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Determinants of Colorectal Cancer Screening among South Asian Americans

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Abstract

BACKGROUND: Colorectal cancer screening rates among South Asian Americans are among the lowest of US population groups. Few population-based studies have examined determinants of screening in this population. The purpose of this study was to identify factors associated with colorectal cancer screening among South Asian Americans.

METHODS: Data from the 2001–2009 California Health Interview Survey and multivariable logistic regression were used to examine determinants of being non-adherent with colorectal cancer screening recommendations. Independent variables include sociodemographic and healthcare access measures.

RESULTS: Overall, 49% of 459 South Asian Americans were non-adherent to screening recommendations. Characteristics associated with non-adherence were the absence of flu shot, absence of doctor visits, sole use of non-English language at home and ≤40% life spent in the United States. In the multivariable model, screening non-adherence was associated with ≤40% life in the United States (odds ratio [95% confidence interval] 3.0 [1.4–6.5]), use of non-English at home (2.8 [1.0–7.8]) and no flu shot (2.5 [1.3–4.8]). Obese (BMI > 27.5 kg/m2) versus normal-weight patients were less likely to be non-adherent (0.4 [0.2–0.9]).

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CONCLUSIONS: Length of time in the United States and language spoken at home rather than English proficiency were associated with non-adherence to colorectal cancer screening, reflecting the importance of acculturation and retention of cultural values. Health conditions and behaviors reflecting more proactive healthcare utilization may reinforce the importance of provider recommendations and perceived efficacy of health prevention. Qualitative research would inform cultural tailoring necessary to improve colorectal cancer screening rates among the rapidly growing South Asian American population.

Keywords

colorectal cancer screening; South Asian; Asian Indian; immigration; acculturation

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Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of cancer deaths among South Asian American males and second in incidence and fourth in cancer mortality among females.[1,2] Screening is effective and associated with widely reported national declines in incidence and mortality[3]; however, CRC incidence among South Asian American females has not declined over the past two decades and has even shown signs of increase.[1,4] Similarly, CRC mortality rates since 2003 among South Asian American males and females have not improved.[2]

The lack of progress in CRC burden among South Asian Americans is likely a reflection of this population's relatively low screening rates. According to the California Health Interview Survey (CHIS) data from 2003 to 2009, CRC screening adherence increased in all racial/ethnic groups, including Asian Americans in aggregate.[4] In 2003, South Asian Americans had the lowest rate of being up-to-date with screening, at less than 30%, half the rate of non-Hispanic White persons. In 2009, all major Asian American ethnic groups saw gains in CRC screening. Yet, still fewer than 60% of South Asian Americans were up-to-date with CRC screening, in contrast to 70% among non-Hispanic Whites and US-born Asian Americans.[4] These patterns among South Asian Americans are corroborated in several other reports based on CHIS data and community-based samples.[5–9] Similar patterns were observed within a healthcare organization, in a largely insured population in Northern California, with Asian Indians (the largest South Asian Americans subgroup) having the lowest level of CRC screening (46%) compared to non-Hispanic White persons (64%) and Asians as an aggregate group (61%).[10] Previous studies have shown the relative comparability of CRC screening rates from clinical electronic health record data compared to CHIS self-report survey data, with similar racial/ethnic patterns observed across data sources.[11]

Recent reports documenting cancer statistics for disaggregated Asian American ethnic groups[1,2,12] demonstrate differences in cancer patterns that reflect the vast heterogeneity in ancestries, cultures, lifestyles, sociodemographics and immigration patterns among the more than 30 Asian American populations in the United States.[13] These reports reinforce the importance, when possible and as numbers permit, of disaggregated data needed to examine distinct ethnic groups. South Asian Americans are one of the fastest-growing and largest Asian American groups in the United States.[13] Over 70% of South Asian Americans are foreign born,[13] and thus native cultural influences are likely to play a strong role in shaping their health beliefs and behaviors.

Despite the increasing burden of CRC and low screening rates, to our knowledge, few studies have focused on CRC screening exclusively among the South Asian populations in the United States, often focusing solely on patterns found in convenience samples.[8,14] Furthermore, the research to-date on determinants of CRC screening among Asian Americans or Asian Americans/Pacific Islanders aggregated as one group or among specific Asian ethnic groups may not be applicable to South Asian Americans. Therefore, we used population-level CHIS data to determine sociodemographic and healthcare access factors associated with CRC screening in California. We examined factors that have been found in prior studies of Asian Americans to be associated with cancer screening.[7,10]

METHODS

Study population

CHIS is a population-based, multilingual, random-digit dial telephone survey, comprising approximately 40,000–50,000 respondents in each wave, that covers a broad range of health topics, including cancer screening, although survey topics varied over time. The survey has been conducted biennially since 2001 and continuously since 2011 among California residents, oversampling select racial/ethnic groups to capture the population diversity in California. To ensure that minority populations, including Asian ethnic groups, and rural populations are well-represented, a multistage sampling design is used and the data are weighted accordingly.[15] To examine the factors associated with CRC screening among South Asian Americans, we pooled data from the 2001, 2003, 2005, 2007 and 2009 CHIS public use datasets, the latest available years for which CRC screening was assessed.[16] This resulted in a study sample of 459 adults aged 50 years or older who self-reported as South Asian (i.e. Asian Indian, Pakistani, Bangladeshi, Sri Lankan or Nepalese). CHIS was not administered in any South Asian languages; however, according to a recent Pew survey, 80% of Asian Indians in the United States are English proficient.[17]

