Published in final edited form as:
Stroke. 2009 May ; 40(5): 1811–1819. doi:10.1161/STROKEAHA.108.539619.

USE OF STROKE SECONDARY PREVENTION SERVICES:

ARE THERE DISPARITIES IN CARE?

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Abstract

Objective—To examine whether there are disparities in use of stroke secondary prevention services because disparities in stroke outcomes have been found among older adults, women, racial minorities, and within Stroke Belt states.

Methods—Using the nationally-representative 2005 Behavior Risk Factor Surveillance System, we examined self-reported use of 11 stroke secondary prevention services queried in the survey. We used multivariable logistic regression to examine the association between service use and age, sex, race, and Stroke Belt state residence, controlling for other socio-demographic and health care access characteristics.

Results—Among 11,862 adults with a history of stroke, 16% were 80 or older, 54% were women, 13% were non-Hispanic black, and 23% lived within a Stroke Belt state. Overall service use varied: 31% reported post-stroke outpatient rehabilitation, 57% regular exercise, 66% smoking cessation counseling, and 91% current use of anti-hypertensive medications. Age 80 or older was not associated with lower use of any of the 11 services. Women were less likely to report post-stroke outpatient

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Financial Disclosures: No external funding was used for this research project.

Author Disclosures
Joseph S. Ross: No disclosures
Ethan A. Halm: No disclosures
Dawn M. Bravata: No disclosures

rehabilitation and regular exercise when compared with men (P values ≤ 0.005); there were no sex-based differences in use of the 9 other services. Blacks were less likely to report pneumococcal vaccination when compared with whites, but were more likely to report post-stroke outpatient rehabilitation (P values ≤ 0.005); there were no race-based differences in use of the 9 other services. Stroke Belt state residence was not associated with lower use of any of the 11 services.

Conclusions—Use of many stroke secondary prevention services was suboptimal. We did not find consistent age, sex, racial, or Stroke Belt state residence disparities in care.

CONDENSED ABSTRACT—We examined the association between stroke secondary prevention service use and age, sex, race, and Stroke Belt state residence using nationally-representative data. Although use of many stroke secondary prevention services was suboptimal, we did not find consistent age, sex, racial, or Stroke Belt state residence disparities in care.

Keywords

Quality of Health Care; Stroke; Cerebrovascular Disorders; Preventive Health Services; Healthcare Disparities

INTRODUCTION

Disparities in stroke incidence and outcomes have been described among older adults, women, racial minorities, and within Stroke Belt states.[1-6] For instance, black Americans are twice as likely to experience a stroke when compared with non-Hispanic whites and are twice as likely to die from a first stroke.[1, 2] However, disparities in clinical practice and outcomes have not been as thoroughly studied for stroke care as they have been for other diseases, particularly cardiovascular care.[7] National practice guidelines have been issued by the American Heart and American Stroke Associations to provide comprehensive and timely evidence-based recommendations on the prevention of ischemic stroke among survivors of ischemic stroke or transient ischemic attack, recommending several secondary prevention services for adults who have already had a stroke in order to lower their subsequent risk of morbidity and mortality from their already established disease.[8, 9] Examples of recommended stroke secondary prevention services include vascular risk reduction through regular aspirin use, annual serum cholesterol testing and management, regular exercise, and smoking cessation, as well as hypertension and diabetes management.[8, 9] Differential use of these services may contribute to observed disparities in stroke incidence and stroke outcomes.[1, 4]

Our objective was to determine whether there are disparities in use of stroke secondary prevention services, according to age, sex, race, and Stroke Belt state residence. We used the 2005 Behavioral Risk Factor Surveillance System (BRFSS), a nationally-representative telephone survey conducted by the Centers for Disease Control and Prevention (CDC). The BRFSS offers a unique opportunity to investigate this question, providing data on past medical history, health behaviors and health care utilization in 2005, including use of 11 stroke secondary prevention services.

METHODS

Study Design and Sample

We performed a cross-sectional study using data from the 2005 BRFSS. The BRFSS is a federally funded cross-sectional telephone survey of the civilian, non-institutionalized adult population more than 17 years of age.[10] The survey is designed and conducted annually by the CDC in collaboration with the state health departments to monitor health-related behaviors and risk factors in the U.S. population. The survey selects state-specific probability samples of households using a multistage cluster design to produce a nationally representative sample.

