HHS Public Access

Author manuscript

P R Health Sci J. Author manuscript; available in PMC 2014 August 07.

Published in final edited form as:

P R Health Sci J. 2013 June ; 32(2): 68–75.

Correlates of Colorectal Cancer Screening among Hispanics: Results from the 2008 Puerto Rico Behavioral Risk Factor Surveillance System Survey

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Abstract

Introduction—Colorectal cancer (CRC) is the second most commonly diagnosed cancer in Puerto Rico (PR). Given the lack of information on cancer screening behavior, we identified factors associated with CRC screening among adults aged ≥ 50 years in PR.

Methods—Age eligible adults who participated in the PR- Behavioral Risk Factor Surveillance System (BRFSS) in 2008 were included in the analysis (n=2,920). Weighted prevalence of fecal occult blood test (FOBT) within two years and of Sigmoidoscopy/Colonoscopy examination within five years before the interview were estimated and logistic regression models were used to assess factors associated with these CRC screening practices.

Results—Overall 8.2% (95% CI 7.1%-9.3%) of the participants had had the FOBT within the past two years, 39.8% (95% CI 37.7%-41.9%) had sigmoidoscopy/colonoscopy examination within 5 years and 46.7% (95% CI= 44.5%-48.8%) had ever had any type of CRC screening. Factors positively associated to CRC screening in multivariate analyses included older age, higher education, and having had a routine check-up in the past year. Gender, body mass index, and other relevant covariates evaluated were not associated to screening behavior.

Conclusions—Prevalence of CRC screening in PR during 2008 was below the goals established by Healthy People 2010 (50.0%) and 2020 (70.5%). We provide the first population-based estimates of CRC screening prevalence and correlates in a US predominantly Hispanic population. Low adherence to CRC screening may result in late stage at diagnosis and poorer disease outcomes. Public health efforts should focus on the promotion of CRC screening and early detection.

Introduction

Colorectal cancer (CRC) is the third most common cause of cancer death worldwide (1). In Puerto Rico, CRC is the second most commonly diagnosed cancer in both males and females, accounting for 14.0% of all cancers diagnosed in both genders from 2005-2009 (2). The incidence and mortality trends of CRC have been shown to be increasing in Puerto Rico, particularly among males (Annual percent change $[APC]_{incidence}$= 2.6%, $APC_{mortality}$= 3.8%), contrary to declining patterns observed among other racial/ethnic groups in the United States (3); this pattern highlights a clear health disparity for this populaiton.

The United States Preventive Services Task Force (USPSTF) guidelines recommend regular screening for CRC, in adults, starting at age 50 years and continuing until age 75 years, by any of the following regimens: 1) annual fecal occult blood testing (FOBT), 2) sigmoidoscopy examination every 5 years combined with fecal occult blood testing every 3 years, or 3) screening colonoscopy at intervals of 10 years (4). In the United States, despite these recommendations, and although significant increasing trends have been documented in the proportion of adults up-to-date with CRC screening from 2000 to 2010, 2010 screening rates, according to the National Health Interview Survey, were still below (58.6%) (5) the *Healthy People 2020* target of 70.5% (6). Although data from the Behavioral Risk Factor Surveillance Survey (BRFSS) also supports this increase in CRC screening in the United States and Puerto Rico, particularly in the use of sigmoidoscopy/colonoscopy examination (Figure 1) (7), the use of these procedures remains low, especially among Hispanics (5, 8-10).

Although CRC screening has been shown to improve treatment outcomes and survival, to our knowledge, no population-based study has previously analyzed factors associated to CRC screening practices in Puerto Rico, a predominantly Hispanic population. This information is essential for the development of targeted interventions and early detection programs in the island. This study aimed to determine the prevalence and factors associated to CRC screening among the population aged ≥50 years living in Puerto Rico.