VARIABLES

Outcome variable

In the CHIS adult survey, study participants were asked several questions regarding CRC screening. First, participants 50 years and older were asked whether they ever had a CRC screening test (fecal occult blood test [FOBT], sigmoidoscopy or colonoscopy), and, if they had been screened, the recency of the test. Using these questions, we created a series of CRC screening adherence variables that were combined to develop a single outcome variable of being up-to-date based on US Preventive Services Task Force recommendations in 2008: FOBT within the past 12 months, sigmoidoscopy within the past 5 years plus FOBT within the past 3 years, and/or colonoscopy within the past 10 years.[18] The sigmoidoscopy and colonoscopy questions varied across the survey years, limiting how we were able to assess the timing for the two modalities. In CHIS 2007 and 2009, questions about timing for screening by each modality were asked separately that allowed coding adherence for sigmoidoscopy within 5 years and for colonoscopy every 10 years; however, in CHIS 2001, 2003 and 2005, participants were asked about timing for sigmoidoscopy, colonoscopy or proctoscopy together. Therefore, respondents who reported having FOBT within the past year, sigmoidoscopy within the past 5 years or colonoscopy within the past 5 years (for CHIS data 2001, 2003, and 2005) or 10 years (for CHIS data 2007 and 2009) were classified as being adherent with CRC screening recommendations. Respondents who reported never having had any of the three tests or did not have any of the tests within the timeframes as defined above were classified as non-adherent.

Independent variables

Selected characteristics were assessed as potential determinants of CRC screening, including demographic factors (age, gender and marital status), socioeconomic factors (education, household income, medical insurance status and type), immigration factors (nativity, percent of life spent in the United States, citizenship, language spoken at home and English proficiency), health conditions (asthma, diabetes, high blood pressure, heart disease) and general health status, health care utilization (number of doctor visits, flu shot in the past year), body mass index (BMI, assessed using Asian-specific cut points19) and urbanicity of residential address (zip code level). Other factors that we hypothesized to be related to CRC screening, such as physical activity, had also been reviewed; these additional factors (e.g. physical activity and use of preventive services) were not included in the analysis due to data availability and harmonization issues across the five survey waves.

STATISTICAL ANALYSIS

We computed frequencies and population-weighted percentages (reported with 95% confidence interval [CI]) for each of the CRC screening outcome variables and independent characteristics. The association of potential predictors with CRC screening was presented as odds of non-adherence and assessed by odds ratio (OR) and 95% CI. Independent variables significantly associated ($P < 0.05$) with screening non-adherence in univariable (unadjusted) models were included in the final multivariable logistic regression model. The independent variables included survey year, age (50–54, 55–59, 60–64, 65–69, 70+), gender, insurance (uninsured; Medi-Cal [California's Medicaid program], age < 65; Medi-Cal, age 65+ years; Medicare; private), percent of life lived in the United States (0–40%, 41–60%, 61+%, unknown), language spoken at home (English; non-English, one language only; English and other language), BMI (underweight+normal weight [BMI<23 kg/m^2], overweight [BMI 23–<27.5 kg/m^2], obese [BMI≥27.5 kg/m^2]), high blood pressure (yes, no, unknown), heart disease (yes, no), number of doctor visits in the past 12 months (0, 1–2, 3–5, 6+ times) and receipt of flu shot in past 12 months (yes, no, unknown).

To account for the complex sampling design of CHIS, all distribution parameters and regression statistics were computed using SAS survey procedures (SAS Institute, version 9.3, Cary, NC) that apply replicate weights to obtain jackknife variance estimates following the guidance of CHIS Methodology and Technical Reports.[20] The level of statistical significance was set at alpha 0.05 for all analyses. Tests for linear trend for ordinal variables were conducted by treating the ordinal categories as continuous values in one single variable. Institutional Review Board (IRB) approval and informed consent were not required as this study was based on an analysis of a public use, de-identified dataset.

RESULTS

There were 459 South Asian Americans aged 50 years or older in the analysis dataset, after pooling CHIS data across the five available survey waves. CHIS did not report more granular data for country of origin for South Asian Americans sampled. More than half the sample was under age 60, nearly two-thirds were male, and the vast majority (87%) were married (Table 1). About half lived in an urban zip code, and another 45% in a small city or suburban zip code. The sample was highly educated, with nearly 80% having a college degree or higher. About 20% were uninsured or had Medi-Cal health insurance. Nearly all (98.8%) were foreign born, and most were recent immigrants, with about 40% having spent ≤40% of their life in the United States. About 11% spoke only a non-English language at home, and 73% spoke another language at home in addition to English. For English proficiency, 5.7% reported having limited English proficiency, that is, spoke English not well or not at all. In terms of health status, 18.5% reported fair or poor health, almost 70% were overweight or obese based on the Asian BMI cutpoints, few had asthma, but nearly 20% had diabetes, nearly 40% had high blood pressure and nearly 12% had heart disease. There was variability within the sample in the healthcare access measures, with about half reporting they had two or fewer doctor visits over the past year, and 43% reported getting a flu shot in the past year.

