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ORIGINAL PAPER

Enhancing CRC Screening in a Predominantly Hispanic Community: Effectiveness of 1-Day vs. 3-Day Stool-Based Testing Kits

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Abstract

Colorectal cancer (CRC) is the leading cause of cancer-related mortality among U.S. Hispanics, with screening proven to decrease both incidence and mortality. Despite rising CRC screening rates in the U.S., Hispanic participation remains disproportionately low. Stool-based tests, particularly popular for reaching underserved populations, may enhance screening adherence. This study evaluates the performance of a 1-day versus a 3-day stool-based testing kit in improving screening completion rates and reducing the need for reminder calls in a Hispanic community along the U.S.-Mexico border. In our quasi-experimental observational study, participants aged 45–75 years who were uninsured or underinsured and overdue for CRC screening were recruited. They received colorectal cancer education and no-cost stool-based screening facilitated by promotoras. Participants were randomly assigned to receive a 1-day or 3-day Fecal Immunochemical Test (FIT) kit. The promotoras swapped FIT kit distribution roles midway through the study period to mitigate performance bias. Our analysis covered 6,660 FITs—3,067 using the 3-day kit and 3,593 with the 1-day kit. Results indicated a higher return rate for the 1-day FIT kit (61.3% vs. 58.7%, adjusted odds ratio [aOR] = 1.22, $p < 0.001$), fewer reminders needed (69.7% vs. 78.1%, aOR = 0.65, $p < 0.001$), and lower abnormal FIT results (5.3% vs. 8.1%, aOR = 0.61, $p < 0.001$). Conclusively, the 1-day FIT kit required fewer reminders and significantly improved return rates, suggesting it may be a more effective option for increasing CRC screening completion among hard-to-reach Hispanic populations.

Keywords Colorectal cancer screening · Hispanic populations · Stool-based testing · Fecal tmmunochemical test (FIT) · Screening adherence · Quasi-experimental study

Introduction

Colorectal cancer (CRC) causes significant morbidity and is a leading cause of cancer-related deaths in the United States (US). Worldwide, CRC ranks third in cancer-related deaths, with mortality rates trending up over the last 20 years [1, 2]. There remains a disparity in CRC incidence and mortality among different racial and ethnic groups. Among Hispanics specifically, CRC ranks second in cancer-related death [3]. Many reasons are attributed to this disparity; however, these reasons have not been fully elucidated [4]. Exploring these disparities and possible interventions further is essential, especially given that Hispanics comprise 20% of the US population [5].

CRC is a slowly progressing disease, and early screening is vital to prevention and to achieving better treatment outcomes. In a longitudinal study, CRC screening reduced the CRC mortality rate from 20 to 12% between 2000 and 2018 [6]. Currently, several methods have been recommended by

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the United States Preventive Services Task Force (USPSTF) for CRC screening. They include the guaiac fecal occult blood testing (gFOBT), fecal immunochemical test (FIT), multitarget stool DNA (sDNA-FIT or MT-sDNA), sigmoidoscopy, computed tomographic colonography (CT colonography), and colonoscopy [7].

Despite the wide variety of CRC screening methods available, Hispanics continue to be screened at a consistently lower rate than the general population [5]. This disparity in screening may contribute to Hispanics being less likely to receive an early-stage diagnosis and more likely to be diagnosed with advanced disease than non-Hispanic whites (NHWs) [8]. Studies have tried to explain these screening disparities, with some attribution to lack of insurance, fear, lack of knowledge, financial resources, mistrust of the healthcare system, and embarrassment [9, 10]. Other studies attributed these disparities to ineffective communication with physicians due to language differences or other scheduling difficulties. A few studies went so far as to conclude that despite having a Spanish-speaking office visit, Hispanic patients were 43% less likely to receive CRC screening [11–13].

