Predictors of FIT Completion and Follow-up Colonoscopy Among Asian Americans & Hawaiian/Pacific Islanders

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Abstracts

Background: Colorectal cancer (CRC) screening among Asian Americans and Hawaiian/Islanders (AA-H/PIs) fall short of the screening goal set by the National Colorectal Cancer Roundtable. A cluster-randomized pragmatic trial, *STOP CRC*, evaluated the effectiveness of mailing fecal immunochemical test (FIT) kits to improve CRC screening. This study, a part of *STOP CRC*, analyzed the relationship between eight potential predictors (age, race, gender, language, tobacco use, poverty level, insurance type, and previous CRC screening) and the completion of both FIT testing and follow-up colonoscopy after a positive FIT result among AA-H/PIs. **Methods:** AA-HP/I participants (n= 2180) in the *STOP CRC* program from February 4, 2014 to February 5, 2015 were included in the exploratory analysis. The team used standard hypothesis tests and logistical regression techniques to determine which of the possible predictors was associated with differences in testing and follow-up. **Results:** There were significant differences in the prevalence for FIT testing between two groups of clinics. English language (OR = 0.56; 95% CI: 0.38,0.82), income >200% of the poverty level (OR = 0.43; 95% CI: 0.21, 0.88), and Medicaid insurance (OR = 1.95, 95% CI: 1.43, 2.66) were associated with differences in FIT testing. Males were more likely than females to adhere to a follow-up colonoscopy after a positive FIT in less time. Although logistical models showed statistically significant relationships between these predictors and the prevalence of testing, there was still significant unexplained variance.

Conclusion: While FIT kits are an appropriate method for CRC screening among AA-H/PIs, both economic and linguistic factors significantly affect screening behaviors.

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Introduction

Colorectal cancer (CRC) is the second leading cause of cancer death among Asian American women and the third among Asian American men in the U.S. (Gomez et al., 2013). Although CRC screening has increased in the U.S., low screening prevalence is consistently seen among minority populations. Despite the benefits of early detection through screening, Asian Americans have some of the lowest screening prevalence. According to the Behavioral Risk Factor Surveillance System, only 63.2% of Asian Americans are up-to-date with CRC screenings and 30.2% have never been screened (CDC, 2013). It is important to note that overall prevalence can mask differences among subgroups. When Asian American subgroups are disaggregated, disparities are observed, in which Koreans showed the lowest CRC screening (32.7%) and the Japanese had the highest (59.8%) (Lee et al., 2011; Hwang, 2013). This is well below the target screening rate of 80% by 2018 set by the National Colorectal Cancer Roundtable. By reaching the target goal, it is estimated to prevent 280,000 new cancer cases and 200,000 cancer deaths within 20 years (Meester et al., 2015).

The United States Preventative Services Task Force (USPSTF) recommends individuals between 50 to 75 years old with an average risk for CRC to be screened by fecal occult blood testing (FOBT) every year, sigmoidoscopy every 5 years with FOBT every 3 years, or colonoscopy every 10 years (2008). Annual fecal immunochemical test (FIT) is a newer stool-based CRC screening test that is recommended by various clinical practice guidelines. FIT kits are unaffected by diet and medications, obtained in

the privacy of patients' homes, and is user-friendly. All of which may improve patient participation in screening. It is important to note that those who select stool-based CRC screening must also be prepared to undergo a follow-up colonoscopy after a positive result. Therefore, it should be considered that CRC screening is not completed until the follow-up colonoscopy is completed after a positive FIT result. FIT screening programs will not reduce mortality if patients with positive results do not undergo a follow-up colonoscopy (Liss et al., 2016).

Recent studies have shown higher screening uptake among those who were sent a FIT kit compared to a colonoscopy or routine care (Gupta et al., 2013). To improve CRC screening, there have been efforts to incorporate FIT testing into population-level interventions. A cluster-randomized pragmatic trial, *STOP CRC*, evaluated the effectiveness of mailing FIT kits in improving CRC screening follow through (Coronado et al., 2014b). However, limited is known about the factors that influence CRC screening through FIT testing and a follow-up colonoscopy, particularly among Asian Americans.

Extant data has emphasized limited English proficiency, low health literacy, lack of access to a regular provider, lack of provider's recommendations, low socioeconomic status, health insurance status, and cultural beliefs as factors that deter cancer screening behaviors (Lee et al., 2014; Sentell et al., 2015; Le et al., 2011; Strong et al., 2014; Thompson et al., 2014). A more recent study has found lack of symptoms, having comorbidities, challenges with health literacy, and concerns with colonoscopy contributed to poor CRC screening prevalence (Kimura et al., 2014). Physician recommendation also plays a crucial role in receiving screening, yet Asian Americans were less likely to report a lack of physician recommendation for CRC screening (May,

Almario, Ponce, & Spiegel, 2015). Nevertheless, there are still limited studies evaluating factors that influence follow-up colonoscopy adherence after positive FIT among Asian Americans.