Table 2 shows the percentages of South Asian Americans from 2001 to 2009 who had each of the specific CRC screening modalities and were considered up-to-date with the 2008 U.S. Preventive Services Task Force screening recommendations. Overall, 49% of the sample were considered non-adherent with CRC screening recommendations, ranging from 48.3% in 2001, 29.8% in 2003, 47.8% in 2005, 58.5% in 2007, and 60.7% in 2009. About 20% reported getting each of the specific screening modalities, except for sigmoidoscopy in the past 5 years, which was less than 7%.

Table 3 shows the unadjusted associations of each sociodemographic, health and healthcare access factor with non-adherence (i.e. not being up-to-date) per USPSTF screening recommendations. Non-adherence was high in earlier survey years (51.7% in 2001, 70.2% in 2003), among younger South Asian Americans (63.3% among 50–54), uninsured (74.8%), immigrants with <40% of life in the United States (60.4%), those who only spoke a language other than English at home (66.5%) and those who had not had a flu shot in the past year (62.2%). Non-adherence was lower among older South Asian Americans (32.7% among 70+), those with private or Medicare insurance (37.3 and 49.1%, respectively), those who have lived in the United States for more than 60% of their life (30.2%), those who speak English at home (37.2%), those who are obese (38.2%), those with health conditions (high blood pressure [38.5%], heart disease [23.1%]), those who received a flu shot in the past year (33.0%) and a non-significant difference for those who had more than two doctor visits in the past year. In the multivariable model (Table 4), the only statistically significant associations remained with percent life in the United States, language spoken at home, BMI and receipt of flu shot.

DISCUSSION

In contrast to national declines in CRC incidence and mortality rates, recent reports show a lack of decline or even increasing trends among South Asian Americans,[1,4] who also happen to have among the lowest CRC screening rates. Regarding lack of adherence to CRC screening guidelines among South Asian Americans, we found that several determinants including being a recent immigrant, not speaking English as the primary language at home and not getting a flu shot in the past year were more likely to be associated with non-adherence to CRC screening recommendations. However, South Asian Americans who were obese based on Asian BMI guidelines,[19] had a greater number of physician visits or had more chronic health conditions were more likely to be adherent to recommendations. These associations suggest the importance of more proactive healthcare utilization, especially preventive care, which may have provided more opportunities for physicians to recommend CRC screening.

We found less adherence to recommendations among recent immigrants and those who primarily spoke another language at home. This finding is consistent with the literature showing these factors to be associated with low cancer screening, specifically CRC screening among various Asian American groups.[5–10] More recent data from the National Health Interview Survey for all Asian Americans combined reported a CRC screening rate of 52.1%; data for South Asian Americans were not available. Supported by qualitative research,[9,21,22] associations with immigration factors likely relate to language barriers, lack of healthcare access and/or adherence to cultural beliefs that tend to not value cancer prevention or early detection. However, very little research to date has focused exclusively on population-level CRC screening among South Asian Americans. Data from 2008 to 2014 for South Asian Americans from the Behavioral Risk Factor Surveillance Study (BRFSS) in California documented a CRC screening rate of 40.0%, but there were only 47 South Asian Americans 50 years and older sampled across this entire time period. With respect to findings found in the larger Asian American population, we failed to identify a positive association between limited English proficiency and CRC screening, even in unadjusted models, indicating that language barriers are likely not an important driver of non-adherence to screening, at least in this California population. Although CHIS was not conducted in any South Asian languages (and therefore, data may be considered to be skewed toward more acculturated South Asian Americans), we believe that these results are likely reasonably representative of South Asians in the United States, as the vast majority (80%) of South Asian Americans are English proficient.[17] Moreover, that recency of immigration and language used at home (as a proxy indicator of acculturation) remained statistically significant in our multivariable model after adjusting for health insurance, socioeconomic status and healthcare utilization suggests that cultural and health beliefs may be more relevant than language barriers, financial resources and healthcare access in this population. Qualitative research specifically among South Asian Americans, with particular attention to the diverse ethnic groups captured under that broader umbrella term, is especially needed to help identify the specific barriers to CRC screening so that clinical and community-based interventions can be targeted to these unique populations.