Methods

We conducted a secondary data analysis of the Puerto Rico Behavioral Risk Factor Surveillance System (PR-BRFSS) conducted in 2008. PR-BRFSS is an annual landline telephone-based survey designed to measure chronic diseases and behavioral risk factors in the adult population 18 years of age or older in Puerto Rico. Initiated in 1996, the PR-BRFSS is conducted by the PR Department of Health in collaboration with the Centers for Disease Control and Prevention (CDC) using a representative data sampling frame for

Puerto Rico. The survey provides data that could be compared across participants; which includes 50 states, the District of Columbia, Guam, the Virgin Islands, and Puerto Rico (11). PR-BRFSS data are recognized as a vital component of the public health monitoring system for the adult residents of Puerto Rico. In addition, the data are used for planning, evaluating and developing public health programs and initiatives for Puerto Rico's adult population. PR-BRFSS data collection instrument is administered by trained interviewers and has an average duration of 17 minutes. Foreigners living in Puerto Rico are also included as part of the survey. For this analysis, we included the 2,920 (65.3% of total sample) adults aged ≥50 years out of the 4,475 adults who participated in the survey that year and that had complete information on CRC screening practices. The majority of age-eligible participants (>96%) responded to the questions of CRC screening. The Institutional Review Board of the University of Puerto Rico Medical Sciences Campus approved this study.

The three outcome variables of interest for this analysis were the proportion of people who had 1) had a FOBT within two years before the interview, 2) a sigmoidoscopy/colonoscopy examination within the five years before the interview, and 3) a combined variable that assessed use of FOBT within two years or sigmoidoscopy/colonoscopy within five years of the interview. Covariates of interest included demographic characteristics, such as gender, age in years, marital status, educational attainment, annual household income, health care coverage, and employment status. Clinical characteristics included body mass index (BMI), routine checkup in the past year, and perceived general health status. Lifestyle characteristics included current smoking status (yes/no), heavy alcohol consumption (consuming for than 1 [women] or 2 [men] alcoholic beverages per day), binge drinking (consuming more than 4 [women] or 5 [men] alcoholic beverages on a single occasion in the past 30 days, [yes/no]), and leisure-time physical activity in the past 30 days.

We performed the statistical analysis using SAS version 9.2 (SAS Institute, Inc, Cary, North Carolina). We first described the study sample according to demographic, clinical, and lifestyle characteristics. Then we assessed the relationship between CRC screening behaviors and specific covariates using Wald Chi-Square Test. Two-sided significance level was established at $p<0.05$.

We estimated the prevalence odds ratios (OR) and their 95% confidence intervals (CI) to determine the magnitude of the association between the specific factors and each CRC screening behavior. To further assess these relationships, we constructed a multivariable logistic regression model for each of the three study outcomes. For each CRC screening outcome, we included the variables at least marginally associated with the outcome ($P < 0.10$) in the bivariate analyses in the respective multivariable logistic regression model. In addition, given its relevance in the literature, we also controlled all models for gender and educational attainment. We used the Hosmer and Lemeshow Goodness-of-Fit Test and residual analyses to evaluate the models. We tested for interactions using the Likelihood ratio (LR) test (12). All data were weighted using post-stratification methodology in which the sample was adjusted using 2008 population data (based on Census 2000 estimates) by gender, age and health region to represent Puerto Rico's population.

Results

Approximately 58% of the participants were 50-64 years of age, 54.4% were females, and 63% had more than high-school education. Also, 27.2% were employed, 95.4% reported having health care coverage, 46.5% reported to be in good or excellent general health and 88.1% had a routine checkup in the previous year (Table 1).

Overall, 8.2% (95% CI= 7.1%-9.3%) of adults had had a FOBT within the past two years; 39.8% (95% CI= 37.7%-41.9%) had sigmoidoscopy/colonoscopy examination within five years; 42.3% (95% CI= 40.3%-44.4%) had either of the recommended CRC screening tests within these time periods (Table 2); and 46.7% (95% CI= 44.5%-48.8%) reported ever having had any type of CRC screening.

In the bivariate analysis, having had an FOBT test within 2 years was significantly ($p<0.05$) associated with age, marital status, employment status, and routine checkup in the past year (Table 2). Having had a sigmoidoscopy/colonoscopy examination within 5 years was significantly ($p<0.05$) associated with age, education, marital status, employment status, health care coverage, smoking, perceived general health status and routine checkup in the past year. Finally, the analysis for any CRC screening test (FOBT or sigmoidoscopy/ colonoscopy combined within the defined time periods) showed that the associations were similar to the sigmoidoscopy/colonoscopy outcome. Sex, BMI, binge drinking and physical activity were not associated to the prevalence of any of the CRC screening tests evaluated. Household income was excluded from multivariate analysis given the number of individuals (n=435, 14.4%) with missing information on this variable.

