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Use of Antithrombotic Agents Among U.S. Stroke Survivors, 2000–2006

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Abstract

Background—Secondary stroke prevention guidelines recommend antithrombotic agents such as over-the-counter aspirin, prescription antiplatelet agents, or anticoagulant agents.

Purpose—The study was designed to measure whether use of outpatient antithrombotic agents is increasing among stroke survivors.

Methods—The sample consisted of 4168 people who self-reported cerebrovascular disease and who participated in the Medical Expenditure Panel Survey, an annual representative sample of the U.S., during the years 2000–2006. Use of antithrombotic agents was calculated from face-to-face interviews about the use of aspirin and from pharmacies about the use of prescription medications. Cochran–Armitage tests were used to detect temporal trends and multivariate models to identify predictors of use of antithrombotic agents.

Results—Pooling results across the 7 years, 57% were taking aspirin, 66% were using any antiplatelet agent, and 75% were using any antithrombotic agent. After excluding people who said aspirin was unsafe, 81% were using any antithrombotic agent. During the study period, use of prescription antiplatelet agents increased ($p < 0.001$), but there was no temporal change in use of antithrombotic agents overall. In multivariate models, age greater than 65, male gender, non-Hispanic ethnicity, having a usual source of care, and poor or fair health status were associated with use of an antithrombotic agent ($p < 0.05$).

Conclusions—Although a high proportion of stroke survivors appear to use an antithrombotic agent, further research should investigate whether and how to improve care among the remaining 20% of stroke survivors, particularly among younger, female, and Hispanic patients.

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Introduction

Since 1999, professional guidelines have recommended the use of the following antithrombotic agents to prevent recurrent ischemic stroke: aspirin (an antiplatelet agent available over-the-counter without a prescription), prescription antiplatelet agents, or prescription anticoagulant agent.^{1–3} Large surveys of the U.S. population have reported the use of aspirin for secondary prevention,^{4–15} but commonly combine people with stroke with coronary artery disease, and only rarely report the use of antithrombotic agents other than aspirin.⁸ Stroke survivors who use prescription antithrombotic medications may be advised not to take aspirin.¹⁶ Therefore, the proportion of stroke survivors taking antithrombotic medications is underestimated by asking about aspirin use only.

The annual Medical Expenditure Panel Survey (MEPS) survey contains data on use of both aspirin and prescription medications. Previously, a gap in use of antithrombotic medications between myocardial infarction and stroke survivors has been reported using 1 year of the MEPS survey.¹⁷ The hypothesis that overall antithrombotic agent usage among people with cerebrovascular disease would increase over a recent 7-year period was tested.

Methods

Data Source

Data were analyzed from the annual 2000–2006 MEPS. MEPS is a survey sponsored by the Agency for Healthcare Research and Quality (AHRQ). The design of MEPS has been extensively described.¹⁸ Each year, a MEPS panel is drawn from respondents from the previous year's National Health Interview Survey, a representative sample of the U.S. civilian noninstitutionalized population with oversampling of minority populations and households with low family income. Data are collected on all members living in the household. A panel is followed for a 2-year period through five face-to-face interviews with a household representative. Therefore, the data for each year of MEPS are composed of one cohort participating in their first year and another cohort participating in their second year. However, each year's weighted MEPS data are a representative sample of the civilian noninstitutionalized U.S. population.

Study Sample

During these visits, the interviewer is shown all prescription medications obtained by the household during the year and given the name of the pharmacies and healthcare providers used by the household. In turn, MEPS contacts healthcare providers and pharmacies about healthcare utilization in that year. In the 2000–2006 surveys, data were collected on 23,839 to 37,418 people per year, and the response rate ranged from 58.3% to 66.3%.