The primary objective of this project was to identify potential predictors of completing FIT testing and follow-up colonoscopies after a positive FIT result among Asian Americans. A secondary outcome focused on evaluating the timeliness of referrals and follow-up colonoscopy. The specific aims include the following:

1. Determine the proportion of Asian Americans who have completed a FIT
2. Test for differences that may decrease or increase the odds of completing a FIT kit and follow-up colonoscopy
3. Perform a retrospective chart review of those with positive FIT to determine timeliness of referrals and follow-up colonoscopies

Theoretical Framework

Two health belief models are commonly utilized among studies to provide a theoretical framework for understanding health behaviors and implementing interventions among AA-H/PIs: Health Belief Model and Ecological Model. The Health Belief Model is based on the construct that motivation is influenced by the perceived susceptibility, severity, benefits, and barriers of health-related events that would adversely affect one's health (Raingruber, 2014). The use of the Health Belief Model helps identify and organize health perceptions unique to Asian immigrants that should be considered when implementing interventions.

However, one criticism of the Health Belief Model is that it primarily focuses on individual factors (Raingruber, 2014). Barriers to screening often extend to those

beyond the control of the individuals. The Health Belief Model may provide distinct perspectives on cultural beliefs, but it may not be the best theory to guide interventions to address social and structural barriers to care. An ecological approach may be a better approach to describe the determinants of health on a broader context, applying multifaceted considerations.

According to the Ecological Model, interventions addressing factors at multiple levels would be highly effective in changing behavior; single-level interventions are unlikely to have sustainable effect (Nguyen et al., 2012). The association between all of the determinants of health is important to consider as interventions are developed. Interventions at the individual, provider, organizational, and community level may be effective ways to encourage screening participation. This would imply implementing multiple interventions to address different barriers to screening.

Study Design

A retrospective chart review and exploratory analysis was performed on participants who have received FIT kits for colorectal cancer screening as part of *STOP CRC*. Twenty-six federally qualified health clinics (FQHC) and eight health organizations are enrolled in *STOP CRC*, and they are divided into an intervention group and usual care group. Within the intervention group, FIT kits were mailed to eligible participants, who were identified through an electronic health record (EHR). A number of participants have completed the kits and mailed them in a pre-paid envelope to a laboratory for analysis. Data was collected from OCHIN, a non-profit health information technology organization that provides EHR systems to affiliated FQHCs. Kaiser Permanente has

data available for review to authorized investigators to access through OCHIN as part of their externship program.

Inclusion and Exclusion Criteria

Inclusion criteria for this retrospective chart review include the following:

1. Participants in *STOP CRC* from February 4, 2014 to February 5, 2015
2. Self-identified race recorded as Asian Americans and/or Hawaiian/Pacific Islanders in the EHR

Exclusion criteria will include the following:

1. Those who were not eligible to participate in the *STOP CRC* Program from February 4, 2014 to February 5, 2015
2. Self-identified race not recorded as Asian Americans or Hawaiian/Pacific Islanders in the EHR

Data Collection

A senior data analyst completed the chart abstractions for participants who were eligible for *STOP CRC*. Health records of those with positive FIT were reviewed through OCHIN on the EHR. Variables in the analysis included demographics, past history, FIT test completion status, FIT results, colonoscopy referral status, follow-up colonoscopy completion status, and reasons for non-adherence of colonoscopy when applicable. Demographics included education level, age, gender, language, poverty level, insurance type, and socioeconomic status. Age was collapsed into ordinal categories. Preferred languages were used to help identify possible subgroups among Asian Americans. Past history included tobacco use and prior colorectal cancer screening.

The primary outcomes reviewed included completion of FIT and follow-up colonoscopy overall. Completion of colonoscopy within 60 days after positive FIT and timeliness of the referral and follow-up colonoscopy were considered as the secondary outcomes. The number individuals with a positive FIT incurred a smaller sample size, and their health records where reviewed to look for receipts of a completed follow-up colonoscopy. Of those who did not complete a follow-up colonoscopy, any documented reasons for non-adherence were collected.

Data Handling

Only pertinent data for the study was extracted. Individual electronic health records were only accessed at OCHIN, and that dataset was transferred according to their organizational policy. Datasets with patient identifiers were accessed at Kaiser Permanente. Information was collected and stored into a password-protected network drive for data sorting and analysis. The datasets were only accessed by the student investigator and STOP CRC investigators. Printed tables without patient identifiers required approval from the primary investigator before it was shared with the student's chair.

