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Assistant Secretary for Planning and Evaluation
Office of Disability, Aging and Long-Term Care Policy

What is the Effect of Dementia on Hospitalization and Emergency Department Use in Residential Care Facilities?

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WHAT IS THE EFFECT OF DEMENTIA ON HOSPITALIZATION AND EMERGENCY DEPARTMENT USE IN RESIDENTIAL CARE FACILITIES?

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ACRONYMS

The following acronyms are mentioned in this report.

ADL	Activity of Daily Living
ADCU	Alzheimer's/Dementia Care Unit
ADRD	Alzheimer's Disease and Related Dementias
ASPE	HHS Office of the Assistant Secretary for Planning and Evaluation
CCRC	Continuing Care Retirement Community
CHF	Congestive Heart Failure
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
ED	Emergency Department
HCBS	Home and Community-Based Services
HHS	U.S. Department of Health and Human Services
HPRD	Hours Per Resident Day
IADL	Instrumental Activity of Daily Living
IDR	Incidence Density Ratio
LOS	Length of Stay
LPN	Licensed Practical Nurse
LTC	Long-Term Care
MSA	Metropolitan Statistical Area
NCHS	HHS National Center for Health Statistics
NSRCF	National Survey of Residential Care Facilities
OR	Odds Ratio
RCF	Residential Care Facility
RN	Registered Nurse
SE	Standard Error

EXECUTIVE SUMMARY

ES.1. Purpose and Research Questions

This study addresses acute care use by older residents of residential care facilities (RCFs) who have severe cognitive impairment, including Alzheimer's disease or dementia. The two main research questions are:

- Does having severe cognitive impairment affect the risk of any hospitalization and emergency department (ED) use among people living in RCFs? Among people living in RCFs who had at least one ED visit, does having severe cognitive impairment affect the number of ED visits?

- Does living in a special care unit or facility that only served people with Alzheimer's disease or dementia affect the risk of any hospitalization and ED use among RCF residents? Among RCF residents with at least one ED visit, does living in a special care unit or facility that only serves people with Alzheimer's disease or dementia affect the number of ED visits?

ES.2. Data and Methods

The study uses the resident file of the 2010 National Survey of Residential Care Facilities (NSRCF) merged with the characteristics of the facilities in which residents live. Although the survey is the most current detailed survey of RCFs, it does not allow for the merging of Medicare or Medicaid claims data. All data on residents are provided by staff who know the resident, in consultation with facility records.

The key independent or explanatory variable of interest in this study is severe cognitive impairment, defined as *either* having a diagnosis of Alzheimer's disease *or* dementia or exhibiting at least three of seven symptoms related to memory impairments, confusion, or problems with orientation that were available in the survey. The seven symptoms related to: (1) long-term memory (e.g., forgetting one's own age or marital status); (2) short-term memory (e.g., having difficulty remembering what the person ate for breakfast or something that was told to them a few minutes earlier); (3) difficulty remembering or experiencing periods of confusion; (4) knowing the location of one's own bedroom; (5) recognizing staff names or faces; (6) knowing that one is in a facility; and (7) knowing what season of the year it is. Residents who did not meet either criterion were considered not to be severely cognitively impaired.

The NSRCF collected limited data on resident use of acute care. Three resident-level outcome variables were defined and analyzed in this study--whether the resident had been hospitalized (been a patient in a hospital overnight or longer, excluding trips to

the ED that did not result in a hospital stay) and whether the resident had been treated in a hospital ED during the past 12 months or since the resident moved into the current facility if his or her length of stay (LOS) had been less than 1 year. The third outcome is the number of times the resident had been treated in a hospital ED over the same period (the number of hospitalizations was not available in the NSRCF).

ES.3. Results

Using logistic regression analysis of data about residents in the 2010 NSRCF, this study found that severe cognitive impairment was a marginally significant negative predictor of any hospitalization or any ED use ($p<0.10$). Using negative binominal regression, severe cognitive impairment was also a marginally significant negative predictor ($p<0.10$) of the number of ED visits among residents who had any ED visit. In other words, people with severe cognitive impairment were less likely to have any hospital or ED use and to use fewer ED visits.

However, when the analysis includes a variable for residence in a dementia-specific setting--that is special care units or facilities that only serve residents with Alzheimer's disease--the findings change. For any hospitalization and ED use, severe cognitive impairment was no longer a significant variable when residence in a special care unit or facility that only served people with Alzheimer's disease was entered into the equation. Residents in a special care unit or facility that only served people with Alzheimer's disease were less likely to have any hospital or ED use. This finding suggests that for severely cognitively impaired residents, living in a special care unit or a facility that only served people with Alzheimer's disease makes a significant difference because they were less likely to be hospitalized or visit the ED compared to similarly cognitively impaired people who did not reside in these types of settings.

Although not the main focus of this paper, this study also sheds light on general factors associated with hospital and ED use in RCFs. Relatively few variables were statistically significant predictors of any hospital or ED use. Only the number of chronic conditions, congestive heart failure, number of limitations in activities of daily living (ADLs), LOS in the facility, bed size, and hospital bed supply were statistically significant variables. Variables that are statistically significant in the equations estimating the number of ED visits among residents who had at least one ED visit include the number of limitations in ADLs, LOS, and local market supply of hospital and nursing home beds. Notably, most of these variables have to do with the health condition or disability of the resident rather than the characteristics of the facility.

Indeed, for the equations estimating any hospital or ED use, none of the potential policy or organizational variables--whether the resident is a Medicaid beneficiary, whether the facility participates in Medicaid, RCF ownership type, chain status, whether the facility is part of a continuing care retirement community, direct care staffing ratio, or the amount of monthly charges--were statistically significant predictors (at the $p<0.05$ level). Moreover, except for the variables already noted, none of the resident

characteristics were significant predictors. The NSRCF data suggest that few of the facility characteristics have much impact on hospitalization or ED use, dementia-specific settings being an important exception.

ES.4. Discussion

This research contributes to the scant literature on the effect of Alzheimer's disease and cognitive impairment on hospitalization and ED use among people living in RCFs. More broadly, it also helps illuminate the relationship between people living in RCFs and the acute care system. Although this study found that having severe cognitive impairment or living in a special care unit or facility that only serves people with Alzheimer's disease seems to reduce the risk of hospitalization and ED use, it was not able to address the question of whether that reduction was appropriate or how that reduction was achieved. Data to estimate the prevalence of potentially avoidable hospitalization or ED use were not available. A finding of the study was that few policy or RCF organizational variables had any statistically significant effect; in general, only a few, largely health status, variables seem to be important in predicting hospitalization and ED use. Given the importance of RCFs in serving people with disabilities, especially cognitive impairment, more research is needed to address these issues.

1. INTRODUCTION AND BACKGROUND

The long-term care (LTC) delivery system has historically favored institutional services, such as nursing home care, over home and community-based services (HCBS). Over the last 20 years, however, HCBS, including residential care facilities (RCFs), adult day services centers, and personal care, have grown in importance. RCFs include a broad array of facilities, including assisted living facilities, board and care homes, personal care homes, and homes for the aged. These facilities provide services and room-and-board to persons who need assistance with activities of daily living (ADLs), such as bathing and dressing, and help with health-related services, such as managing medications. In 2010, 31,100 RCFs served 733,300 residents of all ages and with a wide range of conditions (Caffrey et al., 2012; Park-Lee et al., 2011). By comparison, in the same year, the United States had 15,682 nursing homes with more than 1.6 million beds, serving almost 1.4 million residents (Kaiser Family Foundation, 2012). Although estimates vary, a substantial portion of people living in RCFs have Alzheimer's disease, dementia or other forms of cognitive impairment (Sloane et al., 2005; Khatutsky et al., 2013; Zimmerman et al., 2012, 2014).

