Published in final edited form as:

Arch Phys Med Rehabil. 2010 February ; 91(2): 189–195. doi:10.1016/j.apmr.2009.10.015.

Discharge Destination's Effect on Bounce-Back Risk in Black, White, and Hispanic Acute Ischemic Stroke Patients

Amy J. Kind, M.D., Maureen A. Smith, M.D., M.P.H., Ph.D., Jinn-Ing Liou, M.S., M.B.A., Nancy Pandhi, M.D., M.P.H., Jennifer R. Frytak, Ph.D., and Michael D. Finch, Ph.D.

Departments of Medicine – Geriatrics Section (Kind), Population Health Sciences (Kind, Smith, Liou, Pandhi), and Family Medicine (Pandhi), University of Wisconsin School of Medicine and Public Health, Madison, WI; William S. Middleton Hospital, Geriatric Research Education and Clinical Center, United States Department of Veterans Affairs, Madison, WI (Kind); i3 Innovus, Eden Prairie, MN (Frytak); and the Center for Health Care Policy and Evaluation, Eden Prairie, MN (Finch)

Abstract

Objective—To determine whether racial and ethnic effects on bounce-back risk (i.e., movement to settings of higher care intensity within 30 days of hospital discharge) in acute stroke patients vary depending upon initial post-hospital discharge destination.

Design—Retrospective analysis of administrative data.

Setting—422 hospitals, southern/eastern US.

Participants—All Medicare beneficiaries ≥ 65 years with hospitalization for acute ischemic stroke within one of the 422 target hospitals during the years 1999 or 2000 (N= 63,679).

Interventions—Not applicable.

Main Outcome Measures—Adjusted predicted probabilities for discharge to and for bouncing back from each initial discharge site (i.e., home, home with home health care [HHC], skilled nursing facility [SNF], or rehabilitation center) by race (i.e., Black [B], White [W], and Hispanic [H]). Models included sociodemographics, comorbidities, stroke severity, and length of stay.

Results—Blacks and Hispanics were significantly more likely to be discharged to HHC (B=21% [95%CI: 19.9, 22.8], H=19% [17.1, 21.7] vs. W=16% [15.5, 16.8]) and less likely to be discharged to SNFs (B=26% [95%CI: 23.6, 29.3], H=28% [25.4, 31.6] vs. W=33% [31.8, 35.1]) than Whites. However, Blacks and Hispanics were significantly more likely to bounce-back when discharged to SNFs than Whites (B=26% [95%CI: 24.2, 28.6], H=28% [24, 32.6] vs. W=21% [20.3, 21.9]). Hispanics had a lower risk of bouncing-back when discharged home than either Blacks or Whites (H=14% [95%CI: 11.3, 17] vs. B=20% [18.4, 22.2], W= 18% [16.8, 18.3]). Patients discharged to HHC or rehabilitation centers demonstrated no significant differences in bounce-back risk.

Conclusions—Racial/ethnic bounce-back risk differs depending upon initial discharge destination. Additional research is needed to fully understand this variation in effect.

Keywords

Ethnic Groups; Stroke; Hospitalization; Rehabilitation; Skilled Nursing Facilities

“Bounce-backs” or complicated transitions (i.e., movements from less intense to more intense care settings within the first 30 days of hospital discharge¹) affect acute ischemic stroke patients at remarkably high rates. Twenty percent of acute stroke patients experience at least 1 bounce-back and 16% of those experience 2 or more, primarily to the hospital or emergency room.² Stroke patients who bounce-back have markedly higher 1-year mortality rates and costs than their counterparts with no bounce-backs,³ undoubtedly contributing to stroke's ranking as the third leading cause of death in the United States and one of the most costly (\$57.9 billion annually).⁴ As the Centers for Medicare and Medicaid Services (CMS) consider cutting reimbursement rates for rehospitalizations,⁵ efforts to prevent bounce-backs have garnered more interest. To optimally design stroke bounce-back prevention efforts, a better understanding of the underlying mechanisms and modifiable factors driving bounce-backs is necessary.

Race and initial hospital discharge destination strongly and independently impact stroke patients' bounce-back risk. Black race increases the odds of multiple bounce-backs by 38% over that of White race.² In comparison to an initial discharge home, discharge to a skilled nursing facility increases the risk of multiple bounce-backs while discharge to a rehabilitation center decreases this risk.² However, it is unclear whether the strong relationship between race and bounce-backs differs depending on a patient's initial discharge site. It is possible that patients of a particular race or ethnicity do better in one site than another and that certain initial discharge sites are higher-risk for particular patient groups. To optimize efforts to prevent bounce-backs, it is important to understand the interplay between these two factors.

