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Postdischarge quality of care: Do age disparities exist among Department of Veterans Affairs ischemic stroke patients?

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Abstract—This study examined whether age disparities existed across postdischarge quality indicators (QIs) for veterans with ischemic stroke who received care at Department of Veterans Affairs medical centers (VAMCs). This retrospective cohort included a national sample of 3,196 veterans who were diagnosed with ischemic stroke and received acute and postdischarge stroke care at 127 VAMCs in fiscal year 2007 (10/1/06 through 9/30/07). Data included an assessment of postdischarge stroke QIs in the outpatient setting during the 6 mo postdischarge. The QIs included measurement of and goal achievement for (1) blood pressure, (2) serum international normalized ratio (INR) for all patients discharged on warfarin, (3) cholesterol (low-density lipoprotein [LDL]) levels, (4) serum glycosylated hemoglobin, and (5) depression treatment. The mean age for the 3,196 veterans included in this study was 67.2 +/– 11.3 yr. Before risk adjustment, there were age differences in (1) depression screening/treatment, (2) blood pressure goals, and (3) LDL levels. After we adjusted for patient sociodemographic, clinical, and facility-level characteristics by using hierarchical linear mixed modeling, none of these differences remained significant but INR goals for patients discharged on warfarin differed significantly by age. After we adjusted for patient and facility characteristics, fewer age differences were found in the postdischarge stroke QIs. Clinical trial registration was not required.

Key words: adult, aged, Department of Veteran Affairs, gender, medical record review, postdischarge care, quality of health care, risk factors, stroke, stroke severity.

INTRODUCTION

Older age is one of the most common nonmodifiable risk factors for ischemic stroke [1]. Approximately two-thirds of all strokes occur in those over 65 yr [1].

Abbreviations: HbA1C = serum glycosylated hemoglobin, INR = international normalized ratio, LDL = low-density lipoprotein, OR = odds ratio, QI = quality indicator, rNIHSS = retrospective National Institutes of Health Stroke Scale, VA = Department of Veterans Affairs, VAMC = Department of Veterans Affairs medical center, VHA = Veterans Health Administration.

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However, recent research found that stroke rates are increasing in younger patients compared with older patients [2]. Robust evidence supports the application of a variety of poststroke interventions for the prevention of recurrent vascular events (e.g., hypertension management) across the spectrum of age groups [3]. Although older patients derive as much, if not more, benefit from acute stroke treatments and prevention strategies (e.g., warfarin and thrombolysis) than younger patients [4–6], some studies have found that older stroke patients are less likely to receive interventions than younger patients [7–9]. A few studies have examined age disparities in stroke management. A Canadian study found that rates of antiplatelet and warfarin for atrial fibrillation at discharge were similar across age groups [10]. On the other hand, individuals in the older age groups (60–69, 70–79, and 80 yr) were significantly more likely than their younger counterparts to be discharged with antihypertensive treatment. A separate study found that older individuals (85+ yr) were less likely to receive secondary prevention (e.g., documented measure of blood cholesterol) [11]. Using a nationally representative telephone self-report survey to explore disparities in 11 stroke secondary prevention services (e.g., serum glycosylated hemoglobin [HbA1c] measurement; serum cholesterol measurement), Ross and colleagues reported that individuals younger than 65 were less likely than those 65–79 to report receipt of recommended services (e.g., serum cholesterol measurement) [12]. Still yet a separate study found that the oldest hypertension patients, despite worse blood pressure control, were being treated less aggressively with fewer medications than their younger counterparts [13]. In sum, some previous studies have found age differences in the process of care, but whether the same differences exist in Department of Veterans Affairs (VA) stroke care is unclear.

Recent data indicate that the Veterans Health Administration (VHA) treats a sizable number of veterans with stroke in the ambulatory care setting. In the United States, approximately 7 million individuals have experienced a stroke. Each year, nearly 795,000 people experience a new or recurrent stroke. In the VHA for 2007, nearly 6,000 veterans were admitted to a VA facility with a primary discharge diagnosis of ischemic stroke and more than 61,000 unique patients had an outpatient visit with stroke listed as the primary diagnosis [2].