Severe cognitive impairment places substantial emotional, physical, and financial burdens on individuals suffering from the disease and their family caregivers and on the health and LTC systems that care for them. Dementia, which includes Alzheimer's disease and a variety of other related diseases and disorders, develops when nerve cells in the brain die or no longer function normally, affecting an individual's cognitive and physical functioning and behavior (Alzheimer's Association, 2012). Besides memory loss, these diseases also cause loss of executive function, judgment, orientation, and the ability to understand and communicate effectively, speak or understand spoken or written language, recognize or identify objects, think abstractly, make sound judgments, and plan and carry out complex tasks (American Psychiatric Association, 1994). Alzheimer's disease affected an estimated 4.7 million Americans age 65 and over in 2010, and this number is projected to nearly triple in the next 40 years, to reach 13.8 million in 2050 (Hebert et al., 2013).

Hospitalizations and emergency department (ED) visits are important burdens associated with Alzheimer's disease and other diseases associated with cognitive impairment. These encounters are disruptive, costly, and particularly challenging for individuals with Alzheimer's disease, who are vulnerable to adverse health outcomes, including delirium (Inouye, 2006), falls (Mecocci et al., 2005), functional decline (Pedone et al., 2005), and agitation and related behavioral symptoms (Kovach & Wells, 2002; McCloskey, 2004), often leading to the use of physical restraints (Sullivan-Marx, 2001). These problems are aggravated by poor communication because of cognitive impairments and multiple coexisting acute conditions (Boustani et al., 2010; Cohen & Pushkar, 1999; Hastings et al., 2008; Naylor et al., 2012; Ouslander & Maslow, 2012; Reuben et al., 2010). Older adults with dementia not only tend to use more Medicare and Medicaid, nursing facility, hospital, and home health care than their counterparts

without dementia, but they also have more difficult transitions across care settings (Callahan et al., 2012; Cohen & Pushkar, 1999; Gozalo et al., 2011).

Much of the literature on hospital admissions and ED visits has focused on nursing home residents and the general older population (Grabowski et al., 2008; Gruneir et al., 2008; Ouslander et al., 2010; Walsh et al., 2012). Few studies have investigated how service use varies by whether people have severe cognitive impairment or by the levels of cognitive impairment (Lin et al., 2013). Although some studies found no significant difference in hospital use by older people with Alzheimer's disease and related dementias (ADRD) or cognitive impairments (Leibson et al., 1999; Walsh et al., 2003) or lower use (O'Malley et al., 2011) as compared to others, most studies document more frequent hospitalizations among people with cognitive impairments, partly because people with these conditions also have multiple coexisting acute conditions that complicate their care (Bynum et al., 2004; Fillit et al., 2002; Phelan et al., 2012; Rudolph et al., 2010; Zhao et al., 2008). For example, one study based on a 5 percent sample of claims data for Medicare beneficiaries in 1999 reported a difference of more than threefold and twofold in the adjusted rates of all-cause and potentially avoidable hospitalizations, respectively, between beneficiaries with and without dementia (Bynum et al., 2004).

In addition to hospitalization, ED use is also of particular concern for people with dementia and cognitive impairments, because experiences in the ED are often disorienting and traumatic for this vulnerable population (Jones et al., 2009; Naylor et al., 2005; Smith et al., 2012). However, few studies exist on ED use by older people with ADRD and cognitive impairments. A high proportion of older adults, ranging from 21 percent to 40 percent, who present to the ED have cognitive impairments (Clevenger et al., 2012). The prevalence rates of any ED visit and any ambulatory care sensitive ED visit increase significantly with levels of cognitive impairment (Stephens et al., 2012).

Few analyses exists of the impact of severe cognitive impairment on hospital or ED use by setting--in the community, RCFs, and nursing homes. In a rare exception, using the Health and Retirement Study merged with Medicare data, Feng et al. (2013, 2014) found that people with dementia in the community (including people living in RCFs) had far higher risk of hospital and ED use than people without dementia. In contrast, hospital and ED use by people with dementia in nursing homes did not differ significantly from people without dementia.

Only one published study within the last ten years that examined hospitalization or ED use among people with dementia living in RCFs was identified. In a study primarily comparing persons in residential care/assisted living facilities in Florida, Maryland, New Jersey, and North Carolina, Sloane et al. (2005) found that people with mild dementia had almost twice the hospitalization rates in residential care/assisted living as in nursing homes, but that there was no statistically significant difference for people with moderate or severe dementia.

This study addresses the knowledge gap regarding the patterns of acute care use by older residents of RCFs by people with severe cognitive impairment. Using the 2010 National Survey of Residential Care Facilities (NSRCF), this study assesses the use of hospital or ED use by people with severe cognitive impairment compared to residents without severe cognitive impairment.

The two main research questions are:

1. Does having severe cognitive impairment, such as Alzheimer's disease or other dementias, affect the risk of any hospitalization and ED use among people living in RCFs? Among people living in RCFs who had at least one ED visit, does having severe cognitive impairment affect the number of ED visits?

2. Does living in a dementia special care unit or facility that only serves people with Alzheimer's disease affect the risk of any hospitalization or ED use among people living in RCFs? Among RCF residents with at least one ED visit, does living in a special care unit or facility that only serves people with Alzheimer's disease affect the number of ED visits?

2. METHODS

2.1. Data Sources

This study used merged facility and resident data from the 2010 NSRCF, which was sponsored by several agencies within the U.S. Department of Health and Human Services--the National Center for Health Statistics (NCHS), the Office of the Assistant Secretary for Planning and Evaluation, and the Agency for Healthcare Research and Quality--as well as the U.S. Department of Veterans Affairs, and other federal agencies (Moss et al., 2011). A nationally representative survey of licensed or otherwise regulated residential care providers, the NSRCF collected a broad array of data on facilities and residents. To be eligible for the survey, facilities had to be licensed, registered, listed, certified, or otherwise regulated by a state; have four or more beds and at least one resident currently living in the facility; and provide room and at least two meals a day, round-the-clock onsite supervision, and help with ADLs (e.g., bathing, eating, dressing) or health-related services (e.g., medication management). Facilities also had to serve primarily an adult population. Facilities that exclusively served people with severe mental illness or people with intellectual and developmental disabilities were excluded.

The NSRCF was conducted between March 2010 and November 2010. It used a two-stage probability sampling design in which RCFs were sampled and then, depending on facility size, 3-6 current residents from each facility were sampled. In-person interviews were conducted with facility directors and designated staff. Information on individual residents was collected from staff knowledgeable about the residents; no interviews were conducted with residents.

The NSRCF collected data on 2,302 facilities and 8,094 current residents of all ages. The facility weighted response rate was 81 percent and the resident weighted response rate was 99 percent among participating facilities. The sample for this study included all residents age 65 or older at the time of the survey (unweighted sample N=6,444, representative of 612,502 RCF residents nationwide). The analysis was limited to the elderly population because ADRD is rare among people under age 65. Residents age 65 or older constituted 89.5 percent of all residents (Khatutsky et al., 2013). We merged facility characteristics of the facilities in which residents lived to the NSRCF resident file to conduct resident-level analysis while accounting for facility-level characteristics. We used both the public use and restricted variables to include certain resident and facility characteristics that are not available in the public use files.

Furthermore, we merged the linked files with the 2010 Area Resource File to obtain local area characteristics at the county level which may influence hospital use among RCF residents (described below). All data merges and analyses were conducted at the Research Data Center of NCHS and the Census Data Center in North Carolina,

with the assistance of Research Data Center staff. The Research Data Center has special provisions to protect the confidentiality of data on residents and facilities.

2.2. Dependent Variables

Three resident-level outcome variables were analyzed in this study. Two of them are dichotomous indicating, respectively, whether the resident had been hospitalized (been a patient in a hospital overnight or longer, excluding trips to the ED that did not result in a hospital stay) and whether the resident had been treated in a hospital ED during the past 12 months or since the resident moved into the current facility if his or her length of stay (LOS) had been less than one year. The third outcome is a count variable indicating the number of times the resident had been treated in a hospital ED over the same period (the number of hospitalizations was not available in the NSRCF).