Stool-based testing, such as with fecal immunochemical test (FIT) kits, may reduce the CRC screening disparity between Hispanics and NHWs. The primary advantage of FIT kits' is the relative ease of use compared to alternative CRC screening tests. For instance, patients do not need to modify their diet or undergo surgery, and they can return the tests in person or by mail. Studies have shown that, in general, Hispanics express satisfaction with the ease of use of FIT kits, increasing their likelihood of adopting FIT [14]. If the FIT is abnormal, patients must still undergo a diagnostic colonoscopy to confirm the diagnosis, helping reduce CRC mortality. Although prior studies disagree on whether or not Hispanics have higher or lower diagnostic follow-up rates than NHWs, the bottom line still stands that increased CRC screening should also improve the pool of screened Hispanics, thereby expanding the pool of Hispanics willing to undergo a diagnostic follow-up [15, 16].

Despite inconsistencies in studies reporting CRC follow-up rates in Hispanics, studies have at least shown that sending reminders to patients to return the FIT kits has improved baseline FIT kit return rates with upwards of 17% increase in return rate, with some studies suggesting a response rate directly proportional to the number of reminders [17, 18]. While studies have shown that the number of reminders corresponds to FIT return rates, no studies thus far have examined a direct comparison between 3-day vs. 1-day FIT kit return rates and whether the 1-day FIT, because of its ease of use, would suggest the possibility of a higher return rate. Our study aims to evaluate the effect of a 1-day FIT vs. a 3-day FIT on CRC screening completion in a predominantly Hispanic population living on the US-Mexico border. In addition, our study hopes to explore the effect of navigation intensity measured by the number of outreach on participants' FIT return.

Methods

Design

We designed a quasi-experimental, observational study to evaluate CRC screening completion rates for FITs when comparing the 1-day FIT kit to the 3-day FIT kit. Data collected was part of the routine functioning of the program. We also assessed the navigation intensity (measured by the number of reminder calls) required for the FIT kit return. This study is embedded within a CRC screening program, SuCCCeS (Southwest Coalition for Colorectal Cancer Screening). SuCCCeS is an evidence-based multicomponent CRC screening program that involves community engagement, outreach, education, navigation, and no-cost CRC screening for uninsured and underinsured individuals. This program was built on and expanded from the framework of the original program ACCION (Against Colorectal Cancer in Our Neighborhoods) [19].

Participants

Eligibility for recruiting community members to the SuCCCeS program are individuals aged 45 to 75 years who are due or overdue for CRC screening, uninsured or underinsured, and have a Texas address. This recruitment process occurred as part of a culturally tailored CRC screening program.

Setting

This study was conducted in a community on the U.S.-Mexico border, providing a unique context for understanding CRC screening behaviors in a predominantly Hispanic population. The community population is approximately 850,000, with the majority (82%) identifying as Hispanic of mostly Mexican origin [20]. The population is socioeconomically challenged, with a higher-than-average poverty rate and low rates of health coverage (21% without health insurance compared to 8% in the US) [21].

Intervention

Participants recruited into the program received a comprehensive intervention that included education, outreach, navigation, and the provision of no-cost stool-based CRC

screening kits. A small percentage of participants considered high risk due to their family and personal history were navigated to primary screening colonoscopy and hence were not included in this study. There are several stool-based tests with slightly different properties. The 3-day test uses qualitative immunochemical Chromatography to detect human hemoglobin from blood in stool. In contrast, the 1-day test uses an immunological method to detect or measure hemoglobin in a clinical stool (feces) specimen.

The intervention was delivered by trained community health workers known as promotoras (PM). Average-risk individuals received screening via stool-based testing. Four promotoras carried out the distribution of the FIT kits. Two PMs (PM 1 and 2) distributed the 3-day FIT kit, while two PMs (PM3 and 4) distributed the 1-day kit. A midpoint adjustment was implemented to account for the potential variations in promotor(a) 's performance, wherein the distribution responsibilities were switched between the two promotor(a) groups (See Fig. 1). The date of distribution for the stool-based screening kits was recorded, along with information on the type of kit provided (1-day or 3-day). Our primary exposure was 1-day FIT vs. 3-day FIT.

