Disparities in Preventive Care in Relation to Region, Healthcare Access, Race, Gender, and Socioeconomic Status in North Carolina

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Abstract

The purpose of this study was to investigate the relationship between preventive care and various demographic factors in Eastern North Carolina. The study assessed whether there are significant disparities in the use of preventive care by different demographic groups, which could partially explain why certain illnesses affect and lead to death more frequently among certain people. The preventive care measures examined in this study were influenza shot, pneumonia shot, diabetes screening, cholesterol screening, breast cancer screening, cervical cancer screening, prostate cancer screening, and colorectal cancer screening. The demographic variables were region, healthcare access, race and ethnicity, gender, and socioeconomic status. Data from the North Carolina Behavioral Risk Factor Surveillance System (BRFSS) was analyzed using SUDAAN and SAS. The results of this study support the hypothesis that there are certain groups of people who are less likely to utilize preventive care than other groups. The people who have the lowest use of preventive care are those who have no healthcare coverage, those with no personal healthcare provider, minorities, and people of lower education and income levels. The results from this study can be used to determine which groups are in need of preventive care promotion.

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Introduction

Healthy People 2020 has established science-based national objectives for improving the health of all Americans over this decade. An overarching goal for Healthy People 2020 is to attain high-quality, longer lives free of preventable disease and premature death for all people. Another major objective is the elimination of health disparities due to socioeconomic status, race or ethnicity, geographic location, and any other demographic factor in order to achieve health equity for all Americans. One way Healthy People 2020 plans on achieving these goals is by promoting preventive care to all groups of people, and by eliminating any disparity in the use and access of preventive care.[1]

Heart disease, cancer, diabetes, influenza, and pneumonia are all among the top ten leading causes of mortality in North Carolina.[2] These diseases can be prevented or at least detected by the use of some sort of preventive care, which can increase the chance for survival. Preventive care includes vaccinations and screening for certain diseases. Table 1 displays some of the prevention and screening recommendations for influenza, pneumonia, diabetes, heart disease, breast cancer, cervical cancer, prostate cancer, and colorectal cancer. It also includes the recommended ages and how frequently the screening or immunization should be received. Healthy People 2020 aims to increase the percentage of people who undergo these preventive care measures, specifically influenza and pneumonia immunizations, cholesterol and diabetes screenings, and breast, cervical, and colorectal cancer screenings.[1]

Screenings are used to detect health problems before symptoms are visible, and they are especially important for detecting certain kinds of cancer. Breast, colorectal, cervical, and prostate cancers can all be diagnosed early through screening; however, screening has only been found to reduce the mortality for breast, colorectal, and cervical cancers. Regular cancer

screenings can result in the removal of precancerous growth and a diagnosis of early stage cancer, which is when it is most treatable. [3] Over the past 30 years, mortality due to colorectal cancer has significantly declined, which has been associated with advancements in cancer screening and early detection. [4] This finding provides evidence that early detection through cancer screening can lower cancer mortality.

Influenza and pneumonia vaccinations are also important components of a preventive care routine. The most effective way of preventing the influenza virus and its complications is receiving an influenza vaccine annually. Some studies have shown that influenza vaccination can be up to 80% effective in preventing influenza mortality. [5] Pneumonia vaccine has been found to reduce the risk of systemic infection due to all pneumococcal types by 73%. [6]

One of the leading risk factors for developing heart disease is having high cholesterol. Blood cholesterol screening and early intervention have been found to reduce the risks associated with high blood cholesterol, including heart disease. [7] Screening for Type 2 diabetes using a blood sugar test is also a recommended preventive behavior because early detection and treatment may reduce the complications associated with diabetes. Individuals with undiagnosed Type 2 diabetes have a significantly higher risk for complications such as stroke, heart disease, and peripheral vascular disease than those who do not have diabetes. [8]

Research has consistently found that health disparities are common between different groups of people in society. People living in Eastern North Carolina tend to have higher rates of morbidity and mortality due to illness than do other regions in North Carolina. Ethnic and racial minorities and people of low socioeconomic status have higher rates of morbidity and mortality than do Whites and people of higher socioeconomic status. People with no healthcare access and men also have higher rates of morbidity and mortality due to illness than do people with health

access and women. Numerous studies have sought to explain health disparities, but little research has been done to see if differences in preventive care could play a role in creating the disparities. This study will assess whether there are significant disparities in the use of preventive care by these different groups, which could help explain why certain illnesses affect and lead to death in certain groups more frequently.

In this study, Eastern North Carolina is defined as the 41 counties of the Coastal Plain that are east of Interstate 95. In general, Eastern North Carolina is worse than rest of the state in mortality rates and health related measures.[9] For example, Eastern North Carolina has historically had a higher level of cancer mortality and incidence than the rest of the state, including breast, colorectal, and cervical cancer.[10] By seeing how the use of preventive care in Eastern North Carolina differs from the rest of the state, we can see whether this is a factor that contributes to the region's relatively lower health level. Since Eastern North Carolina has a higher mortality and morbidity rate than the rest of the state, the first hypothesis was that Eastern North Carolinians are less likely to use preventive care than people living in other regions of North Carolina.

In North Carolina, there are significant disparities between the majority and minority populations in mortality rates for many illnesses.[2] Minorities, defined as non-Whites, are more frequently affected by type 2 diabetes; they constitute 25% of all American adult diabetes patients, though they only make up 30.9% of the U.S. population.[1] In Eastern North Carolina the diabetes mortality rate among non-Whites is 129% greater than the White rate.[2] A high level of minority- majority disparity also exists for certain types of cancer. The breast cancer rate among non-White women was 71% greater than that of White women in 2007, and the disparity is continuing to worsen.[11] From 2004 to 2008, White women had a 15% higher rate of breast

cancer than African American women in Eastern North Carolina; however, during the same time period, African American women had a 38% higher breast cancer mortality rate, suggesting that they were not receiving adequate screening or treatment as compared to White women.[10] One study of colorectal, breast, and cervical cancer found that African Americans and Hispanics are more likely to be diagnosed with late-stage cancer, i.e., cancer not detected at an earlier time when it was more treatable. This suggests that minorities may have higher mortality due to cancer because they are less likely to have cancer screenings that could have detected the cancer before it became untreatable.[12] Since minorities tend to have higher rates of morbidity and mortality due to illnesses for which there are available screenings, the second hypothesis was that minorities are less likely to use preventive care than are Whites.

Numerous studies have found that low socioeconomic status is linked to higher rates of morbidity and mortality.[13] This trend can be found in North Carolina, where men living in low-income neighborhoods had a 33% higher rate of prostate cancer deaths than those living in high-income neighborhoods.[14] Before there were improvements in cancer screening, the rate of colorectal cancer mortality was significantly higher among the affluent than among those of lower socioeconomic status. Over the last 30 years, as cancer screening and early detection have advanced, the rate of colorectal cancer death among the affluent has significantly decreased, while the rate of colorectal cancer mortality among those of low socioeconomic status is now much higher; this implies that those of lower socioeconomic status may not have as much access to cancer screenings.[4] Even in countries such as Canada, where citizens have universal access to healthcare, the link between socioeconomic status and health is well-documented,[13] suggesting that healthcare access is not the main issue. Socioeconomic status can affect health directly by determining the kind of resources available to an individual, or it can influence health indirectly

by determining an individual's health related lifestyle practices, an example of which would be preventive care.[13] A study of North Carolinians found that for both African Americans and Whites, cancer screening decreased as income decreased.[14] Since those of lower socioeconomic status have higher rates of morbidity and mortality from certain illnesses such as cancer, I hypothesized that people of lower socioeconomic status are less likely to use preventive care.

Almost 18.7% of Eastern North Carolinians had no health insurance in 2008. Having health insurance has been found to significantly impact health; adults with no health insurance have a 25% greater chance of dying prematurely than those who are insured.[16] As previously mentioned, preventive care and screening can greatly reduce premature mortality from certain illnesses, such as cancer, diabetes, and influenza.[3, 5, 8] Since the uninsured are less likely to seek medical care and to have a regular healthcare provider,[16] it is expected that they do not receive the recommended preventive care and screenings. Although there may be community health services that provide healthcare to low-income people, not all uninsured people qualify for these services if their income is not considered low enough. Because people with no health coverage and no personal healthcare provider are less likely to seek medical care and they have a higher rate of premature death, I hypothesized that they are also less likely to receive preventive care.

It is well documented that women tend to utilize healthcare services more often than men. Women are more likely to have minor illnesses and nonfatal chronic diseases, while men have higher mortality rates and higher rates of fatal chronic diseases.[15] For example, in Eastern North Carolina, men had a 38% higher incidence rate and a 47% higher mortality rate of colorectal cancer than females.[10] Since men do not use healthcare services as much as women,[15] and since they have higher rates of fatal chronic diseases, I hypothesized that men use preventive care less frequently than women.

Although there are various factors that contribute to the disparity in morbidity and mortality among different groups, the use of preventive care could also play a role. In this study, I will investigate the relationship between various forms of preventive care measures and different demographic factors, including region, race and ethnicity, gender, socioeconomic status, health coverage, and access to a personal healthcare provider. By observing differences in the use of preventive care between different kinds of people, we can identify which groups are behind in the utilization of preventive care services.

Table 1: Immunization and Screening Recommendations

Recommendation	Age/ How Often	Recommended By:
Immunizations: Influenza Shot	6 months+/ Annually	Advisory Committee for Immunization Practices (ACIP): CDC
Immunizations: Pneumonia Shot	65+/ Once	Advisory Committee for Immunization Practices (ACIP):CDC
Diabetes Screening: Blood Sugar Test	45+/ Every 3 years	American Diabetes Association (ADA)
Blood Cholesterol Screening	20+/ Every 5 years	National Cholesterol Education Program (NCEP)
Breast Cancer Screening: Mammogram	50+/ Every 2 years	U.S. Preventive Services Task Force (USPSTF)
Cancer of the Cervix Screening: Pap Test	18+/ Every 3 years	U.S. Preventive Services Task Force (USPSTF)
Prostate Cancer Screening: PSA test	No recommendation	U.S. Preventive Services Task Force (USPSTF)
Colorectal Cancer Screening: Sigmoidoscopy/ Colonoscopy	50-75/ sigmoidoscopy every 5 years, colonoscopy every 10 years	U.S. Preventive Services Task Force (USPSTF)
Colorectal Cancer Screening: High-sensitivity fecal occult blood test	50-75/ Annually	U.S. Preventive Services Task Force (USPSTF)

Methods

Survey Data

The data used for this study were obtained from various recent years of the North Carolina Behavioral Risk Factor Surveillance System (BRFSS), ranging from 2005 to 2010, depending on which years the questions were asked. The BRFSS is a nationally lead, state-administered, random-digit dialing telephone survey of non-institutionalized adults ages 18 and older.

Study Variables

The dependent variables in this study were the preventive care behaviors, shown in Table 2, which also displays the years data were collected in the BRFSS for each variable, the question, and the variable name. The preventive care behaviors examined were influenza shot, pneumonia shot, blood sugar test for diabetes, blood cholesterol screening, and mammogram for breast cancer screening, Pap test for cervical cancer screening, PSA test for prostate cancer screening, and colorectal cancer screening, including both sigmoidoscopy/colonoscopy and the fecal occult blood test (FOBT).

Table 3 shows the demographic variables used in this study, along with the questions and variable names. These demographic factors were the independent variables, and they included region, healthcare access, race, sex, and socioeconomic status. Region was computed as Eastern North Carolina, defined as the 41 counties of the Coastal Plain that are east of Interstate 95, versus the rest of the state. The Piedmont and Western regions of North Carolina were also included in the data analysis. Healthcare access in this study consists of healthcare coverage and access to a personal healthcare provider. Healthcare coverage includes health insurance, prepaid plans such as HMOs, or government plans such as Medicare. Race was dichotomized as majority

and minority groups, with the majority group defined as non-Hispanic White and the minority group including non-Hispanic Blacks, Hispanics, Native Americans, and Asians. Gender was defined as either male or female. Education level was determined by the highest grade or year of school completed. The categories for education are less than high school, high school graduate, technical school or some college, and college graduate. In this study, socioeconomic status was based on education and income. Self-reported annual family income was assigned one of three levels: "Low income" being less than $25,000, "middle income" being $25,000 to less than $50,000, and "high income" being $50,000 or more. The programs SAS and SUDAAN were used to perform the data analysis. Table 4 displays the expected results for the study.

Table 2: Preventive Care Variables and Corresponding Data Sources and Questions

Recommendation	Data Source	Question	Variable Name
Immunizations: Influenza Shot	BRFSS 2008, 2009, 2010	During the past 12 months, have you had a flu shot? (18+)	FLUSHOT3 FLUSHOT4 (2010) 1=Yes, 2=No
Immunizations: Pneumonia Shot	BRFSS 2008, 2009, 2010	Have you ever had a pneumonia shot? (65+)	_PNEUMO2 (Computed) 1=Yes, 2=No
Diabetes Screening	BRFSS 2008, 2009, 2010	Have you had a test for high blood sugar or diabetes within the past three years? (45+)	PDIABTST 1=Yes, 2=No
Blood Cholesterol Screening	BRFSS 2005, 2007, 2009	Have you ever had your blood cholesterol checked? (18+)	BLOODCHO 1=Yes, 2=No
Breast Cancer Screening	BRFSS 2006, 2008, 2010	Had a mammogram within the past 2 years (50+)	_MAM502Y (Computed) 1=Yes, 2=No
Cancer of the Cervix Screening	BRFSS 2006, 2008, 2010	Women age 18+ who have had a Pap test in the past 3 years (18+)	_RFPAP32 (Computed) 1=Yes, 2=No
Prostate Cancer Screening	BRFSS 2006, 2008, 2010	Male respondents aged 40+ that have had a PSA test in the past 2 years (40+)	_RFPSA2Y (Computed) 1=Yes, 2=No
Colorectal Cancer Screening	BRFSS 2006, 2008, 2010	Have you ever had either a sigmoidoscopy or a colonoscopy? (50+)	_RFSIGM2 (Computed) 1=Yes, 2=No
Colorectal Cancer Screening	BRFSS 2006, 2008, 2010	Ever had a blood stool test using a home kit (FOBT) (50+)	BLDSTOOL 1=Yes, 2=No

Table 3: Demographic Variables

Variable	Question	Variable Name
Region	Geographic region within a state, imputed from CITYCODE: What county do you live in?	_REGION (Computed) 0=NC, 1=ENC, 2=PNC, 3=WNC
Healthcare Coverage	Do you have any kind of healthcare coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?	HLTHPLAN 1=Yes, 2=No
Personal Healthcare Provider	Do you have one person you think of as your personal doctor or healthcare provider?	PERSONALDOC 1=Yes (PERSDOC2=1 or 2) 2=No (PERSDOC2=3)
Race/ Ethnicity	Which one of these groups would you say best represents your race?	RACE (Computed) 1=Non-Hispanic White 2=Non-Hispanic Black 3=Asian 4=Native American (RACE2=5) 5=Hispanic (RACE2=8)
Gender	Male or Female	SEX: 1=Male, 2=Female
Education	What is the highest grade or year of school you completed?	_EDUCAG (Computed) 1=Did not graduate high school 2=Graduated high school 3=Attended college or technical school 4=Graduated from college or technical school

Income	Is your annual household income from all sources:	INCOME (Computed)
		1=less than $25,000
		    (_INCOMG=1 or 2)
		2=$25,000 to less than $50,000
		    (_INCOMG=3 or 4)
		3=$50,000 or more
		    (_INCOMG=5)

Table 4: Expected Results

Demographics	Influenza Shot	Pneumonia Shot	Diabetes Screening	Cholesterol Screening	Mammog-ram	Pap Test	PSA Test	Sigmoidoscopy /Colonoscopy	FOBT
Region*	ENC<RNC	ENC<RNC	ENC<RNC	ENC<RNC	ENC<RNC	ENC<RNC	ENC<RNC	ENC<RNC	ENC<RNC
Healthcare* Coverage	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No
Personal Healthcare Provider	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No	Yes>No
Race/Ethnicity*	Whites > Minorities	Whites > Minorities	Whites > Minorities	Whites > Minorities	Whites > Minorities	Whites > Minorities	Whites > Minorities	Whites > Minorities	Whites > Minorities
Gender	Female>Male	Female>Male	Female>Male	Female>Male	_____	_____	_____	Female>Male	Female>Male
Income*	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low
Education*	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low	High> Low

*Race/Ethnicity: Minorities= Non-Hispanic Blacks, Hispanics, Native Americans, and Asians

*Education: High=Some college or higher, low= high school graduate and below

*Region: ENC= Eastern NC, RNC= Rest of NC

*Healthcare Coverage: Yes= Has health coverage, No= No health coverage

* Personal Healthcare Provider: Yes= Has personal healthcare provider, No= No personal healthcare provider

Results

Table 5 displays a summary of the actual results obtained from the study. Figures 1a through 8g provide a more detailed look into the results for each variable.

Table 5: Summary of Results

Demographics	Influenza Shot	Pneumonia Shot	Diabetes Screening	Cholesterol Screening	Mammogram	Pap Test	PSA Test	FOBT	Sigmoidoscopy/Colonoscopy
Region	ENC 9.2% <RNC*	ENC 5.3% <RNC*	ENC .8% >RNC	ENC 1.6% <RNC	ENC 2.4% >RNC	ENC 2%> RNC	ENC 2.3% >RNC	ENC 13.2% <RNC*	No sig. diff.
Healthcare Coverage	Yes (46.1%) >No (18.8%)*	Yes (70.2%) >No (54.9%)*	Yes (73.1%) >No (51.7%)*	Yes (85.2%) >No (50.1%)*	Yes (84.4%) >No (55.9%)*	Yes (88.0%) >No (76.7%)*	Yes (61.8%) >No (26.9%)*	Yes (49.6%) > No (26.4%)*	Yes (69.1%) >No (34.5%)*
Personal Healthcare Provider	Yes (47.2%) >No (19.7%)*	Yes (71.2%) >No (46.5%)*	Yes (74.1%) >No (46.0%)*	Yes (87.6%) >No (50.7%)*	Yes (84.4%) >No (51.6%)*	Yes (88%) >No (77.0%)*	Yes (63.9%) >No (23.1)*	Yes (49.8%) >No (24.4%)*	Yes (69.3%) >No (34.2%)*
Race/Ethnicity	Whites > Hispanic, Native American, Black*	Whites > Minorities*	Blacks> Other groups*	Hispanics< Other groups*	Whites >Blacks*, Hispanics< Other groups*	Asians< Other groups*	Asians & Hispanics <Other groups*	Whites > Minorities*	Whites > Minorities*
Gender	Female (44.6%)> Male (37.5%)*	Female (71.1%)> Male (68.3%)	Female (69.5%) <Male (72.2%)*	Female (69.5%) <Male (72.2%)*	_____	_____	_____	Female (49.7%)> Male (45.1%)*	Female (67.4%)> Male (64.8%)*
Education	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*
Income	High> Low*	High> Low	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*	High> Low*

*Statistically significant difference

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Influenza Shot

The figures below show the results for annual flu shots received by region, healthcare coverage, personal healthcare provider, race/ethnicity, gender, education, and income.