The overall objective of this study is to determine whether Black, White, and Hispanic acute ischemic stroke patients' risks of bouncing-back differ depending upon their initial discharge destination (i.e., home, home with home health care, rehabilitation center, or skilled nursing facility [SNF]). In this study we will do the following:

1. Examine differences in the baseline characteristics of Black, White, and Hispanic acute ischemic stroke patients;
2. Determine how race/ethnicity impacts the probability of being discharged to each destination; and
3. Investigate whether the relationship between race/ethnicity and bounce-backs differs depending on initial discharge destination.

Methods

Population and Sampling

Medicare beneficiaries 65 years and older discharged with acute ischemic stroke in 1999 and 2000 from 422 United States hospitals were identified by examination for an International Classification of Diseases, 9th edition (ICD-9) diagnosis code of 434 or 436 in the first position on the acute care hospitalization discharge diagnosis list (N=63,679). This approach accurately identifies acute ischemic stroke in 89-90% of cases.⁶ If a subject had more than 1 acute ischemic stroke discharge over the study period, 1 discharge was randomly selected as the index hospitalization. We chose a random hospitalization so that the index hospitalization would reflect a mix of first admissions and readmissions.

We obtained fee-for-service (FFS) data from the Centers for Medicare and Medicaid Services (CMS) and health maintenance organization (HMO) data from a large national managed care organization. The sample included 60,164 FFS patients discharged with acute ischemic stroke from 422 hospitals in 93 metropolitan counties primarily in the eastern half of the United States. Comparable data were obtained for 3,515 HMO patients enrolled in 11 Medicare Plus Choice

plans and discharged with acute ischemic stroke from the same hospitals. The Institutional Review Board at the participating university approved this study, and we complied with the Institutional Review Board's approved methods and ethical standards.

Data Extraction

We obtained enrollment data and final institutional and physician/supplier claims for all study patients from 1 year prior to 1 year after their index hospital admission date. For all patients, we obtained the Medicare denominator file to determine age, gender, race/ethnicity, zip code, Medicaid enrollment and date of death. This file was used to exclude beneficiaries who had end-stage renal disease, were missing Medicare Part A or Part B coverage, or received railroad retirement benefits.

Variables

The main explanatory variables were race/ethnicity and discharge location. Using methods proposed by Escarce et al., we split race/ethnicity into categories of White, Black, and Hispanic using information reported in the Medicare denominator file.⁷ We obtained initial discharge destination from claims occurring within 1 day of the index hospitalization discharge date. Using facility claims, we identified patients admitted to rehabilitation centers and SNFs. We used the place of service code on subsequent physician claims to identify patients discharged to long-term care facilities. Remaining patients were categorized as either home with home care claims within 30 days of discharge or home with no home care claims.

“Bounce-back” was defined as a movement from a less intensive to a more intensive care setting. The hospital care setting was defined as the most intensive, followed by emergency room (ER), then SNF/rehabilitation center/long-term care, then home with home health care, and lastly home without home health care as the least intensive.¹ We identified all sites of care within thirty days of the index hospitalization discharge date, including ER visits and/or rehospitalizations, using subsequent facility and non-facility claims. For each patient, all identified sites of care were sequentially ordered by date of service, allowing for examination of movement from a less intensive to a more intensive care setting (a bounce-back). Primary diagnoses for the first rehospitalization were categorized using Clinical Classification Software.⁸

We included sociodemographic characteristics on both individual and neighborhood levels as control variables. Individual characteristics included age, gender, region, index hospitalization admit year, HMO membership, and an indicator identifying beneficiaries with low to modest income who were fully enrolled in Medicaid or received some help with Medicare cost-sharing through Medicaid. We linked patient data to the corresponding Census 2000 block group using zip+4 data to obtain neighborhood socioeconomic characteristics, including percent below the poverty line and percent over 24 years of age with a college degree.⁹

Control variables included individual patient comorbidities and measures of stroke severity. Using methods proposed by Elixhauser et al.¹⁰ and Klabunde et al.,¹¹ we identified 30 comorbid conditions by incorporating information from the index hospitalization, all hospitalizations during the prior year, and all physician claims during the prior year. Twelve comorbidities of the initial 30 identified were present in over 5 percent of our sample and were included as indicator variables. An “other comorbidity count” was generated for the remaining conditions present in less than 5 percent of our sample. We also coded hospitalization during the year prior to the index hospitalization, stroke during the year prior to the index hospitalization,¹² dementia,¹³ and concurrent cardiac events (acute myocardial infarction, unstable angina pectoris, coronary artery bypass graft, and cardiac catheterization). We calculated the Centers for Medicare and Medicaid Services hierarchical condition categories

(CMS-HCC) score for the year prior to admission for each subject to serve as a comprehensive risk adjustment measure.¹⁴ Disease severity during the index hospitalization was represented by mechanical ventilation¹⁵ and placement or revision of a gastrostomy tube,¹⁶ both validated indicator variables, and length of index hospital stay was measured in days.