2.3. Independent Variables

Severe Cognitive Impairment. The key independent or explanatory variable of interest in this study is severe cognitive impairment, defined as *either* having a diagnosis of Alzheimer's disease or dementia *or* exhibiting at least three of seven symptoms related to memory impairments, confusion, or problems with orientation that were available in the survey. The seven symptoms related to: (1) long-term memory (e.g., forgetting one's own age or marital status); (2) short-term memory (e.g., having difficulty remembering what breakfast was or something that was told a few minutes earlier); (3) difficulty remembering or experiencing periods of confusion; (4) knowing the location of one's own bedroom; (5) recognizing staff names or faces; (6) knowing that one is in a facility; or (7) knowing what season of the year it is. Residents who did not meet either criterion were considered not severely cognitively impaired. This definition follows the approach used by staff at NCHS (Park-Lee & Sengupta, 2013; Sengupta et al., 2013).

We also created an indicator for whether a resident lived in an Alzheimer's/ dementia care unit (ADCU) of the facility *or* in a dementia/Alzheimer's-only facility; it was coded 1 if either condition was met and 0 otherwise. Facilities with an ADCU or exclusively serving dementia/Alzheimer's patients may be better equipped to manage the care for residents with dementia, which could influence the decision whether to transfer their residents to the hospital or ED.

Other Resident-Level Characteristics. We included resident demographics, health conditions, functional status, and LOS in the facility primarily as control variables in multivariate analyses of hospitalization and ED use. Resident demographics include age, which is categorized into five-year age brackets (except for those age 90 or older who were combined into one group), with age 65-69 as the reference group; male gender (female as reference group); non-White (non-Hispanic White as reference group); education, including three categories--high school or less (reference group),

some college or more, or unknown (missing response); and marital status (married vs. unmarried, the latter including divorced, legally separated, widowed, or never married, as the reference group). Medicaid residents were identified as those who had any of their LTC services at the facility paid for by Medicaid during the last 30 days, as reported by facility staff; others were defined as non-Medicaid residents (reference group).

For each resident, we included the total number of diagnosed conditions other than dementia (of 31 conditions listed in the NSRCF) as a proxy for comorbidities. In addition, we controlled for several specific conditions frequently associated with hospitalizations among older people, including anemia, asthma, cancer, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), depression, diabetes, hypertension, and stroke. For measures of physical functioning status, we included the number of ADLs (for transferring, dressing, eating, toileting, and bathing) for which assistance was provided and the number of limitations in five instrumental activities of daily living (IADLs; e.g., shopping, managing money, using the telephone, doing light housework, and taking medication). LOS in the facility was grouped into four categories, including less than one year (reference group), between one and three years, between three and five years, and more than five years. In addition, we included the total monthly charge for the last month for the resident, partly as a proxy for amenities and services available in each facility. In regression models, this variable is centered at the weighted sample mean, with increments by $100.

Facility-Level Characteristics. In addition to resident-level risk factors specified above, we further controlled for several facility-level variables potentially associated with hospitalization or ED use among RCF residents. Because the resident is the unit of analysis, these facility-level characteristics relate to the facilities in which the residents live. These include facility size, measured by total number of beds and grouped into four categories: small (4-10 beds; reference group), medium (11-25 beds), large (26-100 beds), and extra-large (more than 100 beds). Several dummy variables were created to indicate ownership or facility type, including private for-profit ownership; whether the facility is owned by a chain, group, or multifacility system; whether the facility is a continuing care retirement community (CCRC); and whether it is a Medicaid-participating facility (defined as having at least one resident for whom Medicaid paid for some or all of his or her LTC services during the 30 days prior to the survey). Direct care staffing ratio, in the form of average hours per resident day (HPRD), was calculated as the sum of daily hours worked by registered nurses (RNs), licensed practical nurses (LPNs), aides or certified nurse aides, and the director (to the extent that they provided direct care) divided by the total number of residents in each facility (in regression models, this variable is centered at the weighted sample mean, with increments by 0.5 hours). We also controlled for whether the facility is located in a metropolitan statistical area (MSA) (vs. non-metro area).

Local Area (County) Characteristics. In multivariate regression analyses, we controlled for two supply-related variables at the county level, including the number of hospital beds per 1,000 older people (age 65 or older) and number of certified nursing

home beds per 1,000 older people. Areas that have a larger supply of hospitals may have higher hospital and ED use because services are more readily available. On the other hand, a larger supply of nursing home beds may reduce hospital and ED use by giving RCFs an alternative setting to discharge residents who have higher needs. These variables are publicly available and are derived from the 2010 Area Resource file.

2.4. Analytic Approach

We conducted both descriptive and multivariate analyses. For descriptive analyses, frequencies for categorical variables and means for continuous variables were calculated and between-group differences were assessed using chi-square tests for categorical variables and t-tests for continuous variables. Where applicable, we noted statistical estimates that were potentially unreliable because of insufficient sample size, following the NCHS's conventions.

For multivariate analyses, we used logistic regression models to predict the probability of having any hospitalization and any ED visit during the past 12 months, respectively. Model estimates were presented in the form of odds ratios (OR). To predict the count of ED visits among the residents with any ED visit, we estimated a negative binomial model which accounts for over dispersion in the count of outcome events. Parameter estimates from the negative binomial model are presented in the form of incidence density ratios (IDRs), which are interpreted in a manner similar to ORs.

For each outcome, we estimated and presented two alternative models: Model 1 included all the independent or control variables specified above except the indicator variable for residents living in an ADCU of the facility or in a dementia/Alzheimer's-only facility, and Model 2 included this variable in addition to all other variables also included in Model 1. Approximately 14.1 percent of all residents lived in a dementia care unit or a facility that only served people with Alzheimer's disease. Given that nearly all (98 percent) of those who lived in an ADCU of the facility or in a facility that only admitted people with Alzheimer's disease had severe cognitive impairment, inclusion of this indicator in Model 2 is essentially equivalent to testing the interaction between severe cognitive impairment and living in a dementia special care unit or a dementia-only facility. A negative (i.e., OR less than 1) and statistically significant coefficient for this indicator would suggest a protective effect of living in a dementia special care unit or a dementia-only facility on the odds of hospitalization or ED use. We were interested in investigating how the effect of severe cognitive impairment might change when this indicator was included in the model.

In each regression model we also incorporated state fixed effects by specifying a series of dummy variables for the state in which a facility is located. This was intended to capture any residual effects of unobserved state-specific attributes (e.g., policies and regulations governing RCFs) that may influence hospital use among RCF residents. Because the state fixed effects estimates per se are not of interest and because NCHS

Research Data Center rules do not allow for the identification of states, they are not reported in the results.

All analyses are conducted using SUDAAN® software, which is designed for statistical analysis of correlated data (Research Triangle Institute, 2008). The stratification variables used in the NSRCF (number of beds and census region), in addition to the final sample weights for the facilities and residents and the sampling design method, were incorporated into the SUDAAN procedures to account for the complex sampling design. All results presented are weighted results.

3. RESULTS

3.1. Sample Description

A description of our final study sample, with weighted percentages (for categorical variables) or means (for continuous variables) of all independent or control variables included in multivariate analyses, is provided in **Table 1**. The final study sample includes only those respondents with valid answers to the variables included in the multivariate analyses. The results are summarized for the overall sample and separately for those with and without severe cognitive impairment. Among RCF residents age 65 or older nationwide in 2010, an estimated 313,009 people, or 51 percent, had severe cognitive impairment; the remaining 299,274 people, or 49 percent, did not have severe cognitive impairment.

Compared with those without severe cognitive impairment, older residents with severe cognitive impairment were slightly different, but the differences were not large. Residents with severe cognitive impairment were somewhat younger (e.g., 2.6 percent vs. 6.0 percent in the 65-69 age group), less likely to be male (26.1 percent vs. 28.9 percent), and more likely to be of a racial/ethnic minority group (8.0 percent vs. 6.5 percent) and married (15.6 percent vs. 12.8 percent). On average, residents with severe cognitive impairment had slightly fewer diagnosed chronic conditions other than dementia (3.2 vs. 3.6). Although a lower percentage of residents with severe cognitive impairment had asthma, cancer, CHF, COPD, and diabetes, they were more likely to suffer depression than those without severe cognitive impairment (29.4 percent vs. 23.5 percent). However, residents with severe cognitive impairment had more physical functioning problems than those without severe cognitive impairment (on average, 2.7 vs. 1.4 ADLs for which assistance was received and 4.3 vs. 2.8 IADL limitations). Relatively fewer residents with severe cognitive impairment had stayed in the facility for more than five years (10.9 percent vs. 16.4 percent). Of all residents with severe cognitive impairment, 27.1 percent lived in a special care unit or a facility that only served people with Alzheimer's disease. Thus, most residents with severe cognitive impairment did not live in special care units or facilities that only served people with Alzheimer's disease.

