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Factors Associated with Cancer Screening Among Hopi Men

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Abstract

Cancer screening rates remain low among American Indian men, and cancer screening behaviors and barriers to cancer screening among American Indian men are not well understood. This study evaluated cancer screening behaviors in 102 Hopi men who were 50 years of age or older from the Hopi Survey of Cancer and Chronic Disease. Reported cancer screening frequencies were 15.7%, 45.1%, and 35.3% for fecal occult blood test (FOBT), colonoscopy, and prostate-specific antigen (PSA) test, respectively. Among men who reported having had a FOBT, 81.2% had the test more than 1 year ago. Among men who reported a colonoscopy, 60.8% had colonoscopy within the past 3 years. Similarly, among men who reported having had PSA, 72.3% had PSA within the past 3 years. "No one told me" was the most common answer for not undergoing FOBT (33.7%), colonoscopy (48.2%), and PSA (39.4%). Men who reported having had a PSA or digital rectal exam were three times as likely to also report having a FOBT or colonoscopy (odds ratio [OR] 3.19, 95% confidence interval [CI]: 1.21–8.46). Younger age (< 65) was associated with reduced odds of ever having prostate cancer screening (OR 0.28, 95% CI: 0.10–0.77). Ever having colorectal cancer screening and previous diagnosis of cancer increased odds of ever having prostate cancer screening (OR 3.15, 95% CI: 1.13–8.81 and OR 5.28, 95% CI: 1.15–24.18 respectively). This study illustrates the importance of community cancer education for men to improve cancer screening participation.

Keywords Hopi · Native Americans · American Indians · Men · Cancer screening

Background

Historically, improvement of cancer screening behaviors among women is promoted by activities and advocacy of national programs, such as Centers for Disease Control and Prevention (CDC) for breast and cervical cancer screenings [1], AVON Foundation for Women, and Susan G. Komen for the Cure® for breast health. More recently, the voices of men are being heard, particularly from American Indian and Alaska Native (AI/AN) men, concerning their health and cancer screenings [2, 3]. However, there are few studies about AI/AN men that address the need to improve cancer screening participation [4].

Overall, cancer incidence among AI/ANs is lower compared to non-Hispanic Whites (NHWs), but AI/ANs have higher overall cancer mortality rates [5]. AI/AN men also have higher mortality from colorectal cancer (CRC) and prostate cancer (PCa) [6, 7]. In Indian Health Service (IHS) Contract Health Service Delivery Area (CHSDA) counties, AI/AN men experience a 37% higher CRC mortality rate [6] and a 9% higher PCa mortality rate than NHW men [8].

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Potential causes of the higher CRC and PCa mortality rates among AI/ANs include late stage diagnosis due to lower cancer screening rates, increased barriers to health care access (e.g., their home locations in rural and remote areas and inaccessibility to cancer centers or health care centers), and lack of knowledge about cancer screenings [3, 4, 9]. Screening rates among AI/ANs are generally lower compared to NHWs [10, 11]. The Arizona Behavioral Risk Factor Surveillance System (BRFSS) survey reports that AI/ANs in Arizona have lower CRC and PCa screening rates compared to NHWs. The 2010 Arizona BRFSS survey was the last statewide survey that asked if men ever had prostate-specific antigen (PSA) screening and estimated that less than 20% of AI/ANs ever had a PSA test. The 2016 Arizona BRFSS then reported that 37.0% of NHWs and 25.7% of AI/ANs ever had a fecal occult blood test (FOBT), and 72.0% of NHWs and 37.6% of AI/ANs ever had a sigmoidoscopy or colonoscopy. Although the cancer screening rates for AI/ANs show improvement, these screening rates compared to NHWs remained low. Furthermore, in recent conversations among our research team and the Hopi Tribe in Northern Arizona, community members raised concerns about cancer burden among Hopi men. Therefore, we sought to identify factors associated with these cancer screening behaviors in order to develop culturally appropriate cancer education and intervention programs to reduce cancer burden in AI/AN men.