The findings of better screening adherence among South Asian Americans who are obese and among those who reported having had a flu shot in the previous year likely reflect more intense healthcare utilization and greater endorsement of health preventive measures. With respect to a lower likelihood of non-adherence among obese respondents, this finding contrasts with some studies[23] but is consistent with others.[24] In addition to increased monitoring by physicians due to cardiometabolic risks, a recent study has shown that for those who are obese and experiencing the subsequent health consequences may influence them to actively seek health education and engage in health promotion activities from other sources of information, which may include preventive screenings.[25] Also seen in a study of urban African Americans,[26] obese patients may have more comorbidities or be otherwise monitored more closely by their providers. Indeed, in unadjusted models, having high blood pressure and heart disease were significantly associated with adherence to screening recommendations; however, these associations became statistically non-significant in multivariable models while obesity remained significant. We explored whether the association with receiving a flu shot may be due to the implementation of programs across some California healthcare systems to administer FOBT among patients who come in for a flu shot. We examined this association among South Asian Americans who were members of a large integrated healthcare system that was known to have implemented such a program but did not find this association in this sub-sample. Thus, we surmise that the flu shot finding likely reflects general health preventive attitudes, which is underscored by the success of pairing preventive health efforts such as the FLU-FIT program[27]; flu shots have been used as a proxy for preventive health in other studies.[28,29] We were not able to evaluate in these data the relevance of provider recommendations, but the obesity and flu shot associations indicate that, as with many Asian cultures, endorsement from medical authorities may be a critical leverage point in conveying to South Asian Americans the importance of CRC screening.[14] In addition, it has been postulated that obtaining a flu shot may reflect a broader construct of health literacy, which may be consistent with timely uptake of CRC screening.[30] As more emphasis is placed on timely flu shots, coupled with the development and accessibility of a COVID-19 vaccine to address the 2020 pandemic, this may serve as an opportunity to couple CRC screening with such prioritized preventive health behaviors among South Asian Americans and other non-adherent population groups.

Several limitations in this study should be noted, including the relatively small sample despite pooling across years, the lack of certain screening determinants such as culturally embedded health beliefs, provider recommendations, health literacy, as well as the relative datedness and the long timespan of the sample, from 2001 to 2009, limited by the availability of data on CRC screening in CHIS, and limitations inherent to large population-based and self-reported surveys including low response rates, recall bias and social desirability bias. Another limitation is that CHIS does not differentiate between receipt of these CRC screening tests for routine screening or diagnostic purposes; in an evaluation of data from 2007 and 2009, the majority (71.6%) of South Asian Americans who had CRC screening reported the reason as being ‘part of a routine test’ versus ‘because of a problem’ or ‘other’ reason. Despite the limitations in these data, they are arguably the only population-based data powered in sample size for assessing determinants of CRC screening currently representation of this population group. Although 2009 was the last survey year in which CRC screening data were collected in CHIS, this is still to-date the largest, most representative data for assessing CRC screening among South Asian Americans. Moreover, it is unlikely that the determinants associated with screening found in this study are different in more current California populations.

CONCLUSION

We leveraged a population-based dataset, perhaps among the largest available for South Asian Americans, to examine determinants of CRC screening. Although some findings such as associations with immigration and language variables are similar to those for other Asian American ethnic groups, some other patterns such as prior receipt of flu shots, are unique. Thus, our findings provide support for design and implementation of interventions that are culturally and linguistically tailored to this rapidly growing South Asian American population. These results also have implications for clinical practice in that provider-driven preventive measures, such as coupling FIT with flu (and future COVID-19) vaccinations could be an effective means to encourage CRC screening in the South Asian American population.

Conflict of interest and funding

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POPULAR SCIENTIFIC SUMMARY

- Despite the increasing burden of colorectal cancer (CRC) and low screening rates, few studies have focused on CRC screening exclusively among the South Asian populations in the U.S., thus, we used population-level California Health Interview Survey data to determine sociodemographic and healthcare access factors associated with CRC screening in California.
- In our study, 49% of South Asian American adults, 50 years and older were non-adherent to screening recommendations and several determinants including being a recent immigrant, not speaking English as the primary language at home, and not getting a flu shot in the past year were more likely to be associated with non-adherence to CRC screening recommendations among this population.
- Although some findings such as associations with immigration and language variables are similar to those for other Asian American ethnic groups, some other patterns such as prior receipt of flu shots, are unique; these factors should be considered in interventions that culturally- and linguistically-tailored for this growing population as well as those in clinical settings such as coupling of CRC screening with flu shots.

Table 1.

Distributions of selected characteristics among total study sample, South Asian Americans, 50 years of age and older, N = 459, California Health Interview Survey (CHIS) 2001–2009.

