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Race/Ethnicity Matters: Differences in Poststroke Inpatient Rehabilitation Outcomes

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Objective: To examine racial/ethnic differences in poststroke inpatient rehabilitation outcomes.

Design: Cross-sectional and retrospective study of administrative data across 2002-2018.

Setting: An inpatient rehabilitation facility in Southern California.

Participants: 3,876 racial/ethnic people aged ≥ 18 years.

Main Outcome Measures: Functional Independence Measure (FIM®) and discharge disposition.

Results: Participants were non-Hispanic Whites (NHWs, 68.5%), Hispanics (17.1%), non-Hispanic Asians (NHAs, 7.4%), and non-Hispanic Blacks (NHBs, 6.4%) aged 18-102 years (*Mage* = 68.47±14.66 years; *MLOS* = 19.47±10.05 days). Above and beyond covariates, multivariate hierarchical regression analyses showed race/ethnicity significantly predicted admission, motor efficiency, and discharge FIM® scores. Compared with NHWs, the Hispanic and NHA groups were associated with lower cognitive, motor, and total FIM® scores at admission; the NHB group was associated with lower motor efficiency, lower discharge motor and total FIM® scores, whereas the Hispanic group was associated with higher discharge total FIM® scores. Lastly, Hispanics had higher odds of a discharge home compared with NHWs.

Conclusions: Findings suggest racial/ethnic differences exist in poststroke rehabilitation outcomes. *Ethn Dis*. 2019;29(4):599-608; doi:10.18865/ed.29.4.599

Keywords: Inpatient Poststroke Rehabilitation; Race/Ethnicity; FIM®

Introduction

Cerebrovascular diseases, including stroke, are among the leading causes of disability and death in the United States. Prevalence estimates for cerebrovascular diseases are at 2.7%, with recurrent stroke affecting 795,000 people, resulting in age-adjusted mortality approximating 37.6 per 100,000 people each year.[1] Among communities of color, stroke is the fourth leading cause of death.[2] Despite national trends showing a decline in age-adjusted stroke death, data indicate non-Hispanic Blacks have the highest stroke-related mortality, with Hispanic groups showing an alarming increase in mortality (5.8%) within the last decade.[3] Moreover, data suggest Hispanics, non-Hispanic Blacks, and non-Hispanic Asians will demonstrate the greatest comparative stroke burden by 2030 compared with non-Hispanic White counterparts.[4] Together, these data highlight the relatively high burden of stroke for communities of color.

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Stroke Postacute care (PAC)

Besides a discharge to home with no health services, there are several other PAC settings for acute stroke patients. According to the American Heart Association/American Stroke Association (AHA/ASA) stroke rehabilitation and recovery guidelines, patients are typically referred to rehabilitation services following acute stroke, including inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs), nursing homes, long-term acute care hospitals (LTCHs), and home with home health care.[5] Moreover, data from the Centers for Medicaid/Medicare indicate most poststroke Medicare beneficiaries receive rehabilitation care from SNFs (32%), IRFs (22%), and home health care agencies (15%), with an increase in admission to IRFs noted.[6] Though there are several PAC settings, the IRF milieu provides a unique opportunity to examine ra-

cial/ethnic disparities in rehabilitation outcomes, as this setting allows for the ability to track functional status at admission and discharge with a captive sample. Moreover, a statement from the AHA/ASA suggests there is limited literature on the poststroke inpatient rehabilitation experience of communities of color.[7] Thus, our study focuses on examining the inpatient stroke rehabilitation outcomes of racial/ethnic people.