Data Collection

Data collection included participant demographics such as age, gender, marital status, education, ethnicity, birth country, language, years in the US, and employment status. We also collected data on participants' screening history, including previous tests and results and specific study-related information such as perceived health and awareness of CRC and CRC screening.

Outcomes: The primary outcome was screening completion, measured by the FIT return rate. The secondary outcome was the number of participant reminders needed before the FIT return.

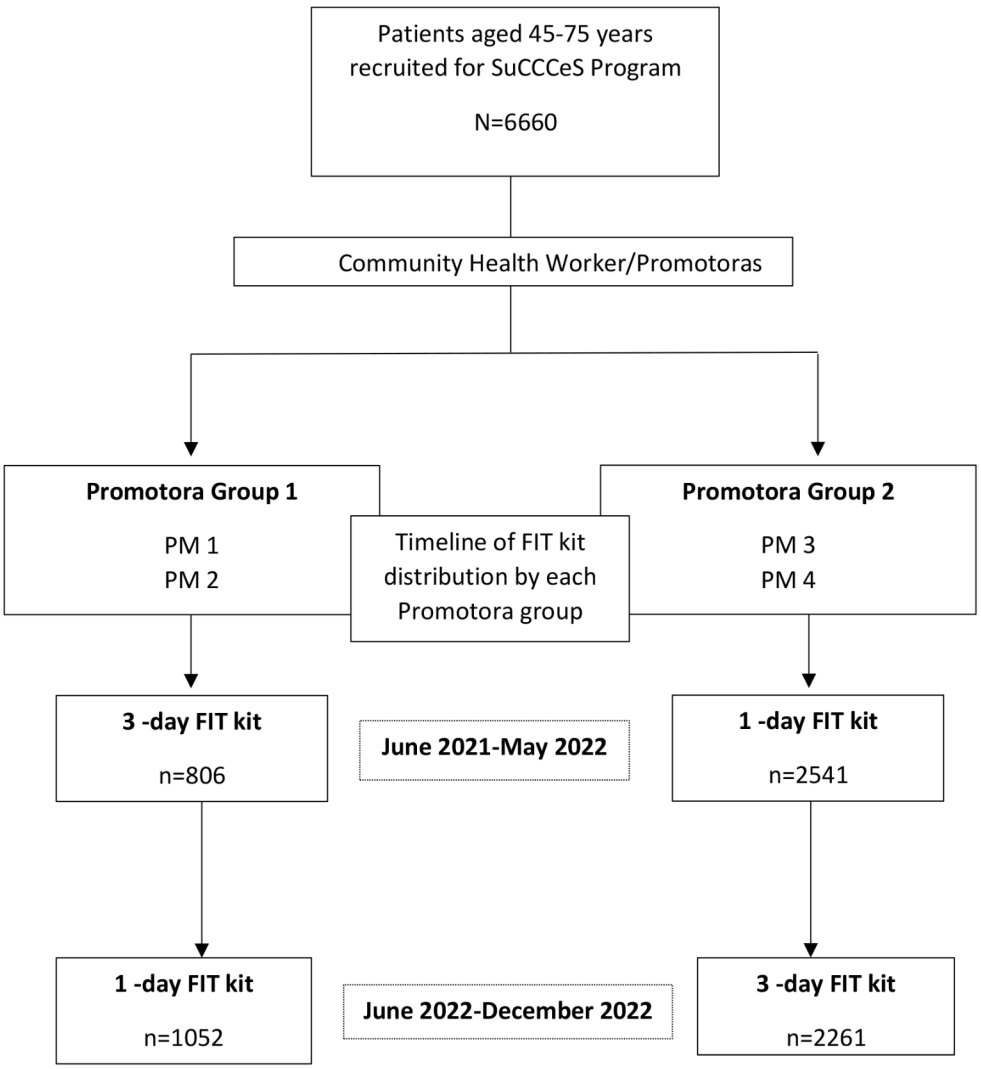

Fig. 1 Flowchart of FIT distribution by promotoras

Statistical Analysis

We described all the study variables by groups (1-day vs. 3-day FIT testing kits) using summary statistics such as mean with standard deviation (SD) for continuous data and frequency and percentages for categorized data. The baseline data and distribution of outcome data were compared between groups using either an unpaired t-test or a chi-square test. A multivariable logistic regression model was used to determine the adjusted effect of the FIT testing group on each binary outcome separately. The model adjusted all the baseline covariates per the research objective [22]. The effect size was also summarized with a relative risk (RR) regression analysis using robust Poisson regression analysis [23]. The results were validated by additionally adjusting for the cross-over effect of promotoras using multiple logistic regression analyses. We further validated results by performing propensity scores-matched and adjusted analyses. In the propensity scores analyses, we first determined propensity scores for 1-day vs. 3-day FIT testing kits using a logistic regression model. After that, we matched the propensity scores between 1-day vs. 3-day FIT testing kits and determined the effect of this grouping on each outcome using a logistic regression analysis. The results were validated by additionally adjusting for propensity scores in the logistic regression analyses or propensity scores with adjustment for additional covariates. The results of logistic regression analyses were summarized with odds ratio (OR), 95% confidence interval (CI), and p-value. All the statistical analyses were carried out using STATA 17, and a p-value less than 5% was considered a statistically significant result.