As seen in Figure 1a, Eastern North Carolina had a significantly lower percentage (38.4%) of people who said they received flu shots as compared to the other regions and North Carolina as a whole. Piedmont and Western North Carolina had significantly higher percentages, at approximately 42%. The regional disparity, ENC versus NC and the other regions, of almost four percentage points is statistically significant.

Figure 1a: Annual Flu Shot by Region: NC Years 2008-2010
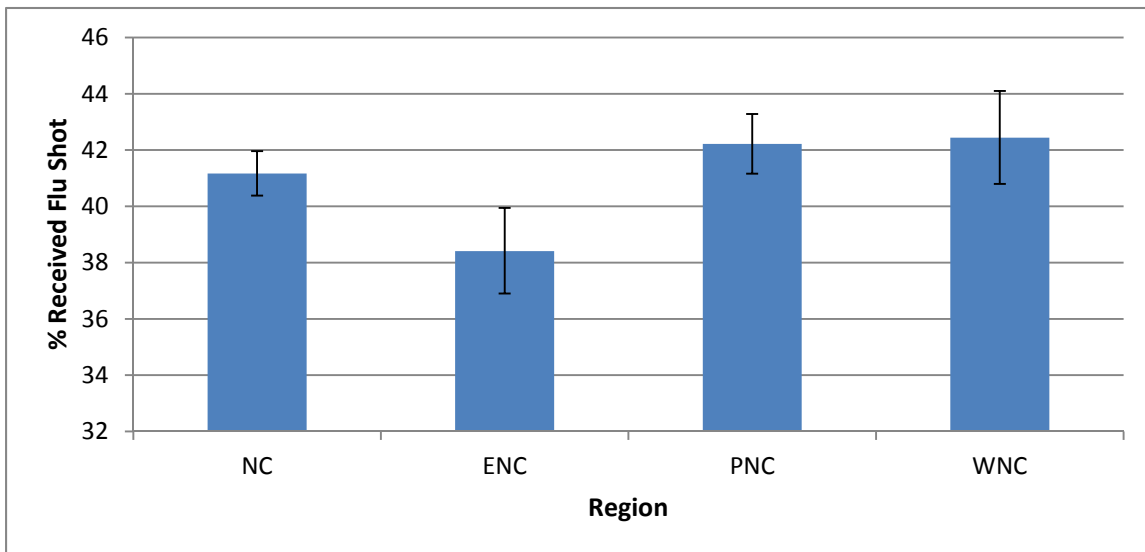
		Region		
	NC	**ENC**	**PNC**	**WNC**
N	20073	5568	10683	3822
%Yes	41.2	38.4	42.2	42.4
Low C.I.	40.4	36.9	41.2	40.8
Upper C.I.	42.0	40.0	43.3	44.1

Figure 1b displays the percentages of people in North Carolina with and without health coverage who received a flu shot. The percentage of people with health coverage who received a flu shot (46.1%) was more than twice the percentage of those with no coverage (18.8%), a very substantial and statistically significant difference.

Figure 1b: Annual Flu Shot and Healthcare Coverage: NC Years 2008-2010
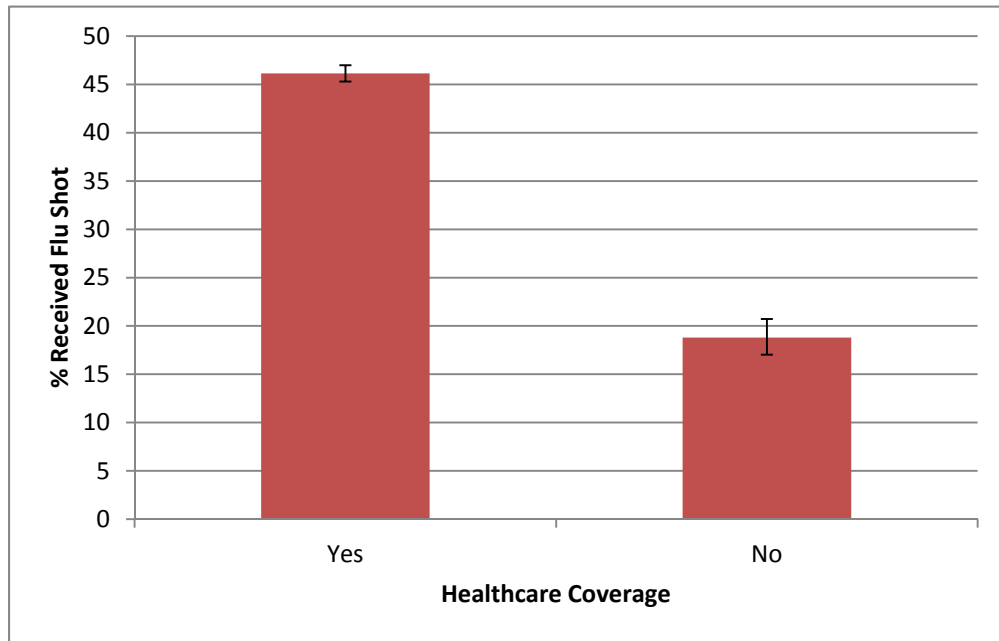
	Healthcare Coverage	
	Yes	**No**
N	18991	1040
%Yes	46.1	18.8
Low C.I.	45.3	17.0
Upper C.I.	47.0	20.7

Similar results can be seen in Figure 1c, which shows the percentages of people who received a flu shot according to whether they had a personal healthcare provider. The percentage of people who had a personal healthcare provider and received a flu shot (47.2%) was more than double the percentage of those with no personal healthcare provider (19.7%), also a significant difference.

Figure 1c: Annual Flu Shot and Personal Healthcare Provider: NC Years 2008-2010
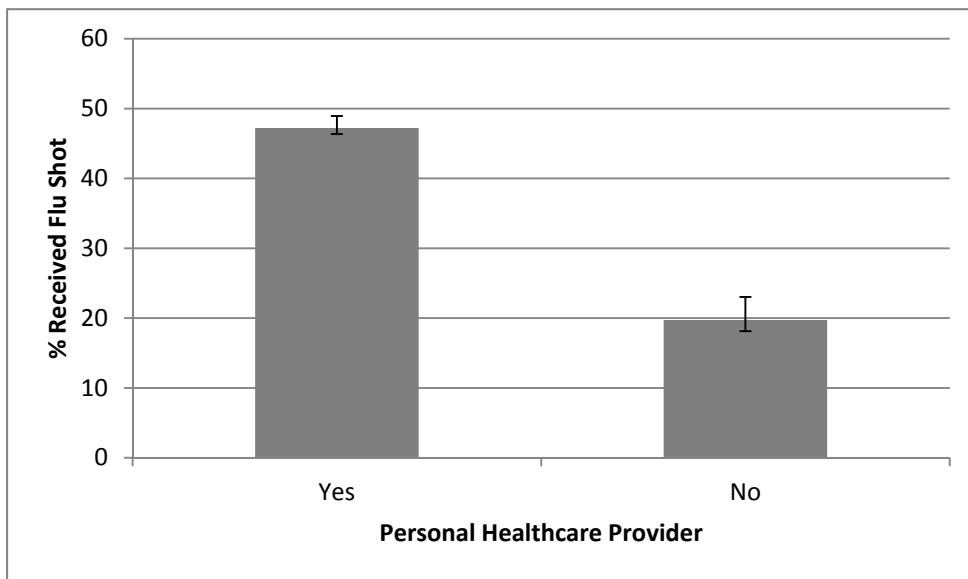
	Personal Healthcare Provider	
	Yes	**No**
N	18706	1338
%Yes	47.2	19.7
Low C.I.	46.4	18.1
Upper C.I.	48.1	21.4

Figure 1d displays the percentages of people who received a flu shot by race. Non-Hispanic Whites had the highest percentage at 44.5%; the percentage (42.8%) of Asians who received f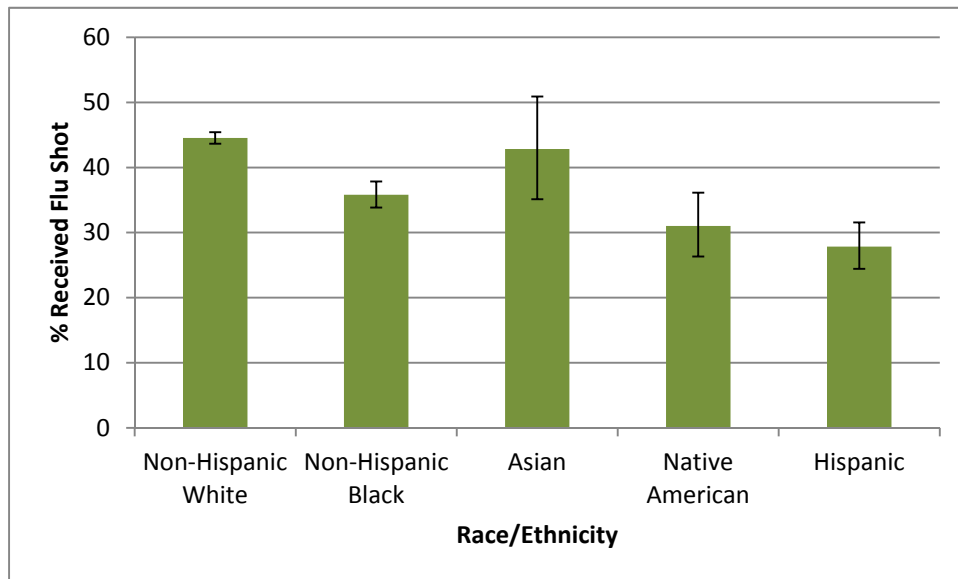lu shots was not significantly different from Non-Hispanic Whites. Hispanics, Native Americans, and Blacks, however, had substantial and statistically significant lower percentages of received flu shots than did Non-Hispanic Whites, with Hispanics having the lowest percentage at 27.9%.

Figure 1d: Annual Flu Shot by Race/Ethnicity: NC Years 2008-2010

	Race/Ethnicity				
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	16303	2363	137	320	504
%Yes	44.5	35.8	42.8	31.0	27.9
Low C.I.	43.7	33.8	35.1	26.3	24.4
Upper C.I.	45.4	37.9	50.9	36.1	31.6

Figure 1e shows that a significantly higher percentage of females (44.6%) received a flu shot as compared to men (37.5%).

Figure 1e: Annual Flu Shot by Gender: NC Years 2008-2010
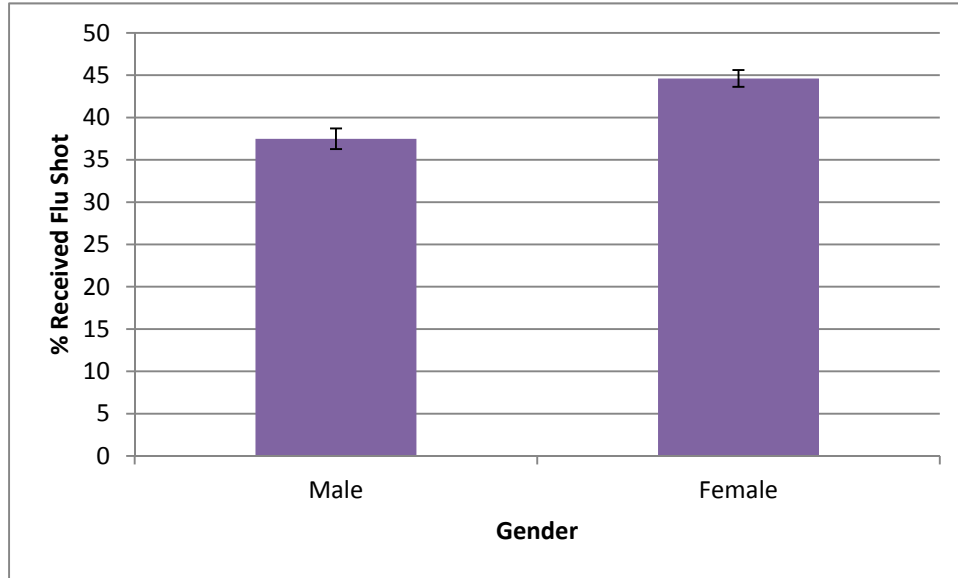
	Gender	
	Male	**Female**
N	7147	12926
%Yes	37.5	44.6
Low C.I.	36.3	43.6
Upper C.I.	38.7	45.6

Figure 1f shows the percentage of people who received a flu shot for each education level. Those respondents who graduated from college or technical school had a significantly higher percentage who received flu shots (47.8%) than people in all other education levels. People who only attended college or technical school had a significantly higher percentage than both those who graduat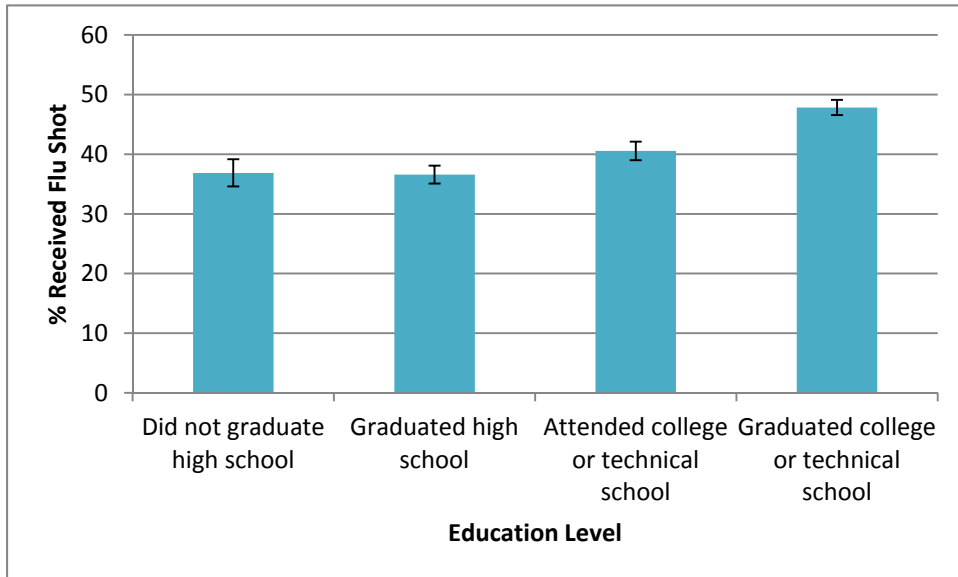ed high school and those who did not graduate from high school. There was no significant difference between those who graduated and those who did not graduate from high school.

Figure 1f: Annual Flu Shot by Education Level: NC Years 2008-2010

	Education Level			
	Did not graduate high	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	2662	5540	4996	6831
%Yes	36.8	36.6	40.6	47.8
Low C.I.	34.6	35.1	39.0	46.6
Upper C.I.	39.2	38.1	42.1	49.1

Figure 1g shows the percentage of flu shots received by each income level. People with an income of $50,000 or more had a substantially significant higher percentage (45.3%) of flu shots than did people of the two lower income levels (39.9% and 35.9%, respectively). All contrasts are statistically significant.

Figure 1g: Annual Flu Shot by Income Level: NC Years 2008-2013
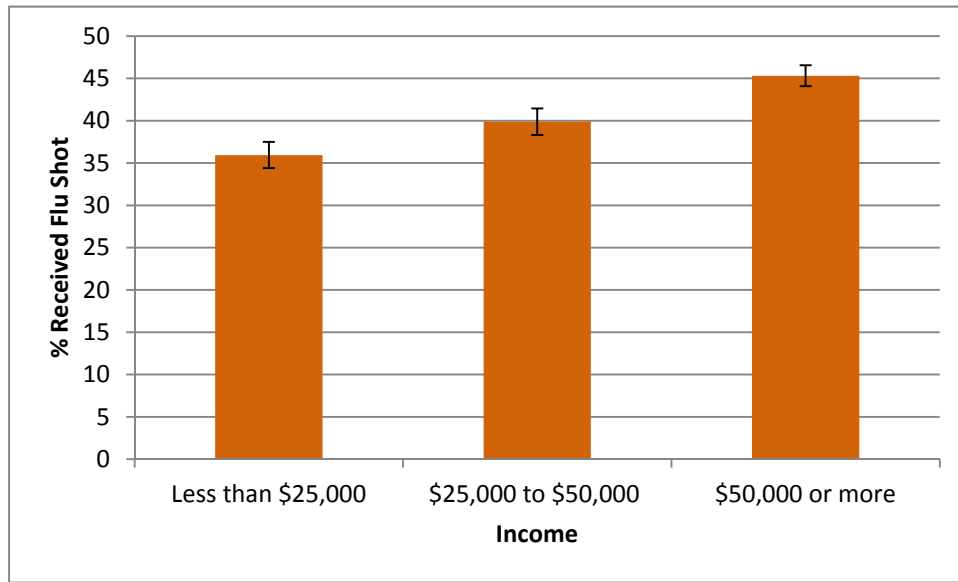
	Income Level		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	5071	4724	7107
%Yes	35.9	39.9	45.3
Low C.I.	34.4	38.3	44.1
Upper C.I.	37.5	41.5	46.6

Pneumonia Shot

The figures below show data for people ages 65 and older who have ever had a pneumonia shot by region, healthcare coverage, personal healthcare provider, race/ethnicity, gender, education, and income.

As seen in Figure 2a, although there are differences between the percentages of people who received pneumonia shots in each region, these differences are not statistically significant. Eastern North Carolina does, however, have the lowest percentage at 67.3%, and Piedmont North Carolina has the highest percentage at 71.3%. The percentage of Eastern North Carolinians who received a pneumonia shot is approximately three percentage points lower than the rate for North Carolina as a whole.

Figure 2a: Pneumonia Shot by Region: NC Years 2008-2010
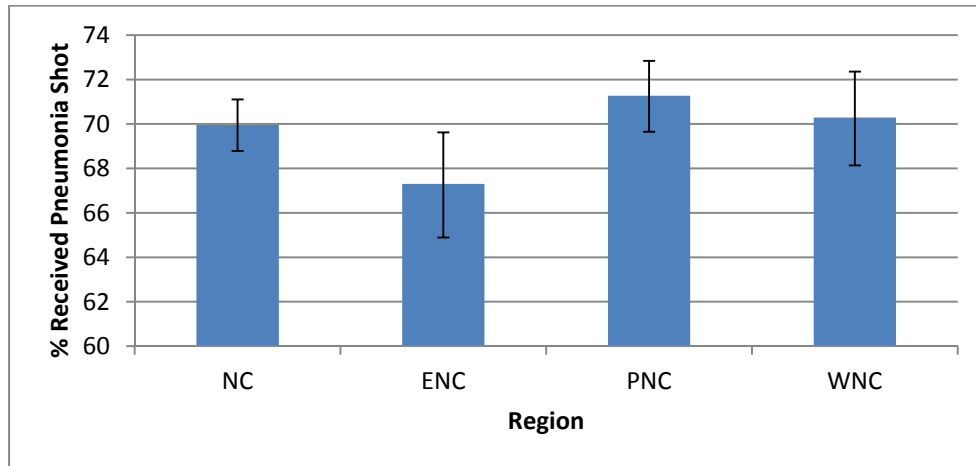
	Region			
	NC	**ENC**	**PNC**	**WNC**
N	8725	2376	4459	1890
% Yes	70.0	67.3	71.3	70.3
Low C.I.	68.8	64.9	69.6	68.1
Upper C.I.	71.1	69.6	72.8	72.4

The effect of healthcare coverage on pneumonia vaccination is similar to the effect on influenza vaccination. Those who did not have healthcare coverage were much less likely to get a pneumonia shot, as compared to those with healthcare coverage (54.9% versus 70.2%).