Race/Ethnicity and Poststroke Inpatient Rehabilitation Outcomes

Inpatient rehabilitation services are recognized as the gold standard treatment for poststroke care.[5] However, when racial/ethnic communities undergo inpatient rehabilitation outcomes, they show differential rehabilitation outcomes compared with NHWs. In a recent review, Ellis and colleagues found evidence of significant differences in poststroke functioning.[8] For example, Bhandari and colleagues examined the functional status in one community-based IRF during the years 1995 and 2001 and found NHBs showed less functional poststroke improvement at discharge compared with NHWs.[9] Moreover, in a retrospective analysis of medical charts at one IRF during the years 2000-2001, Moorthy and colleagues found NHBs had the lowest functional gains, whereas Hispanics demonstrated the highest gains compared with NHWs.[10]

Recent evidence has used larger samples or national inpatient rehabilitation databases. For example, Ottenbacher and colleagues found racial/ethnic differences in poststroke inpatient rehabilitation using the Uniform Data System for Medical Rehabilitation (UDSMR) dataset years 2002-2003 such that NHBs had lower Functional Independence Measure (FIM) efficiency scores compared with NHWs, whereas Hispanics had lower functional status at discharge compared with NHWs.[11] Additionally, in an examination of the UDSMR dataset across years 2000-2003, Chiou-Tan and colleagues found there were significant racial/ethnic differences, with Hispanics demonstrating lower admission FIM scores and NHBs making lower gains at the end of poststroke rehabilitation.[12] Lastly, in an analysis of Medicare assessment and claims data with more than 200,000 patients, Liu and colleagues found that NHBs had lower functional status compared with NHWs.[13] Despite varying methodologies, data points converge and suggest there are significant racial/ethnic disparities in poststroke rehabilitation outcomes.

Our study focuses on examining the inpatient stroke rehabilitation outcomes of racial/ethnic people.

Examining racial/ethnic differences in poststroke inpatient rehabilitation outcomes is important, given the expected change in racial/ethnic composition of the United States. More specifically, current estimates indicate an expected population increase of 143% for NHAs, 114% for Hispanics and 63.6% for NHBs by 2060.[14] Additionally, communities of color (compared with NHWs) are projected to have greater direct and indirect medical costs for stroke care by 2030.[15] Also, racial/ethnic differences in inpatient poststroke outcomes have implications for discharge, as some racial/ethnic patients are more likely to be sent home compared with NHWs; this may present unique challenges to family caregivers of color. Hence, our study addresses the pressing need to examine racial/ethnic differences in rehabilitation outcomes and the inpatient milieu provides a unique setting for this.

Methods

This study was a cross-sectional and retrospective analysis of administrative data pooled across 2002-2018. Participants were 3,911 racial/ethnic people admitted to a local inpatient IRF in southern California, with an admitting diagnosis of stroke. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants at admission to the IRF.

Data Source

Data were extracted from the eRehabData administrative claims database across years 2002-2018. eRehabData is an American Medi-

cal Rehabilitation Providers Association encrypted and secure data service (first offered in 1999) used by IRFs across the United States to facilitate the completion of Inpatient Rehabilitation Facility-Patient Assessment Instrument (IRF-PAI) to meet CMS requirements.[16] Patient information entered on eRehabData is obtained from either paper or electronic health records and entered by trained medical staff. Our study examined years when electronic health records were not fully implemented nationwide (ie, early 2000s).[17] Reports indicate only 13% of facilities across the United States implemented electronic medical record systems (EMR) by 2004.[18] More likely than not, data extracted from earlier years of this study period represent a hybrid of paper and electronic medical records, as few hospitals had fully implemented EMR systems nationwide. Moreover, there have been several regulatory policy changes affecting reimbursement for IRFs. Given significant changes occurred during the study period, admission year was used as a covariate in all analyses.

Health Care System

The current health care system is a non-profit, 99-bed acute care teaching hospital that serves the southern California region. This system is a fully-equipped and state-of-the-art facility, including an acute inpatient rehabilitation unit (certified as an IRF by the CMS), a medical-surgical wing, a Commission on Accreditation of Rehabilitation Facilities (CARF)-accredited transitional care facility, as well as comprehensive outpatient rehabilitation services. Unique to this system is the consultative role of Neuropsychology and Psychology Services alongside rehabilitation health care professionals at every level of care. Relevant to our study, this system has a dedicated comprehensive stroke rehabilitation clinical pathway, including board-certified physiatrists, nursing staff specialized in rehabilitation, therapies (physical, occupational, speech therapy), and rehabilitation facilities designed to meet the needs of stroke patients. The hospital system has been continuously accredited by the Joint Commission since 1967, with the most recent accreditation awarded in 2017.