Residents with severe cognitive impairment were more likely to live in smaller facilities (in terms of bed size) and facilities that are for-profit or located in a MSA, but less likely to live in a CCRC. They were also more likely to live in facilities with higher average facility-level monthly charges per resident and in facilities with somewhat higher direct care staffing ratios (in terms of average staffing HPRD).

TABLE 1. Description of Study Sample						
Characteristics of Residents or the Facilities in Which Residents Live	**All**		**Severe Cognitive Impairment**		**Does Not Have Severe Cognitive Impairment**	
	Percentage or Mean	**(SE)**	**Percentage or Mean**	**(SE)**	**Percentage or Mean**	**(SE)**
Unweighted sample N	6,442	---	3,470	---	2,972	---
Weighted N	612,283	---	313,009	---	299,274	---
Weighted percentage	100.0	---	51.1	(0.9)	48.9	(0.9)
Resident Characteristics						
In a special care unit or a facility that only serves people with Alzheimer's disease	14.1	(0.7)	27.1	(1.3)	0.6[b]	(0.2)***
Age	---	---	---	---	---	***
65-69[a]	4.3	(0.3)	2.6	(0.3)	6.0	(0.6)
70-74	5.1	(0.3)	4.7	(0.4)	5.5	(0.5)
75-79	9.5	(0.5)	10.0	(0.7)	9.1	(0.7)
80-84	20.8	(0.6)	22.3	(0.9)	19.3	(0.9)
85-89	31.5	(0.7)	32.3	(0.9)	30.8	(1.0)
90+	28.8	(0.7)	28.2	(1.0)	29.3	(1.0)
Gender						**
Male	27.4	(0.7)	26.1	(0.9)	28.9	(1.0)
Female[a]	72.6	(0.7)	74.0	(0.9)	71.1	(1.0)
Race/ethnicity	---	---	---	---	---	*
White, non-Hispanic[a]	92.8	(0.5)	92.0	(0.6)	93.6	(0.6)
Non-White	7.3	(0.5)	8.0	(0.6)	6.5	(0.6)
Education						
High school or less[a]	49.0	(1.0)	50.0	(1.2)	47.9	(1.3)
Some college or more	36.6	(0.9)	35.7	(1.1)	37.5	(1.3)
Unknown	14.5	(0.9)	14.3	(1.0)	14.6	(1.2)
Marital status	---	---	---	---	---	**
Married	14.3	(0.5)	15.6	(0.8)	12.8	(0.8)
Unmarried[a]	85.7	(0.5)	84.4	(0.8)	87.2	(0.8)
Payer status						
Medicaid	14.8	(0.8)	14.6	(0.9)	15.0	(1.0)
Non-Medicaid[a]	85.2	(0.8)	85.4	(0.9)	85.0	(1.0)
Number of chronic conditions other than dementia (range 0-31) (mean)	3.4	(0.0)	3.2	(0.1)	3.6	(0.1)***
Selected conditions						
Anemia	10.04	(0.5)	9.9	(0.7)	10.2	(0.7)
Asthma	4.2	(0.3)	3.5	(0.4)	4.9	(0.5)**
Cancer	11.5	(0.5)	10.0	(0.6)	13.0	(0.8)***
CHF	14.5	(0.6)	12.2	(0.7)	16.9	(0.9)***
COPD	10.8	(0.5)	8.6	(0.6)	13.1	(0.8)***
Depression	26.5	(0.8)	29.4	(1.0)	23.5	(1.0)***
Diabetes	16.2	(0.6)	13.9	(0.7)	18.7	(0.9)***
Hypertension	59.4	(0.9)	58.2	(1.1)	60.6	(1.2)
Stroke	11.3	(0.5)	11.0	(0.7)	11.6	(0.7)
Functional limitations						
Number of ADLs (0-5) (mean)	2.0	(0.0)	2.7	(0.0)	1.4	(0.0)***
Number of IADLs (0-5) (mean)	3.5	(0.0)	4.3	(0.0)	2.8	(0.0)***
LOS in the facility	---	---	---	---	---	***
<1 year[a]	31.8	(0.7)	33.2	(1.0)	30.3	(1.1)
1-3 years	38.0	(0.8)	39.7	(1.0)	36.2	(1.1)
3-5 years	16.7	(0.6)	16.3	(0.8)	17.1	(0.9)
>5 years	13.6	(0.6)	10.9	(0.7)	16.4	(0.9)
Resident-level average monthly charges (mean)	$3,293	(35.0)	$3,552	(42.2)	$3,022	(40.9)***

TABLE 1 (*continued*)						
Characteristics of Residents or the Facilities in Which Residents Live	**All**		**Severe Cognitive Impairment**		**Does Not Have Severe Cognitive Impairment**	
	Percentage or Mean	**(SE)**	**Percentage or Mean**	**(SE)**	**Percentage or Mean**	**(SE)**
Characteristics of Facilities in Which Residents Live						
Size						***
Small (4-10 beds)[a]	8.8	(0.3)	12.3	(0.5)	5.2	(0.3)
Medium (11-25 beds)	8.2	(0.3)	8.7	(0.4)	7.8	(0.4)
Large (26-100 beds)	53.4	(0.9)	53.4	(1.2)	53.5	(1.4)
Extra-large (more than 100 beds)	29.5	(0.9)	25.7	(1.2)	33.5	(1.4)
For-profit	74.1	(1.3)	79.0	(1.3)	68.9	(1.7)***
Part of a chain, group, or multifacility system	59.1	(1.4)	59.8	(1.5)	58.5	(1.8)
CCRC	14.3	(1.1)	11.8	(1.1)	17.0	(1.5)***
Medicaid-participating	35.9	(1.4)	35.2	(1.6)	36.6	(1.7)
Direct care staffing ratio, HPRD (mean)	2.3	(0.0)	2.6	(0.0)	1.9	(0.0)***
MSA	83.1	(0.9)	86.0	(0.9)	80.0	(1.2)***
Area (county) Characteristics						
Hospital beds per 1,000 elderly (mean)	27.1	(0.5)	27.0	(0.6)	27.1	(0.6)
Certified nursing home beds per 1,000 elderly (mean)	45.4	(0.5)	44.0	(0.5)	46.9	(0.6)***

SOURCE: RTI International analysis of the NSRCF.
NOTES: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$. Results are weighted.
a. Used as the reference (omitted) category in regression models.
b. Sample size is too small ($n \leq 30$) by NCHS standards.

3.2. Descriptive Analysis Results

Results from bivariate analysis of the association between each of the resident and facility characteristics and the percentage of residents with any hospitalization or ED visit in the past 12 months are presented in **Table 2**. Overall, an estimated 25 percent of all RCF residents age 65 or older in 2010 were hospitalized at least once in the past 12 months, and roughly 36 percent had at least one ED visit during the same period. There was no statistically significant difference in either measure between residents with and without severe cognitive impairment.

Several resident characteristics appeared to be associated with both outcomes, including the total number of conditions and almost all of the selected specific conditions, number of ADL and IADL limitations, and LOS. A greater percentage of Medicaid residents had a hospitalization than non-Medicaid residents. No statistically significant associations with either outcome were observed for any of the demographic characteristics. In terms of facility characteristics, larger facility size appeared to be associated with more frequent ED visits (but not with hospitalization) among their residents, and facilities located in metro areas had higher percentages of residents with both hospitalization and ED visits.