Analysis

Analyses were conducted using SAS version 8.0 (SAS Institute, Inc., Cary, NC) and Stata version 10.0 (StataCorp, LP, College Station, TX). We calculated adjusted predicted probabilities with 95% confidence intervals by race/ethnicity for initial discharge to and bouncing-back from each site. For patients with rehospitalizations within the first 30 days, we calculated adjusted predicted probabilities for the primary rehospitalization diagnoses by race/ethnicity. To determine whether site-specific 30-day mortality rates could explain some of the racial or ethnic differences noted in bounce-back risk, we calculated race/ethnicity-specific 30-day mortality in each discharge site for patients with no bounce-backs. All comparisons were tested for significance at p -value < 0.05 . All confidence intervals and significance tests were calculated using robust estimates of the variance that allowed for clustering of patients within hospitals. Control variables included age (65-69 years, 70-74 years, 75-79 years, 80-85 years, and 85+ years), gender, Medicaid, HMO membership, percentage of the census block group aged 25+ with college degrees, percentage of persons in the census block group below the poverty line, region, index hospitalization admit year, prior hospitalization, prior stroke, cardiac arrhythmias, congestive heart failure, chronic pulmonary disease, uncomplicated diabetes mellitus, complicated diabetes mellitus, hypertension, fluid and electrolyte disorders, valvular disease, peripheral vascular disorders, hypothyroidism, solid tumor without metastasis, deficiency anemias, depression, dementia, concurrent cardiac event, other comorbidity count, CMS-HCC score, length of index hospital stay, mechanical ventilation, and presence of gastrostomy tube.

Results

Descriptive Characteristics

White, Black, and Hispanic patients differed significantly in a number of areas (Table 1). Black and Hispanic stroke patients tended to be younger, be on Medicaid, belong to HMOs, and live in poorer, lower-educated neighborhoods than White stroke patients. Black and Hispanic patients were also more apt than Whites to have longer initial hospital stays, prior hospitalizations, prior strokes, diabetes, hypertension, anemia, fluid and electrolyte disorders, and to have gastrostomy tubes placed. Blacks tended to experience more bounce-backs than either White or Hispanic patients.

Primary diagnoses for initial rehospitalizations ($N = 9,780$) did not differ by race (data not shown). Infections and aspiration pneumonia were the most common primary diagnoses, accounting for 17-20% of initial rehospitalizations regardless of racial group. Heart disease was the next most common primary diagnosis, accounting for 10-15% of initial rehospitalizations, while recurrent acute stroke accounted for 13-14%.

Initial Discharge Destination

Predicted probabilities of stroke patients' initial discharge destinations differed significantly by race/ethnicity, even after adjusting for sociodemographics, comorbidity, and disease severity (Table 2). Black stroke patients were significantly more likely to be discharged home with home health care (Black [B] = 21% versus White [W] = 16%) and significantly less likely to be discharged to SNFs (B = 26% versus W = 33%) than Whites. Hispanics were also significantly more likely to be discharged home with home health care than Whites (Hispanic [H] = 19% versus W = 16%) and, although non-significant, Hispanics tended to be less

frequently discharged to SNFs than Whites. Blacks, Whites, and Hispanics were all equally likely to be discharged home (without home health care services) and to rehabilitation facilities.

Bounce-Back Risk and Initial Discharge Destination

The relationship between race/ethnicity and predicted probabilities for 30-day bounce-back risk differs significantly depending on initial discharge destination (Table 3). Blacks and Hispanics were both significantly more likely to bounce-back when initially discharged to SNFs than Whites (B = 26%, H = 28% versus W = 21%). Blacks also had a statistically significant, but only slightly greater risk of bouncing-back than Whites when initially discharged to home (B = 20% and W = 18%). In comparison, Hispanics had a lower risk of bouncing-back when initially discharged home than either Blacks or Whites (H = 14% versus B = 20%, W = 18%). No significant differences were noted for the home with home health care or rehabilitation settings.

30-Day Mortality and Initial Discharge Destination

To determine whether early patient mortality could explain some of the site-specific racial/ethnic differences in bounce-back risk, predicted probabilities for site-specific 30-day mortality rates for patients with no bounce-backs were calculated (Table 4). White patients who were initially discharged to SNFs and who did not bounce-back had significantly higher 30-day mortality than either Blacks or Hispanics (W = 8% versus B = 5%, H = 5%). Hispanics discharged to rehabilitation centers experienced a slightly lower mortality than both Whites and Blacks (H = 1% versus W = 2%, B = 2%). However, no significant differences in 30-day mortality existed among Black, White, and Hispanic patients initially discharged to home with or without home health care.

