The Influence of Rural Residence on the Use of Preventive Health Care Services

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EXECUTIVE SUMMARY

This study used data from the 1997 Behavioral Risk Factor Surveillance System (BRFSS) and the 1999 Area Resource File to describe the utilization of specific preventive health care services by rural women and men, and to assess the impact of rural residence, the availability of health care providers and technology, demographic factors, and health insurance status on the likelihood of obtaining the following preventive health care services: blood pressure screening, cholesterol screening, colon cancer screening, Pap smears, mammograms, flu shots, and pneumonia vaccinations.

Respondents were grouped by gender, age, and residence in an urban, rural adjacent, or rural non-adjacent county, based on the USDA rural-urban continuum codes. Rural adjacent counties are non-metropolitan counties that are physically adjacent to one or more metropolitan areas and have at least 2 percent of their employed labor force commuting to central metropolitan counties; rural non-adjacent counties are non-metropolitan counties that do not meet the above criteria. Physician to population ratios are lower in rural non-adjacent counties than in adjacent counties, and non-adjacent residents generally must travel greater distances to access health care resources. Consequently, non-adjacent residents may be significantly less likely to obtain preventive health services than those who reside in adjacent areas.

Eleven logistic regression models were used to assess the impact of the following variables on the likelihood of obtaining each preventive health care service: the respondent's residence in a rural adjacent, rural non-adjacent, or urban county, Census Region, education, income, race/ethnicity, gender, age, health insurance status, ability to afford medical care, the physician to population ratio and mammography facility to population ratio (mammograms only) in the respondent's county.

Several demographic and health insurance status variables were significantly related to the likelihood of obtaining preventive services, while controlling for other variables. Respondents with less than a high school education are significantly less likely than those with more education to have routine medical checkups, blood pressure screening, cholesterol screening, Pap smears, mammograms, and flu shots. Compared to respondents with employer-provided insurance, uninsured persons and those with individually purchased insurance are significantly less likely to obtain all of the preventive services, while respondents with Medicare or Medicaid coverage were more likely to receive checkups, blood pressure screening, colon cancer screening (Medicare), and Pap smears (Medicaid). Respondents who reported having a time during the past year when they could not afford to visit a doctor were significantly less likely to obtain all services except for colon cancer screening and pneumonia vaccinations. Black, non-Hispanic respondents are more likely than White, non-Hispanic respondents to receive all of the preventive services except flu shots and pneumonia vaccinations.

Controlling for demographic characteristics, health insurance status, and health system characteristics, rural non-adjacent residents are significantly less likely than urban residents to have a routine medical checkup, blood pressure screening, cholesterol test, mammogram, Pap test, and fecal occult blood test, proctoscopy, or sigmoidoscopy. Rural adjacent residents are significantly less likely than urban residents to have a routine medical checkup, cholesterol test, mammogram (women

aged 40 to 49 years), and fecal occult blood test, proctoscopy, or sigmoidoscopy. Overall, differences between rural non-adjacent respondents and urban respondents were greater than those between rural adjacent respondents and urban respondents. The results indicate that rural residents are less likely than urban residents to obtain certain preventive health services and are further behind in meeting the Healthy People 2010 National Health Promotion and Disease Prevention objectives.

Efforts to increase preventive services utilization rates among rural populations need to build on federal, state, and community-based initiatives to increase preventive service utilization by underserved populations, as well as recognizing the special challenges that rural areas present in the delivery of health care services. The results of this study, along with previous research on programs to increase preventive health services utilization among underserved populations, indicate that strategies to increase rural preventive services utilization must reduce financial, geographic, and cultural barriers to care. In addition, efforts are needed to increase awareness of the importance of obtaining these preventive health services among rural populations and health care providers, and to ensure that follow-up diagnostic and treatment services are available to persons with abnormal test results.

INTRODUCTION

A variety of factors are associated with low utilization of preventive health care services including financial barriers, such as lack of health insurance, or insurance that does not cover preventive services, and patient characteristics, such as low income, fewer years of education, lack of knowledge about the potential benefits of preventive services, not having a regular source of medical care, and residing at a distance from medical care (Makuc, Fried, and Kleinman, 1989; The National Cancer Institute Breast Cancer Screening Consortium, 1990, 1995; Bostick, Sprafka, Virnig, and Potter, 1993; Frazier, Jiles and Mayberry, 1996; Faulkner and Schauffler, 1997).

Many of the factors associated with low utilization of preventive services are those that characterize rural populations, including lower incomes, lower educational status, and inadequate health insurance. Surveys and focus groups of rural residents have identified several barriers to obtaining preventive health services, including cost, lack of insurance coverage, travel distance, transportation problems, difficulty taking time off work, and lack of recommendations regarding the need for the preventive service from a health care provider (Walker, Lucas and Crespo, 1994; Elnicki, Morris , and Shockcor., 1995; Carr et al., 1996; Sparks, Ragheb, Given, and Swanson, 1996; Strickland and Strickland, 1996; Reding et al.,1997).

Some studies in the U.S. and Canada have found that rural populations underutilize many types of preventive health services (OTA, 1990; Bryant and Mah, 1992). Underutilization of preventive services may result in a failure to identify health care problems that might be successfully managed with medication and/or lifestyle changes, e.g., hypertension. Failure to obtain timely screening tests for certain cancers, such as breast, cervical and colon cancer, may result in diagnosis at later stages of the disease, when the prognosis is poorer. There is some evidence that cancer tends to be diagnosed at more advanced stages among rural populations (Monroe, Ricketts, and Savitz, 1992; Liff, Chow, and Greenberg, 1991).

This study has two purposes: 1) to describe the utilization of specific preventive health care services by rural women and men, and 2) to assess the impact of rural residence, demographic factors, health insurance status, and health system characteristics on the likelihood of obtaining each preventive health care service.

DATA AND METHODS

The data sources for the project are the 1997 Behavioral Risk Factor Surveillance System (BRFSS) and the 1999 Area Resource File (ARF). The BRFSS is a state-based survey of the U.S. non-institutionalized population. Through the BRFSS, the Centers for Disease Control and Prevention and the states collect data annually on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases. Adults aged 18 years and older are surveyed by phone. Most analyses of BRFSS data on preventive health services have focused on state-by-state comparisons. Some analyses have also compared utilization of preventive health services by gender, and by racial and ethnic groupings. Limited analyses have been conducted of the BRFSS data by rural or urban residence of respondents. The ARF database provides county-level data on the availability of health care providers and technology. Each BRFSS record has a county FIPS code, allowing the data to be merged with county-level data from the ARF.

The BRFSS questionnaire includes a core component, consisting of the fixed, rotating, and emerging core, and optional modules (CDC, 1998a). The fixed core is a set of questions asked of BRFSS participants in all states. It includes questions about demographic characteristics, health status, health insurance, tobacco use, and selected cancer screening procedures. The rotating core consists of two distinct sets of questions, each asked in alternating years by all states, addressing different topics. In 1997, the rotating core items covered cholesterol, hypertension, injury, immunization, colorectal screening and alcohol use. The emerging core is a set of up to five questions that are added to the fixed and rotating cores. Emerging core questions typically focus on issues of a "late breaking"nature. These questions are part of the core for one year and are evaluated during or soon after the year concludes to determine their potential value in future surveys. Emerging questions for 1997 focused on health care coverage. States may also choose to include optional CDC modules, which are sets of questions on specific topics.

All 50 states, the District of Columbia, and U.S. territories participated in the BRFSS in 1997. The initial file contained 135,582 observations. After removing respondents whose BRFSS records could not be linked to ARF data using county FIPS codes (e.g., respondents missing county codes or residing in Alaska and Puerto Rico), a total of 130,452 respondents remained. California modified the wording of questions on mammograms and pap smears, so its data were excluded for those services but included for all other analyses.

For the initial descriptive analyses, respondents were grouped by gender and residence in an urban, rural adjacent, or rural non-adjacent county, based on the USDA rural-urban continuum codes. Rural adjacent counties are non-metropolitan counties that are physically adjacent to one or more metropolitan areas and have at least 2 percent of their employed labor force commuting to central metropolitan counties; rural non-adjacent counties are non-metropolitan counties that do not meet the above criteria. Physician to population ratios are lower in rural non-adjacent counties than in adjacent counties, and non-adjacent residents generally must travel greater distances to access health care services in metropolitan areas. Consequently, non-adjacent residents may be significantly less likely to obtain preventive health services than those who reside in adjacent areas.

Some analyses were conducted of subgroups by age, based on relevant guidelines. Three-way urbanicity comparisons were used to differentiate between urban, rural adjacent, and rural non-adjacent counties. Comparisons were also made between women and men within urbanicity categories, for preventive services that were relevant to both women and men. Z-tests were calculated to identify statistically significant differences between these groups. Next, multivariate analyses were performed to identify which factors significantly affect the likelihood of an individual obtaining each preventive health care service, while controlling for the effects of other factors. The statistical analyses used SUDAAN (Survey Data Analysis for Multistage Sample Design) software, which takes into account the complex sample design used to obtain BRFSS data.