MEPS interviewers specifically ask the household respondent whether any people in the household reported being given the diagnosis of “stroke, transient ischemic attack (TIA), or ministroke” (this category is herein called cerebrovascular disease); all such people composed the current sample. To determine whether temporal changes reflect secular trends, a comparison group was created of all people who reported being given the diagnoses: “heart attack, myocardial infarction, or MI”, or “angina or angina pectoris” (this category is herein called cardiac disease). As in the case for people with cerebrovascular disease, guidelines recommend the use of antithrombotic agents among people with cardiac disease to prevent recurrent atherosclerotic events.^{19,20} As a sensitivity analysis, the sample was restricted to subjects with ICD-9 codes of cerebrovascular disease (ICD-9 430–438) or cardiac disease (ICD-9 codes 410–414) in the Medical Conditions File of MEPS.²¹ This file contains all active conditions spontaneously reported by the respondent, and the verbatim responses are translated

to ICD-9 codes by professional coders, and ICD-9 codes reported by a sample of medical providers in a given year.

Dependent Variable

Use of antithrombotic agents was measured with the following set of face-to-face interview questions and data from pharmacies. Current aspirin use was evaluated using response to the interview question, “Is aspirin taken at least every other day?” If participants reported that aspirin was not taken at least every other day, they were asked a follow-up question on whether health problems made taking aspirin unsafe. Participants were then assessed on whether a prescription of guideline-recommended antithrombotic agents (generic or brand name) in a given year. For cerebrovascular patients, based on guidelines in existence at the start of the study period, prescriptions of clopidogrel, dipyridamole (including combinations of dipyridamole and aspirin), ticlopidine, and warfarin were counted as appropriate antithrombotic agents.^{1–3} For cardiac patients, based on guidelines in existence at the start of the study period, prescriptions of clopidogrel and warfarin were counted as appropriate antithrombotic agents.^{19,20}

Independent Variable: Sample Characteristics

The following information was collected on all subjects: age, gender, race/ethnicity, region of country, urban status (defined as respondents living in a Metropolitan Statistical Area (MSA) established by the Office of Management and Budget), marital status, attainment of high school education, and poverty status (defined as respondents with a family income below the applicable poverty level based on family size and composition. Each year of MEPS used the Census Bureau definitions of poverty for that given year). Health status was evaluated using responses of *excellent*, *very good*, and *good* versus *fair* or *poor* to the item, “Compared to other people of the same age, how is the person's health?” Access to care characteristics included having a usual source of care, type of insurance coverage (public, private, or uninsured), and presence of prescription medication coverage among people with private insurance. MEPS indicated whether the information was directly collected from the patient or from the household representative (proxy response).

Analysis

All analyses were performed in STATA statistical package, version 9 (College Station, Texas, 2004). All analyses were conducted in 2009. All results accounted for clustering by household using the Huber “correction” approach and incorporated MEPS weights, which are derived using a respondent's age, gender, race/ethnicity, region of country, and urban/rural status to account for the nonrespondents when developing estimates for the civilian noninstitutionalized population of the U.S.

To calculate the proportion of people taking antithrombotic medications, the numerator consisted of all people who were taking aspirin at least every other day according to the face-to-face survey plus people who obtained a prescription for an appropriate antithrombotic medication in that year. Two sets of denominators were used. The first denominator consisted of all people. The second denominator excluded people who were not taking an antithrombotic agent and who reported that they had health problems that would make taking aspirin unsafe. This question may identify people with hemorrhagic stroke, although it also may identify people with an aspirin allergy or a gastrointestinal intolerance to aspirin. Up to 13% of all strokes are hemorrhagic, and for such people,²¹ the risks may outweigh the benefits of taking an antithrombotic medication.

To examine temporal trends of patient characteristics and use of aspirin, prescription antiplatelet agents, anticoagulant agents, and any antithrombotic agent, logistic regression

models were constructed with year as a continuous, independent variable, adjusting for weighting to account for nonrespondents and clustering by household. A linear temporal trend was detected if the coefficient for year was significantly different from zero (by examining the p-value). This is equivalent to performing the Cochran–Armitage test for linear trend. A direct comparison of the cerebrovascular and cardiac disease groups is not possible because a substantial number of patients have both types of disease.