Results of the data analysis will be disseminated to the participating clinics so that strategies may be developed for improving clinical processes to increase adherence to screening and follow-up care related to CRC prevention. The results will also be shared with investigators of *STOP CRC* to help inform future studies. A manuscript about this study will also be written for publication.

Risks and Benefits

A confidentiality breach is a risk associated with any chart review research. It is recognized that a breach of confidentiality may result in psychological or social harm to individuals. Physical harm, extra financial costs, and time burden are not anticipated as risks to the subjects.

The individuals whose charts were reviewed are not likely to receive any benefit directly from the proposed study; however, society and investigators will benefit from the knowledge gained. It can also help investigators plan for future studies. Participating health care organizations will also benefit from the information to help guide their clinical processes and future quality improvement projects targeted to improve CRC screening and referrals.

Data Analysis

STATA version 13 for Windows was used to perform the statistical analysis. GPower and Excel was also used to assist with data sorting and statistical analysis. Descriptive statistics and hypothesis testing for difference between proportions were performed. Chi-square and Fisher's exact tests were used for each predictor variable to test for non-random association. Differences were assessed using Kruskal-Wallis, Wilcoxon rank-sum, Mood's median tests.

Logistic regression models were performed to assess the association between multiple predictor variables and completion to FIT testing as well follow-up colonoscopy. Unadjusted and adjusted analysis were reviewed to look at potential confounders. All associations with a p-value < 0.05 were considered statistically significant.

Power Analysis

Prior to receiving approval from Kaiser IRB, a power analysis was performed with an estimated and tentative sample size. Estimating that Asian Americans will have a response rate of 13.1%, a sample size between 470 to 24232 is needed to maintain an 80% power with 5% significance level. Given the total sample size of n = 1424 and assuming that the proportion of completed FIT will be close to the population proportion of 12.5%, a 95% confidence interval would expect a margin of error of 0.017 (1.7%).

The effect size on the timeliness of referral and follow-up colonoscopies were determined using the t-test. Large effect sizes are expected with a small sample size of n = 93. For determining the timeliness of referral, a minimum of 40% difference between the means of English speaking and non-English speaking participants can be detected with a power of 80% and $\alpha = 0.05$. With time to colonoscopy, at least a 48% difference between the means can be detected with a power of 80% and $\alpha = 0.05$. Looking at the difference on the timeliness of referral between gender, at least a 28% difference between the means can be detected with a power of 80% and $\alpha = 0.05$. At least a 49% difference between the means of the female and male group can be detected with a power of 80% and $\alpha = 0.05$ for timeliness of follow-up colonoscopy.

Informed Consent

A waiver of consent was requested for the retrospective chart review, as it will be impractical to locate and contact all of the participants for consent. The study involved large number of participants who are seen at multiple locations; therefore, consent was not practical. The waiver should not adversely affect the rights and welfare of the participants. Results will not be given to the participants, as they will not be in contact with the investigators.

IRB Approval

OHSU had originally ceded IRB review to Kaiser Permanente for *STOP CRC*. IRB approval of modification have been received from Kaiser Permanente IRB board, Pro00004364.

Results

A total of 2180 participants between age 50 to 75 years were eligible for *STOP CRC* from February 4, 2014 to February 5, 2015 (Table 1). A significant proportion of the individuals were less than 65 years old (72.5%), male (59.6%), and non-tobacco users (68.8%). Many were self-identified as Asian Americans (92.7%) and non-English speakers (73.4%). A majority of Asian Americans are non-English speakers (77.2%), whereas most of Hawaiian/Pacific Islanders speak English (74.2%) (Table 2). At least half were below the federal poverty line (55.5%) and almost a third were uninsured (29.0%), while the remaining received insurance benefits through Medicaid (44.3%), Medicare (19.7%), or other forms of insurance (6.8%).

Completion of FIT Kits

Among Asian Americans, only 28.8% completed the FIT, whereas 13.8% of Hawaiian/Pacific Islanders completed it (Table 3). There was a statistically significant difference ($z=10.13$, $p=0.0001$) in the proportions of completed FIT among AA-H/PIs. Among non-English speakers, 31.7% completed the FIT for CRC screening, higher than the proportion of English speakers, which was statistically significant ($z=6.89$, $p=0.0000$). There was no statistically significant difference in the proportion of the completed FIT among those who were uninsured and those who received Medicaid benefits ($z=1.80$, $p=0.07$).

Because organizational structure and care process varied among the clinics, the clinics were stratified into two groups based on their performance of completed FIT. Stratifying the clinics into two groups allowed primarily patient level characteristics to be considered in the logistic regression models. In Group A, the clinics had a proportion of 27.4% to 34.5% of the patients complete the FIT. Group B varied from 10.6% to 12.6% (Table 4).