The BRFSS excludes households without phones, since it is conducted only as a telephone survey. Overall, 95 percent of households in the United States have a telephone, however, telephone coverage rates vary by geographic location, income, race, and age of the householder. A higher proportion of non-MSA residents (8.2 percent) lack a telephone in their household than central city MSA residents (7.4 percent) or residents of MSAs outside central cities (4.4 percent). Households with annual incomes of less than $15,000 are much more likely to lack a telephone than those with higher incomes. By race and ethnicity, American Indians, Hispanic, and African-American householders are more likely than Asian or White householders to lack a phone. Householders under the age of 25 are also more likely to be without a phone (US Bureau of the Census, 1998). The BRFSS does not employ a direct method of compensating for non-telephone coverage; however, the post-stratification weights used may partially correct for any bias caused by non-telephone coverage (CDC, 1998a).

County-level data from the ARF used in the study include data on the number of primary care physicians serving adults (MDs and DOs in family practice, general practice, internal medicine, and obstetrics/gynecology) who are actively practicing in each county as of 1995, county population as of 1996, and the number of Medicare certified mammography facilities in each county as of 1994.

We used three sets of nationally accepted preventive services guidelines or recommendations to evaluate the adequacy of preventive services provided to rural and urban women and men: the American Cancer Society (ACS) cancer screening guidelines; the Healthy People 2010 National Health Promotion and Disease Prevention Objectives (USDHHS, 1998); and the United States Task Force for Preventive Services (USTFPS, 1996).

The ACS was founded in 1913 to disseminate information concerning the symptoms, treatment and prevention of cancer. It funds intramural and extramural research, establishes treatment and detection guidelines, and advocates at all levels of government to improve and ensure access to preventive, diagnostic and treatment services, as well as to affect other cancer related policies. The HP 2010 initiative has three broad goals: to increase the span of healthy life for Americans, to reduce health disparities among Americans, and to achieve access to preventive services for all Americans. These goals are divided into 26 priority areas. USTFPS provides recommendations for clinical practice on preventive interventions, screening tests, counseling interventions, immunizations, and chemoprophylactic regimens for the prevention of 80 target conditions. Its recommendations are based on a standardized review of the current scientific evidence.

The results section is organized as follows. First, the report describes basic demographic characteristics of the respondents, and presents data on factors that may influence utilization of preventive services, including health insurance status. Next, for each type of preventive service, the report 1) describes the relevant ACS, HP 2010, and USTFPS guidelines or recommendations; 2) summarizes previous research on utilization rates and factors associated with obtaining the recommended services; and 3) presents the results of bivariate analyses of utilization rates for the recommended services by category of urbanicity and, where appropriate, gender and age, using the 1997 BRFSS data. The final section discusses the results of logistic regression models that examine the relationship between rural residence and the likelihood of obtaining each recommended service, controlling for demographic characteristics, health insurance status, and health system characteristics.

RESULTS

Demographic Characteristics and Health Care Access Measures

Table 1 displays selected demographic characteristics of the women and men in the sample: age, income, education and race. Differences in demographic characteristics between respondents by category of urbanicity are consistent with census data, e.g., non-metropolitan populations generally have higher percentages of persons over age 65, lower percentages of minority populations, and lower average incomes and levels of education than metropolitan populations (Ricketts, Johnson-Webb, and Randolph, 1999).

Table 2 shows several statistically significant differences in respondents= self-reported health status by gender and category of urbanicity. Within each category of urbanicity, men are significantly more likely than women to report their health status as Aexcellent.@ Across categories of urbanicity, urban women are significantly more likely than either rural adjacent or rural non-adjacent women to report their health status as Aexcellent;@ urban men are also significantly more likely than either rural adjacent or rural non-adjacent men to report their health status as Aexcellent.@

By source of health insurance, several statistically significant differences also exist by gender and category of urbanicity (Table 3). Within each category of urbanicity, men are significantly more

Table 1

Demographic Characteristics of Rural and Urban Women
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Age						
18 - 24	9.8	13.8	10.6	12.2	11.8	13.4
25 - 34	17.8	17.8	16.1	19.0	19.8	22.0
35 - 44	18.8	20.0	19.6	21.4	21.7	22.5
45 - 54	15.9	18.0	16.2	17.7	16.4	17.0
55 - 64	12.7	12.8	13.7	12.1	11.0	10.8
65+	25.0	17.5	23.8	17.7	19.4	14.3
Education						
Elementary or less	6.4	6.9	6.0	6.4	4.5	4.6
Some high school	11.5	10.5	11.9	9.8	8.2	7.8
High school grad/GED	38.2	37.1	40.5	39.0	32.1	29.2
Some college/technical	27.0	25.5	26.0	26.2	28.9	27.3
College grad or higher	16.7	19.8	15.5	18.4	26.2	31.0
Income						
< $10,000	8.2	4.7	7.2	4.5	6.1	4.2
$10,000 to $14,999	8.7	5.8	6.8	4.7	5.9	4.3
$15,000 to $19,999	10.4	9.6	9.5	8.6	7.5	6.4
$20,000 to $24,999	12.3	13.3	11.9	12.1	9.7	9.0
$25,000 to $34,999	17.2	19.9	16.3	18.3	14.1	15.0
$35,000 to $49,999	15.0	17.9	16.7	19.5	15.6	18.3
$50,000 to $74,999	8.6	11.2	10.0	12.8	13.6	16.2
$75,000 or more	4.1	6.0	4.4	7.8	10.8	14.6
Don't know	9.6	5.5	9.5	6.2	8.1	4.8
Refused	6.0	6.2	7.7	5.5	8.7	7.0
Race						
White non-Hispanic	87.0	86.3	86.6	86.4	72.7	73.2
Black non-Hispanic	5.8	5.8	7.0	6.0	11.7	9.5
Hispanic	4.0	4.3	4.3	4.7	10.6	11.6
Other	3.0	3.4	1.9	2.5	4.6	5.2

Table 2

Self-Reported Health Status
Rural and Urban Women and Men Age 18 and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	Men	Women	Men	Women	Men
Excellent [1]	20.1	23.5	20.3	22.0	23.2	26.1
Very Good [2]	32.5	32.1	31.4	33.3	34.4	34.2
Good [3]	29.4	28.7	30.1	29.6	28.3	27.1
Fair [4]	12.2	10.7	12.8	10.9	10.6	9.5
Poor [5]	5.9	5.0	5.4	4.1	3.5	3.1

[1] Differences between 1) urban women and men, 2) urban and rural adjacent women, 3) urban and rural non-adjacent women, and 4) urban and rural adjacent men are significant at $p < .001$. Differences between rural non-adjacent women and men are significant at $p < .01$. Differences between urban and rural non-adjacent men are significant at $p < .05$.

[2] Differences between 1) urban and rural adjacent women are significant at $p < .01$. Differences between urban and rural non-adjacent women are significant at $p < .05$.

[3] Differences between urban and rural non-adjacent men are significant at $p < .05$.

[4] Differences between urban women and men, and between urban and rural non-adjacent women, are significant at $p < .05$. Differences between urban and rural adjacent women are significant at $p < .01$.

[5] Differences between 1) urban and rural adjacent women, 2) urban and rural non-adjacent women, and 3) urban and rural non-adjacent men are significant at $p < .001$. Differences between urban and rural adjacent men are significant at $p < .05$.

Table 3

Source of Health Insurance
Rural and Urban Women and Men 18 Years and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	Men	Women	Men	Women	Men
Source of Health Insurance						
Own Employer [1]	29.1	42.3	30.7	47.9	34.9	50.8
Medicare [2]	27.1	21.5	25.9	20.2	20.8	16.3
Someone Else's Employer [3]	18.3	8.5	21.1	9.0	21.8	9.5
Purchased on Own [4]	6.5	8.7	6.0	5.7	5.4	5.8
Medicaid [5]	4.1	1.8	4.3	1.4	4.0	1.5
Military [6]	1.3	2.5	0.9	2.5	1.2	2.2
Other [7]	0.9	1.5	0.9	1.3	1.1	1.3
None [8]	12.7	13.3	10.3	12.1	10.9	12.6

[1] Differences between 1) urban women and men, 2) rural adjacent women and men, 3) rural non-adjacent women and men, 4) urban and rural adjacent women, 5) urban and rural non-adjacent women, and 6) urban and rural non- adjacent men are significant at p< .001. Differences between rural adjacent and rural non-adjacent men are significant at p < .01. Differences between urban and rural adjacent men are significant at p< .05.
[2] Differences between 1) urban women and men, 2) rural adjacent women and men, 3) rural non-adjacent women and men, 4) urban and rural adjacent women, 5) urban and rural non-adjacent women, 6) urban and rural adjacent men, and 7) urban and rural non-adjacent men are significant at p< .001.
[3] Differences between 1) urban women and men, 2) rural adjacent women and men, 3) rural non-adjacent women and men, and 4) urban and rural non-adjacent women are significant at p< .001. Differences between rural adjacent and rural non-adjacent women are significant at p< .05.
[4] Differences between 1) urban and rural non-adjacent men, and 2) rural adjacent and rural non-adjacent men are significant at p< .001. Differences between rural non-adjacent women and men are significant at p< .01. Differences between urban and rural non-adjacent women are significant at p< .05.
[5] Differences between 1) urban women and men, 2) rural adjacent women and men, 3) rural non-adjacent women and men are significant at p< .001.
[6] Differences between 1) urban women and men, 2) rural adjacent women and men are significant at p< .001., 3) rural non-adjacent women and men are significant at p< .01.
[7] No significant differences.
[8] Differences between 1) urban women and men, 2) urban and rural non-adjacent women, and 3) rural adjacent and rural non-adjacent women are significant at p< .01.

likely than women to have health insurance through their own employer, while women are significantly more likely than men to have insurance through Medicare or through someone else's employer, e.g, a spouse's employer.

