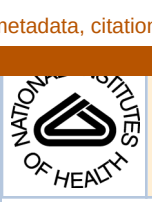

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Rural-Urban Differences in Preventable Hospitalizations Among Community-Dwelling Veterans with Dementia

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Abstract

Context—Alzheimer's patients living in rural communities may face significant barriers to effective outpatient medical care.

Purpose—We sought to examine rural-urban differences in risk for ambulatory care sensitive hospitalizations (ACSH), an indicator of access to outpatient care, in community-dwelling veterans with dementia.

Methods—Medicare and VA inpatient claims for 1,186 United States veterans with dementia were linked to survey data from the 1998 National Longitudinal Caregiver Survey. ACSH were identified in inpatient claims over a one-year period following collection of independent variables. Urban Influence Codes were used to classify care-recipients into four categories of increasing county-level rurality: large metropolitan; small metropolitan; micropolitan; and non-core rural counties. We used the Andersen Behavioral Model of Health Services Use to identify veteran, caregiver, and community factors that may explain urban-rural differences in ACSH.

Findings—Thirteen percent of care-recipients had at least one ACSH. Likelihood of ACSH was greater for patients in non-core rural counties versus large metropolitan areas (22.6% versus 12.8%, unadjusted odds ratio [OR] = 1.99; $p < .05$). The addition of other Andersen behavioral model variables did not eliminate the disparity (adjusted OR = 1.97; $p < .05$).

Conclusions—We found that dementia patients living in the most rural counties were more likely to have an ACSH; this disparity was not explained by differences in caregiver, care-recipient, or community factors. Furthermore, the annual rate of ACSH was higher in community-dwelling dementia patients compared to previous reports on the general older adult population. Dementia patients in rural areas may face particular challenges in receiving timely, effective ambulatory care.

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Keywords

Preventable hospitalizations; rural; dementia; caregivers; access

INTRODUCTION

Approximately 4.5 million Americans currently have dementia.,[1] and its prevalence is expected to triple over the next 50 years as the U.S. population ages.[1] Dementia predominately affects older persons, and in the United States, 25% of older adults lives in rural communities.[2] Compared to more urban areas, the prevalence of dementia in rural communities may be disproportionately high and growing more rapidly due to the desire to "age-in-place," out-migration of youth to urban areas, and immigration of retirees from urban areas.[3] This increasing proportion of seniors in rural areas, coupled with the medical complexity of dementia and resource constraints on the current primary care system,[4] raises questions about the capacity of rural communities to support the health care needs of this rapidly expanding population.

These health care needs are extensive, and change as dementia progresses.[5] Dementia disorders, such as Alzheimer's disease, are characterized by loss of cognitive ability, motor skills, and overall functional abilities, and are typically incurable, irreversible, and progressive.[6] Although cognitive impairment is the most prominent symptom, dementia patients are also more likely to suffer from behavioral disturbances,[7] and specific forms of co-morbidity including depression and hypertension. [8] To support primary care providers in managing such complex patients, current models of dementia care augment primary care with specialist care and other support services as needed.[9] Access to a range of health care services, therefore, is critical for managing the changing, complex needs of dementia patients.

Although there is limited research on access to care among dementia patients, prior studies suggest that accessing high-quality medical care may be especially challenging for those residing in rural areas. The provision of medical care in rural areas has been a longstanding challenge to policy makers, where a substantial literature documents the potential barriers to primary and specialty care among rural populations.[10, 11] For one, rural areas are supported by fewer physicians per capita compared to urban areas.[12] Consequently, people living in areas with fewer primary care providers are required to travel greater distances to reach medical care.[10] Further, rural residents are less likely to obtain preventive health services, and are further behind in meeting the Healthy People 2010 objectives.[13] Rural-urban disparities have even been found in those with potential access to a comprehensive healthcare system such as the Veterans Health Administration.[14] Specific to dementia, caregivers and patients in rural areas are less likely to use formal support services,[15] and rural healthcare providers report inadequate consultative support services for managing dementia patients.[16] Further, caregivers in rural areas report having greater difficulty managing behavioral problems.[17] While evidence suggests that dementia patients living in rural areas may face greater barriers to health services than their urban counterparts, little research has evaluated urban-rural disparities in access to timely and effective primary care services in these patients.[2]