The BRFSS uses random-digit dialing within blocks of telephone numbers to identify a probability sample of households with telephones in each state. In each household, one adult is randomly identified and interviewed and then assigned a *weight* within the sample. The BRFSS includes respondent weights to be used for analyses in order to compensate for unequal probabilities of selection, to adjust for non-response and telephone non-coverage, to ensure that results are consistent with population data and to make population estimates. All 50 states, in addition to the District of Columbia, participated in the 2005 BRFSS. In 2005, the number of completed interviews per state ranged from 2707 to 22,590 with a median overall response rate of 36.5 percent and a median cooperation rate of 75.1 percent.[11]

The BRFSS survey instrument has two relevant parts. The *core* is a standard set of questions asked by all states concerning health-related perceptions, conditions, and behaviors, as well as questions on socio-demographic characteristics. The *optional CDC modules* are sets of questions on specific topics that states may elect to use. States that asked questions relevant to each health care service that we examined varied in number.[12] Questions examining cardiovascular risk reduction services were asked within both core and optional modules, such that the number of states asking about these services varied from 17 to 51 and accounted for 32%-100% of the weighted 2005 BRFSS sample (depending on the question). Questions examining hypertension and diabetes management services were also asked within both core and optional modules by 16 to 51 states, accounting for 31%-100% of the weighted 2005 BRFSS sample. Questions examining infectious disease prevention services were asked within core modules by all states. Because the BRFSS is a publicly-available anonymous data source, our study was exempted from review by the Mount Sinai School of Medicine Institutional Review Board. Additional information about BRFSS survey instruments and procedures is available from the CDC.[10]

Our cohort included 11,862 adults aged 18 years and older from all 50 states and the District of Columbia who reported ever having had a stroke, identified by their responding “yes” to the following question: “Has a doctor, nurse, or other health professional ever told you that you had a stroke?” We excluded adults who did not report their age (0.6%) or health insurance coverage (0.5%).

Study Variables

Our dependent variables were 11 self-reported measures of recommended stroke secondary prevention for cardiovascular risk reduction, hypertension and diabetes management, and infectious disease prevention (Table 1). All dependent variables were categorized dichotomously as use or non-use of the service within an appropriate time interval.

Recommended services for vascular risk reduction include regular aspirin use for all adults without therapeutic contraindications, post-stroke outpatient rehabilitation, annual serum cholesterol testing, regular exercise, and annual advice from a health professional regarding smoking cessation for all adults who smoke.[8, 9] Recommended services for hypertension management for all adults with hypertension who have had a prior stroke include regular use of anti-hypertensive medications and annual advice from a health professional regarding low salt and low fat diets.[8, 9] Recommended services for diabetes management for all adults with diabetes who have had a prior stroke include annual measurement of serum glycosylated hemoglobin (HbA1c).[8, 9] Recommended services for infectious disease prevention include annual influenza vaccination and pneumococcal vaccination within their lifetime.[13, 14] Although neither vaccination is recommended specifically for stroke secondary prevention care, because each is recommended for all adults with severe co-morbid disease, such as a history of stroke, we included them in our investigation.

We examined several independent variables to determine whether there were disparities in use of stroke secondary prevention services according to age, sex, race, and Stroke Belt state residence. Age was categorized as 18-44 years, 45-64 years, 65-79 years, or 80 years and older. Sex was categorized as male or female. Race was categorized as white/non-Hispanic, black/non-Hispanic, or other. Stroke Belt state residence was assigned to adults living in the following states: Alabama, Arkansas, Georgia, Indiana, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia, as defined by the National Heart, Lung, and Blood Institute during its Stroke Belt Initiative of the early 1990s.[15]

We also categorized the sample by the following socio-demographic and health care access characteristics, all of which were included in our analyses after testing for multicollinearity: annual household income, employment, education, marital status, household size, self-reported health status, health insurance coverage, and identification of a personal health care provider. The BRFSS defined response categories for the self-report of all socio-demographic and health care access variables, including race/ethnicity, in addition to self-reported health status. Response categories were combined when necessary to ensure sufficient numbers in each group; for instance, annual household income response categories '<$10,000' and '$10-$15,000' were combined into the single category '<$15,000'. Socio-demographic and health care access characteristics were included in regression analyses to adjust for their effects on each outcome.

Statistical Analysis

We described respondent characteristics using standard means and frequency analyses. We used Chi-square tests to examine the bivariate relationships between use of each of the 11 recommended stroke secondary prevention services and age, sex, race, and Stroke Belt state residence. Analyses for each of the 4 main socio-demographic characteristics were conducted independently. We used multivariable logistic regression to assess the independent effect of each of our 4 main independent variables on the use of each of the 11 recommended services, creating three independent models for each outcome.

The first set of models examined the unadjusted relationship between each of the 11 recommended services and each main independent variable alone in independent models. Thus, as an example, we independently tested the association between regular aspirin use and age, regular aspirin use and sex, regular aspirin use and race, and regular aspirin use and Stroke Belt state residence.