The current study used data from the 2012 Hopi Survey of Cancer and Chronic Disease to understand cancer screening behavior among Hopi men 50 years of age or older. The Hopi Survey of Cancer and Chronic Disease was a community survey conducted in 2012 on the Hopi Reservation for both men and women. The results for cancer screening behaviors for women and self-identified caregivers have been reported [12, 13] and show that cancer screening participation for Hopi adult women living on the reservation increased over the years since the 1990s when Hopi Cancer Support Services received CDC funding for their Breast and Cervical Cancer Program [12, 14]. However, the survey data on cancer screening participation have not previously been thoroughly examined for Hopi men.

Materials and Methods

Community Survey

This cross-sectional study used the data collected in the 2012 Hopi Survey of Cancer and Chronic Disease, a population-based survey of randomly selected adult Hopi members (age 18 or older) living on the reservation. The goal of the survey was to characterize chronic disease burden and health behaviors. The survey was conducted between June 2012 and December 2012. The 2012 survey was a collaborative project between the Hopi Tribe, The University of Arizona, and the Northern Arizona University. The research team cooperatively worked to obtain funding, design and conduct survey, and disseminate survey findings. The survey protocol was approved by the Hopi Tribal Council and University of Arizona Institutional Review Board.

Recruitment and survey procedures of the 2012 Hopi community survey were described previously [13]. Briefly, a study coordinator provided Hopi interviewers with a list of potential study participants to call. The list of potentially eligible study participants was provided by the Hopi tribal enrollment office, which had then been randomized to assure that all villages were represented for both men and women with a goal to recruit 250 men and 250 women. The interviewers called potential study participants up to five times to schedule at-home survey. Surveys were conducted either in English or Hopi. A total of 500 Hopi community members participated in the 2012 survey, and 248 were men, including 146 aged < 50 years old and 102 aged ≥ 50 years old.

The 2012 Hopi survey included 206 questions on basic demographic information, chronic diseases, previous cancer diagnosis, cancer screening participation, and family history of cancer. The survey asked the last time that men had received a FOBT, colonoscopy, or PSA screening; the main reasons for undergoing screening; and reasons for not having completed a cancer screening. The survey also asked questions to evaluate knowledge and attitudes on cancer screening (e.g., how strongly the study participants agreed with a statement about cancer and cancer screening). Other questions were about seeking cancer information and attending cancer education events. The survey questions were multiple choice for quantitative analysis.

In 2016, the Hopi Department of Health and Human Services and Hopi community stakeholders identified men's health as a priority area for disease prevention. The Hopi Cancer Support Services responded to this priority area and re-established a collaboration with The University of Arizona and Northern Arizona University to develop a plan to understand Hopi men's needs for cancer prevention and to conduct a secondary analysis of the 2012 survey data. Criteria for inclusion for this secondary analysis include Hopi men who completed the survey and were age 50 years or older regardless of a prior diagnosis of cancer.

Statistical Analysis

The characteristics and cancer screening rates of the study participants were summarized by associated frequencies and percentages. Odds ratios (OR) and the associated 95% confidence intervals (CI) were calculated using logistic regression to identify factors associated with having a prior cancer screening for CRC (ever having FOBT or colonoscopy) and PCa (ever having digital rectal exam or PSA test). Based on a

moderate sample size of 102, this study used a more restrictive rule to decide what factors to include in the adjusted analysis. Specifically, factors with a significant unadjusted OR at a significance level of 5% were included in adjusted analyses. All analyses were done in SAS 9.4.

Results

This study included a total of 102 Hopi men who were aged 50 years or older (Table 1). Most men ($n = 91$, 89.2%) were in the recommended age group for cancer screening (age 50–74). About half of the men reported a high school education or less than high school education ($n = 56$, 54.5%), while 13 men (12.8%) completed two or more years of college. Of 13 men, four men had a bachelor's degree. Approximately, a quarter of men ($n = 29$, 28.9%) had a full-time job. More than half ($n = 57$, 55.9%) had household income of less than $25,000 and 16.7% ($n = 17$) did not have reliable transportation. About half of the men ($n = 53$, 52.0%) spoke Hopi as a primary language at home. Use of traditional medicine in the past 5 years was not common ($n = 4$, 3.9%). Less than half of the men ($n = 46$, 45.1%) self-reported having diabetes.