Discussion

Black, White, and Hispanic stroke patients' risks of bouncing-back differ significantly depending on their initial hospital discharge destination. Certain initial discharge sites are higher-risk for Blacks and Hispanics, most notably the SNF. Other sites, such as rehabilitation centers and home with home health, show no significant racial/ethnic differences in bounce-back rates. The effect magnitude of these differences is moderate, but significant. Racial/ethnic differences in 30-day mortality may explain a portion of these site-specific differences in bounce-back rates, but not all.

Our finding that Blacks experience a higher bounce-back risk than Whites in the SNF setting is consistent with previous studies.^{17, 18} However, to our knowledge this is the first study to demonstrate similar (but less pronounced) patterns of care within the Hispanic population and the first to demonstrate that certain post-hospital settings are higher risk than others for minorities. The mechanism driving these differences remains unclear. Previous work has shown that Black nursing home patients often receive poorer quality care than Whites.¹⁹⁻²³ The decreased discharge rate to SNFs for Blacks and Hispanics in this study may reflect active patient choices to avoid a discharge setting viewed as "low-quality." Alternatively, racial/ethnic variation in SNF bounce-back risk may reflect racial/ethnic differences in the approach to end of life care. Multiple studies have shown that minorities more often have aggressive in-hospital care than palliative care at the end of life.²⁴⁻³⁰ Our finding that Black and Hispanic stroke patients discharged to SNFs are less likely to die without bouncing-back than Whites may support this contention.

Interestingly, Hispanic stroke patients did remarkably well when discharged home. Despite being discharged to home more often than Whites, Hispanic bounce-back rates were comparable to those of Whites when discharged to home with home health and tended to be

lower than those of Whites discharged to home without home health care. The Hispanic culture and its reliance on a strong and extended family-unit may underlie some of this success.³¹⁻³³

Notably, initial discharge to rehabilitation centers or to home with home health care resulted in no racial/ethnic differences in bounce-back risk. It is possible that these settings are not prone to the same quality problems which plague many of the SNFs serving the highest concentrations of Black residents.³⁴ Additionally, end of life care decisions may be less common in home health and rehabilitation settings than they are in SNFs and, therefore, do not significantly contribute to racial/ethnic differences in bounce-back risks from these settings.

To best construct efforts to prevent bounce-backs it is important to be able to learn more about the mechanisms underlying the racial/ethnic differences in bounce-back risk observed within this study. Additional research is needed to both explain these effects and to examine the impact of transitional care, advanced directive planning, and palliative care programs, as well as perceived primary care access, in minority stroke populations. Research of this type may provide important new avenues for bounce-back prevention.

Study Limitations

The current study has a number of limitations arising from our reliance on administrative data. We have no direct measures of patient preference, including code status and end of life care wishes. We have attempted to address this limitation by analyzing 30-day mortality rates in patients with no bounce-backs, but this provides only a very limited indication of patient end of life care wishes. More research is needed to understand how code status and end of life care affect bounce-back risk, especially in Black and Hispanic patients. Additionally, although valid,^{15, 16} our measures of stroke severity are limited to those factors obtainable via administrative data. This may have led to incomplete adjustment for differences in stroke severity. Without more definitive severity measures it is impossible to comment on the appropriateness of patient triage to the initial discharge site. Our data originate from eleven regions of the country, including a wide-array of metropolitan areas, but may not be reflective of patterns of care within rural areas. This remains an area for further research. Given the age of this data, it is possible that current stroke bounce-back rates differ from those represented within this study and that overall bounce-back rates may have actually increased for stroke patients.³⁵ However, although overall rates may have changed, we are aware of no evidence that these changes would differ by race/ethnicity. Therefore, the relative between-group differences represented within this study are still likely to be highly relevant. Finally, administrative data provides no measures of social support,^{36, 37} post-stroke functionality,^{38, 39} or care process,^{40, 41} all of which are important predictors of rehospitalization. Further study of these factors within the post-hospital setting would be helpful in designing, developing, and targeting bounce-back prevention efforts.

Conclusion

In conclusion, racial/ethnic bounce-back risk in acute ischemic stroke differs depending upon initial post-hospital discharge destination. Within this study, certain initial discharge sites (SNFs) were higher-risk for Black and Hispanic acute ischemic stroke patients, while other sites (rehabilitation centers and home health care) demonstrated no racial/ethnic differences in bounce-back risk. These differences may, in part, reflect racial/ethnic variation in approach to end-of-life care and to advanced directive planning. However, additional research is necessary to fully understand these variations in effect.

