 2020.⁴

Among year-2 participants who completed the initial FOBT and had a negative result, 46% completed a second FOBT – 38% in the enhanced care arm, 33% in the health literacy education arm, and 59% in the arm with the added nurse telephone support.¹⁵ These results favorably compare to the few previously reported studies in the US national VA retrospective analysis of 5-year adherence to FOBT which found 42% of eligible male participants completed one FOBT, 26% completed 2, 17% completed 3, and 14% completed 4 FOBT screening tests.¹⁷ All other US studies are limited to 2 years. In a random telephone survey of predominately low-income African-American women in Washington DC, 29% reported adherence to 2 FOBT completions within the recommended interval.⁴² A study of Medicare beneficiaries in Kansas found only 4% completed FOBTs both years.¹³ An urban community health network retrospective analysis found 25% of participants who completed an initial FOBT completed a repeat FOBT within 18 months.¹⁴ In a study where FOBTs were mailed to Health Maintenance Organization (HMO) eligible enrollees, 23% completed 2 rounds of screening with initial adherence being a strong predictor of serial adherence.¹⁶ Population-based screening programs abroad, where FOBTs are mailed from a country's centralized public health service, have documented higher repeat FOBT screening rates (39% to 55%).^{43–46}

A 2-year electronic health record (EHR) CRCs screening study with predominately Spanish-speaking participants in one Chicago FQHC network has important implications. This study found that an intervention that included EHR-generated reminder letters, kits mailed with simplified instructions and stamped return envelope, and automated phone calls greatly improved CRC completion rates when compared to care that included EHR prompted standing orders only (to assure medical assistants give participants kits during regularly scheduled clinic visit) (82% vs 37%).⁷ Of note only 8% of completions in the intervention arm were aided with personal calls from a clinic navigator. In a small, year 2 follow-up study (N = 124) with EHR-generated reminder letters, mailed FOBT kits, automated phone calls or text, and if needed, a personal phone call, an impressive 89% of participants completed a second FOBT.³² This study suggests EHR records may facilitate continued screening and that FOBT completion may be aided with automatic calls (and may not require a clinic visit or personal call). However, it is not known if automated calls or texts would be effective in non-urban areas.

Study limitations include differences between arms in socio-demographic characteristics (adjustments were made in the statistical analyses) and generalizability of the results, which included predominantly African-American and female participants receiving care from FQHCs in one state. Half of the sample had low health literacy, which is more common in

older, lower-income populations. FQHC network was the unit of randomization instead of by clinic or patient due to common providers across clinics in FQHCs as well as potential communication contamination among participants or providers. During the duration of this project no study clinic had an EHR, which could now affect generalizability since all FQHCs are now required to have an EHR.

Our findings identified that in community health clinics in Louisiana, annual FOBT screening rates, measured annually for 3 years, could be sustained at significantly higher rates than baseline FOBT CRC screening rates. The theory-based interventions of understandable instructions and mailing of FOBT kits were specifically effective in participants with limited health literacy, and the availability of a study nurse enhanced screening in participants with adequate health literacy. *Post hoc* analyses of the results analyzed by health literacy skills found that participants with both low and adequate health literacy skills were more likely to complete their FOBT when mailed simplified instructions. This suggests that mailing FOBT kits with instructions formatted and illustrated for reading ease may aid participants in independently completing FOBTs. Strategies for improving yearly CRC screening with FOBTs are imperative for resource challenged settings. Future studies need to employ EHRs to track patients and mail reminder letters and test kits with simplified instructions and stamped envelopes to return FOBTs by mail. Use of automated calls or text to prompt completion needs to be explored for patients cared for in rural clinics.