One potentially useful measure for monitoring access to appropriate primary care in dementia patients is the rate of hospitalizations for ambulatory care sensitive conditions, defined as conditions where adequate provision of primary care in outpatient settings would reduce the need for hospital-based services.[18] These conditions are typically chronic and require ongoing medical care[19] Both the Institute of Medicine (IOM) and Agency for

Healthcare Research and Quality (AHRQ) have recommended using ambulatory care sensitive hospitalizations (**ACSH**) as a measure of relative access to primary care services across patient populations.[18, 20] Although prior research in non-dementia populations suggest that individuals in rural areas have an increased likelihood of ACSH,[21] we know of only one other study examining ACSH rates in persons with dementia.[22] In this study of Medicare beneficiaries, dementia patients were 2.4 times more likely to have an ACSH, and dementia patients with more co-morbid chronic conditions were at increased risk for ACSH compared to those with fewer conditions. Although this study demonstrates the increased healthcare needs of dementia patients, it did not focus on community-level risk factors, such as rurality, for ACSH among dementia patients.

The purpose of this research was to use ACSH rates to examine potential rural-urban disparities in access to ambulatory care in persons with dementia. We further examined whether predisposing, enabling, and medical need variables related to the caregiver, dementia patient, and the community would explain any identified rural-urban disparities in ACSH rates.

Conceptual Framework

A modified version of the Andersen behavioral model of health service use served as the basis for our conceptual model and selection of factors that may explain the relationship between rurality and ACSH. [23] The Andersen model was developed to help explain factors that affect health care utilization, and includes three domains: predisposing, enabling, and medical need. Implicit in this model is the assumption that individuals are acting on their own behalf as rational decision-makers; however, community-dwelling dementia patients largely rely on informal caregivers to facilitate their access to medical care. Therefore, we used an expanded conceptualization of the Andersen model that incorporates caregiver factors,[24, 25] described in more detail below.

METHODS

Sample

Our sample of older veterans with dementia was identified as part of the National Longitudinal Caregiver Study (NLCS), a longitudinal investigation of primary informal caregivers of elderly male U.S. veterans with dementia.[25] The NLCS defined primary caregiver as “the person who spent the most time with the older veteran and provided the most care, assistance, and support”. The NLCS first identified all veterans who had an outpatient visit associated with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code of Alzheimer’s disease (331.0) or vascular dementia (290.4) in 1997 to any of 176 VA Medical Centers nationwide, were age 60 or above, resided in the community, and had a next-of-kin or emergency contact. A total of 3,665 surveys were sent in 1998 to eligible primary caregivers. Sixty-two percent of caregivers responded, providing a baseline sample of 2,268 caregiver care-recipient dyads.

We further refined the baseline sample to control for potential confounding factors where small groups sizes limited our ability to make statistical adjustments. Given the potential for cross-cultural differences in reporting burden and depressive symptoms and that there were too few caregivers within the smaller ethnic minority subgroups to support reliable estimation,[26] we excluded dyads with caregivers who reported a race/ethnicity other than African American or White (n=171). Because of gender differences in approaches to caregiving,[27] we excluded male caregivers (n=50). Veterans under age 65 (n=100) were excluded because of potential differences in health and health insurance coverage.[28] We further excluded caregivers whose relationship with the veteran was other than spouse,

daughter, or sister (n=65), and those that resided in U.S. territories (n=5). Due to differences in patterns of informal care for co-residing dyads,[29] we excluded veterans that did not reside with their caregiver (n=56). We also excluded care-recipients who either died (n=223) or entered a nursing home (n=296) during the 12-month observation period. Bivariable logistic regression analysis revealed no significant difference with regard to likelihood of death or institutionalization by rurality. Additionally, observations were excluded if no reliable follow-up data was available at the end of the 12-month observation period (n=89). Finally, 27 observations were dropped because the county-level Federal Information Processing Standard (FIPS) code was not available. The final sample consisted of 1,186 community-dwelling older male veterans with dementia (hereafter referred to as "care-recipient"), and their co-residing female informal caregivers.