Acknowledgments

We would like to acknowledge Bernie Tennis and Alexandra (Sandy) Wright for assistance in variable creation and Colleen Brown for manuscript preparation.

This study was supported by grants from the National Institute of Aging (grant no. R01-AG19747, Principal Investigator: Maureen Smith, M.D., Ph.D.) and from the University of Wisconsin's John A. Hartford Center of Excellence in Geriatrics Medicine and Education. Dr. Kind is supported by a KL2 through the NIH grant 1KL2RR025012-01 [Institutional Clinical and Translational Science Award (UW-Madison) (KL2)]. Additional support was provided by the Health Innovation Program and the Community-Academic Partnerships core of the University of Wisconsin Institute for Clinical and Translational Research (UW ICTR), grant 1UL1RR025011 from the Clinical and Translational Science Award (CTSA) program of the National Center for Research Resources, National Institutes of Health.

We certify that no party having a direct interest in the results of the research supporting this article has or will confer a benefit on us or on any organization with which we are associated AND, if applicable, we certify that all financial and material support for this research (eg, NIH or NHS grants) and work are clearly identified in the title page of the manuscript.

Abbreviations

CMS	Centers for Medicare and Medicaid Services
SNF	Skilled nursing facility
HMO	Health maintenance organization
ER	Emergency room
CMS-HCC	Centers for Medicare and Medicaid Services hierarchical condition categories
B	Black
W	White
H	Hispanic

References

1. Coleman EA, Min SJ, Chomiak A, Kramer AM. Posthospital care transitions: Patterns, complications, and risk identification. *Health Serv Res* 2004;39:1449–65. [PubMed: 15333117]
2. Kind AJ, Smith MA, Frytak JR, Finch MD. Bouncing back: Patterns and predictors of complicated transitions 30 days after hospitalization for acute ischemic stroke. *J Am Geriatr Soc* 2007;55:365–73. [PubMed: 17341238]
3. Kind AJ, Smith MA, Liou JI, Pandhi N, Frytak JR, Finch MD. The price of bouncing back: One-year mortality and payments for acute stroke patients with 30-day bounce-backs. *J Am Geriatr Soc* 2008;56:999–1005. [PubMed: 18422948]
4. Thom T, Haase N, Rosamond W, Howard VJ, Rumsfeld J, Manolio T, Zheng ZJ, Flegal K, O'Donnell C, Kittner S, Lloyd-Jones D, Goff DC Jr, Hong Y, Adams R, Friday G, Furie K, Gorelick P, Kissela B, Marler J, Meigs J, Roger V, Sidney S, Sorlie P, Steinberger J, Wasserthiel-Smoller S, Wilson M, Wolf P. Heart disease and stroke statistics--2006 update: A report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2006;113:e85–151. [PubMed: 16407573]
5. Medicare Payment Advisory Commission. Payment Policy for Inpatient Readmissions. Washington, D.C.: Medicare Payment Advisory Commission; 2007 Jun.
6. Benesch C, Witter DM Jr, Wilder AL, Duncan PW, Samsa GP, Matchar DB. Inaccuracy of the International Classification of Diseases (ICD-9-CM) in identifying the diagnosis of ischemic cerebrovascular disease. *Neurology* 1997;49:660–4. [PubMed: 9305319]
7. Escarce JJ, McGuire TG. Methods for using Medicare data to compare procedure rates among Asians, blacks, Hispanics, Native Americans, and whites. *Health Serv Res* 2003;38:1303–17. [PubMed: 14596392]