The multivariable logistic regression model for FOBT showed that people aged 65-75 ($\hat{OR}$: 1.89, 95% CI=1.34-2.67) and those aged older than 75 years ($\hat{OR}$: 1.79, 95% CI=1.18-2.72) were more likely to have had an FOBT within the past two years compared with people aged 50-64 years. Participants who had less than high school ($\hat{OR}$: 0.79, 95% CI=0.51-0.99) were less likely to have had an FOBT than those with higher educational level. Finally, people who reported a routine checkup in the past year had higher odds of having been screened with FOBT, however this association was marginally significant ($\hat{OR}$: 1.71, 95% CI=1.00-2.92) (Table 3).

According to the sigmoidoscopy/colonoscopy multivariate logistic regression model, people aged 65-75 ($\hat{OR}$: 1.65, 95% CI=1.35-2.03) and those >75 years ($\hat{OR}$: 2.24, 95% CI=1.73-2.91) had significantly higher odds of having had the sigmoidoscopy/colonoscopy examination within five years than those aged 50-64 years. Participants who had completed high school ($\hat{OR}$: 0.66, 95% CI=0.54-0.81) and those with less than high school ($\hat{OR}$: 0.39, 95% CI=0.31-0.48) had significantly lower odds of having sigmoidoscopy/colonoscopy examination than those with more than high school education. Employed individuals ($\hat{OR}$: 0.55, 95% CI=0.44-0.68) also had lower odds of having sigmoidoscopy/colonoscopy than those unemployed. Finally, people who reported a routine checkup in the past year ($\hat{OR}$: 2.56, 95% CI=1.90-3.46) had higher odds of having been screened as compared to those who had not had a routine checkup. Smoking, education, marital status and health-care coverage were not associated to this outcome in multivariate analyses ($p>0.05$).

The third multivariate logistic regression model for any CRC screening test (FOBT or sigmoidoscopy/colonoscopy combined) showed that the factors associated to this outcome were similar to those associated to sigmoidoscopy/colonoscopy examination in multivariate analysis (Table 3). No significant interactions were found in any of the previous three the models, and all of them showed to have a good fit ($p>0.05$).

Discussion

In 2004, premature CRC related deaths accounted for 11.7% ($7.5 million) of the total productivity loss in Puerto Rico, making it the second most costly cancer in this population (13). This issue is of concern as CRC is highly preventable and can be diagnosed early. Correlates of cancer screening practices help describe and explain how CRC screening is used in the population, information that is of great relevance for the development of CRC prevention and control strategies. This study provides the first population-based estimates of CRC screening prevalence and describes its correlates in Puerto Rico, a predominantly Hispanic subpopulation of the United States. Our results demonstrate that less than half (42.3%) of the population aged ≥ 50 years in Puerto Rico in 2008 reported undergoing CRC screening test within the USPSTF recommended time intervals. This is below the prevalence of CRC screening in adults aged 50 to 75 years living in the United States in 2008 (62.9%) (10) and in 2010 (58.6%) (5), and below the Healthy People 2010 (50%) (14) and 2020 goals (70.5%) (6). Similar results are observed when we limit our prevalence estimate to people aged 50 to 75 years in Puerto Rico (40.1%, 95% CI=37.8%-42.4%). Our result is consistent with racial/ethnic disparities in CRC screening that exist in the United States, with lowest rates observed among Hispanics (5,8-10). In 2008, more non-Hispanics (59.8%) reported having had lower endoscopy (sigmoidoscopy or colonoscopy) within the past 10 years compared with Hispanics (45.8%); estimates were also higher for non-Hispanic Whites (59.8%) and Blacks (56.6%) (10). Meanwhile, recent data from the 2010 NHIS have also shown that CRC screening in the United States during this period was lower among Hispanics (46.5%) than among non-Hispanics (59.9%) (5). Our results also show that Puerto Ricans have lower adherence rates to CRC screening compared with Hispanics living in New York (15). In 2008, 14.4% of Hispanics, 17.9% of Blacks, and 19.3% of non-Hispanic Whites in New York reported FOBT within the past two years, compared with only 8.2% of Puerto Ricans in the current study. Similarly, 59.1% of Hispanics in New York self-reported to have had sigmoidoscopy or colonoscopy examination within five years, compared with 39.8% of the participants in our study.

