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Colorectal Cancer Knowledge and Screening Change in African Americans: Implementation Phase Results of the EPICS Cluster RCT

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Introduction: African Americans are disproportionately affected by mortality risk for colorectal cancer. This study aimed to determine the most effective educational approach of 4 study arms that enhances the likelihood of pursuing subsequent colorectal cancer screening, and to identify the associated factors.

Methods: Age-eligible adults (N=2,877) were recruited to participate in a cluster randomized control dissemination and intervention implementation trial titled Educational Program to Increase Colorectal Cancer Screening. The project began in May 2012 and ended in March 2017 (the implementation phase lasted 36 months). Educational sessions were conducted through 16 community coalitions that were randomized into 1 of 4 conditions: website access (to facilitator training materials and toolkits) without technical assistance, website access with technical assistance, in-person training (provided by research staff and website access) without technical assistance, and in-person training with technical assistance. A follow-up to determine participant CRC screening was conducted 3 months later.

Results: Compared with the website access with technical assistance intervention group, 2 groups, in-person training with technical assistance and without technical assistance, indicated significantly higher odds for obtaining colorectal cancer screening (OR=1.31; 95% CI=1.04, 1.64; p=0.02 and OR=1.35; 95% CI=1.07, 1.71; p=0.01, respectively). Though sociodemographic factors were not significantly associated with pursuing subsequent colorectal cancer screening, the postintervention cancer knowledge increased significantly among the study participants.

Conclusions: The importance of in-person interactions, local coalitions, and community contexts may play a key role for successfully increasing colorectal cancer screening rates among African Americans as reflected through this study. The integration of telehealth and use of other virtual technologies to engage the public in research have increased since the COVID-19 pandemic and should be assessed to determine their impact on the degree to which in-person interventions are significantly more effective when compared with solely web-assisted ones.

Trial registration: The study is registered at www.clinicaltrials.gov NCT01805622.

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INTRODUCTION

Colorectal cancer (CRC) is the second-leading cancer-related cause of death for both men and women in the U.S., and it is estimated to have been responsible for about 53,000 deaths in 2022.[1] African Americans are among the races with the highest incidence and mortality rates for CRC.[1] Given the impact of this disease and the effectiveness of screening in reducing mortality,[2] promoting CRC screening should be a national priority. Less than 70% of Americans have been screened according to the recommended schedules.[3] Given the racial/ethnic disparities in incidence and mortality, promoting screening among African Americans should particularly be a national priority. Only 66% of African Americans are up to date regarding CRC screening, slightly less than the percentage of Whites (69%) but greater than the percentages of Hispanics, Native Americans, or Asians (59%, 56%, and 58%, respectively).[3]

The authors developed an educational intervention to promote CRC screening among African Americans and demonstrated its efficacy in a community intervention trial.[4] Subsequently, the authors showed its effectiveness in public health practice, and it was accepted to the National Cancer Institute's (NCI) Evidence-Based Cancer Control Programs (EBCCP), formerly known as Research-Tested Intervention Programs compendium of cancer prevention interventions.[5] The EBCCP website provides detailed instructions on implementing cancer prevention interventions and currently includes 202 interventions for 13 cancers, cancer risk factors, and related topics.[5]

In this report, authors present the results of a dissemination and intervention implementation trial of the CRC screening intervention, now named Educational Program to Increase Colorectal Cancer Screening (EPICS).[6] The intervention was implemented by African American community coalitions in 16 cities in the U.S. under different conditions to test the most effective approach for increasing CRC screening in this population group. The primary aims of this study were (1) to determine the most effective educational approach(es) of the 4 study intervention randomization arms that enhances the likelihood of pursuing subsequent CRC screening and (2) to identify other significant factors that predict the likelihood of pursuing CRC screening.

METHODS

The Intervention

EPICS, which has been described elsewhere,[4,7] is an effective intervention for increasing CRC screening rates among African Americans in both research setting and practice. Briefly, age-eligible African American men and women who have not been screened for CRC within the time interval recommended by the U.S. Preventive Services Task Force were recruited to participate in 3 small-group (8−12 individuals) educational sessions conducted by a facilitator who is a professional community health educator or a trained lay community health worker. The eligibility criteria for this project were: African American, aged >49 years, no history of CRC, and no previous CRC screening test within the recommended time interval. Facilitators made contacts in person at senior centers, churches, community centers, and public health clinics. The sessions, conducted a week apart, included information and discussions on CRC, on primary prevention and screening, and on cancer more generally. The approach to delivery was based on group-on-group discussion and the development of supportive interaction among participants. A follow-up to determine whether participants had been screened (and if so, by what method) was conducted 3 months later.