Across categories of urbanicity, both rural adjacent and rural non-adjacent women are significantly less likely than urban women to have health insurance through their own employer. Both rural women and men (adjacent and non-adjacent) are significantly more likely to have Medicare than their urban counterparts, reflecting the greater proportion of persons over age 65 in the rural adjacent and non-adjacent populations.

Across all urbanicity categories, women are significantly more likely than men to report having had a time during the past 12 months that they could not afford to visit the doctor (Table 4). Rural non-adjacent women are also significantly more likely than urban women to report an affordability of care problem.

Bivariate Analyses of Preventive Health Care Services Utilization Rates

Routine Medical Checkups

Routine medical checkups are an occasion to provide certain preventive services, for example, blood pressure checks, as well as providing an opportunity for physicians and other health professionals to recommend that patients obtain preventive services that require advanced scheduling or use of specialized equipment, e.g., mammograms. Across all urbanicity categories, women are significantly more likely than men to have obtained a routine medical checkup within the past year or the past two years (Table 5). Urban men are also more likely than rural non-adjacent men to have had a checkup in the past year.

Table 4

Affordability of Care
Rural and Urban Women and Men 18 Years and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Affordability of Care Had a time in past 12 months could not afford to see doctor	14.5	9.4	12.6	9.3	12.1	8.6

Differences between 1) urban women and men, 2) rural adjacent women and men, and 3) rural non-adjacent women and men are significant at $p < .001$. Differences between urban and rural non-adjacent women are significant at $p < .01$.

Table 5

Routine Medical Checkups
Rural and Urban Wome n and Men 18 Years and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

Time since last routine medical checkup	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	Men	Women	Men	Women	Men
Within past year [1]	76.5	58.2	77.0	60.7	77.9	61.1
Within past 2 years [2]	10.9	14.4	10.8	14.1	10.9	15.3
Within past 5 years [3]	5.8	10.7	5.2	10.0	5.1	10.4
More than 5 years [4]	6.0	14.9	6.0	12.8	4.8	10.8
Never [5]	0.8	1.8	1.0	2.4	1.3	2.5

[1] Differences between 1) urban women and men, 2) rural adjacent women and men, and 3) rural non-adjacent women and men are significant at p< .001. Differences between urban men and rural non-adjacent men are significant at p< .05.

[2] Differences between 1) urban women and men and 2) rural non-adjacent women and men are significant at p< .001. Differences between rural adjacent women and men are significant at p < .01.

[3] Differences between 1) urban women and men, 2) rural adjacent women and men, and 3) rural non-adjacent women and men are significant at p< .001.

[4] Differences between 1) urban women and men, 2) rural adjacent women and men, 3) rural non-adjacent women and men, and 4) urban and rural non-adjacent men are significant at p< .001. Differences between 1) urban and rural adjacent women, 2) urban and rural non-adjacent women, 3) urban and rural adjacent men are significant at p< .05.

[5] Differences between 1) urban women and men are significant at p< .001. Differences between 1) rural adjacent women and men and 2) rural non-adjacent women and men are significant at p< .01. Differences between 1) urban and rural non-adjacent women are significant at p< .05.

Blood Pressure Screening

Hypertension (high blood pressure) is a risk factor for heart disease and stroke, which are the first and third leading causes of death in the U.S. Almost one-fourth of all adults have high blood pressure (NCHS, 1998).

Guidelines/Recommendations

- USPSTF guidelines recommend Aperiodic screening@ for people $\geq$ 21 years; there is a weak recommendation for screening every 2 years.
- HP 2010 goal is that 95% of people > 18 years will report having a blood pressure check within the last 2 years.

Utilization Rates and Factors Associated with Obtaining Recommended Services

Using 1985 NHIS data on women only, Makuc et al. (1989) found that blood pressure screening rates differed by race, income, and age. Low income white women were least likely to be tested while higher income black women were most likely, and women over age 60 were more likely than younger women to have their blood pressure checked. BRFSS data for 1991 indicate that blood pressure screening rates by age and gender were similar, ranging from 96 percent for men aged 18 to 39 years to 99 percent for women in the same age group (Faulkner and Schauffler, 1997). National Health Interview Survey (NHIS) data for 1994 indicate that 84 percent of persons aged 18 and over had their blood pressure checked in the last 2 years (USDHHS, 1998).

Analysis of 1997 BRFSS Data

Table 6 shows that respondents in all gender and urbanicity categories have high levels of compliance with blood pressure screening recommendations. This high level of compliance reflects the fact that blood pressure screening is a routine part of basically all medical encounters. Consistent with their greater likelihood of receiving a routine medical checkup in the last two years, women are significantly more likely than men to have had their blood pressure taken by a health

Table 6

Blood Pressure Screening
Rural and Urban Women and Men Age 18 and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Had blood pressure taken by health professional in past two years	95.6	90.1	96.1	91.4	96.3	91.4

Differences between 1) rural non-adjacent women and men, 2) rural adjacent women and men, and 3) urban women and men are all significant at p< .001.

professional in the past two years. None of the differences in blood pressure screening rates across urbanicity categories are significant.

Cholesterol Screening

High blood cholesterol level is a risk factor for coronary heart disease, which is the leading cause of death in the United States (CDC, 1993).

Guidelines/Recommendations

- USPSTF guidelines recommend periodic screening for men 35 to 65 years old, and women 45 to 65 years old. Screening after age 65 may be considered on a case-by-case basis; older persons with major risk factors for coronary heart disease (smoking, hypertension, and diabetes) who are otherwise healthy may be more likely to benefit from screening. USPSTF states that a five year interval for screening has been recommended by experts but longer intervals may be reasonable in low-risk persons.

- HP 2010 goal is that ≥75 percent of men and women aged 20 years and older will have their cholesterol checked within the past five years.

Utilization Rates and Factors Associated with Obtaining Recommended Services

Analysis of state-level BRFSS data for 1988 found that the median percentage of adults who reported ever having their cholesterol checked was 50 percent. The median percentage increased with increasing age, and was similar for men and women (Anda et al., 1990). National Health Interview Survey (NHIS) data for 1993 indicate that 66 percent of persons aged 18 and over had a cholesterol screen in the last 5 years (USDHHS, 1998).

Analysis of 1997 BRFSS Data

The proportion of women who have had their blood cholesterol checked within the past five years is significantly higher ($p < .001$) than that of men in all three urbanicity categories (Table 7). Urban men are also significantly more likely than rural adjacent or rural non-adjacent men, and urban women are significantly more likely than rural adjacent or rural non-adjacent women, to have had a cholesterol check in the past 5 years.

Table 7

Cholesterol Screening
Rural and Urban Women and Men Age 18 and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
Blood cholesterol check	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**
Within past 5 years [1]	69.1	60.6	70.5	62.9	73.4	67.0
More than 5 years [2]	4.4	4.8	4.2	4.9	3.6	3.8
Not checked [3]	26.5	34.6	25.4	32.2	23.0	29.3

[1] Differences between 1) rural non-adjacent women and men, 2) rural adjacent women and men, 3) urban women and men, 4) urban and rural non-adjacent women, and 5) urban and rural non-adjacent men are significant at p < .001. Differences between 1)urban and rural adjacent women and 2) urban and rural adjacent men are significant at p < .01.

[2] Differences between 1) urban and rural non-adjacent women, 2) urban and rural adjacent men, and 3)urban and rural non-adjacent men are significant at p<.05.

[3] Differences between 1) urban women and men, 2) rural adjacent women and men, 3) rural non-adjacent women and men, 4) urban and rural non-adjacent women , and 5) urban and rural non-adjacent men are all significant at p < .001. Differences between 1) urban and rural adjacent women and 2) urban and rural adjacent men are significant at p<.05.

Colon Cancer Screening

For both men and women, colorectal cancer is the third most commonly diagnosed cancer, and the second leading cause of cancer-related deaths. Older age, inflammatory bowel disease, certain hereditary conditions, and family history of colorectal cancer are well-established risk factors for colorectal cancer (CDC, 1996).

Guidelines/Recommendations

- ACS guidelines recommend that men and women aged 50 and older should either have a fecal occult blood test, digital rectal exam, and proctosigmoidoscopy every five years or a colonoscopy and a digital rectal exam every 10 years.