The VHA is the largest healthcare system in the United States and has a record of providing high-quality care; however, little data are available regarding the existence of age differences in postdischarge stroke care quality. The purpose of this study was to examine whether age differences exist in performance on postdischarge stroke care quality indicators (QIs) among VHA stroke survivors. VHA traditionally has not dealt with the frontline care of stroke victims and tends to treat stroke patients in the rehabilitation setting.

METHODS

Materials and Patients

The data were obtained from a retrospective cohort of veterans who were admitted to a VA medical center (VAMC) with an ischemic stroke during fiscal year 2007 (October 1, 2006–September 30, 2007). Medical record review was performed on a sample of 5,000 patients; the sample was constructed by including 100 percent of patients from smaller volume medical centers and an 80 percent sample from larger volume medical centers. Patients were excluded if they were admitted for elective carotid endarterectomy, admitted only for poststroke rehabilitation, initially admitted for a nonstroke condition when the ischemic stroke event occurred, or admitted to a VAMC that did not use the VHA electronic medical record system. The original cohort included 3,965 patients (from 129 VAMCs) who were eligible for at least one inpatient QI. For the current study, we excluded veterans who died in the hospital, were readmitted within 30 d, died within 30 d, or left the hospital against medical advice, yielding a total sample size of 3,196 patients at 128 VAMCs. Note that numbers for exclusions are not mutually exclusive.

Quality Indicators

We examined five discharge QIs. By design, eligibility for each of these QIs was restricted to patients who had received postdischarge stroke care in the outpatient setting within 6 mo. No standard protocol exists for postacute stroke care across the system. The types of procedures performed on the patients over this 6 mo period involved many factors of consideration (e.g., patient's condition including physical and mental deficits, availability and accessibility of services) and are done at the discretion of the provider. These QIs included both the measurement and achievement of the following goals: (1) blood pressure of <140/90 mm Hg for patients without

diabetes or kidney disease and <130/80 mm Hg for patients with diabetes or kidney disease; (2) serum international normalized ratio (INR) measurement of between 2 and 3 inclusive for patients discharged on warfarin; (3) low-density lipoprotein (LDL) cholesterol <100 mg/dL for all patients; (4) HbA1c <8 percent for patients with diabetes (or patients who had HbA1c of 7% or greater during stroke hospitalization without a previous history of diabetes); and (5) depression screening and, for those with a positive screen, appropriate management through counseling and/or pharmacologic treatment. Each of these five QIs was measured as the proportion of eligible patients in the designated age appropriately managed per QI specifications [1]. When patients had multiple outpatient visits during the 6 mo after discharge, the last measurement was selected for analysis.

Independent Variable

Patient age was based on chart review and measured in years and calculated by subtracting each patient's date of birth from the date of stroke diagnosis, then dividing by 365.25 d. Age was classified as an ordinal variable consisting of five categories: <55, 55–64, 65–74, 75–84, and ≥85 yr.

Patient and Facility Characteristics

The following patient characteristics were considered potential confounders and were included in the risk adjustment for the final model that examined whether age was associated with the five postdischarge QIs: sex, race, marital status, medical comorbid conditions, stroke severity, overall patient disease severity, discharge destination, prestroke residence, and admission code status. Race was classified as African American, non-Hispanic white, and all others. Marital status was coded as married versus all others. The Charlson Comorbidity score was included as a measure of medical comorbidity [14]. The retrospective National Institutes of Health Stroke Scale (rNIHSS) [15] was used as an adjustment for stroke severity and was categorized as mild (NIHSS ≤2), moderate (NIHSS 3–9), and severe (NIHSS ≥10). The admission modified Acute Physiology and Chronic Health Evaluation III was used to adjust for the overall patient disease severity [16]. Admission code status was classified as full code (i.e., do not resuscitate or do not intubate) versus other. Prestroke residence was classified as home versus all other. Discharge disposition was classified as home versus all other settings. We also controlled for the clustering effect of the VA facilities.

Statistical Analysis

We compared patients' demographic and clinical characteristics across the five age categories by using chi-square tests for categorical variables and analysis of variance or Kruskal-Wallis tests for continuous variables. The probability values indicate a test for increasing or decreasing trends across age groups. The performance on each QI measure was compared among age groups with risk-adjustment for patient sociodemographic, clinical, and facility-level characteristics (as described) using hierarchical generalized linear modeling. All tests were two-tailed and $p < 0.05$ was considered significant. All statistical analyses were performed using SAS version 9.2 (SAS Institute Inc; Cary, North Carolina).

