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Physician Intervention and Chinese Americans' Colorectal Cancer Screening

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Human Subjects Statement

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Conflict of Interest Statement

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Abstract

Objective—We conducted a cluster-randomized trial evaluating an intervention that trained Chinese-American primary care physicians to increase their Chinese patients' colorectal cancer (CRC) screening.

Methods—Twenty-five physicians (13 randomized to the intervention arm and 12 to the control arm) and 479 of their patients (aged 50–75 and nonadherent to CRC screening guidelines) were enrolled. The intervention, guided by Social Cognitive Theory, included a communication guide and 2 in-office training sessions to enhance physicians' efficacy in communicating CRC screening with patients. Patients' CRC screening rates (trial outcome) and rating of physician communication before intervention and at 12-month follow-up were assessed. Intention-to-treat analysis for outcome evaluation was conducted.

Results—Screening rates were slightly higher in the intervention vs. the control arm (24.4% vs. 17.7%, p = .24). In post hoc analyses, intervention arm patients who perceived better communication were more likely to be screened than those who did not (OR = 1.09, 95% CI: 1.03, 1.15). This relationship was not seen in the control arm.

Conclusions—This physician-focused intervention had small, non-significant effects in increasing Chinese patients' CRC screening rates. Physician communication appeared to explain intervention efficacy. More intensive interventions are needed to enhance Chinese patients' CRC screening.

Keywords

physician-focused intervention; colorectal cancer screening

The US Preventive Services Task Force (USPSTF) recommends routine colorectal cancer (CRC) screening for average-risk persons ages 50–75.[1] Asian Americans have the lowest CRC screening rates among all ethnic minority groups.[2,3] Chinese Americans, 76% of whom are immigrants,[4] have lower screening rates than other Asian subgroups,[5] despite CRC being the second leading cause of cancer death in Chinese Americans.[6]

Physician recommendation is a strong predictor of Chinese Americans' CRC screening use.[7] However, as many as 50% of unscreened Chinese immigrants report that they have never received a physician recommendation for CRC screening.[8] This finding may be related to the tendency of Chinese Americans to seek care from Chinese-speaking physicians.[9] These physicians, who are often not trained in the US, may not have kept up with various screening guidelines.[10] Alternatively, many older Chinese immigrants may have limited English proficiency, retain traditional practices of only visiting doctors when symptoms appear, perceive themselves to be at low risk due to the absence of a family history of CRC, or are underinsured and unable to afford out-of-pocket costs related to CRC screening.[7,8,11,12]

Cross-sectional research showed that patients' CRC screening behavior is positively associated with their perception of whether physicians explained CRC screening tests and

responded to their screening concerns and barriers.[13,14] Few intervention studies have focused on training physicians to enhance patients' adherence to CRC screening guidelines.[15] Such studies mostly utilized academic detailing approaches to increase primary care physicians' recommendations for CRC screening.[16–21] Academic detailing consists of multiple components including in-person training to provide feedback on physicians' CRC screening practices and how to overcome office-based barriers to screening, and providing printed materials or tools to increase physicians' knowledge about and recommendations for cancer screening. These approaches are guided in part by social cognitive theory which emphasizes increasing physicians' behavioral capacity in order to increase their self-efficacy in cancer screening practice.[22] Many of these academic detailing intervention studies reported a moderate effect in increasing patients' CRC screening uptake (increased screening rates ranged from 0.1 to 9%).[17–21,23] Alternatively, one study that provided physicians with communication strategies to talk with patients with low literacy, in addition to utilizing academic detailing, showed a stronger effect in increasing the patients' CRC screening uptake than using clinical reminders only (the former had a 15% higher rate).[19] None of these studies was designed to increase Chinese-American primary care physicians' behavioral capacity and self-efficacy in addressing their Chinese patients' language, cultural, and access issues regarding CRC screening.

This paper reports on a cluster randomized controlled trial testing the efficacy of an intervention to increase CRC screening by enhancing Chinese-speaking primary care physicians' efficacy in communication about CRC screening to counteract Chinese-American patients' screening barriers and concerns. Additionally, *post hoc* analysis was conducted to examine whether the intervention effects, if any, would be explained by patients' perception of their physicians' communication quality.