Measures

Dependent variables—Veterans Affairs and Medicare inpatient claims were merged with wave 1 of the NLCS. For each care-recipient, a 365-day observation window was created beginning on the day following their NLCS survey return date (a period from February 1998 to October 1999). This ensured that independent variables collected in the NLCS preceded measurement of hospital use. ICD-9-CM diagnosis codes for the hospitalization principal diagnosis were then used to classify each hospitalization as ambulatory care sensitive (ACS) or not, according to the algorithm adopted by Bindman et al.[30] We analyzed the resultant dependent variable as a dichotomous outcome (1=any ACSH; 0=no ACSH). Hospitalizations for principal diagnoses other than ACS conditions were classified as non-ACSH (1=any non-ACSH; 0=no non-ACSH).

Rurality—County-level rurality was determined using 2003 county-level Urban Influence Codes (UIC).[31] Consistent with the Office of Management and Budget definitions of metropolitan, the UIC taxonomy begins by dividing all U.S. counties into metropolitan counties (metro) and non-metropolitan counties (non-metro). Metro counties are further divided into "large" areas (≥ 1,000,000 residents) and "small" areas (< 1,000,000 residents). Non-metro counties are first divided into micropolitan (micro; area based around a core city or town with a population of 10,000 to 49,999) and non-core areas (< 10,000 residents). Micro and non-core counties are then further classified into subcategories based on adjacency to large metro areas, small metro areas, or no metro area. Sample size limitations, however, prevented us from using the sub-classifications for micropolitan and non-core areas; instead, we classified counties into the four higher-level categories of large metropolitan, small metropolitan, micropolitan, and non-core rural.

Predisposing variables—Caregivers reported their own age (years), race (0=White, 1=African-American), relationship to care-recipient (0=sister or daughter, 1=wife), and education (years), and care-recipient age (years).

Care-recipient medical need—Caregivers reported the care-recipients' ADL limitations using 7 physical activity items and 7 instrumental activity items from the Older Americans' Resources and Services (OARS) Multidimensional Functional Assessment Questionnaire,[32] where higher scores indicate more impairment (Cronbach's alpha = 0.92). Caregivers rated care-recipients' level of behavioral disturbance during the previous month using the 16-item Behavior Rating Scale-Dementia (BRS-D),[33] in which a total score, ranging from 0–58, is calculated and higher scores indicate higher levels of behavioral disturbance (Cronbach's alpha = 0.82). A total Charlson co-morbidity score (range 0–13) was used to characterize care-recipient co-morbidity by searching 1997 VA inpatient and outpatient records.[34] Total number of comorbid conditions was assessed by the caregivers using questions from the Duke OARS comorbidity scale.[32]

Individual-level enabling variables—Caregiver perceived financial adequacy was measured as a mean score of responses to three items about their ability to pay bills, their financial ability to take of needs, and their ability to purchase "little extas – those small luxuries". Caregiver instrumental support was measured using the 13-item instrumental support subscale from the Duke Social Support Index,[35] in which caregivers rate the level (1=never, 2=rarely, 3=now and then, 4=regularly) of unpaid tangible assistance available to them from friends and family. Higher scores (range 13–52, Cronbach's alpha = 0.87) indicate higher levels of support. Caregiver emotional support was measured with the 12-item emotional support subscale from the Duke Social Support Index;[35] higher scores (range = 12–36; Cronbach's alpha = 0.82) indicate more support. Caregiver limitations from comorbid conditions were assessed using 25 items from the Duke OARS comorbidity scale,[32] where caregivers report for each condition whether they do not have the condition, and the level of interference in daily activities due to the condition. Caregiver psychological distress was measured using the Center for Epidemiologic Studies Depression Scale (CES-D) short Boston form.[36] Scores range from 0–20 (Cronbach α = 0.73). Finally, caregivers indicated all health insurance benefits that applied to the care-recipient (Medicare, Medicaid, Medigap, private insurance, VA insurance benefit, and/or HMO). Note that at the time of this study, Medicare did not provide a prescription drug benefit. Because care-recipients in this study with Medicaid, Medigap, private, or HMO insurance may have had better access to providers and prescription medications, care-recipient health insurance coverage was coded as (1) any private insurance (private, HMO, Medigap) or Medicaid coverage, (2) both Medicare and VA benefits, (3) Medicare with no VA benefit, and (4) VA benefit with no Medicare.