In this population, 14 men (13.7%) were cancer survivors, while 36 men (35.3%) had a family history of cancer. A small proportion of men reported that they had sought cancer information; 22.6% of men ($n = 23$) had sought cancer information for themselves and 10.8% ($n = 11$) had their family member sought cancer information for them. Only 19.6% of men ($n = 20$) answered that they have attended at least one cancer education presentation offered by Hopi Cancer Support Services. A majority of men ($n = 84$; 82.4%) strongly agreed to the statement "cancer screening helped find cancer earlier." Thirty-four men (33.3%) strongly agreed that "cancer is almost always fatal," while 14.7% strongly agreed that "cancer is often caused by a person's lifestyle."

Table 2 shows that Hopi men had low cancer screening rates; self-reported cancer screening rate was 15.7% ($n = 16$), 45.1% ($n = 46$), and 35.3% ($n = 36$) for FOBT, colonoscopy, and PSA, respectively. Among men who reported a prior FOBT, a majority had the FOBT more than 1 year ago ($n = 13$, 81.2%). Among men who had a colonoscopy previously, 60.8% ($n = 28$) had a colonoscopy within the past 3 years, and only one man had colonoscopy more than 10 years ago. Similarly, 72.3% of men ($n = 26$) reported a PSA screening within 3 years, and only two men had a PSA test over 10 years ago. Among men who reported receiving a cancer screening, many men self-reported that their routine test was the main reason for having FOBT ($n = 11$, 68.8%), colonoscopy ($n = 28$, 60.9%), and PSA screening ($n = 25$, 69.4%). On the other hand, over 70% of Hopi men who have not had CRC or PCa screening reported, "no one told me," "never heard of cancer screening," "don't know much about it," or "don't know where to get tested" as reasons for not having had cancer screening. "No one told me" was the most common answer for not undergoing FOBT ($n = 29$, 33.7%), colonoscopy ($n = 27$, 48.2%), and PSA ($n = 26$, 39.4%).

Multiple variable logistic regression analysis was performed to identify factors associated with reporting a CRC and PCa screening. Only a history of having PCa screening was significantly associated with ever having received a CRC screening (Table 3). Men who reported ever receiving a PCa screening had over threefold increased odds of a CRC screening (OR 3.19, 95% CI: 1.21–8.46). Three factors were statistically significantly associated with ever having PCa screening (Table 4). Younger age (< 65) was associated with reduced odds (OR 0.28, 95% CI: 0.10–0.77) of ever having PCa screening, while ever having a CRC screening and a previous diagnosis of cancer increased odds of ever having PCa screening (OR 3.15, 95% CI: 1.13–8.81 and OR 5.28, 95% CI: 1.15–24.18 respectively). Higher income also showed a borderline significance (OR 3.12, 95% CI: 0.98–9.86).

Discussion

This secondary analysis evaluated CRC and PCa screening behavior among Hopi men age 50 years or older living on the Hopi Tribal lands. Many Hopi men in this age group understood that cancer screening helped detect cancer early. However, CRC and PCa screening rates were low, perhaps because Hopi men did not have adequate knowledge on cancer screening, or they did not receive sufficient information on cancer screening. Many Hopi men did not seek cancer information themselves or did not attend cancer education sessions held within the reservation. Important factors associated with undergoing screening were having had cancer screening previously and a prior diagnosis of cancer.

Low cancer screening rates among AI/ANs were previously reported [11, 15, 16]. The 2000–2010 US BRFSS data show 61.5% of NHW men and 44.3% of AI/AN men living in IHS CHSDA counties reported having a FOBT within 1 year or an endoscopy (sigmoidoscopy or colonoscopy) within 5 years [15]. Similarly, 54.6% of NHW men and 42.5% of AI/AN men living in IHS CHSDA counties reported undergoing a PSA test within 1 year. The 2013 National Health Interview Survey and 2008 Health and Retirement Study data similarly show lower CRC and PCa screening rates for AI/ANs compared to NHWs [11, 16]. Moreover, the 2000–2010 BRFSS data showed evidence for even lower cancer screening rates for AI/AN men in the Southwest region [15]. CRC screening rates were 44.3% for overall AI/AN men, but 36.6% for AI/AN men in the Southwest. PSA screening rates were 42.5% for overall AI/AN men, but 35.1% for AI/AN men in the Southwest. It is of note that in 2010 the Hopi Tribe initiated a state-funded program to promote CRC