METHODS

Study Design

This 2-arm cluster trial randomized 25 primary care physicians (cluster unit) to either the intervention or usual care control arm. Figure 1 summarizes the design of this study based on the 2010 consort statement for cluster trials.[24] Patients who were non-adherent to CRC screening were enrolled from each participating physician's office and were automatically assigned to their physician's study arm. Physicians were blinded to their patients' participation to avoid bias in examining intervention effects. All physicians completed a one-time paper-and-pencil background information survey. Trained Chinese interviewers speaking either Mandarin or Cantonese administered 2 surveys via telephone to patients: a pre-intervention baseline assessment and a 12-month post-baseline assessment. Patients in both arms were encouraged to visit their participating physicians during the 12-month follow-up. Patients were given $15 gift cards when they completed each assessment. The study outcome was self-reported receipt of CRC screening within the 12-month follow-up. Thirty-seven percent of self-reported screening was verified with medical records.

Study Sample and Setting

Physician recruitment—This study used nonprobability, purposive sampling to enroll Chinese-American primary care physicians from 2 geographic areas: (1) metropolitan Washington DC (including District of Columbia, Northern Virginia, and Maryland) and (2) Philadelphia and New York City areas (hereafter referred to as DC and PA/NYC). The target physician sample was ascertained from 4 main sources: (1) telephone directories, including Chinese-American physician directories, the Yellow Pages, and the American Medical Association (AMA) master file; (2) existing Asian Community Cancer networks; (3) social events for Chinese physicians advertised in local newspaper advertisements; and (4) referrals from physicians and community partners. Through these resources, 118 potentially eligible physicians (41 in DC and 77 in PA/NYC) were identified. Details are described elsewhere.[25]

From October 2008 to December 2011, 57 of 118 potentially eligible physicians were contacted. Inclusion criteria for eligible physicians were: (1) be able to communicate with their patients in Chinese (ie, Mandarin or Cantonese); (2) have a minimum of 75 Chinese-American patients age 50+; and (3) practice primary care, including family medicine, internal medicine, or geriatrics.

This study focused on individual physicians rather than the entire practice units as most of the eligible physicians (80%) practiced individually. Nine of the 57 were ineligible because their practice was too small, leaving 48 eligible physicians. Of these, 25 consented to participate (52% participation rate); 13 from DC and 12 from PA/NYC (Figure 1). Participating physicians received $400 gift cards to compensate for their time. Physician staff that assisted with project logistics was reimbursed on an hourly basis.

Randomization of physicians—Participating physicians were randomized immediately after consent. They were assigned into one of the blocks by 3 stratification factors: (1) study sites: DC or PA/NYC areas, (2) approximate practice size: small (< 200 Chinese-speaking patients) or large (≥ 200 patients), and (3) approximate baseline CRC screening rates within each practice: < 50% or ≥ 50%. After randomization, eligible patients were enrolled from each physician's office.

Patient recruitment—Eligible Chinese patients were: (1) 50–75 years old, (2) active patients of participating physicians (visited within 2 years from the enrollment date), (3) without a personal history of CRC, and (4) non-adherent to the 2008 USPSTF CRC screening guidelines in place during the study period (including never screened, or last FOBT > 1 year, or sigmoidoscopy > 5 years, or colonoscopy > 10 years).[1] Details about patient recruitment are described elsewhere.[26] Patients from each physician's practice were randomly selected from patient charts or electronic records. Bilingual research staff called and enrolled eligible patients. A small number of patients were enrolled by the staff directly from the waiting room. Unless the practice exhausted its patient list, research staff made efforts to enroll at least 17 non-adherent patients from each office. A total of 479 non-adherent patients consented to participate and 371 (77.5%) completed a 12-month post-baseline follow-up (Figure 1).

Physician-focused Intervention

We used social cognitive theory (SCT)[27] to develop the intervention as patient-physician communication about CRC screening is a reciprocal learning process. In this process, physicians would elicit and address patients' barriers to CRC screening and provide information about CRC screening. SCT constructs (eg, physicians' knowledge about CRC screening and self-efficacy) that formed the basis for development of the intervention have been detailed elsewhere.[25]

The intervention consisted of 3 components: (1) a printed communication guide, (2) 2 structured, in-office training sessions with simulated patients, and (3) auxiliary materials, including a desk-style flip chart summarizing key points from the guide, FOBT instruction sheets for patients, and local free/low-cost screening information sheets. All materials were provided in both Chinese and English languages. All 13 physicians in the intervention arm were instructed to read the communication guide and review the materials prior to the in-office training.