The Coalitions

In 1985, a group of African American businessmen, academics, cancer survivors, and cancer advocates launched the National Black Leadership Initiative on Cancer (NBLIC).[8] From 1989 to 2010, a central coordinating office and 4 regional offices were funded by the NCI. NBLIC pursued several strategies to promote cancer prevention among African Americans, the most important of which was community organization. More than 20 community coalitions in cities across the country were organized by the NBLIC staff. Although the coordinating offices no longer exist, most of the coalitions continue to function. The coalitions consist of health professionals, cancer survivors, cancer advocates, and family members, with some variability in composition across sites. All or nearly all members of each coalition are African Americans. Some coalitions are funded by grants or donations; others function only through the work of volunteers. This project was conducted in collaboration with 16 of the coalitions, each of which received a small grant to support its participation.

The Dissemination and Implementation Trial

The specific aim of the trial was to determine the most efficacious approach to the dissemination of EPICS and to identify the factors associated with this success. A computer program generating random numbers between 1 and n was used to assign the 16 NBLIC community coalitions to 1 of the following 4 conditions:

1. Website access to facilitator training materials and toolkits without technical assistance (WA−TA). The materials and toolkits were posted on the NCI website in EBCCP section[5] (Cohort 1).
2. Website access to facilitator training materials and toolkits with technical assistance (WA+TA). The materials were accessed from the EBCCP website, and in addition to what the investigators provided in person (Cohort 2).
3. In-person training was provided by research staff and access to facilitator training materials and toolkits without technical assistance (IP−TA) (Cohort 3).
4. In-person training was provided by research staff and access to facilitator training materials and toolkits with technical assistance (IP+TA) (Cohort 4).

The 16 coalitions that participated in the project and the conditions to which they were assigned are listed in Table 1. Each community coalition was responsible for identifying facilitators from among its members. The in-person training that was provided to facilitators in Cohorts 3 and 4 focused on both the educational content of the intervention and the approach to its delivery. This reflects the material available on the EBCCP website that was studied by facilitators in Cohorts 1 and 2 in lieu of in-person training.

Fidelity to the core elements of intervention delivery was evaluated by recurrent site visits to all 16 sites by 1 of the investigators. *Technical assistance (TA)* was defined as any kind of assistance or response (other than administrative) given to the coalition leaders to effectively implement the protocol. TA consisted largely of responding to questions presented by the facilitators, such as *how to best recruit male participants* or *how to reach study participants for the 90-day follow-up if their contact addresses have changed.*

After the participants were recruited, the interventions were delivered over a period of 36 months (2014−2017). At baseline, each participant completed a demographic questionnaire and took a written quiz regarding their knowledge of CRC. The quiz was administered again at the conclusion of the intervention. Three months after the completion of the intervention for each group of 8−12 participants, the facilitator who delivered the intervention attempted to contact each participant by telephone to inquire whether they had been screened for CRC and, if so, which method was used.

Study Design

The underlying implementation for this study follows a pre− and post−4-arms parallel randomized design. Study participants were randomized over 4 study (educational) arms: (1) web access to facilitator training materials and toolkits without technical assistance (WA−TA); (2) web access with technical assistance (WA+TA); (3) in-person access to facilitator training materials and toolkits without technical assistance (IP−TA); and (4) in-person access with technical assistance (IP+TA).

Outcome Measures

These included (1) the pursuit of a CRC screening test after intervention (yes/no) and (2) the percentage (%) of correct answers for the different topics underlying the knowledge of participant's own cancer.

Table 1. Cohorts of the EPICS

Cohort 1 WA−TA	Cohort 2 WA+TA	Cohort 3 IP−TA	Cohort 4 IP+TA
Houston (TX) NBLIC Community Coalition	Kentucky African Americans Against Cancer (Louisville, KY)	Philadelphia (PA) NBLIC Community Coalition	Chicago NBLIC Community Coalition
West Central Georgia Cancer Coalition (Columbus, GA)	Concerned Citizens to Combat Cancer, Inc. (Orlando, FL)	Chi & Phi Sorority, Inc. (Cleveland, OH)	Memphis (TN) NBLIC Community Coalition
African American Health Coalition, Inc. (Portland, OR)	African American Community Healthcare Group (San Diego, CA)	Black Women for Wellness (Los Angeles, CA)	Nassawadox, Virginia NBLIC Community Coalition
Atlanta (GA) Cancer Awareness Partnership	—	Black Healthcare Initiative Coalition (Rockford, IL)	Florida NBLIC Community Coalition
—	—	—	Augusta (GA) NBLIC Community Coalition

CA, California; EPICS, Educational Program to Increase Colorectal Cancer Screening; FL, Florida; GA, Georgia; IL, Illinois; IP+TA, in-person access with technical assistance; IP−TA, in-person access to facilitator training materials and toolkits without technical assistance; KY, Kentucky; NBLIC, National Black Leadership Initiative on Cancer; OH, Ohio; OR, Oregon; PA, Pennsylvania; TN, Tennessee; TX, Texas; WA+TA, web access with technical assistance; WA−TA, web access to facilitator training materials and toolkits without technical assistance.