The second set of models examined the adjusted relationship between each of the 11 recommended services and each main independent variable, while including all four variables in independent models. Thus, as another example, we tested the association between regular aspirin use and age, sex, race, and Stroke Belt state residence.

The third set of model examined the adjusted relationship between each of the 11 recommended services and each main independent variable, still including all four variables in independent models (age, sex, race, and Stroke Belt state residence), but also including additional socio-demographic and health care access characteristics in the models: annual household income, employment, education, marital status, household size, self-reported health status, health insurance coverage, and identification of a personal health care provider. Because the results from the second and third models were similar, we present only the results from the third model as our fully adjusted findings.

Individuals missing outcome data were excluded from the relevant adjusted analyses: data were missing for less than 4% of eligible respondents for each recommended service, except for annual glycosylated hemoglobin measurement among adults with diabetes (missing for 23%).

No imputations were made for missing data. Individuals with missing socio-demographic data were also excluded from adjusted analyses (<1% of respondents for each characteristic), except annual household income, for which a category was created for those missing data because they did not know or report the information, representing 18% of the weighted sample.

To facilitate interpretation of our results given our analysis of non-rare events, odds ratios from adjusted analyses were converted to risk ratios using standard techniques.[16] All analyses took into account the complex survey design and weighted sampling probabilities of the data source and were performed using SAS-callable SUDAAN statistical software (SUDAAN 9.01, Research Triangle Institute, Research Triangle Park, NC).[17, 18] All statistical tests were 2-tailed and used a type I error rate of 0.05, adjusted to 0.005 after a Bonferroni correction to account for multiple simultaneous comparisons among the sample for 11 outcomes.

RESULTS

There were 11,862 adults included in our sample who reported ever having had a stroke, accounting for 2.6% of the weighted 2005 BRFSS sample. The majority of this sample was between 45 and 79 years of age, female, white, poor, not in the labor force, had received a high school education or less, were married, and lived in a household with 2 or fewer people (Table 2). Nearly one-quarter of the sample lived in a Stroke Belt state, 90% were insured, and 90% identified one or more personal healthcare providers. Only 18% self-reported having excellent or very good health status and 62% self-reported one or more disabling health conditions. Nearly one-quarter currently smoked tobacco, 29% were obese, 68% had hypertension, 58% hyperlipidemia, 37% ischemic heart disease, and 27% diabetes mellitus.

Use of Stroke Secondary Prevention Services

Use of stroke secondary prevention services varied widely among the different types of services (Table 3). Among cardiovascular risk reduction services, 31% received post-stroke outpatient rehabilitation whereas 77% used aspirin regularly and 81% reported annual cholesterol measurement. Among services for hypertension management, 62% received low fat diet counseling whereas 91% used anti-hypertensive medications regularly; 89% reported annual glyosylated hemoglobin measurement for diabetes management. Among services for infectious disease prevention, 52% and 53% reported influenza and pneumococcal vaccination respectively.

Age-based Disparities in Use of Stroke Secondary Prevention Services

In unadjusted analyses (Table 3), adults 80 years of age or older were more likely to report influenza and pneumococcal vaccination when compared with adults 65-79 years of age (P-values ≤ 0.005); there were no differences in use of the other 9 recommended services. In fully adjusted analyses (Table 4), adults 80 years of age or older remained 10% more likely to report influenza vaccination (relative risk [RR]=1.10, 95% Confidence Interval [CI], 1.06-1.14; $p<0.001$) and 7% more likely to report pneumococcal vaccination (RR=1.07, 95% CI, 1.02-1.11; $p=0.003$) when compared with adults 65-79 years of age.

In unadjusted analyses (Table 3), adults 44 years of age or younger were less likely to report use of 5 of 11 recommended services when compared with adults 65-79 years of age (P-values ≤ 0.005), including regular use of both aspirin and antihypertensive medications, as well as cholesterol measurement. In fully adjusted analyses (Table 4), adults 44 years of age or younger remained less likely to report use of 4 of 11 recommended services when compared with adults 65-79 years of age (P-values ≤ 0.005).

Sex-based Disparities in Use of Stroke Secondary Prevention Services

In unadjusted analyses (Table 3), women were less likely to report regular exercise when compared with men and were more likely to report pneumococcal vaccination (P-values ≤ 0.005); there were no differences in use of the other 9 recommended services. In fully adjusted analyses (Table 4), women were 23% less likely to receive post-stroke outpatient rehabilitation (RR=0.77, 95% CI, 0.64-0.93; p=0.005) and 19% less likely to report regular exercise (RR=0.81, 95% CI, 0.74-0.89; p<0.001) when compared with men.

