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The effects of cognitive impairment on nursing home resident ED visits and hospitalizations

Caroline Stephens, PhD, MSN, RN[*,a,b], **Robert Newcomer, PhD**[b], **Mary Blegen, PhD, RN**[a], **Bruce Miller, MD**[c], and **Charlene Harrington, PhD, RN**[b]

[a]UCSF School of Nursing, Dept. of Community Health Systems

[b]UCSF School of Nursing, Dept. of Social & Behavioral Sciences

[c]UCSF School of Medicine, Dept of Neurology

Abstract

BACKGROUND—Little is known about the relationship of cognitive impairment (CI) in nursing home (NH) residents and their use of ED and subsequent hospital services.

METHODS—We analyzed 2006 Medicare claims and resident assessment data for 112,412 Medicare beneficiaries aged >65 residing in U.S. nursing facilities. We estimated the effect of resident characteristics and severity of CI on rates of Total ED Visits/year then estimated the odds of hospitalization after ED evaluation.

RESULTS—Mild CI predicted higher rates of ED visits relative to no CI and ED rates decreased as severity of CI increased. In unadjusted models, mild CI and very severe CI predicted higher odds of hospitalization after ED evaluation, however, after adjusting for other factors, severity of CI was not significant.

CONCLUSIONS—Higher rates of ED visits among those with mild CI may represent a unique marker in the presentation of acute illness and warrants further investigation.

Keywords

emergency department; hospitalization; nursing home; cognitive impairment; dementia; transitions in care; health care utilization; palliative care

Corresponding Author: Caroline Stephens, PhD, MSN, RN, 2 Koret Way, N531E, San Francisco, CA 94143-0608, Phone: 415-502-6340, Fax: 415-476-6042, Caroline.stephens@ucsf.edu.
Alternate Corresponding Author: Charlene Harrington, PhD, RN, 3333 California St., Ste. 455, San Francisco, CA 94118-0612, Phone: 415-476-4030, Fax: 415-476-6552, Charlene.harrington@ucsf.edu

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CES, RN, MB, BM and CH were involved in the conceptual formation and design of the study. CES acquired and analyzed the data and drafted the manuscript. CES, RN, MB, BM and CH reviewed and interpreted the data and participated in the critical revision of the manuscript's intellectual content.

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None

1. Introduction

Nursing home (NH) residents represent a large and growing percentage of older adults visiting the emergency department (ED), with more than 2.2 million ED visits annually.[1] This vulnerable group has higher medical acuity and complexity than non-NH residents,[1] with a three-fold increased risk of acute respiratory or gastrointestinal infection following a visit to the ED.[2] The presence of cognitive impairment (CI) can significantly complicate the care of NH residents in the ED due to frequent mood and behavioral difficulties, as well as inability to communicate symptoms and medical history.[3–6] Such complex patients commonly experience poor quality and fragmented care during transitions between care settings[7] and may do less well if sent to the hospital than if given treatment in the NH.[8] Moreover, care transitions in vulnerable groups often result in greater cognitive and functional decline, as well as iatrogenic complications such as incontinence, falls, infection, adverse drug events and even death.[9]

Thus, any care transition can place this population at higher risk for adverse outcomes and excess disability. Most studies to date have focused on hospitalizations of NH residents[10] but little is known about ED use that does not result in hospitalization, particularly among those with CI. While some ED visits and hospitalizations are inevitable and appropriate, cognitively impaired NH residents are at higher risk for potentially preventable acute care transfers than those without CI.[5,11–14] While a recent investigation found that the risk for such acute care transfers varies by the severity of CI[12], the study only examined whether any ED visit occurred and could not address the issue of repeated ED visits nor the risk of hospitalization after ED evaluation.

No studies to date have specifically examined whether these vulnerable residents, when sent to the ED, are more commonly hospitalized or returned to the facility without hospital admission. Clinical characteristics, such as feeding tube use or heart failure, may impact a NH resident's risk of having an ED visit, but not hospital admission. Like hospitalizations, frequent ED care transitions may set off a cascade of excess disability, reduce resident quality of life, and increase health care costs. Addressing conditions related to ED use during an illness episode may reduce inappropriate ED and hospital service use and improve health outcomes. This analysis extends the existing literature by describing the severity of CI and other resident characteristics of a national random sample of NH residents. By using a two-stage analytic approach, we further estimate the effect of those characteristics and severity of CI on rates of total ED visits/year, then estimate the odds of hospitalization after being evaluated in the ED.