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References

1. American Cancer Society. Colorectal Cancer Facts & Figures 2014–2016. Atlanta, GA: American Cancer Society; 2014.
2. US Preventive Services Task Force. Screening for colorectal cancer. *Ann Intern Med.* 2008; 149(9): 627–637. [PubMed: 18838716]
3. Zuber AG, Lansdorp-Vogelaar I, Knudsen AB, et al. Evaluating test strategies for colorectal cancer screening: a decision analysis for the U.S. Preventive Services Task Force. *Ann Intern Med.* 2008; 149(9):659–669. [PubMed: 18838717]
4. US Department of Health and Human Services, Office of Disease Prevention and Health Promotion. [Accessed January 25, 2016] Healthy People 2020. Available at: <http://www.healthypeople.gov/2020/data-search/Search-the-Data?nid=4054>
5. US Cancer Statistics Working Group. United States Cancer Statistics: 1999–2012 Incidence and Mortality Web-based Report. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute; Available at: www.cdc.gov/uscs [Accessed January 25, 2016]
6. Agency for Healthcare Research and Quality. [Accessed January 25, 2016] National Healthcare Disparities Report. 2013. Available at: <http://www.ahrq.gov/research/findings/nhqrdr/nhdr13/index.html>
7. Baker DW, Brown T, Buchanan DR, et al. Comparative effectiveness of a multifaceted intervention to improve adherence to annual colorectal cancer screening in community health centers: a randomized clinical trial. *JAMA Intern Med.* 2014; 174(8):1235–1241. [PubMed: 24934845]
8. Gupta S, Haim E, Rockey D, et al. Comparative effectiveness of fecal immunochemical test outreach, colonoscopy outreach, and usual care for boosting colorectal cancer screening among the

- underserved: a randomized clinical trial. *JAMA Intern Med.* 2013; 173(18):1725–1732. [PubMed: 23921906]
9. Fisher J, Fikry C, Troxel A. Cutting cost and increasing access to colorectal cancer screening: another approach to following the guidelines. *Cancer Epidemiol Biomarkers Prev.* 2006; 15(1):108–113. [PubMed: 16434595]
 10. Wilschut JA, Habbema JDF, Van Leerdam ME, et al. Fecal occult blood testing when colonoscopy capacity is limited. *J Natl Cancer Inst.* 2011; 103(23):1741–1751. [PubMed: 22076285]
 11. Wender R. Barriers to screening for colorectal cancer. *Gastrointest Endosc Clin N Am.* 2002; 12(1):145–170. [PubMed: 11916157]
 12. Fenton J, Elmore J, Buist D, et al. Longitudinal adherence with fecal occult blood test screening in community practice. *Ann Fam Med.* 2012; 8(5):397–401. [PubMed: 20843880]
 13. Engelman K, Ellerbeck E, Ahluwalia J, et al. Fecal occult blood test use by Kansas medicare beneficiaries. *Prev Med.* 2001; 33:622–626. [PubMed: 11716659]
 14. Liss D, Petit-Homme A, Feinglass J, et al. Adherence to repeat fecal occult blood testing in an urban community health center network. *J Community Health.* 2013; 38(5):829–833. [PubMed: 23546555]
 15. Davis TC, Arnold CL, Bennett CL, et al. Strategies to improve repeat fecal occult blood testing cancer screening. *Cancer Epidemiol Biomarkers Prev.* 2014; 23(1):134–143. [PubMed: 24192009]
 16. Myers RE, Balshem AM, Wolf TA, et al. Adherence to continuous screening for colorectal neoplasia. *Med Care.* 1993; 31(6):508–519. [PubMed: 8501998]
 17. Gellad ZF, Stechuchak KM, Fisher DA, et al. Longitudinal adherence to fecal occult blood testing impacts colorectal cancer screening quality. *Am J Gastroenterol.* 2011; 106(6):1125–1134. [PubMed: 21304501]
 18. Peterson N, Dwyer K, Mulvaney S, et al. The influence of health literacy on colorectal cancer screening knowledge, beliefs and behavior. *J Nat Med Assoc.* 2007; 99(10):1105.
 19. Holmes-Rovner M, Williams G, Hoppough S, et al. Colorectal cancer screening barriers in persons with low income. *Cancer Pract.* 2002; 10(5):240–247. [PubMed: 12236837]
 20. O'Malley A, Beaton E, Yabroff K, et al. Patient and provider barriers to colorectal cancer screening in the primary care safety-net. *Prev Med.* 2004; 39(1):56–63. [PubMed: 15207986]
 21. Miller D, Brownlee C, McCoy T, Pignone M. The effect of health literacy on knowledge and receipt of colorectal cancer screening: a survey study. *BMC Fam Pract.* 2007; 8(1):16. [PubMed: 17394668]
 22. White S, Chen J, Atchison R. Relationship of preventive health practices and health literacy: a national study. *Am J Health Behav.* 2008; 32(3):227–242. [PubMed: 18067463]
 23. Von Wagner C, Semmler C, Good A, Wardle J. Health literacy and self-efficacy for participating in colorectal cancer screening: the role of information processing. *Patient Educ Couns.* 2009; 75:352–357. [PubMed: 19386461]
 24. Sarfaty M, Doroshenko M, Hotz J, et al. Strategies for expanding colorectal cancer screening at community health centers. *CA Cancer J Clin.* 2013; 63(4):221–231. [PubMed: 23818334]
 25. Potter MB, Walsh JM, Yu TM, et al. The effectiveness of the FLU-FOBT program in primary care a randomized trial. *Am J Prev Med.* 2011; 41(1):9–16. [PubMed: 21665058]
 26. Levy B, Daly J, Xu Y, Ely J. Mailed fecal immunochemical tests plus educational materials to improve colon cancer screening rates in Iowa Research Network (IRENE) practices. *J Am Board Fam Med.* 2012; 25(1):73–82. [PubMed: 22218627]
 27. Tu SP, Taylor V, Yasui Y, et al. Promoting culturally appropriate colorectal cancer screening through a health educator: a randomized controlled trial. *Cancer.* 2006; 107(5):959–966. [PubMed: 16865681]
 28. Roetzheim R, Christman L, Jacobsen P, et al. A randomized controlled trial to increase cancer screening among attendees of community health centers. *Ann Fam Med.* 2004; 2(4):294. [PubMed: 15335126]
 29. Green BB, Wang C, Anderson M. An automated intervention with stepped increases in support to increase uptake of colorectal cancer screening: a randomized trial. *Ann Intern Med.* 2013; 158:301–311. [PubMed: 23460053]