Figure 2b: Pneumonia Shot and Healthcare Coverage: NC Years 2008-2010
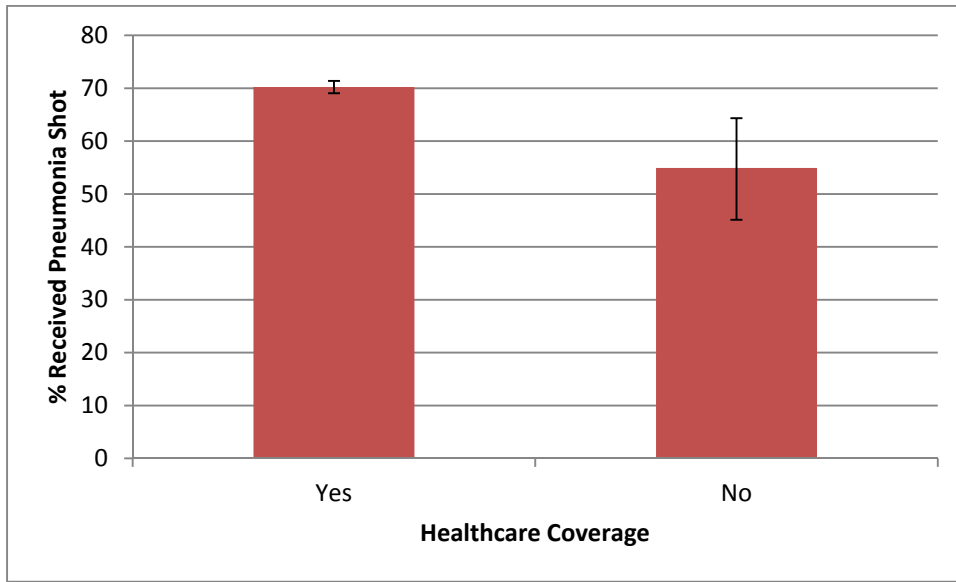
	Healthcare Coverage	
	Yes	**No**
N	8617	98
% Yes	70.2	54.9
Low C.I.	69.0	45.1
Upper C.I.	71.4	64.3

The same relationship can be seen in terms of healthcare provider; people with a personal healthcare provider had a very substantial and significantly greater percentage of received pneumonia shots (71.2%), than did those with no regular healthcare provider (46.5%).

Figure 2c: Pneumonia Shot and Personal Healthcare Provider: NC Years 2008-2010
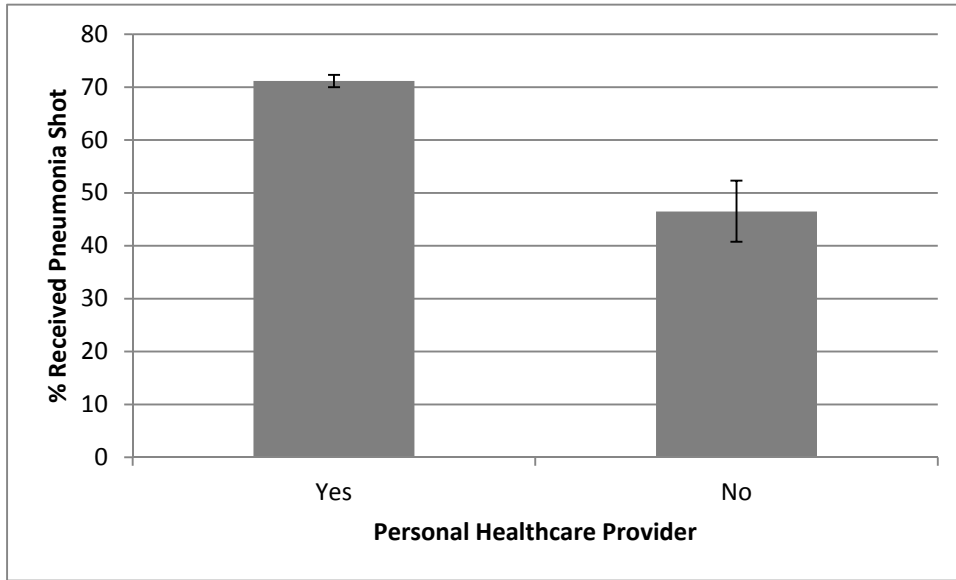
	Personal Healthcare Provider	
	Yes	**No**
N	8425	284
% Yes	71.2	46.5
Low C.I.	70.0	40.7
Upper C.I.	72.3	52.3

Figure 2d displays the percentage of people of each race or ethnicity who received the pneumonia shot. Non-Hispanic Whites had a significantly higher percentage, 73.1%, of people who received pneumonia shots than all the other racial/ethnic groups. 58.0% of Blacks received a pneumonia shot, which was significantly greater than the percentage of Asians (29.0%). There were no significant differences between Asians, Native Americans and Hispanics in the percentage of people who received pneumonia shots. The percentage of Blacks also did not differ significantly from the percentages of Native Americans and Hispanics who received pneumonia shots.

Figure 2d: Pneumonia Shot by Race/Ethnicity: NC Years 2008-2010
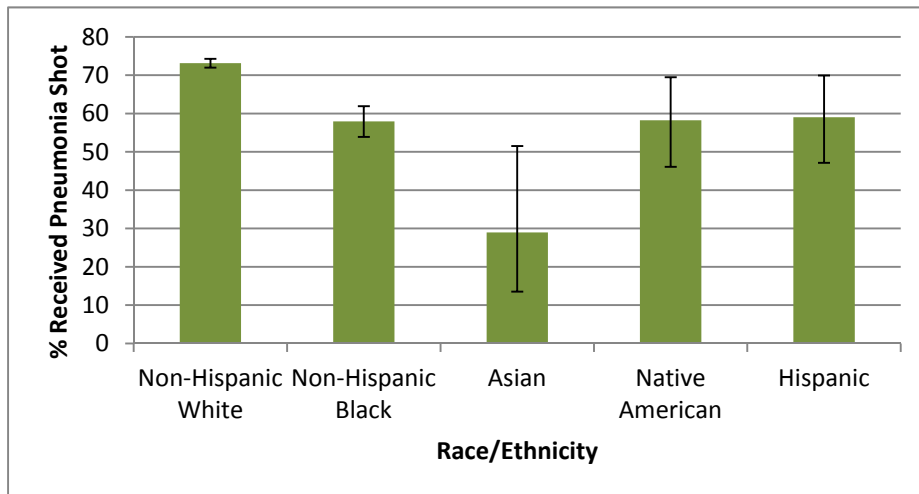
	Race/Ethnicity				
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	7552	785	11	114	84
% Yes	73.1	58.0	29.0	58.2	59.0
Low C.I.	72.0	53.9	13.5	46.1	47.1
Upper C.I.	74.3	61.9	51.5	69.5	69.9

As seen in Figure 2e, the percentages of women and men who received a pneumonia shot did not differ significantly. Women, however, had a slightly higher percentage (71.1%) than men (68.3%), a difference of approximately three percentage points.

Figure 2e: Pneumonia Shot by Gender: NC Years 2008-2010
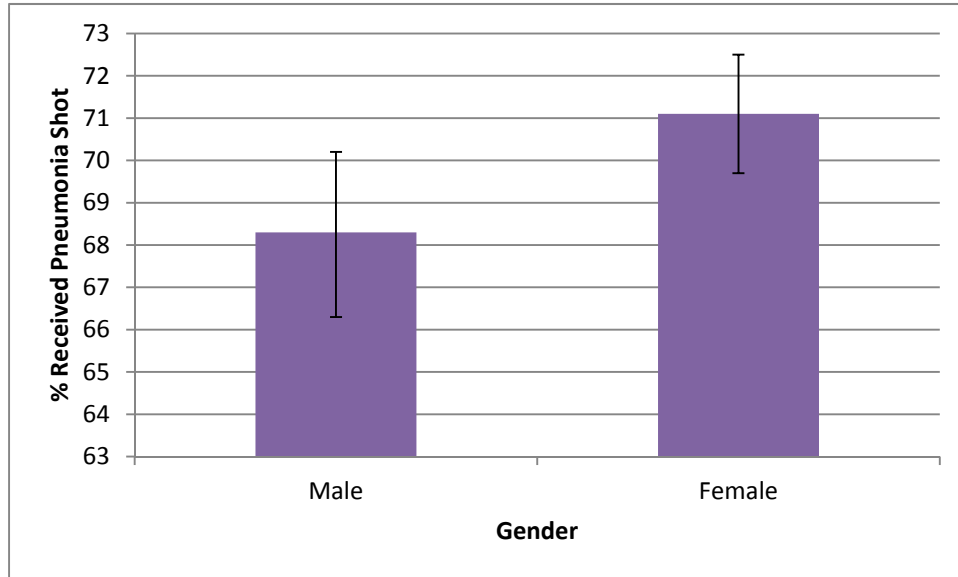
	Gender	
	Male	**Female**
N	2891	5834
% Yes	68.3	71.1
Low C.I.	66.3	69.7
Upper C.I.	70.2	72.5

Figure 2f shows the percentage of people who received the pneumonia shot by each education level. The only significant difference was between people who did not graduate from high school and people who attended college or technical school: 66.6% of people who did not graduate from high school received a pneumonia shot as compared to 73.2% of those who attended college or technical school.

Figure 2f: Pneumonia Shot by Education Level: NC Years 2008-2010
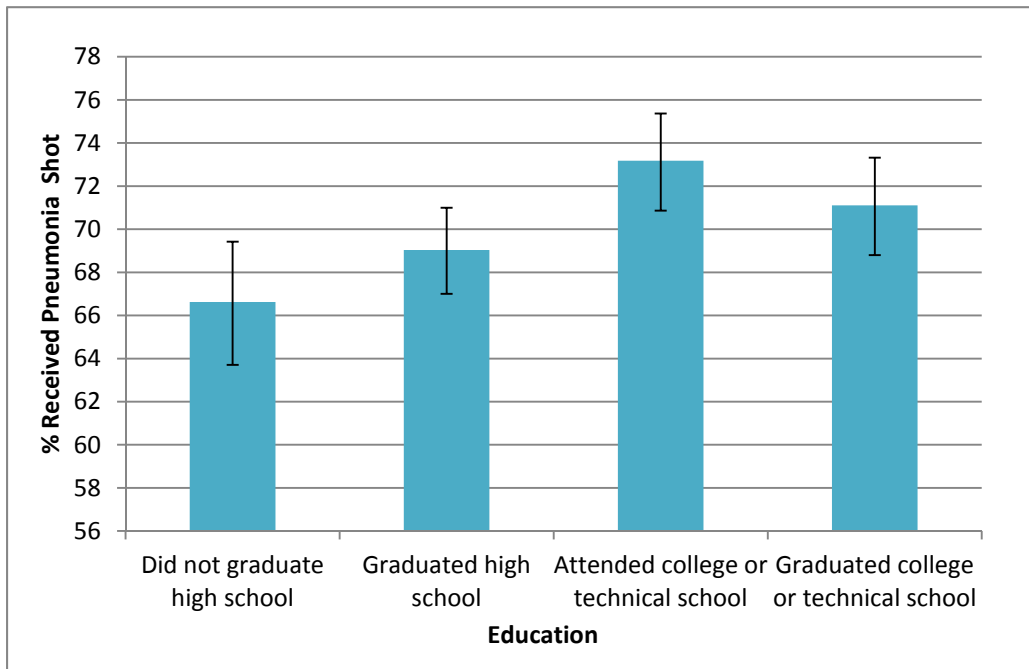
	Education			
	Did not graduate high school	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	1787	2822	2065	2035
% Yes	66.6	69.0	73.2	71.1
Low C.I.	63.7	67.0	70.9	68.8
Upper C.I.	69.4	71.0	75.4	73.3

As Figure 2g shows, there is no significant difference between the three income levels in the percentage of people who received the pneumonia shot, although the middle income level had the highest percentage of people who received the pneumonia shot (71.2%).

Figure 2g: Pneumonia Shot by Income Level: NC Years 2008-2010
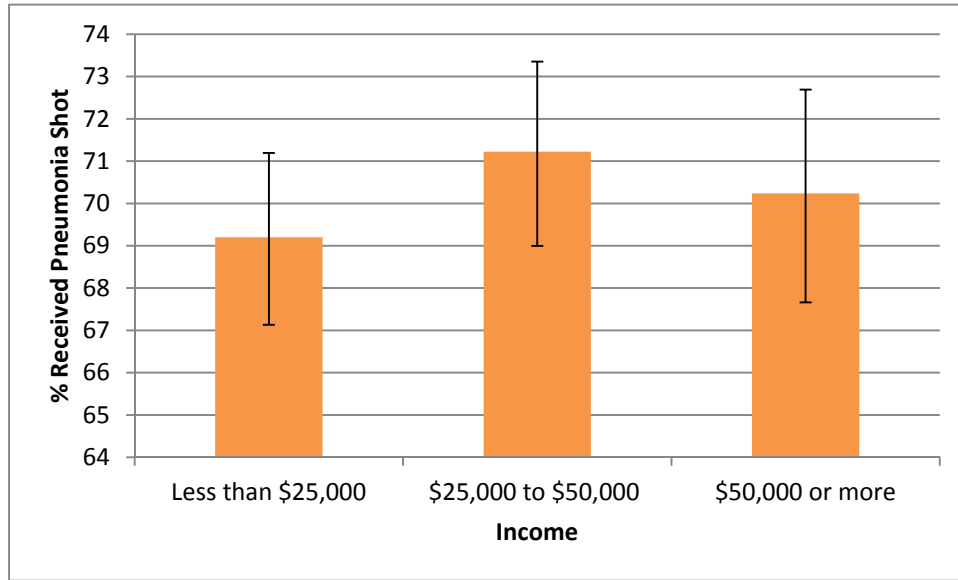
	Income		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	3076	2172	1631
% Yes	69.2	71.2	70.2
Low C.I.	67.1	69.0	67.7
Upper C.I.	71.2	73.4	72.7

Diabetes Screening

The following figures show the results for people 45 years and older who received a blood sugar test for diabetes screening within the past three years by region, healthcare coverage, personal healthcare provider, race/ethnicity, gender, education, and income.

As shown in Figure 3a below, Eastern North Carolina, Piedmont North Carolina, and North Carolina as a whole did not differ significantly in terms of the percentage of people who were screened for diabetes. In Western North Carolina, however, the percentage of people screened for diabetes was significantly lower, 67.1%, than the other regions and North Carolina as a whole.

Figure 3a: Diabetes Screening by Region: NC Years 2008-2010
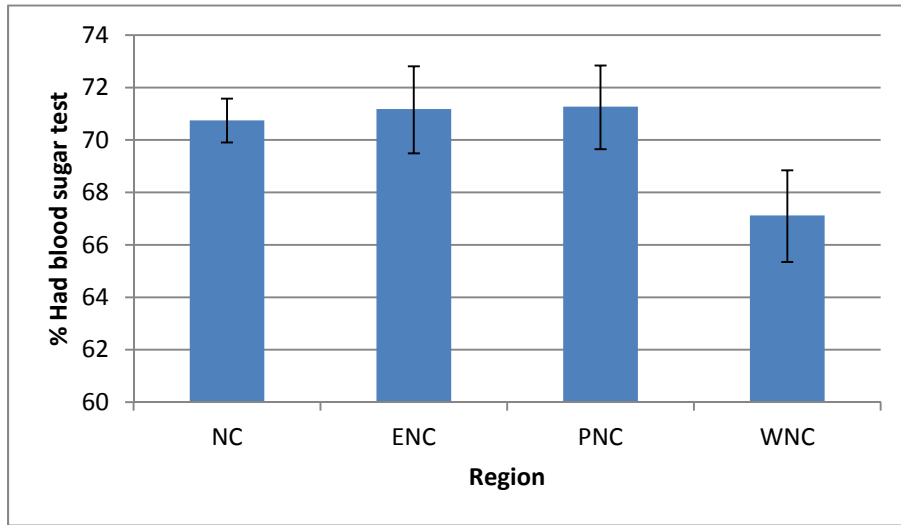
	Region			
	NC	**ENC**	**PNC**	**WNC**
N	16695	4687	4459	3203
% Yes	70.7	71.2	71.3	67.1
Low C.I.	69.9	69.5	69.6	65.3
Upper C.I.	71.6	72.8	72.8	68.8

The percentage of people with healthcare coverage who had a blood sugar test was significantly greater than the percentage of those with no healthcare coverage. Of people with healthcare coverage, 73.1% were screened for diabetes, as compared to only 51.7% of people with no healthcare coverage, a substantial difference of about 21 percentage points.

Figure 3b: Diabetes Screening and Healthcare Coverage: NC Years 2008-2010
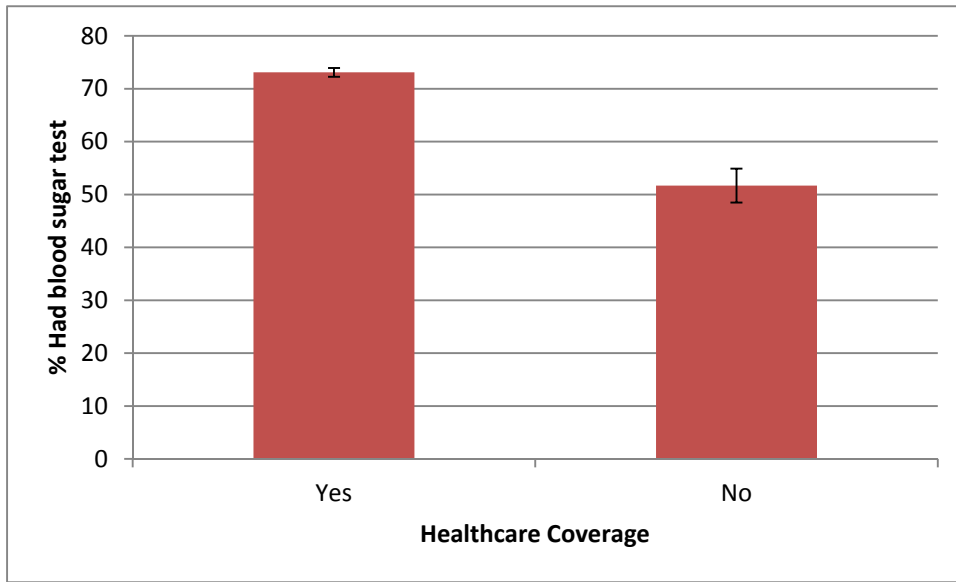
	Healthcare Coverage	
	Yes	**No**
N	15560	1114
% Yes	73.1	51.7
Low C.I.	72.2	48.5
Upper C.I.	73.9	54.9

Figure 3c shows that a much greater percentage of people who have a personal healthcare provider received diabetes screening than did people with no personal healthcare provider. Of those who have a personal healthcare provider, 74.1% have had a blood sugar test within the last three years, a rate 61% higher than that of people with no personal healthcare provider.