Results

This study included all the participants who received a FIT kit in the SuCCCeS program regardless of type. 6660 participants were analyzed, including 3067 in the 3-day and 3593 in the 1-day group. The average age of the participants was 57 (SD: 6.3) years, with the majority Hispanics (99.3%), birth country Mexico (86%), Spanish speaker (93%), and married (59.4%). In both groups (those receiving the 3-day FIT[3DF] and 1-day FIT [1DF]), there was no statistically significant difference in age, race, marital status, education, birth status, years spent in the US, employment status, or health status (Table 1). Most of the participants in both groups identified as White with Hispanic ethnicity. However, at baseline, the group receiving the 1DF was less likely to have a primary care provider (PCP) (26.2% vs. 29.1%, $p=0.008$), have heard of CRC screening (69.5% vs. 73.1%, $p=0.001$), have had a previous recommendation for CRC screening (53.8% vs. 58.6%, $p<0.001$), and less likely to have had a prior FIT test done (56.1% vs. 60.5%, $p<0.001$) (Table 1).

Overall, the unadjusted FIT kit return rate was higher for the 1DF than the 3DF FIT return rate (61.3% vs. 58.7%, $p=0.035$). The group receiving the 1DF required fewer reminders than those receiving the 3DF (69.7% vs. 78.1%, $p<0.001$). Additionally, it was found that the 1DF required fewer reminders, especially no reminders (30.3% vs. 21.9%) and less than or equal to 1 reminder (21.1% vs. 27.0%), and the 1DF was less likely to have abnormal results (5.3% vs. 8.1%, $p<0.001$) (Table 2).

Following adjustment for all baseline characteristics, 1DF was associated with a higher FIT return rate (OR = 1.22; 95%CI: 1.10–1.35, $p<0.001$), lower reminder (OR = 0.62; 95%CI: 0.55–0.69, $p<0.001$), and fewer abnormal results (OR = 0.61, 95%CI: 0.47–0.79, $p<0.001$) (Table 3). The relative effect size was also found to be significantly associated with 1DF compared to 3DF for FIT return (RR = 1.08, $p<0.001$), FIT reminder (RR = 0.89, $p<0.001$), and FIT abnormal result (RR = 0.63, $p<0.001$) (Table 3). These associations remained unchanged even after additionally adjusted for the cross-over effect of promotoras (Table 4) or propensity scores-matched, propensity scores–matched with additionally adjusted covariates, or weighted analyses (Table 4).