Screening for CRC reduces mortality by allowing detection of cancer at earlier and more treatable stages (16). FOBT screening has been shown to reduce CRC mortality by 18%-33% in randomized, controlled trials (17-18); and screening with more sensitive FOBT, flexible sigmoidoscopy, colonoscopy, or combinations of these tests also reduce the burden of CRC (19). Although the prevalence of advanced colorectal neoplasia (adenomas ≥1 cm and/or advanced histology) among screening colonoscopy cohorts has been shown to be lower in Puerto Rican than that reported for Hispanics in the United States (20), the lower adherence rates to CRC screening observed in Puerto Rico may result in late stage diagnosis, higher mortality, and, thus, poorer disease outcomes in this population (3). Efforts must be made to increase the prevalence of CRC screening in the Puerto Rican population,

particularly among men, who have exhibited increasing CRC incidence and mortality rates (3), and among underserved populations identified in this study. For example, and consistent with other studies in the United States (5,21), older individuals in Puerto Rico were more likely to be screened for CRC than younger individuals. This is of concern as although current screening guidelines include people aged 50-64 years, our results support that this group is not properly benefiting from screening. Also of interest is the fact that although current USPSTF guidelines recommend to continue screening until the age of 75 years, a high prevalence of CRC screening was observed among adults aged older than 75 years in Puerto Rico. This evidences that physicians in Puerto Rico are using this test upon discretion after this age.

Higher educational attainment and having a routine checkup in the past year were also associated with a greater likelihood of being screened for CRC in our study population, a finding that is consistent with earlier studies (5,9,21-22). This last result is also consistent with a previous study that documented that routine check-up in the past year was also positively associated to cervical cancer screening in women in Puerto Rico (23). These associations suggest that opportunistic screening is occurring as part of these regular interactions of patients with the health care system. Also consistent with this finding, previous studies have in fact reported that lack of physician discussion was responsible for not being current with screening (24) and that one-on-one patient interactions with practice staff, patient reminders, and system level interventions improve CRC screening (25). Meanwhile, employed individuals were less likely to have ever had an FOBT or a sigmoidoscopy/colonoscopy or to have had been screened with sigmoidoscopy/colonoscopy within the past five years than those unemployed. This is consistent to results in the United States (9) where retired and out of work persons have been shown to be more likely to have had an FOBT within the past year and/or colonoscopy/sigmoidoscopy examination within the preceding 5 years. Despite employed individuals are more likely to have a health insurance, the time commitments required to prepare for and perform CRC screening tests might be a barrier. Furthermore, 6.5% of employed individuals in our sample did not have health insurance, a factor that could also influence the observed result. In our study, no gender differences were seen in CRC screening. This result is consistent with the nearly identical proportions of men (58.5%) and women (58.8%) reported being up-to-date in CRC screening in the 2010 NHIS survey (5). Meanwhile, our results of no association between BMI and FOBT are consistent with previous data from the 2001 BRFSS performed in the United States (26). Nonetheless, contrary to our results, this study performed in the United States by Heo and colleagues found that overweight and obese men (class I) were significantly more likely to have been screened with sigmoidoscopy in the past 5 years than their normal weight counterparts, while obese women (class I and II) were less likely to undergo screening, suggesting that BMI may be associated with CRC screening behavior in different ways between genders (26).

In the United States, the improvement of CRC screening utilization has occurred in the context of expanding Medicare coverage (27-28). Altough most of our study sample had health care coverage (95.4%), contrary to data in the United States (5,22), in Puerto Rico, having health insurance coverage was not associated with CRC screening test in this study. Given the low adherence rates of CRC screening observed in our study, this result suggests

that despite health care coverage, many persons in Puerto Rico are not complying with CRC screening guidelines. In the US, lack of physician's recommendation to perform the corresponding tests is one of the most common barriers among persons who reported no CRC testing (22). Given that this information is not available in the BRFSS database, future studies in Puerto Rico should explore the barriers to physician recommendation such as insurance coverage, dealing with other urgent medical problems, prior patient refusal of screening, physician forgetfulness, lack of reminders, and inadequate patient tracking systems (29). Furthermore, these studies should evaluate if differences in screening practices exist between those with private and those with government-based health care coverage. This is of relevance, as for example, in the United States, Medicaid coverage has been associated with lower screening rates (9). All this information will help elucidate if it is patient's behavior and/or physician/health-care system barriers that most influence CRC screening practices.