Stroke Diagnosis

Patients were identified using either International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM) and ICD-10-CM diagnostic codes for stroke, depending on the year of admission. For example, stroke patients hospitalized from 2002-2015 were identified using ICD-9-CM codes 430, 431/432, 433/434, 436, 437, and 438. Due to the implementation of ICD-10-CM on October 1, 2015, those who were hospitalized in 2015 to 2018 who had the new ICD codes in their diagnosis were identified using ICD-10-CM codes I60, I61/I62, I63, I67, and I69. For analytic purposes, ICD codes were collapsed into the following stroke type categories: subarachnoid hemorrhage (ICD-9-CM 430; ICD-10-CM I60), intracerebral hemorrhage (ICD-9-CM 431/432; ICD-10-CM I61/62), ischemic stroke (ICD-9-CM 433/434; ICD-10-CM I63), and other stroke types (ICD-9-CM 436/437; ICD-10-CM I67/I69). These ICD codes were used, given recent systematic review evidence found these codes demonstrate good sensitivity and specificity in identifying stroke patients using administrative claims databases.[19]

Race/Ethnicity

The primary independent variable reflects combined ethnicity and race, in line with governmental standards for data collection.[20] Ethnicity was self-reported by the patient at admission, resulting in Hispanic or non-Hispanic categories. Race was also self-reported by the patient at admission from a standard list that included Black, White, and Asian. This study focused only on four groups: non-Hispanic Whites (NHWs), non-Hispanic Blacks (NHBs), non-Hispanic Asians (NHAs), and Hispanics.

Length of Stay

The length of stay (LOS) variable represents the total time (in days) during inpatient rehabilitation, from admission to discharge.

Functional Independence Measure

Functional status was assessed with the FIM®, a clinician-administered instrument composed of 18 items with response options from 1 (complete dependence) to 7 (complete independence), where higher scores indicate greater functional independence. The FIM® instrument is comprised of motor and cognitive scores, which assess the level of motor and cognitive assistance required by the patient.[21] Scores on the FIM® instrument show robust psychometric properties.[22]

Discharge Disposition

For descriptive purposes, all discharge disposition categories are listed in Table 1. Due to several changes in the coding system across years 2002-2013, discharge disposition coded by IRF-PAI training manuals before 2014 were matched to those in the coding system of the 2014 IRF-PAI manual. In those cases where a discharge code from earlier versions of the IRF-PAI manual did not match the 2014 manual, the discharge was coded as "not listed." The 2014 version of the IRF-PAI manual was used as the primary coding system for discharge disposition, given the coding for this variable has remained the same since 2014. As such, the discharge disposition for years 2015-2018 align with the 2014 IRF-PAI coding system. Lastly, for inferential analyses, the discharge disposition variable was collapsed into either a non-home discharge (reference) or home discharge, consistent with the literature.[9-13]

Covariates

Covariates were selected based on previously published work in the area of inpatient stroke rehabilitation outcomes.[9-13] In our study, the covariates available in the dataset were grouped as either sociodemographic (eg, age, sex, marital status, admission year) or clinical characteristics (eg, stroke type, LOS, and admission motor, cognitive, total FIM® scores). Moreover, covariates were further selected based on whether there were