2. Methods

2.1 Study design and population

In this retrospective cohort study, we examined Medicare administrative claims and NH resident assessment data linked by beneficiary across the continuum of care. The study cohort consisted of a 5% national random sample of Medicare beneficiaries over age 65 residing in U.S. nursing facilities with a Minimum Data Set (MDS) assessment between January 1 and December 31, 2006 (n=112,412). The first available MDS assessment with

complete MDS-COGS data was used to select the study cohort. NH residents with HMO insurance or hospice use were excluded. This study was approved by the University's Committee on Human Subjects.

2.2 Data sources

Medicare administrative claims and MDS resident assessment data were obtained from the Centers for Medicare and Medicaid Services (CMS) Chronic Conditions Data Warehouse (CCW). CCW data are linked by a unique, unidentifiable beneficiary key, which allows researchers to analyze information across the care continuum (https://www.ccwdata.org/web/guest/about-ccw). The 2006 Beneficiary Summary File, which contains beneficiary demographic and enrollment information, was linked by CCW to the 2006 MDS resident assessment data to identify a cohort of NH residents during the study year. The federally-mandated MDS is a comprehensive resident assessment completed within 2 weeks of admission to the facility, and then quarterly, annually, upon readmission and when there is a significant change in the resident's status.[15] Beneficiaries identified in the above MDS file were matched to their inpatient and outpatient claims from the 2006 Medicare Provider Analysis & Review (MEDPAR) File and Outpatient Standard Analytic Files (SAF), respectively.

2.3 Outcome measures

The three primary outcomes of interest were ED Visits With Hospitalization, ED Visits Without Hospitalization and Total ED Visits. The 2006 Inpatient MEDPAR file was used to capture ED visits by NH residents that resulted in a hospitalization. If the ED charge amount variable in the MEDPAR was not zero this indicated there was an ED visit resulting in a hospital admission (classified as a "Hospitalization"). Revenue center codes in the Outpatient SAF file were used to capture NH residents who went to the ED but were not admitted to the hospital (classified as an "ED Visit"). "Total ED Visits" was defined as any ED visit with or without hospitalization. The number of hospitalizations, ED visits and Total ED Visits were each summed as outcome measures. Outcomes were only counted after the MDS assessment was identified and then evaluated through death or end of calendar year 2006, whichever came first, and adjusted for differential exposure time.

2.4 Primary predictor of interest – severity of cognitive impairment

Severity of CI was defined using the MDS-Cognition Scale (MDS-COGS). This measure uses an 11-point summative rating of CI that ranges from 0 = cognitively intact to 10 = very severe impairment. The MDS-COGS is easier to compute, and more sensitive for capturing levels of severity of CI than the Cognitive Performance Scale (CPS), another widely used MDS cognitive measure.[16–17] Dummy variables were used for each of the 11 points on the MDS-COGS scale.

2.5 Covariates

We controlled for several resident characteristics identified in the MDS, many of which have been used in previous studies examining predictors of acute care utilization by NH residents.[3,5,10,12,18–20] Categorical covariates included sociodemographic characteristics such as sex

(male/female), race/ethnicity (white, black, other), age group (65–75, 76–85, 86+), and marital status (married, other). Additional resident categorical variables were included, such as specific diagnoses (e.g., diabetes, heart failure, emphysema/chronic obstructive pulmonary disease), depression, history of a fall in the past 30 days, and level of ADL impairment. Resident treatments/preferences were also included as categorical MDS variables (Do Not Resuscitate order; receipt of any psychotropic medications; presence of feeding tube or urinary catheter). The Changes in Health, End-Stage Disease and Symptoms and Signs (CHESS) scale, which is a MDS composite measure of clinical instability and predicts adverse outcomes including mortality among NH residents, was used as a summary case-mix control.[21] The model also included contextual factors with a known differential effect on acute care utilization including insurance status (dual eligible, private pay), and residence on a dementia special care unit (Yes/No).

2.6 Analytic approach

Descriptive statistics were used to characterize the sample of NH residents by severity of CI. Distributions and descriptive statistics were used to evaluate the distribution of outcome variables and calculate the average annual estimate of ED visits for residents with different levels of CI. Frequency counts, chi-square and Kruskal-Wallis test p-values were calculated to compare the proportion of residents that had a hospitalization or ED visit. A two-tailed t-test was used to assess the significance of the unadjusted difference between group means.