Characteristic	*N*	Weighted %	(95% confidence interval)
Survey year			
2001	63	11.2	(7.3–15.1)
2003	68	15.4	(11.5–19.2)
2005	87	24.3	(18.4–30.1)
2007	114	22.0	(17.4–26.6)
2009	127	27.2	(21.9–32.5)
Age			
50–54	132	29.3	(23.4–35.2)
55–59	115	24.7	(19.0–30.5)
60–64	71	12.5	(8.9–16.1)
65–69	60	15.3	(11.2–19.3)
70+	81	18.2	(13.6–22.8)
Gender			
Male	268	63.3	(58.0–68.6)
Female	191	36.7	(31.4–42.0)
Marital status			
Married	367	87.2	(83.4–91.1)
Never married	18	2.4	(0.8–4.0)
Widowed/separated/divorced/living with partner	74	10.4	(6.8–14.0)
Rural/urban (zip code)			
Urban	191	50.9	(44.9–57.0)
Smaller city	91	15.8	(11.7–19.9)
Suburban	153	29.2	(24.1–34.3)
Town and rural	24	4.0	(2.1–5.9)
Education			
≤High school	62	14.8	(10.3–19.3)
Some college	31	6.9	(4.3–9.5)
College graduate	162	35.1	(29.1–41.2)
Graduate school	204	43.2	(36.8–49.6)
Annual household income per household member			
Tertile 1 (0–18,750)	151	39.6	(33.6–45.5)
Tertile 2 (18,751–39,167)	159	33.9	(28.2–39.6)
Tertile 3 (39,168+)	149	26.6	(21.1–32.0)
Insurance type & age [1]			
Uninsured	34	9.1	(5.6–12.6)

Characteristic	*N*	Weighted %	(95% confidence interval)
Medi-Cal, <65	19	5.3	(1.3–9.2)
Medi-Cal, 65+	25	6.8	(3.8–9.7)
Medicare	129	26.1	(21.3–31.0)
Private	252	52.8	(46.7–58.8)
Nativity			
Foreign-born	450	98.8	(97.7–99.9)
US-born	9	1.2	(0.1–2.3)
Percent of life in the United States			
0–40%	145	41.2	(34.1–48.2)
41–60%	167	35.5	(29.3–41.7)
61%+	84	12.1	(9.1–15.1)
Missing: 2001 data	63	11.2	(7.3–15.1)
Citizenship			
US-born citizen	9	1.2	(0.1–2.3)
Naturalized citizen	383	82.6	(78.0–87.1)
Non-citizen	67	16.3	(11.8–20.7)
Language used at home			
English	80	15.3	(10.9–19.7)
Non-English only	42	11.4	(6.6–16.2)
English + other	337	73.3	(67.0–79.7)
English proficiency [2]			
English only	80	15.3	(10.9–19.7)
Very well	230	48.3	(42.4–54.1)
Well	130	30.8	(24.9–36.6)
Not well/at all	19	5.7	(2.5–8.9)
General health status			
Excellent	94	20.9	(15.8–26.0)
Very good	125	25.7	(20.6–30.8)
Good	153	34.9	(28.5–41.4)
Fair	59	11.6	(8.0–15.2)
Poor	28	6.9	(3.9–9.9)
Body mass index (Asian-specific cut points)			
Underweight/Normal (<23)	144	30.5	(24.8–36.2)
Overweight (23–<27.5)	224	51.8	(45.6–57.9)
Obese (27.5+)	91	17.7	(13.5–22.0)
Asthma			
Yes	45	7.9	(5.2–10.7)
No	414	92.1	(89.4–94.8)
Diabetes			

Characteristic	*N*	Weighted %	(95% confidence interval)
Yes	79	19.4	(14.2–24.7)
No	371	78.3	(72.8–83.9)
Unknown	9	2.2	(0.3–4.2)
High blood pressure			
Yes	170	39.9	(34.2–45.6)
No	284	59.3	(53.6–64.9)
Unknown	5	0.8	(0.0–1.6)
Heart disease			
Yes	60	11.7	(8.2–15.2)
No	399	88.3	(84.8–91.8)
Doctor visits in past year (number of visits)			
0	60	12.5	(8.5–16.4)
1–2	174	38.3	(32.2–44.4)
3–5	148	31.7	(26.5–37.0)
6+	77	17.5	(12.4–22.5)
Flu shot in the past 12 months [3]			
Yes	193	42.9	(37.2–48.7)
No	210	47.2	(41.1–53.2)
Unknown	56	9.9	(6.6–13.3)

1. Based on two variables in CHIS, current insurance for participants <65 and participants ≥65. Category Public/Medi-Cal includes the following levels: Medi-Cal/Medicaid (age < 65), CHIP/other public program (age< 6 5), Medicare + Medi-Cal/Medicaid (age ≥ 65); Category Public/ Medicare includes the following levels: Medicare (age < 65), Medicare + other (age≥ 65), Medicare only (age ≥ 65); Category Private includes the following levels: employment-based(age < 65), privately purchased (age < 65), other only (age ≥ 65).

2. English proficiency (self-reported) is available across all years, but the way the sample was asked the questions varies across years. The universe is adults who don't speak English only in 2001 and 2003, and adults who speak language other than English at home and/or were interviewed in language other than English in 2005, 2007 and 2009.

3. Unknowns are adults aged 50–64 years participating in CHIS 2001 survey who were not asked if they had the flu shot the past 12 months. The flu-shot variable is available for adults 65 years or older in 2001 data, 50 or older in 2003 data, and all adults in 2005–2009 data.

Table 2.

Distributions of colorectal cancer screening among total study sample, South Asian Americans, 50 years of age and older, $N = 459$, California Health Interview Survey (CHIS) 2001–2009.