Bivariate analyses of use of aspirin, antiplatelet agents, and antithrombotic agents by demographic characteristics gender were performed through chi-square tests. A multivariate logistic regression model was run to determine predictors of use of any antithrombotic agent adjusting for demographic variables, health status, and access to care variables.

As a sensitivity analysis, the multivariate models were repeated on several subsamples. First, the sample was restricted to self-respondents and dropping all proxy responses. Second, the sample was restricted to participants who self-reported a diagnosis (for example, stroke) and who had a medical provider who assigned an ICD code for that diagnosis in that year. Another sensitivity analysis was done by expanding the definition of aspirin users to also include those people who obtained a prescription of aspirin (including brand name, generic name, and in combination with other medications such as formulations for pain relief) in addition to those people who reported taking aspirin in the face-to-face interview. In the original analysis, a person was considered an aspirin user if they reported taking aspirin in the face-to-face survey.

Because this study uses anonymous data, it was deemed exempt from review by the IRBs at the VA Greater Los Angeles Healthcare System and by University of California, Los Angeles.

Results

In the seven annual MEPS data sets from 2000–2006, there were 4168 people who reported a cerebrovascular event (Table 1). Cochran–Armitage tests for trend were significant for an increasing proportion who had a high school education and a decreasing proportion who made an appointment for routine care in the past year.

Pooling data across the 7 years, 57% reported using aspirin in the face-to-face interview, 20% were using a prescription antiplatelet agent, 14% were using a prescription anticoagulant agent, 66% were using any antiplatelet agent, and 75% were using any antithrombotic agent (Table 2). Because 693 people were taking aspirin and another antithrombotic agent, use of any antiplatelet agent is not simply the sum of aspirin use and use of a prescription antiplatelet agent. Among those who reported not using aspirin in the face-to-face interview, 18% stated that aspirin was unsafe; after excluding these people among those not taking any antithrombotic agents, the proportion using aspirin was recalculated at 70%, using any antiplatelet agent at 76%, and using any antithrombotic agent at 81%. In a sensitivity analysis, expanding the definition of aspirin users to also include those with a prescription of aspirin changed the overall use of antithrombotic agent by less than 1%.

To compare these results with a noncerebrovascular population, the same analyses were repeated for the 6720 people with cardiac disease (Table 2). For aspirin use, there was an absolute difference of 13% between people with cerebrovascular and cardiac disease, but because people with cerebrovascular disease were more likely to be taking a prescription antiplatelet or anticoagulant agent (33% versus 25%), the gap in use of any antithrombotic agent was reduced to only 4%. Repeating these calculations after excluding people who stated that aspirin was unsafe, the gap in aspirin use was reduced to 10% and the gap in use of any antithrombotic agent remained at 4%. Because there were 1164 people with both cerebrovascular and cardiac disease, statistical comparisons between the two groups were not performed.

The overall proportion of people with cerebrovascular disease who use antithrombotic agents was calculated as well as proportions after excluding people who reported that a health problem made taking aspirin unsafe for each year. The Cochran–Armitage tests for trend showed increasing use of aspirin, prescription antiplatelet medication, and any antiplatelet medication ($p < 0.05$), but no change in use of any antithrombotic agent. Because use of antithrombotic agents was particularly low in the first 2 years of the data set, a post hoc sensitivity analysis was performed by excluding data from these 2 years. After dropping data from 2000, the Cochran–Armitage tests for trend were now significant only for increasing use of prescription antiplatelet agents; after dropping data from 2000 and 2001, no temporal trends were detected. Among people with cardiac disease, Cochran–Armitage tests for trend also showed increasing use of prescription antiplatelet medication and any antiplatelet agent ($p < 0.001$), but not for use of any antithrombotic agent. These trends among antiplatelet agents were still significant when data from the years 2000 and 2001 were excluded.