- USPSTF guidelines recommend that men and women aged 50 and older should have an annual fecal occult blood test, or a proctosigmoidoscopy every three to five years.

- HP 2010 goal is $\geq$ 75 percent of men and women aged 50 and older will have a fecal occult blood test every one to two years, and at least 50 percent will ever have had a proctosigmoidoscopy and digital rectal exam.

Utilization Rates and Factors Associated with Obtaining Recommended Services

Overall rates of screening for colorectal cancer are low. National Health Interview Survey (NHIS) data for 1992 indicate that 26 percent of persons aged 50 to 64 reported having a fecal occult blood test (FOBT) in the last two years, and 10 percent of persons aged 50 to 64 and 12.7 percent of those 65 and over reported having had a proctosigmoidoscopy within the last three years (Potosky, Breen, Graubard, and Parsons, 1998). In 1993, 28 percent of BRFSS respondents reported having had a proctosigmoidoscopy within the past five years (CDC, 1996).

Among persons aged 40 to 64 years old, factors significantly associated with lower rates of FOBT include younger age, less education, lack of health insurance coverage and fee-for-service health insurance (versus managed care). For those age 65 and over, the significant factors include lower income, less education, and type of insurance (persons with Medicare and Medicaid, or

Medicare only, had lower rates than those with Medicare plus supplemental coverage or Medicare managed care) (Potosky et al., 1998).

Factors associated with lower rates of proctosigmoidoscopy include less education, younger age, and female gender (CDC, 1996; Potosky et al., 1998). The perception that colon cancer is a Aman=s disease,@ primary care providers= lack of awareness of updated guidelines, patients= lack of compliance with multiple screening tests and their fear of discomfort have been identified as barriers to women undergoing colorectal screening (Donovan and Syngal, 1998).

Prior to 1998, Medicare only covered the FOBT, proctoscopy, and sigmoidoscopy for diagnosis and treatment, not for screening purposes. Coverage of these services for screening purposes was added on January 1, 1998. An annual FOBT is covered with no coinsurance or deductible. For beneficiaries 50 years and older, Medicare pays for a sigmoidoscopy every four years, subject to a 20 percent copayment and annual deductible. In addition, for persons at high risk, Medicare covers a screening colonoscopy every two years, also subject to the 20 percent copayment and deductible (Scanlon, 2000).

Analysis of 1997 BRFSS Data

This analysis was based on all women and men aged 50 and over. Table 8 shows that women are more likely than men to have had a FOBT within the past year, but men are more likely to have had a sigmoidoscopy or proctoscopy within the past five years. By gender and urbanicity category, the percentage of the population that has had at least one of the recommended screening tests for colon cancer (either FOBT within the past year, or a sigmoidoscopy or proctoscopy within the past five years), ranges from 32.2 percent for rural non-adjacent women to 43.1 percent for urban men. Urban women are significantly less likely ($p < .001$) than urban men to have had at least one of the tests.

Table 8

Colon Cancer Screening for Rural and Urban Women and Men Age 50 and Over
1997 Behavioral Risk Factor Survey Data
(49 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	**Men**	**Women**	**Men**	**Women**	**Men**
Fecal occult blood test within past year [1]	17.0	14.1	18.0	15.5	22.1	19.4
Sigmoidoscopy or proctoscopy within past 5 years [2]	24.5	30.0	24.4	30.4	27.6	36.8
Either a fecal occult blood test within past year or sigmoidoscopy or proctoscopy within past 5 years [3]	32.6	35.4	32.8	35.7	38.1	43.1

[1] Differences between 1) rural non-adjacent and urban women and 2) rural non-adjacent and urban men are significant at $p < .001$. Differences between 1) urban women and men and 2) rural adjacent and urban women are significant at $p < .01$. Differences between rural adjacent men and urban men are significant at $p < .05$.

[2] Differences between 1) urban women and men and 2) rural non-adjacent and urban men are significant at $p < .001$. Differences between 1) rural adjacent women and men , 2) rural non-adjacent women and men, and 3) rural adjacent men and urban men are significant at $p < .01$. Differences between 1) rural adjacent and urban women and 2) rural non-adjacent and urban women are significant at $p< .05$.

[3] Differences between 1) urban women and men, 2) rural adjacent women and urban women, 3) rural non-adjacent women and urban women, 4) rural adjacent men and urban men and 5) rural non-adjacent men and urban men are significant at $p < .001$.

Women and men in both rural categories are significantly less likely ($p < .001$) than their urban counterparts to have had at least one of the tests.

Cervical Cancer Screening

Cervical cancer is one of the most treatable forms of cancer if detected early. Regular Pap smear testing is widely accepted as an important means for early identification of cervical cancer.

Guidelines/Recommendations

- ACS guidelines recommend annual Pap smear tests for women aged 18 and older or who are sexually active. After three normal screenings, ACS recommends that a woman discuss the frequency of future testing with her physician.
- USPSTF guidelines recommend Pap tests for women aged 18 and older or who are sexually active every three years depending on personal history.
- HP 2010 goal is that ≥ 85 percent of women aged 18 and older will have had a Pap smear within the last three years.

Utilization Rates and Factors Associated with Obtaining Recommended Services

National Health Interview Survey (NHIS) data for 1992 indicate that 80 percent of women aged 18 to 64 and 52 percent of those 65 and over reported having a Pap smear test in the last three years (Potosky, 1998). Several studies have found that lower income and lower education levels are associated with lower rates of Pap screening (National Cancer Institute, 1995; Calle et al., 1993; and Makuc et al., 1989). National Cancer Institute (1995) found that women over age 80 and women under age 65 without insurance had lower rates of Pap screening; Calle et al. (1993) found that women over age 65 were less likely to be screened. Makuc et al. (1989) also identified increasing age and white race as factors associated with not having a recent Pap screen.

Potosky et al. (1998) found that, compared to those with managed care coverage, women under age 65 on Medicaid were significantly more likely to have a Pap screen and those without health insurance were significantly less likely. Black women and married women were more likely than white women and unmarried women to have been tested, and level of education was also significantly related to having a recent Pap screen. A study of rural female Medicare beneficiaries found that younger (65 to 69 years), college-educated, and non-widowed women were more likely to have Pap smears than women in other categories (Ives et al., 1996).

Analysis of 1997 BRFSS Data

This analysis was based on women aged 18 and over who did not report having had a hysterectomy. The American College of Obstetricians and Gynecologists recommends continued Pap testing of women who have had hysterectomies (Makuc et al., 1989); however, women with hysterectomies were excluded from this analysis to be consistent with CDC's analyses of the BRFSS data (CDC, 1997). The BRFSS data do not include information on other aspects of a woman's personal medical history that could affect a health care professional's recommendations regarding the frequency of testing (e.g., a history of three previous normal screenings, or being at higher risk for cervical cancer because of exposure to human papillomavirus). Some research has suggested that women's self-reports regarding timing of Pap smears may not be accurate, with women being more likely to overestimate how recently they had a Pap smear (Sawyer et al., 1989; Whitman et al., 1993). Consequently, the proportion of women who have had a test within the past year, past two years, and past three years are presented here.

Differences in the rates of Pap screening by urbanicity are similar for testing in the past year, past two years, or past three years (Table 9). For all three time periods, both rural adjacent women and rural non-adjacent women are significantly less likely ($p < .001$) than urban women to have had a Pap test.

Table 9

Proportion of Rural and Urban Women Age 18 and Over Without A Hysterectomy Who Have Had A Pap Test 1997 Behavioral Risk Factor Survey Data (48 states)

	Rural Non-Adjacent	Rural Adjacent	Urban
Past Year [1]	63.2	65.3	70.7
Past Two Years [1]	76.7	78.2	82.6
Past Three Years [1]	81.4	82.4	85.9

[1] For all three measures, differences between 1) rural adjacent and urban women and 2) rural non-adjacent women and urban women are significant at $p < .001$.

Mammograms

Breast cancer is the most common cancer among women, and the second leading cause of cancer deaths (Janes et al., 1999). Mammograms are an effective means of screening for breast cancer (CDC, 1998b).

Guidelines/Recommendations

- ACS guidelines recommend annual mammograms for women aged 40 and older.
- USPSTF guidelines recommend mammograms every one to two years for women aged 50 to 69 years.
- HP 2010 goal is $\geq$ 60 percent of women aged 50 and older to have had a mammogram and a clinical breast exam within the last two years.

Utilization Rates and Factors Associated with Obtaining Recommended Services

Several studies have identified lower income and lower levels of education as factors associated with lower rates of mammography screening (Lee and Vogel, 1995; Siegel, Waller, Frazier, and Moriolis, 1993; National Cancer Institute, 1995; NCI Breast Cancer Screening Consortium, 1990, and Sparks et al., 1996). Lee and Vogel (1995) found that black women, Hispanic women, and women who lacked health insurance were less likely to be screened, while women with a family history of breast cancer, those who had a previous breast biopsy, and were under the regular care of an OB/GYN were more likely to be screened. In a comparison of data from the 1987 and 1990 NHIS surveys, Breen and Kessler (1994) found that race declined in importance as a predictor of mammogram screening, while income and education remained strong positive predictors. Using NHIS data from 1987 to 1994, Makuc and colleagues (1999) found that mammography utilization increased rapidly between 1987 and 1991 for both low-income and higher income women. By 1994, low-income black women were more likely than low income white women to obtain mammograms, even after adjusting for current health insurance coverage, usual source of care, central city residence, education, geographic region, and age, providing some evidence of the success of targeted screening programs.