In Group A, language, poverty level, and insurance were significantly associated with the completion of FIT testing in both the unadjusted and adjusted models (Table 5). English speakers were less likely to complete the FIT than non-English speakers (adjusted OR=0.56; 95% CI: 0.38, 0.82). Those above 200% of the poverty level also have lower odds (adjusted OR=0.43; 95% CI:0.21, 0.88) compared to those below the poverty level. Patients with Medicaid benefits have a 0.95 greater odds (adjusted OR=1.95; 95% CI: 1.43, 2.66) than those who were uninsured. Hawaiian/Pacific Islanders were significantly associated with having lower odds of completing FIT testing in the unadjusted model (unadjusted OR=0.38; 95% CI: 0.21, 0.69), but it was not statistically significant in the adjusted model (adjusted OR=0.59; 95% CI: 0.27, 1.27).

In Group B, only poverty level was significantly associated with completing a FIT in both unadjusted and adjusted models (Table 5). Patients 100 to 150% above the poverty level had higher odds (adjusted OR=2.73; 95% CI: 1.25, 5.98) compared to those below the federal poverty level. Race, language, tobacco use, and insurance were not significant predictors.

Follow-up Colonoscopy After a Positive FIT

The sample size decreased when looking at patients with positive FIT test (n=89), as it is expected that not everyone will have a positive test. Among non-English speakers, the majority of the preferred languages were Chinese (30.3%) Vietnamese (24.7%), and Other (24.7%). Trends of patient characteristics are described in Table 6.

Among the participants with a positive FIT (n=89), 46 received a follow-up colonoscopy (52%). More males (61.5%) had a colonoscopy than females (44.0%), but there was no statistically significant difference between gender (z=-1.64, p=0.10). The difference between screening status was not statistically significant either (z=1.01, p=0.31).

The mean time to colonoscopy was 167.2 days (SD ± 136.8), refer to Table 7. However, time to referral and colonoscopy were not normally distributed, and they had a skewed-right distribution. Wilcoxon rank-sum (Mann-Whitney) test was performed to determine if there is a difference between gender with time to referral, (Table 8), and it was found that there was not statistically significant difference (z=0.33, p=0.74). Mood's median test reveals that the difference of the medians for time to referral between gender is not statistically significant ($\chi^{2=}$0.18, p=0.892). The same tests were used to determine if there was a difference between gender with time to colonoscopy. It can be concluded that time to colonoscopy was significantly longer for females than males (z=2.55, p=0.01). There was also a notable difference in the medians for time to colonoscopy between gender ($\chi^{2=}$0.71, p=0.008).

A Kruskal-Wallis H test was conducted to determine if time to referral and time to colonoscopy were different with English, Chinese, Vietnamese, or Other (Table 9). The

test showed that there was no statistically significant difference in time to colonoscopy between the four groups, (χ^2=0.3.66, p=0.30).

In the unadjusted and adjusted models, age, language, tobacco use, poverty level, and prior screening were not significantly associated with adherence to colonoscopy or overall (Table 10). The odds of completing a colonoscopy was greater for males compared to female in the adjusted model (adjusted OR=3.87; 95% CI: 1.12, 13.43). The association between participant characteristics and adherence to follow-up colonoscopy within 60 days was investigated because it is important for patients to have timely follow-up care after a positive FIT. There were no predictors of completing a colonoscopy within 60 days (Table 11).

Documented Reasons for Non-adherence to follow-up colonoscopy

Many reasons have been documented as to why those with a positive FIT did not have a follow-up colonoscopy (Table 12). Among those who have received referrals, 5 (19%) had a recent colonoscopy within the last 10 years. 9 (33%) did not respond to reminders about the referrals and to schedule an appointment. Only 2 (4%) declined to have a colonoscopy. Among one of the reasons for not having a colonoscopy was 22% of those with a referral were on the waiting list. Approximately 7 (26%) did not have a documented reason for non-adherence to follow-up colonoscopy.

Discussion

The primary purpose of this study was to find predictors of FIT completion and adherence to follow-up colonoscopy after a positive FIT. The overall screening prevalence is lower compared to other studies among Asian Americans that ranges from 51% to 76% (Inadomi et al., 2012; Thompson et al., 2014; Fedewa et al., 2016;

CDC, 2013). The proportion of Hawaiian/Pacific Islanders are comparable to another study (Kaalekahi, Gandhi, Chen, & Kuwada, 2016). Language, poverty level, and insurance status were associated with completing FIT testing in Group A. Group A also had a higher proportion of Asian Americans (94.8%) and non-English speakers (84.6%) than Group B. The reason for lower odds of FIT completion among English speakers in Group A is not entirely clear. Potential reasons for English speakers having lower odds may be related to the screening processes and services offered by the clinics. With a large portion of patients who are minorities, they may have more familiarity in working with non-English speakers and have a higher cultural awareness. One of the health care organizations in Group A frequently utilizes interpretation/translation services and bilingual community health workers to provide navigational assistance for patients. Prior research suggests that non-English speakers may benefit from culturally-sensitive interventions or navigational assistance (Carney et al., 2014; Walsh et al., 2010; Nguyen-Truong, Lee-Lin, & Gedaly-Duff, 2013; Nguyen et al., 2015; Braun et al., 2015).