Race-based Disparities in Use of Stroke Secondary Prevention Services

In unadjusted analyses (Table 3), blacks were less likely to report regular exercise and both influenza and pneumococcal vaccination when compared with whites (P-values ≤ 0.005); there were no differences in use of the other 8 recommended services. In fully adjusted analyses (Table 4), blacks remained 34% less likely to report pneumococcal vaccination when compared with whites (RR=0.66, 95% CI, 0.53-0.82; p<0.001), although they were also 33% more likely to receive post-stroke outpatient rehabilitation (RR=1.33, 95% CI, 1.13-1.54; p=0.002).

Stroke Belt State Residence-based Disparities in Use of Stroke Secondary Prevention Services

In unadjusted analyses (Table 3), adults residing in Stroke Belt states were less likely to report regular exercise and influenza vaccination when compared with adults not residing in Stroke Belt states (P-values ≤ 0.005); there were no differences in use of the other 9 recommended services. In fully adjusted analyses (Table 4), there were no differences in use of stroke secondary prevention services between adults residing in and not residing in Stroke Belt states.

DISCUSSION

Using data from a nationally-representative survey of adults, our study provides recent, nationally representative estimates of the use of recommended secondary prevention services among adults who have had stroke, including services for vascular risk reduction, hypertension and diabetes management, and infectious disease prevention. Even though 90% of adults in our study had health insurance coverage and 90% identified at least one personal health care provider, use of accepted, guideline-recommended care was suboptimal. Alarmingly high numbers of adults did not receive stroke secondary prevention services. Less than one-third reported post-stroke outpatient rehabilitation. Just over half reported influenza and pneumococcal vaccination, as well as reported regular exercise. And only two-thirds reported smoking cessation and low fat diet counseling.

Suboptimal care has important implications for the care of adults who have had a stroke. Regular exercise, reported by 57% in our study, is among the most straightforward stroke prevention strategies,[19, 20] even if limited only to modest leisure-time physical activity,[21] and needs to be prioritized for counseling by primary care physicians and neurologists. Other opportunities to counsel patients, including smoking cessation as well as low fat and low salt dietary counseling, also need to be taken advantage of so that rates may exceed the 62%-74% we observed. Similarly, routine monitoring of serum cholesterol and glycosylated hemoglobin are essential to determine the effectiveness of treatment, ensure appropriate control, and to identify disease complications at an early enough stage to prevent morbidity and mortality.

Our study found no consistent age, sex, racial, or Stroke Belt state residence disparities in stroke secondary prevention care. Given that disparities in stroke incidence and outcomes have been described among older adults, women, racial minorities, and within Stroke Belt states,[1-6] our study provides no evidence to suggest that differential use of stroke secondary prevention services may contribute to these observed disparities. Stroke secondary prevention quality

improvement efforts should focus on care which is underused by the entire population. However, our not finding disparities in stroke secondary prevention may be a consequence of adults, once experiencing a stroke, gaining improved access to care and treatment, even if such care is suboptimal. Disparities in stroke incidence, or perhaps in primary stroke prevention, may be due to differing access to and affordability of care among older adults, women, racial minorities, or within Stroke Belt states.

On the other hand while our study found no consistent age, sex, racial, or Stroke Belt state residence disparities in stroke secondary prevention care, we did observe potentially important relationships that need to be further studied. For instance, we found older adults to be more likely to have reported receiving influenza and pneumococcal vaccination. Because guidelines recommend that all adults 50 years or older receive the influenza vaccination annually and all adults 65 years or older receive the pneumococcal vaccination in their lifetime,[13, 14] our findings may reflect that younger adults who have experienced a prior stroke, and their physicians, may not be aware that it is recommended that they receive such vaccinations even at younger ages because of their medical history. We also found that women were less likely, while blacks were more likely, to report receiving post-stroke outpatient rehabilitation. Perhaps more women have inpatient rehabilitation, as opposed to outpatient rehabilitation, because they do not have a spouse at home capable of providing support in other activities of life, such as cooking and cleaning, during rehabilitation.