Covariates/Factors

These included (1) age in years (50−60, 61−74, 75−95), (2) sex at birth (female or male), (3) race/ethnicity (African American/Black, non-Hispanic; White, Non-Hispanic; or Other [Asian, Native American, Pacific Islanders, other]), (4) marital status (married or equivalent, single, divorced, or widowed), (5) education status (elementary/primary, high school, technical/vocational/some college, college, or graduate/postgraduate), (6) health insurance status/type (no insurance, Medicare, Medicaid, or health insurance/HMO), (7) CRC screening status/type (none, colonoscopy, double-contrast barium enema, colonoscopy/double-contrast barium enema, and fecal occult blood test [FOBT]/fecal immunochemical test [FIT]/flexible sigmoidoscopy [FLEX SIG]/colonoscopy or FLEX SIG, FOBT/FIT and FLEX SIG, FOBT/FIT), and (8) recruitment site (church, clinical, and community site). Apart from the recruitment site, information for the remaining covariates, including sex, was self-reported.

Statistical Analysis

Power and sample size. With a sample size of 2,877 participants, 4 randomization groups (interventions) as the main covariate, and adjusting for the other covariates of age, sex, education, and health insurance status (yes/no), iterative logistic regression calculations assuming variable distributions of the covariates yielded at least 0.90 statistical power to detect OR values of obtaining a CRC screening between 1.25 and 1.5 for at least 1 intervention group when compared with 1 preset reference. The calculations were conducted using procedure power in SAS, version 9.4, and assuming a $p<0.05$ overall significance level.

Data summary. Continuous variables were summarized by means/median/SDs, and categorical variables were summarized by frequencies and percentages. The first study outcome measure, the percentage of participants who pursued CRC screening, is presented by randomization groups and study covariates. Preliminarily, chi-square analysis was done to test the significance of the association between the study covariates and the percentage of participants who subsequently pursued CRC screening. Additionally, *t*-test was used for evaluating the before and after differences in cancer knowledge.

Following univariate analysis to identify potentially associated covariates with the primary outcome of completing a CRC screening (yes/no), multivariate analyses using the generalized linear mixed modeling with the logit link function (log of the odds of obtaining a CRC screening) were conducted to determine (1) the most effective randomization arm (intervention) and (2) the significant predictors of CRC screening. The generalized linear mixed modeling will accommodate random effects inclusion (like the different community sites) and afford each participant his/her intercept for the likelihood of pursuing CRC screening while determining the effects of race/ethnicity (White race/ethnicity compared with African American/Black and other races/ethnicities), demographics, socioeconomic status, insurance, and type of CRC screening. Overall, $p<0.05$ significance level was used, and where needed multiple comparisons adjustments were pursued. Missing/unknown values were estimated using Bayesian imputation algorithms based on the predictability of covariates to missing observations.

Ethical Approval and Informed Consent

Two IRBs (Morehouse School of Medicine and Augusta University) approved the research plan. Free and informed consent was obtained from all study participants (community coalition leaders, EPICS facilitators, and individual participants). The study is registered with www.clinicaltrials.gov as NCT01805622.

RESULTS

A total of 4,354 individuals were recruited for the EPICS cluster RCT, out of which 2,971 met the eligibility criteria. At the end of this study, 94 individuals (3.2%) overall were lost to follow-up (Cohort 1=20 individuals, Cohort 2=18 individuals, Cohort 3=24 individuals, and Cohort 4=32 individuals). A total N=2,877 participants were included in the final analysis of this study (Figure 1).