Figure 3c: Diabetes Screening and Personal Healthcare Provider: NC Years 2008-2010
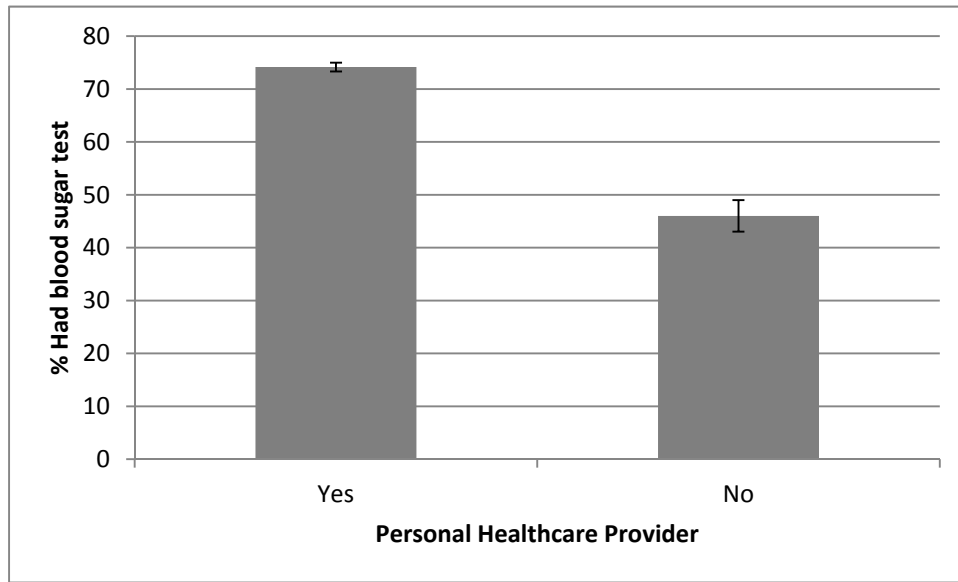
	Personal Healthcare Provider	
	Yes	**No**
N	15544	1129
% Yes	74.1	46.0
Low C.I.	73.3	43.0
Upper C.I.	75.0	49.0

As shown in Figure 3d, a significantly greater percentage of Blacks 74.9% were screened for diabetes than were members of the other racial and ethnic groups. The Asian percentage (49.6%) is a statistically significant lower rate than all other groups except for Hispanics.

Figure 3d: Diabetes Screening by Race/Ethnicity: NC Years 2008-2010
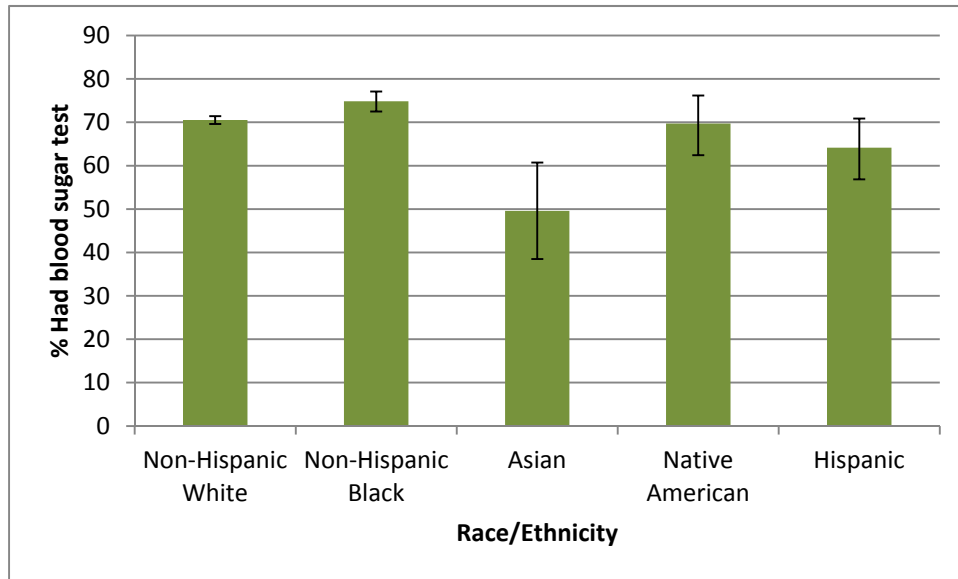
	Race/Ethnicity				
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	13574	2149	62	264	274
% Yes	70.5	74.9	49.6	69.7	64.1
Low C.I.	69.6	72.5	38.5	62.4	56.8
Upper C.I.	71.4	77.1	60.7	76.2	70.8

Figure 3e shows that 72.2% of males received a blood sugar test, which was slightly greater, by 2.7 percentage points, than females.

Figure 3e: Diabetes Screening by Gender: NC Years 2008-2010
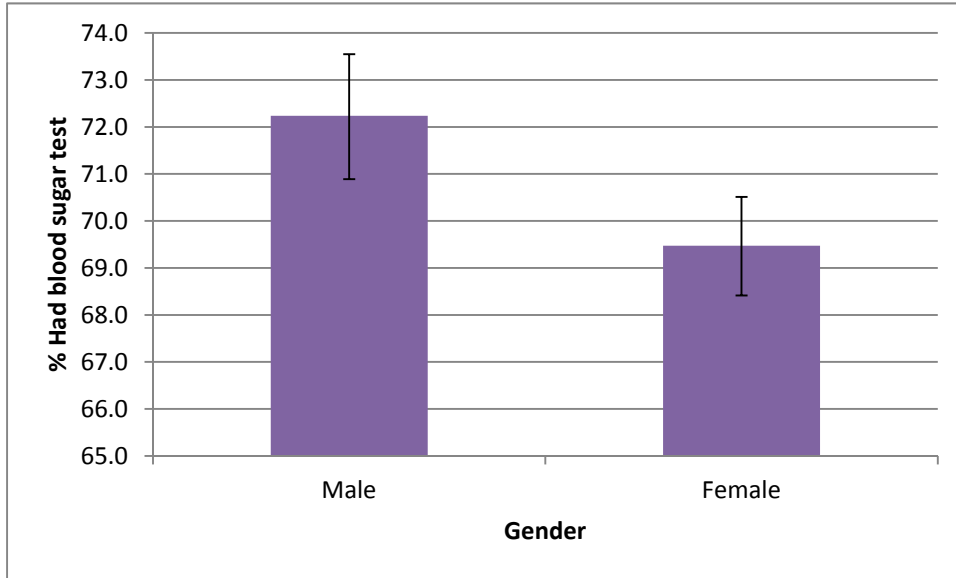
	Gender	
	Male	**Female**
N	6338	10357
% Yes	72.2	69.5
Low C.I.	70.9	68.4
Upper C.I.	73.5	70.5

The percentage of people who were screened for diabetes was about 73% for both people who attended or graduated from college or technical schools. This was significantly greater than among people who did not graduate from high school or who graduated from high school. The percentage of high school graduates who received diabetes screening (68.7%) was more than five percentage points greater than the percentage of those who did not graduate from high school (63.1%).

Figure 3f: Diabetes Screening by Education Level: NC Years 2008-2010
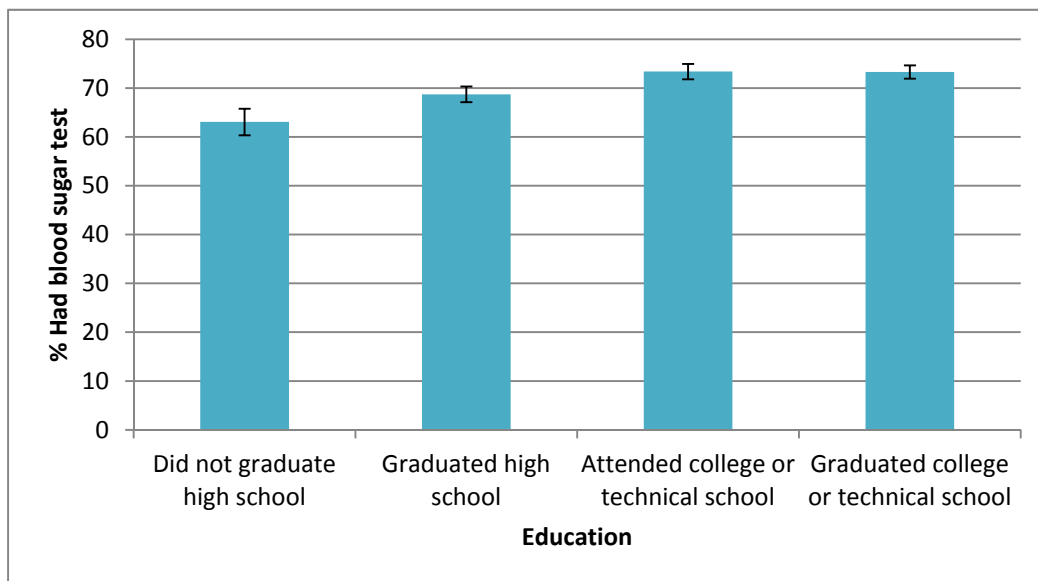
	Education Level			
	Did not graduate high school	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	1939	4950	4366	5417
% Yes	63.1	68.7	73.4	73.3
Low C.I.	60.3	67.1	71.8	71.9
Upper C.I.	65.8	70.3	75.0	74.6

Approximately 70% of both middle and high income people received a blood sugar test, which was slightly greater, by about five percentage points, than the 66.2% of low income people who received the test.

Figure 3g: Diabetes Screening by Income Level: NC Years 2008-2010
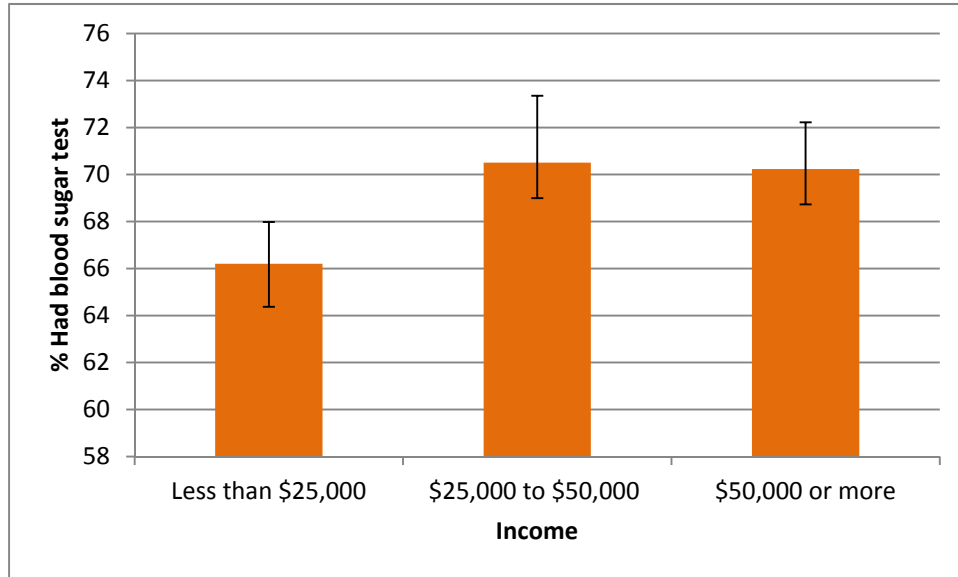
	Income Level		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	4174	4026	1631
% Yes	66.2	70.5	70.2
Low C.I.	64.4	69.0	68.7
Upper C.I.	68.0	73.4	72.2

Blood Cholesterol Screening

The figures below show the percentage of people who have ever had their blood cholesterol checked by region, healthcare coverage, personal healthcare provider, race/ethnicity, gender, education, and income.

Figure 4a shows that there is no significant difference between the regions in the percentage of people who had their cholesterol checked. Eastern and Western North Carolina both have the lowest raw percentage, at 78.3%, and Piedmont North Carolina has a slightly higher percentage, at 80.3%.

Figure 4a: Cholesterol Screening by Region: NC Years 2005, 2007 & 2009
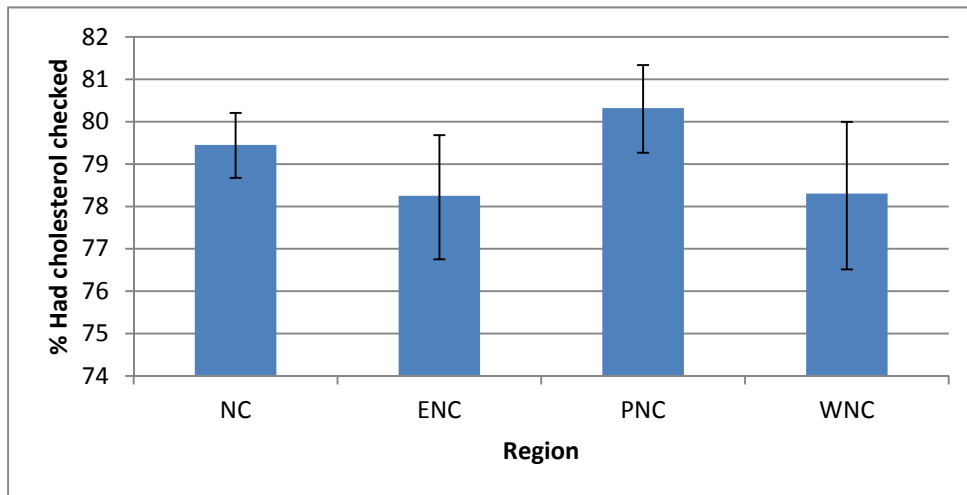
	Region			
	NC	**ENC**	**PNC**	**WNC**
N	38287	11657	20055	6575
% Yes	79.5	78.3	80.3	78.3
Low C.I.	78.7	76.8	79.3	76.5
Upper C.I.	80.2	79.7	81.3	80.0

As seen in Figure 4b, the percentage of people who have had their cholesterol checked differed substantially between people with healthcare coverage and those without. For those with healthcare coverage, 86.2% had their cholesterol checked, 72% greater than the rate of those with no healthcare coverage (50.1%).

Figure 4b: Cholesterol Screening and Healthcare Coverage: NC Years 2005, 2007 & 2009
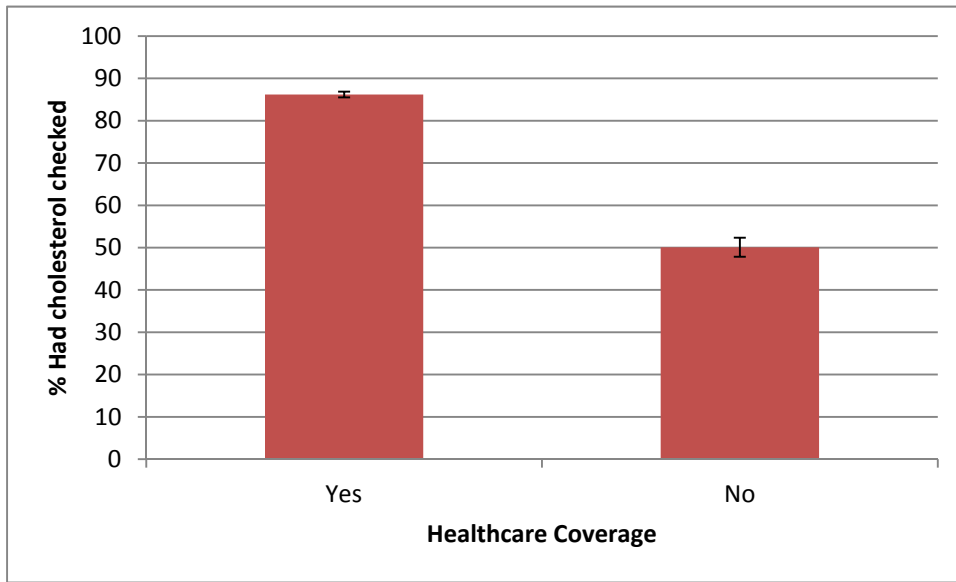
	Healthcare Coverage	
	Yes	**No**
N	34676	3560
% Yes	86.2	50.1
Low C.I.	85.5	47.8
Upper C.I.	86.9	52.3

Very similar percentages to the ones in Figure 4b can be seen in Figure 4c, which displays results according to whether one has a personal healthcare provider or not. Of people with a personal healthcare provider, 87.6% had their blood cholesterol checked, compared to 50.7% of those with no healthcare provider, a very substantial and statistically significant difference.

Figure 4c: Cholesterol Screening and Personal Healthcare Provider: NC Years 2005, 2007 & 2009
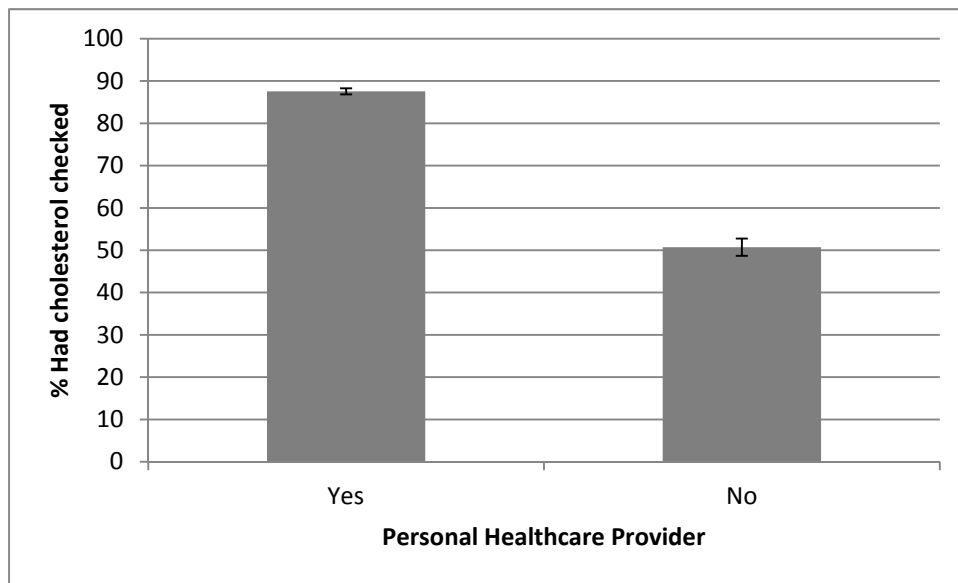
	Personal Healthcare Provider	
	Yes	**No**
N	34328	3910
% Yes	87.6	50.7
Low C.I.	86.9	48.7
Upper C.I.	88.3	52.8

There were no significant differences in the percentage of people who had their cholesterol check between the different races and ethnicities, except for Hispanics. Hispanics had a significantly lower percentage, 40.4%, than all the other groups. Whites had the highest raw percentage, at 84.3%, about 44 percentage points higher than the rate for Hispanics.