Discussion

We found a significant increase in screening completion, as measured by FIT return rates, in the 1-day FIT kit compared to the 3-day FIT kit. Moreover, our analysis revealed that the 1-day FIT kit was associated with fewer reminders and a lower incidence of abnormal results than the 3-day FIT kit. As an aside, it is essential to note that we will not draw definitive conclusions regarding the clinical efficacy or diagnostic accuracy of the 1-day FIT kit over the 3-day FIT kit based solely on a difference in abnormal results between the tests: Potential implications of the observed differences in abnormal result rates require careful consideration, as they could reflect variations in sensitivity, specificity, or other factors that were not directly measured in our study. Additionally, of the two FIT tests that were used, there is no existing literature directly comparing the efficacy of the 1-day test versus the 3-day test, with the closest paper discussing the transition from guaiac-fecal occult blood testing to the FIT test in a Canadian screening program [24]. Therefore, therein lies a potential avenue to corroborate these results with colonoscopic findings to fully understand the clinical relevance of the reduced rate of abnormal results in a 1-day FIT kit. Regardless, the results remained consistent regardless of baseline differences in covariates or even

Table 1 Baseline characteristics of participants between three-day versus one-day tests

Factor	Three-day	One-day	*p*-value
N	3067	3593	
Age, mean (SD)	57.10 (6.26)	56.85 (6.24)	0.11
Community health workers			0.007
PMs 1 and 2	806 (26.3%)	1052 (29.3%)	
PMs 3 and 4	2261 (73.7%)	2541 (70.7%)	
Ethnicity			0.025
Hispanic/Latino	3053 (99.5%)	3560 (99.1%)	
Non-Hispanic/Latino	14 (0.5%)	33 (0.9%)	
Race			0.084
White	3062 (99.8%)	3579 (99.6%)	
Other	5 (0.2%)	14 (0.4%)	
Marital status			0.74
Non-married	1238 (40.4%)	1464 (40.8%)	
Married	1829 (59.6%)	2127 (59.2%)	
Education			0.45
< GED	1305 (42.5%)	1496 (41.6%)	
>=GED	1762 (57.5%)	2097 (58.4%)	
Preferred language			0.008
Both	152 (5.0%)	194 (5.4%)	
English	42 (1.4%)	85 (2.4%)	
Spanish	2873 (93.7%)	3314 (92.2%)	
Birth Country			0.087
Mexico	2666 (86.9%)	3071 (85.5%)	
Others	401 (13.1%)	522 (14.5%)	
Years in US, mean (SD)	26.07 (15.61)	26.06 (15.76)	0.98
Employment status			0.24
No	1529 (49.9%)	1843 (51.3%)	
Yes	1538 (50.1%)	1750 (48.7%)	
Health status			0.49
Poor/Fair	1512 (49.3%)	1740 (48.4%)	
Good/Very Good/Excellent	1555 (50.7%)	1852 (51.6%)	
Have you had a PCP			0.008
No	2174 (70.9%)	2651 (73.8%)	
Yes	893 (29.1%)	942 (26.2%)	
Heard of CRC			0.001
No	825 (26.9%)	1097 (30.5%)	
Yes	2242 (73.1%)	2496 (69.5%)	
Recommended for CRC Screening			< 0.001
No	1269 (41.4%)	1659 (46.2%)	
Yes	1798 (58.6%)	1933 (53.8%)	

Table 1 (continued)

Factor	Three-day	One-day	*p*-value
Have you had FIT in the past			< 0.001
No	1212 (39.5%)	1579 (43.9%)	
Yes	1854 (60.5%)	2014 (56.1%)	

SD: standard deviation; GED: graduate equivalent degree; PM: promotoras; CRC: colorectal cancer; FIT: fecal immunochemical test

when accounting for cross-over effects owing to promotora changes. Thus, our findings suggest that the 1-day kit may offer a more efficient screening option in resource-limited settings with less need for navigation efforts.