TABLE 2. Residents With a Hospitalization or ED Visit in Past 12 Months				
Characteristics of Residents or the Facilities in Which Residents Live	**Any Hospitalization**		**Any ED Visit**	
	Percentage	**(SE)**	**Percentage**	**(SE)**
Unweighted sample N	6,444	---	6,442	---
Weighted N	612,502	---	612,283	---
Weighted percentage with the outcome	24.5	(0.7)	35.5	(0.8)
Resident Characteristics				
Severe cognitive impairment				
No	24.7	(1.0)	34.7	(1.1)
Yes	24.3	(0.9)	36.4	(1.1)
In a special care unit or a facility that only serves people with Alzheimer's disease				
No	24.8	(0.8)	35.5	(0.8)
Yes	22.3	(1.8)	35.6	(2.0)
Age				
65-69	23.6	(3.0)	34.6	(3.2)
70-74	23.1	(2.8)	30.6	(3.0)
75-79	23.6	(2.2)	34.9	(2.4)
80-84	25.6	(1.5)	35.5	(1.7)
85-89	24.3	(1.2)	35.6	(1.3)
90+	24.5	(1.2)	36.7	(1.3)
Gender				
Male	24.8	(1.3)	35.9	(1.5)
Female	24.4	(0.8)	35.4	(0.9)
Race/ethnicity				
White, non-Hispanic	24.5	(0.7)	35.3	(0.8)
Non-White	24.7	(2.6)	38.0	(2.6)
Education				
High school or less	25.4	(1.0)	35.7	(1.0)
Some college or more	24.0	(1.2)	36.0	(1.3)
Unknown	22.8	(1.7)	33.7	(2.1)
Marital status				
Married	22.2	(1.8)	32.7	(2.0)
Unmarried	24.9	(0.8)	36.0	(0.8)
Payer status				
Medicaid	28.6	(1.8)	35.8	(1.8)
Non-Medicaid	23.8	(0.8)	35.5	(0.9)
Number of conditions other than dementia (range 0-31)				
0	10.1[a]	(2.1)	18.7[a]	(2.6)
1	16.3	(1.7)	27.0	(2.1)
2	20.7	(1.5)	31.8	(1.7)
3	24.0	(1.5)	35.9	(1.6)
4	26.9	(1.6)	37.5	(1.8)
5	28.9	(2.1)	40.3	(2.3)
6+	35.9	(2.0)	47.0	(2.0)
Selected conditions				
Anemia	29.6	(2.2)**	42.0	(2.4)***
Asthma	33.1	(3.5)**	43.5	(3.7)**
Cancer	28.8	(2.1)**	35.8	(2.3)
CHF	37.0	(1.9)***	46.2	(2.0)***
COPD	30.8	(2.1)***	43.4	(2.4)***
Depression	28.2	(1.3)***	39.7	(1.5)***
Diabetes	28.5	(1.7)**	40.1	(1.8)**
Hypertension	25.8	(0.9)**	37.7	(1.0)***
Stroke	31.5	(2.2)***	42.5	(2.2)***
Functional limitations				
Number of ADLs	---	***	---	***
0	17.2	(1.2)	24.6	(1.4)
1-2	24.1	(1.1)	35.4	(1.3)
3-4	28.6	(1.2)	40.9	(1.3)
5	32.0	(2.7)	48.0	(2.7)

TABLE 2 (*continued*)				
Characteristics of Residents or the Facilities in Which Residents Live	**Any Hospitalization**		**Any ED Visit**	
	Percentage	**(SE)**	**Percentage**	**(SE)**
Number of IADLs	---	**	---	***
0	16.8[a]	(2.9)	18.2[a]	(2.9)
1-2	22.5	(1.6)	32.3	(1.8)
3-4	25.7	(1.0)	36.7	(1.1)
5	25.0	(1.1)	38.1	(1.3)
LOS	---	***	---	***
<1 year	21.1	(1.1)	31.7	(1.3)
1-3 years	27.0	(1.2)	38.9	(1.3)
3-5 years	23.9	(1.7)	34.8	(1.8)
>5 years	26.1	(1.9)	36.1	(2.0)
Resident-level average monthly charges			---	***
Below median	23.3	(0.9)	33.0	(1.0)
Above median	25.7	(1.1)	38.1	(1.2)
Characteristics of Facilities in Which Residents Live				
Size	---	---	---	***
Small (4-10 beds)	23.0	(1.4)	29.5	(1.5)
Medium (11-25 beds)	24.0	(1.3)	34.8	(1.4)
Large (26-100 beds)	25.2	(1.0)	37.6	(1.1)
Extra-large (more than 100 beds)	23.8	(1.5)	33.8	(1.6)
For-profit				
No	24.4	(1.5)	34.1	(1.6)
Yes	24.5	(0.8)	36.1	(0.9)
Part of a chain, group, or multifacility system				
No	25.2	(1.1)	34.0	(1.1)
Yes	24.0	(0.9)	36.6	(1.1)
CCRC				
No	24.8	(0.8)	35.9	(0.8)
Yes	22.6	(2.0)	33.2	(2.1)
Medicaid-participating				
No	23.8	(0.9)	35.6	(1.0)
Yes	25.8	(1.2)	35.4	(1.3)
Direct care staffing ratio, HPRD				
Below median	23.7	(1.1)	35.0	(1.2)
Above median	25.3	(0.9)	36.1	(1.0)
MSA	---	*	---	*
No	21.9	(1.4)	32.7	(1.5)
Yes	25.0	(0.8)	36.1	(0.9)
Area (county) Characteristics				
Hospital beds per 1,000 elderly	---	***	---	**
Below median	22.3	(0.9)	33.4	(1.1)
Above median	26.7	(1.1)	37.7	(1.1)
Certified nursing home beds per 1,000 elderly	---	---	---	---
Below median	24.1	(1.0)	35.4	(1.1)
Above median	24.8	(1.0)	35.6	(1.1)

SOURCE: RTI International analysis of the NSRCF.
NOTES: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$. Results are weighted.
a. Estimates are likely to be unreliable because sample size is between 30 and 59 or the sample size is greater than 59 but has a relative standard error (SE) of 30% or more.

3.3. Multivariate Analysis Results

3.3.1. Residents with any Hospitalization

Multivariate logistic regression model results predicting the probability of any hospitalization in the past 12 months are shown in **Table 3**. Controlling for all other resident, facility, and local market (county) characteristics, *except* the variable for residents living an ADCU or in a dementia/Alzheimer's-only facility, residents with

severe cognitive impairment had somewhat lower odds of hospitalization as compared to those without severe cognitive impairment, but this association is only marginally significant (OR=0.85, $p<0.10$; Model 1). However, in the model further adjusting for living in a dementia special severe care unit or facility that only admits people with Alzheimer's disease (Model 2), the OR for severe cognitive impairment loses statistical significance (although it is in the same direction). In contrast, residents who lived in a special care units or in facilities that only served people with Alzheimer's disease were significantly *less* likely to be hospitalized as compared to residents in regular units or living in facilities without specialization (OR=0.71, $p<0.05$), after controlling for severe cognitive impairment status and all other covariates in the model.

The total number of diagnosed conditions emerged as a strong predictor of hospitalization, with comparable estimates from Model 1 (OR=1.15, $p<0.01$) and Model 2 (OR=1.14, $p<0.01$). Residents with CHF were roughly 56 percent more likely to have a hospitalization than others without the condition; no significant association was found with other selected conditions. Another significant predictor of hospitalization was the number of ADLs for which residents receive assistance (OR=1.21, $p<0.01$; Model 2), but not IADL limitations. Residents with a LOS in the facility between one year and three years had greater odds of being hospitalized as compared to new residents within their first year of stay in the facility (OR=1.35, $p<0.01$). The ORs for those with a longer LOS (3-5 years or more than five years) were positive but not statistically significant. Adjusting for health conditions and functional limitations, none of the demographic variables, including age, gender, race/ethnicity, education, and marital status, showed an independent and statistically significant impact on hospitalization, although the ORs for several of these variables (e.g., age, education, and marital status) went in an expected direction. The OR for Medicaid residents, as compared to non-Medicaid residents, was positive but not statistically significant.

