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Post-Stroke Rehospitalization and Mortality: A Comparison between VA Community Living Centers and VA Contracted Community Nursing Homes

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Abstract

Background: Rehospitalization and mortality are commonly used indicators for quality of care. Veterans Health Administration (VHA) Community Living Centers (CLC) and Community Nursing Homes (CNH) are two major sources of long-term care for Veterans with stroke; however, reports on quality of care for Veterans in CLCs and CNHs are limited.

Objectives: This study is to evaluate and compare the difference in stroke rehospitalization and all-cause mortality between CLC-Veterans with stroke versus CNH-Veterans with stroke.

Research Design: Retrospective observational.

Subjects: All VHA Veteran enrollees who were diagnosed with stroke and admitted to the CLCs or CNHs. Measures: Stroke rehospitalization and mortality referred to the event occurring within 12 months post-nursing home admission.

Methods: This study included all Veterans diagnosed with stroke (N=18,272) and residing in 133 VHA CLCs and 2,346 VHA-contracted CNHs between 2006 and 2009. Multiple-source data were obtained for the study.

Results: The 12-month unadjusted rehospitalization rate was 19.9% for the overall study Veterans, 16.2% for the CLC cohort, and 28.3% for the CNH cohort. The 12-month unadjusted mortality rate was 24.6% for all the study Veterans, 25.1% for the CLC cohort, and 23.4% for the CNH cohort. Logistic adjusted regression models showed that the CLC Veterans (vs. the CNH Veterans) were significantly less likely to be rehospitalized for stroke (AOR=0.49, CI=0.39, 0.62, $p<0.001$), but they were significantly more likely to die (AOR=1.13, CI=1.12, 1.14, $p=0.009$). Further studies are warranted to explore the causes of differences in these outcomes between the two long-term care settings.

Keywords: Long-term care; Rehospitalization; Mortality

Abbreviations

VHA: Veterans Health Administration; CLC: Community Living Centers; CNH: Community Nursing Homes; AOR: Adjusted Odds Ratio; CI: Confidence Interval; CMS: Centers for Medicare and Medicaid Services; ADL: Activities of Daily Living; MDS: Minimum Dataset; ICD: International Classification of Diseases; MedPAR: Medicare Provider Analysis and Review; PS: Propensity Score.

Introduction

Stroke is the fifth cause of death and a major cause of serious disability for U.S. adults [1]. Within the Veterans Health Administration (VHA), over 6,00 Veterans receive acute stroke care each year, costing an estimated \$111 million for acute inpatient care, \$75 million for post-acute inpatient care, and \$88 million for follow-up care 6-month post-stroke [2]. The National Stroke Association reported that among the stroke survivors, 25% live with minor impairments, 40% experience moderate to severe impairments requiring special care, and 10% require care in a long-term care facility [3].

VHA Community Living Centers (CLC) and Community Nursing Homes (CNH) are the two major post-acute, long-term care settings for VHA stroke survivors. There are 133 CLCs across the VHA system. These CLCs, formerly known as VHA nursing homes, are affiliated to the local VHA

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medical centers, have different authorized bed numbers (ranging from 10 beds to 240 beds), and serve about 49,000 Veterans each year [4]. Additionally, VHA contracts over 2,500 CNHs each year to place its enrollees who need institutional long-term care [5]. Detailed description about VHA-CNH contract and Veterans' eligibility for CNH placement are published elsewhere by this research team [6]. Briefly, all the VHA-contracted CNHs are registered by Centers for Medicare and Medicaid Services (CMS) and Veterans' CNH placements are based on the needs assessment conducted prior to their hospital discharges. System-wide monitoring of these Veterans' care at the CNHs is inadequate [7], and studies on quality of care of these Veterans are scarce [8].

This paper is a part of our study on nursing home care by Veterans who were diagnosed with stroke. In an early article, we used the same data as in this current study to compare Veterans' rehabilitation utilization between the CLCs and VHA-contracted CNHs. We demonstrated that CLC-Veterans had significantly fewer average days for rehabilitation therapy (e.g., physical, occupational, and speech therapy), but they were significantly more likely to receive restorative nursing care (e.g., range of motion, walking, and bed transfer) [9]. In a second article using the same study data, we assessed Veterans' activities of daily living (ADL) function between the two care settings: CLC vs. CNH. Our risk-adjusted longitudinal analysis showed that CLC Veterans experienced more ADL improvement than their counterparts at the CNHs, particularly during the initial 3 months of their nursing home stay [10].

