Disproportionate Effects of Dementia on Hospital Discharge Disposition in Common Hospitalization Categories

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BACKGROUND: The impact of dementia on hospitalization discharge dispositions (HDDs) in the United States has not been quantified, and dementia prevalence in various hospitalization categories has not been detailed in recent years.

OBJECTIVE: To characterize hospitalizations prevalent with dementia, and to examine the relationship between dementia and HDDs.

DESIGN: A retrospective cross-sectional study.


PATIENTS: Hospitalizations in persons ≥65 years old assigned to 1 of 12 Diagnosis Related Groups (DRGs) with a high number of dementia patients.

INTERVENTION: None.

MEASUREMENTS: The databases were queried for 12 DRGs (versions 18/24). Predictor effects for dementia on HDD categories were modeled adjusting for other defined comorbidities/covariates using logistic regression. Adjusted predictor effects of dementia on HDD in the DRG groupings were determined. Dementia prevalence and trends were assessed.

RESULTS: Increasing proportions of dementia were noted in 4 DRGs studied. Dementia was strongly associated with being discharged to a nonhome setting. The most marked dementia effects were noted in DRGs 174 (gastrointestinal hemorrhage), 88 (chronic obstructive pulmonary disease), 182 (esophagitis/gastroenteritis), 138 (cardiac arrhythmias), 127 (congestive heart failure), and 89 (simple pneumonia and pleurisy), where there was at least a 76% reduction in the adjusted odds ratio (0.18–0.24) for home discharge. In contrast, DRGs 14 (stroke), 79 (respiratory infections/inflamations), and 320 (kidney/urinary infections) had a smaller reduction in dementia-associated adjusted odds ratio (0.41–0.46) for home discharge. DRGs 79 and 320 had the highest proportions of dementia (>10%).

CONCLUSIONS: Dementia proportions in many hospitalization categories have increased. The variable effect of dementia on home discharge suggests that dementia has a differential influence on hospital discharge disposition depending on the DRG. These findings have implications for healthcare allocation and long-term care planning.

common acute medical conditions and which diagnoses impact substantially the likelihood of discharge to home? Awareness of the prevalence of dementia comorbidity with conditions that generate hospitalization can provide a stimulus for institutions to allocate appropriate resources to address the special needs of persons with cognitive impairment. Hospitalists and providers at all levels of care armed with this information can adapt their practices and interventions to influence outcomes and transitions in care.

METHODS

Basic Data and Design
We performed a retrospective cross-sectional study of hospitalized patients using the National Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project (HCUP), which contains annual hospital discharge data from a stratified, random sample of hospitals across the United States. Data fields include diagnostic fields, procedure codes, age, sex, race, total charges, length of stay (LOS), admission source, and disposition status. The database for each year accessed contains hospital discharges accounting for 36,417,575 (2000) to 39,008,298 (2010) discharges per year. These databases for the years 2000 through 2012 allowed for examination of recent temporal trends in dementia, and assessment of dementia’s association with discharge status after adjusting for relevant covariates.

Case Selection and Classification, and Data Elements
We defined dementia on the basis of International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9) codes for dementia described by Quan et al. (331.2, 290.8 and 294.1) or Alzheimer’s disease (ICD-9 331.0). These ICD-9 codes being present in any diagnosis field classified the hospitalization as having dementia as a comorbidity. All databases used in this study had Diagnosis Related Groups (DRGs) coding for version 18 and the similar DRG version 24. Both DRG versions were used to tabulate the frequency of dementia coding by DRG. Twelve medical DRGs that were among the 20 highest number of dementia coding diagnoses for each year were identified. Orthopedic DRGs, degenerative nervous system disorders, organic disturbances and mental retardation, psychoses, and rehabilitation DRGs were excluded from the study to focus on medical disorders without dementia as a component of the principal diagnosis. The DRGs for sepsis were also excluded, because significant change in the coding relating to mechanical ventilation duration were made on later DRG versions during the study period, making comparisons between different study years difficult. The DRGs chosen as inclusion criteria were 79 (respiratory infections and inflammations [non–community-acquired pneumonia], 320 (kidney and urinary tract infections [UTI] age >17 years with complications or comorbidities [CC]), 141 (syncope and collapse with complications, comorbidities [syncope]), 14 (intracranial hemorrhage and stroke with infarction [stroke]), 89 (simple pneumonia and pleurisy age >17 years with CC [community-acquired pneumonia]), 127 (heart failure and shock [CHF]), 88 (chronic obstructive pulmonary disease [COPD]), 138 cardiac arrhythmias and conduction disorders [arrhythmia]), 316 (kidney failure [AKI]), 182 (esophagitis/gastroenteritis age >17 years with CC [enteritis]), 174 (gastrointestinal hemorrhage with CC [GI bleed]), and 296 (nutritional and miscellaneous metabolic disorders [dehydration]). Only hospitalizations of patients aged ≥65 years were included, as geriatric patients were of primary interest.