RESULTS

Table 1 presents the characteristics of the cohort by age group. Among the 3,196 veterans, 12.2 percent were <55 yr of age, 35.8 percent were 55–64, 22.0 percent were 65–74, 23.1 percent were 75–84, and 7.0 percent were ≥85. Stroke severity increased substantially with age, with 5.1 percent of patients in the youngest group versus 13.5 percent in the oldest group having an rNIHSS ≥10 ($p < 0.001$).

Table 2 shows the unadjusted results for each individual postdischarge QI by age categories. Overall QI performance rates varied widely (from 33.2% for screening and treatment for depression to 61.8% for LDL goal achievement). Three QIs had significant differences between the age groups: treatment of depression was *higher* for veterans <55 yr than for older veterans ($p < 0.05$) and LDL goal achievement was *lower* for veterans <55 yr than for their older counterparts ($p < 0.05$). Blood pressure goal achievement was *lower* for veterans 55–64 yr than for veterans 75–84 yr.

Table 3 presents the adjusted odds ratios (ORs) for postdischarge QI scores. We used the age <55 group as a reference category. After patient and facility characteristics were adjusted for, postdischarge INR control was substantially higher for veterans 85 yr or older than for those <55 yr (OR = 5.6, 95% confidence interval = 1.2–27.0, $p = 0.03$).

Table 1.
Patients' baseline demographic and clinical characteristics.

Variable	Overall, *N* = 3,196	Age Group <55, *n* = 389 (12.2%)	55–64, *n* = 1,144 (35.8%)	65–74, *n* = 702 (22.0%)	75–84, *n* = 739 (23.1%)	85+, *n* = 222 (7.0%)	*p*-Value
Age (Mean ± SD)	67.2 ± 11.3						
Sex: Female (%)	2.6	5.1	2.4	2.0	2.2	2.7	0.02
Married (%)	43.1	30.3	38.2	49.0	50.6	46.9	<0.001
Race (%)							<0.001
White, Non-Hispanic	62.1	47.6	60.4	64.0	67.8	71.6	
African American	23.6	38.3	25.8	21.5	17.1	15.3	
Other	14.3	14.1	13.8	14.5	15.2	13.1	
Charlson Index							
Median (IQR)	4 (3–6)						
Mean ± SD Score	4.6 ± 2.0	2.6 ± 1.5	3.7 ± 1.4	4.9 ± 1.5	6.2 ± 1.6	6.8 ± 1.4	<0.001
rNIHSS							
Median (IQR)	2 (1–5)						
Mean ± SD Score	3.7 ± 4.5	3.2 ± 4.1	3.5 ± 4.2	3.7 ± 4.4	4.1 ± 4.8	4.7 ± 5.5	<0.001
≤2	51.4	54.2	54.5	50.9	47.9	44.6	0.003
3–9	40.5	40.6	37.6	41.6	43.3	41.9	
≥10	8.1	5.1	8.0	7.6	8.8	13.5	
APACHE							
Median (IQR)	11.0 (7–16)						
Mean ± SD Score	12.1 ± 7.1	11.0 ± 6.5	11.6 ± 7.0	12.3 ± 7.4	13.0 ± 7.1	13.5 ± 7.4	<0.001
Systolic Blood Pressure, mmHg							
Median (IQR)	150 (133–169)						
Mean ± SD	152.0 ± 28.1	152.5 ± 29.3	152.1 ± 28.7	152.6 ± 28.2	151.5 ± 27.4	150.2 ± 24.5	0.37
Diastolic Blood Pressure, mmHg							
Median (IQR)	82 (71–93)						
Mean ± SD	82.7 ± 16.9	91.2 ± 17.0	85.4 ± 16.6	81.3 ± 16.3	77.2 ± 15.5	76.2 ± 14.8	<0.001
LDL, mg/dL (*n* = 2,065)							
Median (IQR)	101 (77–128)						
Mean ± SD	105.4 ± 42.2	113.4 ± 38.7	111.7 ± 42.9	101.4 ± 36.1	95.3 ± 35.8	99.4 ± 69.1	<0.001
HbA1c, % (*n* = 1,103)							
Median (IQR)	7.3 (6.4–8.9)						
Mean ± SD	7.8 ± 2.0	8.9 ± 2.5	8.0 ± 2.1	7.7 ± 2.0	7.3 ± 1.4	7.2 ± 1.6	<0.001
Medical History (%)							
Hypertension	78.9	73.0	77.4	83.2	81.5	75.7	<0.001
Diabetes	39.5	33.4	42.5	44.0	37.6	26.1	<0.001
Hyperlipidemia	48.5	40.6	49.1	53.4	49.9	38.7	<0.001
Atrial Fibrillation	9.4	1.5	4.6	8.0	18.5	21.2	<0.001
CHF	10.6	5.4	9.5	9.8	15.4	11.3	<0.001
Cancer	1.7	1.3	1.7	1.4	2.3	1.8	0.68
Dementia	7.0	0.8	1.8	5.3	15.0	23.9	<0.001
Stroke	24.6	16.7	23.7	27.4	27.5	24.3	<0.001
TIA	6.9	4.4	6.6	7.1	7.9	9.0	0.16
Carotid Stenosis	4.9	2.1	3.6	5.4	8.1	3.6	<0.001
CAD	26.7	13.1	23.9	29.8	33.6	32.0	<0.001
MI	10.0	6.7	9.0	12.7	10.8	10.4	0.02
Depression	16.6	19.0	20.1	13.4	13.9	13.5	<0.001