In multivariate logistic regression models, age from 65 to 75 (OR 2.8, 95% CI [2.0, 3.8]), age greater than 75 (OR 3.6, 95% CI [2.7–5.0]), male gender (OR 1.4, 95% CI [1.1–1.8]), non-Hispanic ethnicity (OR 1.6, 95% CI [1.1–2.3]), currently married (OR 1.3, 95% CI [1.0–1.7]), having a usual source of care (OR 2.0, 95% CI [1.4–3.0]), and poor or fair health status (OR 1.3, 95% CI [1.1 to 1.6]) and self-response (OR 1.3, 95% CI [1.0 to 1.7]) were independent predictors of greater use of any antithrombotic agent for people with cerebrovascular disease (Table 3).

After restricting the sample by dropping all proxy responses, the variables significantly associated with taking antithrombotic therapy in the original analysis were again found to be significant. In the Medical Conditions file, 1470 (35.2% of the original sample) people with cerebrovascular disease and 2066 (31%) people with cardiac disease were assigned these conditions through methods other than the direct question posed by the MEPS interviewer. Rerunning the multivariate logistic models on the restricted sample showed that age >75 years, male gender, non-Hispanic ethnicity, having at least a high school education were independent predictors of greater use of any antithrombotic agent among for people with cerebrovascular disease.

Discussion

Aspirin remains the predominant antithrombotic agent used for secondary stroke prevention. There were no improvements in use of any antithrombotic agent. Use of aspirin, prescription antiplatelet agents, and use of any antiplatelet agent increased over the 7-year period, but after dropping the first 2 years, no temporal trend was detected, indicating that temporal changes had plateaued.

The lack of improvement in use of any antithrombotic agent may be due to a ceiling effect because usage is already high. Another study has shown marked improvements in blood pressure and cholesterol control by 2002, which is near the start of this study period.²² Studies of the two most commonly used prescription antiplatelet agents were published in 1996,^{23,24} so the greatest improvements in use of an antithrombotic agent may have occurred just prior to the current study period. However, room for improvement in use of antithrombotic agents may still exist. At hospital discharge, use of antithrombotic agents is even higher. Among 300,000+ patients enrolled the 2003–2007 Stroke Get-with-the-Guidelines program, over 99% of stroke patients were discharged with an antithrombotic agent.²⁵ Second, the threshold used for assessing adherence through the minimum refills method was quite low; if data were available to calculate adherence more rigorously such as “proportion of days covered,” it would have likely led to lower rates of use of an antithrombotic agent.²⁶

After reviewing the medical literature for other large surveys of aspirin use for secondary prevention, a few summary points can be made. First, although differences in methodology of studies make comparisons difficult, aspirin use appears to be increasing. An analysis of the National Ambulatory Medical Care Survey (NAMCS) reported lower rates of aspirin use than other studies, but this study relied on physician report.¹² If patients take aspirin without the knowledge of their providers, then aspirin use based on self-report would be more accurate. Also, two studies conducted within HMOs showed higher levels of aspirin use than other studies conducted at the same time, possibly reflecting quality improvement efforts by the health plan. Second, aspirin use among people with cerebrovascular disease are occasionally reported separately^{4,8,11}, but are usually combined with people with cardiac disease. Third, studies do not consistently identify and exclude people with contraindications to aspirin. Fourth, only one study reported use of antithrombotic agents in addition to aspirin.⁸ Among nationally representative surveys, the current study reports on the most number of stroke survivors, and it contains information on both contraindications to aspirin as well as use of prescription antithrombotic agents.

Our results are most comparable to those reported by Brown et al. among 2500 people with a discharge diagnosis of cardiovascular disease in a northwest HMO.⁸ They too reported a considerable gap of aspirin use between people with coronary heart disease and stroke, but because people with stroke were more likely to be taking a prescription antithrombotic agent (27% versus 10%), they did not report a gap in people taking any antithrombotic agent (86% for both).