Our study has several limitations. The response rate for the PR-BRFSS 2008 was 70.2%, and although response rate of questions related to CRC screening was high (>96%), this non-response may introduce selection bias in our study. However, response rates in Puerto Rico for 2008 were much higher than those in the overall United States BRFSS for the same year (median=53.3%) (30). Also, self-reported information of participants could have introduced information bias. In addition, because the BRFSS is a telephone-based survey, it is unable to survey those who reside in households without telephone access. Consequently, the above data may not be generalizable to the entire adult Puerto Rican population aged ≥50 years. Finally, although differences in CRC screening by socioeconomic status and other related indicators have been reported in previous studies in the United States (21, 31), our study could not evaluate this variable in multivariate analysis given the high percentage of individuals with missing data. Nonetheless, this study provides the first population-based estimates of CRC screening prevalence and an understanding of how these practices vary across demographic, clinical, and lifestyle characteristics in the Puerto Rican population. Future studies should further evaluate how social determinants of health may be related to CRC screening behavior. In addition, as delineated by the Cancer Control Plan for Puerto Rico (32), it is important to increase knowledge about CRC cancer screening and early detection among the Puerto Rican population with particular emphasis on high-risk geographic areas and high-risk populations (i.e. uninsured, low-educational level, rural communities, undocumented immigrants, and handicapped populations). Population-based programs, such as the CDC's Colorectal Cancer Control Program, that target underserved populations should be implemented in this population (33).

In conclusion, our study found a low prevalence of use of CRC screening methods in Puerto Rico in 2008 that was below screening rates in the United States and Healthy People 2010 and 2020 recommendations. This finding has public health implications as this low adherence to CRC screening may result in late stage at diagnosis and poorer disease outcomes, and thus have an impact on CRC morbidity and mortality. In addition, main correlates of underutilization of CRC screening included being aged 50-64 years, having low educational attainment, being employed and not having had a routine clinical check-up in the past year. Results from this study should be used for the development of targeted intervention efforts in Puerto Rico aimed at reducing CRC disparities in this population.

These interventions should be promoted through the Cancer Control Coalition and the Colorectal Cancer Coalition of Puerto Rico; and should focus on the promotion of screening practices among these identified under-screened populations. Furthermore, CRC prevention and education in Puerto Rico will be necessary at all levels, from the healthcare providers to the general population, to effect change.

Acknowledgments

The project described was supported by U54CA096297 and U54CA096300 from the "UPR-MDACC Partnership for Excellence in Cancer Research program" from the National Cancer Institute, National Institutes of Health (NIH); U54RR026139- 01A1 from the National Center for Research Resources; 8U54MD007587-03 from the National Institute on Minority Health and Health Disparities (NIH); and by 5U58DP222931- 05 (PR-Behavioral Risk Factor Surveillance System) from the Centers for Disease Control and Prevention. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute.