Table 1. (cont)
Patients' baseline demographic and clinical characteristics.

Variable	Age Group						*p*-Value
	Overall, *N* = 3,196	**<55, *n* = 389 (12.2%)**	**55–64, *n* = 1,144 (35.8%)**	**65–74, *n* = 702 (22.0%)**	**75–84, *n* = 739 (23.1%)**	**85+, *n* = 222 (7.0%)**	
Smoking History	36.1	63.5	50.3	30.1	14.6	5.0	<0.001
Comfort Measure	0.5	0.3	0.3	0.4	0.7	2.3	0.02
DNR/DNI	9.2	4.1	5.2	8.7	13.9	24.8	<0.001
Preambulatory	94.8	98.2	96.5	96.2	91.3	88.3	<0.001
Prestroke Residence, Home (%)	95.3	95.9	97.1	95.9	93.1	90.1	<0.001
Discharge Disposition, Home (%)	65.4	79.7	71.2	65.8	57.0	37.8	<0.001
Outpatient Visits (Mean ± SD)	2.9 (2.7)	3.4 (3.1)	3.0 (2.7)	3.0 (2.5)	2.8 (2.7)	2.1 (2.5)	<0.001

APACHE = Acute Physiologic and Chronic Health Evaluation, CAD = coronary artery disease, CHF = congestive heart failure, DNR/DNI = do not resuscitate/do not intubate, HbA1c = serum glycosylated hemoglobin, IQR = interquartile range (25%, 75%), LDL = low-density lipoprotein, MI = myocardial infarction, rNIHSS = retrospective National Institutes of Health Stroke Scale, SD = standard deviation, TIA = transient ischemic attack.

Table 2.
6 mo postdischarge quality indicators (QIs) for veterans with ischemic stroke by age group (unadjusted). Data shown as *n* (%).

Postdischarge QI	Age Group						*p*-Value for Trend
	Overall, *N* = 3,196	**<55, *n* = 388 (12.2%)**	**55–64, *n* = 1,142 (35.8%)**	**65–74, *n* = 701 (22.0%)**	**75–84, *n* = 737 (23.1%)**	**85+, *n* = 222 (7.0%)**	
Depression Measured and Meets Goal (*n* = 3,190)	1,059 (33.2)	158 (40.7)	389 (34.1)	227 (32.4)	223 (30.3)	62 (27.9)	<0.001
Blood Pressure Measured and Meets Goal (*n* = 2,568)	1,448 (56.4)	191 (58.6)	502 (52.3)	314 (55.3)	344 (61.3)	97 (63.4)	0.008
HbA1c Measured and Meets Goal (*n* = 190)	111 (58.4)	13 (44.8)	54 (60.0)	21 (52.5)	20 (76.9)	3 (60.0)	0.089
LDL Measured and Meets Goal (*n* = 1,063)	657 (61.8)	72 (48.3)	264 (59.2)	145 (64.7)	141 (71.6)	35 (74.5)	<0.001
INR Measured and Meets Goal (*n* = 328)	151 (46.0)	11 (47.8)	45 (41.7)	36 (50.7)	48 (43.6)	11 (68.8)	0.38

HbA1c = serum glycosylated hemoglobin, INR = international normalized ratio, LDL = low-density lipoprotein.