8. Clinical Classifications Software (ICD-9-CM): Summary and Downloading Information. Rockville, MD: Agency for Healthcare Research and Quality; 2003. computer program
9. Krieger N, Williams DR, Moss NE. Measuring social class in US public health research: Concepts, methodologies, and guidelines. *Annu Rev Public Health* 1997;18:341–78. [PubMed: 9143723]
10. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Med Care* 1998;36:8–27. [PubMed: 9431328]
11. Klabunde CN, Potosky AL, Legler JM, Warren JL. Development of a comorbidity index using physician claims data. *J Clin Epidemiol* 2000;53:1258–67. [PubMed: 11146273]
12. Samsa GP, Bian J, Lipscomb J, Matchar DB. Epidemiology of recurrent cerebral infarction: A Medicare claims-based comparison of first and recurrent strokes on 2-year survival and cost. *Stroke* 1999;30:338–49. [PubMed: 9933269]
13. Pippenger M, Holloway RG, Vickrey BG. Neurologists' use of ICD-9CM codes for dementia. *Neurology* 2001;56:1206–9. [PubMed: 11342688]
14. Pope GC, Kautter J, Ellis RP, Ash AS, Ayanian JZ, Lezzoni LI, Ingber MJ, Levy JM, Robst J. Risk adjustment of Medicare capitation payments using the CMS-HCC model. *Health Care Financ Rev* 2004;25:119–41. [PubMed: 15493448]
15. Horner RD, Sloane RJ, Kahn KL. Is use of mechanical ventilation a reasonable proxy indicator for coma among Medicare patients hospitalized for acute stroke? *Health Serv Res* 1998;32:841–59. [PubMed: 9460489]
16. Quan H, Parsons GA, Ghali WA. Validity of procedure codes in International Classification of Diseases, 9th revision, clinical modification administrative data. *Med Care* 2004;42:801–9. [PubMed: 15258482]
17. Culler SD, Parchman ML, Przybylski M. Factors related to potentially preventable hospitalizations among the elderly. *Med Care* 1998;36:804–17. [PubMed: 9630122]
18. Mor V, Papandonatos G, Miller SC. End-of-life hospitalization for African American and non-Latino white nursing home residents: variation by race and a facility's racial composition. *J Palliat Med* 2005;8:58–68. [PubMed: 15662174]
19. Smith DB, Feng Z, Fennell ML, Zinn J, Mor V. Racial disparities in access to long-term care: the illusive pursuit of equity. *J Health Polit Policy Law* 2008;33:861–81. [PubMed: 18818425]
20. Mor V, Zinn J, Angelelli J, Teno JM, Miller SC. Driven to tiers: socioeconomic and racial disparities in the quality of nursing home care. *Milbank Q* 2004;82:227–56. [PubMed: 15225329]
21. Bernabei R, Gambassi G, Lapane K, Landi F, Gatsonis C, Dunlop R, Lipsitz L, Steel K, Mor V. Management of pain in elderly patients with cancer. SAGE Study Group. Systematic Assessment of Geriatric Drug Use via Epidemiology. *JAMA* 1998;279:1877–82. [PubMed: 9634258]
22. Christian JB, Lapane KL, Toppa RS. Racial disparities in receipt of secondary stroke prevention agents among US nursing home residents. *Stroke* 2003;34:2693–7. [PubMed: 14551402]
23. Miller B, McFall S, Campbell RT. Changes in sources of community long-term care among African American and white frail older persons. *J Gerontol* 1994;49:S14–24. [PubMed: 8282985]
24. Caralis PV, Davis B, Wright K, Marcial E. The influence of ethnicity and race on attitudes toward advance directives, life-prolonging treatments, and euthanasia. *J Clin Ethics* 1993;4:155–65. [PubMed: 8334279]
25. Hopp FP, Duffy SA. Racial variations in end-of-life care. *J Am Geriatr Soc* 2000;48:658–63. [PubMed: 10855602]
26. Mitchell SL, Teno JM, Intrator O, Feng Z, Mor V. Decisions to forgo hospitalization in advanced dementia: a nationwide study. *J Am Geriatr Soc* 2007;55:432–8. [PubMed: 17341248]
27. O'Brien LA, Grisso JA, Maislin G, LaPann K, Krotki KP, Greco PJ, Siegert EA, Evans LK. Nursing home residents' preferences for life-sustaining treatments. *JAMA* 1995;274:1775–9. [PubMed: 7500508]
28. Shepardson LB, Gordon HS, Ibrahim SA, Harper DL, Rosenthal GE. Racial variation in the use of do-not-resuscitate orders. *J Gen Intern Med* 1999;14:15–20. [PubMed: 9893086]
29. Johnson KS, Kuchibhatala M, Sloane RJ, Tanis D, Galanos AN, Tulskey JA. Ethnic differences in the place of death of elderly hospice enrollees. *J Am Geriatr Soc* 2005;53:2209–15. [PubMed: 16398911]