It is possible that patients who were 200% above the poverty level were less likely to have a FIT because they were more likely to have a colonoscopy rather than a FIT. One study found that patients tended to prefer colonoscopy as household incomes increased (Xu et al., 2015; Powell et al., 2009). This could be related to a significant decrease in the percentage of who were uninsured as household income increased (Cohen & Martinez, 2014). Private insurance coverages also tend to be higher among those who were above the federal poverty level (Cohen & Martinez, 2014).

The odds of completing FIT testing were higher among those with Medicaid benefits. Those receiving Medicaid benefits are expected to have less financial barriers

for completing recommended CRC screening services as most Medicaid program cover screening in full (Choi et al., 2015). The clinics included in the study are located in states that have elected for Medicaid expansion. Those who have not been screened before and newly insured with Medicaid benefits now have better opportunities to access CRC screening services (Choi et al., 2015). It is unknown how the proportions of CRC screening in this study were influenced by the expansion of Medicaid through the Affordable Care Act.

More recently, some states, including Oregon, have passed state legislations to provide full coverage of follow-up colonoscopy after a positive FIT, as colorectal screening with FIT testing is a process. However, some providers will not accept patients with Medicaid benefits because colonoscopy reimbursements rates are lower than other forms of insurance (Green & Coronado, 2014). There is also a waitlist for a having a colonoscopy with clinics who do accept Medicaid. Being waitlisted contributes an increased follow-up colonoscopy time among Medicaid patients. Some are still waiting over a year for their colonoscopy (Table 12).

For follow-up colonoscopy overall, males have higher odds than females in adhering to a follow-up colonoscopy after a positive FIT. The results also showed females wait longer for follow-up colonoscopy than males. Other studies have also reported gender differences in CRC screening (Oluloro, 2015; Yager, Chen, & Cheung, 2014; Wardle, Miles, & Atkin, 2005; McQueen et al., 2006). The differences may stem from sociocultural norms and attitudinal beliefs. They may express different perceived susceptibility, fears and education preferences regarding procedures (Brenner et al., 2015; Lee & Im, 2013; Friedmann-Sanchez, Griffin, & Partin, 2007; Ritvo et al., 2013;

Walsh et al., 2013; Wong et al., 2013). Studies in breast and cervical cancers screening among Asian Americans have found family obligation over individual physical health needs delay Asian women from seeking health care (Gomez et al., 2010). The inability to maintain modesty and keep the body private during screening procedures also acts as barriers to screening for women (Tang, Solomon, & McCracken, 2001; Bhise et al., 2016).

Except for gender, there were no other associations with colonoscopy overall and within 60 days. The sample size may not be adequate to detect statistically significant differences with time to colonoscopy between languages. Although no study has been found that assesses time to follow-up colonoscopy after a positive fit.

Implications

When compared to the 80% screening goal established by the National Colorectal Cancer Roundtable and Health People 2020, CRC screening prevalence remains low among AA-H/PIs. However, the findings suggest that FIT kits may be an appropriate method for CRC screening for non-English speakers among AA-H/PIs. Medicaid patients may be more willing to engage in screening when there are no out-of-pocket expenses involved with FIT testing. Prior studies support the use of FIT as an efficient CRC screening strategy in economically and medically underserved population (Cai, S et al., 2011). The screening goals of achieving 80% by 2018 cannot be achieved by colonoscopy alone, and it will require utilizing of various strategies, including the utilization of FIT kits.

The findings also suggest a need for interventions that will minimize barriers to a follow-up colonoscopy after a positive FIT, particularly for vulnerable and underserved

populations. The difference in time to colonoscopy between gender suggests a need for a gender specific approach. Programs that primarily rely on FIT testing need to ensure that there is an effective referral process in place for patients with a positive FIT for appropriate follow-up evaluations. Future interventions to improve follow-up evaluation should focus also on clinic factors rather than primarily on patient factors. These may include implementing standing orders that will promote consistent recommendations for CRC screening among the clinics within the same health care organization. Implementing patient navigators can assist all patients through the screening process and reduce barriers associated with follow-up colonoscopy.