The Charlson comorbidities as updated by Quan et al. (12 comorbidities) were queried using published enhanced ICD-9 algorithms. Also tabulated were Alzheimer’s disease (ICD-9 331.0) and falls (E880–E888). The primary reimbursement status coded as Medicaid or self-pay was considered a field of interest, as it reflects socioeconomic status. Medicare as the sole reimbursement source was also considered a field of interest, as this influences the hospital LOS requirement prior to reimbursable skilled nursing facilities (SNF) transfer. Discharges were grouped into expired, discharge to home, transfers to SNF, and discharge to another acute-care facility. Admission source from an SNF was identified.

Data Handling, Statistical Analysis, and Graphical Representation
The number of hospitalizations with dementia coding for each DRG was tabulated for each year. Negative binomial regression was performed using SAS for version 9.1 (SAS Institute, Cary, NC) for Windows (Microsoft Corp., Redmond, WA) to analyze time (year) effect for dementia in each DRG using the GENMOD procedure, taking into account the total number of hospitalizations for that DRG as the offset variable as previously described.

Most summary data generation and all logistic regression analyses were performed using SPSS for Windows version 13 (SPSS Inc., Chicago, IL). Multinomial logistic regression was performed to determine the degree to which dementia influenced the odds of being discharged home using SNF discharges as the reference group, with adjustment for other variables. The predictor variables included the updated Charlson comorbidities and gender. As all patients chosen were age 65 years or older, this Charlson predictor variable was not part of the primary model. Expanded models added predictor variables: admission source from SNF, decade of age, calendar year, Medicaid or self-pay status (socioeconomic status), Medicare alone status, and coding for a fall (E880–E888). Model fit was examined. Regression analyses were performed without race, an identifier missing in a significant number of discharges (14%–28% per year).
TABLE 1. General Characteristics of Study Hospitalizations

<table>
<thead>
<tr>
<th>DRG</th>
<th>Descriptor</th>
<th>Total No.</th>
<th>Average LOS</th>
<th>Median LOS</th>
<th>Discharge Dispositions (Dementia/Non-dementia)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Dementia</td>
<td>No Dementia</td>
<td>Dementia</td>
<td>No Dementia</td>
</tr>
<tr>
<td>79</td>
<td>Non–community-acquired pneumonia</td>
<td>415,127</td>
<td>1,958,315</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>Stroke</td>
<td>379,725</td>
<td>4,089,142</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>320</td>
<td>Urinary tract infection</td>
<td>540,994</td>
<td>2,899,678</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>141</td>
<td>Syncope</td>
<td>173,325</td>
<td>1,705,651</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>296</td>
<td>Dehydration</td>
<td>341,681</td>
<td>2,894,380</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>316</td>
<td>Acute kidney injury</td>
<td>243,264</td>
<td>2,612,594</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>89</td>
<td>Community-acquired pneumonia</td>
<td>591,555</td>
<td>6,530,468</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>182</td>
<td>Enteritis</td>
<td>167,677</td>
<td>3,430,585</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>88</td>
<td>Chronic obstructive pulmonary disease</td>
<td>183,466</td>
<td>5,654,675</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>127</td>
<td>Congestive heart failure</td>
<td>397,838</td>
<td>9,012,723</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>174</td>
<td>Gastrointestinal bleeding</td>
<td>233,665</td>
<td>3,482,551</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>138</td>
<td>Arrhythmia</td>
<td>162,629</td>
<td>3,279,538</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

NOTE: Twelve DRG dementia proportions, LOS, and dispositions: Non–community-acquired pneumonia (respiratory infections and inflammations), stroke = cerebrovascular accident (intracranial hemorrhage and stroke with infarction), urinary tract infections (kidney and urinary tract infections age >17 years with complications or comorbidities), syncope (syncope and collapse with CC), dehydration (nutritional and miscellaneous metabolic disorders), acute kidney injury (kidney failure), community-acquired pneumonia (simple pneumonia and pleurisy age >17 years with CC), enteritis = gastrointestinal disorders (esophagitis/gastroenteritis age >17 years with CC), congestive heart failure (heart failure and shock), gastrointestinal bleeding (gastrointestinal hemorrhage with CC), and arrhythmias = cardiac arrhythmias and conduction disorders. Transfer = transfer to a different acute-care facility. Abbreviations: CC, complications or comorbidities; DRG, Diagnosis Related Group; LOS, length of stay; SNF, skilled nursing facility.