Since an initial transfer to an ED is required for both types of ED visits (with and without hospitalization), we used a two-stage modeling approach. Over-dispersed poisson regression was used to model all ED visits (e.g., total ED Visits), then logistic regression was used to model the odds of hospitalization after being evaluated in the ED. Over-dispersed poisson regression, adjusted for NH resident sociodemographic and health related characteristics, was used to examine how the rate of Total ED visits/year varied by severity of CI. Descriptive statistics showed that the variance of Total ED visits were greater than the mean, confirming over-dispersed count data. Both the zero-inflated negative binomial and over-dispersed poisson models were tested and the results revealed that the over-dispersed poission model provided a better fit of the data. An exposure offset was included in the model to account for the fact that NH residents with MDS evaluations early in the year were at risk for ED visits and/or hospitalizations for a longer period of time than NH residents with MDS evaluations later in the year. One resident was identified as having 141 ED visits without hospitalization during the study year. While theoretically possible, this data point represented an extreme outlier. Over-dispersed poisson regression outcomes are presented in person-years of observation with 95% confidence intervals. (We evaluated the models with and without the outlier and there was no appreciable change in coefficients. The final models shown exclude this extreme outlier).

Among the 49,643 NH residents evaluated in the ED, we used multivariate logistic regression to estimate the unadjusted and adjusted odd ratios of being hospitalized with 95% confidence intervals. In addition, given the potential overlap in measurement between the CHESS variable and our primary predictor and outcomes of interest, we conducted the poisson and logistic models with and without the CHESS variable. Since there was no

appreciable/meaningful change in the point estimates or direction of effect, we opted to use the analysis with the CHESS variable included as this is the customary variable used to adjust for case mix severity in this study population. All analyses were performed using SAS version 9.2.

3. Results

Table 1 shows the characteristics of NH residents according to their level of CI. Of the 112,412 NH residents included in the study, 69% were female, 9% were Black, 39% were over age 86, and 28% did not have any CI. Forty-percent of all residents were Dual Eligible (Medicare and Medicaid), 35% had depression, 27% had had a fall in the past 30 days, and 26% had severe ADL impairment. One-third of the total sample had a DNR order and 35% were taking psychotropic medications. As severity of CI increased (from MDS-COGS score of 0 to 10), there was a higher proportion of females, Blacks, dual eligibles, DNR orders, severe ADL impairment, and feeding tube use. Residents with mild-moderate CI (MDS-COGS scores 3–6) had the highest rates of depression and residents with moderate/severe CI (MDS-COGS scores 7–9) had the highest rates of private pay status, psychotropic drug use and residence on a special care unit. NH residents had a higher average number of ED visits *without* hospitalization than *with* hospitalization/year (1.89 vs. 1.66). About 8% of the study sample had 3 or more ED visits without hospitalization during the study year (data not shown).

Table 2 shows the poisson regression model results according to characteristics of study NH residents. After adjusting for resident sociodemographics, insurance status, diagnoses/conditions, treatments and preferences, mild CI (MDS-COGS score 1–3) was predictive of higher rates of total ED visits compared to no CI and ED visit rates decreased as severity of CI increased. Factors associated with higher rates of total ED visits included: male sex [IRR=1.14(1.12–1.17)]; black race [IRR=1.18(1.15–1.21)]; married marital status [IRR=1.05(1.02–1.07)]; diabetes [IRR=1.22(1.20–1.24)]; heart failure [IRR=1.33(1.30–1.35)]; emphysema/COPD [IRR=1.34(1.31–1.37)]; history of fall in the past 30 days [IRR=1.20(1.18–1.22)]; FT present [IRR=1.73(1.67–1.80)]; any urinary catheter use [IRR=1.22(1.19–1.25)]; and psychotropic medication use [IRR=1.14(1.12–1.16). Moderate and severe CHESS score and ADL impairment categories were also predictive of higher rates of total ED visits compared to those with a mild CHESS score or level of ADL impairment.

Table 3 shows the logistic regression results modeling the odds of hospitalization among NH residents evaluated in the ED (n=49,643). In the unadjusted logistic regression, only mild CI (MDS-COGS = 1) and very severe CI (MDS-COGS = 10) were predictive of higher odds of hospitalization after an ED visit, compared to no CI [AOR=1.07(1.01–1.14), AOR=1.23(1.09–1.39), respectively]. However, after adjusting for covariates, severity of CI was not significantly associated with higher odds of hospitalization. Compared to those without CI, NH residents with more advanced CI (MDS-COGS=8–9) were more likely to be seen in the ED and returned to the SNF without being hospitalized.