There were no differences in antithrombotic use by SES or by health insurance status; a possible explanation is that aspirin is inexpensive and available without a prescription. However, there were disparities by gender and ethnicity. Studies conducted in several countries, some with universal health coverage, have shown that women are less likely than men to receive antithrombotic agents for secondary stroke prevention.^{27–29} Less is known among Hispanics, but one U.S. nationally representative study showed that Hispanics were less likely than non-Hispanics to be using aspirin.¹¹

Prior studies have reported good agreement between self-report and medical charts for the diagnosis of stroke.^{30,31} However, when the sample was restricted to people who were assigned these conditions through methods other than the direct question posed by the MEPS interviewer, similar results to the original sample were obtained. It is not surprising that only one third of the sample had a provider who assigned a code for cerebrovascular or cardiac disease because providers gave information about encounters in the current year only and not the entire medical record.

The following limitations should also be noted in this secondary data analysis. The response rate in MEPS is about 5%–10% lower than the telephone-based Behavioral Risk Factor Surveillance Survey. The lower response rate in MEPS may reflect reluctance to undergo the more intensive data collection of five face-to-face interviews and direct assessment of healthcare utilization. In addition, the presence of clinical conditions, such as atrial fibrillation, was not available to determine if the most appropriate antithrombotic agent was used. Finally, the sensitivity and specificity of the questions of aspirin safety for detecting contraindications to antithrombotic therapy, such as hemorrhagic stroke, is unknown. However, other large surveys of aspirin use either employ a similar question of aspirin safety or do not make an attempt to account for hemorrhagic stroke.

Among people with stroke, the increasing use of prescription antiplatelet medications makes surveys of aspirin use an incomplete gauge of the overall use of any antithrombotic agent. Although the level of use of antithrombotic agents appears high, further research should

investigate whether the remaining 20% truly have indications for antithrombotic therapy that outweigh any contraindications, and, if so, why they are not taking these medications, particularly among younger, female, and Hispanic patients.

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References

1. Albers GW, Easton JD, Sacco RL, Teal P. Antithrombotic and thrombolytic therapy for ischemic stroke. *Chest* 1998;114(5 Suppl):683S–698S. [PubMed: 9822071]
2. Wolf PA, Clagett GP, Easton JD, Goldstein LB, Gorelick PB, Kelly-Hayes M, et al. Preventing ischemic stroke in patients with prior stroke and transient ischemic attack: A statement for healthcare professionals from the Stroke Council of the American Heart Association. *Stroke* 1999;30(9):1991–1994. [PubMed: 10471455]
3. Albers GW, Hart RG, Lutsep HL, Newell DW, Sacco RL. Supplement to the guidelines for the management of transient ischemic attacks: a statement from the Ad Hoc Committee on Guidelines for the Management of Transient Ischemic Attacks, Stroke Council, American Heart Association. *Stroke* 1999;30(11):2502–2511. [PubMed: 10548693]
4. Shahar E, Folsom AR, Romm FJ, Bisgard KM, Metcalf PA, Crum L, et al. Patterns of aspirin use in middle-aged adults: the Atherosclerosis Risk in Communities (ARIC) Study. *Am Heart J* 1996;131(5):915–22. [PubMed: 8615310]
5. O'Connor PJ, Pronk NP, Tan AW, Rush WA, Gray RJ. Does professional advice influence aspirin use to prevent heart disease in an HMO population? *Eff Clin Pract* 1998;1(1):26–32. [PubMed: 10345257]
6. Cook NR, Chae C, Mueller FB, Landis S, Saks AM, Hennekens CH. Mis-medication and underutilization of aspirin in the prevention and treatment of cardiovascular disease. *MedGenMed* 1999;E1. [PubMed: 11104403]
7. Rolka DB, Fagot-Campagna A, Narayan KM. Aspirin use among adults with diabetes: estimates from the Third National Health and Nutrition Examination Survey. *Diabetes Care* 2001;24(2):197–201. [PubMed: 11213865]
8. Brown JB, Delea TE, Nichols GA, Edelsberg J, Elmer PJ, Oster G. Use of oral antithrombotic agents among health maintenance organization members with atherosclerotic cardiovascular disease. *Arch Intern Med* 2002;162(2):193–199. [PubMed: 11802753]
9. Kim C, Beckles GL. Cardiovascular disease risk reduction in the Behavioral Risk Factor Surveillance System. *Am J Prev Med* 2004;27(1):1–7. [PubMed: 15212768]
10. Persell SD, Baker DW. Aspirin use among adults with diabetes: recent trends and emerging sex disparities. *Arch Intern Med* 2004;164(22):2492–9. [PubMed: 15596642]
11. Brown DW, Shepard D, Giles WH, Greenlund KJ, Croft JB. Racial differences in the use of aspirin: an important tool for preventing heart disease and stroke. *Ethn Dis* 2005;15(4):620–6. [PubMed: 16259485]
12. Stafford RS, Monti V, Ma J. Underutilization of aspirin persists in U.S. ambulatory care for the secondary and primary prevention of cardiovascular disease. *PLoS Med* 2005;2(12):e353. [PubMed: 16277554]
13. Ajani UA, Ford ES, Greenland KJ, Giles WH, Mokdad AH. Aspirin use among U.S. adults: Behavioral Risk Factor Surveillance System. *Am J Prev Med* 2006;30(1):74–7. [PubMed: 16414427]