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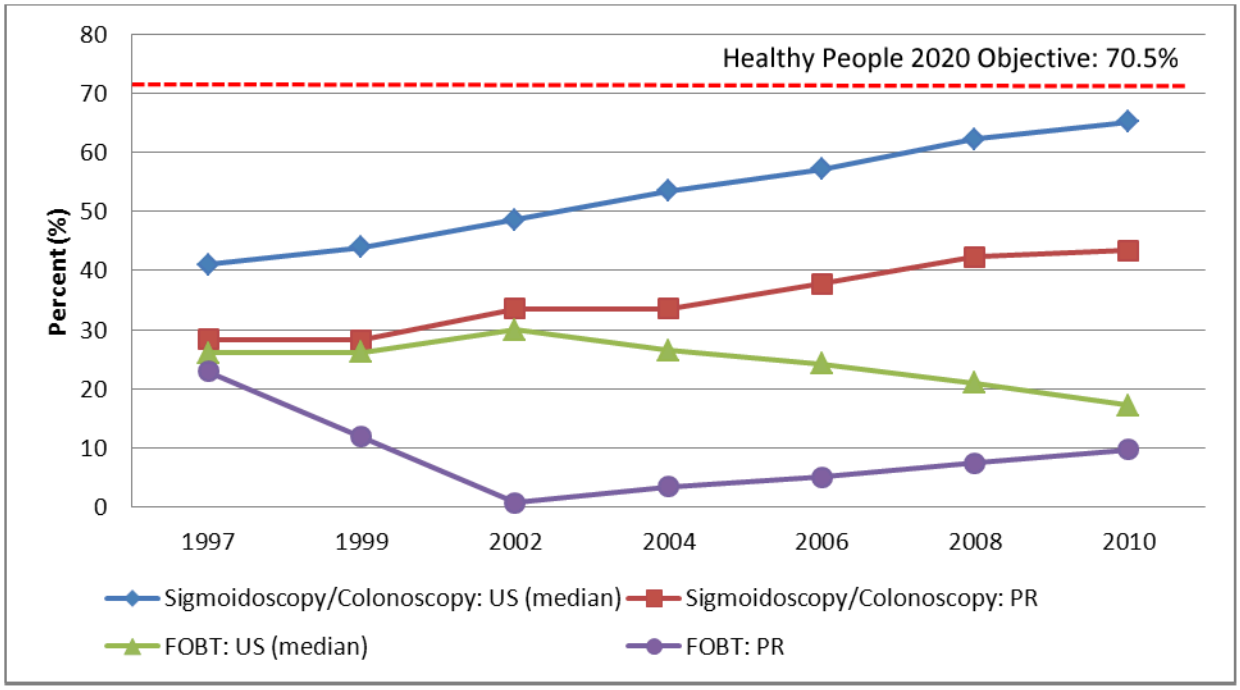

Figure 1.

Weighted percentage of adults aged 50+ who have ever had a sigmoidoscopy or colonoscopy and who have had a blood stool test within the past two years in the US and Puerto Rico, BRFSS (1997-2010) (7).

Table 1

Demographic characteristics and medical history of persons aged ≥ 50 years, Behavioral Risk Factor Surveillance System (BRFSS) Puerto Rico, 2008

Characteristic	All Respondents	
	n	% (95% CI)
Age group (years) (N=2,920)		
50 –64	1,688	57.8 (55.8-59.8)
65 –75	764	26.2 (24.5-27.9)
>75	468	16.0 (14.6-17.4)
Gender (N=2,920)		
Male	1,331	45.6 (43.4-47.7)
Female	1,589	54.4 (52.3-56.6)
Education level (N=2,916)		
< High School	1,078	37.0 (35.0-39.0)
High School Graduate	753	25.8 (23.9-27.7)
> High School	1,085	37.2 (35.1-39.3)
Marital status (N=2,912)		
Married/Cohabitating	1,923	66.0 (64.1-67.9)
Divorced/Separated	393	13.6 (12.2-14.9)
Widowed	453	15.5 (14.3-16.8)
Single	143	4.9 (4.0-5.8)
Employment status (N=2,920)		
Employed	794	27.2 (25.1-29.3)
Not employed	459	15.7 (14.1-17.3)
Retired	604	20.7 (19.1-22.3)
Homemaker	1063	36.4 (34.4-38.4)
Household income (N=2,485)		
≤ $14,999	1,234	49.7 (47.3-52.0)
$15,000 - $34,999	875	35.2 (32.9-37.5)
$35,000 - $49,999	178	7.2 (5.8-8.5)
≥ $50,000	198	8.0 (6.6-9.4)
Have any health care coverage (N=2,916)		
Yes	2,781	95.4 (94.5-96.3)
No	135	4.6 (3.7-5.5)
Perceived general health status (N=2,905)		
Good to Excellent	1,352	46.5(44.4-48.7)
Fair to Poor	1,553	53.5(51.3-55.6)
Routine checkup in the past year (N=2,827)		
Yes	2,491	88.1 (86.6-89.6)
No	336	11.9 (10.4-13.4)

Characteristic	All Respondents	
	n	% (95% CI)
Body mass index (BMI) (N=2,733)		
Underweight/Normal	816	29.9 (27.9-31.8)
Overweight	1,148	42.0 (39.8-44.2)
Obese	769	28.1 (26.1-30.2)
Heavy alcohol consumption (N=2,875)		
Yes	475	16.5 (14.9-18.2)
No	2400	83.5 (81.8-85.2)
Binge drinking (N=2,870)		
Yes	43	1.5 (1.0-2.1)
No	2827	98.5 (98.0-99.1)
Current smoking status (N=2,919)		
Yes	252	8.6 (7.4-9.9)
No	2667	91.4 (90.1-92.6)
Leisure-time physical activity (N=2,920)		
Yes	1380	47.3 (45.1-49.4)
No	1540	52.7 (50.6-54.9)

Abbreviations: CI, confidence interval.