Stroke rehospitalization is an indicator of quality and efficiency of post-stroke care [11,12]. An earlier literature review showed that post-stroke rehospitalization rate was high: the 30-day stroke-related readmission ranged from 7.4% to 9.4%, and 1-year stroke-related readmission ranged from 10.5% to 31.1% [13]. A recent systematic review on stroke patient hospital rehospitalization showed that among the 24 studies included in the review, only 4 studies assessed causes of readmission in stroke patients with the follow-up duration from 30 days to 5 year, and recurrent stroke was one of the most frequent causes of rehospitalization for stroke patients [14]. There is a limited understanding about the stroke rehospitalization among nursing home Veterans with stroke. Post-stroke mortality is also a legitimate indicator for quality of care. Reports on post-stroke mortality vary due to the differences in study design, stroke definition, and care setting. In an earlier study among Veteran stroke survivors, we reported a 12-month post-stroke mortality rate of 11.7% among all VHA stroke patients in the State of Florida [15]. In addition, the reported cumulative mortality rate for VHA stroke patients ranged from 9.9% within 30 days, 14.3% within 90 days, and 21.8% within 365 days post-stroke [16]. However, we found no study report on mortality among VHA stroke patients in post-acute, long-term care settings. The objective of this study is to evaluate and compare the difference in stroke readmissions and all-cause mortality between the Veterans who were diagnosed with stroke and resided in VHA CLCs versus their counterparts with stroke who were residents CNHs with a VHA-contract.

Materials and Methods

Study design and sample

This retrospective study included all Veterans who were admitted to VHA CLCs or CNHs with stroke as their primary medical diagnosis between January 1, 2006 and December 31, 2009. All eligible Veterans were followed for a maximum of 12 months after their nursing home

admission date. This study was approved by University of Florida's Health Science Center's Institutional Review Board and the local Veterans Affairs Research and Development Committee.

Data source

The two primary databases for the study were the VHA Minimum Dataset (MDS 2.0) for CLC information and Centers for Medicare and Medicaid Services (CMS) MDS 2.0 for CNH information. The MDS is the standardized nursing home assessment tool, and the MDS dataset contains patient-level sociodemographic, environmental, health, functional status measures, and assessment data of residents of nursing homes certified to participate in Medicare or Medicaid programs. All CLCs and CNHs are federally mandated to conduct resident MDS assessment at admission, after any significant change in health status, quarterly, annually, and at discharge [17].

We linked the CLC- and CNH-MDS data with the following national databases to create a comprehensive dataset for the study: (1) the VHA Inpatient, VHA Fee Basis and Medicare MedPAR data provide the Veterans' inpatient care encounters occurred within the VHA healthcare system, through VHA out-sourcing programs, and through the Medicare program; (2) the VHA Vital Status File provides the most reliable death information for all VHA enrollees; and (3) the Nursing Home Compare file and VHA facility data were used to obtain the facility characteristic information. Details about the data sources and multiple source data linkage are published elsewhere [9].

Dependent variables

(1) Stroke Rehospitalization was coded as 1=yes and 0=no. Veterans' stroke rehospitalization was determined by matching the commonly used High Sensitivity Stroke ICD-9 Codes (i.e., 430-438 and 342) [18] with the primary admission or primary discharge diagnostic codes in the VHA Inpatient, VHA Fee Basis data and Medicare MedPAR data during the 12-month follow-up time post-nursing home admission date. (2) Mortality refers to the Veterans' vital status within 12 months of their nursing home admission. In this study, the mortality variable was coded as 1=yes and 0=no.

Independent variable

Facility Type (CLC or CNH) specified where the Veterans resided during the study period.

Covariates: (1) District: All the CLCs and CNHs were grouped into 5 districts (North Atlantic, Southeast, Midwest, Continental, and Pacific District) by the VHA regional framework. (2) Propensity Score (PS) was used in this study as a covariate for adjustment. The PS was estimated using 14 baseline facility and Veteran sociodemographic and clinical characteristics variables presented in Table 1. PS covariate method is used to balance the distribution of observed baseline covariates between CLC Veterans and CNH Veterans [19]. (3) Rehabilitation Therapy Days, (4) Restorative Nursing Care Days and (5) Depression Treatment Days referred to average weekly utilization days for these services during Veterans' CLC or CNH stays. More details about calculating the rehabilitation therapy days and restorative nursing days are published elsewhere [9]. Depression treatment days were the average weekly days for Veteran psychotherapy and antidepressant use.