DISCUSSION

In this nationally representative sample of VHA ischemic stroke survivors, several age-related differences in postdischarge QIs were found in unadjusted analysis; however, after adjustment for key sociodemographic, clinical, and facility-level characteristics, only one difference in performance on postdischarge QIs remained. Postdischarge INR control was substantially higher for veterans 85 yr of age and older. Neither the unadjusted nor the adjusted results demonstrated a consistent decrement in quality with increasing age, but rather some processes of care were provided more often to older patients (i.e., LDL goal achievement) whereas other processes were provided more often to younger patients (i.e., treatment of depression and blood pressure goal achievement). The age difference for postdischarge INR control was inconsistent with previous studies, which found that stroke patients with atrial fibrillation discharged on warfarin either did not differ by age [10,17] or postdischarge INR control was lower in older patients (aged 80 and older) than younger patients [1]. Because the number of patients in the study who had atrial fibrillation and were eligible for this QI in the age 80 and older category was

Table 3.
Adjusted odds ratio (OR) for postdischarge quality indicators (QIs) for veterans with ischemic stroke.

Postdischarge QI	Adjusted	
	OR (95% CI)	*p*-Value
Depression Measured and Meets Goal		
Age		
<55	ref	
55–64	0.8 (0.6–1.1)	0.17
65–74	0.9 (0.6–1.2)	0.30
75–84	0.9 (0.7–1.3)	0.67
85+	1.0 (0.6–1.6)	0.98
Blood Pressures Measured and Meet Goal		
Age		
<55	ref	
55–64	0.8 (0.6–1.0)	0.09
65–74	1.0 (0.7–1.3)	0.80
75–84	1.3 (0.9–1.8)	0.14
85+	1.4 (0.9–2.3)	0.14
LDL Measured and Meets Goal		
Age		
<55	ref	
55–64	1.2 (0.8–1.8)	0.31
65–74	1.4 (0.8–2.2)	0.23
75–84	1.6 (0.9–2.8)	0.11
85+	1.5 (0.6–3.5)	0.34
HbA1c Measured and Meets Goal		
Age		
<55	ref	
55–64	1.7 (0.5–5.5)	0.36
65–74	1.0 (0.2–4.4)	0.95
75–84	3.9 (0.7–22.4)	0.12
85+	0.4 (0.0–8.7)	0.59
INR Measured and Meets Goal		
Age		
<55	ref	
55–64	1.1 (0.4–2.8)	0.90
65–74	2.1 (0.7–6.1)	0.18
75–84	1.7 (0.6–5.1)	0.35
85+	5.6 (1.2–27.0)	0.03

*QI indicator measures were adjusted for age, Charlson, Acute Physiologic and Chronic Health Evaluation score, retrospective National Institutes of Health Stroke Scale, sex, race, marital status, discharge disposition, prestroke residence, admission code status, and clustering effect of hospitals.
CI = confidence interval, HbA1c = serum glycosylated hemoglobin, INR = (serum) international normalized ratio, LDL = low-density lipoprotein, ref = reference.

so small, this result may be due to chance. It is also possible that older people on warfarin were more carefully monitored, given the concern for bleeding. Even though our study was not designed to evaluate the appropriateness of anticoagulation decision making, our findings suggest follow-up questions that future research should explore. Future research should investigate the association between the frequency of INR monitoring and outcomes

such as readmissions for either thromboembolic events (e.g., stroke) or hemorrhagic events (e.g., gastrointestinal bleeds).