Table 1 Characteristics of Hopi men aged 50 years or older ($n = 102$) in the 2012 Hopi Survey of Cancer and Chronic Disease

Variable	*n* (%)
Age	
50–64 years	66 (64.7%)
65–74 years	25 (24.5%)
75+ years	11 (10.8%)
Education	
Never attended school	5 (4.9%)
Less than 8th grade	10 (9.8%)
8–12 grade but did not graduate	29 (28.4%)
High school graduate/GED	12 (11.8%)
Trade, technical, or vocational school after high school	17 (16.7%)
Some college but no degree	15 (14.7%)
2-year college graduate or greater	13 (12.8%)
Do not know/refused	1 (1.0%)
Married	55 (53.9%)
Employed full time	29 (28.4%)
Household income	
Less than $10,000	38 (37.3%)
$10,000–$24,999	19 (18.6%)
$25,000–$34,999	19 (18.6%)
$35,000–$49,999	14 (13.7%)
≥ $50,000	9 (8.8%)
Do not know/refused	3 (2.9%)
Has reliable transportation	85 (83.3%)
Use internet	33 (32.4%)
Hopi culture (yes/no)	
Primary language at home: Hopi	53 (52.0%)
Used traditional medicine at least once in past 5 years	4 (3.9%)
Health status (yes/no)	
Diabetes	46 (45.1%)
Thinks his health is better than most	66 (64.7%)
Healthy behaviors (yes/no)	
Current smoker	18 (17.7%)
Never smoked	42 (41.2%)
Have you ever visited a dentist?	73 (71.6%)
Have you ever had teeth cleaned	59 (57.8%)
Exercise at least once in past 30 days	75 (73.5%)
Screening history (yes/no)	
Ever had colorectal cancer screening (had colonoscopy or FOBT)	52 (51.0%)
Ever had prostate screening (had PSA or DRE)	36 (35.3%)
Cancer experience (yes/no)	
Has/had cancer	14 (13.7%)
Family history of cancer	36 (35.3%)
A caregiver	18 (17.7%)
Have you ever looked for information on cancer?	23 (22.6%)
Has a family member ever looked for information on cancer for you	11 (10.8%)
Applied for Radiation Exposure Compensation Education Program (RECEP)	6 (5.9%)
Attended at least 1 Hopi Cancer Support Services presentation	20 (19.6%)
Attitudes about cancer (strongly agree vs. somewhat agree/disagree/neither agree or disagree)	
Cancer almost always fatal	34 (33.3%)
Cancer often caused by a person's behavior or lifestyle	15 (14.7%)
Screening for cancer helps find cancer earlier	84 (82.4%)

screening, and the current study found that Hopi men had slightly higher CRC screening rate among Hopi men (51.0% having had either FOBT or colonoscopy) compared to other AI/AN men. PCa screening rates for Hopi men (35.3%) were similarly as low as AI/AN men in the Southwest.

The identified factors that were associated with cancer screening participation were consistent with findings from other studies in AI/ANs. First, studies have consistently found that younger age was associated with not having cancer screening [17–20]. In this study, younger men were less likely to have PCa screening than other men, and younger Hopi women also had reduced odds of undergoing CRC screening compared to old women in a previous study [12]. Second, studies in AI/ANs have shown that having a family history of cancer, a previous diagnosis of cancer, a personal health care provider, and multiple chronic medical conditions increased cancer screening [18–20]. Among Hopi men, previous cancer screening and having a cancer diagnosis increased the likelihood of having cancer screening. Having been treated for any medical conditions or exposure to health care system personally or through family members may have increased cancer screening awareness and facilitate cancer screening behaviors. Furthermore, in the Education and Research Towards Health study, additional factors associated with increased odds of cancer screening were having higher educations and income, while native language use at home was associated with reduced odds of cancer screening [20]. In this study, Hopi men with higher income showed a trend for significant association with cancer screening participation, but the use of Hopi language was not associated with undergoing cancer screening.