As for facility characteristics, the results suggest some evidence that residents were at greater risk for hospitalization if they resided in large facilities (with 26-100 beds) (OR=1.39, $p<0.05$) or extra-large facilities (with more than 100 beds) (OR=1.34, $p<0.10$), as compared to those in small facilities (with 4-10 beds) (Table 3, Model 2). Larger facilities may have more standard protocols for transfer to a hospital or may have more professional nursing staff that can assess medical conditions. No significant difference in the risk of hospitalization was observed by other facility characteristics, such as types of ownership, Medicaid-participating status, direct care staffing ratios, or average monthly charges per resident.

The odds of hospitalization among RCF residents increased with the total number of hospital beds per 1,000 elderly people in the county in which the facility is located (OR=1.05, per one bed increase, $p<0.05$). A larger bed supply may make it easier to admit residents to hospitals, which may have empty beds that they wish to fill. Nursing home bed supply in the same county did not have an impact on hospitalization of residents from RCFs.

TABLE 3. Probability of Any Hospitalization in Past 12 Months: Logistic Regression Model Results				
Characteristics of Residents or the Facilities in Which Residents Live	**Model 1**		**Model 2**	
	OR	**(95% CI)**	**OR**	**(95% CI)**
Resident Characteristics				
Severe cognitive impairment	0.852*	(0.709, 1.024)	0.902	(0.749, 1.085)
In a special care unit or a facility that only serves people with Alzheimer's disease	---	---	0.710**	(0.545, 0.926)
Age (reference = 65-69)				
70-74	1.008	(0.628, 1.618)	0.995	(0.619, 1.598)
75-79	1.140	(0.739, 1.758)	1.127	(0.730, 1.739)
80-84	1.203	(0.815, 1.776)	1.182	(0.800, 1.745)
85-89	1.130	(0.767, 1.664)	1.110	(0.752, 1.638)
90+	1.129	(0.766, 1.663)	1.096	(0.742, 1.618)
Male	1.089	(0.915, 1.296)	1.091	(0.916, 1.300)
Non-White race	1.072	(0.803, 1.431)	1.072	(0.802, 1.433)
Education (reference = high school or less)				
Some college or more	0.933	(0.786, 1.107)	0.933	(0.786, 1.108)
Unknown	0.910	(0.722, 1.147)	0.908	(0.721, 1.145)
Married	0.882	(0.702, 1.110)	0.888	(0.706, 1.117)
Medicaid resident	1.157	(0.923, 1.450)	1.163	(0.928, 1.458)
Number of conditions other than dementia (range 0-31)	1.147***	(1.083, 1.215)	1.143***	(1.079, 1.211)
Selected conditions				
Anemia	0.969	(0.759, 1.237)	0.976	(0.764, 1.247)
Asthma	1.075	(0.759, 1.521)	1.064	(0.753, 1.503)
Cancer	1.050	(0.827, 1.332)	1.053	(0.829, 1.338)
CHF	1.568***	(1.280, 1.921)	1.562***	(1.274, 1.915)
COPD	0.991	(0.786, 1.251)	0.999	(0.791, 1.262)
Depression	1.038	(0.870, 1.239)	1.036	(0.868, 1.238)
Diabetes	1.012	(0.827, 1.238)	1.017	(0.831, 1.245)
Hypertension	0.911	(0.770, 1.079)	0.908	(0.767, 1.075)
Stroke	1.141	(0.910, 1.432)	1.130	(0.901, 1.418)
Functional limitations				
Number of ADLs (range 0-5)	1.201***	(1.131, 1.276)	1.214***	(1.142, 1.290)
Number of IADLs (range 0-5)	0.965	(0.896, 1.039)	0.973	(0.903, 1.048)
LOS in the facility (reference = less than 1 year)				
1-3 years	1.351***	(1.132, 1.612)	1.349***	(1.130, 1.611)
3-5 years	1.131	(0.902, 1.417)	1.117	(0.891, 1.401)
>5 years	1.222	(0.957, 1.559)	1.223	(0.958, 1.560)
Resident-level average monthly charges	1.000	(0.999, 1.001)	1.000	(1.000, 1.001)
Characteristics of Facilities in Which Residents Live				
Size (reference = small [4-10 beds])				
Medium (11-25 beds)	1.155	(0.889, 1.499)	1.223	(0.938, 1.594)
Large (26-100 beds)	1.297*	(0.993, 1.693)	1.390**	(1.059, 1.825)
Extra-large (more than 100 beds)	1.253	(0.916, 1.714)	1.339*	(0.973, 1.843)
For-profit	1.016	(0.821, 1.256)	1.007	(0.813, 1.247)
Part of a chain, group, or multifacility system	0.941	(0.794, 1.115)	0.950	(0.801, 1.126)
CCRC	0.810	(0.619, 1.059)	0.805	(0.615, 1.054)
Medicaid-participating	1.034	(0.841, 1.270)	1.034	(0.841, 1.272)
Direct care staffing ratio, HPRD	1.000	(0.983, 1.018)	1.003	(0.986, 1.020)
MSA	1.176	(0.955, 1.447)	1.171	(0.951, 1.441)
Area (county) Characteristics				
Hospital beds per 1,000 elderly	1.052**	(1.002, 1.103)	1.054**	(1.005, 1.105)
Certified nursing home beds per 1,000 elderly	0.998	(0.946, 1.052)	0.996	(0.945, 1.050)
State fixed effects (not shown)				
Unweighted sample N	6,444	---	6,444	---
Weighted N	612,502	---	612,502	---
Model X^2	378.95	---	390.06	---
Degrees of freedom	88	---	89	---

SOURCE: RTI International analysis of the NSRCF.
NOTES: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$.
--- Variable excluded from model.

3.3.2. Emergency Department Use

Results from logistic regression models predicting the probability of any ED visit in the past 12 months are reported in **Table 4**. Overall, these results are remarkably similar to those described for the models predicting hospitalizations. Severe cognitive impairment by itself has a marginally significant effect, reducing the odds of any ED visit (OR=0.86, $p<0.10$, Model 1). Thus, residents with severe cognitive impairment were somewhat less likely than others to have any ED use. Again, when the dementia-specific setting indicator is added, we observed a significant impact of living in a special care unit or a facility that only serves people with Alzheimer's disease on lowering the risk of ED use (OR=0.71, $p<0.01$), with severe cognitive impairment no longer showing an independent effect (Model 2). As is the case with hospitalizations, the total number of conditions, CHF, number of ADL limitations, LOS in the facility for 1-3 years, larger facility size, and greater supply of hospital beds in the local market (county) were each associated with increased odds of ED use among RCF residents.

TABLE 4. Probability of Any ED Visit in Past 12 Months: Logistic Regression Model Results