Our study is one of the first to examine use of a variety of recommended stroke secondary prevention services among a nationally-representative sample of adults who have had a stroke. However, there are several considerations in interpreting its results. First, the BRFSS is limited to the civilian, non-institutionalized adult population and so our findings can not be generalized to adults who have had a stroke and now reside in institutionalized settings for care. In addition, some questions which could have improved our study were not asked, particularly with respect to clinical characteristics such as the time since an individual had a stroke, the stroke severity and residual effects, and acute treatment received for the initial stroke. However, federally funded and conducted health surveys such as this provide an ongoing and accessible data source for nationally-representative studies of health conditions and health-related behaviors and comparisons of health care quality among populations.[22, 23] Second, we studied post-stroke outpatient rehabilitation, which may also be provided as an inpatient service, as well as two services which may not be considered stroke secondary prevention care: influenza and pneumococcal vaccination. However, we found no evidence to suggest that rehabilitation is more likely to be used as an outpatient vs. as an inpatient service according to age, sex, race, and Stroke Belt state residence, although rates of use may not be as low as the 31% we observed. In addition, because each vaccination is recommended for all adults who have had a stroke, they offer the potential to illustrate possible disparities in stroke secondary preventive care. Third, the survey data are self-reported. Although the tendency of respondents to over-report health promotion and disease-prevention activities is widely recognized,[24-26] there is little reason to think that over-reporting would be different according to age, sex, race, and Stroke Belt state residence. Fourth, our study focused on processes of care for stroke secondary prevention primarily delivered in the ambulatory care setting and cannot be generalized to acute or inpatient care or other important dimensions of quality, such as clinical outcomes and patient care experiences. Finally, cross-sectional data can demonstrate associations but cannot prove causality.

In conclusion, we found that despite studying a sample of adults who predominantly had health insurance coverage and access to health care professionals, adults who have had a stroke reported suboptimal rates of stroke secondary prevention services for vascular risk reduction, hypertension and diabetes management, and infectious disease prevention. In addition, we

found no consistent age, sex, racial, or Stroke Belt state residence disparities in stroke secondary prevention care.

Acknowledgments

Funding/Support: This project was not directly supported by any external grants or funds. Dr. Ross is currently supported by Department of Veterans Affairs Health Services Research and Development Service project no. TRP-02-149. The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs. Dr. Ross is also currently supported by the Hartford Foundation. Neither the Department of Veterans Affairs nor the Hartford Foundation had any role in the design or conduct of the study; collection, management, analysis or interpretation of the data; preparation, review or approval of the manuscript.

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Table 1

Stroke secondary prevention services examined, including respondent eligibility by co-morbid condition, time interval, and sample size, from the Behavioral Risk Factor Surveillance System, 2005*

Stroke Secondary Prevention Service	Co-Morbid Condition	Time Interval	Sample Size, No.*
Vascular Risk Reduction			
Regular aspirin use	n/a	n/a	3494
Post-stroke outpatient rehabilitation	n/a	n/a	4284
Serum cholesterol measurement	n/a	1 year	11,349
Regular exercise	n/a	n/a	11,842
Smoking cessation counseling	Current Smokers	1 year	726
Hypertension Management			
Regular use of anti-hypertensive medications	Hypertension	n/a	8208
Low fat diet counseling	Hypertension	1 year	1980
Low salt diet counseling	Hypertension	1 year	1990
Diabetes Management			
Serum glycosylated hemoglobin measurement	Diabetes Mellitus	1 year	1666
Infectious Disease Prevention			
Influenza vaccination	n/a	1 year	11,815
Pneumococcal vaccination	n/a	Ever	11,327

* The sample number indicates the number of eligible respondents who provided all relevant information.

Table 2

Socio-demographic, health care access and clinical characteristics for adults with a self-reported past medical history for stroke, stratified by age, sex, race, and residence within a Stroke Belt state, from the Behavioral Risk Factor Surveillance System, 2005*