Table 1. Patient characteristics by race/ethnicity

Variable	NHW	Hispanic	NHB	NHA	Total
N (%)	2678 (68.5)	667 (17.1)	250 (6.4)	289 (7.4)	3884 (99.3)[a]
Female[b]	1374	318	132	138	1962(50.4)
Male[b]	1304	349	118	151	1922(49.6)
Age[c], yrs	69.43±14.64	67.03±14.42	64.96±14.82	66.14±14.08	68.47±14.66
Married[d]	1243	341	105	178	1867(48.2)
Ischemic stroke[e]	1298(48.5)	360(54.0)	131(52.4)	105(36.3)	1898(48.5)
Subarachnoid hemorrhage[e]	104(3.9)	33(4.9)	8(3.2)	22(7.6)	169(4.3)
Intracerebral hemorrhage	390(14.6)	114(17.1)	40(16.0)	69(23.9)	616(15.8)
Stroke[e]	886(33.1)	160(24.0)	71(28.4)	93(32.2)	1228(31.4)
LOS[f]	19.21±9.94	19.75±9.12	19.75±10.02	21.28±12.51	19.47±10.05
FIM admit motor	31.75±11.75	29.81±11.29	32.00±11.92	30.01±11.59	31.31±11.69
FIM admit cognitive	18.52±6.66	17.05±6.62	18.14±6.62	16.72±6.98	18.11±6.70
FIM admit total	50.27±11.33	46.85±16.03	50.13±16.10	46.73±16.62	49.41±16.35
FIM motor efficiency	1.08± .829	.981± .746	.966± .679	1.03± .810	1.05± .805
FIM cognitive efficiency	.309± .634	.306± .283	.297± .286	.281± .223	.306± .547
Total efficiency	1.39±1.14	1.28± .913	1.26± .850	1.31± .904	1.35±1.07
Discharge FIM motor	49.83±17.41	47.32±16.61	48.61±16.74	49.26±16.93	49.28±17.22
Discharge FIM cognitive	23.96±7.17	22.67±7.31	23.62±7.01	22.48±7.28	23.61±7.21
Discharge FIM total	73.79±22.67	69.99±22.14	72.23±21.46	71.74±22.40	72.89±22.52
Discharge home[g]					2433(62.2)
Discharge not-home					1478(37.8)
Short-term /general hospital					114(2.9)
SNF					719(18.4)
Intermediate care					4(.1)
Home health[h]					216(5.5)
Expired in IRF					3(.1)
Another IRF					382(9.8)
Long-term care hospital					3(1)

Data are n or n(%) or mean score±SD unless specified otherwise.
a. Missing race/ethnicity data = 27(.7).
b. 27 missing cases (.01); Non-significant racial/ethnic differences, $\chi 2(3) = 4.228$, P = .238.
c. Significant racial/ethnic differences $F(3,3880) = 13.36$, P <.001.
d. Significant racial/ethnic differences, $\chi 2(12) = 66.479$, P< .001.
e. Significant racial/ethnic differences, $\chi 2(9) = 53.557$, P< .001.
f. Significant racial/ethnic differences $F(3,3856) = 3.936$, P=.008.
g. Discharge Home (private home/apt., board/care, asst. living, group home, transitional living).
h. Under care of organized home health service organization.

racial/ethnic differences via chi-square analyses (for categorical data) or ANOVAs (for continuous data).

Analytic Strategy

Data were aggregated and analyzed across years 2002-2018 using the Statistical Package for the Social Sciences (SPSS®).[23] Differences in covariates were tested using chi-square or ANOVAs. Nine separate multivariate hierarchical regression models predicting FIM® scores throughout rehabilitation (ie, admission motor, cognitive, total; motor, cognitive, and total efficiency; discharge motor, cognitive, total) were created. For the three separate models predicting admission FIM® scores, sociodemographic (ie, age, sex, marital status, admission year) and clinical characteristics (ie, stroke type, LOS) were specified into block one, whereas block two contained the three dummy coded race/ethnicity variables (ie, NHBs, NHAs, and Hispanics) using NHWs as the reference group. Regarding the six separate models predicting efficiency and discharge scores, block one contained sociodemographic variables (ie, age, sex, marital status, admission year) and the clinical characteristic stroke type; block two had the corresponding admission FIM® score (eg, if the model was predicting motor efficiency scores, then admission motor FIM® scores were entered into block 2) as well as the LOS variable; block three included the three dummy coded race/ethnicity variables with NHWs as the reference group. Moreover, logistic regression analyses were used to calculate the likelihood of discharge to home using NHWs as the reference group, controlling for the sociodemographic and clinical covariates. The analytic strategies described above, including model specifications at each block of hierarchical and logistic regression analyses, are similar to those used by Ottenbacher and colleagues.[11]

Results

After exclusion of participants not meeting criteria for inclusion due to age (N = 8) and missing data on the race/ethnicity variable (N = 27), the final sample size included a total of 3,876 female (50.4%) and male (49.6%) NHWs (68.5%), Hispanics (17.1%), NHAs (7.4%), and NHBs (6.4%) admitted during the 2002-2018 study period aged 18-102 (*Mage* = 68.47±14.66 years; *MLOS* = 19.47±10.05 days). The majority of the sample was married (48.2%). Ischemic stroke accounted for 48.5% of strokes across the study period. There were few missing data (< 1%) for all variables of interest. Table 1 provides further detail of patient characteristics of the current sample.