The communication guide used the Kalamazoo Consensus Statement on the essential elements of patient-physician communication[28] to guide the training. Specifically, physicians were trained in patient-centered communication: build rapport with patients, understand each patient's purpose for the visit, inquire about past receipt of CRC screening, discuss current CRC screening options, understand patients' perspectives, respond to patients' concerns, and encourage screening.[25] Physicians were asked to apply these elements during clinical encounters and to incorporate any culturally relevant messages needed to address patients' concerns about CRC screening.[25] For example, if a patient holds traditional Chinese self-care views ("*I pay close attention to my diet and exercise regularly. I have no problems with my colon, so I don't need screening.*"), the physician was instructed to explain to the patient: "*You can continue following traditional Chinese principles of healthcare. We should screen to confirm that you have taken good care of yourself. Early stage colon cancer doesn't have any symptoms. When someone feels something is wrong, it often means that a disease has progressed to a later stage and only palliative treatment is available."* If a patient is concerned about the cost ("*The test is too expensive and too troublesome. I cannot add more burden to my children. They are already paying rent for me*"), physicians could respond with: "*I know we Chinese like to be independent, but your children probably prefer that you are making sure you are healthy. You can think of cancer screening as a way to prevent real trouble for you and your family. I can help you find a low-cost test in your area.*"

We applied the aforementioned instructions to both of the 2 training sessions. Particularly, 4 simulated Chinese-speaking patients (age > 50) were trained at each study site to perform 4 story scripts (each described patients' various screening concerns) to mimic real encounters with physicians. Every intervention physician separately met 2 simulated patients per training session (each about 15 minutes). Trained research staff observed each simulated patient encounter in person and provided feedback on the physicians' performance immediately after the encounter. Each training session lasted approximately 45 minutes. The first in-office training was delivered after patients of intervention physicians completed

baseline interviews. A second session occurred 4–6 months later. The sessions were not audiotaped. Physicians were granted CME credits after completing the training.

Usual Care Control Arm

Physicians in the control arm practiced usual primary care and did not receive any intervention materials except the local free/low-cost screening information sheet.

Measures

Outcome measure—The study outcome was patients' self-reported receipt of CRC screening at the 12-month follow-up. In ascertaining the outcome, the interviewer described each screening test, then asked if the participant had had this test. If participants reported screening, they were then asked where it was performed and reason for testing (eg, check-up or symptomatic).

Physician measures—Physicians completed a self-administered survey ascertaining demographics, practice type, and responses to SCT constructs (ie, self-efficacy in communication, CRC and screening knowledge, awareness of patient barriers, and expected positive outcomes after communication) at baseline (see details in our prior report).[25]

Patient measures—Patient-reported demographics (eg, birthplace and years in the US) and medical resource variables (eg, health insurance and physician recommendation for cancer screening) were assessed at baseline. Patients were asked if they had family history of CRC (response options included "yes" with "parents," "siblings," "children," or "other family members;" "no history;" and "don't know"). Patients' *perceived relative risk* for developing CRC was assessed at baseline by one item: "Compared to other men and women your age, what do you think the chances are that you will get CRC?"[7] Patients' responses were categorized to 3 levels: lower, same, and higher risk.

Knowledge about CRC screening guidelines was assessed by 4 items about age eligibility for CRC screening and the 2008 USPSTF recommended testing intervals for each screening modality. A correct response was coded as one point; otherwise, it was coded as zero.

Perceived communication quality refers to patients' perception of their physician's adequacy of communicating about CRC screening. Based on Makoul et al's medical communication framework,[28,29] there were 9 items developed to assess communication quality (eg, asked patients' screening concerns or encouraged patients to get CRC screening). Patients evaluated how well their physician communicated with them in each scenario with response options including 1 = never communicated, 2 = not well, 3 = just fine, and 4 = very well. The scale (Appendix A) had excellent internal consistency reliability (Cronbach's alpha = .90).

Self-care views were measured based on prior studies on cultural constructs and cancer screening.[30–33] Self-care views are defined as an emphasis on taking care of one's own health versus obtaining regular checkups.[30] It was assessed by a previously validated 2-item scale (eg, I do not visit doctors if I'm not feeling sick; choice options ranging from 1 =

strongly agree to 5 = strongly disagree) (Cronbach alpha = .83).[31] Higher mean scores indicate lower beliefs in self-care.

Patients' CRC knowledge about CRC screening guidelines, perceived communication quality, and self-care views were measured at baseline and 12-month follow-up.

Data Analysis

Estimates used in the power analysis were based on primary care provider-based intervention studies designed to improve both mammography and CRC screening uptake[15,19,34] because of the scarcity of data on CRC screening among immigrant patients when the study was developed. It was estimated that 30% of non-adherent patients in the intervention arm would obtain CRC screening versus 15% in the control arm (baseline screening rate = zero). Assuming a binomial distribution and an intra-cluster correlation (rho = .05) among patients within each physician cluster, this study needed to enroll at least 12 physicians per arm and 17 non-adherent patients per physician office for 80% power to detect a 15% difference between the 2 arms at $p < .05$ (one-tailed test). Figure 1 depicts the procedures of the cluster trial used for outcome analysis.