Although patients with Medicaid are more likely to have FIT completion, they still experience from long wait time for colonoscopy. As mentioned above, only a limited number of gastroenterology practices accept Medicaid patients, and this presents as an access barrier. Long wait times may have an impact on patient adherence and contribute to potential delayed diagnosis (Patel, Nahar, Murray, Salner, 2013). With more than half of the states adopting Medicaid expansion, the Medicaid population is expected to increase, and the demands for services will also increase. This will require policy changes to provide better reimbursements for colonoscopy and ensure that patients receive timely screening services.

Refinement to the EHR is also recommended to help clinics better identify patients requiring screening and track patients through the referral process. It is important to note that there were a few patients who were up-to-date with CRC screening with a colonoscopy within the last 10 years, yet they were flagged as eligible for the *STOP CRC*. This is also seen in a similar study through *STOP CRC* (Oluloro,

2015). It is a concern that prior colonoscopy is captured inconsistently in the EHR (Coronado et al., 2014a). There was variability in the ways primary care documented colonoscopies and different fields where information on CRC screening could be documented (Coronado et al, 2014a). There was also challenges in tracking patients through the referral process. After a referral was cancelled when patients were unable to notify or schedule, it is unknown whether the providers were notified. One could argue that this is more related to clinical flow processes, but the EHR can be used to communicate with providers about the patients. Refinement of alert systems within the EHR when screening or referrals are not completed may help ensure that patients are appropriately screened for CRC.

Limitations

There were several limitations to consider when interpreting the results of this study. The results may not be generalized to other populations and settings as the study includes over 26 FQHCs that consist mostly of underserved populations. The sample size was also small among those with positive FIT results; subtle differences or associations may not have been detected because of the small sample size. The study does not incorporate all possible explanatory variables of completing a FIT or adhering to a follow-up colonoscopy. There may be clinic level factors not included within the study that influence the status of FIT and colonoscopy completion. Because there are different styles of documentation among primary care providers, it is not surprising that there was also missing data. Asian Americans were not disaggregated due to the fact detailed information of the subgroups were unavailable. A listwise deletion of missing data was used in the statistical analysis, which may reduce the statistical power and

create unintended bias related to the exclusion of participants from analysis. However, the sample size for evaluating the predictors of FIT completion remained sufficient to maintain an 80% power and 5% significant level. Utilizing the EHR to verify the receipt of completed FIT and follow-up colonoscopy helped validated the data; although, it is important to consider that there may be potential errors in documentation and abstraction.

Conclusion

Although this study has found patient level factors associated with FIT completion and adherence to follow-up colonoscopy, it does not capture all of the possible association of CRC screening, such as clinic and provider level factors. Future research should also examine screening differences among subgroups of Asian Americans rather than aggregating them under one group, which may mask the true health disparities that each subgroup faces. Because most Asian Americans are immigrants, it would also be beneficial to consider immigration status, length of stay in the U.S., age of immigration, and acculturation level. However, this data may be challenging to obtained if the EHR is the primary source of data collection, because it will most likely not be recorded within the EHR. Further investigation of clinic processes among the clinics will help identify characteristics that have an impact on screening behaviors and provide directions for future quality improvement projects. Qualitative research to explore CRC screening barriers, attitude, and preferences may help determine culturally sensitive ways to minimize barriers for CRC screening.

Table 1. Cohort demographics of Asian Americans & Hawaiian/Pacific Islanders aged 50-75 years

Patient Characteristics	n	%
Age		
<65 years	1581	72.5
>65 years	599	27.5
Gender		
Male	1299	59.6
Female	881	40.4
Race		
Asian Americans	2021	92.7
Hawaiian/Pacific Islanders	159	7.3
Language		
English	566	26.0
Non-English	1600	73.4
Unknown	14	0.6
Tobacco Use		
No	1351	68.8
Yes	613	31.2
Unknown	216	9.9
Federal Poverty Level		
<100%	1209	55.5
100-150%	273	12.5
151-200%	92	4.2
>200%	144	6.6
Unknown	462	21.2
Insurance Status		
Uninsured	633	29.0
Medicaid	965	44.3
Medicare	422	19.4
Commercial/Other	147	6.8
Unknown	13	0.6
Clinic Group		
Group A	1586	72.8
Group B	594	27.2

Table 2. Cohort demographics of Asian Americans & Hawaiian/Pacific Islanders aged 50-75 years by Language