Factors associated with higher odds of hospitalization after being evaluated in the ED included: male sex [IRR=1.10(1.06–1.15)]; black race [IRR=1.16(1.09–1.24)]; advanced age [age 76–85 IRR=1.07(1.02–1.13); age 86+ IRR=1.11(1.05–1.17)]; diabetes [IRR=1.11(1.07–1.16)]; heart failure [IRR=1.31(1.25–1.37)]; emphysema/COPD [IRR=1.26(1.20–1.32)]; severity of ADL impairment [moderate ADL, IRR=1.24(1.18–1.31); severe ADL, IRR=1.59(1.49–1.71)]; and any urinary catheter use [IRR =1.11(1.06–1.17)]. Among the NH residents evaluated in the ED, those with depression [IRR=.92(.89–.96)], history of falls [IRR=.92(.88–.96)], DNR order [IRR=.81(.78–.84)], and psychotropic medications [IRR=.96(.93–.99)] had lower odds of being hospitalized than those residents without those conditions.

4. Discussion

To our knowledge, this is the first study to describe the characteristics of a national random sample of NH residents by the severity of their CI and estimate the effect of those characteristics and severity of CI on rates of ED visits and odds of hospitalization after being evaluated in the ED. We found there was a higher average number of ED visits *without* hospitalization than *with* hospitalization/year, with 8% of the study sample having had 3+ ED visits without hospitalization in 2006. After adjusting for covariates, mild CI (MDS-COGS score 1–3) was predictive of higher rates of total ED visits compared to no CI, and ED rates decreased as severity of CI increased. Severity of CI, however, was not significantly associated with higher odds of hospitalization after being evaluated in the ED. Compared to those without CI, NH residents with more advanced CI (MDS-COGS=8–9) were more likely to be seen in the ED and returned to the SNF without being hospitalized.

Most previous studies have examined NH resident acute care utilization using CI as a dichotomous predictor and generally found a lower risk of hospitalization among those with CI.[22,23] Only one prior investigation has examined the effect of severity of CI on any ED visit and any potentially preventable ED visit,[12] but did not differentiate between evaluation in the ED and subsequent odds of hospitalization. This current study demonstrates NH residents with mild CI have higher rates of total ED visits compared to those without CI, and that there are fewer total ED visits among those with more severe CI. Moreover, advanced CI appears, in fact, to be protective against odds of being hospitalized.

Such differential acute care utilization patterns based on severity of CI, particularly among residents with mild CI, may indicate that residents, families and providers prefer to more aggressively treat acute illnesses or exacerbations of chronic disease in early stage CI. Alternatively, there might not necessarily be an explicit preference for more aggressive care, rather under-recognition of mild CI (MCI) and the role it may play in the presentation of acute disease. The early neuropsychiatric symptoms often common in MCI (e.g., depression, apathy, irritability),[24] may create an unstable clinical picture and greater uncertainty regarding how best to treat an acute illness thereby leading to an ED transfer[12]. Evidence suggests that persons with MCI exhibit behavioral challenges which negatively influence caregiver well-being.[25] Further research is needed to determine which unique clinical features of persons with MCI contribute to greater ED use and how behavioral symptoms of dementia, particularly in the early stages, impact NH caregivers and rates of ED transfers.

Consistent with earlier studies[12], the findings that rates of total ED visits and odds of hospitalization after ED evaluation decrease with increased severity of CI may be related to differential intensity of care based on the recognition of the negative consequences of a hospital stay in this vulnerable group. While advanced directives are uncommon in advanced dementia,[26] the treatment pattern found in this study may reflect family and provider desire to more aggressively treat illness in the earlier stages of CI before assuming a more comfort/palliative approach in the final stages of dementia.