30. Davis T, Arnold C, Rademaker A, et al. Improving colorectal cancer screening in community clinics. *Cancer*. 2013; 119(21):3879–3886. [PubMed: 24037721]
31. Lee, Jk; Reis, V.; Liu, S., et al. Improving fecal occult blood testing compliance using a mailed educational reminder. *J Gen Intern Med*. 2009; 24(11):1192–1197. [PubMed: 19774423]
32. Baker DW, Brown T, Goldman SN, et al. Two-year follow-up of the effectiveness of a multifaceted intervention to improve adherence to annual colorectal cancer screening in community health centers. *Cancer Causes Control*. 2015; 26(11):1685–1690. [PubMed: 26337733]
33. Bandura A. Health promotion by social cognitive means. *Health Educ Behav*. 2004; 31(2):143–64. [PubMed: 15090118]
34. Janz, NK.; Champion, VL.; Strecher, VJ. The health belief model. In: Glanz, K.; Lewis, F.; Viswanath, K., editors. *Health Education and Health Behavior: Theory, Research, and Practice*. 4. San Francisco, CA: Jossey-Bass; 2008. p. 31-44.
35. Wolf MS, Wilson EAH, Rapp DN, et al. Literacy and learning in health care. *Pediatrics*. 2009; 124(Suppl 3):S275–S281. [PubMed: 19861481]
36. Weiss, B.; Schwartzberg, J.; Davis, T., et al. *Health Literacy and Patient Safety: Help Patients Understand*. Chicago, IL: AMA Foundation; 2007.
37. Hecht J, Borrelli B, Breger R, et al. Motivational interviewing in community-based research: experiences from the field. *Ann Behav Med*. 2005; 9(2):29–34. [PubMed: 15921487]
38. Davis T, Arnold CL, Rademaker A, et al. FOBT completion in FQHCs: impact of physician recommendation, FOBT information, or receipt of the FOBT kit. *J Rural Health*. 2012; 28:306–311. [PubMed: 22757955]
39. Davis T, Long S, Jackson R, et al. Rapid estimate of adult literacy in medicine: a shortened screening instrument. *Fam Med*. 1993; 25(6):391. [PubMed: 8349060]
40. SAS Institute Inc. *SAS OnlineDoc® 9.4*. Cary, NC: SAS Institute Inc; 2012.
41. Davis T, Arnold C, Rademaker A, et al. Improving colorectal cancer screening in community clinics. *Cancer*. 2013; 119(21):3879–3886. [PubMed: 24037721]
42. O'Malley AS, Forrest CB, Mandelblatt J. Adherence of low-income women to cancer screening recommendations. *J Gen Intern Med*. 2002; 17(2):144–154. [PubMed: 11841530]
43. Duncan A, Turnbull D, Wilson C, et al. Behavioural and demographic predictors of adherence to 3 consecutive faecal occult blood test screening opportunities: a population study. *BMC Public Health*. 2014; 14(1):238. [PubMed: 24606951]
44. Steele RJ, McClements PL, Libby G, et al. Patterns of uptake in a biennial faecal occult blood test screening programme for colorectal cancer. *Colorectal Dis*. 2014; 16(1):28–32. [PubMed: 24034143]
45. Janda M, Hughes K, Auster J, et al. Repeat participation in colorectal cancer screening utilizing fecal occult blood testing: a community-based project in a rural setting. *J Gastroenterol Hepatol*. 2010; 25:1661–1667. [PubMed: 20880176]
46. Cole SR, Gregory T, Whibley A, et al. Predictors of re-participation in faecal occult blood test-based screening for colorectal cancer. *Asian Pac J Cancer Prev*. 2012; 13(12):5989–5994. [PubMed: 23464391]