Statistical analysis

SAS version 9.4 (SAS Institute, Cary, NC) was used for all analyses: First, descriptive statistics were obtained on all the variables. Statistical inference (χ^2 test or Fisher exact test on discrete variables

Table 1: Comparison of facility and resident characteristics between CLC and CNH [n(%) or Mean±SD][†].

Variable	All	CLC	CNH
	Veterans 18,272/ Facility 2479	12,660(69.3)/ 133(5.4)	5,612(30.7)/ 2,346(94.6)
Facility:			
Hospital based-facilities	211(8.5)	118(88.7)	93(4.0)
Rural facility	1,102(44.5)	28(20.9)	1,074(45.8)
Facility beds	135.9±76.1	126.7±63.5	156.8±95.5
Resident/bed ratio	0.8±0.1	0.8±0.1	0.9±0.1
Veterans:			
Age: ≤64	5,511(30.2)	4,316(34.1)	1,195(21.3)
65-69	1,477(8.1)	1,082(8.5)	395(7.0)
70-74	1,927(10.5)	1,359(10.7)	568(10.1)
75-79	2,853(15.6)	1,922(15.2)	931(16.6)
≥80	6,504(35.6)	3,981(31.4)	2,523(45.0)
Female	512(2.8)	295(2.3)	217(3.9)
Education: <High school	3,851(21.1)	2,655(21.0)	1,196(21.3)
High school	8,240(45.1)	5,795(45.8)	2,445(43.6)
Some college	4,102(22.4)	2,880(22.7)	1,222(21.8)
Bachelor degree	1,263(6.9)	816(6.4)	447(8.0)
Graduate degree	573(3.1)	335(2.6)	238(4.2)
Race/ethnicity: White	13,407(73.4)	8,970(70.9)	4,437(79.1)
Black	3,716(20.3)	2,774(21.9)	942(16.8)
All other	1,132(6.2)	899(7.1)	233(4.2)
Marital status: Never married	1,962(10.7)	1,262(10.0)	700(12.5)
Married	8,325(45.6)	5,739(45.3)	2,586(46.1)
Widowed	3,142(17.2)	1,868(14.8)	1,274(22.7)
Separated/Divorced	4,841(26.5)	3,791(29.9)	1,050(18.7)
High VHA priority	14,730(80.6)	10,727(84.7)	4,003(71.3)
Rural residents	8,412(46)	5,787(45.7)	2,625(46.8)
Comorbidity	1.7±2.0	1.8±2.1	1.3±1.7
Baseline ADL score [‡]	13.7±8.2	12.7±8.4	16.1±7.3
Baseline cognition score [‡]	3.0±2.8	2.7±2.7	3.6±2.8
Baseline depression score [‡]	0.5±1.2	0.4±1.2	0.7±1.3
Number of assessment	4.3±2.1	4.2±2.0	4.6±2.4

[†]All these differences were significant (p<0.001), except baseline cognition score that was not significant (p=0.94) and excluded from the backward selection in the logistic regression for propensity score modeling.

[‡]For the baseline functional assessments (ADL, cognition, and depression), lower score represents better functional performance or less depressed.

and ANOVA test on continuous variables) was performed to compare the variables between the CLCs and CNHs. Second, the correlation coefficient was used to assess multicollinearity among all covariates. Consequently, we removed the patient rural/urban resident variable from our final analyses due to its strong positive correlation (r>0.5) between facility rural/urban status and rehabilitation therapy days and restorative care days. Third, the PS was estimated using backward stepwise logistic regression to regress the Facility Type variable on the facility and resident characteristic variables described in Table 1. Finally, logistic regression was applied for the rehospitalization and mortality models respectively, adjusting for propensity score, geographic region, and the number of days for rehabilitation therapy,

Table 2: Comparison of stroke rehospitalization and mortality between CLC and CNH [n (%)].

Data Source	All	CLC	CNH	P
	Veterans 18,272	Veterans 12,660(69.3)	Veterans 5,612(30.7)	
Rehospitalization: All	3,631(19.9)	2,045(16.2)	1,586(28.3)	<0.001
VHA system	912(25.1)	793(38.8)	119(7.5)	<0.001
Fee Basis	111(3.1)	76(3.7)	35(2.2)	0.009
Medicare	2,608(71.8)	1,176(57.5)	1,432(90.3)	<0.001
12-M Mortality	4,487(24.6)	3,174(25.1)	1,313(23.4)	0.015

nurse restorative care, and depression treatment.