Physician recommendation has been identified as an important factor influencing receipt of a mammogram. In the North Carolina 1997 BRFSS survey, 86 percent of women who reported discussing mammography with a provider during the past two years also reported having had a mammogram during the past two years, compared to 44 percent of women who did not report such a discussion (Conlisk, Herrick, and Passaro, 1999).

Rural residence was found to be a strong predictor of mammography underuse in the 1987 National Health Interview Survey (Calle et al., 1993). An analysis of 1988-92 Nebraska BRFSS data revealed that rural Nebraska women were less likely than urban women to have had a mammogram in the previous year (Rettig, Nelson, and Faulk, 1994). A study of rural female Medicare beneficiaries found that younger women (65 to 69 years), those with a high school or college education, those with Medicare supplemental insurance, and women who did not have arthritis or diabetes or need assistance with activities of daily living were more likely to have mammograms than women in other categories (Ives et al., 1996).

In a sample of 474 women receiving care from a family practice network in rural Michigan, education, health insurance status, income, and physician recommendation were significantly related to the likelihood of having a mammogram in the past two years (40 to 49 years old) or past year (50 years and older) (Kreher, Hickner, Ruffin, and Lin, 1995). Travel distance and time were not significantly related to the likelihood of having had a recent mammogram; however, only 26 percent of respondents lived 20 miles or more from a mammography facility. A study of 606 rural farm women in Minnesota only found a weak association between the likelihood of ever having a mammography and distance to a mammography center; physician recommendation to have a mammogram had the strongest association (Carr et al., 1996).

Analysis of 1997 BRFSS Data

Because of the differences among guidelines regarding the age at which mammograms should begin and the frequency with which they should be done, two analyses were done. First, we examined the proportion of women aged 40 to 49 who reported having had a mammogram in the past two years. Second, we examined the proportion of women aged 50 and over who reported having had a mammogram in the past year.

For women aged 40 to 49, both rural adjacent women and rural non-adjacent women are significantly less likely ($p < .001$) than urban women to have had a mammogram within the past two years (Table 10). Among women 50 years or older, both rural adjacent women and rural non-adjacent women are significantly less likely ($p < .001$) than urban women to have had a mammogram within the past year; rural non-adjacent women are also significantly less likely ($p < .05$) to have had a mammogram than rural adjacent women.

Influenza and Pneumonia Vaccinations

In 1996, influenza and pneumonia were the fifth leading cause of death among persons aged 65 and older (CDC, 1998c). For the elderly, influenza and pneumonia are frequent reasons for physician visits and hospitalizations (Ives et al., 1994).

Guidelines/Recommendations

- USPSTF guidelines recommend an annual influenza vaccination for persons aged 65 and older and all persons at risk (residents of chronic care facilities, persons over six months old suffering from certain chronic diseases, and health care providers for high-risk patients). They also recommend a one-time pneumonia vaccination for persons aged 65 and older and all persons at increased risk of pneumoccal disease (institutionalized persons aged 50 and older, and persons aged two years and older with certain medical conditions or who live in special environments or social settings with an identified increased risk).

Table 10

Proportion of Rural and Urban Women Who Have Had A Mammogram 1997 Behavioral Risk Factor Survey Data (48 states)

	Rural Non-Adjacent	Rural Adjacent	Urban
Women Age 40 to 49 Who Have Had A Mammogram in Past Two Years[1]	59.4	59.3	67.6
Women Age 50 and Over Who Have Had A Mammogram in Past Year[1]	51.8	56.1	61.5

[1] For both age groups, differences between 1) rural adjacent and urban women and 2) rural non-adjacent women and urban women are significant at $p < .001$. For women age 50 and over, differences between rural adjacent and rural non-adjacent women are also significant at $p<.05$.

- HP 2010 goal for annual influenza vaccinations and one-time pneumonia vaccinations is $\geq$ 90 percent coverage for those 65 years and older, and $\geq$ 60 percent coverage for those aged 18 to 64 years.

Utilization Rates and Factors Associated with Obtaining Recommended Services

Using 1995 BRFSS data, 59 percent of a national sample of seniors 65 and over received a flu shot in the past year, and 38 percent ever received pneumonia vaccination (Arday et al., 1997). Results were similar for men (60 percent for the flu shot and 36 percent for pneumonia vaccine) and women (59 percent and 38 percent respectively). Rates differed by region, with the North Central and West regions reporting lower rates than the Northeast and Southeast, and by race, with black and Hispanic respondents reporting lower rates than white respondents.

A national analysis of 1995 and 1997 BRFSS data revealed that influenza and pneumoccal vaccination rates increased overall, but varied substantially by state (CDC, 1998c). Several factors were associated with receipt of the vaccinations. Persons aged 75 and over were more likely than those aged 65 to 74 years to report receipt of the vaccines. Non-Hispanic whites were more likely than Hispanics and non-Hispanic blacks to have had the vaccines. Persons with more than a high school education, those with a checkup within the last year, and self-reported poor health status were more likely to have the immunizations.

Data from the 1996 Medicare Current Beneficiary Survey indicate that most beneficiaries aged 65 and over who had never received the pneumoccal vaccination did not think that they needed it; those who had not received a flu shot also did not know that they needed it, and were concerned about its safety and efficacy (CDC, 1999).

In a phone survey of Iowa seniors 65 and over with chronic disease, residing in rural and urban areas (n = 787), 68 percent received a flu shot in the past year, 57 percent ever received pneumonia vaccination, and 44 percent received both vaccines at recommended levels (Petersen et al., 1999). Factors positively associated with receipt of the influenza vaccine were an education level greater than or equal to a high school degree, having a physician visit within the last year, current prescription medication use, and being a non-smoker. Factors positively associated with receipt of a pneumonia vaccination included age greater than or equal to 70 years, being married, currently working, having Medicare supplemental insurance, having a physician visit within the last year, current prescription medication use, and an increased number of target medical conditions. Receipt of the vaccines was not related to residence in a rural area.

Analysis of 1997 BRFSS Data

This analysis was based on persons aged 65 and over in the fifteen states reporting data on influenza and pneumoccal vaccinations in 1997. The BRFSS does not have data needed to identify persons less than 65 years old who would be classified by USPSTF guidelines as being at high risk for influenza and pneumonia.

Among persons aged 65 and over, there are no significant differences by gender or category of urbanicity in pneumonia vaccination rates (Table 11). There is only one statistically significant difference in flu shot rates: urban women are significantly less likely ($p < .05$) than urban men to have had a flu shot in the past year.

Relationship Between Rural Residency and Likelihood of Obtaining Recommended Preventive Health Care Services

In the second part of our analysis, we estimated a series of logistic regression models to examine the relationship between rural residence and the likelihood of obtaining each recommended service, controlling for demographic characteristics, health insurance status, and health care market characteristics. For each model, the dependent variable was a yes/no variable indicating whether or not the respondent had received the recommended preventive service.

Table 11

Flu Shots and Pneumonia Vaccinations for Rural and Urban Women and Men Age 65 and Over 1997 Behavioral Risk Factor Survey Data (15 states)

	Rural Non-Adjacent		Rural Adjacent		Urban	
	Women	Men	Women	Men	Women	Men
Flu shot in last year [1]	65.3	66.3	63.5	65.3	64.4	67.7
Ever had pneumonia vaccination	45.6	44.7	42.9	46.1	46.3	45.1

[1] Differences between urban women and men are significant at p<.05.

The independent variables in the models included dummy variables for category of urbanicity (rural non-adjacent, rural adjacent, and urban); level of education (elementary or some high school, high school graduate or GED, some college, and college graduate); income level (less than $25,000, $25,000 to $50,000, and more than $50,000 in annual household income); race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic, and other); gender (if the test was appropriate for both women and men); health insurance coverage (uninsured, individually purchased insurance, employer-provided and other insurance, Medicaid, and Medicare); whether or not the respondent reported having a time in the past year when s/he could not afford a doctor visit; and census region (Northeast, Midwest, West, and South). Continuous variables in the models included age of the respondent and two health care market variables: the number of primary care physicians per 1000 population in the county and the number of mammography facilities per 1000 population in the county (for the two mammogram models).

Age was expected to be related to utilization of preventive services because the incidences of hypertension, high blood cholesterol, and cervical, colon and breast cancer increase with age. Among the elderly, however, other factors such as increasing disability due to chronic diseases and reduced ability to tolerate aggressive medical treatment may reduce utilization of preventive health services. Previous research comparing preventive service utilization among women over age 65 in three groups (65-74 years, 75-84 years, 85 years and over), found that, except for immunizations, the number of clinical preventive services received decreased with increasing age (Bergman-Evans and Walker, 1996). Bivariate analyses of the relationship between age and utilization rates for some of the preventive services in this study indicated that the relationships between these variables were not linear, i.e., the relationships changed from positive to negative. Therefore, a squared term for the age variable was also included in the three Pap test models, the colon cancer screening model, and the mammogram model for women aged 50 and over, to account for non-linear relationships between age and utilization rates for these services.