Patient Characteristics	Non-English, n (%)	English, n (%)
Gender		
Male	626 (71.1%)	251 (28.5%)
Female	974 (75.0%)	315 (24.3%
Race		
Asian Americans	1561 (77.2%)	448 (22.2%)
Hawaiian/Pacific Islanders	39 (24.5%)	118 (74.2%)
Federal Poverty Level		
<100%	941 (77.8%)	263 (21.8%)
100-150%	182 (66.7%)	90 (33.0%)
151-200%	62 (67.4%)	29 (31.5%)
>200%	71 (49.3%)	73 (50.7%)
Insurance Status		
Uninsured	507 (80.1%)	123 (19.4%)
Medicaid	726 (75.2%)	230 (23.8%)
Medicare	300 (71.1%)	121 (28.7%)
Commercial/Other	57 (39.0%)	89 (61.0%)
Clinic Group		
Group A	1337 (84.6%)	244 (15.4%)
Group B	263 (45.0%)	322 (55.0%)

Table 3. Proportions of completed FIT

Characteristics	Completed FIT, n (%)	Z
Race	581 (28.8%)	4.05***
Asian Americans	22 (13.8%)	
Hawaiian/Pacific Islanders		
Language	507 (31.7%)	6.89***
Non-English	94 (16.6%)	
English		
Clinic Group	533 (33.6%)	10.14***
Group A	70 (11.8%)	
Group B		

*p-value<0.05; **p-value<0.01; ***p-value<0.001

Table 4. Demographics between Group A and Group B

Patient Characteristics	Group A, n (%)	Group B, n (%)	p-value
Age			
<65 years	1139 (71.8)	442 (74.4)	0.30
>65 years	447 (28.2)	152 (25.6)	0.54
Gender			
Male	650 (41.0)	231 (38.9)	0.58
Female	936 (59.0)	363 (61.1)	0.49
Race			
Asian Americans	1503 (94.8)	518 (87.2)	0.00
Hawaiian/Pacific Islanders	83 (5.23)	76 (12.8)	0.00
Language			
English	244 (15.4)	322 (55.0)	0.00
Non-English	1337 (84.6)	263 (45.0)	0.00
Tobacco Use			
No	1004 (69.5)	347 (66.7)	0.60
Yes	440 (30.5)	173 (33.3)	0.72
Federal Poverty Level			
<100%	914 (73.4)	295 (62.4)	0.00
100-150%	194 (15.6)	79 (16.7)	0.82
151-200%	64 (5.1)	28 (5.9)	0.48
>200%	73 (5.9)	71 (15.0)	0.00
Insurance Status			
Uninsured	514 (32.5)	119 (20.3)	0.01
Medicaid	747 (47.3)	218 (37.1)	0.01
Medicare	283 (17.9)	139 (23.7)	0.16
Commercial/Other	36 (2.3)	111 (18.9)	0.59

Table 5. Predictors of completing a FIT between Group A and Group B

	Group A		Group B	
Patient Characteristics	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)**	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)**
Race				
Asian Americans	1.00	1.00	1.00	1.00
Hawaiian/Pacific Islanders	0.38 (0.21, 0.69)***	0.59 (0.27, 1.27)	0.87 (0.40, 1.89)	0.79 (0.28, 2.27)
Language				
English	1.00	1.00	1.00	1.00
Non-English	0.61 (0.45, 0.83)**	0.56 (0.38, 0.82)**	0.74 (0.45, 1.23)	0.52 (0.26, 1.03)
Tobacco Use				
No	1.00	1.00	1.00	1.00
Yes	0.96 (0.7, 1.18)	0.98 (0.75, 1.28)	0.82 (0.46, 1.47)	1.01 (0.52, 1.98)
Federal Poverty Level				
<100%	1.00	1.00	1.00	1.00
100-150%	0.99 (0.72, 1.37)	1.09 (0.77, 1.56)	2.20 (1.06, 4.31)*	2.73 (1.25, 5.98)*
151-200%	1.23 (0.73, 2.06)	1.67 (0.95, 2.92)	1.19 (0.34, 4.20)	0.37 (0.05, 3.05)
>200%	0.35 (0.19, 0.67)***	0.43 (0.21, 0.88)*	1.82 (0.86, 3.87)	1.71 (0.59, 4.93)
Insurance Status				
Uninsured	1.00	1.00	1.00	1.00
Medicaid	1.64 (1.29, 2.10)***	1.95 (1.43, 2.66)***	1.16 (0.56, 2.39)	0.88 (0.36, 2.16)
Medicare	1.18 (0.86, 1.62)	1.37 (0.93, 2.01)	1.24 0.57, 1.72)	0.80 (0.30, 2.11)
Commercial/Other	1.87 (0.94, 3.73)	1.87 (0.80, 4.34)	1.39 (0.62, 3.12)	1.81 (0.61, 5.38)

*p-value<0.05; **p-value<0.01; ***p-value<0.001

Table 6. Demographics of cohort with a positive FIT result

Patient Characteristics	n	%
Age		
<65 years	55	61.8
>65 years	34	38.2
Gender		
Female	50	56.2
Male	39	43.8
Preferred Language		
English	18	20.2
Chinese	27	30.3
Vietnamese	22	24.7
Other	22	24.7
Federal Poverty Level		
<100%	52	58.4
>100%	23	25.8
Unknown	14	15.7
Insurance		
No Medicaid	50	56.2
Medicaid	39	43.8
Prior Screening		
No	38	42.7
Yes	51	57.3