Across all factors in the model, severe ADL impairment had the greatest influence on the odds of hospitalization after being evaluated in the ED. Concerned that severity of ADL impairment was highly correlated with CI thereby resulting in shared variance and diminishing effect of CI in the model, we tested for an interaction. The interaction term was statistically significant, however it had too little clinical or substantive effect to be of practical or meaningful value. Thus, study findings, leaving both measures in the model, are consistent with prior research suggesting that those with more functional impairment are at higher risk for hospitalization.[27–29]

While numerous studies question the utility and appropriateness of using feeding tubes (FTs) in persons with advanced CI,[30–33] we found that the proportion of NH residents with FTs more than tripled in advanced dementia from 9.9% (MDS-COGS=8) to 33.8% (MDS-COGS score=10). Extrapolating from our 5% random sample, this suggests that over 24,000 tube-fed NH residents in the U.S. are in the very end-stages of dementia, essentially comatose or without any discernable consciousness. Moreover, we found that tube-fed NH residents had 73% higher rates of total ED visits, but once evaluated in the ED this group was no more likely to be hospitalized than those without FTs. Previous studies suggest that there is wide regional variability in the use of FTs and associated rates of acute care visits, [31].[12] This is the first study, however, to find that tube-fed NH residents have higher rates of total ED visits but no higher odds of hospitalization compared to those without FTs. Such a pattern of ED utilization may be related to FT complications, such as clogs or dislodgement that do not require hospitalization. Frequent visits to the ED are not only costly, but may be deleterious to the health and quality of life of an already frail population. Additional research is needed to delineate the potential burdens and causes of acute care transfers among persons with FTs and different levels of CI.

Study findings support the body of evidence suggesting that providers need to improve communication and shared decision making with cognitively impaired NH residents and their families regarding goals of care, especially related to the natural progression of dementia and associated eating difficulties.[33–34] The high rates of ED transfers among tube-fed NH residents found in this study may further help providers educate residents and families regarding the many potential burdens of FTs in persons with CI. Moreover, improving the quality and nature of communication, as well as care coordination with the ED, may reduce the ED churning and hopefully reduce these often burdensome transitions at the end of life.

There is growing recognition of the pivotal role of the ED in preventing hospitalizations as well as hospital readmissions - a focus of health care reform. Evidence suggests that ED care

providers can play an important role in supporting early palliative care interventions along a patient's disease trajectory, promoting quality of life, as well as reducing treatment costs.[35–38] These studies indicate that ED palliative care interventions may improve timely provision of care, improve care outcomes, increase direct hospice referrals, decrease lengths of stay, improve patient/family satisfaction, and reduce intensive care utilization and costs. Additional research is needed to evaluate the effect of such interventions with frail NH residents, such as those with FTs and CI, who may frequently visit the ED.

This study has a few notable limitations. Medicare claims records do not contain information regarding services not billed to Medicare. In addition, most claims data do not include information for beneficiaries enrolled in a Medicare managed care plan. We opted to exclude 17,055 NH residents with HMO insurance due to the risk of incomplete data, as well as known differential effects of HMO status on acute care utilization. Consequently, study results are only generalizable to the fee-for-service NH population. Lastly, this study did not include many of the organizational, market or policy factors frequently associated with hospitalization of NH residents in general and cognitively impaired residents in particular.[3,5,10] Future research should examine how these factors influence ED use (without hospital admission) in this patient population.

4.1 Conclusion

While much of the current health reform debate and policy focus has centered around reducing NH resident hospitalizations, this is the first study to demonstrate in a national random sample of NH residents that there was a higher average number of ED visits without hospitalization than with hospitalization/year, with 8% of the study sample having had 3+ ED visits without hospitalization. Moreover, this study found that resident severity of CI differentially impacts rates of total ED visits and odds of hospitalization after being evaluated in the ED. The higher rates of ED visits among those with MCI may represent a unique marker in the presentation of acute illness and warrants further investigation.

Cognitively impaired NH residents are very vulnerable to decline with frequent transitions in care[9] and may fare better if given treatment in the NH[8]. Identifying and addressing the unique needs of these high-risk populations, particularly those with MCI, may result in better, more appropriate use of ED and hospital services, and improved health outcomes. Moreover, the ED is playing an increasingly important role in how hospitals are responding to health care reform efforts to avoid Medicare readmissions penalties, and warrants greater attention from policy makers, researchers and clinicians, particularly as it relates to early palliative care interventions.

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Research in Context

Systematic review

We searched PubMed for English-language original research that examined the effect of nursing home (NH) resident severity of cognitive impairment on hospitalization or emergency department (ED) visits. One study was identified [12], however, this study included hospitalizations in their ED outcome variables.

Interpretation

We describe the characteristics of a national random sample of NH residents by the severity of their CI and estimate the effect of those characteristics and severity of CI on rates of ED visits and odds of hospitalization after being evaluated in the ED. Mild CI was predictive of higher rates of total ED visits, and rates decreased as severity of CI increased. Unadjusted results revealed only mild CI and very severe CI were predictive of higher odds of being hospitalized after ED evaluation. After adjusting for covariates, severity of CI was not significantly associated with higher odds of being hospitalized.