Figure 4d: Cholesterol Screening by Race/Ethnicity: NC Years 2005, 2007 & 2009

		Race/Ethnicity			
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	30071	5591	229	641	935
% Yes	84.3	78.7	78.4	79.6	40.4
Low C.I.	83.5	76.8	70.9	74.9	36.9
Upper C.I.	85.0	80.6	84.4	83.6	44.0

A slightly lower percentage of women (69.5%) received cholesterol screening than did men (72.2%).

Figure 4e: Cholesterol Screening by Gender: NC Years 2005, 2007 & 2009
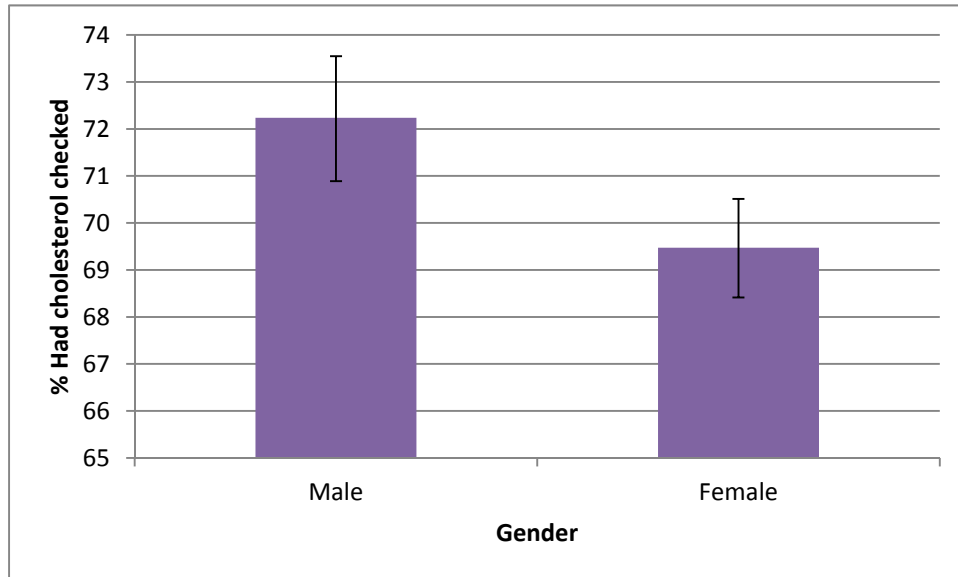
	Gender	
	Male	**Female**
N	6338	10357
% Yes	72.2	69.5
Low C.I.	70.9	68.4
Upper C.I.	73.5	70.5

Figure 4f shows that there was a significant difference in cholesterol screening between each education level. People in each education level had a significantly higher percentage of cholesterol screening than the education level below it. People who graduated from college or technical school had the highest percentage, 90.1%, and people who did not graduate from high school had the lowest percentage at 61.9%, a very substantial difference of about 28 percentage points.

Figure 4f: Cholesterol Screening by Education Level: NC Years 2005, 2007 & 2009
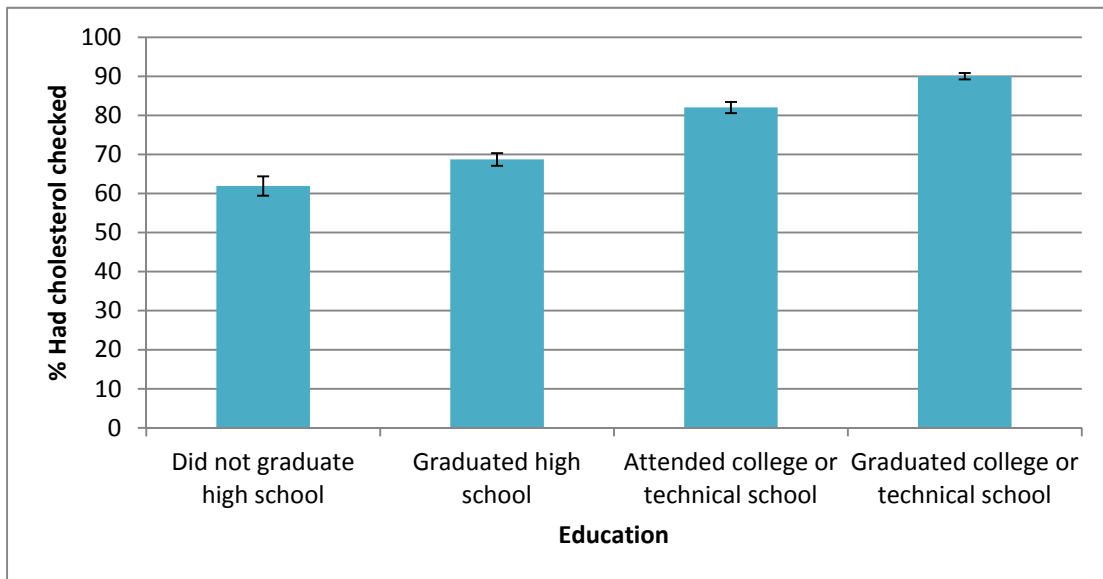
	Education Level			
	Did not graduate high school	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	4993	11172	9755	12314
% Yes	61.9	68.7	82.1	90.1
Low C.I.	59.4	67.1	80.6	89.2
Upper C.I.	64.4	70.3	83.4	90.9

The same pattern can be seen in Figure 4g. Every income level had a significantly higher percentage of people who had their cholesterol checked than the income level below it. 69% of low income people, 80.1% of middle income people, and 89.4% of high income people received cholesterol screening.

Figure 4g: Cholesterol Screening by Income Level: NC Years 2005, 2007 & 2009
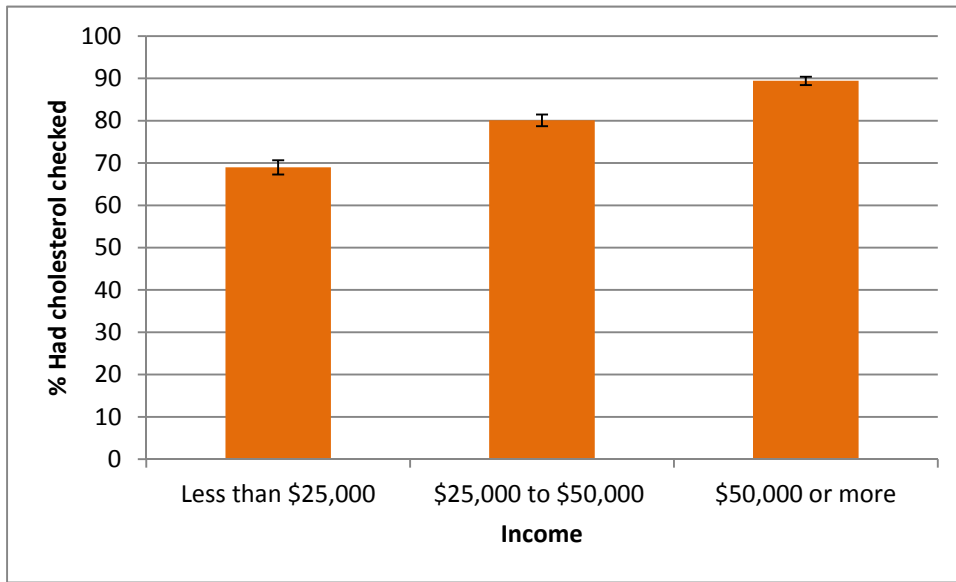
	Income		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	10044	9511	13364
% Yes	69.0	80.1	89.4
Low C.I.	67.3	78.7	88.4
Upper C.I.	70.7	81.5	90.4

Breast Cancer Screening

The following figures show the results for women 50 years and older who have received a mammogram within the past two years by region, healthcare coverage, personal healthcare provider, race/ethnicity, education, and income.

Western North Carolina is the only region that differs significantly in the percentage of women who have received a mammogram. This region has a significantly lower percentage (78.4%) of women who have received a mammogram than all the other regions. ENC has the highest raw percentage at 83.4%, five percentage points higher than WNC.

Figure 5a: Breast Cancer Screening by Region: NC Years 2006, 2008 & 2010
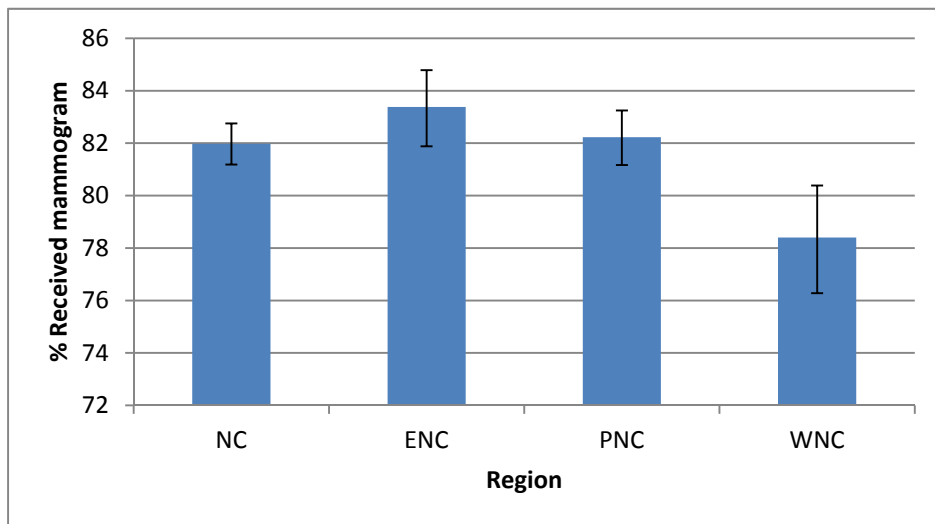
	Region			
	NC	**ENC**	**PNC**	**WNC**
N	13409	4324	6998	2087
% Yes	82.0	83.4	82.2	78.4
Low C.I.	81.2	81.9	81.2	76.3
Upper C.I.	82.8	84.8	83.2	80.4

A greater percentage of women with healthcare coverage received a mammogram (84.4%) as compared to of women with no healthcare coverage (55.9%). The difference of 28.5 percentage points between these two groups is substantial and statistically significant.

Figure 5b: Breast Cancer Screening and Healthcare Coverage: NC Years 2006, 2008 & 2010
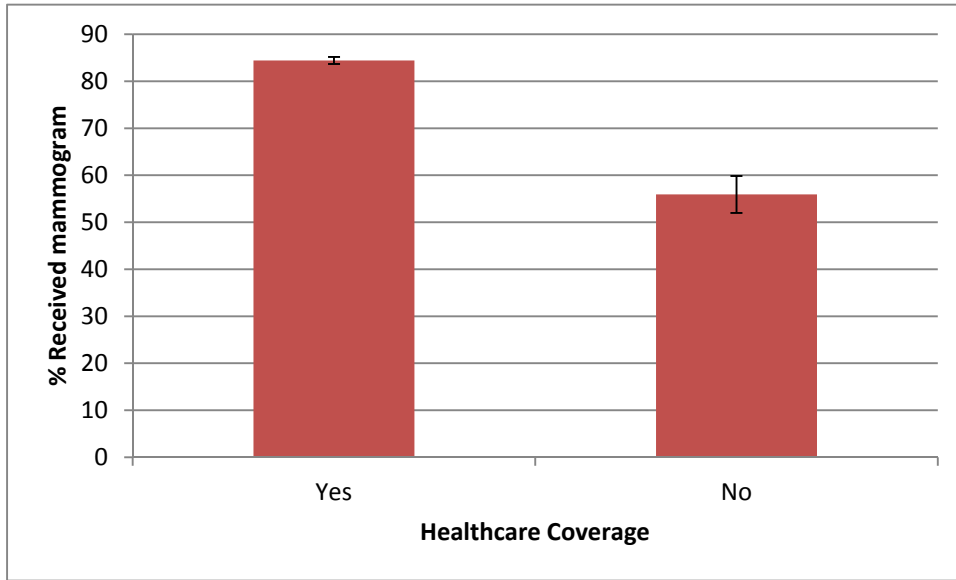
	Healthcare Coverage	
	Yes	**No**
N	12726	671
% Yes	84.4	55.9
Low C.I.	83.7	52.0
Upper C.I.	85.2	59.8

The rate of women who have a personal healthcare provider and have received a mammogram is 84.4%, 32.8 percentage points greater than the rate of women with no healthcare provider, a substantial and statistically significant difference.

Figure 5c: Breast Cancer Screening and Personal Healthcare Provider: NC Years 2006, 2008 & 2010
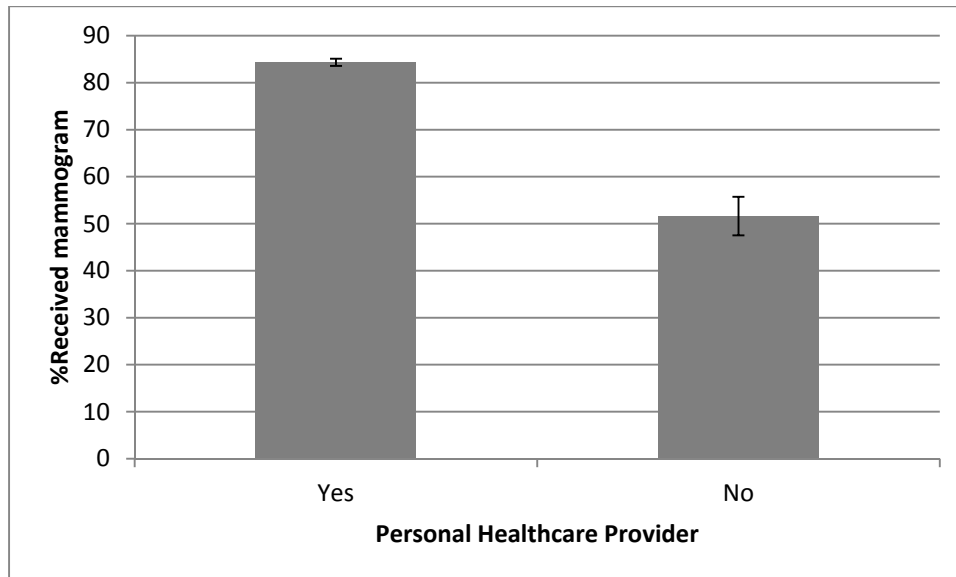
	Personal Healthcare Provider	
	Yes	No
N	12824	563
% Yes	84.4	51.6
Low C.I.	83.6	47.5
Upper C.I.	85.1	55.7

Figure 5d displays the results for women who received a mammogram by race and ethnicity. According to the results, a significantly higher percentage of White women received a mammogram, 84.3%, than did Black women, 78.7%. Although Asians and Native Americans did not differ significantly from both Non-Hispanic Whites and Blacks, their raw percentages were closer to the rate of Blacks. Hispanic women had a substantially lower percentage, 40.4%, than all the other racial and ethnic groups.

Figure 5d: Breast Cancer Screening by Race/Ethnicity: NC Years 2006, 2008 & 2010

	Race/Ethnicity				
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	30071	5591	229	641	935
% Yes	84.3	78.7	78.4	79.6	40.4
Low C.I.	83.5	76.8	70.9	74.9	36.9
Upper C.I.	85.0	80.6	84.4	83.6	44.0

Figure 5e shows the results for women who received a mammogram by education level. A significantly lower percentage of women who did not graduate from high school received a mammogram (71.4%) as compared to women of the higher education levels. Women who graduated from college or technical school had a significantly higher percentage (86.8%) than women of the lower education levels.

Figure 5e: Breast Cancer Screening by Education Level: NC Years 2006, 2008 & 2010
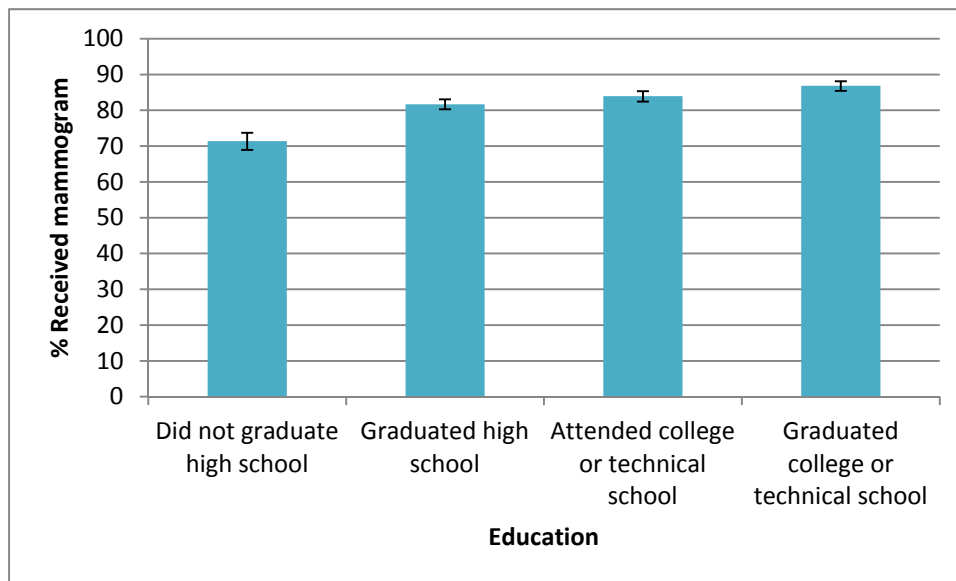
	Education			
	Did not graduate high school	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	1937	4383	3539	3531
% Yes	71.4	81.7	83.9	86.8
Low C.I.	69.0	80.3	82.4	85.4
Upper C.I.	73.7	83.0	85.3	88.1

As shown in Figure 5f, every income level had a significantly higher percentage of women that received a mammogram than the income level below it. 74% of low income women, 83.4% of middle income women, and 89.1% of high income women have received a mammogram within the past two years.