	Total	Age				Sex		Race			Stroke Belt State	
	Sample, % (n=11,862)	18-44, % (n=927)	45-64, % (n=3908)	65-79, % (n=4801)	≥80, % (n=2226)	Male, % (n=4547)	Female, % (n=7315)	White, % (n=9265)	Black, % (n=1151)	Other, % (n=1274)	Yes, % (n=2749)	No, % (n=9113)
Socio-Demographic Characteristics												
Age†‡§												
18-44	15	--	--	--	--	15	14	11	17	28	14	15
45-64	33	--	--	--	--	34	32	30	42	37	37	32
65-79	37	--	--	--	--	38	35	40	33	26	35	37
≥ 80	16	--	--	--	--	13	18	19	8	9	14	16
*Sex**‡												
Male	46	48	48	48	37	--	--	45	40	57	45	47
Female	54	52	52	52	63	--	--	55	60	43	55	53
*Race**†§												
White	70	54	64	76	83	68	72	--	--	--	71	69
Black	13	15	17	12	7	11	15	--	--	--	22	11
Other	17	32	19	12	10	21	13	--	--	--	7	21
*Annual Household Income**†‡§												
< $15,000	22	25	22	22	18	20	24	17	30	33	22	22
$15,000-$24,999	21	17	20	24	22	20	22	21	25	19	21	21
$25,000-$34,999	12	9	12	13	11	13	11	12	11	13	11	12
$35,000-49,999	10	12	11	9	9	12	9	12	7	7	9	11
$50,000-74,999	8	10	11	6	5	9	7	9	6	6	7	8
≥ $75,000	9	16	12	6	4	11	7	10	3	8	7	10
Did Not Know or Refused	18	12	12	20	30	15	20	18	17	14	22	16
*Employment**†‡												
Employed for wages	19	53	27	6	1	22	17	17	14	33	17	20
Self-employed	4	7	6	2	1	6	3	4	4	4	4	4
Unemployed	3	5	7	1	0	3	4	3	7	3	4	3
Not in labor force//	74	36	60	90	98	69	77	76	75	60	76	73
Education†‡§												
< High school graduate	24	25	20	25	25	24	24	19	30	38	28	22
High school graduate	32	28	32	34	31	30	34	34	32	24	34	32
1-3 years of college	25	30	27	23	22	24	27	27	24	22	23	26
≥ 4 years of college	19	17	20	18	22	23	16	21	15	15	16	20
*Marital Status**†‡												
Married	54	49	60	57	37	64	45	56	40	54	55	53
Divorced, Separated, Widowed	39	22	33	40	61	25	50	39	48	30	39	39
Never Married	8	29	7	3	2	11	5	5	12	16	7	8
Household Size¶*†‡												
1 Person	28	6	22	32	49	20	34	30	30	17	28	28
2 People	41	16	40	52	39	47	35	45	35	25	43	40
3 People	13	21	17	8	7	13	13	12	14	18	14	13
4 People	9	27	11	4	3	9	9	8	10	16	8	10
5 or more People	10	29	11	4	3	11	8	6	12	24	7	10
*Living Within A Stroke Belt State**‡												
Yes	23	22	26	22	20	22	23	23	36	9	--	--
No	77	78	74	78	80	78	77	77	64	91	--	--
Healthcare Access Characteristics												

	Total	Age				Sex		Race			Stroke Belt State	
	Sample, % (n=11,862)	18-44, % (n=927)	45-64, % (n=3908)	65-79, % (n=4801)	≥80, % (n=2226)	Male, % (n=4547)	Female, % (n=7315)	White, % (n=9265)	Black, % (n=1151)	Other, % (n=1274)	Yes, % (n=2749)	No, % (n=9113)
Health Insurance Coverage *‡	90	75	86	96	98	89	91	93	85	80	88	90
Identified 1 or More Personal Physicians or Healthcare Providers *†‡	90	74	89	93	96	86	92	94	84	77	91	89
Clinical Characteristics												
Self-Reported Health Status *‡§												
Excellent	5	9	4	5	3	6	5	5	5	4	3	6
Very Good	13	14	11	13	14	12	13	15	8	9	12	13
Good	29	30	26	31	31	30	29	29	32	29	26	30
Fair	29	29	27	29	32	29	28	28	30	32	30	28
Poor	24	18	31	23	19	23	25	23	25	27	29	22
Health-Related Disability #*†‡§												
0 conditions	38	47	32	40	39	42	35	38	31	44	33	40
1 condition	24	19	22	26	26	22	25	25	20	20	27	22
2 conditions	24	24	27	23	23	23	25	24	31	23	26	24
3 conditions	14	11	19	11	12	13	15	13	18	13	14	14
Current Smoker *§	23	41	33	15	3	25	21	22	26	26	27	22
Obese (BMI≥30) *†‡	29	24	39	27	16	26	32	27	39	27	32	28
Hypertension *‡§	68	37	68	76	75	66	69	67	79	59	72	66
Ischemic Heart Disease *†	37	20	37	41	41	42	32	36	34	41	35	37
Hyperlipidemia *	58	41	61	62	56	58	59	59	60	55	58	58
Diabetes Mellitus *‡	27	13	30	32	20	28	25	24	36	30	27	26
Arthritis *†§	57	36	60	63	67	51	65	60	61	52	62	58
Asthma *†	14	17	18	12	7	9	18	13	17	13	13	14

Note: Percentages are observed (unadjusted) rates, although each was weighted to account for the sampling probabilities of the data source; percentages may not sum to 100 because of rounding.

*P≤0.005 for difference across age categories.

†P≤0.005 for difference between men and women.

‡P≤0.005 for difference across race categories.

§P≤0.005 for difference between adults living and not living within Stroke Belt states.

//Includes students, homemakers, retirees, and those not able to work.

¶Includes total number of adults and children living in the home.

#Health-related disability conditions were defined as self-reporting 5 or more days in the past month where poor physical or mental health interfered with normal daily activities; self-reporting any activity limitation due to physical, mental, or emotional problems; and self-reporting any health problem that requires use of special equipment (i.e., cane or wheelchair).