Physicians' and patients' demographic characteristics were compared between intervention and control arms using t-test and chi-square test. Guided by the methods described by Donner and Klar,[35] the intervention effect in increasing CRC screening rates was analyzed by using each physician as a cluster. Sample size in each cluster was weighted to account for variation in the number of patients among clusters. Because the 2 arms were not different in physician characteristics, 2 sample t-tests were used to compare the average CRC screening rates between the 2 arms after the 12-month follow-up. Weighted analysis was conducted for the intention-to-treat analysis (ITT) (N = 479) and per-protocol analysis (N = 371) who completed the 12-month follow-up. In the ITT analysis, patients who did not participate in the 12-month post-baseline follow-up were assumed to not have received CRC screening. The sample of 371 was used to perform all other analysis. A sensitivity analysis was also conducted to examine whether the intervention effect was different if patients had a doctor visit during the 12-month study period. Hierarchical logistic regression (HLR) was conducted to examine intervention effects with adjustment for baseline differences in patient characteristics by study arm. Physician assignment was included as a random effect to account for clustering of patients within each physician office.

We used t-tests for *post hoc* exploration of whether the intervention arm had a greater mean change than the control arm in patient variables (eg, perceived communication quality) between the baseline and the follow-up periods. An exploratory *post hoc* analysis used logistic regression to examine whether changes in patient variables affected CRC screening uptake within each arm. Odds ratios (OR) and corresponding 95% confidence intervals (CI) were reported. All analyses were performed by SAS version 9.3.

RESULTS

Sample Characteristics

Physicians in the intervention and control arms were not significantly different in age, practice type, years of practice, and the SCT constructs (Table 1). Most physicians were over 50 years old (60%), male (72%), and foreign-born (92%). Most (80%) were in solo private practices and approximately 76% received their medical training outside the US.

There were some differences in patients' baseline characteristics between the 2 study arms (Table 2). Patients in the intervention arm were less likely than patients in the control arm to report receipt of a cancer screening recommendation at baseline (46% vs 58%, $p = .01$) and have a relationship with their physician for less than 5 years (64% vs 76%, $p < .01$). These differences persisted at follow-up. Overall, most study patients were never screened (91%), were insured (88%), and had lived in the US for over 10 years (81%).

CRC Screening Rates after Intervention

Among those screened (N = 101), colonoscopy was the most common test (83%), followed by FOBT (15%); only 2% had sigmoidoscopies. Thirty-seven percent of self-reports (37 out of 101 screened) were validated by medical records and results were concordant for 100%. The 2 main patient-reported reasons for not obtaining CRC screening included: having no symptoms (59.6%) and leading a healthy lifestyle (43%).

Approximately 24.4% of patients in the intervention arm obtained screening compared to 17.7% in the control arm ($\Delta = 6.7\%$; binomial test, $p = .24$, ITT analysis using weighted percentages) (Table 3). When adjusting for group differences in patient characteristics, there was no difference in the odds of CRC screening for the intervention versus the control arm (OR = 1.57, 95% CI: 0.76, 3.27).

Based on the per-protocol analysis of those completing 12-month follow-up, 30.8% of the intervention patients obtained CRC screening compared with 23.3% control patients ($\Delta = 7.5\%$, binomial test, $p = .17$). Results from the sensitivity analysis showed a slightly greater difference in screening rates between the 2 arms (35% intervention and 24% control arms, ($\Delta = 11\%$, $p = .19$).

Post hoc Exploratory Results

Patients in the intervention arm had greater improvement in knowledge (mean change $\Delta = .98$ on a 0–4 scale, SD = .89) and perceived communication quality ($\Delta = 1.56$ on a 4-point scale, SD = 6.81) from baseline to follow-up than patients in the control arm ($\Delta = .68$, SD = .88 and $\Delta = -.63$, SD = 6.9; both t-test, $p < .01$).

Results from the *post hoc* analysis indicated that within the intervention arm, patients who had a positive change in perceived communication quality had a 9% increased likelihood of obtaining CRC screening for each one-point increase on a 9–36-point scale (OR = 1.09, 95% CI: 1.03, 1.15). This communication effect on screening outcome was not found in the control arm. Interestingly, participants who held stronger self-care views in both intervention

(OR = 1.19, 95% CI: 1.05, 1.35) and control (OR = 1.22, 95% CI: 1.03, 1.46) arms were less likely to obtain CRC screening.