County-level enabling variables—We appended data from the Health Resources and Services Administration's Area Resource File[37] to characterize for the county in which dyads resided 1) the presence or absence of a Rural or Federally-Qualified Health Center in the county ("Community Health Clinic"), and 2) partial- or whole-county designation as a primary medical care Health Professional Shortage Area.[38] Distance was measured as straight-line miles from the center of the care-recipient's zip code to the nearest VA facility.

Data Analysis

Main Analyses—Analyses were conducted using STATA version 10.0 (STATA Corp, College Station, TX). Bivariable logistic regression was performed to examine unadjusted associations between independent variables and likelihood of an ACSH. Multiple logistic regression was then used to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for adjusted associations among ACSH and county-level rurality and predisposing, enabling, and need variables. Standard errors were adjusted for potential clustering within counties.

Although higher ACSH rates in rural areas may indicate barriers to effective ambulatory care in rural areas, an alternative explanation may be that dementia patients in rural areas have higher overall hospitalization rates, including non-ACS hospitalization. We conducted a parallel set of analyses on non-ACS hospitalizations to explore this alternative explanation.

All independent variables were examined with regard to percent missing values, which ranged from 0.0 to 5.3. With less than 10% missing, we used conditional mean imputation to generate a single complete data set in order to maximize statistical power.[39] Examination of variance inflation factors (VIF) revealed a mean VIF of 1.5, and no VIF greater than 5.0.

RESULTS

Sample Characteristics

Table 1 profiles characteristics for the 1,186 caregivers and care-recipients in the sample. Eleven percent of caregiver/care-recipient dyads lived in non-core (rural) counties, 13% lived in micropolitan counties, 33% lived in small metro counties, and 43% lived in large metro counties. Of the 1,186 care-recipients, 37% had at least one hospitalization over the 1-year observation window. Thirteen percent (n=156) had at least one ACSH, and 30% (n=356) had at least one non-ACSH.

Bivariate Results

Supplemental Table 1 displays unadjusted associations between independent variables and ACSH, as well as non-ACSH. Compared to those in large metropolitan counties, the odds of having an ACSH were 1.99 times greater for care-recipients living in non-core counties (12.8% versus 22.6%; OR = 1.99, $p < .01$). Odds of ACSH did not differ significantly between large metropolitan counties, small metros, and micropolitan counties. The relationship between county rurality and non-ACSH was not statistically significant.

Multivariate Results

ACS Hospitalizations—Table 2 contains adjusted odds ratios for ACSH. Consistent with bivariate results, the adjusted odds of an ACSH for care-recipients living in non-core counties were 1.97 times the odds of care-recipients in large metro counties; that is, the rural-urban difference in likelihood of ACSH was not explained by inclusion of predisposing, medical need, or enabling variables in the model.

While the addition of Andersen model variables did not explain the relationship of rurality to likelihood of ACSH, a number of these variables were independently associated with greater risk of ACSH in the fully-adjusted model (Table 2). These included greater caregiver age, greater care-recipient age, greater care-recipient ADL limitations, higher care-recipient scores on the Charlson comorbidity index, and living in a county designated as a primary care shortage area. In addition, living in a county with at least one community health clinic was associated with a 55% decrease in the odds of ACSH.