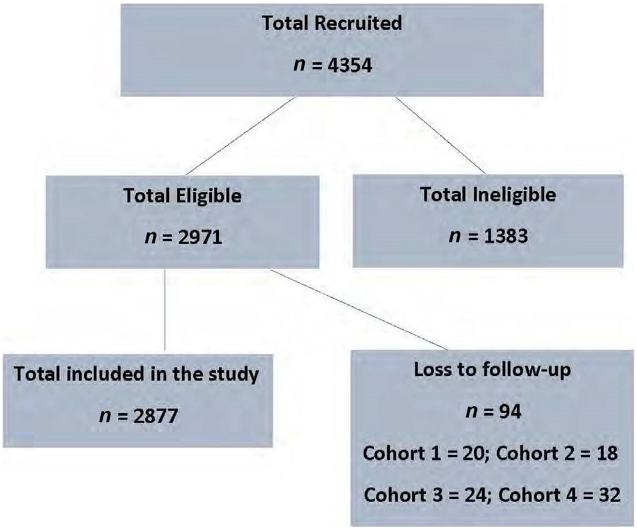

Figure 1. Flowchart of participant recruitment and loss to follow-up of the EPICS cluster RCT.
EPICS, Educational Program to Increase Colorectal Cancer Screening.

Table 2. Distribution of Study Covariates by Randomization/Intervention Groups

		Study groups			
Variables	All, *n* (%)	Cohort 1 (WA−TA), *n* (%)	Cohort 2 (WA+TA), *n* (%)	Cohort 3 (IP−TA), *n* (%)	Cohort 4 (IP+TA), *n* (%)
All	2,877 (100.0)	599 (20.8)	562 (19.5)	742 (25.8)	974 (33.9)
Age (years)					
50−60	888 (30.9)	130 (21.7)	153 (27.2)	312 (42.1)	293 (30.1)
61−74	1,506 (52.4)	346 (57.8)	322 (57.3)	338 (45.6)	500 (51.3)
75−95	483 (16.8)	123 (20.5)	87 (15.5)	92 (12.4)	181 (18.6)
Sex					
Male	956 (33.2)	143 (23.9)	195 (34.7)	288 (38.8)	330 (33.9)
Female	1,876 (65.2)	445 (74.3)	363 (64.6)	446 (60.1)	622 (63.9)
Missing	45 (1.6)	11 (1.8)	4 (0.7)	8 (1.1)	22 (2.3)
Marital status					
Married	936 (32.5)	202 (33.7)	200 (35.6)	215 (29.0)	319 (32.8)
Single	784 (27.3)	136 (22.7)	127 (22.6)	275 (37.1)	246 (25.3)
Divorced	627 (21.8)	132 (22.0)	133 (23.7)	141 (19.0)	221 (22.7)
Widowed	509 (17.7)	125 (20.9)	98 (17.4)	105 (14.2)	181 (18.6)
Missing	21 (0.7)	4 (0.7)	4 (0.7)	6 (0.8)	7 (0.7)
Race					
African American/Black, NH	2,697 (93.7)	561 (93.7)	526 (93.6)	684 (92.2)	926 (95.1)
White, NH	100 (3.5)	19 (3.2)	27 (4.8)	29 (3.9)	25 (2.6)
Other	58 (2.0)	17 (2.8)	5 (0.9)	25 (3.4)	11 (1.1)
Missing	22 (0.8)	2 (0.3)	4 (0.7)	4 (0.5)	12 (1.2)
Education					
Elementary/primary	127 (4.4)	15 (2.5)	16 (2.9)	29 (3.9)	67 (6.9)
High school	866 (30.1)	171 (28.6)	129 (23.0)	249 (33.6)	317 (32.6)
Technical/vocational/some college	1,071 (37.2)	231 (38.6)	250 (44.5)	246 (33.2)	344 (35.3)
College graduate	445 (15.5)	84 (14.0)	87 (15.5)	118 (15.9)	156 (16.0)
Postgraduate	341 (11.9)	92 (15.4)	76 (13.5)	90 (12.1)	83 (8.5)
Missing	27 (0.9)	6 (1.0)	4 (0.7)	10 (1.4)	7 (0.7)
Health insurance coverage					
None	222 (7.7)	46 (7.7)	61 (10.9)	52 (7.0)	63 (6.5)
Medicare	1,291 (44.9)	293 (48.9)	271 (48.2)	263 (35.4)	464 (47.6)
Medicaid	252 (8.8)	48 (8.0)	31 (5.5)	100 (13.5)	73 (7.5)
HMO	1,044 (36.3)	199 (33.2)	188 (33.5)	301 (40.6)	356 (36.6)
Missing	68 (2.4)	13 (2.2)	11 (2.0)	26 (3.5)	18 (1.9)
Recruitment site					
Church	1,114 (38.7)	229 (38.2)	222 (39.5)	300 (40.4)	363 (37.3)
Clinical	131 (4.6)	65 (10.9)	—	—	66 (6.8)
Community site	1,556 (54.1)	301 (50.3)	310 (55.2)	427 (57.6)	518 (53.2)
Missing	76 (2.6)	4 (0.7)	30 (5.3)	15 (2.0)	27 (2.8)

HMO, health maintenance organization; IP, in person; NH, non-Hispanic; TA, technical assistance; WA, web access.