30. Connor S, Elwert F, Spence C, Christakis N. Racial disparity in hospice use in the United States in 2002. *Palliat Med* 2008;22:205–13. [PubMed: 18477714]
31. Greene VL, Monahan DJ. Comparative utilization of community based long term care services by Hispanic and Anglo elderly in a case management system. *J Gerontol* 1984;39:730–5. [PubMed: 6436361]
32. Schweizer T, Schnegg M, Berzborn S. Personal networks and social support in a multiethnic community of southern California. *Social Networks* 1998;20:1–21.
33. Boden-Albala B, Litwak E, Elkind MS, Rundek T, Sacco RL. Social isolation and outcomes post stroke. *Neurology* 2005;64:1888–92. [PubMed: 15955939]
34. Gruneir A, Miller SC, Feng Z, Intrator O, Mor V. Relationship between state Medicaid policies, nursing home racial composition, and the risk of hospitalization for black and white residents. *Health Serv Res* 2008;43:869–81. [PubMed: 18454772]
35. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among Patients in the Medicare Fee-for-Service Program. *N Engl J Med* 2009;360:1418–28. [PubMed: 19339721]
36. Evans RL, Bishop DS, Matlock AL, Stranahan S, Halar EM, Noonan WC. Prestroke family interaction as a predictor of stroke outcome. *Arch Phys Med Rehabil* 1987;68:508–12. [PubMed: 3619614]
37. Ottenbacher KJ, Smith PM, Illig SB, Linn RT, Fiedler RC, Granger CV. Comparison of logistic regression and neural networks to predict rehospitalization in patients with stroke. *J Clin Epidemiol* 2001;54:1159–65. [PubMed: 11675168]
38. Kane RL, Chen Q, Finch M, Blewett L, Burns R, Moskowitz M. Functional outcomes of posthospital care for stroke and hip fracture patients under Medicare. *J Am Geriatr Soc* 1998;46:1525–33. [PubMed: 9848813]
39. Ottenbacher KJ, Smith PM, Illig SB, Fiedler RC, Gonzales V, Granger CV. Characteristics of persons rehospitalized after stroke rehabilitation. *Arch Phys Med Rehabil* 2001;82:1367–74. [PubMed: 11588739]
40. Ashton CM, Del Junco DJ, Soucek J, Wray NP, Mansyur CL. The association between the quality of inpatient care and early readmission: A meta-analysis of the evidence. *Med Care* 1997;35:1044–59. [PubMed: 9338530]
41. Smith MA, Frytak JR, Liou JI, Finch MD. Rehospitalization and survival for stroke patients in managed care and traditional Medicare plans. *Med Care* 2005;43:902–10. [PubMed: 16116355]

Table 1
Key Characteristics of White, Black, and Hispanic Acute Ischemic Stroke Patients in Sample (N=63,679)

Characteristic*	White (N=52,396)	Black (N=9,015)	Hispanic (N=2,268)	P-Value
<i>Sociodemographic</i>				
Average age in years (standard deviation)	80 (7.4)	78 (8)	79 (7.5)	0.000
65-69 years	8	17	11	
70-74 years	16	21	21	
75-79 years	23	22	24	
80-84 years	23	18	20	
>85 years	30	22	25	
Male	39	34	39	0.000
Medicaid	11	41	58	0.000
HMO member	5	8	8	0.000
% in block group below the poverty line (standard deviation)	9 (8)	24 (16)	17 (13)	0.000
% adults ≥25 years in block group with college degree (standard deviation)	26 (18)	15 (14)	20 (17)	0.000
<i>Index Hospitalization</i>				
Length of stay in days (standard deviation)	5.8 (5.1)	7.2 (6.9)	6.5 (5.5)	0.000
<i>Discharged from Index Hospital Stay to:</i>				
Home	30	28	29	
Home with home health	16	20	21	
Rehabilitation center	20	22	18	
Skilled nursing facility or long-term care	34	29	31	
<i>Prior Medical History</i>				
HCC ^a score prior to index hospital discharge (standard deviation)	2 (1.3)	2 (1.4)	3 (1.5)	0.000
Prior hospitalization	39	41	43	0.000
Prior stroke	7	9	9	0.000
Cardiac arrhythmias	42	29	35	0.000
Congestive heart failure	24	26	24	0.001
Chronic pulmonary disease	20	16	22	0.000
Diabetes mellitus, uncomplicated	20	31	30	0.000
Diabetes mellitus, complicated	7	10	10	0.000

Characteristic *	White (N=52,396)	Black (N=9,015)	Hispanic (N=2,268)	P-Value
Hypertension	72	83	79	0.000
Fluid and electrolyte disorders	23	29	26	0.000
Valvular disease	17	11	17	0.000
Peripheral vascular disorders	15	14	14	0.523
Hypothyroidism	14	6	9	0.000
Solid tumor without metastasis	14	9	8	0.000
Deficiency anemias	15	21	19	0.000
Depression	9	5	8	0.000
Dementia	22	29	24	0.000
Concurrent cardiac event	2	2	3	0.251
Other comorbidity count (standard deviation)	0.4 (0.7)	0.5 (0.8)	0.5 (0.8)	0.000
<i>Disease Severity</i>				
Mechanical ventilation	3	5	4	0.000
Gastrostomy tube	7	11	10	0.000
<i>Bounce-Backs During the First 30 Days</i>				<i>0.000</i>
0 bounce-backs	82	77	79	
1 bounce-back	15	19	17	
2 or more bounce-backs	3	4	3	

* Values represent percents unless otherwise specified

† HCC = Center for Medicare and Medicaid Services Hierarchical Condition Category Score