Non-ACS Hospitalizations—Table 2 also contains adjusted odds ratios for non-ACSH. Only care-recipient medical need variables, including greater ADL limitations, behavioral disturbance, and Charlson comorbitity index scores, were significantly associated with increased risk of non-ACSH.

Supplemental Analyses

ACSH are thought to be preventable with access to timely and effective ambulatory care, implying that utilization of ambulatory care is a mediator between Andersen behavioral model factors (such as rurality) and ACSH. We explored this potential link by adding to the model the total number of VA outpatient visits for the care-recipient in the year leading up to the 365-day ACSC hospitalization tracking period. We found that total outpatient visits were not significantly associated with ACSH, and the association between rurality and ACSH did not change.

DISCUSSION

There is a great deal of public policy interest in assisting persons with dementia to continue living in community settings for as long as possible. Before encouraging community-based care over institutional care for persons with dementia, however, it is important to define and

monitor indicators of access to quality ambulatory care, and to identify potential barriers to this care. In this national sample of veterans with dementia, we examined one important indicator of quality outpatient care --hospitalization rates for ACS conditions. We found that 13.2% of persons with dementia had at least one ACSH during the 365-day tracking period, which is over 4 times higher than previous reports of ACSH rates among the general community-dwelling elderly,[40, 41] and is consistent with prior work indicating dementia as an independent risk factor for ACSH.[22] We also found that care-recipients living in non-core rural areas were at increased risk for ACSH compared to those in large metro counties (22.6% vs. 12.8%), and that this disparity persisted after controlling for predisposing, enabling, and medical need factors. Adjusted for other variables, the predicted probability of ACSH for care-recipients living in non-core rural counties was 15.9% versus 8.8% for those living in large metropolitan counties. While care-recipients in non-core rural counties were found to be at greater risk for ACSH, the relationship between county rurality and non-ACSH was not significant. This finding suggests the relationship between rurality and ACSH is not simply a consequence of greater overall hospitalization rates in rural areas.

Our findings are consistent with previous research indicating preventable hospitalization rates are higher in residents of rural communities.[40] Adjusting for county-level availability of providers and distance to the nearest VA did not statistically explain the rural disparity, suggesting that provider accessibility alone may not eliminate access barriers in rural areas. Several possible explanations exist for this persistent disparity. As an intermediate measure of health outcomes, ACSHs reflect multiple, complex aspects of care. The Institute of Medicine's model for monitoring access to care, for example, suggests a number of mediators between utilization of outpatient services and health outcomes,[20] including appropriateness of care and patient adherence to treatment regimens. It is possible that rural residents are more likely to experience barriers along these intervening factors. Wolfe et al,[42] for example, surveyed a national sample of family physicians on the use of clinical practice guidelines and found that guideline use was lowest among physicians practicing in rural areas.[42] Dementia patients in rural areas may not have sufficient access to the range of primary, specialty, and community-based support services (e.g., home health care) necessary for managing their complex and dynamic healthcare needs.[10, 15] Additionally, residents in rural areas may face greater financial and geographic barriers in accessing pharmaceuticals,[43] which could negatively impact adherence to medications necessary for controlling chronic illnesses. Finally, studies suggest that rural norms and values, such as a sense of independence and hesitation to seek assistance, may result in foregoing or delaying medical attention.[44] Future studies should explore these potential explanations.

We also found that county-level enabling factors (i.e., presence of a community health clinic; availability of primary care providers) were associated with decreased odds of having an ACSH, which is consistent with prior studies in other patient populations.[45] These findings underscore the importance of policies and programs designed to increase access to timely and effective care to medically underserved populations in order to avoid unnecessary hospitalizations for conditions that can often be managed effectively on an outpatient basis.

Contrary to expectations, the total number of outpatient visits received by the dementia patient -- an indicator of access to ambulatory care -- was not significantly associated with risk of ACSH. This finding is perplexing, and reflects an ongoing issue in the ACSH literature.[46] It is possible that crude measures of health care access such as total number of outpatient visits fail to adequately elucidate the important processes linking ambulatory medical care and outcomes such as ACSH. Given the ubiquitous use of ACSH rates as an indirect measure of health care system failures, this line of research would benefit from the

development and use of more refined measures of ambulatory care utilization that better reflect patients' access to high-quality and appropriately-timed care.