Differences in Covariates

In addition to recommendations of covariates in the literature, ANOVA and chi-square analyses were conducted to guide the selection of covariates. Results of five separate ANOVAs indicated there were significant racial/ethnic differences in age, length of stay, and admission motor, cognitive, and total FIM® scores. Four separate chi-square analyses revealed there were significant racial/ethnic differences by stroke type, admission year, marital status but not sex. However, sex was used as a covariate in analyses, given the sizeable literature on this as a covariate in hierarchical and logistic regression models. (Table 1)

Race/ethnicity and FIM Scores

Nine separate multilevel hierarchical regression analyses were conducted to determine the effect of race/ethnicity above and beyond covariates in predicting admission, FIM® efficiency and discharge FIM® scores. Results indicated that the addition of race/ethnicity was a significant predictor above and beyond sociodemographic and clinical characteristics in six of the nine models: admission motor ($F(8, 3857) = 8.612$, $P < .001$, $R2 = .018$), admission cognitive ($F(8, 3857) = 11.248$, $P < .001$, $R2 = .023$), admission total ($F(8, 3857) = 11.325$, $P < .001$, $R2 = .023$), motor efficiency ($F(10, 3832) = 150.152$, $P < .001$, $R2 = .282$), discharge motor ($F(10, 3832) = 809.079$, $P < .001$, $R2 = .679$), and discharge total ($F(10, 3832) = 1019.961$, $P < .001$, $R2 = .727$). Compared with NHWs, the Hispanic and NHA groups were associated with lower cognitive, motor, and total FIM® scores at admission; the NHB group was associated with lower motor FIM® efficiency; the NHB group was associated with lower discharge motor and total FIM® scores; the Hispanic group was associated with higher discharge total FIM® scores. Tables 2-4 provide details for hierarchical regression models for admission, efficiency, and discharge scores.

Table 2. Regression analysis of race/ethnicity predicting admission FIM scores

	Block 1	Block 2		
Variables	**Covariates[a]**	**Admission Motor[b]**	**Admission Cognitive**	**Admission Total**
Race/ethnicity				
Reference (NHW)				
NHB		.134	-.522	-.388
Hispanic		-1.81[c]	-1.41[c]	-3.22[c]
NHA		-2.03[d]	-1.94[c]	-3.98[c]
R^2 all models	.013	.018	.023	.023

a. Block 1 had sociodemographic (eg, age, sex, marital status, admission year) and clinical covariates (eg, stroke type, length of stay [LOS], and admission motor or cognitive or total FIM® scores depending on the DV) entered.
b. Block 2 contained the dummy coded race/ethnicity variable predicting admission FIM® scores.
c. P < .001.
d. P < .01.

Table 3. Regression analysis of race/ethnicity predicting FIM efficiency scores

	Block 1	Block 2		
Variables	**Covariates[a]**	**FIM motor Efficiency[b]**	**FIM cog Efficiency[b]**	**FIM total Efficiency[b]**
Race/ethnicity				
Reference (NHW)				
NHB		-.111[c]	-.005	-.100
Hispanic		.007	.013	.051
NHA		-.005	-.033	.004
R^2 all models	.080	.282	.052	.246

a. Block 1 had sociodemographic (eg, age, sex, marital status, admission year) and clinical covariates (eg, stroke type, length of stay [LOS], and admission motor or cognitive or total FIM® scores depending on the DV) entered.
b. Block 2 contained the dummy coded race/ethnicity variable predicting FIM® efficiency scores.
c. P < .05.