Colorectal cancer screening outcomes	***N***	**Weighted %**	**(95% confidence interval)**
Survey year 2001–2005			
Fecal occult blood test in last year (CHIS 2001–2005)			
Yes	34	16.7	(10.2–23.1)
No	183	82.9	(76.4–89.4)
Unknown	1	0.5	(0.0–1.3)
Sigmoidoscopy or colonoscopy in past 5 years (CHIS 2001–2005)			
Yes	68	34.3	(25.9–42.7)
No	150	65.7	(57.3–74.1)
Colorectal cancer screening adherence [1]			
Adherent (up-to-date)	94	44.7	(35.3–54.2)
Nonadherent (not up-to-date)	124	55.3	(45.8–64.7)
Survey year 2007–2009			
Fecal occult blood test in last year (CHIS 20072009)			
Yes	58	22.0	(15.6–28.5)
No	183	78.0	(71.5–84.4)
Sigmoidoscopy in past 5 years (CHIS 2007–2009)			
Yes	34	14.1	(8.3–19.8)
No	207	85.9	(80.2–91.7)
Colonoscopy in past 10 years (CHIS 2007–2009)			
Yes	111	43.3	(34.5–52.1)
No	130	56.7	(47.9–65.5)
Colorectal cancer screening adherence [1]			
Adherent (up-to-date)	148	59.7	(50.6–68.8)
Nonadherent (not up-to-date)	93	40.3	(31.2–49.4)
Survey Year 2001–2009			

Colorectal cancer screening outcomes	*N*	Weighted %	(95% confidence interval)
Colorectal cancer screening adherence [1]			
Adherent (up-to-date)	242	52.1	(45.4–58.8)
Nonadherent (not up-to-date)	217	47.9	(41.2–54.6)

1. Had blood stool test in the past year, sigmoidoscopy past 5 years, and/or colonoscopy past 10 years (for data from CHIS 2007, 2009), had blood stool test in the past year, sigmoidoscopy past 5 years and/or colonoscopy past 5 years (for data from CHIS 2001, 2003 and 2005).

Note: sigmoidoscopy and colonoscopy questions varied across the years in how they captured the timeframe for these screening modalities; thus we have multiple time intervals for the exams.

Table 3.

Unadjusted associations with non-adherence to colorectal cancer screening, South Asian Americans, 50 years of age and older, *N* = 459, California Health Interview Survey (CHIS) 2001–2009.

Characteristic	*N* non-adherent[1]	% Non-adherent (weighted)	(95% confidence interval)	Odds ratio[2]	(95% confidence interval)
Survey year (each year)					
2001	38	51.7	(34.5–69.0)	1.7	(0.7–4.1)
2003	46	70.2	(56.8–83.7)	**3.6**	**(1.6–8.6)**
2005	46	52.2	(36.3–68.1)	1.7	(0.7–4.0)
2007	47	41.5	(30.1–52.9)	1.1	(0.7–2.3)
2009	46	39.3	(25.7–52.9)	1.0	
P-trend[3]					**0.02**
Age					
50–54	84	63.3	(52.4–74.2)	1.0	
55–59	58	49.4	(35.4–63.3)	0.6	(0.3–1.2)
60–64	32	49.7	(34.0–65.4)	0.6	(0.3–1.2)
65–69	23	40.2	(26.0–54.3)	**0.4**	**(0.2–0.8)**
70+	26	32.7	(19.1–46.4)	**0.3**	**(0.1–0.6)**
P-trend[3]					**<0.01**
Gender					
Male	119	46.3	(38.1–54.5)	1.0	
Female	104	53.8	(43.2–64.4)	1.4	(0.8–2.3)
Marital status					
Married	175	49.1	(42.1–56.0)	1.0	
Never married	10	51.4	(13.5–89.2)	1.1	(0.2–5.0)
Widowed/separated/divorced/living with partner	38	48.3	(30.0–66.7)	1.0	(0.5–2.1)
Rural/urban (zip code)					
Urban	79	44.6	(34.2–55.0)	1.0	
Smaller city	54	58.9	(44.8–73.1)	1.8	(0.9–3.6)
Suburban	80	53.0	(42.5–63.4)	1.4	(0.8–2.5)