This study has important limitations to consider when evaluating its results. First, our results represent the patterns of inpatient care in only a subset of persons with progressive dementia: community-dwelling male veterans, with a co-residing female caregiver, who use VA health services. To the extent that utilization patterns differ for other dementia patients, after controlling for Andersen behavioral model variables, these results may not generalize to other community-dwelling caregiving dyads. While our results may not be widely generalizable, they are still important given that the VA is one of the largest single-payer systems in the US, serving an estimated 271,000 persons with dementia in 2002.[47] Second, by excluding care-recipients who died or entered a nursing home over the 365-day track period, our sample may be biased toward healthier dementia patients. We did not, however, find significant differences between rurality and likelihood of death or institutionalization, and thus, our estimates are unlikely to be biased by differential attrition. Third, this observational study used a lagged independent variable approach in an attempt to interrupt potential temporal reverse causality, but we are not able to establish causality. Finally, it is possible that not all ACSHs are preventable even with optimal ambulatory care. While more research is needed to examine the true "sensitivity" of each of the commonly-used ACS conditions, our findings reveal potentially important rural-urban disparities in access to ambulatory care in dementia patients.

Despite these limitations, this research represents a first step in identifying barriers to high-quality ambulatory care among community-dwelling elderly with dementia, an understudied topic in a rapidly growing and vulnerable population. We found that the ACSH rate is considerably higher than in the general older adult population. We also found that rural dementia patients were more likely to have an ACSH, and this disparity was not explained by differences in caregiver, care-recipient, or community factors. These findings raise concerns that dementia patients living in more rural areas may face barriers in accessing timely and effective outpatient care. Improving access to ambulatory care in rural areas not only supports the goal of persons with dementia to "age-in-place," but may also help control health care costs associated with caring for dementia patients by shifting health care service needs from acute hospital care to outpatient care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Description Of Sample (N=1,186)

	n (%)	Mean (standard deviation)	Range in Sample
County rurality			
Rural (non-core)	133 (11.2)		0–1
Micropolitan	157 (13.2)		0–1
Small Metropolitan	388 (32.7)		0–1
Large Metropolitan (reference)	508 (42.8)		0–1
Predisposing characteristics			
CG age in years		68.5 (9.8)	29–90
CG Race			
White (reference)	1009 (85.1)		0–1
African-American	177 (14.9)		0–1
Relationship to care-recipient			
CG is wife (reference)	1115 (94.0)		0–1
CG is daughter or sister	71 (6.0)		0–1
CG education in years		12.0 (2.6)	2–22
CR age in years		75.7 (5.3)	65–95
CR medical need characteristics			
ADL limitations		8.4 (3.4)	0–14
Behavioral disturbance		17.5 (11.5)	0–55
Charlson comorbidity index		1.4 (1.8)	0–13
Count of comorbid conditions		5.0 (2.8)	0–14
Enabling characteristics			
CG perceived financial adequacy		2.2 (0.5)	1–3
CR health insurance			
Any private or Medicaid	527 (44.4)		0–1
Medicare only	50 (4.2)		0–1
Medicare + VA	347 (29.3)		0–1
VA only (reference)	262 (22.1)		
CG instrumental social support		30.8 (7.9)	13–52
CG emotional social support		28.5 (4.3)	12–34
CG limitations from comorbidities		5.3 (4.0)	0–15
CG CES-D		5.7 (4.7)	0–20
County-level Enabling Indicators			
Primary care shortage area			
Yes	862 (72.7)		0–1
No (reference)	324 (27.3)		0–1
Community health clinic in county			
Yes	907 (76.5)		0–1
No (reference)	279 (23.5)		0–1
Distance to nearest VA medical center (miles)		13.5 (14.3)	.01–101.7

	n (%)	Mean (standard deviation)	Range in Sample
Hospitalizations			
Any Hospitalization	434 (36.6)		0–1
Any ACSC Hospitalization	156 (13.2)		0–1
Any Non-ACSC Hospitalization	356 (30.0)		0–1