Some study limitations deserve mention. First, as a result of the clinical context of the VHA, the study sample of ischemic stroke patients was overwhelmingly male (97.5%) and may not be generalizable outside the VHA. Second, we had no available data on use of non-VHA care; Medicare-eligible veterans, most of whom were ≥65, may have been more likely than younger veterans to have received some of their care outside the VA. As a previous report indicated, 70 percent of VHA stroke patients also received some poststroke care from non-VHA healthcare programs, including 60 percent VHA-Medicare dual system users, 3 percent VHA-Medicaid dual system users, and 7 percent VHA-Medicare-Medicaid triple system users [18]. Future research should consider VHA stroke patients' service use beyond the VHA system in order to obtain a more comprehensive evaluation of stroke patients. Third, adherence to medical appointments and medications may be associated with outcomes of these interventions. As a result of the limitations of the data set, we were unable to control for patient adherence (e.g., the extent to which patients were able to keep their regularly scheduled appointments) in the multivariate models. Future studies should further explore the association between the visits and adherence between discharge and 6 mo. Future research should also investigate the extent to which adherence to visits is associated with patient age, which, in turn, could affect whether or not patients received postdischarge stroke care in the outpatient setting. Fourth, VHA does not deal with the frontline care of most stroke victims. Such care tends to occur in each community's emergency medical services and trauma care system. After stabilization, the patient is transferred to the VHA facility nearby. This lack of first contact for many veterans with stroke and possible transfer trauma could significantly affect the outcomes of these patients' recoveries. Future research should investigate the extent to which this transition of care impacts future VHA care, especially in a rehabilitation setting.

Despite these limitations, our study makes an important contribution to the literature in at least two ways. First, our study had an admission rNIHSS on all study participants, enabling the adjustment for stroke severity as a key covariate in understanding the relationship between age and quality of care. In the present study, patient stroke severity and comorbidities were the two variables that consistently accounted for the differences between the unadjusted and adjusted findings. Previous studies either did not control for stroke severity [12] or did not have stroke severity uniformly available and consequently could not adjust for stroke severity in the entire cohort [1]. Second, in contrast to some previous studies that depended exclusively on patients' self-report [4], the present study included actual clinical data collected during medical encounters and abstracted from medical charts.

CONCLUSIONS

In sum, after we adjusted for a comprehensive set of patient and facility characteristics, overall postdischarge quality for ischemic stroke in VHA did not vary consistently by age. However, the few differences that emerged from this study should encourage the VHA to maintain awareness about possible age disparities. Stroke management should be guided by the best clinical evidence and guidelines irrespective of age.

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Regulatory oversight: D. M. Bravata.