DISCUSSION

This physician-focused communication intervention with Chinese-speaking physicians showed a positive, but not statistically significant increase in Chinese patients' CRC screening rates relative to the control arm. This effect may be related to findings in *post hoc* analyses in which patients' perception of improvements in physicians' communication quality was related to their CRC screening behavior. Moreover, patients in both arms that had a strong preference for self-care over regular CRC screening had lower screening rates than those with lower endorsement of self-care. The results of this study provide implications for future physician-focused intervention design.

The effect size for this physician intervention is similar to those observed in other physician-focused trials as described in the introduction.[17–21,23] The effect of training Chinese-speaking primary care physicians is likely comparable to training physicians from other ethnic groups.[17–21,23] There are several possible explanations for these small effects. First, most of participating physicians had large practices, and this might have constrained the time available to incorporate intervention messages into their clinical encounters. Based on the process evaluation of this study, approximately 84% of intervention physicians reported spending less than 20 minutes reading the communication guide.[25] Although intervention physicians were trained to present screening options to patients, time constraints might have precluded a full discussion of different screening modalities with patients. The process evaluation report indicated that about 77% of intervention physicians presented 1–2 recommended screening tests with simulated patients during the training instead of all 3 tests.[25] Inadomi et al[36] found that patients, including Chinese Americans, were more likely to adhere to CRC screening guidelines when they could choose their screening method. These findings echo the arguments that educating providers is inadequate for changes in physician behavior unless system-level changes (eg, reminders, compensating care management resources and longer visit time) are addressed.[37–39]

Another explanation for the small effect of the intervention was that by design all physicians were blinded to their patients' participation. Thus, it was not possible to record actual communication patterns to determine if the intervention physicians consistently delivered intervention messages in accordance with the training protocol to participating patients. Additionally, 14% of the patient sample did not visit their physician during the 12-month study period. Lack of exposure to the intervention is likely to bias results towards the null. Additionally, participation in trial may have reminded control physicians to recommend CRC screening, biasing results toward the null. Overall, the real-world dynamics in clinical practice may explain why this study's initially expected intervention effect was not realized.

Despite the small, non-significant effects, *post hoc* analyses suggested that patients in the intervention arm increased their screening knowledge and perceived a greater improvement in their physicians' communication quality about CRC than patients in the control arm. Patients in the intervention arm who perceived higher communication quality were more

likely to obtain CRC screening than those who perceived lower quality. These results are consistent with the theoretical assumption that obtaining CRC screening is a result of reciprocal interactions between physicians and patients; when physicians better understand patients' various concerns about CRC screening and are efficacious in communicating to address these concerns, patients in turn better understand CRC and are motivated to undertake CRC screening. Results from the process evaluation showed that physicians in the intervention arm had a significant increase in their self-efficacy in communicating CRC screening with patients and demonstrated more patient-centered communication, even if their knowledge did not change.[25] Participating physicians' knowledge scores did not increase because the knowledge assessment included all recommended screening while they only focused on blood stool tests and colonoscopy, excluding sigmoidoscopy and double contract barium enema. This was reflected in the study findings where most screened patients reported obtaining FOBT or colonoscopy. According to SCT, physicians' awareness of patients' screening barriers and positive expectancies for screening recommendation could also affect physicians' behavior. As Table 1 shows, physicians' awareness and positive expectancies scores were already high, both of which were not significantly improved after intervention per the process evaluation results.[25] Our results suggest that physicians' perceived efficacy in communicating with patients was key to affecting patients' participation in CRC screening.

However, over 70% of participants remained reluctant to be screened. The result showed that many of the Chinese participants were reluctant to obtain screening because of strong self-care views (eg, preferring healthy lifestyle over intrusive medical examinations for prevention especially when lacking symptom). Self-care views are negatively associated with cancer screening uptake among Chinese Americans.[30–33] However, this belief can be counteracted by culturally appropriate patient education.[32] It is possible that it was difficult for physicians to counteract their patients' ingrained beliefs during a short visit. The intervention effects may have been enhanced if patients at the intervention site were educated about how early detection of CRC through screening enhances self-care since healthy lifestyles cannot completely prevent CRC. A brief patient education before doctor visits may facilitate the efficiency of patient-doctor communication about CRC screening.[40] Research found that minority patients educated to actively talk to their physicians about CRC screening have higher rates of CRC screening than those who passively receive screening information.[41] The other reasons that patients reported not obtaining screening included being too busy, lacking health insurance, and not receiving a physician recommendation.