Future directions

Higher rates of ED visits among those with mild CI may represent a unique marker in the presentation of acute illness and warrants further investigation.

Table 1

Characteristics of Nursing Home Residents[a] According to Level of Cognitive Impairment[b] (n=112,412)

Characteristic	Total Sample	Severity of Cognitive Impairment (MDS-COGS)										
	n=112412, %	0 n=31491, %	1 n=13256, %	2 n=11968, %	3 n=10485, %	4 n=10025, %	5 n=9298, %	6 n=6258, %	7 n=7367, %	8 n=5136, %	9 n=3591, %	10 n=3537, %
Sociodemographics												
Sex												
Female	68.9	68.7	67.4	67.6	67.3	68.4	67.0	69.0	71.3	71.8	74.1	76.8
Male	31.1	31.3	32.6	32.4	32.7	31.6	33.0	31.0	28.7	28.2	25.9	23.2
Race/Ethnicity												
White	87.3	90.9	88.7	88.1	87.8	85.9	84.2	84.6	85.5	83.5	82.7	76.9
Black	9.3	6.4	8.2	8.5	8.9	10.5	11.6	11.6	10.9	13.0	13.4	16.6
Other	3.4	2.7	3.1	3.4	3.2	3.6	4.1	3.8	3.5	3.5	3.9	6.5
Age Group												
65–75	19.6	28.9	23.3	18.2	16.3	15.6	13.5	12.1	10.8	10.8	12.8	16.9
76–85	41.0	44.4	42.5	40.7	40.6	38.5	38.4	38.7	38.0	38.2	37.5	39.6
86+	39.4	26.7	34.2	41.0	43.2	45.9	48.1	49.2	51.2	51.1	49.7	43.5
Marital Status												
Married	24.8	30.8	25.7	22.2	21.4	19.9	21.6	22.3	23.5	22.4	21.6	22.4
Widowed	53.7	55.8	54.7	55.4	53.9	53.7	51.7	52.8	52.5	50.7	48.6	43.4
Other	21.5	13.4	19.6	22.5	24.7	26.4	26.7	24.9	24.0	26.9	29.8	34.2
Insurance Status												
Dual Eligible	40.4	24.4	36.2	42.3	45.6	49.7	49.7	49.2	48.3	52.2	55.9	64.8
Private Pay	6.2	3.3	4.6	6.5	7.1	7.8	8.6	8.5	9.8	9.0	9.6	5.5
Resident Diagnoses & Conditions												
Diabetes	29.3	31.1	32.4	30.8	29.7	29.5	28.0	27.3	24.9	23.9	23.8	26.0
Heart Failure	20.1	20.3	23.8	23.9	22.6	20.3	18.9	18.4	16.0	14.8	14.6	12.1
Emphysema/COPD	16.7	20.0	20.3	18.7	17.2	15.3	14.1	13.7	11.7	10.7	8.9	7.9
Depression	34.8	24.6	32.3	38.1	42.1	42.4	41.6	41.9	39.5	39.1	37.8	30.3
History of Fall in Last 30 Days	27.3	27.2	28.0	28.5	28.8	28.6	28.6	29.7	30.4	25.5	18.0	9.4

Characteristic	Total Sample	Severity of Cognitive Impairment (MDS-COGS)										
	n=112412, %	0 n=31491, %	1 n=13256, %	2 n=11968, %	3 n=10485, %	4 n=10025, %	5 n=9298, %	6 n=6258, %	7 n=7367, %	8 n=5136, %	9 n=3591, %	10 n=3537, %
CHESS Category												
Mild (0)	36.2	28.5	33.3	36.4	38.0	39.9	39.2	39.7	40.8	42.8	46.4	55.5
Moderate (1–3)	61.9	71.3	66.0	61.8	59.4	57.1	57.4	56.8	56.0	53.5	50.7	42.4
Severe (4–5)	1.9	0.2	0.8	1.8	2.6	3.0	3.4	3.5	3.2	3.6	2.9	2.1
ADL Impairment												
Mild (0–7)	16.3	22.4	20.2	21.3	19.5	17.6	12.7	6.9	6.1	2.1	0.2	0.0
Moderate (8–14)	57.5	73.2	64.5	64.3	61.9	59.1	54.8	44.2	46.4	25.4	8.4	0.9
Severe (15–20)	26.2	4.3	15.3	14.4	18.6	23.3	32.5	48.9	47.5	72.5	91.5	99.1
Treatments & Preferences												
Do Not Resuscitate Order	33.0	22.9	28.3	33.0	34.5	36.6	38.6	40.9	42.9	44.9	47.4	45.6
Feeding Tube Present	4.6	1.4	2.3	2.3	3.0	2.9	4.2	6.8	6.1	9.9	15.4	33.8
Any Urinary Catheter Use	15.8	16.7	17.0	15.2	14.6	13.5	14.1	16.4	14.2	16.0	16.8	20.2
Psychotropic Medications	35.3	28.8	31.7	32.7	35.2	39.1	42.4	42.8	46.1	47.7	42.2	26.6
Dementia Special Care Unit	4.6	0.1	0.4	1.0	2.7	5.2	10.0	10.3	14.5	14.5	12.5	9.7