Table 12 summarizes the statistically significant differences in preventive services utilization between rural adjacent and urban residents, and between rural non-adjacent and urban residents, identified in the logistic regression models. Rural non-adjacent residents are significantly less likely than urban residents to have a routine medical checkup, blood pressure screening, cholesterol test, mammogram, Pap test, and fecal occult blood test, proctoscopy, or sigmoidoscopy. Rural adjacent residents are significantly less likely than urban residents to have a routine medical checkup, cholesterol test, mammogram (women aged 40 to 49 years), and fecal occult blood test, proctoscopy, or sigmoidoscopy. Overall, differences between rural non-adjacent respondents and urban respondents were greater than those between rural adjacent respondents and urban respondents.

Flu shots and pneumonia vaccinations for persons aged 65 and over were the only preventive services in the study for which there were no statistically significant differences by category of urbanicity. At the time the data were collected, flu and pneumonia vaccinations were covered by the regular Medicare program without a copayment, thus the vast majority of persons aged 65 and over had access to them free of charge, regardless of whether they had supplemental coverage. In addition, the immunizations can be obtained in a range of settings in addition to physicians' offices, for example, in pharmacies and immunization clinics provided by public health nurses, consequently they are more accessible in rural areas than other preventive services that require use of specialists and/or specialized equipment, e.g., proctoscopies, sigmoidoscopies, or mammograms.

Table 12

Summary of Statistically Significant Differences between Rural and Urban Respondents in Receipt of Preventive Services, Controlling for Demographic and Health Care Market Characteristics: Results of Logistic Regressions

Preventive Service	Target Population	Significant Differences	
		Urban and Rural Adjacent	Urban and Rural Non-Adjacent
Checkup (2 years)	Women and men 18 years and over	p <.001	P <.001
Blood pressure screen (2 years)	Women and men 18 years and over	NS	P <.05
Cholesterol test (5 years)	Women and men 18 years and over	p <.001	P <.001
Mammogram (2 years)	Women aged 40 to 49	p <.01	P <.05
Mammogram (1 year)	Women aged 50 and over	NS	P <.001
Pap test (3 years)	Women 18 years and over	p<.05	P <.05
Pap test (2 years)	Women 18 years and over	p<.05	P <.01
Pap test (1 year)	Women 18 years and over	p<.05	P <.01
Blood stool test (1 year) or proctoscopy or sigmoidoscopy (5 years)	Women and men aged 50 and over	p <.001	P <.001
Flu shot (1 year)	Women and men aged 65 and over	NS	NS
Pneumonia vaccination (ever)	Women and men aged 65 and over	NS	NS

Table 13 presents the odds ratios for the significant independent variables across all models. The results of the tests of significance, beta coefficients, standard errors, and odds ratios for all of the variables in each model are in Appendix A (Tables A-1 through A-11). In addition to rural-urban differences in preventive services utilization, Table 13 shows that there were statistically significant differences in utilization rates for certain preventive health services by education, income, race, gender, age, health insurance status, the ability to afford needed care, and census region.

For the most part, the magnitude and direction of these differences were as expected and consistent with the results of previous research. Utilization rates were generally lower for respondents with lower levels of education and household income. For services recommended for both women and men, women were more likely than men to obtain any of the services except for colon cancer screening. Compared to white non-Hispanic respondents, black non-Hispanic respondents had higher utilization rates of all preventive services except for flu shots and pneumonia vaccinations. Consistent with our hypotheses, age had a significant positive effect in all the models, while the age squared variable had a significant negative effect in the models in which it was included. This means that the likelihood of obtaining the preventive service initially increased with increasing age, and then decreased.

In comparison to respondents with employer-provided or other health insurance, uninsured individuals were much less likely to obtain the recommended services (odds ratios ranged from .30 to .48). Respondents who purchased their insurance individually were also less likely to obtain recommended services, as were individuals who reported having a time during the past year when they could not afford to see a physician (odds ratios ranged from .66 to .91). The Medicare variable was positive and significant in three models: the medical checkup, blood pressure screening, and colon cancer screening models. The Medicaid variable had a positive, statistically significant effect

Table 13

Logistic Regression Models: Summary of Odds Ratios for Significant Independent Variables

	Women and Men age 18 and over			Women and Men age 50 and over	Women age 18 and over	Women age 40 - 49	Women age 50 and over	Women and Men age 65 and over	
Independent Variables	**Checkup (2 yrs)**	**Blood Pressure (2 yrs)**	**Cholesterol (5 yrs)**	**Blood stool (1 yr) or procto/sigmoidoscopy (5 yrs)**	**Pap test (3 yrs)**	**Mammogram (2 yrs)**	**Mammogram (1 yr)**	**Flu Shot (1 yr)**	**Pneumonia Vaccination (Ever)**
Rural adjacent [1]	0.88	NS	0.82	0.83	0.86	0.75	0.93	NS	NS
Rural non-adjacent [1]	0.88	0.90	0.80	0.82	0.88	0.81	0.82	NS	NS
Elementary or some high school [2]	0.87	0.78	0.72	NS	0.76	NS	0.72	0.87	NS
Some college [2]	1.09	1.27	1.34	1.15	NS	NS	NS	NS	NS
College graduate [2]	NS	1.20	1.63	1.24	1.57	1.37	1.20	1.19	NS
Income < $25,000 [3]	NS	NS	0.80	0.83	0.80	0.75	0.75	0.88	NS
Income > $50,000 [3]	1.09	1.40	1.33	1.29	1.33	1.35	1.21	NS	NS
Black non-Hispanic [4]	2.15	1.73	1.10	1.15	1.79	1.50	1.32	0.60	0.51
Hispanic [4]	1.24	NS	NS	NS	NS	1.38	NS	NS	0.68
Other race [4]	1.21	0.78	NS	0.71	0.51	NS	NS	NS	NS
Male	2.55	2.52	1.36	0.85	-	-	-	NS	1.13
Age	1.01	1.01	1.05	1.34	1.07	1.13	1.28	1.04	1.04
Age Squared	-	-	-	1.00	1.00	-	1.00	-	-
Uninsured [5]	0.41	0.30	0.48	0.40	0.47	0.36	0.39	-	-
Individually purchased insurance [5]	0.76	0.65	0.90	0.81	0.77	NS	0.78	-	-
Medicaid [5]	1.41	1.69	NS	NS	1.46	NS	NS	-	-
Medicare [5]	1.88	1.94	NS	1.15	NS	NS	NS	-	-
Time could not afford doctor visit in past yr	0.66	0.87	0.91	NS	0.81	NS	0.67	0.76	NS
Primary care physicians /1000 population	NS	NS	NS	1.13	1.13	NS	NS	NS	NS
Mammography facilities/1000 population	-	-	-	-	-	NS	NS	-	-
North East Census Region [5]	1.17	NS	NS	1.17	0.88	NS	NS	NS	0.84
Midwest Census Region [5]	0.82	0.85	0.72	NS	0.87	NS	NS	NS	0.85
West Census Region [5]	0.56	0.70	0.78	1.17	NS	NS	0.83	NS	1.15

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

NS = Not Significant
N/A = Not included in the model.
See Appendix A for results of the Pap test models for 2 years and 1 year.

on utilization of three types of services: medical checkups, blood pressure screening, and Pap smear tests, probably reflecting the amount of contact that women on Medicaid are likely to have with health care providers for pregnancy-related services.

Compared to respondents in the South Census Region, those in the Midwest had significantly lower utilization rates for several tests, e.g., checkup, blood pressure check, cholesterol, 3 year Pap test, and pneumonia vaccination. The Northeast and West Census Region variables had more mixed effects, with some rates significantly lower (e.g., blood pressure screening and cholesterol testing in the West and 3 year Pap test in the Northeast), and others significantly higher than the South (e.g., colon cancer screening in both the West and Northeast). The primary care physician to population variable was only statistically significant for two types of preventive services: colon cancer screening tests and Pap tests. The mammography facility to population variable was not statistically significant in either mammogram model.

SUMMARY AND CONCLUSIONS

Using 1997 BRFSS data, this study examined the likelihood of obtaining several key preventive health services in the time frame recommended by nationally accepted guidelines. The results indicate that rural residents are significantly less likely than urban residents to obtain certain preventive health services (even after controlling for demographic characteristics, health insurance status, and health care market characteristics) and are further behind in meeting the Healthy People 2010 National Health Promotion and Disease Prevention objectives.

There are several possible explanations for the significant rural-urban differences that remain after controlling for these factors. First, there may be rural-urban differences in respondents' out-of-pocket costs for preventive services that affect preventive services utilization. The logistic models in this study controlled for household income, whether the respondent had any health insurance, their primary type of health insurance coverage, and whether or not the respondent had a time during the past year when s/he could not afford a doctor visit. However, we did not have information regarding coverage of the recommended preventive services, for example, whether each service was covered by the respondent's insurance, and the dollar amounts of copayments and deductibles, if any, that applied to it.