14. Opatowsky AR, McWilliams JM, Cannon CP. Gender differences in aspirin use among adults with coronary heart disease in the U.S. *J Gen Intern Med* 2007;22(1):55–61. [PubMed: 17351840]
15. Pignone M, Anderson GK, Binns K, Tilson HH, Weisman SM. Aspirin use among adults aged 40 and older in the U.S.: results of a national survey. *Am J Prev Med* 2007;32(5):403–407. [PubMed: 17478266]
16. Diener PHC, Bogousslavsky PJ, Brass PLM, Cimminiello PC, Csiba PL, Kaste PM, et al. Aspirin and clopidogrel compared with clopidogrel alone after recent ischaemic stroke or transient ischaemic attack in high-risk patients (MATCH): randomised, double-blind, placebo-controlled trial. *The Lancet* 2004;364(9431):331–337.
17. Cheng E, Chen A, Vassar S, Lee M, Cohen S, Vickrey B. Comparison of secondary prevention care after myocardial infarction and stroke. *Cerebrovasc Dis* 2006;21:235–241. [PubMed: 16446536]
18. Cohen SB. Design strategies and innovations in the Medical Expenditure Panel Survey. *Med Care* 2003;41(7 Suppl):III5–III12. [PubMed: 12865722]
19. Cairns JA, Theroux P, Lewis HD Jr, Ezekowitz M, Meade TW, Sutton GC. Antithrombotic agents in coronary artery disease. *Chest* 1998;114(5 Suppl):611S–633S. [PubMed: 9822067]
20. Smith SC Jr, Blair SN, Bonow RO, Brass LM, Cerqueira MD, Dracup K, et al. AHA/ACC Scientific Statement: AHA/ACC guidelines for preventing heart attack and death in patients with atherosclerotic cardiovascular disease: 2001 update: A statement for healthcare professionals from the American Heart Association and the American College of Cardiology. *Circulation* 2001;104(13):1577–9. [PubMed: 11571256]
21. Rosamond W, Flegal K, Furie K, Go A, Greenlund K, Haase N, et al. Heart disease and stroke statistics—2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2008;117(4):e25–146. [PubMed: 18086926]
22. Muntner P, DeSalvo KB, Wildman RP, Raggi P, He J, Whelton PK. Trends in the prevalence, awareness, treatment, and control of cardiovascular disease risk factors among noninstitutionalized patients with a history of myocardial infarction and stroke. *Am J Epidemiol* 2006;163(10):913–20. [PubMed: 16597707]
23. Committee CS. A randomised, blinded, trial of clopidogrel versus aspirin in patients at risk of ischaemic events (CAPRIE). *Lancet* 1996;348(9038):1329–39. [PubMed: 8918275]
24. Diener HC, Cunha L, Forbes C, Sivenius J, Smets P, Lowenthal A. European Stroke Prevention Study. 2. Dipyridamole and acetylsalicylic acid in the secondary prevention of stroke. *J Neurol Sci* 1996;143(1–2):1–13. [PubMed: 8981292]
25. Schwamm LH, Fonarow GC, Reeves MJ, Pan W, Frankel MR, Smith EE, et al. Get With the Guidelines—Stroke Is Associated With Sustained Improvement in Care for Patients Hospitalized With Acute Stroke or Transient Ischemic Attack. *Circulation*. 2008
26. Caetano PA, Lam JM, Morgan SG. Toward a standard definition and measurement of persistence with drug therapy: Examples from research on statin and antihypertensive utilization. *Clin Ther* 2006;28(9):1411–24. [PubMed: 17062314]
27. Glader EL, Stegmayr B, Norrving B, Terent A, Hulter-Asberg K, Wester PO, et al. Sex differences in management and outcome after stroke: A Swedish national perspective. *Stroke* 2003;34(8):1970–1975. [PubMed: 12855818]
28. Tuhim S, Cooperman A, Rojas M, Brust JC, Koppel B, Martin K, et al. The association of race and sex with the underuse of stroke prevention measures. *J Stroke Cerebrovasc Dis* 2008;17(4):226–34. [PubMed: 18589344]
29. Simpson CR, Wilson C, Hannaford PC, Williams D. Evidence for age and sex differences in the secondary prevention of stroke in Scottish primary care. *Stroke* 2005;36(8):1771–5. [PubMed: 16040591]
30. Walker MK, Whincup PH, Shaper AG, Lennon LT, Thomson AG. Validation of patient recall of doctor-diagnosed heart attack and stroke: a postal questionnaire and record review comparison. *Am J Epidemiol* 1998;148(4):355–61. [PubMed: 9717879]
31. Okura Y, Urban LH, Mahoney DW, Jacobsen SJ, Rodeheffer RJ. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. *J Clin Epidemiol* 2004;57(10):1096–103. [PubMed: 15528061]