It is remarkable to note that despite the initial disadvantage that the 1DF group had in that the group was less likely to have a PCP, less likely to have had a prior recommendation for a FIT screen, and less likely to have had a FIT in the past, that the 1DF group still had higher return rates than the 3DF group. The role of PCPs in bridging the gap between overall healthcare services and underserved communities is well-established in the medical literature [25]. This role holds for CRC screenings, where a study comparing the effects of having a PCP instead of simply receiving informational materials found that having a PCP increases rates of CRC screening adherence and participation threefold when compared to a control group [26]. In addition to having a PCP, a lack of awareness around CRC screening and a lack of prior FIT experiences were also correlated to the FIT participation drop-out rate [27]. Despite all of the advantages PCPs bring, it is possible that the influence of promotoras in this study also increased FIT return rates. Indeed, the role of promotoras in bridging the gap between healthcare services and underserved Hispanic communities is also documented in the medical literature [28]. Due to their advantage of being deeply embedded within the cultural fabric of the Hispanic community, it is possible that their culturally competent approach played a role in increasing overall FIT return rates. The trust and rapport that promotoras build within their communities highlight a crucial lesson from our study: in addition to access to healthcare with PCPs, it is vital to leverage community-based health workers as well as healthcare workers to reach improvement in public health outcomes, particularly in underserved or minority communities [29]. Despite the initial barriers faced by the 1DF group, such as a lower likelihood of having a PCP, being recommended for prior FIT screening, and previous FIT participation—this group still demonstrated higher return rates than the 3DF group. This finding highlights a significant opportunity emphasizing the distribution of FIT kits and integrating comprehensive physician engagement strategies to improve screening outcomes in underserved areas.

Although we did observe differences in reminders between groups, the overall reminders were much lower in 1DF compared to 3DF. This finding reflects that non-responsive participants will remain similar irrespective of the type of testing. However, the ease of the 1-day test might be associated with fewer reminders. In addition to revealing statistical significance after matching samples, our study also showed that the 1DF needed fewer reminders for test compliance than the 3DF, and the 1DF's test results in the

Table 2 Unadjusted differences in outcomes between one-day testing kits and three-day testing kits

Factor	Three-day	One-day	*p*-value
N	3067	3593	
FIT returned			0.035
No	1266 (41.3%)	1392 (38.7%)	
Yes	1801 (58.7%)	2201 (61.3%)	
FIT reminder required			< 0.001
No	673 (21.9%)	1087 (30.3%)	
Yes	2394 (78.1%)	2506 (69.7%)	
Number of FIT reminders			< 0.001
0	673 (21.9%)	1087 (30.3%)	
1	828 (27.0%)	758 (21.1%)	
2	316 (10.3%)	286 (8.0%)	
3	1250 (40.8%)	1462 (40.7%)	
FIT results			< 0.001
Normal	1630 (91.9%)	2070 (94.7%)	
Abnormal	144 (8.1%)	117 (5.3%)	

Table 3 Adjusted association between type of testing kits and outcomes

	OR*	95%CI		*p*-value
FIT return rate				
1-day vs. 3-day (reference)	1.22	1.10	1.35	< 0.001
FIT reminder required				
1-day vs. 3-day (reference)	0.62	0.55	0.69	<0.001
FIT results				
1-day vs. 3-day (reference)	0.61	0.47	0.79	< 0.001
	RR*	**95%CI**		**p-value**
FIT return rate				
1-day vs. 3-day (reference)	1.08	1.04	1.12	< 0.001
FIT reminder required				
1-day vs. 3-day (reference)	0.89	0.86	0.91	<0.001
FIT results				
1-day vs. 3-day (reference)	0.63	0.50	0.80	<0.001

OR: odds ratio; RR: relative risk; CI: confidence interval. *Models were adjusted for age, years in the US, ethnicity, marital status, education, language, birth country, employment status, health status, had PCP, heard of CRC, recommended for screening, previous FIT, and community health worker group

Table 4 Validation analysis for the adjusted association between the type of testing kits and outcomes