Table 2

Factors associated to Colorectal Cancer Screening tests among persons ≥ 50 years, Behavioral Risk Factor Surveillance System (BRFSS) Puerto Rico, 2008 (N=2,920)

Characteristic	FOBT within 2 years % (95% CI) (n=2848)	p-value[a]	Sigmoidoscopy/Colonoscopy within 5 years % (95% CI) (n=2830)	p-value[a]	FOBT within two years or Sigmoidoscopy/Colonoscopy within 5 years % (95% CI) (n=2901)	p-value[a]
All Respondents	8.2 (7.1-9.3)	NA	39.8 (37.7-41.9)	NA	42.3 (40.3-44.4)	NA
Age Group (years)						
50 – 64	6.1 (4.7-7.5)	<0.001	33.3 (30.4-36.1)	<0.001	35.7 (32.8-38.6)	<0.001
65-75	11.2 (8.9-13.4)		46.7 (43.1-50.3)		50.0 (46.2-53.3)	
>75	11.1 (8.2-13.9)		53.1(48.4-51.6)		54.3 (49.8-59.0)	
Gender						
Male	8.5 (6.7-10.4)	0.61	37.8(34.4-41.2)	0.09	40.4 (37.0-43.7)	0.09
Female	8.0 (6.6-9.3)		41.5(38.9-44.1)		44.0 (41.4-46.6)	
Education Level						
< High School	7.8(6.1-9.5)	0.36	33.7(30.6-36.8)	<0.001	36.5 (33.3-39.6)	<0.001
High School Graduate	7.3(5.3-9.4)		39.7(35.4-43.9)		41.4 (37.2-45.6)	
> High School	9.3(7.3-11.2)		45.7(42.1-49.3)		48.7(45.1-52.3)	
Marital Status						
Married/Cohabitating	7.9 (6.5-9.5)	0.03	41.6(38.8-44.3)	<0.001	43.7(40.9-46.4)	<0.001
Divorced/Separated	6.6 (4.3-8.8)		30.9 (26.3-35.6)		33.4(28.8-38.1)	
Widowed	11.6 (8.9-14.2)		41.7 (37.5-45.8)		45.9(41.7-50.0)	
Single	6.5 (2.6-10.4)		34.3 (26.0-42.7)		37.0(28.5-45.4)	
Employment Status						
Employed	7.1 (5.0-9.2)	<0.001	28.0(23.8-32.1)	<0.001	31.8(27.5-36.1)	<0.001
Not employed	5.9 (3.4-8.4)		41.9(36.4-47.5)		42.4(36.9-47.9)	
Retired	4.9 (3.2-6.5)		36.8(32.7-40.9)		38.9 (34.9-43.0)	
Homemaker	2.0 (9.9-14.1)		49.7(46.4-53.0)		52.1(48.9-55.3)	
Health Care Coverage						
Yes	8.3(7.2-9.4)	0.45	40.6(38.5-42.8)	<0.001	43.2 (41.1-45.3)	<0.001
No	6.4(1.7-11.1)		23.3(15.3-31.4)		24.2 (16.1- 32.2)	