Table 1

Characteristics of people with cerebrovascular disease surveyed in the 2000–2006 Medical Expenditure Panel Surveys^a

	Cerebrovascular (n=4168)	Cardiac (n=6720)
	n (%)	n (%)
Age category (years)		
≤64	1694 (37.3)	2854 (41.1)
65–74	1040 (25.6)	1719 (25.7)
≥75	1434 (37.0)	2147 (33.2)
Age (years, M [SE])	67.4 (0.25)	66.6 (0.19)
Male	1792 (45.1)	3693 (58.5)
Race		
White	3266 (84.9)	5719 (89.1)*
Black	808 (12.9)	852 (8.6)
Others (Asian/ Pacific Islander/ American Indian)	94 (2.2)	149 (2.3)
Hispanic ethnicity	451 (5.5)	697 (5.3)*
Urban (versus rural)	3092 (77.6)	4846 (75.4)
Currently married	2038 (51.8)	3697 (57.3)
High school graduate (including GED)	2659 (70.7)*	4509 (73.4)*
Poverty status	930 (14.8)	1307 (13.3)
Insurance Coverage		
Private insurance with prescription coverage	1357 (37.9)	2551 (43.5)
Private insurance without prescription coverage	621 (16.9)	1042 (17.2)
Medicare	2871 (70.7)	4405 (65.8)
Medicaid	1227 (21.7)	1548 (16.7)
Uninsured	195 (3.6)	394 (4.9)
Patient has usual source of care provider	3903 (95.4)	6258 (94.3)
Made appt for routine care in past year	3143 (86.2)*	5323 (88.2)*
Perceived Health Status		
Excellent, very good, or good (versus fair or poor)	2047 (54.2)	3541 (57.0)
1st respondent (versus proxy response)	2550 (62.0)	4094 (60.8)

Results weighted by age, gender, race/ethnicity, region of country, and urban/rural status to account for nonrespondents when developing estimates for the civilian noninstitutionalized population of the U.S.