Results and Discussion

This study included 18,272 Veterans who were diagnosed with stroke (69.3% from CLCs and 30.7% from VHA-contracted CNHs) and resided at 2,479 nursing homes (5.4% for CLCs and 94.6% for the CNHs) during the study period (January 1, 2006 and December 31, 2009).

Table 1 shows the comparison of facility and Veteran characteristics between CLCs and CNHs. All the variables listed in the table were used in our propensity score calculation except two variables (rural residents and baseline cognition score) that were excluded from the backward selection of our propensity score modeling. The facility comparison showed that CNHs (vs. CLCs) were less likely to be hospital-based, but more likely to be in rural areas. The CNHs were also larger in average resident/bed ratio and in average bed numbers. The CNH Veterans differed from their CLC counterparts in several aspects: they were more likely to be older than 65, female, with bachelor or graduate degrees, white, married or widowed, in the low VHA priority group, and living in rural areas. Furthermore, the CNH Veterans had less comorbidity burdens as measured by the modified Charlson’s Comorbidity Index [20], and worse functional performances (activities of daily livings, cognition, and depressive behavior) at the baseline or time of nursing admission. All these comparisons were significant at p<0.05.

Table 2 compares stroke rehospitalization and mortality between CLC Veterans and the CNH Veterans. First, 19.9% of the overall study Veterans (N=18,272) had a hospitalization for acute stroke within 12 months of their CLC or CNH admission. The crude rehospitalization rate was lower for the CLC Veterans than the CNH Veterans (16.2% vs. 28.3%, p<.001). The CLC Veterans were more likely to be admitted within the VHA system (38.8% vs. 7.5%, p<0.001), whereas the CNH Veterans were more likely to be admitted to non-VHA facilities under the Medicare program (90.3% vs. 57.5%, p<0.001). Second, about a quarter (24.6%) of the study Veterans died within the 12-month follow-up study time. The unadjusted mortality rate was significantly higher for the CLC Veterans than the CNH Veterans (25.1% vs. 23.4%).

Table 3 presents the logistic regression model results for stroke rehospitalization and mortality. As shown, the CLC Veterans (vs. the CNH Veterans) had a 52% decrease in the odds of being hospitalized for stroke (AOR=0.49, CI=0.39, 0.62, p<0.001), but they had a 13% decrease in the odds of death (AOR=1.13, CI=1.12, 1.14, p=0.009). For the rehospitalization model, other covariates that were significantly (p<0.05) associated with higher rehospitalization include Veterans in North Atlantic, Southeast, and Continental regions (reference = Pacific Veterans); increased rehabilitation therapy, and increased

Table 3: Logistic regression results for all-source stroke rehospitalization and mortality.

Variable	Rehospitalization		Mortality	
	AOR(CI)	p	AOR(CI)	p
Facility Type: CLC vs CNH	0.49(0.39,0.62)	<0.001	1.13(1.12,1.14)	0.009
Region: Reference = Pacific				
North Atlantic	1.64(1.36,1.97)	<0.001	1.20(1.09,1.31)	<0.001
Southeast	1.44(1.18,1.75)	0.001	1.05(0.95,1.16)	0.338
Midwest	0.97(0.78,1.21)	0.806	0.84(0.76,0.94)	0.003
Continental	1.58(1.28,1.94)	<0.001	0.83(0.74,0.92)	0.001
Rehabilitation therapy days	1.08(1.07,1.09)	<0.001	0.95(0.94,0.96)	<0.001
Restorative care days	1.01(1.00,1.01)	0.034	0.99(0.98,0.99)	<0.001
Depression treatment days	1.00(0.99,1.01)	0.794	0.99(0.98,1.00)	0.002
Propensity score	0.87(0.72,1.06)	0.171	1.24(1.04,1.47)	0.014
Facility-region interaction: Reference = CLC-Pacific				
CLC-North Atlantic	0.68(0.53,0.87)	0.002	0.95(0.84,1.19)	0.564
CLC-Southeast	0.74(0.56,0.97)	0.031	1.12(0.98,1.27)	0.087
CLC-Midwest	1.44(1.10,1.88)	0.008	1.39(1.22,1.58)	<0.001
CLC-Continental	1.08(0.82,1.41)	0.580	1.00(0.88,1.14)	0.500

AOR: Adjusted Odds Ratio; CI: Confidence Interval.

restorative nursing care. For the mortality model, other variates that were significantly ($p < 0.05$) associated with mortality were Veterans in the North Atlantic, Midwest and Continental regions (reference = Pacific Veterans), lower baseline propensity score, and fewer days for rehabilitation therapy, restorative care and depression management.