Characteristic	FOBT within 2 years % (95% CI) (n=2848)	p-value[a]	Sigmoidoscopy/Colonoscopy within 5 years % (95% CI) (n=2830)	p-value[a]	FOBT within two years or Sigmoidoscopy/Colonoscopy within 5 years % (95% CI) (n=2901)	p-value[a]
Perceived General Health Status						
Good to Excellent	8.1 (6.5-9.7)	0.85	36.7 (33.6-39.7)	0.006	39.6 (36.5-42.7)	0.02
Fair to Poor	8.4(6.8-9.9)		42.6(39.7-45.4)		44.8 (42.0-47.6)	
Routine checkup in the past year						
Yes	8.9 (7.6-10.1)	0.01	43.1 (40.8-45.3)	<0.001	45.5 (43.2-47.8)	<0.001
No	4.8 (2.0-7.6)		19.0 (13.9-24.0)		22.3 (16.9-27.7)	
Body mass index (BMI)						
Underweight/Normal	7.4 (5.5-9.2)	0.47	42.6 (38.7-46.5)	0.26	45.0 (41.1-48.9)	0.40
Overweight	8.9 (7.1-10.8)		40.2 (36.8-43.6)		42.5 (39.2-45.9)	
Obese	8.5(6.3-10.8)		37.8 (33.7-41.9)		41.2 (37.0-45.3)	
Heavy alcohol consumption						
Yes	8.7 (5.8-11.6)	0.76	40.7 (35.3-46.2)	0.78	42.8 (37.3-48.2)	0.95
No	8.2 (7.0-9.4)		39.9(37.6-42.2)		42.6 (40.3-44-9)	
Binge drinking						
Yes	8.4(0.0-19.0)	0.98	29.4 (12.8-46.0)	0.24	27.5 (12.0-43.0)	0.10
No	8.3(7.2-9.4)		40.3 (38.2-42.4)		42.9 (40.8-45.0)	
Current smoking status						
Yes	7.9(4.0-11.9)	0.88	31.9 (24.7-39.1)	0.03	35.2 (28.0-42.5)	0.05
No	8.3(7.1-9.4)		40.6 (38.4-42.8)		43.0 (40.9-45.2)	
Leisure-time physical activity						
Yes	8.7(7.1-10.2)	0.46	40.1 (37.8-43.8)	0.38	43.9 (40.8-46.9)	0.17
No	7.8(6.3-9.4)		38.9 (36.0-41.8)		40.9 (38.1-43.8)	

Abbreviations: FOBT, fecal occult blood test; CI, confidence interval; NA, not applicable.

[a]Calculated by using Wald χ^2 tests. Significant p-value: $p<0.05$

Table 3

Multivariate logistic regression models of factors associated to CRC Screening tests among persons ≥ 50 years, BRFSS PR, 2008

	FOBT within two years	Sigmoidoscopy/Colonoscopy within 5years	FOBT within two years or Sigmoidoscopy/Colonoscopy within 5 years
Predictor	$\hat{OR}$ **(95%CI)**[a]	$\hat{OR}$ **(95%CI)**[a]	$\hat{OR}$ **(95%CI)**[a]
Gender			
Female	0.88 (0.66-1.19)	1.10 (0.92-1.30)	1.10 (0.93-1.30)
Male	1.00	1.00	1.00
Age in years			
50-64	1.00	1.00	1.00
65-75	1.89 (1.34-2.67)	1.65 (1.35-2.03)	1.69 (1.38-2.06)
>75	1.79 (1.18-2.72)	2.24 (1.73-2.91)	2.11 (1.64-2.71)
Education Level			
Less than High School	0.79 (0.51-0.99)	0.39 (0.31-0.48)	0.66 (0.53-0.80)
High School	0.94 (0.43-2.09)	0.66 (0.54-0.81)	0.42 (0.34-0.51)
More than High School	1.00	1.00	1.00
Marital status			
Divorced/Separated	0.94 (0.43-2.09)	0.73 (0.47-1.13)	0.74 (0.48-1.13)
Widowed	1.11 (0.55-2.24)	0.88 (0.57-1.38)	1.04 (0.68-1.60)
Married/Cohabitating	1.60 (0.75-3.42)	1.25 (0.84-1.84)	1.22 (0.84-1.79)
Single	1.00	1.00	1.00
Employment status			
Yes	1.10 (0.55-2.24)	0.55 (0.44-0.68)	0.63 (0.51-0.77)
No	1.00	1.00	1.00
Health care coverage			
Yes	NA	1.39 (0.87-2.20)	1.51 (0.97-1.34)
No		1.00	1.00
Perceived general health status			
Fair to Poor	NA	1.17 (0.99-1.39)	1.14 (0.96-1.34)
Good to Excellent		1.00	1.00
Routine checkup past year			
Yes	1.71 (1.00-2.92)	2.56 (1.90-3.46)	2.33 (1.76-3.10)
No	1.00	1.00	1.00
Current smoking status			
Yes	NA	1.03 (0.76-1.40)	1.09 (0.84-1.47)
No		1.00	1.00

Abbreviations: FOBT, fecal occult blood test; CI, confidence interval; NA, not applicable.

[a] Significant p-value: $p < 0.05$