[a] Sample based on person years of observation

[b] All characteristics were significantly different across all levels of CI (p<.0001)

Table 2

Rates of Total ED visits/Year According to Characteristics of Nursing Home Residents (n=112,119)

Characteristic	Total ED Visits Incident Rate Ratio (95% CI[&])	
	Unadjusted	Adjusted[a]
Severity of Cognitive Impairment[b]		
0	ref	ref
1	1.07(1.04–1.10)***	1.08(1.06–1.12)***
2	1.01(0.97–1.04)	1.06(1.03–1.10)***
3	0.99(0.95–1.02)	1.05(1.02–1.09)**
4	0.92(0.89–0.95)***	1.02(0.98–1.05)
5	0.92(0.89–0.95)***	1.02(0.99–1.06)
6	0.93(0.89–0.97)**	1.02(0.98–1.07)
7	0.89(0.85–0.92)***	1.02(0.97–1.06)
8	0.84(0.80–0.88)***	0.96(0.91–1.00)
9	0.75(0.71–0.80)***	0.86(0.81–0.92)***
10	0.75(0.71–0.80)***	0.79(0.74–0.84)***
Sociodemographics		
Sex		
Female	ref	ref
Male	1.27(1.25–1.29)***	1.14(1.12–1.17)***
Race/Ethnicity		
White	ref	ref
Black	1.20(1.16–1.23)***	1.18(1.15–1.21)***
Other	1.00(0.95–1.05)	0.98(0.93–1.03)
Age Group		
65–75	ref	ref
76–85	0.89(0.87–0.91)***	0.95(0.93–0.97)***
86+	0.77(0.75–0.78)***	0.90(0.88–0.92)***
Marital Status		
Married	1.22(1.20–1.25)***	1.05(1.02–1.07)***
Other[c]	ref	ref
Insurance Status		
Dual Eligible	0.90(0.88–0.92)***	0.93(0.91–0.95)***
Private Pay	0.70(0.67–0.73)***	0.78(0.74–0.81)***
Resident Diagnoses & Conditions		
Diabetes	1.34(1.32–1.37)***	1.22(1.20–1.24)***
Heart Failure	1.48(1.45–1.51)***	1.33(1.30–1.35)***

	Total ED Visits Incident Rate Ratio (95% CI[&])	
Characteristic	**Unadjusted**	**Adjusted[a]**
Emphysema/COPD	1.54(1.51–1.57)***	1.34(1.31–1.37)***
Depression	0.93(0.91–0.95)***	0.97(0.95–0.99)**
History of Fall in Last 30 Days	1.25(1.22–1.27)***	1.20(1.18–1.22)***
CHESS Category		
Mild (0)	ref	ref
Moderate (1–3)	1.30(1.27–1.32)***	1.16(1.14–1.18)***
Severe (4–5)	1.61(1.50–1.72)***	1.32(1.24–1.42)***
ADL Impairment		
Mild (1–7)	ref	ref
Moderate (8–14)	1.19(1.16–1.22)***	1.08(1.05–1.12)***
Severe (15–20)	1.13(1.10–1.17)***	1.05(1.01–1.08)**
Treatments & Preferences		
Do Not Resuscitate Order	0.89(0.88–0.91)***	0.91(0.89–0.93)***
Feeding Tube Present	1.72(1.66–1.78)***	1.73(1.67–1.80)***
Any Urinary Catheter Use	1.47(1.44–1.51)***	1.22(1.19–1.25)***
Psychotropic Medications	1.10(1.08–1.12)***	1.14(1.12–1.16)***
Dementia Special Care Unit	0.64(0.61–0.67)***	0.78(0.75–0.82)***