Table 3

Use of stroke secondary prevention services, stratified by age, sex, race, and residence within a Stroke Belt state, from the Behavioral Risk Factor Surveillance System, 2005

Stroke Secondary Prevention Service	Total Sample, %	Age				Sex		Race			Stroke Belt State	
		18-44, %	45-64, %	65-79, %	≥ 80, %	Male, %	Female, %	White, %	Black, %	Other, %	Yes, %	No, %
Vascular Risk Reduction												
Regular aspirin use[*]	77	56	78	83	76	78	77	78	75	76	77	77
Post-stroke outpatient rehabilitation	31	31	30	31	33	34	28	29	37	30	30	32
Serum cholesterol measurement[*‡]	81	51	83	90	86	80	82	84	81	69	83	81
Regular exercise[†‡§]	57	64	56	58	52	62	53	58	48	62	53	59
Smoking cessation counseling	66	63	65	71	46	61	70	70	63	49	71	62
Hypertension Management												
Regular use of anti-hypertensive medications[*]	91	68	88	95	97	90	91	92	91	84	92	90
Low fat diet counseling[*]	62	71	75	57	44	63	61	59	67	74	62	62
Low salt diet counseling	74	64	78	73	73	70	77	72	78	77	75	73
Diabetes Management												
Serum glycosylated hemoglobin measurement	89	88	88	90	90	88	90	90	90	84	88	89
Infectious Disease Prevention												
Influenza vaccination[*‡§]	52	22	39	65	76	52	51	55	40	49	47	53
Pneumococcal vaccination[*†‡]	53	19	39	68	76	49	56	58	39	41	50	54

Note: Percentages are observed (unadjusted) rates, although each was weighted to account for the sampling probabilities of the data source.

[*] P≤0.005 for difference across age categories.

[†] P≤0.005 for difference between men and women.

[‡] P≤0.005 for difference across race categories.

[§] P≤0.005 for difference between adults living and not living within Stroke Belt states.

Table 4

Unadjusted and fully adjusted risk ratios with 95% confidence intervals for use of stroke secondary prevention services by age, sex, race, and residence within a Stroke Belt state, from the Behavioral Risk Factor Surveillance System, 2005