Figure 5f: Breast Cancer Screening by Income Level: NC Years 2006, 2008 & 2010
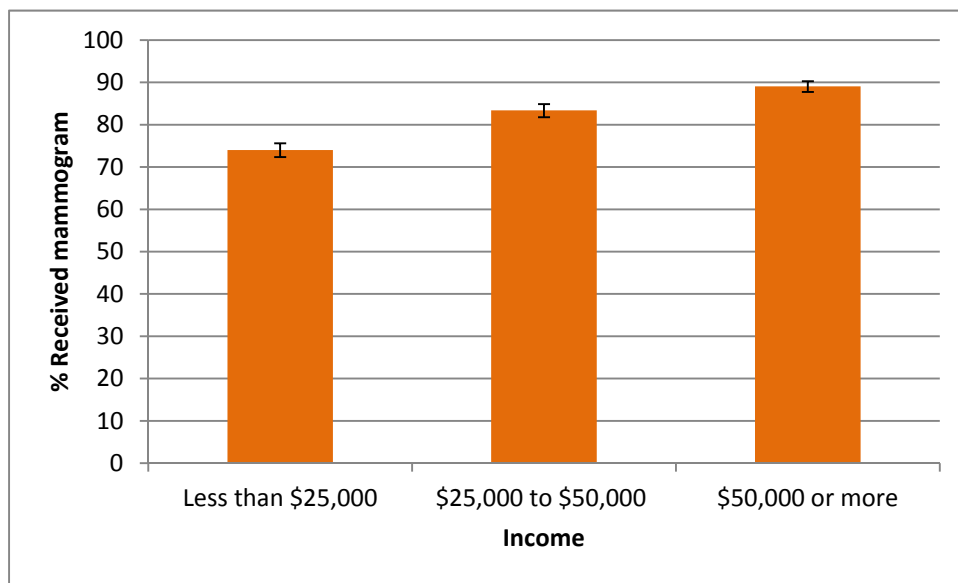
	Income		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	4094	3239	3476
% Yes	74.0	83.4	89.1
Low C.I.	72.4	81.8	87.7
Upper C.I.	75.6	84.9	90.3

Cancer of the Cervix Screening

The following graphs and tables show the results for women 18 years and older who have had a Pap test within the past three years by region, healthcare coverage, personal healthcare provider, race/ethnicity, education, and income.

The percentage of women who received a Pap test did not differ significantly between North Carolina as a whole, Eastern North Carolina, and Piedmont North Carolina. Western North Carolina, however, had a significantly lower percentage of women who received a Pap test than the other regions.

Figure 6a: Cervical Cancer Screening by Region: NC Years: 2006, 2008 & 2010
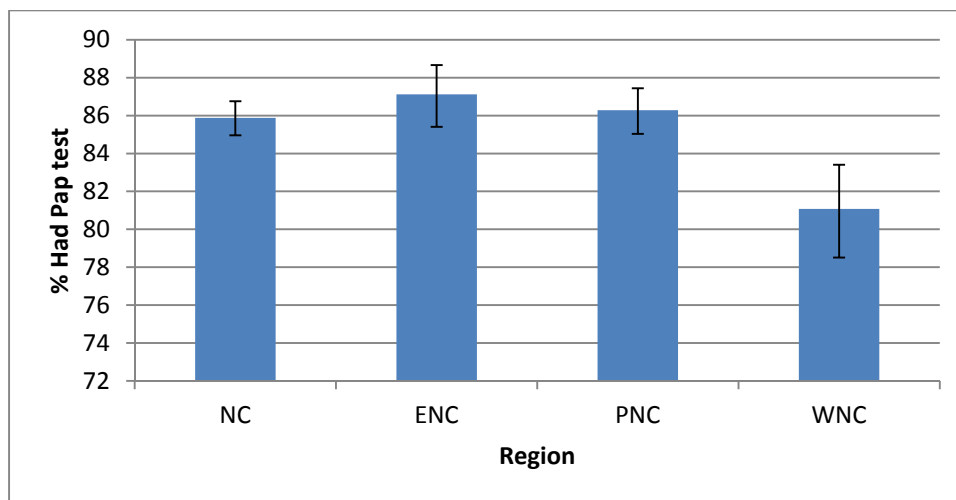
	Region			
	NC	**ENC**	**PNC**	**WNC**
N	15258	5015	8296	1947
% Yes	85.9	87.1	86.3	81.1
Low C.I.	85.0	85.4	85.0	78.5
Upper C.I.	86.8	88.7	87.4	83.4

Figure 6b shows that 76.8% of women with no healthcare coverage had a Pap test, which was significantly lower by about 11 percentage points than the rate of women (88%) with healthcare coverage.

Figure 6b: Cervical Cancer Screening and Healthcare Coverage: NC Years 2006, 2008 & 2010
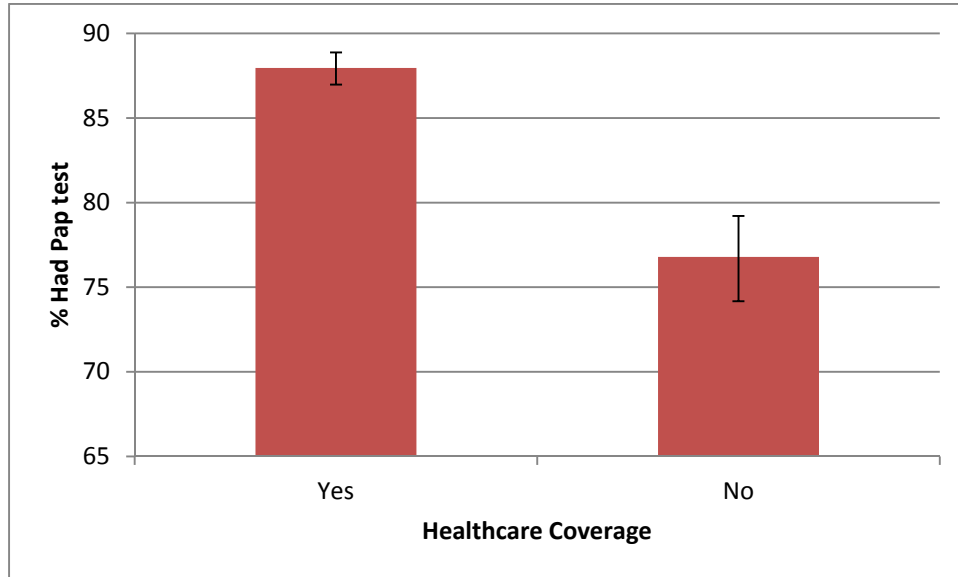
	Healthcare Coverage	
	Yes	**No**
N	13373	1869
% Yes	88.0	76.8
Low C.I.	87.0	74.2
Upper C.I.	88.9	79.2

88% of women with a personal healthcare provider had a Pap test, which is significantly greater than the 77% of those with no healthcare provider. The difference between these two groups, 11 percentage points, is virtually the same as the difference between women with healthcare coverage and those without coverage.

Figure 6c: Cervical Cancer Screening and Personal Healthcare Provider: NC Years 2006, 2008 & 2010
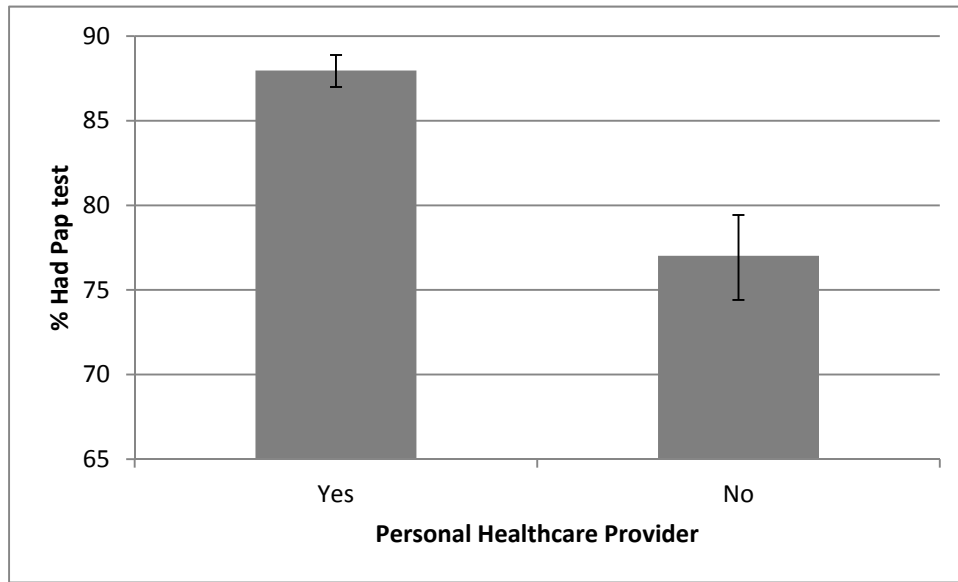
	Personal Healthcare Provider	
	Yes	**No**
N	13333	1902
% Yes	88.0	77.0
Low C.I.	87.0	74.4
Upper C.I.	88.9	79.4

Figure 6d shows that there was no significant difference in the percentage of women who received a Pap test for each racial or ethnic group, except for Asians. A significantly lower percentage of Asian women received a Pap test, 70.8%, than did women of the other races and ethnicities

Figure 6d: Cervical Cancer Screening by Race/Ethnicity: NC Years 2006, 2008 & 2010
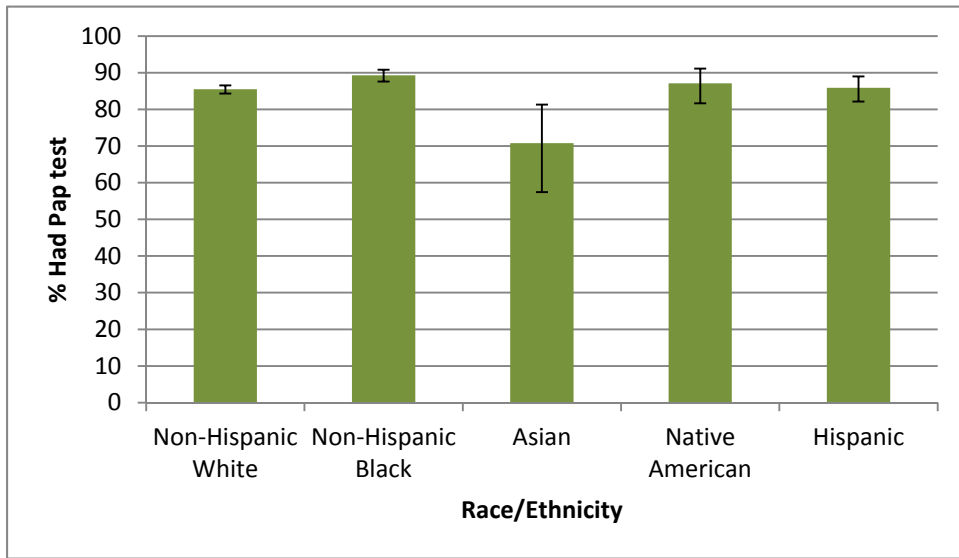
	Race/Ethnicity				
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	11097	2642	130	278	778
% Yes	85.5	89.3	70.8	87.1	85.9
Low C.I.	84.3	87.6	57.4	81.7	82.1
Upper C.I.	86.6	90.8	81.3	91.1	89.0

As shown in Figure 6e, 77.3% of women who did not graduate from high school have had a Pap test within the last three years, significantly lower than women of the higher education levels. Women who graduated from college or technical school had the highest percentage, 91.9%, significantly higher than the lower education categories. Women who graduated from high school and women who just attended college or technical school did not differ significantly in terms of receiving a Pap test.

Figure 6e: Cervical Cancer Screening by Education Level: NC Years 2006, 2008 & 2010
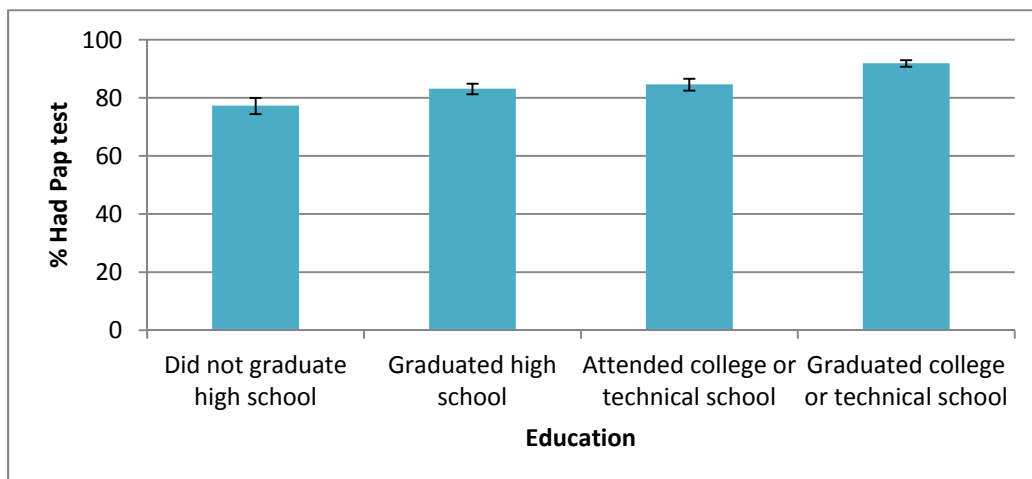
	Education			
	Did not graduate high school	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	1458	4007	4197	5585
% Yes	77.3	83.1	84.6	91.9
Low C.I.	74.4	81.2	82.5	90.7
Upper C.I.	80.0	84.9	86.6	93.0

Figure 6f below shows that the percentage of women who had a Pap test at each income level was significantly greater than the percentage at the income level below it. Of low income women, 80% have had a Pap test, 85.7% of middle income women have had a Pap test, and 93.4% of high income women have had a Pap test.

Figure 6f: Cervical Cancer Screening by Income Level: NC Years 2006, 2008 & 2010
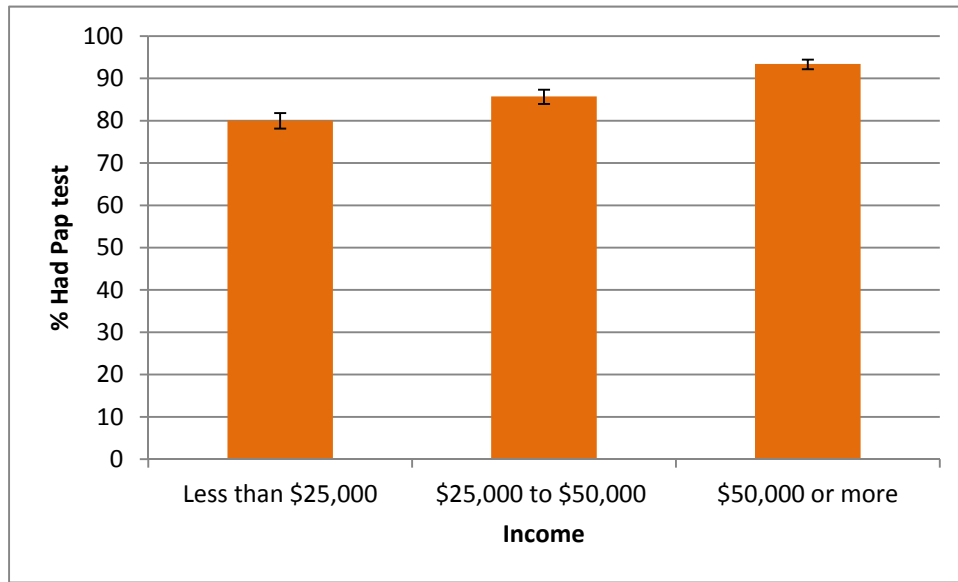
	Income		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	3668	3780	5681
% Yes	80.0	85.7	93.4
Low C.I.	78.2	84.0	92.2
Upper C.I.	81.8	87.3	94.5

Prostate Cancer Screening

The figures below show the results for men 40 years and older who have had a PSA test within the past three years by region, healthcare coverage, personal healthcare provider, race/ethnicity, education, and income.

The percentage of men who have had a PSA test did not differ significantly by region, as shown in Figure 7a. The Piedmont region, however, had the lowest raw percentage of men who had a PSA test (56.1%).

Figure 7a: Prostate Cancer Screening by Region: NC Years 2006, 2008 & 2010
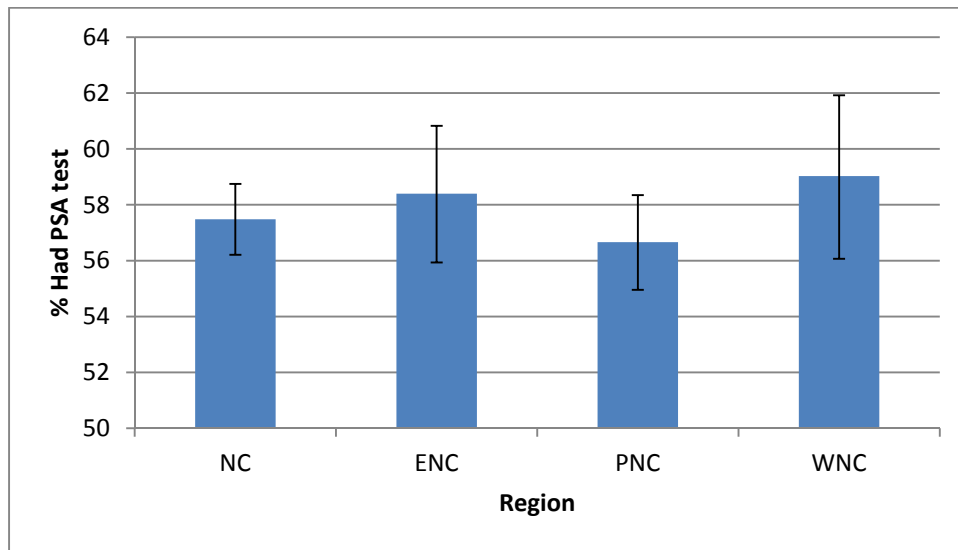
	Region			
	NC	**ENC**	**PNC**	**WNC**
N	7367	2203	3934	1230
% Yes	57.5	58.4	56.7	59.0
Low C.I.	56.2	55.9	55.0	56.1
Upper	58.7	60.8	58.3	61.9

Men with healthcare coverage and those without healthcare coverage differed substantially in terms of the percentage of those who have received a PSA test. Of men with healthcare coverage, 61.8% had a PSA test, over twice as much as those with no healthcare coverage, 26.9%; this is a difference of almost 35 percentage points, a very substantial and statistically significant disparity.

Figure 7b: Prostate Cancer Screening and Healthcare Coverage: NC Years 2006, 2008 & 2010
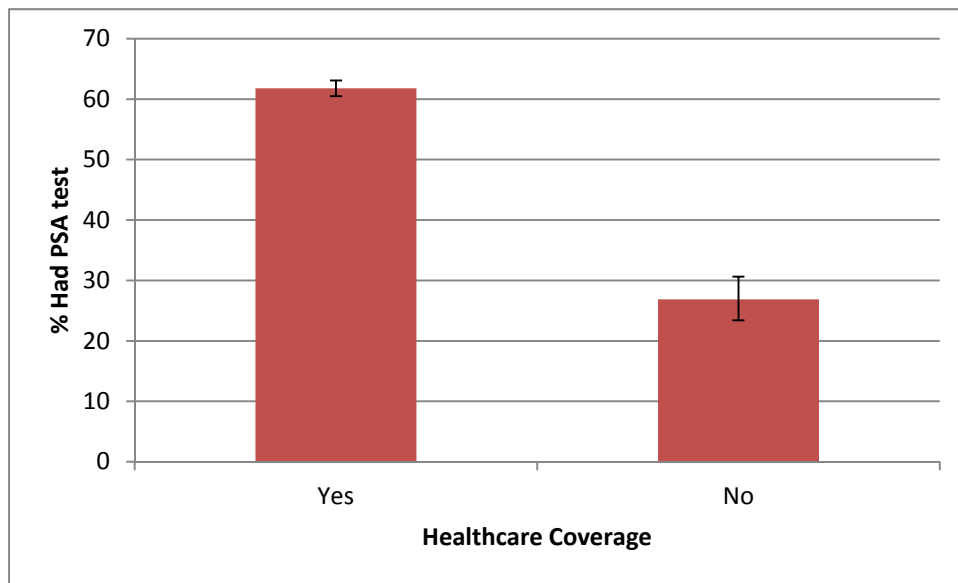
	Healthcare Coverage	
	Yes	**No**
N	7006	352
% Yes	61.8	26.9
Low C.I.	60.5	23.4
Upper C.I.	63.1	30.6

The results according to having a personal healthcare provider, shown in Figure 7c, are very similar to those by healthcare coverage. A significantly greater percentage of men who had a personal healthcare provider, 63.9%, received a PSA test, as compared to only 23.1% of those with no healthcare provider.