Limitations

This study has several limitations. First, the CRC screening measure of this study was mainly based on patient self-report. However, research shows that self-report through survey questions are reliable when patients are provided a description of CRC screening tests, as was done in the current study.[42,43] There was 100% concordance between self-report and medical records in the sub-sample verification, so this is not likely to have had a major effect on results. Second, the results of this study may only be applied to groups similar to the majority of the physicians who were not educated in the US and in solo private practices.

Third, this study was not able to audio- or video-tape patient-physician communication, limiting an understanding of intervention physicians' compliance with the intervention protocol and communication difference between the intervention and control arms. Fourth, about 14% of the 371 patients did not visit their physician. Our results suggest that the screening rate differences between the intervention and control arms were greater when outcome analysis only included patients who reported visiting their physicians during the follow-up. These patients may be more likely to be active in their healthcare and adherent to yearly check-ups. To increase internal and external validity of physician-focused intervention research in the future, researchers may collect CRC screening outcomes through patients' medical records if resources are available, compare physicians' actual communication with patients before and after the intervention (including physicians in the control arm), and attempt to enroll physicians in diverse practice structures other than solo private practice.

Implications for Future Research

The findings from this physician-focused, theoretically designed intervention have several implications for the design of future trials to increase CRC screening in Chinese and other populations. First, it is essential to increase physicians' efficacy in CRC communication by providing them with strategies to address patients' screening concerns. Moreover, physicians have limited time for reading printed materials and remembering how to respond to all of patients' screening barriers. Future interventions should consider timesaving approaches to help physicians learn updated CRC screening information and communication strategies in a timely fashion. Physicians also should be reminded to provide all recommended CRC screening options so that patients can decide which CRC screening method is best for them. Second, the physician-focused intervention effect may be significantly enhanced when leveraged to a system-level intervention where physicians will be provided with care management resources and positive feedback on their patient-centered communication. Third, patient-physician communication is bi-directional. Increasing patients' basic knowledge about CRC and screening options, and encouraging patients to ask physicians about CRC screening prior to meeting their physicians would be useful.

This study is the first that we are aware of that uses a rigorous randomized design to evaluate the effect of an intervention with Chinese-speaking physicians on increasing their Chinese American patients' receipt of CRC screening. A physician-focused intervention with multi-level components or more intensity may achieve higher impact on increasing screening rates.

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(Disclaimer: This work was prepared while Dr. Wenchi Liang was employed at Georgetown University. The opinions expressed in this article are the author's own and do not reflect the view of the National Institutes of Health, the Department of Health and Human Services, or the United States government)

Appendix A: Patients' Perceived Communication Quality Survey

How well would you say that the physician's communication about colorectal cancer screening in the past 2 years? Please tell me: The physician is doing very well, just fine, not enough, or never communicating with me about colorectal cancer screening.				
Communication items	**Never /**	**Not well /**	**Just fine /**	**Very well**
1. Described pros/cons of CRC screening	1	2	3	4
2. Encourage you to talk about your opinions	1	2	3	4
3. Asked about your concerns of CRC screening	1	2	3	4
4. Address your concerns about CRC screening	1	2	3	4
5. Was enthusiastic about CRC screening	1	2	3	4
6. Encouraged you to get CRC screening	1	2	3	4
7. Cared about your health	1	2	3	4
8. Was trustworthy	1	2	3	4
9. Respected your feeling and concerns	1	2	3	4