Characteristic	*N* non-adherent[1]	% Non-adherent (weighted)	(95% confidence interval)	Odds ratio[2]	(95% confidence interval)
Town and rural	10	37.9	(14.6–61.3)	0.8	(0.3–2.3)
Education [4]					
≤High school	33	44.4	(28.2–60.5)	0.7	(0.3–1.6)
Some college	14	50.7	(29.5–71.9)	0.9	(0.4–2.4)
College graduate	84	52.5	(41.5–63.5)	1.0	
Graduate school	92	47.7	(38.7–56.7)	0.8	(0.5–1.4)
P-trend[3]					*0.79*
Annual household income per household member[5,6]					
Tertile 1 (0–18,750)	81	54.5	(43.7–65.4)	1.3	(0.7–2.4)
Tertile 2 (18,751–39,167)	75	43.4	(34.1–52.6)	0.8	(0.5–1.4)
Tertile 3 (39,168+)	67	48.1	(37.0–59.2)	1.0	
P-trend[3]					*0.34*
Insurance type & age [7]					
Uninsured	25	74.8	(55.5–94.0)	**3.1**	**(1.0–9.2)**
Medi-Cal, <65	13	77.3	(47.4–100.0)	3.5	(0.7–17.6)
Medi-Cal, 65+	12	37.3	(16.5–58.1)	0.6	(0.2–1.6)
Medicare	48	37.3	(26.7–48.0)	0.6	(0.4–1.1)
Private	125	49.1	(40.3–58.0)	1.0	
Percent of life in the United States					
0–40%	84	60.4	(49.7–71.1)	**3.5**	**(1.7–7.5)**
41–60%	72	41.5	(31.9–51.2)	1.6	(0.8–3.4)
61%+	29	30.2	(17.9–42.4)	1.0	
Missing: 2001 data	38	51.7	(34.5–69.0)	2.5	(1.0–6.2)
P-trend[3]					***<0.01***
Citizenship					
US-born citizen	4	31.4	(0.0–65.1)	0.5	(0.1–2.6)
Naturalized citizen	177	47.3	(39.9–54.7)	1.0	

Characteristic	***N* non-adherent[1]**	**% Non-adherent (weighted)**	**(95% confidence interval)**	**Odds ratio[2]**	**(95% confidence interval)**
Non-citizen	42	59.4	(45.4–73.3)	1.6	(0.9–3.1)
Language used at home					
English	32	37.2	(21.3–53.0)	1.0	
non-English only	26	66.5	(46.2–86.8)	**3.4**	**(1.2–9.7)**
English + other	165	48.8	(41.7–56.0)	1.6	(0.8–3.2)
English proficiency [8]					
English only	32	37.2	(21.3–53.0)	1.0	
Very well	116	52.6	(43.5–61.7)	1.9	(0.9–4.0)
Well	65	50.1	(38.9–61.2)	1.7	(0.8–3.5)
Not well/at all	10	45.5	(16.2–74.8)	1.4	(0.4–5.6)
General health status					
Excellent	48	52.7	(39.6–65.8)	1.00	
Very good	61	45.9	(34.5–57.4)	0.8	(0.4–1.5)
Good	72	47.0	(35.9–58.1)	0.8	(0.4–1.5)
Fair	30	57.6	(41.8–73.4)	1.2	(0.5–2.8)
Poor	12	45.9	(20.8–71.0)	0.8	(0.2–2.4)
Body mass index (Asian-specific cut points)					
Underweight/Normal(<23)	78	56.5	(45.9–67.0)	1.0	
Overweight (23-<27.5)	103	48.4	(39.4–57.4)	0.7	(0.4–1.2)
Obese (27.5+)	42	38.2	(27.0–49.5)	**0.5**	**(0.3–0.9)**
P-trend[9]					***0.02***
Asthma					
Yes	20	36.0	(19.9–52.0)	0.6	(0.3–1.2)
No	203	50.2	(43.1–57.2)	1.0	
Diabetes					
Yes	31	44.9	(27.9–62.0)	0.8	(0.4–1.6)
No	189	50.6	(43.5–57.6)	1.0	
Unknown	3	31.5	(0.0–86.6)	0.5	(0.0–19.7)

Characteristic	*N* non-adherent[1]	% Non-adherent (weighted)	(95% confidence interval)	Odds ratio[2]	(95% confidence interval)
High blood pressure					
Yes	66	38.5	(28.0–49.0)	**0.5**	**(0.3–0.8)**
No	156	56.5	(48.2–64.7)	1.0	
Unknown	1	25.5	(0.0–70.0)	0.3	(0.0–2.2)
Heart disease					
Yes	16	23.1	(10.0–36.3)	**0.3**	**(0.1–0.6)**
No	207	52.5	(45.3–59.7)	1.0	
Doctor visits in past 12 months					
0	43	66.5	(49.4–83.6)	1.5	(0.7–3.3)
1–2 visits	94	56.6	(47.1–66.1)	1.0	
3–5 visits	58	37.8	(27.7–47.9)	**0.5**	**(0.3–0.8)**
6+ visits	28	40.6	(21.7–59.5)	0.5	(0.2–1.3)
P-trend[3]					***0.01***
Flu shot[10]					
Yes	65	33.0	(24.8–41.2)	1.0	
No	123	62.2	(52.5–72.0)	**3.3**	**(1.9–5.8)**
Unknown	35	55.8	(37.6–74.1)	**2.6**	**(1.1–5.9)**

1. Did not have blood stool test in the past year, sigmoidoscopy past 5 years and/or colonoscopy past 10 years (for data from CHIS 2007, 2009) and did not have blood stool test in the past year, sigmoidoscopy past 5 years and/or colonoscopy past 5 years (for data from CHIS 2001, 2003 and 2005).