Deductibles and copayments have a significant negative influence on utilization of Pap smears, mammograms, and preventive counseling (Solanki and Schauffler, 1999). Among women and men aged 18 to 64 years old, higher levels of coverage for preventive care are associated with higher use of preventive services, including checkups, blood pressure screening, blood cholesterol tests, mammography, clinical breast exams, and Pap tests (Faulkner and Schauffler,1997). Rural persons in Missouri were found to be less likely than urban persons to have health insurance coverage for preventive services (Hagdrup, Simoes, and Brownson, 1997).

Second, there may be rural-urban differences in respondents' access to medical care that were not adequately measured by the two health care market variables in our models, primary care physicians and mammogram facilities per 1000 population in the respondents' county of residence. The county-level data did not allow us to calculate the distance from an individual's residence to a physician's office or mammography facility, or whether the respondent had access to a mobile mammography unit. Some counties, especially in the western United States, cover large geographic areas, and residents of those counties may have a considerable distance to travel to medical care facilities, even within the county.

Although several studies have identified physician recommendation as a significant factor in patients' decisions to obtain preventive services, we did not have information on whether respondents had been advised by their physician or another health care professional to obtain any of the services analyzed. Consequently, it was not possible to determine whether there were rural-urban differences in the proportion of respondents who have a physician's recommendation to receive each preventive service.

Finally, cultural barriers may also limit rural residents' use of preventive services. Several researchers have suggested that traditional rural values such as self-reliance, individualism, a preference for informal support networks, and reluctance to seek medical care unless seriously impaired by health problems, may make rural residents hesitant to seek preventive care services (Walker, Lucas, and Crespo, 1994; Reding et. al., 1997; Strickland and Strickland, 1996).

The Medicare program has expanded coverage of several preventive health services in recent years. Most recently, the Balanced Budget Act increased coverage for breast, cervical, and colon cancer screening, an important step in reducing financial barriers to preventive services for Medicare beneficiaries. The Health Care Financing Administration, the Centers for Disease Control, other federal agencies, states, and community-based organizations are working in partnership to increase preventive service utilization by underserved populations, and have achieved some success in increasing utilization rates of breast and cervical cancer screening, in particular (CDC, 1998b; Scanlon, 2000; Vellozi, Romans, and Roghenberg, 1996).

Efforts to increase preventive services utilization rates among rural populations need to build on these initiatives, as well as recognizing the special challenges that rural areas present in the delivery of health care services. The results of this study, along with previous research on programs to increase preventive health services utilization among underserved populations, indicate that strategies to increase rural preventive services utilization must reduce financial, geographic, and cultural barriers to care. In addition, efforts are needed to increase awareness of the importance of obtaining these preventive health services among rural populations and health care providers, and to ensure that follow-up diagnostic and treatment services are available to persons with abnormal test results.

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APPENDIX A

Logistic Regression Models of the Relationship Between Rural Residence and the Likelihood of Obtaining Specific Preventive Health Care Services

Table A-1

Logistic Regression Model: Respondent Has Had Medical Checkup in Past Two Years or Not (unweighted n = 110,521)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.13***	0.04	0.88
Rural non-adjacent [1]	-0.13***	0.04	0.88
Elementary or some high school [2]	-0.14**	0.05	0.87
Some college [2]	0.08*	0.03	1.09
College graduate [2]	0.05	0.04	1.05
Income < $25,000 [3]	-0.03	0.04	0.97
Income > $50,000 [3]	0.08*	0.03	1.09
Black non-Hispanic [4]	0.77***	0.06	2.15
Hispanic [4]	0.22***	0.05	1.24
Other race [4]	0.19*	0.08	1.21
Male	0.93***	0.03	2.55
Age	0.01***	0.00	1.01
Uninsured [5]	-0.90***	0.04	0.41
Individually purchased insurance [5]	-0.28***	0.05	0.76
Medicaid [5]	0.34***	0.10	1.41
Medicare [5]	0.63***	0.06	1.88
Time could not afford doctor visit in past year	-0.42***	0.04	0.66
Primary care physicians/1000 population 1995-96	0.04	0.03	1.04
North East Census Region [6]	0.16***	0.04	1.17
Midwest Census Region [6]	-0.19***	0.03	0.82
West Census Region [6]	-0.58***	0.04	0.56

*** p <.001
** p < .01
* p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage.
[6] Omitted category is South Census Region.

Table A-2

Logistic Regression Model: Respondent Has Had Blood Pressure Taken by Health Professional in Past Two Years or Not (unweighted n = 109,477)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.02	0.06	0.98
Rural non-adjacent [1]	-0.11*	0.06	0.90
Elementary or some high school [2]	-0.25***	0.07	0.78
Some college [2]	0.24***	0.06	1.27
College graduate [2]	0.18**	0.06	1.20
Income < $25,000 [3]	-0.07	0.05	0.93
Income > $50,000 [3]	0.34***	0.06	1.40
Black non-Hispanic [4]	0.55***	0.10	1.73
Hispanic [4]	-0.02	0.08	0.98
Other race [4]	-0.24*	0.12	0.78
Male	0.92***	0.04	2.52
Age	0.01**	0.00	1.01
Uninsured [5]	-1.21***	0.06	0.30
Individually purchased insurance [5]	-0.44***	0.08	0.65
Medicaid [5]	0.53**	0.17	1.69
Medicare [5]	0.67***	0.09	1.94
Physician/1000 population 1995-96	-0.02	0.05	0.97
North East Census Region [6]	-0.01	0.07	0.99
Midwest Census Region [6]	-0.16**	0.05	0.85
West Census Region [6]	-0.35***	0.06	0.70
Time could not afford doctor visit in past year	-0.14*	0.07	0.87

*** p <.001
** p < .01
* p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-3

Logistic Regression Model: Respondent Has Had a Blood Cholesterol Check Within past 5 Years or Not (unweighted n = 106,793)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.19***	0.04	0.82
Rural non-adjacent	-0.22***	0.03	0.80
Elementary or some high school	-0.33***	0.04	0.72
Some college	0.29***	0.03	1.34
College graduate	0.49***	0.03	1.63
Income < $25,000	-0.22***	0.03	0.80
Income > $50,000	0.29***	0.03	1.33
Black non-Hispanic	0.09*	0.04	1.10
Hispanic	0.06	0.05	1.06
Other race	-0.12	0.07	0.89
Male	0.31***	0.02	1.36
Age	0.05***	0.00	1.05
Uninsured	-0.74***	0.04	0.48
Individually purchased insurance	-0.11*	0.05	0.90
Medicaid	0.11	0.07	1.12
Medicare	0.09	0.05	1.09
Time could not afford doctor visit in past year	-0.10*	0.04	0.91
County physician to population ratio1996	0.00	0.03	1.00
North East Census Region[5]	-0.02	0.03	0.98
Midwest Census Region[5]	-0.32***	0.03	0.72
West Census Region[5]	-0.24***	0.04	0.78

*** p <.001
** p < .01
*   p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-4

Logistic Regression Model: Respondent Age 50 and Over Has Had at Least One of the Following: A Blood Stool Test Within past Year or Sigmoidoscopy or Proctoscopy Within past 5 Years or Not (unweighted n = 40,201)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.18***	0.05	0.83
Rural non-adjacent [1]	-0.19***	0.04	0.82
Elementary or some high school [2]	-0.02	0.05	0.98
Some college [2]	0.14**	0.04	1.15
College graduate [2]	0.22***	0.05	1.24
Income < $25,000 [3]	-0.19***	0.04	0.83
Income > $50,000 [3]	0.26***	0.05	1.29
Black non-Hispanic [4]	0.14*	0.07	1.15
Hispanic [4]	-0.11	0.10	0.90
Other race [4]	-0.35*	0.13	0.71
Male	-0.17***	0.03	0.85
Age	0.29***	0.02	1.34
Age Squared	-0.00***	0.00	1.00
Uninsured	-0.91***	0.11	0.40
Individually purchased insurance	-0.22**	0.07	0.81
Medicaid	-0.06	0.16	0.94
Medicare	0.14**	0.06	1.15
Time could not afford doctor visit in past year	-0.13	0.07	0.88
County physician to population ratio1996	0.12**	0.04	1.13
North East Census Region [5]	0.16***	0.05	1.17
Midwest Census Region [5]	0.06	0.04	1.06
West Census Region [5]	0.16***	0.05	1.17

*** p <.001
** p < .01
*   p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-5

Logistic Regression Model: Female Respondent Aged 18 and over Without a Hysterectomy Has Had a Pap Test Within the past Three Years