	OR	95%CI		*p*-value
Regression-adjusted analysis*				
FIT return rate	1.16	1.04	1.29	0.009
FIT reminder required	0.65	0.57	0.74	<0.001
FIT results	0.62	0.47	0.81	0.001
PS-matched analysis (one-day vs. three-day-reference)				
FIT return rate	1.16	1.05	1.30	0.005
FIT reminder required	0.63	0.56	0.70	< 0.001
FIT results	0.67	0.52	0.87	0.003
PS-matched with adjusted factors (one-day vs. three day-reference)*				
FIT return rate	1.13	1.02	1.27	0.025
FIT reminder required	0.67	0.59	0.76	< 0.001
FIT results	0.66	0.50	0.87	0.003
Adjusted PS-weighted analysis				
FIT return rate	1.19	1.07	1.32	0.001
FIT reminder required	0.61	0.54	0.68	< 0.001
FIT results	0.61	0.47	0.79	< 0.001

OR: odds ratio; CI: confidence interval.PS: propensity scores; *Additionally adjusted for cross-over effect of promotoras. PS model included age, years in the US, ethnicity, marital status, education, language, birth country, employment status, health status, had PCP, heard of CRC, recommended for screening, previous FIT, community health worker group, and switching time of promotoras. *Additionally, adjusted factors are community health worker group, cross-over effect of promotoras, birth country, and working status

1DF showed a lower likelihood of abnormal findings in contrast to the 3DF. This finding holds promising implications for reducing CRC screening disparities within the Hispanic population. The need for fewer reminders and the enhanced test integrity observed in the 1-day FIT kit group indicate a positive impact on screening participation and outcomes.

As our matched samples saw a higher FIT return rate combined with a lower abnormal test rate than the null hypothesis, our results strongly suggest that the 1-day FIT kit is promising to improve CRC screening rates in the Hispanic community. More recent literature shows that after receiving a positive FIT test result, patients are quick to follow up with a diagnostic colonoscopy and are more likely to adhere to future CRC screens [30, 31]. Moreover, previous studies show that the estimated cost of mailing FIT CRC screening intervention of a patient fell between $60.03 and $67.05 [32]. In general, patients without insurance are less likely to be screened for cancer and more likely to be diagnosed than patients with insurance [33]. Historically, uninsured rates in El Paso have been very high, with uninsured rates hovering around 25% in 2016 [34]. Seeing as mailed FIT tests are much more cost-effective annually than a colonoscopy while still maintaining a high "catch" rate for CRC, FIT tests remain highly accessible, highly affordable, and likely to improve health outcomes for Hispanics in areas such as El Paso [35].

Keeping with the results, the data suggest that adopting a 1-day FIT kit can significantly enhance return rates compared to its 3-day counterpart. In a broader context, utilizing mailed FIT tests is a promising pathway to augment CRC screening rates within Hispanic communities. Mailed FIT tests present a compelling advantage due to their cost-effectiveness and widespread use, making them more accessible and appealing than colonoscopies for a demographic where approximately a quarter of the El Paso population lacks insurance coverage. This financial aspect becomes a pivotal determinant in a patient's decision to seek care, and the affordability of FIT tests may bridge a critical gap in preventive healthcare. Furthermore, the appeal of the 1-day FIT kit lies in its lower likelihood of returning abnormal results.

This characteristic not only eases the patient process but also reduces the burden on healthcare providers, promoting a more convenient and efficient screening experience.

This study has several limitations. First, the participant demographic was predominantly Hispanic, which may limit the generalizability of the findings to broader populations. Although the results may have limited external validity, we are confident that the study's internal validity is intact. We also believe that a more convenient testing method, such as the 1-day FIT, could be similarly effective in broader patient populations, including non-Hispanics. Additionally, the uneven distribution of participants across the four promotoras could have introduced variability that could affect the consistency of the results. However, because the promotoras followed a uniform guide when interacting with patients, we are confident in the consistency and reliability of our results. A significant strength of our study is its applicability to the border population. With a nearly 100% Hispanic origin of our sample, our study provides a substantial insight into the likelihood of adopting a 1-day FIT over a 3-day FIT in similar populations. Such specificity enhances our understanding of screening behaviors and outcomes within this underrepresented group, offering valuable perspectives for targeted health interventions.

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Data Availability Data was collected as part of program implementation and is not available in an accessible database. However, deidentified data may be provided by the corresponding author upon reasonable request.

Declarations

Conflict of Interest The authors declare that there is no conflict of interest.

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