Table 7. Timeliness of referrals and follow-up colonoscopy

Characteristics	Mean (SD)	Median
Timeliness of referral (days)	23.6 (98.8)	1
Timeliness of colonoscopy (days)	167.2 (136.8)	114.5

Table 8. Timeliness of referrals and follow-up colonoscopy by gender

Characteristics	Male	Female	p-value
Timeliness of referral (days)			
Mean (SD)	23.3 (82.8)	23.8 (111.2)	0.741[a]
Median	1	3	0.892[b]
Completed colonoscopy			
No	15 (38.5%)	28 (54.0%)	0.100
Yes	24 (61.5%)	22 (44.0%)	
Timeliness of colonoscopy (days)			
Mean (SD)	108.1 (75.9)	231.6 (159.5)	0.010[a]
Median	86	223.5	0.008[b]

[a] Wilcoxon rank-sum; [b] Mood's median test

Table 9. Timeliness of referrals and follow-up colonoscopy by preferred language

Characteristics	English	Chinese	Vietnamese	Other	χ2
Timeliness of referral (days)					
Mean (SD)	49.7 (118.9)	34.3 (144.1)	5.5 (6.9)	2.3 (3.5)	1.00
Median	3	1.5	3	1	
Timeliness of colonoscopy (days)					
Mean (SD)	170.1 (156.1)	203.6 (140.3)	171.5 (149.3)	104.9 (84.7)	3.66
Median	132	159	91	84.5	

*p-value<0.05; **p-value<0.01; ***p-value<0.001

Table 10. Predictors of adherence to follow-up colonoscopy overall

Patient Characteristics	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age		
<65 years	1.00	1.00
>65 years	0.50 (0.81, 2.38)	0.38 (0.09, 1.58)
Gender		
Female	1.00	1.00
Male	2.04 (0.87, 4.78)	3.87 (1.12, 13.23)*
Preferred Language		
English	1.00	1.00
Chinese	1.00 (0.30, 3.32)	1.18 (0.27, 5.10)
Vietnamese	0.80 (0.23, 2.79)	1.28 (0.28, 5.90)
Other	0.67 (0.19, 2.33)	0.70 (0.15, 3.24)
Tobacco Use		
No	1.00	1.00
Yes	1.08 (0.46, 2.55)	0.59 (0.70, 2.11)
Federal Poverty Level		
<100%	1.00	1.00
>100%	1.44 (0.53, 3.91)	1.02 (0.31, 3.42)
Insurance		
No Medicaid	1.00	1.00
Medicaid	1.48 (0.64, 3.44)	0.80 (0.21, 3.07)
Prior Screening		
No	1.00	1.00
Yes	0.65 (0.28, 1.51)	0.65 (0.22, 1.90)

*p-value<0.05; **p-value<0.01; ***p-value<0.001

Table 11. Predictors of adherence to follow-up colonoscopy within 60 days

Patient Characteristics	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age		
<65 years	1.00	1.00
>65 years	0.82 (0.18, 3.69)	0.55 (0.07, 4.07)
Gender		
Female	1.00	1.00
Male	1.13 (0.29, 4.41)	1.44 (0.21, 9.83)
Preferred Language		
English	1.00	1.00
Chinese	0.36 (0.04, 2.65)	0.34 (0.03, 4.33)
Vietnamese	0.88 (0.13, 5.82)	1.02 (0.11, 9.52)
Other	1.00 (0.15, 6.77)	0.83 (0.08, 8.58)
Tobacco Use		
No	1.00	1.00
Yes	0.50 (0.11, 2.21)	0.34 (0.42, 2.76)
Federal Poverty Level		
<100%	1.00	1.00
>100%	3.30 (0.78, 13.88)	2.28 (0.43, 11.96)
Insurance		
No Medicaid	1.00	1.00
Medicaid	1.17 (0.29, 4.74)	1.57 (0.26, 9.36)
Prior Screening		
No	1.00	1.00
Yes	1.85 (0.46, 7.48)	0.90 (0.16, 5.04)

*p-value<0.05; **p-value<0.01; ***p-value<0.001

Table 12. Documented reasons for non-Adherence to follow-up colonoscopy

Documented Reasons	N (%)
Recent colonoscopy	5 (19%)
Patient unable to be notified	9 (33%)
Patient declined	2 (7%)
Inadequate tolerance	1 (4%)
Unknown/Other (i.e. on wait list)	10 (37%)

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