Characteristics of Residents or the Facilities in Which Residents Live	Model 1		Model 2	
	OR	(95% CI)	OR	(95% CI)
Resident Characteristics				
Cognitive impairment	0.858*	(0.729, 1.009)	0.907	(0.769, 1.069)
In a special care unit or a facility that only serves people with Alzheimer's disease	---	---	0.714***	(0.564, 0.905)
Age (reference = 65-69)				
70-74	0.835	(0.550, 1.266)	0.822	(0.541, 1.250)
75-79	1.089	(0.751, 1.581)	1.076	(0.740, 1.564)
80-84	1.033	(0.741, 1.441)	1.013	(0.725, 1.416)
85-89	1.041	(0.743, 1.457)	1.021	(0.726, 1.435)
90+	1.090	(0.786, 1.512)	1.057	(0.759, 1.472)
Male	1.117	(0.955, 1.308)	1.121	(0.957, 1.312)
Non-White race	1.263*	(0.989, 1.614)	1.265*	(0.988, 1.620)
Education (reference = high school or less)				
Some college or more	0.996	(0.856, 1.159)	0.997	(0.857, 1.161)
Unknown	0.896	(0.728, 1.101)	0.894	(0.727, 1.099)
Married	0.848	(0.695, 1.036)	0.854	(0.699, 1.044)
Medicaid resident	0.866	(0.700, 1.072)	0.871	(0.704, 1.079)
Number of conditions other than dementia (range 0-31)	1.114***	(1.059, 1.171)	1.110***	(1.055, 1.167)
Selected conditions				
Anemia	1.007	(0.808, 1.257)	1.016	(0.815, 1.266)
Asthma	1.042	(0.748, 1.450)	1.029	(0.740, 1.430)
Cancer	0.843	(0.674, 1.053)	0.844	(0.675, 1.056)
CHF	1.357***	(1.114, 1.654)	1.351***	(1.108, 1.647)
COPD	1.100	(0.875, 1.381)	1.108	(0.882, 1.393)
Depression	1.057	(0.900, 1.242)	1.055	(0.898, 1.240)
Diabetes	1.070	(0.892, 1.284)	1.077	(0.897, 1.293)
Hypertension	1.015	(0.873, 1.181)	1.013	(0.871, 1.178)
Stroke	1.099	(0.892, 1.353)	1.087	(0.884, 1.338)
Functional limitations				
Number of ADLs (range 0-5)	1.249***	(1.183, 1.318)	1.263***	(1.196, 1.334)
Number of IADLs (range 0-5)	1.011	(0.945, 1.082)	1.020	(0.953, 1.091)
LOS (reference = less than 1 year)				
1-3 years	1.362***	(1.163, 1.595)	1.360***	(1.161, 1.594)
3-5 years	1.132	(0.928, 1.381)	1.118	(0.916, 1.364)
>5 years	1.227*	(0.986, 1.527)	1.228*	(0.987, 1.528)
Resident-level average monthly charges	1.000	(0.999, 1.001)	1.000	(1.000, 1.001)

TABLE 4 (*continued*)				
Characteristics of Residents or the Facilities in Which Residents Live	**Model 1**		**Model 2**	
	OR	**(95% CI)**	**OR**	**(95% CI)**
Facility Characteristics				
Size (reference = small [4-10 beds])				
Medium (11-25 beds)	1.459***	(1.153, 1.846)	1.552***	(1.223, 1.969)
Large (26-100 beds)	1.656***	(1.306, 2.102)	1.782***	(1.400, 2.268)
Extra-large (more than 100 beds)	1.510***	(1.148, 1.986)	1.619***	(1.229, 2.132)
For-profit	0.987	(0.818, 1.190)	0.978	(0.810, 1.182)
Part of a chain, group or multifacility system	1.141*	(0.984, 1.323)	1.152*	(0.993, 1.338)
CCRC	0.885	(0.705, 1.111)	0.880	(0.700, 1.106)
Medicaid-participating	0.943	(0.783, 1.136)	0.943	(0.783, 1.137)
Direct care staffing ratio, HPRD	0.995	(0.978, 1.013)	0.998	(0.981, 1.015)
MSA	1.122	(0.935, 1.346)	1.118	(0.932, 1.341)
Area (county) Characteristics				
Hospital beds per 1,000 elderly	1.035	(0.991, 1.081)	1.037*	(0.993, 1.083)
Certified nursing home beds per 1,000 elderly	1.009	(0.961, 1.059)	1.008	(0.959, 1.059)
State fixed effects (not shown)				
Unweighted sample N	6,442	---	6,442	---
Weighted N	612,283	---	612,283	---
Model X^2	452.19	---	465.81	---
Degrees of freedom	88	---	89	---

SOURCE: RTI International analysis of the NSRCF.
NOTES: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$.
--- Variable excluded from model.

There are also a few differences in the results between the two models. For example, the odds of ED visits were greater for non-White residents than for White residents and the difference is marginally significant (OR=1.27, $p<0.10$; Table 4, Model 2). The effect of facility size on the risk of ED use is more robust and highly significant, in comparison to its effect on hospitalization. The risk for ED visits is somewhat higher for residents in facilities owned by a chain, group, or multifacility system than for others, although the difference is marginally significant (OR 1.15, $p<0.10$; Table 4, Model 2).

Lastly, **Table 5** presents regression results from the negative binomial models predicting the count of ED visits in the past 12 months among residents with at least one ED visit. Conditional on having any ED visit, residents with severe cognitive impairment tended to have somewhat fewer repeat visits to the ED than those without severe cognitive impairment, although this difference is only marginally significant (IDR=0.91, $p<0.10$; Model 2). No difference in the count of ED visits was observed by whether living in an ADCU or a dementia/Alzheimer's-only facility. Neither the total number of conditions nor specific conditions were predictive of repeat ED visits. However, the number of ADLs for which assistance was received remained a significant risk factor for repeat ED visits (IDR=1.04, $p<0.05$).

Only one facility characteristic, for-profit ownership, was associated with more frequent ED visits, although the estimate is only marginally significant (IDR=1.09, $p<0.10$). Interestingly, both supply-related variables at the local market (county) level are predictive of repeat ED visits among RCF residents: although the number of hospital beds per 1,000 elderly people is associated with more frequent ED visits, the number of certified nursing home beds is associated with fewer ED visits.

TABLE 5. Number of ED Visits in Past 12 Months Among Residents With Any ED Visit: Negative Binomial Model Results				
Characteristics of Residents or the Facilities in Which Residents Live	**Model 1**		**Model 2**	
	IDR	**(95% CI)**	**IDR**	**(95% CI)**
Resident Characteristics				
Cognitive impairment	0.929*	(0.851, 1.014)	0.914*	(0.832, 1.005)
In a special care unit or a facility that only serves people with Alzheimer's disease	---	---	1.094	(0.957, 1.251)
Age (reference = 65-69)				
70-74	1.035	(0.755, 1.420)	1.046	(0.762, 1.436)
75-79	0.907	(0.697, 1.182)	0.913	(0.701, 1.188)
80-84	0.964	(0.751, 1.238)	0.973	(0.757, 1.251)
85-89	0.825	(0.646, 1.055)	0.832	(0.651, 1.063)
90+	0.875	(0.688, 1.114)	0.885	(0.695, 1.127)
Male	1.064	(0.979, 1.156)	1.064	(0.979, 1.156)
Non-White race	0.944	(0.838, 1.064)	0.942	(0.836, 1.061)
Education (reference = high school or less)				
Some college or more	1.021	(0.933, 1.117)	1.019	(0.931, 1.115)
Unknown	0.931	(0.824, 1.051)	0.931	(0.824, 1.051)
Married	1.023	(0.920, 1.139)	1.018	(0.915, 1.133)
Medicaid resident	1.042	(0.916, 1.185)	1.038	(0.913, 1.182)
Number of conditions other than dementia (range 0-31)	1.025	(0.990, 1.062)	1.026	(0.990, 1.063)
Selected conditions				
Anemia	0.956	(0.842, 1.086)	0.955	(0.842, 1.084)
Asthma	0.983	(0.820, 1.180)	0.988	(0.824, 1.186)
Cancer	1.003	(0.895, 1.125)	1.003	(0.894, 1.124)
CHF	0.988	(0.892, 1.095)	0.990	(0.893, 1.097)
COPD	1.078	(0.956, 1.217)	1.079	(0.956, 1.217)
Depression	0.945	(0.855, 1.044)	0.945	(0.855, 1.045)
Diabetes	1.032	(0.919, 1.160)	1.031	(0.918, 1.159)
Hypertension	0.962	(0.859, 1.077)	0.961	(0.858, 1.076)
Stroke	0.937	(0.842, 1.042)	0.940	(0.844, 1.046)
Functional limitations				
Number of ADLs (range 0-5)	1.038**	(1.004, 1.074)	1.036**	(1.002, 1.071)
Number of IADLs (range 0-5)	0.987	(0.950, 1.026)	0.985	(0.948, 1.023)
LOS (reference = less than 1 year)				
1-3 years	1.095*	(0.998, 1.201)	1.098**	(1.002, 1.204)
3-5 years	1.166**	(1.019, 1.334)	1.173**	(1.025, 1.343)
>5 years	0.970	(0.857, 1.099)	0.975	(0.861, 1.104)
Resident-level average monthly charges	1.000	(0.999, 1.000)	1.000	(0.999, 1.000)
Facility Characteristics				
Size (reference = small [4-10 beds])				
Medium (11-25 beds)	0.955	(0.825, 1.106)	0.942	(0.812, 1.091)
Large (26-100 beds)	1.025	(0.875, 1.200)	1.006	(0.860, 1.178)
Extra-large (more than 100 beds)	1.116	(0.931, 1.338)	1.100	(0.921, 1.315)
For-profit	1.088*	(0.989, 1.197)	1.092*	(0.992, 1.202)
Part of a chain, group, or multifacility system	0.992	(0.915, 1.074)	0.988	(0.912, 1.070)
CCRC	0.918	(0.813, 1.035)	0.919	(0.814, 1.036)
Medicaid-participating	1.026	(0.933, 1.128)	1.027	(0.934, 1.130)
Direct care staffing ratio, HPRD	0.994	(0.983, 1.004)	0.993	(0.983, 1.003)
MSA	1.056	(0.974, 1.145)	1.057	(0.975, 1.145)
Area (county) Characteristics				
Hospital beds per 1,000 elderly	1.035***	(1.015, 1.057)	1.035***	(1.014, 1.056)
Certified nursing home beds per 1,000 elderly	0.971**	(0.946, 0.997)	0.971**	(0.945, 0.997)
State fixed effects (not shown)				
Unweighted sample N	2,218	---	2,218	---
Weighted N	216,732	---	216,732	---
Model X^2	176.84	---	179.32	---
Degrees of freedom	88	---	89	---