^a 1164 people reported both cerebrovascular and cardiac disease. Due to the considerable overlapping sample, no statistical comparisons between the two groups were made.

* p<0.05 by Cochran–Armitage test for trend of that group over the 7-year period

Table 2

Use of antithrombotic medications among people with cerebrovascular disease in the 2000–2006 Medical Expenditure Panel Surveys

	Cerebrovascular <i>n</i> (%)	Cardiac <i>n</i> (%)
Proportion in entire sample (<i>n</i> =4168 for cerebrovascular, <i>n</i> =6720 for cardiac)		
Aspirin use in face-to-face interview	2370 (57.1)*	4609 (69.8)
Prescription antiplatelet agent	863 (20.3)*	1059 (14.4)*
Prescription anticoagulant agent	534 (14.4)	741 (11.5)
Use of any antiplatelet agent	2729 (65.9)*	4831 (72.9)*
Use of any antithrombotic agent	3074 (75.3)	5265 (79.6)
Proportion in sample excluding those who reported that aspirin was unsafe (<i>n</i> =3437 for cerebrovascular, <i>n</i> =5850 for cardiac)		
Aspirin use in face-to-face interview	2370 (70.0)	4609 (80.1)
Use of any antiplatelet agent	2729 (76.4)	4831 (82.0)
Use of any antithrombotic agent	3074 (81.3)	5265 (85.2)

Any antiplatelet agent includes aspirin use in face-to-face interview and prescription antiplatelet agent. Any antithrombotic agent includes aspirin use in face-to-face interview, prescription antiplatelet agent or prescription anticoagulant agent.

Results weighted by age, gender, race/ethnicity, region of country, and urban/rural status to account for nonrespondents when developing estimates for the civilian noninstitutionalized population of the U.S.

*
p<0.05 by Cochran–Armitage test for trend over the 7-year period

Table 3

Predictors of use of any antithrombotic agent among people with cerebrovascular disease in the 2000-2006 Medical Expenditure Panel Surveys **

Use of any antithrombotic agent	OR (95% CI)
Age (ref=less than 65)	
65 to 74	2.76 (2.00 to 3.80) *
75 and over	3.63 (2.66 to 4.96) *
Male	1.42 (1.11 to 1.83) *
White (ref= nonwhite)	1.45 (0.84 to 1.57)
Non-Hispanic ethnicity (ref= Hispanic)	1.60 (1.10 to 2.33) *
Urban area	0.91 (0.69 to 1.20)
Currently married	1.33 (1.02 to 1.73)
Education at least high school	1.11 (0.85 to 1.44)
Poverty status	0.95 (0.72 to 1.27)
Insurance (ref=uninsured)	
Private insurance with prescription coverage	1.28 (0.79 to 2.05)
Private insurance without prescription coverage	1.01 (0.60 to 1.73)
Medicare	0.89 (0.54 to 1.47)
Medicaid	1.19 (0.70 to 2.05)
Having a usual source of care	2.03 (1.35 to 3.04) *
Fair or poor health status (ref= excellent, very good, or good)	1.31 (1.05 to 1.62) *
Self-respondent (ref=proxy respondent)	1.30 (1.01 to 1.68) *

Results weighted by age, gender, race/ethnicity, region of country, poverty status, and urban/rural status to account for nonrespondents when developing estimates for the civilian noninstitutionalized population of the U.S. Sample for analysis excluded people who reported that a health problem made taking aspirin unsafe

*
p≤0.05

**
pseudo R² of 0.11