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REFERENCES

1. Fonarow GC, Reeves MJ, Zhao X, Olson DM, Smith EE, Saver JL, Schwamm LH; Get With the Guidelines-Stroke Steering Committee and Investigators. Age-related differences in characteristics, performance measures, treatment trends, and outcomes in patients with ischemic stroke. Circulation. 2010;121(7):879–91. [PMID:20142445] http://dx.doi.org/10.1161/CIRCULATIONAHA.109.892497
2. Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, Borden WB, Bravata DM, Dai S, Ford ES, Fox CS, Fullerton HJ, Gillespie C, Hailpern SM, Heit JA, Howard VJ, Kissela BM, Kittner SJ, Lackland DT, Lichtman JH, Lisabeth LD, Makuc DM, Marcus GM, Marelli A, Matchar DB, Moy CS, Mozaffarian D, Mussolino ME, Nichol G, Paynter NP, Soliman EZ, Sorlie PD, Sotoodehnia N, Turan TN, Virani SS, Wong ND, Woo D, Turner MB; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2012 update: a report from the American Heart Association. Circulation. 2012;125(1):e2–220. [PMID:22179539] http://dx.doi.org/10.1161/CIR.0b013e31823ac046
3. Sacco RL, Adams R, Albers G, Alberts MJ, Benavente O, Furie K, Goldstein LB, Gorelick P, Halperin J, Harbaugh R, Johnston SC, Katzan I, Kelly-Hayes M, Kenton EJ, Marks M, Schwamm LH, Tomsick T; American Heart Association/American Stroke Association Council on Stroke; Council on Cardiovascular Radiology and Intervention; American Academy of Neurology. Guidelines for prevention of stroke in patients with ischemic stroke or transient ischemic attack: a statement for healthcare professionals from the American Heart Association/American Stroke Association Council on Stroke: co-sponsored by the Council on Cardiovascular Radiology and Intervention: the American Academy of Neurology affirms the value of this guideline. Circulation. 2006;113(10):e409–49. [PMID:16534023]
4. Gómez-Choco M, Obach V, Urra X, Amaro S, Cervera A, Vargas M, Chamorro A. The response to IV rt-PA in very old stroke patients. Eur J Neurol. 2008;15(3):253–56. [PMID:18190509] http://dx.doi.org/10.1111/j.1468-1331.2007.02042.x
5. Glader EL, Sjölander M, Eriksson M, Lundberg M. Persistent use of secondary preventive drugs declines rapidly during the first 2 years after stroke. Stroke. 2010;41(2):397–401. [PMID:20075360] http://dx.doi.org/10.1161/STROKEAHA.109.566950
6. Ford GA, Ahmed N, Azevedo E, Grond M, Larrue V, Lindsberg PJ, Toni D, Wahlgren N. Intravenous alteplase for stroke in those older than 80 years old. Stroke. 2010;41(11):2568–74. [PMID:20930163] http://dx.doi.org/10.1161/STROKEAHA.110.581884
7. Olindo S, Cabre P, Deschamps R, Chatot-Henry C, René-Corail P, Fournerie P, Saint-Vil M, May F, Smadja D. Acute stroke in the very elderly: epidemiological features, stroke subtypes, management, and outcome in Martinique, French West Indies. Stroke. 2003;34(7):1593–97. [PMID:12829873] http://dx.doi.org/10.1161/01.STR.0000077924.71088.02
8. Lau E, Bungard TJ, Tsuyuki RT. Stroke prophylaxis in institutionalized elderly patients with atrial fibrillation. J Am Geriatr Soc. 2004;52(3):428–33. [PMID:14962160] http://dx.doi.org/10.1111/j.1532-5415.2004.52117.x
9. Tabereaux PB, Brass LM, Concato J, Bravata DM. Hospital admissions for stroke among the very old in the USA. Neuroepidemiology. 2008;31(2):93–99. [PMID:18645263] http://dx.doi.org/10.1159/000146250
10. Saposnik G, Black SE, Hakim A, Fang J, Tu JV, Kapral MK; Investigators of the Registry of the Canadian Stroke Network (RCSN); Stroke Outcomes Research Canada (SORCan) Working Group. Age disparities in stroke quality of care and delivery of health services. Stroke. 2009;40(10):3328–35. [PMID:19696418] http://dx.doi.org/10.1161/STROKEAHA.109.558759
11. Rudd AG, Hoffman A, Down C, Pearson M, Lowe D. Access to stroke care in England, Wales and Northern Ireland: the effect of age, gender and weekend admission. Age Ageing. 2007;36(3):247–55. [PMID:17360793] http://dx.doi.org/10.1093/ageing/afm007
12. Ross JS, Halm EA, Bravata DM. Use of stroke secondary prevention services: are there disparities in care? Stroke. 2009;40(5):1811–19. [PMID:19265044] http://dx.doi.org/10.1161/STROKEAHA.108.539619
13. Borzecki AM, Glickman ME, Kader B, Berlowitz DR. The effect of age on hypertension control and management. Am J Hypertens. 2006;19(5):520–27. [PMID:16647627] http://dx.doi.org/10.1016/j.amjhyper.2005.10.022
14. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987;40(5):373–83. [PMID:3558716] http://dx.doi.org/10.1016/0021-9681(87)90171-8
15. Williams LS, Yilmaz EY, Lopez-Yunez AM. Retrospective assessment of initial stroke severity with the NIH Stroke Scale. Stroke. 2000;31(4):858–62. [PMID:10753988] http://dx.doi.org/10.1161/01.STR.31.4.858

16. Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG, Sirio CA, Murphy DJ, Lotring T, Damiano A, Harrell FE. The APACHE III prognostic system. Risk prediction of hospital mortality for critically ill hospitalized adults. Chest. 1991;100(6):1619–36. [PMID:1959406] http://dx.doi.org/10.1378/chest.100.6.1619
17. Gladstone DJ, Bui E, Fang J, Laupacis A, Lindsay MP, Tu JV, Silver FL, Kapral MK. Potentially preventable strokes in high-risk patients with atrial fibrillation who are not adequately anticoagulated. Stroke. 2009;40(1):235–40. [PMID:18757287] http://dx.doi.org/10.1161/STROKEAHA.108.516344
18. Jia H, Zheng YE, Cowper DC, Wu SS, Vogel BW, Duncan PW, Reker D. How veterans use stroke services in the VA and beyond. Fed Pract. 2006;23:21–24.

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