CG=caregiver; CR=care-recipient; VA=Veterans Administration; CES-D=Center for Epidemiologic Studies Depression Scale;

Table 2

Adjusted Odds Ratios Of Hospitalizations for ACSC and Non-ACSC Among Community-Dwelling Dementia Patients (N=1,186)

	ACSC Hospitalizations		Non-ACSC Hospitalizations	
	Odds Ratio	**95% CI**	**Odds Ratio**	**95% CI**
County rurality				
Rural (non-core)	1.97*	(1.08 – 3.58)	1.18	(0.72 – 1.93)
Micropolitan	1.06	(0.59 – 1.89)	1.08	(0.71 – 1.64)
Small Metropolitan	0.87	(0.54 – 1.38)	0.86	(0.63 – 1.18)
Large Metropolitan				
Predisposing characteristics				
CG age in years	0.98*	(0.96 – 1.00)	0.99	(0.98 – 1.01)
CG Race				
White (reference)				
African-American	1.09	(0.60 – 1.96)	0.99	(0.68 – 1.44)
Relationship to care-recipient				
CG is wife (reference)				
CG is daughter or sister	0.78	(0.39 – 1.59)	0.81	(0.48 – 1.36)
CG education in years	1.00	(0.92 – 1.08)	1.00	(0.95 – 1.05)
CR age in years	1.04*	(1.01 – 1.08)	1.03*	(1.00 – 1.05)
CR medical need characteristics[1]				
ADL limitations	1.21**	(1.14 – 1.30)	1.06**	(1.02 – 1.11)
Behavioral disturbance	1.01	(0.99 – 1.03)	1.02**	(1.00 – 1.03)
Charlson comorbidity index	1.18**	(1.06 – 1.31)	1.11*	(1.02 – 1.20)
Count of comorbid conditions	1.13	(0.99 – 1.31)	1.02	(0.92 – 1.12)
Enabling characteristics				
CG perceived financial adequacy	1.26	(0.86 – 1.85)	0.91	(0.69 – 1.20)
CR health insurance				
Any private or Medicaid	0.72	(0.43 – 1.20)	1.27	(0.92 – 1.75)
Medicare only	0.92	(0.31 – 2.74)	1.86	(0.98 – 3.54)
Medicare + VA	0.74	(0.40 – 1.39)	1.09	(0.77 – 1.54)
VA only (reference)				
CG instrumental social support	1.01	(0.98 – 1.03)	0.99	(0.97 – 1.00)
CG emotional social support	1.03	(0.98 – 1.09)	0.97	(0.93 – 1.01)
CG limitations from comorbidities	1.00	(0.95 – 1.05)	1.01	(0.97 – 1.05)
CG CES-D	1.01	(0.95 – 1.07)	0.97	(0.94 – 1.01)
County-level Enabling Indicators				
Primary care shortage area				
Yes	1.61*	(1.00 – 2.57)	1.04	(0.75 – 1.45)
No (reference)				
Community health clinic in county				

	ACSC Hospitalizations		Non-ACSC Hospitalizations	
	Odds Ratio	**95% CI**	**Odds Ratio**	**95% CI**
Yes	0.45 **	(0.28 – 0.70)	0.92	(0.65 – 1.28)
No (reference)				
Distance to nearest VA medical center (miles)	1.00	(0.99 – 1.02)	1.00	(0.99 – 1.01)

* significant at 5%;

** significant at 1%

1 Medical need also included dummy variables not presented indicating the presence of the following chronic conditions: copd/asthma, diabetes, stroke, heart disease, hypertension, gastrointestinal disorders, urinary tract disorders, skin disorders, and ulcers of the digestive system.

ACSC= Ambulatory Care Sensitive Condition; N/A = Not Applicable; CG=caregiver; CR=care-recipient; VA=Veterans Administration; CES-D=Center for Epidemiologic Studies Depression Scale;