A lack of or inadequate knowledge on cancer screening was probably one of the major reasons why Hopi men reported that they did not have CRC or PSA screening, especially for men who did not report being treated for any medical conditions. Although 82% of men understood that cancer screening could help with early detection, it was not associated with cancer screening participation. Many men never looked for cancer information or had not attended cancer education presentations. Also, over 70% of Hopi men who have not had CRC or PCa screening reported lack of or insufficient knowledge and information on cancer screening as major reasons for not undergoing screening. "No one told me," "never heard of cancer screening," "don't know much about it," or "don't know where to get tested" were common reasons for not having had cancer screening. Previous studies in AIs have also reported the lack of and limited knowledge on cancer screening. A study conducted among AIs and NHWs who were newly diagnosed with cancer reported that AIs had significantly lower scores of cancer screening knowledge even after adjusting for socioeconomic and demographic factors [21]. A study to identify barriers to CRC screening for AI men and women from Kansas and Missouri reported that AI community members did not openly talk about CRC and lacked knowledge on CRC screening [4].

Table 2 Profile of cancer screening behaviors among Hopi men, aged 50 years or older, by type of screening test

Cancer screening type	FOBT	Colonoscopy	PSA
Ever screened	16 (15.7%)	46 (45.1%)	36 (35.3%)
Last screened			
< 1 year	3 (18.8%)	10 (21.7%)	15 (41.7%)
1~2 years	1 (6.3%)	7 (15.2%)	6 (16.7%)
2~3 years	7 (43.8%)	11 (23.9%)	5 (13.9%)
3~5 years	3 (18.8%)	7 (15.2%)	6 (16.7%)
5~10 years	2 (12.5%)	7 (15.2%)	2 (5.6%)
10 years	0 (0%)	3 (6.5%)	0 (0%)
> 10 years	0 (0%)	1 (2.2%)	2 (5.6%)
Main reason for most recent screen			
Health provider told me	2 (12.5%)	13 (28.3%)	9 (25.0%)
Routine test	11 (68.8%)	28 (60.9%)	25 (69.4%)
Specific problems	3 (18.8%)	5 (10.9%)	2 (5.6%)
Never screened	86 (84.3%)	56 (54.9%)	66 (64.7%)
Main reason for not screened			
Afraid results	2 (2.3%)	3 (5.4%)	2 (3.0%)
Afraid screen	2 (2.3%)	1 (1.8%)	2 (3.0%)
Do not know where to get tested	7 (8.1%)	4 (7.1%)	6 (9.1%)
Embarrassed	0 (0%)	1 (1.8%)	0 (0%)
Do not know much about it	11 (12.8%)	7 (12.5%)	10 (15.2%)
I am healthy	2 (2.3%)	3 (5.4%)	3 (4.6%)
I am too young	0 (0%)	0 (0%)	1 (1.5%)
I am too old	1 (1.2%)	0 (0%)	1 (1.5%)
Never heard of cancer screening	15 (17.4%)	10 (17.9%)	11 (16.7%)
No one told me	29 (33.7%)	27 (48.2%)	26 (39.4%)
No transportation	1 (1.2%)	1 (1.8%)	1 (1.5%)
Going to die anyway	0 (0%)	0 (0%)	1 (1.5%)
Do not have time	1 (1.2%)	2 (3.6%)	2 (3.0%)
Other	3 (3.5%)	3 (5.4%)	6 (9.1%)
Do not know/refused	6 (7.0%)	6 (10.7%)	6 (9.1%)

Another study also found a low level of cancer knowledge among AI/AN community members [22].