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.15*	0.06	0.86
Rural non-adjacent [1]	-0.13*	0.06	0.88
Elementary or some high school [2]	-0.27***	0.07	0.76
Some college [2]	0.10	0.05	1.10
College graduate [2]	0.45***	0.06	1.57
Income < $25,000 [3]	-0.23***	0.05	0.80
Income > $50,000 [3]	0.28***	0.07	1.33
Black non-Hispanic [4]	0.58***	0.08	1.79
Hispanic [4]	-0.16	0.09	0.85
Other race [4]	-0.68***	0.11	0.51
Age	0.06***	0.01	1.07
Age Squared	-0.00***	0.00	1.00
Uninsured	-0.76***	0.07	0.47
Individually purchased insurance	-0.26**	0.09	0.77
Medicaid	0.38**	0.13	1.46
Medicare	0.16	0.09	1.17
Time could not afford doctor visit in past year	-0.21**	0.06	0.81
County physician to population ratio1996	0.12*	0.05	1.13
North East Census Region [5]	-0.13*	0.06	0.88
Midwest Census Region [5]	-0.14**	0.05	0.87
West Census Region [5]	-0.12	0.07	0.89

*** p <.001
** p < .01
* p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-6

Logistic Regression Model: Female Respondent Aged 18 and over Without a Hysterectomy Has Had a Pap Test Within the past Two Years

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.14*	0.06	0.87
Rural non-adjacent [1]	-0.15**	0.05	0.86
Elementary or some high school [2]	-0.27***	0.06	0.77
Some college [2]	0.12*	0.05	1.13
College graduate [2]	0.43***	0.06	1.54
Income < $25,000 [3]	-0.20***	0.05	0.81
Income > $50,000 [3]	0.26***	0.06	1.29
Black non-Hispanic [4]	0.56***	0.07	1.75
Hispanic [4]	-0.12	0.08	0.89
Other race [4]	-0.51***	0.11	0.60
Age	0.05***	0.01	1.05
Age Squared	-0.00***	0.00	1.00
Uninsured	-0.75***	0.06	0.47
Individually purchased insurance	-0.17*	0.08	0.84
Medicaid	0.32**	0.11	1.38
Medicare	0.08	0.08	1.08
Time could not afford doctor visit in past year	-0.29***	0.06	0.75
County physician to population ratio1996	0.10*	0.05	1.11
North East Census Region [5]	-0.06	0.06	0.95
Midwest Census Region [5]	-0.16***	0.05	0.85
West Census Region [5]	-0.16**	0.06	0.85

*** p <.001
** p < .01
* p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-7

Logistic Regression Model: Female Respondent Aged 18 and over Without a Hysterectomy Has Had a Pap Test Within the past Year

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.09*	0.05	0.91
Rural non-adjacent [1]	-0.13**	0.04	0.88
Elementary or some high school [2]	-0.25***	0.06	0.78
Some college [2]	0.10*	0.04	1.11
College graduate [2]	0.30***	0.04	1.34
Income < $25,000 [3]	-0.12**	0.04	0.88
Income > $50,000 [3]	0.16***	0.04	1.18
Black non-Hispanic [4]	0.45***	0.06	1.57
Hispanic [4]	-0.02	0.07	0.98
Other race [4]	-0.33***	0.09	0.72
Age	0.01*	0.01	1.01
Age Squared	-0.00***	0.00	1.00
Uninsured	-0.65***	0.05	0.52
Individually purchased insurance	-0.13*	0.07	0.88
Medicaid	0.24**	0.09	1.28
Medicare	0.11	0.07	1.12
Time could not afford doctor visit in past year	-0.48***	0.05	0.62
County physician to population ratio1996	0.11**	0.04	1.12
North East Census Region [5]	-0.04	0.05	0.96
Midwest Census Region [5]	-0.22***	0.04	0.80
West Census Region [5]	-0.28***	0.05	0.76

*** p <.001
** p < .01
*   p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-8

Logistic Regression Model: Female Respondent Aged 40 to 49 Has Had a Mammogram in past Two Years or Not (unweighted n = 13,035)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.28**	0.09	0.75
Rural non-adjacent [1]	-0.21*	0.08	0.81
Elementary or some high school [2]	-0.10	0.12	0.90
Some college [2]	0.04	0.07	1.04
College graduate [2]	0.32***	0.08	1.37
Income < $25,000 [3]	-0.29***	0.08	0.75
Income > $50,000 [3]	0.30***	0.07	1.35
Black non-Hispanic [4]	0.41***	0.10	1.50
Hispanic [4]	0.32*	0.15	1.38
Other race [4]	0.22	0.18	1.25
Age (within 40 to 49 years)	0.12***	0.01	1.13
Uninsured	-1.01***	0.11	0.36
Individually purchased insurance	-0.18	0.12	0.83
Medicaid	-0.11	0.19	0.89
Medicare	0.17	0.18	1.18
Time could not afford doctor visit in past year	-0.20*	0.09	0.82
Primary care physicians/1000 county pop. 1996	-0.04	0.07	0.96
Mammography facilities (1994)/1000 population (1996)	1.53	1.26	4.63
North East Census Region [5]	0.17	0.09	1.19
Midwest Census Region [5]	-0.09	0.07	0.92
West Census Region [5]	-0.14	0.08	0.87

*** p <.001
** p < .01
*   p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-9

Logistic Regression Model: Female Respondent Aged 50 and over Has Had a Mammogram in the past Year or Not (unweighted n = 23,150)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.07	0.06	0.93
Rural non-adjacent [1]	-0.20***	0.06	0.82
Elementary or some high school[2]	-0.33***	0.06	0.72
Some college [2]	0.07	0.05	1.07
College graduate [2]	0.18**	0.07	1.20
Income < $25,000 [3]	-0.29***	0.05	0.75
Income > $50,000 [3]	0.19**	0.07	1.21
Black non-Hispanic [4]	0.28***	0.08	1.32
Hispanic [4]	0.24	0.14	1.27
Other race [4]	0.11	0.15	1.12
Age (within aged 50 and over)	0.25***	0.03	1.28
Age Squared	-0.00***	0.00	1.00
Uninsured	-0.95***	0.11	0.39
Individually purchased insurance	-0.25**	0.09	0.78
Medicaid	-0.15	0.17	0.86
Medicare	-0.10	0.07	0.91
Time could not afford doctor visit in past year	-0.40***	0.08	0.67
Primary care physicians/1000 county pop.1996	-0.09	0.05	1.10
Mammography facilities (1994)/1000 population (1996)	-0.59	0.80	0.56
North East Census Region[5]	0.07	0.06	1.07
Midwest Census Region[5]	-0.02	0.05	0.98
West Census Region[5]	-0.18**	0.06	0.83

*** p <.001
** p < .01
*   p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-10

Logistic Regression Model: Respondent over Age 65 Has Had Flu Shot in past Year or Not (unweighted n =18,876)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.04	0.07	0.96
Rural non-adjacent [1]	-0.02	0.06	0.98
Elementary or some high school [2]	-0.14*	0.06	0.87
Some college [2]	0.02	0.07	1.02
College graduate [2]	0.17*	0.08	1.19
Income < $25,000 [3]	-0.13*	0.06	0.88
Income > $50,000 [3]	0.18	0.09	1.19
Black non-Hispanic [4]	-0.51***	0.10	0.60
Hispanic [4]	-0.22	0.15	0.80
Other race [4]	-0.10	0.19	0.91
Male	0.02	0.05	0.98
Age (within aged 65and over)	0.04***	0.06	1.04
Time could not afford doctor visit in past year	-0.27*	0.11	0.76
Primary care physician/1000 county pop.1996	-0.02	0.06	0.98
North East Census Region [5]	-0.01	0.07	0.99
Midwest Census Region [5]	-0.02	0.06	0.98
West Census Region [5]	0.01	0.07	1.01

*** p <.001
** p < .01
* p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.

Table A-11

Logistic Regression Model: Respondent over Age 65 Has Had Pneumonia Vaccination or Not (unweighted n = 18,442)

Independent Variables	Beta Coeff	SE Beta	Odds Ratio
Rural adjacent [1]	-0.00	0.07	1.00
Rural non-adjacent [1]	-0.05	0.06	0.95
Elementary or some high school [2]	-0.11	0.06	0.89
Some college [2]	0.04	0.06	1.04
College graduate [2]	0.07	0.07	1.07
Income < $25,000 [3]	-0.07	0.05	0.93
Income > $50,000 [3]	0.09	0.09	1.10
Black non-Hispanic [4]	-0.68***	0.10	0.51
Hispanic [4]	-0.39**	0.15	0.68
Other race [4]	-0.05	0.20	0.95
Male	0.12*	0.05	1.13
Age	0.04***	0.00	1.04
Time could not afford doctor visit in past year	-0.14	0.11	0.87
Primary care physician/1000 county pop.1996	0.03	0.06	1.03
North East Census Region [5]	-0.17*	0.07	0.84
Midwest Census Region [5]	-0.17**	0.06	0.85
West Census Region [5]	0.14*	0.07	1.15

*** p <.001
** p < .01
*   p < .05

[1] Omitted category is urban.
[2] Omitted category is high school graduate/GED.
[3] Omitted category is income $25,000 to $50,000.
[4] Omitted category is White non-Hispanic.
[5] Omitted category is employer-provided insurance, military, and other health care coverage
[6] Omitted category is South Census Region.