Table 4. Regression analysis of race/ethnicity predicting discharge FIM scores

	Block 1	Block 2		
Variables	**Covariates[a]**	**Discharge Motor[b]**	**Discharge Cognitive[b]**	**Discharge Total[b]**
Race/ethnicity				
Reference (NHW)				
NHB		-1.77[c]	-.037	-1.63[c]
Hispanic		.473	.282	1.09[c]
NHA		.705	-.231	.932
R^2 all models	.084	.679	.721	.727

a. Block 1 had sociodemographic (eg, age, sex, marital status, admission year) and clinical covariates (eg, stroke type, length of stay [LOS], and admission motor, cognitive, total FIM® scores depending on the DV) entered.
b. Block 2 contained the dummy coded race/ethnicity variable predicting discharge FIM® scores.
c. P < .05.

Differences in Discharge Disposition

Separate logistic regression analyses were used to examine the likelihood of discharge to home for NHBs, NHAs, and Hispanics using NHWs as the reference group. Controlling for relevant sociodemographic and clinical covariates, there were no significant differences in odds of a discharge to home for NHBs (*OR* = .951, 95% CI = .727–1.24, *Wald*(1) = .134, P= .714, *Nagelkerke R2* = *.014*) or NHAs (OR = 1.05, 95% CI = .816–1.35, *Wald*(1) = .149, P= .700, *Nagelkerke R2* = .014) relative to NHWs. In contrast, Hispanics, had significantly higher odds of

being discharged home compared to NHWs (OR = 1.277, 95% CI = 1.065–1.530, *Wald*(1) = 6.979, P= .008, *Nagelkerke R2* = .017).

Discussion

This study found racial/ethnic differences in poststroke inpatient rehabilitation outcomes and discharge disposition in one IRF in southern California. Results indicate NHA and Hispanic race/ethnicity were associated with lower cognitive and motor FIM® scores at admission, the NHB group was associated with lower motor FIM® efficiency and discharge scores, and Hispanic group was associated with higher discharge FIM® total scores, relative to NHWs. Further, Hispanics were about 28% more likely to be discharged home compared with NHWs.

The current investigation contributes to the limited literature in several ways. For example, study admission findings for Hispanics and NHAs are in line with previous work, with scholars indicating the impact of linguistic differences between patients and health care providers in the assessment of functionality. Chiou-Tan and colleagues found significantly lower admission FIM® scores for Hispanic patients admitted to a safety-net hospital.[12] Moreover, Wang and colleagues found NHAs admitted to a regional IRF showed lower cognitive gains compared to NHWs.[24] Given the linguistic diversity of Hispanic and NHA patients, lower scores may reflect an underestimation of functional status in FIM® scores secondary to language barriers (though this was not directly assessed herein). Additionally, NHBs in the current study demonstrated worse motor FIM® efficiency and discharge total FIM® scores. Lower discharge functional status for NHBs is consistent with findings from Ottenbacher and colleagues, who found worse overall discharge functional status for NHBs compared with NHWs in the robust UDSMR dataset.[11] Reasons for worse poststroke functioning among NHBs are multifactorial and complex, which contribute to the mixed findings in the field[24-28] but warrant further exploration. Higher discharge total FIM® scores for Hispanics is a relatively novel finding. Chiou-Tan and associates found significantly greater difference only in FIM® gain but not discharge total FIM® scores between Hispanics and NHWs.[12] Wang and colleagues' analysis found non-significant greater FIM® gain in Hispanics relative to NHWs.[25] In contrast, Moorthy and colleagues found Hispanics had the highest functional gains relative to NHWs.[10] The reasons for a significant functional advantage for Hispanics (relative to NHWs) in poststroke rehabilitation outcomes in our study are unclear and warrant further study.

In addition to the abovementioned functional status findings, Hispanics were more likely to be discharged home following poststroke inpatient rehabilitation. Decisions to discharge Hispanic stroke patients home are complex, but they may potentially reflect sociocultural values salient to Hispanics, such as the importance of caring for family or having strong support (*familismo*) in the context of stroke.[29] If this is the case, perhaps social support networks impact the discharge decisions of Hispanic stroke patients. In contrast, the decision of health care systems to discharge Hispanic patients home may also reflect an implicit bias to do so.[30] Both of these plausible explanations for this finding must be further tested and explored in the context of inpatient rehabilitation.