Figure 7c: Prostate Cancer Screening and Personal Healthcare Provider: NC Years 2006, 2008 & 2010
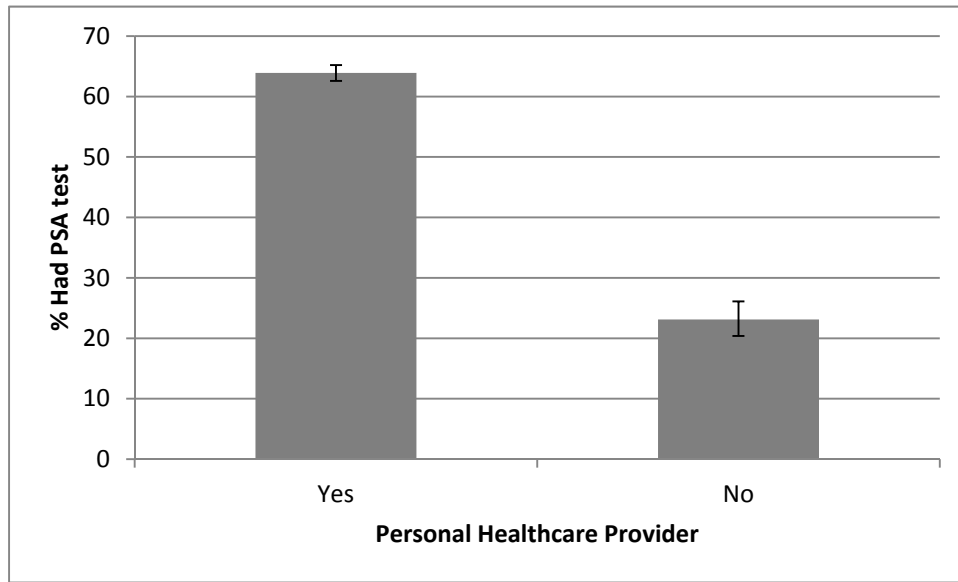
	Personal Healthcare Provider	
	Yes	**No**
N	6941	417
% Yes	63.9	23.1
Low C.I.	62.6	20.4
Upper C.I.	65.2	26.1

The results in Figure 7d show that Asians and Hispanics had significantly lower percentages of men who had a PSA test than did the other racial and ethnic groups. Of Asian men, 25.3% have had a PSA test, and 34.8% of Hispanic men have had a PSA test. Non-Hispanic Blacks had the highest percentage of men who have had a PSA test, 60.2%.

Figure 7d: Prostate Cancer Screening by Race/Ethnicity: NC Years 2006, 2008 & 2010
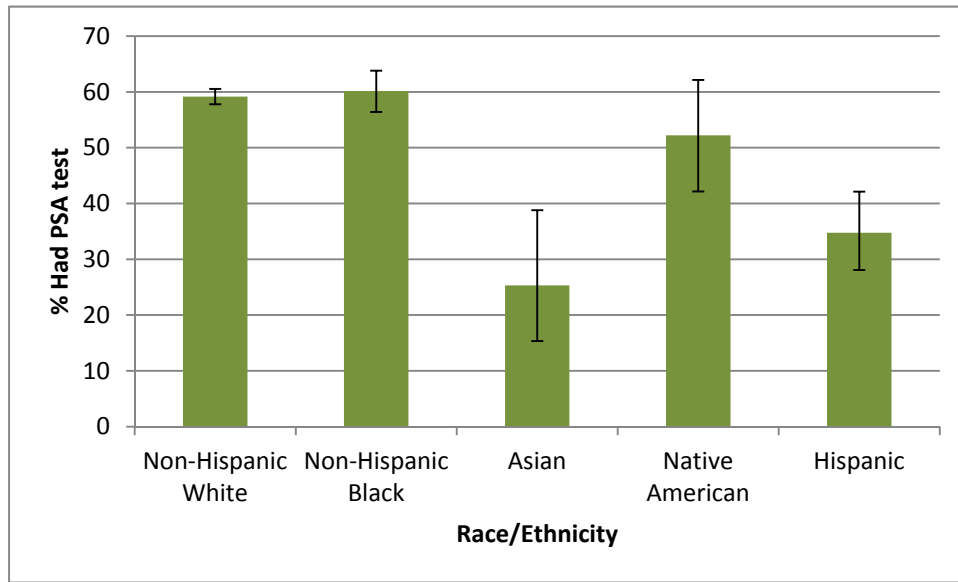
	Race/Ethnicity				
	Non-Hispanic White	**Non-Hispanic Black**	**Asian**	**Native American**	**Hispanic**
N	6015	918	22	122	110
% Yes	59.2	60.2	25.3	52.2	34.8
Low C.I.	57.8	56.4	15.3	42.1	28.1
Upper C.I.	60.5	63.8	38.8	62.1	42.1

Each education level had a significantly greater percentage of men who had a PSA test than the education level below it. Men who did not graduate high school had the lowest percentage of men who received a PSA test (44%), and men who graduated from college or technical school had the highest percentage (64.5%). Men who just attended college or technical school were 11.2% less likely to get the PSA test than those who graduated from college or technical school.

Figure 7e: Prostate Cancer Screening by Education Level: NC Years 2006, 2008 & 2010
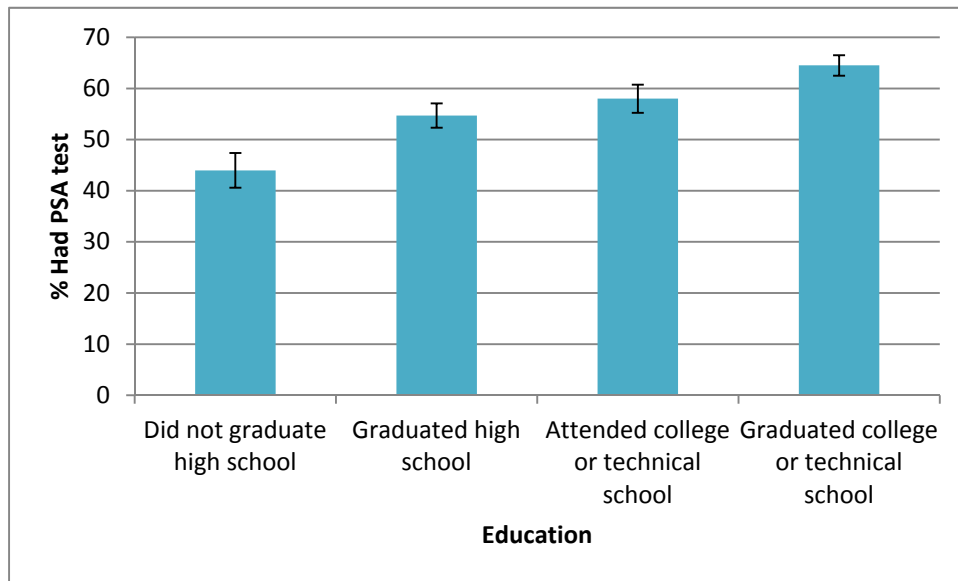
	Education			
	Did not graduate high school	**Graduated high school**	**Attended college/ technical school**	**Graduated college/ technical school**
N	874	2013	1665	2803
% Yes	44.0	54.7	58.0	64.5
Low C.I.	40.6	52.3	55.2	62.5
Upper C.I.	47.4	57.1	60.8	66.5

A significantly lower percentage of low income men had a PSA test (46.9%) than did men of the two higher income levels. This rate is 24.3% less than the rate for middle income men, and 32% less than the high income group, which are very substantial differences. The percentage of men who received a PSA test did not differ significantly between middle and high income men.

Figure 45: Prostate Cancer Screening by Income Level: NC Years 2006, 2008 & 2010
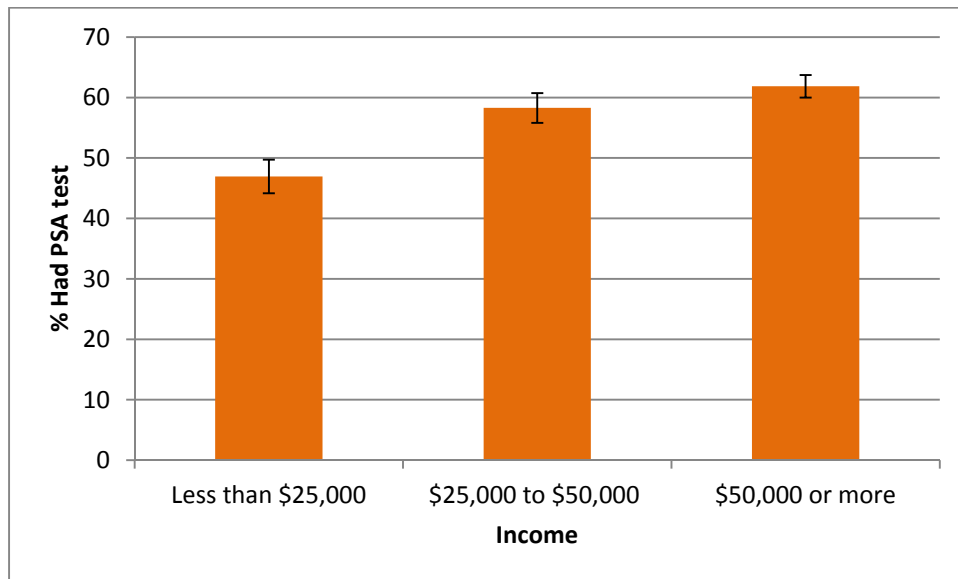
	Income		
	Less than $25,000	**$25,000 to $50,000**	**$50,000 or more**
N	1485	1945	3212
% Yes	46.9	58.3	61.9
Low C.I.	44.2	55.8	60.0
Upper C.I.	49.7	60.7	63.7

Colorectal Cancer Screening

      Figures 8a to 8g show the results for people age 50 years and older who have ever had colorectal screening, using either of two methods, a blood stool test using a home kit (FOBT) or a sigmoidoscopy/colonoscopy. The results are displayed by region, healthcare coverage, personal healthcare provider, race/ethnicity, gender, education, and income. A common pattern seen throughout the results is that more people tend utilize the sigmoidoscopy/colonoscopy for colorectal screening rather than a FOBT.

A significantly lower percentage of people use a FOBT in ENC (42.9%) than in any other region. There is no significant difference in the use of the sigmoidoscopy/colonoscopy between the different regions.

Figure 8a: Colorectal Cancer Screening by Region: NC Years 2006, 2008 & 2010
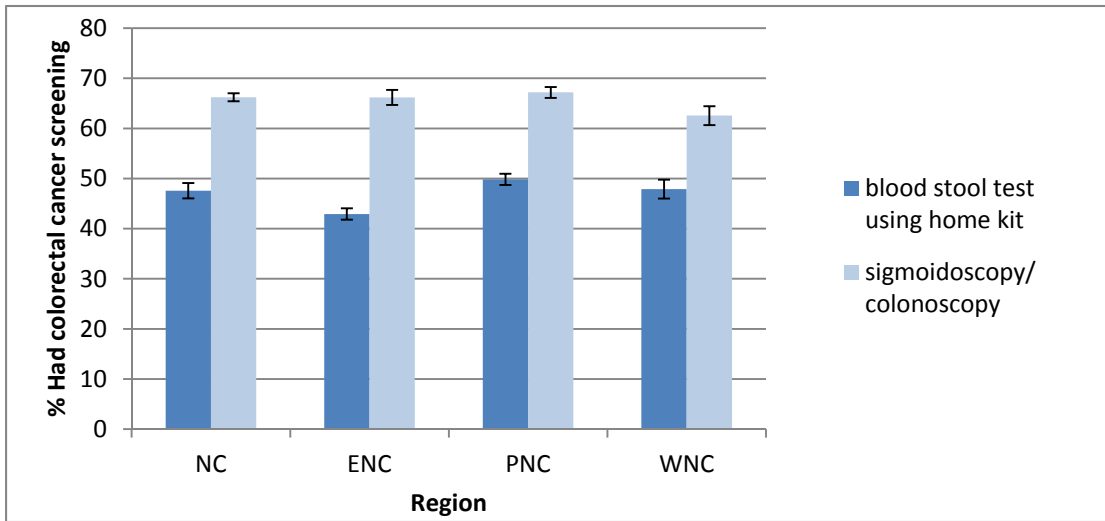
Region	NC	ENC	PNC	WNC
Blood stool test using home kit (N)	13040	3552	7384	2104
% Yes	47.6	42.9	49.8	47.9
Low C.I.	46.7	41.4	48.7	46.0
Upper C.I.	48.4	44.5	51.0	49.8
Sigmoidoscopy/colonoscopy (N)	17483	5390	9355	2738
% Yes	66.2	66.2	67.2	62.6
Low C.I.	65.4	64.7	66.1	60.7
Upper C.I.	67.0	67.7	68.3	64.4

There is a significantly lower percentage of use for both the FOBT and the sigmoidoscopy/colonoscopy among people with no healthcare coverage. Of people with no healthcare coverage, 26.4% have had a FOBT and 31.6% have had a sigmoidoscopy/colonoscopy. This is in contrast to 68.3% of people with healthcare coverage who have had a FOBT, and 69% who have had a sigmoidoscopy/colonoscopy. The disparity is close to 40 percentage points for both forms of colorectal screening, a very substantial and statistically significant difference.

Figure 8b: Colorectal Cancer Screening and Healthcare Coverage: NC Years 2006, 2008 & 2010
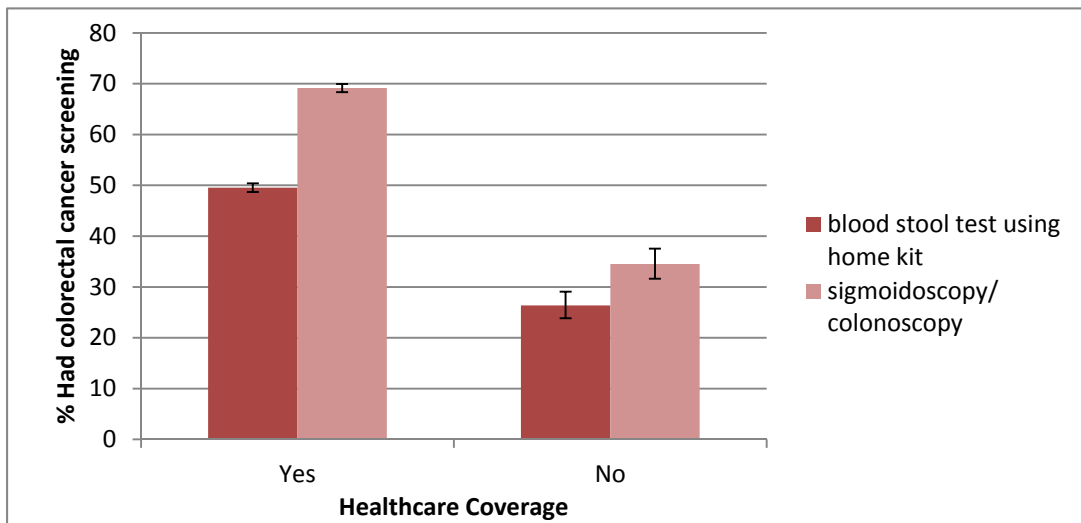
Healthcare Coverage	Yes	No
blood stool test using home kit (N)	12460	569
% Yes	49.6	26.4
Low C.I.	48.7	23.9
Upper C.I.	50.4	29.1
sigmoidoscopy/ colonoscopy (N)	16770	690
% Yes	69.1	34.5
Low C.I.	68.3	31.6
Upper C.I.	69.9	37.5

As shown in Figure 8c, there is a significantly lower percentage of use for both forms of colorectal screening among people with no personal healthcare provider. Of people with no healthcare provider, 24.4% have had a FOBT, 51% lower than the rate for people with a personal healthcare provider. This same pattern can be seen for the sigmoidoscopy/colonoscopy, with 34.2% of people with no personal healthcare provider and 69.3% of those with a healthcare provider having had the screening.

Figure 8c: Colorectal Cancer Screening and Personal Healthcare Provider: NC Years 2006, 2008 & 2010
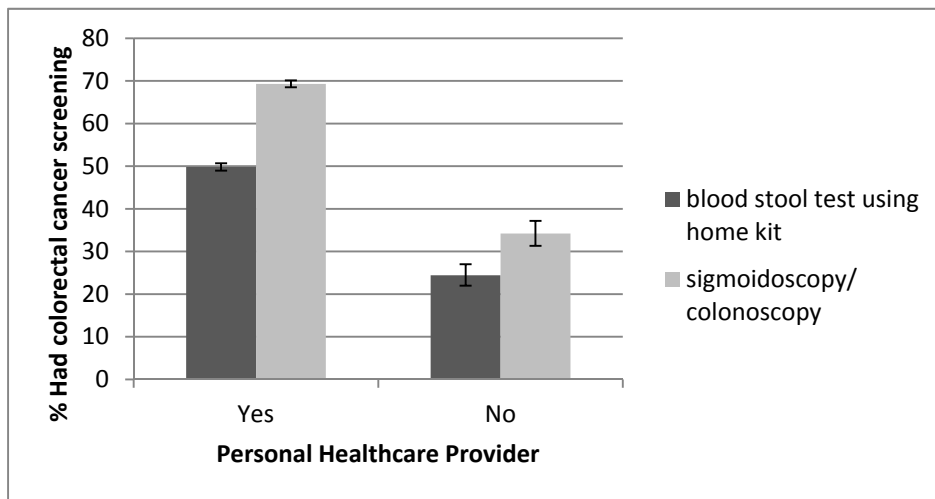
Personal Healthcare Provider	Yes	No
blood stool test using home kit (N)	12454	568
% Yes	49.8	24.4
Low C.I.	49.0	22.0
Upper C.I.	50.7	27.0
sigmoidoscopy/ colonoscopy	16728	736
% Yes	69.3	34.2
Low C.I.	68.5	31.3
Upper C.I.	70.1	37.2

All of the racial and ethnic minorities had significantly lower percentages of people who have had a FOBT and people who have had a sigmoidoscopy/colonoscopy than did Non-Hispanic Whites. Blacks, however, had a significantly higher percentage (42.3%) of people who had a FOBT than both Asians (20.1%) and Hispanics (26.4%).