2. Model without any additional adjustment. Bolded estimates are statistically significant at $P < 0.05$.

3. Trend analysis on ordinal values corresponding to the categories listed; missing values were excluded if applicable.

4. Education ordinal variable with values 1–10: 1 = ‘grad 1–8’, 2 = ‘grade 9–11’, 3 = ‘grade 12’, 4 = ‘some college’, 5 = ‘vocational school’, 6 = ‘AA or AS’, 7 = ‘BA or BS’, 8 = ‘some graduate school’, 9 = ‘MA or MS’, 10 = ‘Ph.D or equivalent’.

5. Household income divided by a number of household members. One unit increase in continuous variable is increase in $1,000 per person.

6. Income ordinal variable with values 1–14: 1 = ‘0–5 k’, 2 = ‘5<−10 k’, 3 = ‘10<−15 k’, 4 = ‘15<−20 k’, 5 = ‘20<−30 k’, 6 = ‘30<−40 k’, 7 = ‘40<−50 k’, 8 = ‘50<−60 k’, 9 = ‘60<−70 k’, 10 = ‘70<−80 k’, 11 = ‘80<−90 k’, 12 = ‘90<−100 k’, 13 = ‘100<−135 k’, 14 = ‘135 k+’.

7. Based on two variables in CHIS data, current insurance for participants <65 and participants ≥65.

8. English proficiency (self-reported) is available across all years, but the universal population is slightly changed across years. The universe is adults who don't speak English only in 2001 and 2003, and adults who speak language other than English at home and/or were interviewed in language other than English in 2005, 2007 and 2009.

9. Underweight adults were excluded for the trend analysis.

10. Unknowns are adults aged 50–64 years participating in the CHIS 2001 survey. The flu-shot variable is available for adults 65 or older in 2001 data, 50 or older in 2003 data and all adults in 2005–2009 data.

Table 4.

Multivariable associations with non-adherence to colorectal cancer screening guidelines, California Health Interview Survey (CHIS) 2001–2009 South Asian Americans, 50 years of age and older.

Characteristic	Association with non-adherence	
	Odds ratio[1]	**(95% confidence interval)**
Survey year (continuous)	**0.8**	**(0.7–0.9)**
Age		
50–54	1.0	
55–59	0.5	(0.2–1.2)
60–64	0.5	(0.2–1.5)
65–69	0.6	(0.2–2.1)
70+	0.4	(0.1–1.7)
P-trend[2]		*0.19*
Male	1.0	
Female	1.5	(0.8–3.0)
Insurance type & age[3]		
Uninsured	2.4	(0.5–12.5)
Medi-Cal, <65	2.1	(0.5–9.7)
Medi-Cal, 65+	0.9	(0.3–3.0)
Medicare	0.9	(0.3–2.5)
Private	1.0	
Percent of life in the United States		
0–40%	**3.0**	**(1.4–6.5)**
41–60%	1.3	(0.6–2.8)
61%+	1.0	
Missing: 2001 data	0.2	(0.0–6.0)
P-trend[2]		***0.01***
Language used at home		

Characteristic	Association with non-adherence	
	Odds ratio[1]	(95% confidence interval)
English	1.0	
non-English only	**2.8**	**(1.0–7.8)**
English + other	1.7	(0.8–3.4)
Body mass index (Asian-specific cut points)		
Underweight/Normal(<23)	1.0	
Overweight (23-<27.5)	0.6	(0.3–1.3)
Obese (27.5+)	**0.4**	**(0.2–0.9)**
P-trend[4]		***0.03***
High blood pressure		
Yes	0.8	(0.4–1.4)
No	1.0	
Unknown	0.4	(0.0–5.4)
Heart disease		
Yes	0.4	(0.2–1.1)
No	1.0	
Doctor visits in past 12 months		
0	1.7	(0.6–4.8)
1–2 visits	1.0	
3–5 visits	0.8	(0.4–1.5)
6+ visits	0.8	(0.3–1.9)
P-trend[2]		*0.31*
Flu shot[5]		
Yes	1.0	
No	**2.5**	**(1.3–4.8)**
Unknown	4.6	(0.2–140.8)

1. Model adjusted for all variables in the table including survey year. Bolded estimates are statistically significant at $P < 0.05$.

2. Trend analysis on ordinal values corresponding to the categories listed; missing values were excluded if applicable.

[3] Based on two variables in CHIS data, current insurance for participants <65 and participants ≥65. Category Public/Medi-Cal includes the following levels: Medi-Cal/Medicaid (age < 65), CHIP/other public program (age < 65), Medicare + Medi-Cal/Medicaid (age ≥ 65). Category Public/Medicare includes the following levels: Medicare (age < 65), Medicare + other (age ≥ 65), Medicare only (age ≥ 65). Category Private includes the following levels: employment-based (age < 65), privately purchased (age < 65), other only (age ≥ 65).

[4] Underweight adults were excluded for the trend analysis.

[5] Unknowns are adults aged 50–64 years participating in CHIS 2001 survey. The flu-shot variable is available for adults 65 years or older in 2001 data, 50 or older in 2003 data and all adults in 2005–2009 data.