Stroke Secondary Prevention Service	Relative Risk (95% Confidence Interval)									
	Age				Sex		Race/Ethnicity		Stroke Belt State	
	18-44	45-64	65-79	80	Men	Women	White	Black	Yes	No
Vascular Risk Reduction										
Regular aspirin use										
Unadjusted model	0.46 (0.32-0.63)*	0.93 (0.85-1.01)	1.00	0.89 (0.77-0.99)	1.00	0.98 (0.91-1.05)	1.00	0.96 (0.85-1.05)	1.00 (0.93-1.05)	1.00
Fully adjusted model†	0.69 (0.47-0.95)	0.93 (0.84-1.01)	1.00	0.93 (0.81-1.03)	1.00	1.00 (0.92-1.06)	1.00	0.97 (0.86-1.06)	0.99 (0.92-1.06)	1.00
Post-stroke outpatient rehabilitation										
Unadjusted model	1.01 (0.74-1.31)	0.98 (0.81-1.16)	1.00	1.08 (0.87-1.30)	1.00	0.82 (0.70-0.97)	1.00	1.25 (1.06-1.45)	0.93 (0.79-1.08)	1.00
Fully adjusted model†	1.35 (0.96-1.78)	1.11 (0.90-1.34)	1.00	1.14 (0.91-1.38)	1.00	0.77 (0.64-0.93)*	1.00	1.33 (1.13-1.54)*	0.87 (0.73-1.03)	1.00
Serum cholesterol measurement										
Unadjusted model	0.22 (0.16-0.30)*	0.89 (0.83-0.94)*	1.00	0.94 (0.88-0.99)	1.00	1.02 (0.98-1.06)	1.00	0.95 (0.88-1.01)	1.02 (0.98-1.05)	1.00
Fully adjusted model†	0.33 (0.24-0.46)*	0.92 (0.86-0.97)*	1.00	0.94 (0.89-0.99)	1.00	0.98 (0.94-1.02)	1.00	1.02 (0.96-1.07)	1.00 (0.96-1.03)	1.00
Regular exercise										
Unadjusted model	1.09 (0.98-1.19)	0.96 (0.89-1.04)	1.00	0.88 (0.79-0.98)	1.00	0.84 (0.76-0.91)*	1.00	0.78 (0.67-0.90)*	0.89 (0.83-0.96)*	1.00
Fully adjusted model†	1.08 (0.95-1.20)	1.00 (0.91-1.08)	1.00	0.87 (0.77-0.96)	1.00	0.81 (0.74-0.89)*	1.00	0.84 (0.71-0.98)	0.99 (0.91-1.06)	1.00
Smoking cessation counseling										
Unadjusted model	0.85 (0.54-1.15)	0.90 (0.67-1.10)	1.00	0.50 (0.19-1.05)	1.00	1.11 (0.95-1.22)	1.00	0.87 (0.56-1.16)	1.11 (0.96-1.21)	1.00
Fully adjusted model†	1.01 (0.69-1.28)	0.90 (0.63-1.14)	1.00	0.44 (0.14-1.06)	1.00	1.03 (0.86-1.17)	1.00	0.89 (0.62-1.14)	0.99 (0.83-1.13)	1.00
Hypertension Management										
Regular use of anti-hypertensive medications										
Unadjusted model	0.28 (0.19-0.41)*	0.84 (0.75-0.91)*	1.00	1.01 (1.00-1.01)	1.00	1.01 (0.99-1.03)	1.00	1.00 (0.94-1.03)	1.02 (0.99-1.03)	1.00
Fully adjusted model†	0.36 (0.23-0.54)*	0.91 (0.84-0.97)*	1.00	1.01 (0.99-1.01)	1.00	1.00 (0.96-1.02)	1.00	1.04 (1.00-1.06)	1.01 (0.99-1.03)	1.00
Low fat diet counseling										
Unadjusted model	1.15 (0.94-1.28)	1.16 (1.11-1.20)*	1.00	0.73 (0.55-0.93)	1.00	0.96 (0.85-1.08)	1.00	1.11 (0.98-1.22)	1.00 (0.89-1.10)	1.00
Fully adjusted model†	1.14 (0.95-1.27)	1.14 (1.07-1.19)*	1.00	0.74 (0.56-0.96)	1.00	1.10 (0.98-1.20)	1.00	1.11 (0.97-1.22)	0.97 (0.86-1.08)	1.00
Low salt diet counseling										
Unadjusted model	0.85 (0.49-1.18)	1.06 (0.97-1.12)	1.00	1.01 (0.89-1.11)	1.00	1.07 (0.99-1.13)	1.00	1.06 (0.94-1.14)	1.02 (0.94-1.09)	1.00
Fully adjusted model†	1.11 (0.80-1.32)	1.05 (0.95-1.12)	1.00	0.99 (0.86-1.10)	1.00	1.06 (0.98-1.12)	1.00	1.07 (0.97-1.15)	1.00 (0.91-1.08)	1.00
Diabetes Management										
Serum glycosylated hemoglobin measurement										
Unadjusted model	0.97 (0.75-1.08)	0.98 (0.88-1.05)	1.00	1.00 (0.89-1.06)	1.00	1.02 (0.95-1.06)	1.00	1.00 (0.92-1.05)	0.98 (0.89-1.04)	1.00

Stroke Secondary Prevention Service	Relative Risk (95% Confidence Interval)									
	Age				Sex		Race/Ethnicity		Stroke Belt State	
	18-44	45-64	65-79	80	Men	Women	White	Black	Yes	No
Fully adjusted model†	1.06 (0.90-1.12)	1.07 (1.01-1.10)	1.00	1.02 (0.91-1.08)	1.00	1.04 (0.99-1.07)	1.00	1.00 (0.93-1.05)	0.96 (0.85-1.03)	1.00
Infectious Disease Prevention										
Influenza vaccination										
Unadjusted model	0.19 (0.12-0.27)*	0.47 (0.41-0.54)*	1.00	1.11 (1.07-1.15)*	1.00	0.98 (0.90-1.06)	1.00	0.67 (0.56-0.81)*	0.88 (0.81-0.95)*	1.00
Fully adjusted model†	0.27 (0.19-0.38)*	0.53 (0.45-0.62)*	1.00	1.10 (1.06-1.14)*	1.00	1.00 (0.92-1.09)	1.00	0.86 (0.71-1.02)	0.95 (0.87-1.03)	1.00
Pneumococcal vaccination										
Unadjusted model	0.13 (0.09-0.19)*	0.42 (0.34-0.51)*	1.00	1.09 (1.05-1.13)*	1.00	1.11 (1.03-1.18)*	1.00	0.59 (0.48-0.71)*	0.92 (0.85-1.00)	1.00
Fully adjusted model†	0.18 (0.12-0.25)*	0.49 (0.42-0.57)*	1.00	1.07 (1.02-1.11)*	1.00	1.07 (0.99-1.15)	1.00	0.66 (0.53-0.82)*	0.93 (0.86-1.01)	1.00

*P≤0.005.

†Fully adjusted model accounts for the following covariates in logistic regression analyses: age, sex, race, residence within a Stroke Belt state, annual household income, education, employment, marital status, household size, self-reported health status, insurance coverage, and identification of a personal health care provider.