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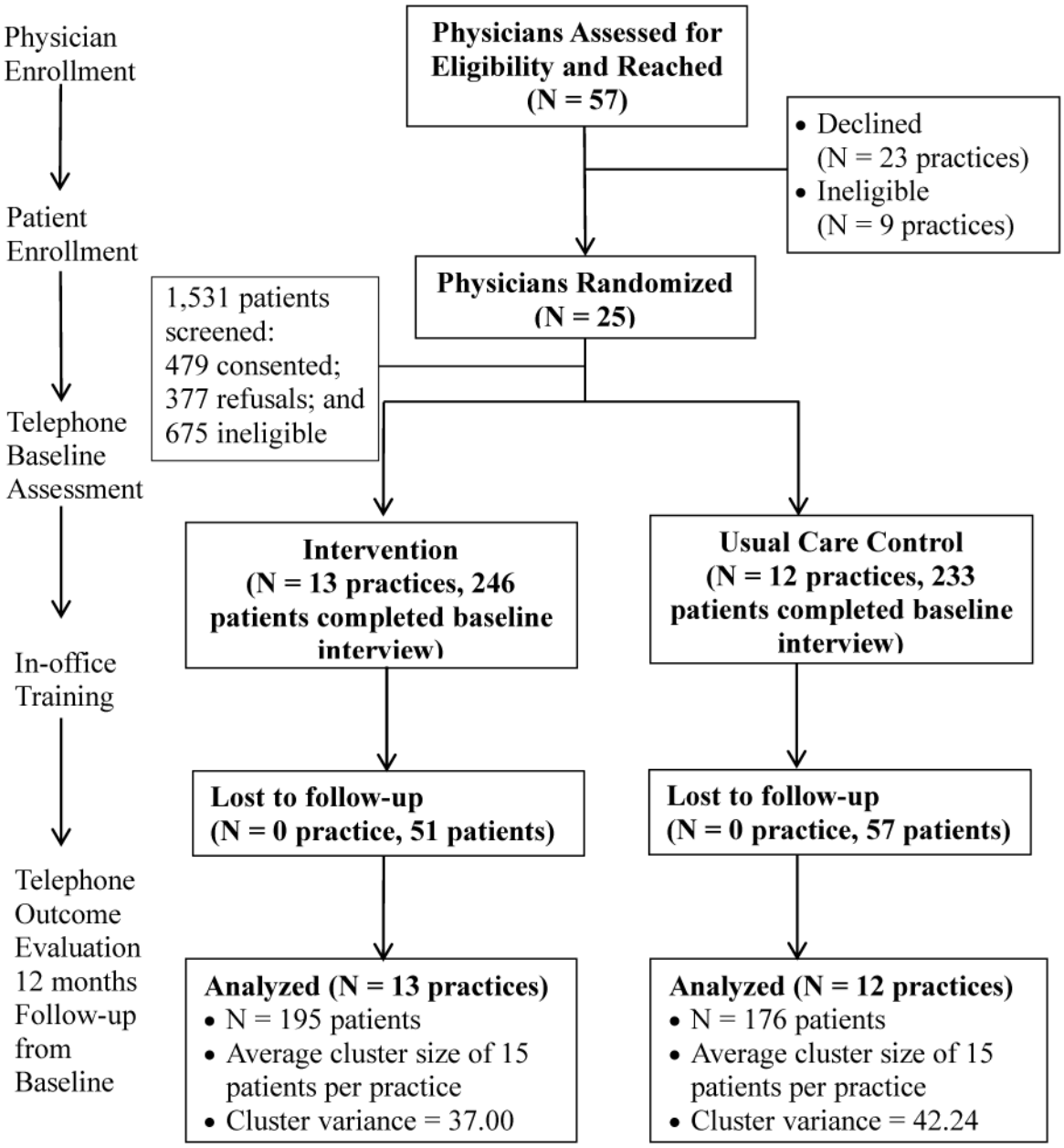

Figure 1.
Cluster Trial Consort Diagram

Table 1

Physician Characteristics by Intervention and Control Arms at Baseline

Characteristics	Total (N = 25)	Intervention (N = 13)	Control (N = 12)	p[c]
		N (%)		
Age				.43
50 years old or younger	15 (60)	9 (69)	6 (50)	
>50 years old	10 (40)	4 (31)	6 (50)	
Sex				>.99
Male	18 (72)	9 (69)	9 (75)	
Female	7 (28)	4 (31)	3 (25)	
Birthplace				>.99
United States (US)	2 (8)	1 (8)	1 (8)	
China	17 (68)	9 (69)	8 (67)	
Hong Kong	5 (20)	3 (23)	2 (17)	
Others	1 (4)	0 (0)	1 (8)	
Receipt of medical training				.76
US	6 (24)	3 (23)	3 (25)	
Non-US	19 (76)	10 (77)	9 (75)	
Practice type				.19
Private solo	20 (80)	12 (92)	8 (67)	
Private group	4 (16)	1 (8)	3 (25)	
Teaching hospital	1 (4)	0 (0)	1 (8)	
Practice year				.85
10 years or less	12 (48)	6 (46)	6 (50)	
10+ years	13 (52)	7 (54)	6 (50)	
Baseline scores:		Mean(SD)		
Age of coming to the US[a]	28.73 (6.94)	29.83 (8.03)	27.40 (5.46)	.43
Years since medical school graduation	26.52 (6.26)	25.92 (4.87)	27.18 (7.69)	.64
Self-efficacy in communication[b] **(Score: 5–20)**	17.78 (2.11)	17.25 (2.38)	18.36 (1.69)	.21
CRC and screening knowledge[b] **(Score: 0–7)**	4.00 (1.41)	4.23 (1.24)	3.75 (1.60)	.41
Awareness of patient barriers[b] **(Score: 6–24)**	20.57 (2.52)	21.08 (2.61)	19.89 (2.37)	.29
Expected positive outcomes after communication[b] **(Score: 9–45)**	33.75 (4.79)	33.00 (5.16)	34.64 (4.39)	.42

Note.