The distribution of the study covariates by the randomization groups are presented in Table 2. Overall, N=2,877 participants aged between 50 and 95 years were eligible and randomized over the 4 intervention arms: WA−TA=599 (20.8%), WA+TA=562 (19.5%), IP−TA=742 (25.8%), and IP+TA=974 (33.9%). The mean age of the study participants was 65.4 years. The majority were females (65.2%), African American/Black (93.7%), and had some form of health insurance coverage (92.4%). A plurality of the study participants were married (32.5%) and had technical/vocational/some college education (37.2%).

Table 3 displays the distribution by study covariates and randomization groups of the proportion of the study

Table 3. Frequency Distribution and Percentage of Postintervention Colorectal Cancer Screening by Study Cohort and Selected Participants' Characteristics

Variables	All	Study groups (Cohorts)			
	All *n* (%)	Cohort 1 (WA−TA) *n* (%)	Cohort 2 (WA+TA) *n* (%)	Cohort 3 (IP−TA) *n* (%)	Cohort 4 (IP+TA) *n* (%)
All	1,084 (37.6)	213 (35.5)	186 (33.0)	297 (40.0)	388 (39.8)
Age (years)					
50−60	334 (37.6)	47 (36.2)	52 (33.9)	124 (39.7)	111 (37.8)
61−74	576 (38.2)	128 (36.9)	102 (31.6)	141 (41.7)	205 (41.0)
75−95	174 (36.0)	38 (30.9)	32 (36.8)	32 (34.7)	72 (39.8)
Sex					
Male	347 (36.3)	48 (33.6)	64 (32.8)	105 (36.5)	130 (39.4)
Female	718 (38.3)	160 (36.0)	121 (33.3)	190 (42.6)	247 (39.7)
Missing	19 (42.2)	5 (45.5)	1 (25.0)	2 (25.0)	11 (50.0)
Marital status					
Married	356 (38.0)	75 (37.1)	67 (33.5)	79 (36.7)	135 (42.3)
Single	307 (39.2)	54 (39.7)	45 (35.4)	112 (40.7)	96 (39.0)
Divorced	229 (36.5)	39 (29.5)	41 (30.8)	57 (40.4)	92 (41.6)
Widowed	184 (36.1)	44 (35.2)	33 (33.7)	45 (42.9)	62 (34.3)
Missing	8 (38.1)	1 (25.0)	0 (0.0)	4 (66.7)	3 (42.9)
Race/ethnicity					
African American/Black, NH	1,016 (37.7)	196 (34.9)	180 (34.2)	272 (39.8)	368 (39.7)
White, NH	38 (38.0)	8 (42.1)	2 (7.4)	15 (51.7)	13 (52.0)
Other	20 (34.5)	8 (47.1)	2 (40.0)	8 (32.0)	2 (18.2)
Missing	10 (45.5)	1 (50.0)	2 (50.0)	2 (50.0)	5 (41.7)
Education					
Elementary/primary	48 (37.8)	5 (33.3)	7 (43.8)	10 (34.5)	26 (38.8)
High school	319 (36.8)	54 (31.5)	39 (30.2)	92 (36.9)	134 (42.3)
Technical/vocational/some college	391 (36.5)	83 (35.9)	77 (30.8)	102 (41.5)	129 (37.5)
College graduate	182 (40.9)	34 (40.5)	36 (41.4)	45 (38.1)	67 (42.9)
Postgraduate	138 (40.5)	35 (38.0)	27 (35.5)	45 (50.0)	31 (37.3)
Missing	6 (22.2)	2 (33.3)	0 (0.0)	3 (30.0)	1 (14.3)
Health insurance coverage					
None	74 (33.3)	15 (32.6)	23 (37.7)	21 (40.4)	15 (23.8)
Medicare	489 (37.9)	98 (33.4)	88 (32.5)	99 (37.6)	204 (44.0)
Medicaid	96 (38.1)	20 (41.7)	10 (32.3)	39 (39.0)	27 (37.0)
HMO	401 (38.4)	75 (37.7)	63 (33.5)	129 (42.9)	134 (37.6)
Missing	24 (35.3)	5 (38.5)	2 (18.2)	9 (34.6)	8 (44.4)
Recruitment site					
Church	412 (37.0)	75 (32.8)	71 (32.0)	131 (43.7)	135 (37.2)
Clinical	58 (44.3)	28 (43.1)	.	.	30 (45.5)
Community site	591 (38.0)	108 (35.9)	110 (35.5)	163 (38.2)	210 (40.5)
Missing	23 (30.3)	2 (50.0)	5 (16.7)	3 (20.0)	13 (48.1)
Colorectal screening status/type					
Colonoscopy	946 (32.9)	186 (31.0)	172 (30.6)	243 (32.7)	345 (35.4)
DCB, colonoscopy/DCB and FOBT/FIT/FLEX SIG/ colonoscopy or FLEX SIG	33 (1.1)	5 (0.8)	4 (0.7)	9 (1.2)	15 (1.5)
FOB/FIT & FLEX SIG	61 (2.1)	12 (2.0)	5 (0.9)	30 (4.0)	14 (1.4)
FOBT/FIT	44 (1.5)	10 (1.7)	5 (0.9)	15 (2.0)	14 (1.4)