Study Limitations

Our study has notable limitations. First, the study reports on pooled, cross-sectional, and retrospective data from one inpatient rehabilitation facility using administrative claims data; this limits generalizability to other IRFs across the United States. Second, analyses do not account for important clinical comorbidities such as body mass index, diabetes status, or stroke severity. Third, the FIM® instrument is a clinician-based assessment that is sensitive to underestimation or overestimation (ie, bias) of functional ability by rehabilitation professionals.[31] Fourth, there was no disaggregation of racial/ethnic groups in the Hispanic or NHA pan-ethnic labels in our study. Additionally, a limitation of the current findings is that some of the data (ie, early 2000s)

Hispanics were about 28% more likely to be discharged home compared with NHWs.

were extracted during a time where EMRs were virtually non-existent across the country; however, this is not a problem exclusive to this health care system but rather a challenge faced by all health care facilities at that time. Also, there have been several policy changes to the reimbursement of inpatient rehabilitation and documentation of functionality by CMS across 2002-2014 in the United States, which may have impacted study findings; nevertheless, the current investigation controlled for study year in analyses as an attempt to mitigate the effect of these policy changes. Moreover, the variance accounted for in the models were small, with the exception of efficiency, motor, and discharge scores; nonetheless, these differences in functionality may still impact the lives of racial/ethnic people with stroke.[11] Finally, the study did not examine differences in poststroke outcomes by insurance type (ie, Medicare vs private insurance) or other socioeconomic-related factors, as these variables were not available in the current dataset.

Future Directions

Data on racial/ethnic disparities and access to stroke care are plentiful. However, less is known about the psychosocial processes that influence stroke inpatient rehabilitation outcomes for communities of color. For NHBs, perhaps experiences of racial/ethnic discrimination or differential treatment within health care systems may complicate the attainment of optimal stroke rehabilitation outcomes; this may be an interesting area of future research.

In light of our findings of lower functional status assessment at admission, the integration of bilingual/bicultural clinical neuropsychologists in stroke rehabilitation care to assess cognitive functioning of multicultural/linguistically diverse populations may be helpful. Bilingual/bicultural clinical neuropsychologists can provide culturally and linguistically responsive assessments of cognitive status at admission.[32] These recommendations are proposed in the context of recent AHA/ASA guidelines, which highlight the inclusion of psychology in poststroke rehabilitation care.[7]

Related to the discharge findings for Hispanics, it may be that the functional advantage for Hispanics (compared with NHWs) reflects the documented health advantage known as the "Hispanic health paradox," which appears to extend to cerebrovascular health.[33] However, whether better poststroke functioning among Hispanics is due to a health advantage or a result of clinician bias in assessment of functionality must be further parsed and explored.

There are also larger unanswered questions in this literature. Some scholars propose current functional measures were not designed for an examination of racial/ethnic disparities; this is an important, yet understudied matter.[34] Moreover, proposed models highlight the importance of social determinants of health at all stages of poststroke care, including the poststroke rehabilitation phase, for racial/ethnic communities;[35] this may be a fruitful area for future scholarship to empirically test.

Conclusion

Our study adds to the limited literature on racial/ethnic differences in poststroke rehabilitation outcomes. Relative to NHWs, findings indicate worse poststroke status for Hispanics and NHAs at admission, worse motor scores for NHBs at discharge, and greater overall functionality scores for Hispanics at discharge. Additionally, Hispanics had greater likelihood of being discharged home compared with NHWs. Findings from our study suggest a need to implement culturally responsive assessment of functional status by rehabilitation health care professionals. Improving the cultural responsiveness of health care providers may help reduce the disproportionate burden of cerebrovascular health disparities and promote equity in poststroke rehabilitation outcomes for communities of color in the United States.

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Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Garcia, Warren; Acquisition of data: Garcia; Data analysis and interpretation: Garcia; Manuscript draft: Garcia, Warren; Statistical expertise: Garcia; Acquisition of funding: Garcia; Administrative: Garcia, Warren; Supervision: Garcia

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