Figure 8d: Colorectal Cancer Screening by Race/Ethnicity: NC Years 2006, 2008 & 2010
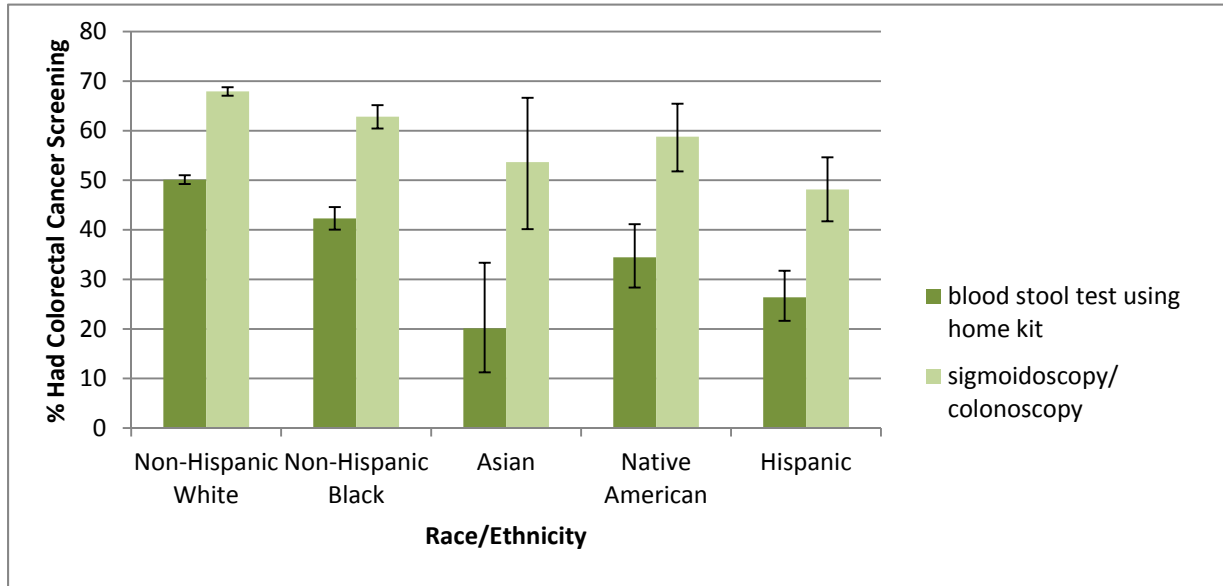
Race/Ethnicity	Non-Hispanic White	Non-Hispanic Black	Asian	Native American	Hispanic
blood stool test using home kit (N)	10905	1615	16	160	150
% Yes	50.1	42.3	20.1	34.5	26.4
Low C.I.	49.2	40.0	11.2	28.4	21.6
Upper C.I.	51.0	44.6	33.4	41.1	31.7
sigmoidoscopy/colonoscopy (N)	14356	2289	44	243	227
% Yes	67.9	62.8	53.6	58.8	48.1
Low C.I.	67.1	60.4	40.1	51.8	41.7
Upper C.I.	68.8	65.1	66.6	65.5	54.6

Men were significantly less likely to have received either form of colorectal screening than were women. Of the men surveyed, 45.1% have had a FOBT, as compared to 49.7% of women, and 64.8% of men have had a sigmoidoscopy/colonoscopy as compared to 67.4% of women. Although the differences are not very substantial, they are statistically significant.

Figure 8e: Colorectal Cancer Screening by Gender: NC Years 2006, 2008 & 2010
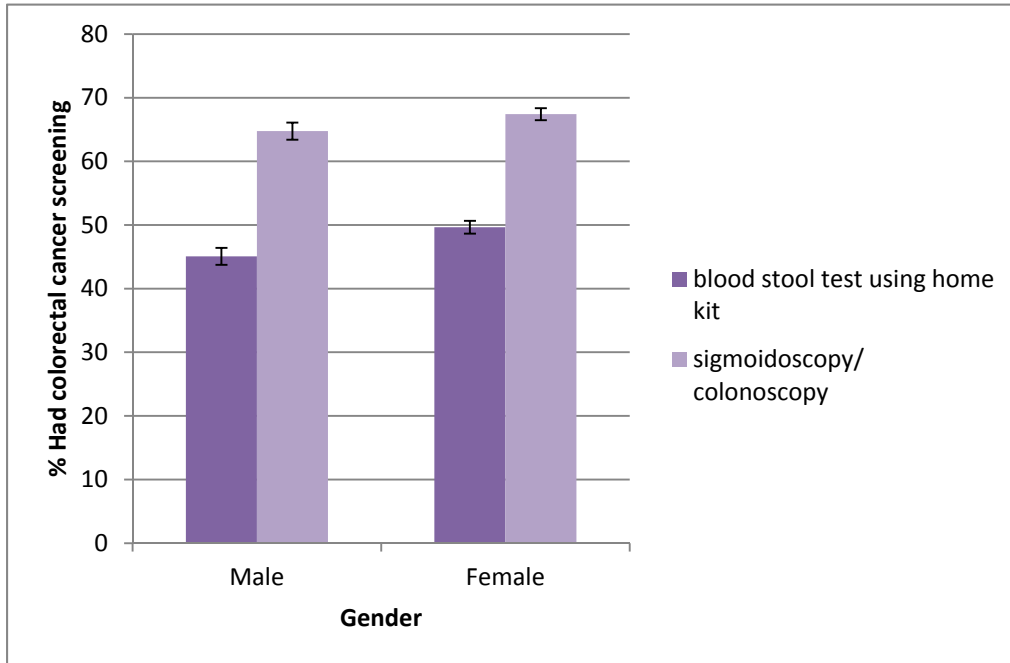
Gender	Male	Female
blood stool test using home kit (N)	4580	8460
% Yes	45.1	49.7
Low C.I.	43.7	48.7
Upper C.I.	46.4	50.7
sigmoidoscopy/ colonoscopy (N)	6303	11180
% Yes	64.8	67.4
Low C.I.	63.4	66.5
Upper C.I.	66.1	68.4

Of people who did not graduate from high school, 38.3% have had a FOBT, which was significantly lower than the percentages for the higher education levels. The other levels, however, did not differ significantly from each other for the FOBT. For the sigmoidoscopy/colonoscopy, each education level had a significantly higher percentage of people who received the test than the level below it. The percentages ranged from 54.7% for people who did not graduate from high school, to 73.7% for people who graduated from college or technical school, a range of 19 percentage points.

Figure 8f: Colorectal Cancer Screening by Education Level: NC Years 2006, 2008 & 2010
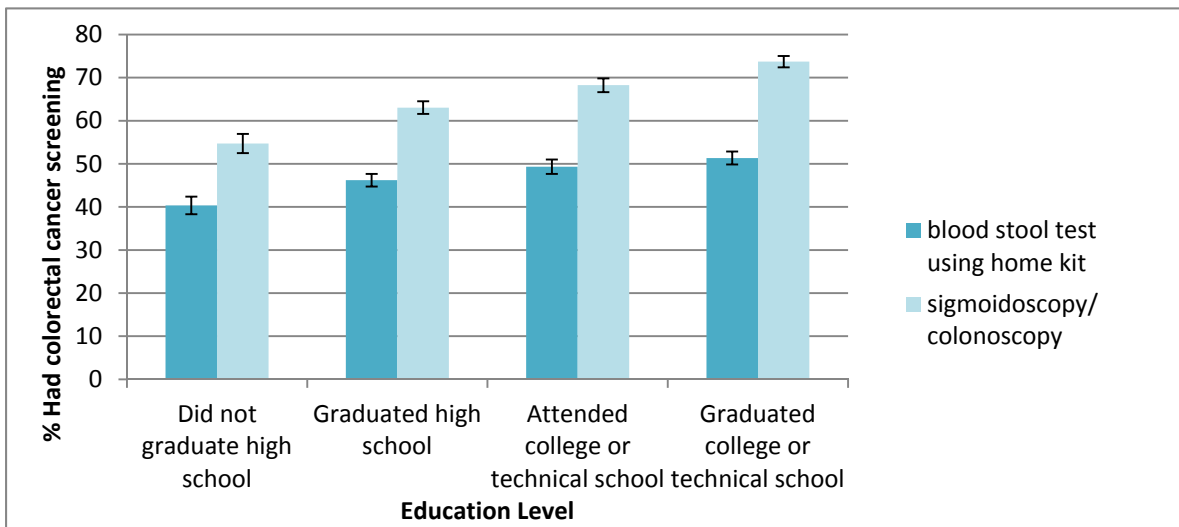
Education Level	Did not graduate high school	Graduated high school	Attended college/ technical school	Graduated college/ technical school
Bl.stool test (N)	1934	3984	3249	3853
% Yes	40.3	46.2	49.3	51.3
Low C.I.	38.3	44.7	47.7	49.8
Upper C.I.	42.4	47.7	51.0	52.9
Sigm./ colon. (N)	2419	5271	4391	5372
% Yes	54.7	63.0	68.3	73.7
Low C.I.	52.5	61.6	66.6	72.4
Upper C.I.	56.9	64.5	69.8	75.0

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The lowest income level had a significantly lower percentage (44%) of people who have had a FOBT test than the two higher income levels, which did not differ significantly from each other, both at around 49%. For the sigmoidoscopy/colonoscopy, however, each income level had a significantly higher percentage than the level below it, ranging from 57% for the lowest income level, to 74.1% for the highest income level. Quite similar to the results for education, the range from the lowest income level to the highest income level was about 17 percentage points.

Figure 8g: Colorectal Cancer Screening by Income Level: NC Years 2006, 2008 & 2010
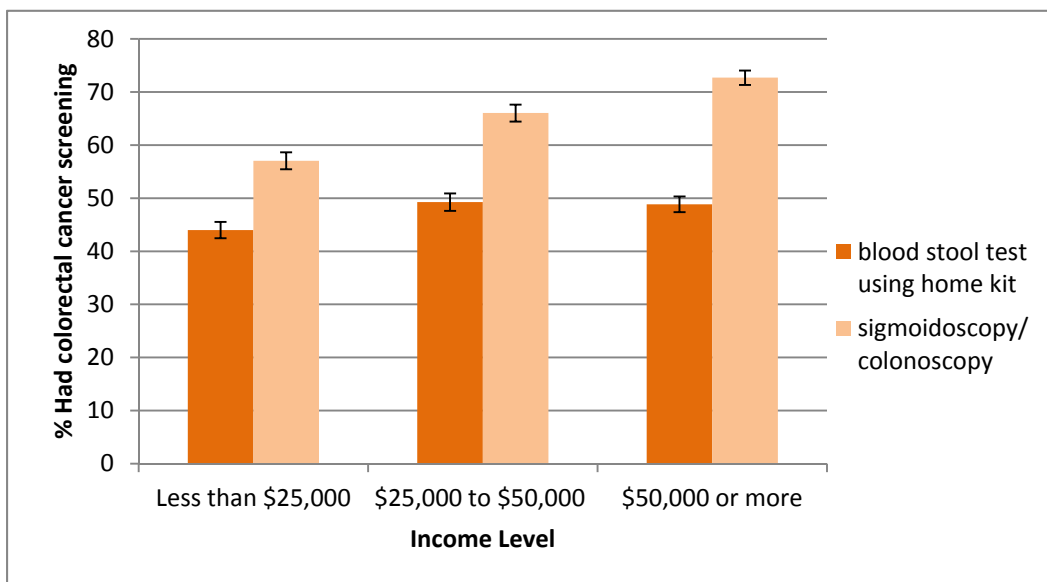
Income	Less than $25,000	$25,000 to $50,000	$50,000 or more
blood stool test using home kit (N)	3757	3316	3813
% Yes	44.0	49.3	48.9
Low C.I.	42.5	47.6	47.4
Upper C.I.	45.5	50.9	50.3
sigmoidoscopy/ colonoscopy (N)	4695	4404	5482
% Yes	57.0	66.1	72.7
Low C.I.	55.4	64.4	71.3
Upper C.I.	58.6	67.6	74.1

Discussion

In this study, I investigated the relationship between preventive care and various demographic factors. The preventive care measures examined in this study were influenza shot, pneumonia shot, diabetes screening, cholesterol screening, breast cancer screening, cervical cancer screening, prostate cancer screening, and colorectal cancer screening. The demographic variables were region, healthcare access, race and ethnicity, gender, and socioeconomic status. The results of this study support the hypothesis that there are certain groups of people who are less likely to utilize preventive care than other groups. The people who have the lowest use of preventive care are those who have no healthcare coverage, those with no personal healthcare provider, minorities, and people of lower education and income levels. Even though East Carolinians and men were less likely to use some forms of preventive care than other regions and women, these results were not consistent enough to provide support for the hypotheses that these groups are less likely to engage in preventive care in general.

People with no healthcare coverage and those with no personal healthcare provider were much less like to receive any forms of preventive care than were those with coverage and a healthcare provider. In this study, healthcare coverage and personal healthcare provider were used as a measurement of healthcare access. The results for these two variables were significant and consistent for each preventive care measure, suggesting that there is a strong relationship between healthcare access and the likelihood of using preventive care. Without healthcare coverage, such as insurance, it is difficult for people to afford medical services, which would include preventive care.[1] This also ties in with having a personal healthcare provider, since the uninsured are less likely to have a regular doctor.[16] When a patient has a regular healthcare provider, greater trust in the provider is fostered, creating an environment of effective and open

communication.[17] Having a regular provider is associated with an increased likelihood that patients receive the appropriate health services, which would include ensuring that the patient receives or is at least aware of preventive care recommendations.[1, 18]

There were significant differences between the racial and ethnic groups for all preventive care variables, supporting the hypothesis that minorities are less likely to receive the recommended preventive care than Whites. For most of the variables, Whites had a significantly higher percentage than the other minority groups, especially for the influenza shot, pneumonia shot, and colorectal cancer screening. In addition to having lower percentages than Whites for many of the preventive care variables, Blacks also had a significantly lower percentage of women who received a mammogram than did Whites. This could provide insight into why Black women have a higher breast cancer mortality rate than White women, even though Blacks have a lower breast cancer incidence rate.[10]

An interesting finding was that Asians had significantly lower percentages than most of the other races for many preventive care measures. A significantly lower percentage of Asians received diabetes screening, a pneumonia shot, and cervical cancer screening than did the other racial and ethnic groups. They, along with Hispanics, also had a significantly lower percentage of people who received prostate cancer screening. Since Asians make up only a small percentage of the North Carolina population, there is not yet much data on their health status in relation to other groups; however, it would be interesting to see whether their lower use of preventive care in these areas has an effect on their health.

Hispanics are another group that had lower use of preventive care; in addition to lower rates for prostate cancer screening, they also had significantly lower percentages for cholesterol and breast cancer screening. The rate of preventive care use among Native Americans was

similar to other minorities in general, and it was actually higher than the rates for Hispanic and Asians for a few of the variables.

Research has found that racial and ethnic minorities, including Blacks, Hispanics, Asians, and Native Americans share many of the same socioeconomic barriers to preventive care.[19] These barriers include not being able to afford medical services, a belief that preventive care is not necessary, and a lack of English fluency among immigrants.[20] There is also a fear and lack of knowledge among some minority women in regards to breast cancer screening, including not knowing the recommendation for mammograms and having an exaggerated fear of the pain associated with the screening.[19] The lower use of preventive care among minorities could be a factor in explaining why these groups generally have lower health status than Whites.

People of lower education and income levels were significantly less likely to receive each of the recommended preventive care measures than people of higher education and income levels; this is consistent with the hypothesis that people of lower socioeconomic status are less likely to receive adequate preventive care. Income and education are directly linked, since people of higher educational levels tend to have better paying jobs, and together they can determine the kinds of resources available to a person, including information and money.[13] One study found that a common perception among low-income people living in rural areas is that preventive care is unnecessary.[20] This belief could be a result of lower education levels since people who are less educated are likely to be unaware of the importance of preventive care. The most probable reason that people of lower socioeconomic status are less likely to get preventive care is because of cost; it is especially difficult for low-income families not covered with Medicare to afford going to the doctor.[20] The findings from this study suggest that the lack of preventive care among

people of low socioeconomic status could be a contributing factor to the higher morbidity and mortality rates among members of this group.

Although it was expected that men would be less likely to receive preventive care, the data supports this hypothesis for only a few types of preventive care. A greater percentage of women received the influenza shot, the pneumonia shot, and colorectal cancer screening than did men. Men, however, had higher rates of cholesterol and diabetes screening. The lower percentage of colorectal cancer screening among men could contribute to their higher incidence and mortality rates of colorectal cancer in comparison to women. The fact that men tend to have higher rates of diabetes may explain why they are more likely to get diabetes screening.[21] Perhaps doctors are more likely to recommend diabetes screening for men since they are more at risk than women. Further research could explore other factors that contribute to the health disparity between men and women.

It was hypothesized that Eastern North Carolina would have lower percentages of people who received the recommended preventive care than other regions of North Carolina; however, this was only true for two preventive care variables. A significantly lower percentage of Eastern North Carolinians received the influenza shot and the FOBT for colorectal cancer screening than the other regions. Western North Carolina had the lowest percentages out of all the regions for diabetes screening, breast cancer screening, and cervical cancer screening. The results from this study suggest that the comparably lower rate of health in Eastern North Carolina is not caused by a lack of preventive care, so there must be other dynamics involved. A possible explanation could be the lower socioeconomic status and the greater proportion of minorities in Eastern North Carolina in comparison to the rest of the state. The rate of poverty is significantly higher in Eastern North Carolina than in other regions: 15.4% of Eastern North Carolinians live in poverty

as compared to 10.4% of the rest of North Carolina.[22] Eastern North Carolina has a significantly greater percentage of African Americans, Native Americans, Hispanics, and Asians.[22] As previously discussed, minorities and people of lower socioeconomic status generally have lower health status than Whites and people of higher socioeconomic status, which could contribute to the lower health of Eastern North Carolina in general.[2, 13]

Although the results from this study suggest that preventive care could play a role in explaining why certain groups have a higher incidence of chronic illness and mortality, the results also imply that there are other factors at work. Many of the variables in this study likely interact with each other, such as socioeconomic status, race, and health coverage, making it difficult to know what the fundamental cause of the disparity is. Future research could further explore causes of health disparities, the relationship between preventive care and health, and why certain groups of people are less likely to partake in preventive care.

Conclusion

Major goals of Healthy People 2020 are to eliminate health disparities, attain lives free of preventable disease and premature death, and to promote preventive care to all people. This study shows that there are certain groups of people who do not receive adequate preventive care, which could help prevent many health problems. In order to achieve the Healthy People 2020 goals, North Carolina should put more effort in promoting preventive care to specific groups of people who are less likely to engage in preventive behavior, including minorities, people with no healthcare access, and people of low socioeconomic status. The data from this study can provide information on which populations should be targeted in future preventive care promotion campaigns.

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