Figure 1.
3rd Year Screening Rates

Table 1

Characteristics of Study Sample at Baseline, Stratified by Study Arm

Characteristic	Study Arm				p-value
	All Patients (N = 206) N (%)	Enhanced care	Education	Nurse	
		(N = 38) N (%)	(N = 52) N (%)	(N = 116) N (%)	
Age, Mean (sd)	59.0 (7.3) N (%)	60.2 (8.2) N (%)	57.6 (6.0) N (%)	59.2 (7.4) N (%)	.16
Age Categories					
50–59	124 (60)	22 (58)	31 (60)	71 (61)	.26
60–69	63 (31)	10 (26)	19 (37)	34 (29)	
70–85	19 (9)	6 (16)	2 (4)	11 (9)	
Sex					
Female	165 (80)	34 (89)	44 (85)	87 (75)	.013
Male	41 (20)	4 (11)	8 (15)	29 (25)	
Years of Education					
Less than high school	59 (29)	11 (29)	15 (29)	33 (28)	.61
High School Graduate	96 (47)	20 (53)	25 (48)	51 (44)	
Some College	36 (17)	3 (8)	9 (17)	24 (21)	
College Graduate	15 (7)	4 (11)	3 (6)	6 (7)	
Race					
African-American	145 (70)	26 (68)	23 (44)	96 (83)	.10
Caucasian/Hispanic	61 (30)	12 (32)	29 (56)	20 (17)	
Marital Status					
Single	62 (30)	5 (13)	6 (12)	51 (44)	< .0001
Married	66 (32)	14 (37)	28 (54)	24 (21)	
Separated	12 (6)	3 (8)	3 (6)	6 (5)	
Divorced	41 (20)	9 (24)	10 (19)	22 (19)	
Widowed	25 (12)	7 (18)	5 (10)	13 (11)	

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Characteristic	All Patients (N = 206)	Study Arm			p-value
		Enhanced care	Education	Nurse	
		(N = 38)	(N = 52)	(N = 116)	
Marital Status Categorized					
Married	66 (32)	14 (37)	28 (54)	24 (21)	< .0001
Not Married	140 (68)	24 (63)	24 (46)	92 (79)	
Health Literacy Level					
Limited (0–60)	108 (52)	23 (61)	13 (25)	72 (62)	.0001
Adequate (61–66)	98 (48)	15 (39)	39 (75)	44 (38)	

Table 2

Return Rates of Initial (FOBT1), First Repeat (FOBT2) and Second Repeat (FOBT3)

	Study Arm			
	Enhanced care		Nurse	
	All Patients (N = 206) N (%)	(N = 38) N (%)	(N = 52) N (%)	(N = 116) N (%)
Return of all 3 FOBTs	99 (48)	13 (34.2)	31 (59.6)	55 (47.4)
				.21
Return of initial FOBT1 and first repeat FOBT2 but not second repeat FOBT3	107 (52)	25 (65.8)	21 (40.4)	61 (52.6)
Screening Ratio ^a		1.00	1.79	1.35
95% Confidence Interval			(.92 – 3.48)	(.78 – 2.33)
p-value			.08	.28
Screening Ratio ^a			1.00	.75
95% Confidence Interval				(.49 – 1.17)
p-value				.20

^aScreening ratios and p-values control for sex, race, marital status (married, not married) and health literacy (limited vs adequate).