DCB, double-contrast barium enema; FIT, fecal immunochemical test; FLEX SIG, Flexible sigmoidoscopy; FOBT, fecal occult blood test; HMO, health maintenance organization; IP, in person; NH, non-Hispanic; TA, technical assistance; WA, web access.

Table 4. AOR of the Likelihood of Postintervention Colorectal Cancer Screening

Variables	Ref	AOR	95% CI		p-Value
			Lower limit	Upper limit	
Study cohorts	Cohort 2 (WA+TA)				
Cohort 1 (WA−TA)		1.08	0.84	1.39	0.547
Cohort 3 (IP−TA)		1.35	1.07	1.72	**0.013**
Cohort 4 (IP+TA)		1.31	1.04	1.64	**0.019**
Age (years)	>70 years				
50−59		0.95	0.76	1.17	0.606
60−70		1.01	0.83	1.22	0.963
Education	Elementary school				
High school		0.89	0.60	1.32	0.558
>High school		0.98	0.66	1.45	0.919
Health insurance coverage	None				
Yes (All insurance)		1.15	0.85	1.55	0.373
Medicare		1.20	0.90	1.70	0.279
Medicaid		1.20	0.80	1.80	0.389
HMO		1.20	0.80	1.60	0.364
Marital status	Married				
Single		1.06	0.87	1.30	0.557
Divorced/widowed		0.91	0.75	1.10	0.311
Race/ethnicity	African American/Black, NH				
White, NH		1.15	0.74	1.79	0.541
Other		0.79	0.44	1.42	0.429
Sex	Male				
Female		1.13	0.95	1.33	0.165

Note: Boldface indicates statistical significance ($p<0.05$).
HMO, health maintenance organization; IP, in person; NH, non-Hispanic; TA, technical assistance; WA, web access.

population who had CRC screening after the educational intervention. Overall, 37.6% (n=1,084) of the 2,877 study participants had a CRC screening test. The highest proportion of those that were screened after intervention were in the IP−TA (40.0%) and IP+TA (39.8%) cohorts, compared with 35.5% and 33.0% in the WA−TA and WA+TA cohorts, respectively.

The AORs of the likelihood of having a CRC screening after the educational intervention are displayed in Table 4. Compared with individuals in the WA+TA intervention group, there were significantly higher odds for obtaining CRC screening among individuals that were in the IP groups (IP+TA and IP−TA). The AOR (95% CI) for IP+TA were 1.31 (1.04, 1.64), with a p=0.019, and for IP−TA, 1.35 (1.07, 1.71), with a p=0.013. It is worth noting that the authors used the Tukey−Kramer test for ad hoc analyses adjustment of pairwise comparison of the cohort groups. The only comparisons that yielded significant adjusted p-values were when comparing Cohort 2 (WA+TA) versus Cohort 3 (IP−TA) (p=0.026) and versus Cohort 4 (IP +TA) (p=0.027). The likelihood of postintervention CRC screening among the other study cohort and covariates was not statistically significant.

The statistical models were re-analyzed, excluding the non-Black ethnic subgroups (White, non-Hispanic, and Other), who were about 5.5% of the analyzed data. The results were similar with respect to the association of the educational group with the likelihood of pursuing CRC screening. Compared with the Cohort 2 (WA+TA) educational group, the OR (95% CI; p-value) for those assigned to Cohort 1 (WA−TA), Cohort 3 (IP−TA), and Cohort 4 (IP + TA) were 1.11 (0.8, 1.42, p=0.41), 1.37 (1.08, 1.73, p=0.010), and 1.39 (1.11, 1.74, p=0.004), respectively.

Table 5 displays the pre and post scores (% correct) of cancer knowledge questions by intervention groups. The total differences between pre and post scores for the 4 cohorts, WA−TA, WA+TA, IP−TA, and IP+TA, were 609.6, 778.3, 560.9, and 551.9, respectively.