SOURCE: RTI International analysis of the NSRCF.
NOTES: Statistical significance: * $p<0.10$; ** $p<0.05$; *** $p<0.01$.
--- Variable excluded from model.

4. DISCUSSION

This study examines the effect of severe cognitive impairment on hospital and ED use by people living in RCFs. To our knowledge, there was only one other study in the last ten years that addresses this issue (Sloane et al., 2005). People with severe cognitive impairment are an important population in RCFs, by our definition accounting for 51 percent of residents age 65 or older.

Using logistic regression analysis of data on residents in the 2010 NSRCF, this study found that severe cognitive impairment was a marginally significant negative predictor of any hospitalization or any ED use ($p<0.10$). Using negative binominal regression, severe cognitive impairment was also a marginally significant ($p<0.10$) negative predictor of the number of ED visits among residents who had any ED visit. Thus, people with severe cognitive impairment were somewhat less likely to have any hospitalization or ED use than residents without severe cognitive impairment.

This finding places the hospital and ED use experience of people with severe cognitive impairment compared to people not having severe cognitive impairment living in RCFs much closer to that of people with dementia living in nursing homes than people living in the community. Using the Health and Retirement Study merged with Medicare data, Feng et al. (2013, 2014) found that people with dementia in the community (including people living in RCFs) had far higher risk of hospital and ED use than people without dementia. In contrast, hospital and ED use by people with dementia in nursing homes did not differ significantly from people without dementia. Although nursing homes arguably have the staffing in-house to meet some of the needs of residents with acute care problems, this is unlikely to be the case in RCFs. Indeed, overall, RCF residents live in facilities that provide only an average of about five minutes of RN care and about ten minutes of LPN/licensed vocational nurse care per resident per day (Khatutsky et al., 2013).

For any hospitalization or ED use, severe cognitive impairment was no longer a significant variable when residence in a special care unit or a facility that only serves people with Alzheimer's disease was entered into the equation. Residents in a special care unit or facility that only serves people with Alzheimer's disease were less likely to have any hospital or ED use compared to people who did not live in those settings ($p<0.05$). The marginal significance of severe cognitive impairment persisted when this additional variable for residence in a special care unit or facility that only served people with Alzheimer's disease was added into the equation for the number of ED visits among residents with any ED visits, but the latter was no longer significant. It is not clear from the data why these special care units or facilities that only serve people with Alzheimer's disease reduce any hospitalization or ED use. Perhaps staff in dementia care units are less likely to send residents to the hospital or EDs because they better understand the possible negative consequences of doing so. Or it may be that being in

a setting with a higher staff ratio and staff who are trained in Alzheimer's disease care, they are not as likely to develop the problems leading to hospitalizations or ED visits. Because no data are available as to whether the hospitalizations or ED visits were appropriate, it is difficult to assess whether this decrease in hospital and ED use among RCF residents with severe cognitive impairment is desirable.

Special care units for people with dementia in RCFs and nursing homes have been controversial, in part because of their high costs compared to normal care (Karon et al., 2014). Most studies have found that special care units in nursing homes and RCFs are not more effective than normal care in terms of outcomes, such as cognition, ADL decline, agitation and social activity, but almost all of those studies are over a decade old and most research has focused on nursing homes rather than RCFs (Leon & Ory, 1999; Maslow & Ory, 2000; Phillips et al., 1997). In a slightly more recent paper, Sloane et al. (2005) examined the effect of special care units on hospitalization rates among RCF residents in four states (Florida, Maryland, New Jersey, and North Carolina), but did not find a statistically significant effect, although residents in these units had higher hospitalization rates.

Although not the main focus of this paper, this study also sheds light on general factors associated with hospital and ED use in RCFs. What is striking is how few variables are statistically significant predictors of any hospital or ED use. Only the number of conditions, CHF, number of ADLs, LOS in the facility, bed size, and hospital bed supply were statistically significant variables. Variables that are statistically significant in the equations estimating the number of ED visits among residents who had at least one ED visit include the number of ADLs, LOS in the facility, and local market supply of hospital and nursing home beds. Notably, most of these variables have to do with the health condition or disability of the resident rather than the characteristics of the facility. Indeed, for the equations estimating any hospital or ED use, none of the potential policy or organizational variables--whether the resident is a Medicaid beneficiary, whether the facility participates in Medicaid, ownership type, chain status, whether the facility is part of a CCRC, direct care staffing ratio, or the amount of monthly charges--were statistically significant (at the 0.05 level) predictors. Moreover, except for the variables already noted, none of the resident characteristics were significant predictors either. The data available in the NSRCF show that few of the facility characteristics beyond dementia-specific settings have much impact on hospitalization or ED use. On the one hand, it should be a comfort to policy makers that clinical variables are the principal determinants of hospital or ED use. On the other hand, aside from promoting special care units, it is not obvious what policies would further reduce hospital and ED use.

This study contributes to knowledge about RCFs and people with dementia or cognitive impairment, but it has several limitations. First, the survey was designed to analyze facilities and residents at the national level and not to produce state estimates, although licensure requirements with regard to staffing, training, admission and discharge criteria and required services vary by state. Second, residents were not directly interviewed for this survey; facility staff reported resident health and functional

status based on their knowledge of the resident and facility records, which may not be complete. To the extent that their knowledge is limited or biased, their reports may contain errors. Importantly, the measures of hospital and ED use were staff reports and were not verified against Medicare records. Thus, measurement error is likely, although there is no reason to think that it would affect residents with severe cognitive impairment more or less than residents without severe cognitive impairment. Third, the lack of ability to link with Medicare claims or other data means that no analyses are possible on the number of hospitalizations, potentially avoidable hospitalizations or ED use or on expenditures.

This research contributes to the scant literature on the effect of Alzheimer's disease and cognitive impairment on hospitalization and ED use among people living in RCFs. More broadly, it also helps illuminate the relationship between people living in RCFs and the acute care system. Although this study found that having severe cognitive impairment or living in a special care unit or facility that only serves people with Alzheimer's disease seems to reduce the risk of hospitalization and ED use, it was not able to address the question of whether that reduction was appropriate or how it was achieved. Data to estimate the prevalence of potentially avoidable hospitalization or ED use were not available. A striking finding of the study was that few policy or RCF organizational variables had any statistically significant effect; in general, only a few health and functional status related variables seem to be important in predicting hospitalization and ED use. Given the importance of RCFs in serving people with disabilities, especially cognitive impairment, more research is needed to address these issues.

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