The findings from the current study and other studies in AI/AN communities illustrate needs for community education program to improve cancer screening awareness and cancer screening rates among Hopi men and in other AI/AN communities. The study participants in the studies in AI/AN communities expressed desire for more community cancer education [4, 22]. Community education, maybe led by Native Patient Navigators from their own communities, may improve cancer knowledge and increase cancer screening participation among AI/ANs [23, 24]. Many Hopi male study participants who were aged 50 years and older reported spoking Hopi language at home suggesting that cancer education may need to be conducted in both English and Hopi.

Changes in cancer screening guidelines may have increased confusion for community members. The US Preventive Services Task Force (USPSTF) recommends annual screening for CRC beginning aged 50 years old [25]. However, PCa screening guidelines are controversial [26–28]. For men with average risk, the USPSTF recommends individually based decision-making after discussing benefits and harms of PCa screening with their health care provider [26]. The USPSTF concluded that there was not enough evidence to provide recommendations for high-risk men. In contrast, the American Urological Association and the American Cancer Society emphasize the importance of early detection, discussion with clinicians about risks and benefits, and screening for high-risk men [27, 28]. The USPSTF recommendations are based on the number and quality of publications from cancer screening trials. However, due to the lack of high-quality publications on AI/AN men or men from other medically underserved racial/ethnic

Table 3 Factors associated with reporting CRC screening among Hopi men, aged 50 years or older

Variable	Unadjusted		Adjusted[1]	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Age < 65	0.75 (0.33–1.70)	0.50		
At least some college education	1.39 (0.63–3.05)	0.41		
Married	1.36 (0.62–2.98)	0.44		
Employed full time	1.04 (0.44–2.47)	0.92		
Income ≥ $35K	3.56 (1.27–9.99)	0.02	2.10 (0.68–6.53)	0.20
Has reliable transportation	2.97 (0.96–9.17)	0.06		
Use internet	1.48 (0.64–3.42)	0.36		
Hopi culture				
Primary language at home: Hopi	0.85 (0.39–1.85)	0.69		
Used traditional medicine at least once in past 5 years	3.00 (0.30–29.85)	0.35		
Screening history				
Ever had PCa screening	4.92 (1.99–12.15)	< 0.001	3.19 (1.21–8.46)	0.02
Cancer experience				
Has/had cancer	4.20 (1.10–16.11)	0.04	2.53 (0.59–10.83)	0.21
Family history of cancer	0.79 (0.35–1.79)	0.58		
A caregiver	1.65 (0.58–4.66)	0.35		
Sought cancer information for self	2.13 (0.81–5.59)	0.13		
Family member sought cancer information for you	1.17 (0.33–4.12)	0.80		
Applied for RECEP	5.21 (0.59–46.29)	0.14		
Health status				
Diabetes	2.07 (0.94–4.59)	0.07		
Current smoker	0.95 (0.34–2.64)	0.93		
Never smoked	0.57 (0.26–1.27)	0.17		
Thinks his health is better than most	0.90 (0.40–2.02)	0.79		
Relationship with HCSS				
Attended at least 1 HCSS presentation	2.05 (0.74–5.66)	0.17		
Healthy behaviors				
Has been to a dentist	3.18 (1.28–7.95)	0.01	2.03 (0.75–5.51)	0.17
Has had teeth cleaned	3.14 (1.38–7.13)	< 0.01		
Exercise at least once in past 30 days	0.64 (0.26–1.55)	0.32		
Attitudes about cancer (strongly agree)				
Cancer almost always fatal	1.34 (0.59–3.07)	0.48		
Cancer often caused by a person's behavior or lifestyle	2.14 (0.68–6.79)	0.20		
Screening for cancer helps find cancer earlier	2.42 (0.83–7.06)	0.11		

[1] Adjusted models include income, PCa screening, prior cancer diagnosis, having been to a dentist, and having had teeth cleaned

minority groups, the USPSTF cannot provide specific recommendations for AI/ANs. While high-quality research may help develop cancer screening recommendation for AI/AN men, Hopi Cancer Support Services should play a critical role in educating men on risk factors for cancers and cancer screening guidelines.