The means of the average proportions of correct answers to the before and after intervention cancer knowledge surveys were calculated. In Table 6, the t-test of paired differences of means shows significant

Table 5. Average Proportions of Participants Correctly Answering the Preintervention and Postintervention Cancer Knowledge Questions

Questions	Cohort 1 (WA−TA)			Cohort 2 (WA+TA)			Cohort 3 (IP−TA)			Cohort 4 (IP+TA)		
	Pre	Post	Diff.	Pre	Post	Diff.	Pre	Post	Diff.	Pre	Post	Diff.
What are the 3 most common cancers?	37.6	61.7	24.1	22.2	64.0	41.8	36.6	58.8	22.2	36.9	64.8	27.9
What is CRC?	46.4	96.1	49.7	34.7	97.0	62.3	48.9	95.0	46.1	51.6	95.1	43.5
Can CRC be prevented?	50.9	97.6	46.7	35.4	96.0	60.6	49.2	94.4	45.2	51.9	95.8	43.9
What are 2 ways to prevent CRC?	47.0	97.3	50.3	32.6	97.0	64.4	46.8	95.6	48.8	50.1	97.0	46.9
Does removing polyps prevent CRC?	49.2	96.6	47.4	35.0	96.0	61.0	45.2	91.6	46.4	52.0	94.7	42.7
Does ulcerative colitis increase CRC risk?	34.2	84.7	50.5	19.7	80.0	60.3	28.7	80.7	52.0	31.0	78.1	46.7
Does CRC screening detect polyps?	47.3	95.2	47.9	35.2	95.0	59.8	47.4	92.5	45.1	54.0	96.1	42.1
How often should one be screened for CRC?	24.2	62.6	38.4	20.2	70.0	49.8	35.8	67.7	31.9	36.0	69.0	33.2
What types of screening tests are used for CRC?	22.0	49.3	27.3	8.4	37.0	28.6	9.1	37.2	28.1	12.0	40.6	29.0
Can polyps become cancerous?	47.7	94.7	47.0	33.3	93.0	59.7	48.4	89.1	40.7	52.0	90.5	38.4
Can screening tests diagnose CRC?	57.0	98.0	41.0	40.7	96.0	55.3	62.6	95.0	32.4	63.0	96.8	34.0
Are polyps trapped feces?	46.6	91.1	44.5	32.0	92.0	60.0	46.1	84.8	38.7	49.0	90.5	41.1
Is pain a symptom of CRC?	30.6	76.8	46.2	19.0	76.0	57.0	22.5	64.1	41.6	25.0	63.6	39.0
Is a family history required for CRC?	41.8	90.4	48.6	31.3	89.0	57.7	42.9	84.6	41.7	41.0	84.8	44.2
Total difference (post−pre)	—	—	609.6	—	—	778.3	—	—	560.9	—	—	551.9

CRC, colorectal cancer; Diff., difference; IP, in person; pre, preintervention; post, postintervention; TA, technical assistance; WA, web access.

differences in the overall before and after cancer knowledge questions among the study participants.

DISCUSSION

African American participants from 16 NBLIC community coalitions assigned to 1 of 4 conditions were recruited to determine the most efficacious approach to the dissemination of the EPICS program and to identify factors associated with this success. These findings reveal that in-person interactions between target populations and program facilitators play a key role in successfully increasing CRC screening rates among African Americans. Compared with the web access groups, WA+TA and WA−TA, the 2 in-person groups, IP+TA and IP −TA, had the highest significant odds and proportions (40%) of individuals that had CRC screening after the educational intervention. These 2 groups had the most effective educational approaches that enhanced the likelihood of pursuing subsequent CRC screening. Previous studies have proposed tailored interventions for increasing the screening rates among target populations.[9,10] This study's results may help guide the development and implementation of tailored programs for CRC screening.

The overall CRC screening rate for the U.S. in 2018 was 65.2%. This rate is below the set goals of 70.5% and 74.4% for *Healthy People 2020* and *Healthy People 2030*, respectively. The lack of knowledge of the risk factors associated with cancers may be a significant barrier to CRC screening.[11] The results from this EPICS study, showing statistically significant increase in the knowledge of CRC among the study participants, support the evidence from previous studies that showed educational programs and interventions are important for increasing knowledge about cancers and screening rates among populations. Marcellon et al.[12] demonstrated a positive change in knowledge following an interactive CRC

Table 6. *t*-Test of Paired Differences of Means (Pre [Mean] − Post [Mean])