This study is the first assessing and comparing 12-month rehospitalization for stroke and mortality among all Veterans who were diagnosed with stroke and received post-acute, long-term care in VHA CLCs versus VHA-contracted CNHs.

First, for the 12-month rehospitalization outcome, we observed that 19.9% of the study population was hospitalized for recurrent stroke within the 12 months of their CLC or CNH admission date. Literature reports on 1-year post-stroke rehospitalization vary, ranging from 10.5% to 31.1% [13,15]. This variability was mainly due to a difference of study design. For example, the current study was at the national level and included all VHA stroke patients at CLC and CNH; whereas an earlier study reporting 31.1% readmission [15] was a Florida-only study consisting of Veteran stroke patients from different post-stroke care settings (inpatient, outpatient, home-based, VHA, Medicare, and Medicaid).

Our adjusted Poisson regression results showed that CLC (vs. CNH) Veterans had 51.0% lower odds of being readmitted for stroke. We found no relevant literature report on the topic for us to benchmark. Regardless, the apparent contrast of stroke rehospitalization between CLC and CNH was consistently observed with or without risk adjustment from this study. In seeking the reasons for the difference, we found that the CLC Veterans were significantly more likely to be admitted within the VHA system (38.8% vs. 7.5%, $p < 0.001$), whereas the CNH Veterans were more likely to be admitted to non-VHA facilities under the Medicare program (90.3% vs. 57.5%, $p < 0.001$). These discrepancies may be associated with the sociodemographic differences between the two study cohorts: Compared with the CLC cohort, the CNH cohort had

a larger proportion of Veterans who were ≥ 65 years of age (78.7% vs. 65.9), but the CNH cohort had a smaller proportion of Veterans with high VHA priority (71.3% vs. 84.7). This is consistent with our previous studies showing that older Veterans are more likely to be VHA-Medicare dual users, and high VHA priority Veterans are more likely to receive care within the VHA system [21]. Furthermore, multiple system users are significantly more likely to be readmitted for recurrent stroke compared with single system users [15].

Secondly, for the 12-month mortality outcome, we found that the overall 12-month, post-admission mortality rate was 24.6% for the study population, 25.1% for the CLC Veterans, and 23.4% for the CNH Veterans. Reports on post-stroke mortality varied due to the differences in stroke definition and study duration on mortality. Counting mortality from index admission date versus index discharge date could lead to different results [15]. A previous study on VHA stroke patients reported that the cumulative mortality rate for VHA stroke patients ($N=40,308$) ranged from 9.9% within 30 days, 14.3% within 90 days, and 21.8% within 365 days post-stroke [16]. That study included all the VHA stroke patients regardless of their care setting, whereas the current study was focused on nursing home Veterans only. Furthermore, a recent study on Canadian long-term care facilities reported an overall 12-month crude mortality rate of 19.9% for all the facilities with higher mortality rate among for-profit facilities than not-for-profit facilities (20.8% vs. 18.5%) [22]. These reported findings are not comparable with the current study because the study patients were different: the literature report included patients with different medical conditions, and this study focused on stroke patients only.

Our adjusted Poisson regression results demonstrated that the CLC Veterans were significantly more likely to die (AOR=1.13, CI=1.12, 1.14, $p=0.009$) within the initial 12-month of nursing home admission date. At first, this mortality difference between the CLC and CNH was difficult to understand as the CLC Veterans were younger and had better functional performance in ADLs, and better cognitive and depression scores at the time of nursing home admission. (As shown in Table 1, lower ADL, cognitive and depression score represents better functional performance or less depressed.) However, we later found that some CLCs also provide palliative care and hospice care for end of life Veterans residents [23]. Therefore, further study is warranted to investigate the cause of mortality for the CLC Veterans to better understand the structural factors underlying these differences.

Like other studies using multiple-source secondary data, this study is limited by the availability of some information that may be crucial to understand factors impacting the study outcomes. For example, the Scope and Severity is a nation-wide system rating the seriousness of deficiencies for the nursing homes. The system, however, was not fully implemented at VHA CLCs during the study time. Facility staffing level or staff hours can have a positive impact on quality of care, but these data were unavailable for the CLCs. Nevertheless, we took the advantage of the multiple-source data and created some measures that were important for the analyses such as Veterans' VHA healthcare priority and medical comorbid conditions.

Conclusion

In conclusion, we compared several socio-economic and clinical characteristics between the CLC and VHA-contracted Veteran nursing home residents, as well as facility characteristics, but

recommend further studies to explore the causes of differences in these outcomes between the two long-term care settings for Veterans.

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