[a] Excluded 2 US-born physicians.

[b] Social cognitive theoretical constructs.

[c] p-values from chi-square test or t-test

Table 2

Patient Characteristics between Intervention and Control Arms at Baseline

	Total (N = 479)	Intervention N = 246 (51%)	Control N = 233 (49%)	p[d]
	N (%)			
Sex				.24
Male	238 (50)	129 (52)	109 (47)	
Female	240 (50)	117 (48)	123 (53)	
Age				.30
50–64 years old	355 (74)	188 (76)	167 (72)	.30
65 years old or older	123 (26)	58 (24)	65 (28)	
Education				.78
Less than college	195 (41)	99 (40)	96 (42)	
≥College	282 (59)	147 (60)	135 (58)	
Birthplace				.06
Born in China	358 (75)	174 (71)	184 (79)	
Other countries	120 (25)	71 (29)	49 (21)	
US residency				.91
≤10 years	89 (19)	45 (19)	44 (19)	
>10 years	386 (81)	198 (81)	188 (81)	
Employment				.64
Employed	289 (61)	151 (61)	138 (59)	
Non-employed	187 (39)	93 (38)	94 (41)	
Insured	423 (88)	214 (87)	209 (90)	.42
Private insurance	259 (54)	129 (53)	130 (56)	
Medicare	87 (18)	42 (17)	45 (19)	
Medicaid	39 (8)	25 (10)	14 (6)	
Type unknown	38 (8)	18 (7)	20 (9)	
English ability				.14
Low	247 (52)	135 (55)	112 (48)	
High	232 (48)	111 (45)	121 (52)	
Physician recommendation for cancer screening				.01
Yes	245 (51)	112 (46)	133 (58)	
No	224 (48)	129 (54)	95 (42)	

	Total (N = 479)	Intervention N = 246 (51%)	Control N = 233 (49%)	p[d]
		N (%)		
Length with physician[a]				<.01
<5 years	322 (69)	152 (64)	170 (76)	
≥5years	142 (31)	87 (36)	55 (24)	
Family history of CRC				.67
No	467 (97.5)	241 (98)	226 (97)	
Yes[b]	6 (1.3)	3 (1.2)	3 (1.3)	
Don't know	6 (1.3)	2 (0.8)	4 (1.7)	
Prior CRC screening				<.01
Ever screened	42 (9)	13 (5)	29 (12)	
Never screened	436 (91)	232 (95)	204 (88)	
Perceived CRC risk				.82
Lower than others	269 (56)	142 (53)	127 (47)	
Same	55 (11.5)	27 (11)	28 (12)	
Higher than others	71 (15)	35 (14)	36 (15.5)	
Unknown[c]	84 (17.5)	42 (17)	42 (18)	
		Mean (SD)		
CRC knowledge about CRC screening (score range: 0–4)	0.20 (0.47)	0.20 (0.48)	0.20 (0.46)	.95
Perceived communication quality (score range: 9–36)	25.01 (4.79)	24.65 (4.83)	25.39 (4.73)	.09
Self-care views (score range: 2–10)	5.74 (1.99)	5.65 (1.89)	5.83 (2.09)	.31

Note.

Patient characteristics of the 371 who completed the 12-month follow-up were similar to the 479 at baseline. Higher mean scores at baseline indicated better knowledge and higher perceived communication quality.

SD = standard deviation.

[a] About 3% of patients did not remember the length of years with their physicians. The percentages were calculated based on the actual responses.

[b] Non-immediate family members such as a spouse's siblings or relatives

[c] Patients did not answer the risk question; over 17.5% were missing values.

[d] p-values from chi-square test or t-test

Table 3

CRC Screening Rates of Participants Who Self-Reported Receipt of CRC Screening within 12-Month Post-baseline by Their Physician's Study Arm

	Intention to treat model among all enrolled patients (N = 479)				Patients who completed a 12-month follow-up survey (N = 371)			
Variables	**Intervention**	**Control**	**p[a]**	**ICC**	**Intervention**	**Control**	**p[a]**	**ICC**
Number of physicians, N (%)	13 (52)	12 (48)	–	0.11	13 (52)	12 (48)	–	0.09
Number of patients, N (%)	246 (51)	233 (49)	–		195 (53)	176 (47)	–	–
Weighted screening rates, %	24.4	17.7	.24		30.8	23.3	.17	

Note.

ICC denotes intra-cluster correlation coefficient.

[a]p-values were calculated from the 2 sample t-test, 2-sided.