Cohorts	Mean	95% CI (mean)		*t*	df	*p*-value
		Lower	Upper			
Cohort 1 (WA−TA)	−43.5	−48.3	−38.7	−19.6	13	**<0.001**
Cohort 2 (WA+TA)	−55.6	−61.2	−50.0	−21.5	13	**<0.001**
Cohort 3 (IP−TA)	−40.1	−35.1	−17.6	−17.6	13	**<0.001**
Cohort 4 (IP+TA)	−39.4	−43.1	−35.8	−23.4	13	**<0.001**

Note: Boldface indicates statistical significance ($p<0.05$).
CRC, colorectal cancer; df, degrees of freedom; IP, in person; TA, technical assistance; WA, web access.

educational session for first-year medical students. Furthermore, a pilot study by Slyne and colleagues[13] showed that an educational intervention about CRC screening for nurse practitioners increased participants' knowledge and subsequently increased the screening rates of their patients.

None of the covariates of this study, such as age, sex, education, health insurance coverage, and income, had a statistically significant effect on the likelihood of CRC screening. This contrasts with the findings from previous studies with different target populations that reported associations between sociodemographic factors and the likelihood of CRC screening. A systematic review of 73 randomized clinical trials by Dougherty et al.[14] showed that interventions that were associated with increased CRC screening completion rates included patient education, among other factors. In a study of American Indians by Sanderson and colleagues,[15] respondents with little or no formal schooling had lower knowledge of CRC and lower CRC screening rates than participants with higher educational levels. Both CRC knowledge and physician–patient interactions were positively associated with participant screening history among Hispanics in New Mexico.[16] A study of adults in Washington, DC, by Chatterjee et al.[17] showed that older age, higher education, having health insurance coverage, being employed, and higher income were independent predictors of CRC screening. Domingo and colleagues[18] showed that higher education and income, employment, regular health provider, and routine checkups were important predictors of CRC screening compliance among Asians and Pacific Islanders. Education and health insurance status were significantly related to CRC screening among Chinese Americans.[19] Those with less than high school education and without health insurance were less likely to screen for CRC.[20] Palmer et al.[20] observed that having a health insurance was a strong correlate of adherence to CRC screening among African Americans living in Maryland.

The possible explanation for the nonstatistically significant association of the covariates (e.g., age, sex, insurance, education) with the likelihood of CRC screening that was observed in this study may be attributed to the following: (1) the distributional balance that was achieved through the randomization mechanism of these covariates among the 4 study educational arms (since the effects of these covariates were adjusted for randomization groups) and (2) the homogeneity of the study population with respect to the socioeconomic/social determinants characterizing the recruited participants, that is, there were no appreciable differences in these covariates to induce statistically significant changes/shifts in the likelihood of pursuing CRC screening.

Findings from this EPICS study hold important implications for future research given the evolving clinical guidelines and public health contexts since its conclusion. First, it demonstrates what the authors trust will be the sustained power of local coalitions and community contexts supporting successful recruitment, retention, and effectiveness of CRC screening intervention for African Americans in future studies. Second, since the completion of this study, the U.S. Preventive Services Task Force has lowered the CRC screening age from 50 to 45 years. Finally, the integration of telehealth and the use of other virtual technologies to engage the public in research have increased since the coronavirus disease 2019 (COVID-19) pandemic. These factors should be assessed to determine their independent and collective impacts on the degree to which the in-person intervention arms are significantly more effective than the web-assisted ones.

This study is a randomized trial that determined the most efficacious approach to the dissemination of EPICS and identified factors associated with this success. Therefore, a cause-effect relationship may be assumed from the presented results. The large sample size of 2,877 participants and the high statistical power contribute to both the high internal and external validity of the results. Because most of the study participants (94%) were African Americans/Blacks, these findings may be generalizable to that specific population.

Limitations

A major limitation, however, is that the findings may not be generalizable to other racial/ethnic groups, such as Caucasians/Whites, Hispanics, and Asians, as they were <6% of the total study population. In addition, most of the coalitions/cohorts were in larger urban centers (Table 1), and a potential limitation is the lack of engagement of primarily rural community coalitions. Although their linkages, leadership, and local trust constitute a strength, rural communities have well-recognized lower CRC rates than their urban counterparts.[21] A review conducted by Huang and colleagues[22] also identified rural geography as among the characteristics of those harder to reach in CRC screening interventions. Because rurality was not among the covariates analyzed in this study, the inclusion of rural community coalitions may have resulted in different study results and should be considered in subsequent interventions and analyses. Well-recognized challenges associated with less access to quality health care, such as transportation barriers and relatively less broadband access for rural communities, along with increased utilization of telehealth services,[23,24] may serve as potential barriers or facilitators associated with the relative effectiveness of IP versus WA interventions adapted in this study.

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