Table 2
Predicted Probabilities for Being Initially Discharged to Home, Home with Home Health Care, a Rehabilitation Center, or a Skilled Nursing Facility/Long-Term Care for White, Black, and Hispanic Patients with Acute Ischemic Stroke (N=63,679) *

Race/Ethnicity	Predicted Probability of Initial Discharge Site [†]					
	Home (%) (N = 17,697)	Home with Home Health Care (%) (N = 9,865)	Rehabilitation Center (%) (N = 11,849)	Skilled Nursing Facility or Long- Term Care (%) (N = 19,434)	95% CI	95% CI
White (N = 52,396)	30	16	20	33	(15.5, 16.8)	(31.8, 35.1)
Black (N = 9,015)	28	21	24	26	(19.9, 22.8)	(23.6, 29.3)
Hispanic (N = 2,268)	31	19	21	28	(17.1, 21.7)	(25.4, 31.6)

* 4,834 patients were missing initial hospital discharge site claims

[†] Adjusted for age, gender, Medicaid, HMO membership, % of the census block group aged 25+ with college degrees, % of persons in the census block group below the poverty line, length of index hospital stay, CMS/HCC score prior to index hospital discharge, prior hospitalization, prior stroke, cardiac arrhythmias, congestive heart failure, chronic pulmonary disease, uncomplicated diabetes, complicated diabetes, hypertension, fluid and electrolyte disorders, valvular disease, peripheral vascular disorders, hypothyroidism, solid tumor without metastasis, deficiency anemias, depression, dementia, concurrent cardiac events, other comorbidity count, mechanical ventilation and gastrostomy tube.

Table 3
Predicted Probabilities for Bouncing-Back During the First 30 Days From Each Initial Discharge Site for White, Black, and Hispanic Acute Ischemic Stroke Patients (N=63,679)*

Race/Ethnicity	Predicted Probability of Bouncing-Back [†]					
	Home (%) (N = 17,697)	Home with Home Health Care (%) (N = 9,865)	95% CI	Rehabilitation Center (%) (N = 11,849)	95% CI	Skilled Nursing Facility or Long- Term Care (%) (N = 19,434)
White (N = 52,396)	18	20	(16.8, 18.3)	18	(17.3, 19.1)	21
Black (N = 9,015)	20	22	(18.4, 22.2)	20	(17.9, 22.7)	26
Hispanic (N = 2,268)	14	19	(11.3, 17)	18	(13.1, 22.9)	28

* 4,834 patients were missing initial hospital discharge site claims

[†] Adjusted for age, gender, Medicaid, HMO membership, % of the census block group aged 25+ with college degrees, % of persons in the census block group below the poverty line, length of index hospital stay, CMS/HCC score prior to index hospital discharge, prior hospitalization, prior stroke, cardiac arrhythmias, congestive heart failure, chronic pulmonary disease, uncomplicated diabetes, complicated diabetes, hypertension, fluid and electrolyte disorders, valvular disease, peripheral vascular disorders, hypothyroidism, solid tumor without metastasis, deficiency anemias, depression, dementia, concurrent cardiac events, other comorbidity count, mechanical ventilation and gastrostomy tube.

Table 4
Predicted Probabilities for 30-Day Mortality by Initial Discharge Site for White, Black, and Hispanic Acute Ischemic Stroke Patients With No Bounce-Backs During the First 30 Days (N=46,819)

Race/Ethnicity	Predicted Probability of 30-Day Mortality*					
	Home (%) (N = 14,649)	Home with Home Health Care (%) (N = 7,789)	95% CI	Rehabilitation Center (%) (N = 9,726)	95% CI	Skilled Nursing Facility or Long-Term Care (%) (N = 14,655)
White (N = 38,855)	5	2	(4.7, 5.5)	2	(1.9, 2.5)	8
Black (N = 6,324)	4	2	(3.5, 5.3)	2	(1.6, 3.3)	5
Hispanic (N = 1,640)	4	2	(2.1, 5.7)	1	(-0.2, 1.5)	5

* Adjusted for age, gender, Medicaid, HMO membership, % of the census block group aged 25+ with college degrees, % of persons in the census block group below the poverty line, length of index hospital stay, CMS/HCC score prior to index hospital discharge, prior hospitalization, prior stroke, cardiac arrhythmias, congestive heart failure, chronic pulmonary disease, uncomplicated diabetes, complicated diabetes, hypertension, fluid and electrolyte disorders, valvular disease, peripheral vascular disorders, hypothyroidism, solid tumor without metastasis, deficiency anemias, depression, dementia, concurrent cardiac events, other comorbidity count, mechanical ventilation and gastrostomy tube.