[&]Confidence Interval

[a]Adjusted for sex, race/ethnicity, age, marital status, insurance status, diagnoses/conditions, ADL impairment, treatments/preferences

[b]Joint test of significance of 10 dummy CI variables type 3 p-value <.0001

[c]Other = Single, Never Married, Widowed, Divorced

*p≤.05;

**p≤.001;

***p≤.0001

Table 3

Odds of Being Hospitalized Among Those Nursing Home Residents Evaluated in the ED (n=49,643)

Characteristic	Odds of Hospitalization Odds Ratio (95% CI[&])	
	Unadjusted	Adjusted[a]
TOTAL		
Severity of Cognitive Impairment[b]		
0	ref	ref
1	1.07(1.01–1.14)**	1.05(0.99–1.12)
2	0.99(0.93–1.05)	1.01(0.94–1.07)
3	0.92(0.86–0.98)**	0.95(0.89–1.02)
4	0.90(0.84–0.97)**	0.95(0.88–1.02)
5	0.91(0.85–0.98)**	0.94(0.87–1.01)
6	1.01(0.93–1.09)	0.99(0.90–1.08)
7	0.92(0.85–0.99)**	0.93(0.86–1.02)
8	0.95(0.87–1.05)	0.90(0.81–1.00)*
9	0.95(0.85–1.06)	0.85(0.75–0.97)**
10	1.23(1.09–1.39)**	1.04(0.91–1.19)
Sociodemographics		
Sex		
Female	ref	ref
Male	1.16(1.12–1.20)***	1.10(1.06–1.15)***
Race/Ethnicity		
White	ref	ref
Black	1.20(1.13–1.27)***	1.16(1.09–1.24)***
Other	1.19(1.07–1.31)**	1.18(1.07–1.31)**
Age Group		
65–75	ref	ref
76–85	1.03(0.99–1.08)	1.07(1.02–1.13)*
86+	1.00(0.96–1.06)	1.11(1.05–1.17)**
Marital Status		
Married	1.10(1.05–1.14)***	0.99(0.95–1.03)
Other[c]	ref	ref
Insurance Status		
Dual Eligible	0.83(0.80–0.86)***	0.81(0.78–0.84)***
Private Pay	0.65(0.60–0.71)***	0.71(0.65–0.78)***
Resident Diagnoses & Conditions		

Characteristic	Odds of Hospitalization Odds Ratio (95% CI[&])	
	Unadjusted	Adjusted[a]
Diabetes	1.17(1.13–1.22)***	1.11(1.07–1.16)***
Heart Failure	1.38(1.32–1.43)***	1.31(1.25–1.37)***
Emphysema/COPD	1.29(1.23–1.35)***	1.26(1.20–1.32)***
Depression	0.86(0.83–0.89)***	0.92(0.89–0.96)***
History of Fall in Last 30 Days	0.94(0.90–0.97)**	0.92(0.88–0.96)***
CHESS Category		
Mild (0)	ref	ref
Moderate (1–3)	1.09(1.05–1.13)***	1.01(0.97–1.05)
Severe (4–5)	0.95(0.83–1.09)	0.87(0.75–1.00)
ADL Impairment		
Mild (1–7)	ref	ref
Moderate (8–14)	1.31(1.24–1.37)***	1.24(1.18–1.31)***
Severe (15–20)	1.58(1.49–1.67)***	1.59(1.49–1.71)***
Treatments & Preferences		
Do Not Resuscitate Order	0.81(0.78–0.84)***	0.81(0.78–0.84)***
Feeding Tube Present	1.28(1.19–1.38)***	1.02(0.93–1.11)
Any Urinary Catheter Use	1.29(1.23–1.35)***	1.11(1.06–1.17)***
Psychotropic Medications	0.90(0.87–0.93)***	0.96(0.93–.99)*
Dementia Special Care Unit	0.72(0.66–0.79)***	0.89(0.81–0.98)

[&]Confidence Interval

[a]Adjusted for sex, race/ethnicity, age, marital status, insurance status, diagnoses/conditions, ADL impairment, treatments/preferences

[b]Joint test of significance of 10 dummy CI variables type 3 p-value <.01

[c]Other = Single, Never Married, Widowed, Divorced

*p≤.05;

**p≤.001;

***p≤.0001