There are three limitations for this secondary analysis study. First, the 2012 Hopi Survey of Cancer and Chronic Disease survey included self-reported cancer screening behaviors. Self-reporting of past behaviors may have introduced a recall bias with over- or under-estimates of cancer screening behavior and knowledge. Second, there were only a small number of men eligible for this study which affected the power of the study. Moreover, men with previous diagnosis of cancer were included in this study to understand general cancer screening behavior among Hopi men. A study excluding men with a prior cancer diagnosis may be necessary to understand barriers to cancer screening, when they were not informed about cancer screening through their own experience of cancer diagnosis.

Table 4 Factors associated with having PCa screening among Hopi men, aged 50 years or older

Variable	Unadjusted		Adjusted[1]	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Age < 65	0.31 (0.13–0.73)	< 0.01	0.28 (0.10–0.77)	0.01
At least some college education	1.21 (0.54–2.75)	0.64		
Married	1.32 (0.58–2.99)	0.51		
Employed full time	0.61 (0.24–1.57)	0.31		
Income ≥ $35K	4.03 (1.53–10.64)	< 0.01	3.12 (0.98–9.96)	0.05
Has reliable transportation	5.00 (1.07–23.27)	0.04	3.41 (0.50–23.02)	0.21
Use internet	1.91 (0.81–4.48)	0.14		
Hopi culture				
Primary language at home: Hopi	0.53 (0.23–1.20)	0.13		
Used traditional medicine at least once in past 5 years	1.88 (0.25–13.96)	0.54		
Screening history				
Ever had CRC screening	4.92 (1.99–12.14)	< 0.001	3.15 (1.13–8.81)	0.03
Cancer experience				
Has/had cancer	5.96 (1.71–20.74)	< 0.01	5.28 (1.15–24.18)	0.03
Family history of cancer	0.88 (0.37–2.06)	0.76		
A caregiver	1.21 (0.42–3.45)	0.73		
Sought cancer information for self	1.24 (0.48–3.23)	0.66		
Family member sought cancer information for you	1.61 (0.46–5.71)	0.46		
Applied for RECEP	0.91 (0.16–5.24)	0.92		
Health status				
Diabetes	2.30 (1.00–5.26)	< 0.05	1.33 (0.49–3.64)	0.58
Current smoker	0.66 (0.21–2.02)	0.46		
Never smoked	0.60 (0.26–1.40)	0.24		
Thinks his health is better than most	0.79 (0.34–1.83)	0.58		
Relationship with HCSS				
Attended at least 1 HCSS presentation	2.15 (0.80–5.81)	0.13		
Healthy behaviors				
Has been to a dentist	3.54 (1.22–10.32)	0.02	1.47 (0.42–5.16)	0.55
Has had teeth cleaned	3.19 (1.30–7.81)	0.01		
Exercise at least once in past 30 days	0.73 (0.29–1.80)	0.49		
Attitudes about cancer (strongly agree)				
Cancer almost always fatal	0.67 (0.28–1.63)	0.38		
Cancer often caused by a person's behavior or lifestyle	1.27 (0.41–3.90)	0.68		
Screening for cancer helps find cancer earlier	3.24 (0.87–12.05)	0.08		

[1] Adjusted models include age, income, transportation, CRC screening, prior cancer diagnosis, diabetes, having been to a dentist, and having had teeth cleaned

Conclusion

This study found low CRC and PCa screening rates among Hopi men who were 50 years and older and live on the Hopi Reservation. A lack of knowledge on cancer screening may be one of the major factors for men reporting not ever having a cancer screening, illustrating the importance of community cancer education to increase cancer screening awareness among Hopi men. These findings on rural Hopi men may also apply to other AI men living in rural and remote reservations, where community members may not have information on the latest cancer screening recommendations.

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Authors' Contributions KB, PRS, LJ, DR, SRB, and RBH designed the research; KB, PRS, JO, and RBH wrote the manuscript; PRS, LJ, LJ, DR, SRB, DA, and RBH collected the data; CHH and KS performed statistical analysis; LB advised the research; all authors read and approved the final manuscript.

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Compliance with Ethical Standards

The research protocol was approved by the Hopi Tribal Council and The University of Arizona Institutional Review Board.

Conflict of Interest The authors declare that they have no conflict of interest.

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