RESULTS

General DRG Characteristics

The 12 DRG hospitalization dementia proportions are shown in Tables 1 and 2. The DRG hospitalizations studied constituted 29.8% of all hospitalizations in patients aged ≥65 years. The greatest number of hospitalizations was for DRG127 (CHF) and the least for DRG141 (syncope). The highest cumulative proportions of dementia codings (>13%) were associated with DRG79 (respiratory infections and inflammations [non–community-acquired pneumonia]) and DRG320 (urinary tract infections age >17 years with CC [UTI]) (Table 2). The cumulative proportions (for all years) of dementia codings encompassing all years were between 5% and 11% in DRG141 (syncope), DRG89 (community-acquired pneumonia), DRG316 (AKI), DRG174 (GI bleed), DRG296 (dehydration), and DRG14 (stroke). DRGs 88 (COPD), 182 (enteritis), 138 (arrhythmia), and 127 (CHF) had cumulative proportions >3% but <5%.

Patients hospitalized with dementia were older, had a higher proportion of females (range, 50.8%–73.9% dementia; range, 46.9%–69.8% nondementia), and had more falls (range, 1.5%–14.6% dementia; range, 0.9%–14.5% nondementia). The median LOS was 1 day greater for hospitalizations with dementia coding for DRGs 14 (stroke), 89 (community-acquired pneumonia), 138 (arrhythmia), 182 (enteritis), and 296 (dehydration) (Table 1).

Temporal Characteristics

Using negative binomial regression, a significant positive time effect for dementia (ie, a greater proportion of dementia hospitalizations was noted with more recent years) was observed in DRGs 316 (AKI), 127 (CHF), 182 (enteritis), and 88 (COPD) (Table 2). Negative time effects (ie, a lower proportion of dementia hospitalizations was noted with more recent years) were noted for DRGs 79 (non–community-acquired pneumonia), 89 (community-acquired pneumonia), 174 (GI bleed), and 296 (dehydration) (Table 2).

Multivariate Effects of Dementia on Discharge Disposition

Nominal regression, using the Charlson comorbidities/comorbidities only, showed that the presence of dementia was associated with an adjusted odds ratio of <0.5 (0.18–0.46) for being discharged home for all DRGs (Table 3). For DRGs 174 (GI bleed), 88 (COPD),...
We found that dementia comorbidity strongly predicts nonhome discharge locations for a number of chronic conditions such as CHF and COPD. These findings could help inpatient and outpatient providers better anticipate post–acute-care needs. In addition, the increases in dementia-associated admissions for CHF and COPD highlight the need to understand how the growing dementia population may impact hospitals’ public reporting (and penalties) of hospital readmissions or ambulatory care-sensitive hospitalization. The prevalence of dementia over time changed for particular DRGs. We found hospitalizations for CHF and COPD DRGs to have an increase in dementia proportions over time. CHF and COPD are conditions with a prevalence of dementia comorbidity among Medicare recipients of 16% to 17%. These 2 diagnoses, as well as dementia, have been shown to have statistical predictor effects for acute ambulatory-care sensitive hospitalizations. Ambulatory care-sensitive conditions and nursing home–sensitive avoidable conditions are proposed indicators/classifiers of hospitalizations that could have been avoided by care in their respective nonhospital settings. The increasing dementia proportion over time in both CHF and COPD DRGs suggests that dementia may increasingly contribute to avoidable hospitalizations. The decrease in dementia proportion over time was in conditions that could be characterized as acute conditions (community-acquired pneumonia, non–community-acquired pneumonia, dehydration, and GI bleed), whereas the conditions with increasing dementia over time included at least 2 chronic conditions, namely CHF and COPD. It is not known why AKI and enteritis should also be associated with increasing dementia over time. These patterns may reflect differences in management. For example, certain acute conditions in

<p>| TABLE 3. Adjusted Odds Ratios With 95% Confidence Interval for the Predictive Effect of Dementia on Home Discharge |
|---------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>DRG</th>
<th>% Predicted</th>
<th>OR</th>
<th>95% CI</th>
<th>% Predicted</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non–community-acquired pneumonia</td>
<td>79</td>
<td>61.2</td>
<td>0.46</td>
<td>0.46–0.47</td>
<td>64.9</td>
<td>0.51</td>
</tr>
<tr>
<td>Stroke</td>
<td>14</td>
<td>61.9</td>
<td>0.46</td>
<td>0.46–0.47</td>
<td>65.5</td>
<td>0.55</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>320</td>
<td>59.4</td>
<td>0.41</td>
<td>0.40–0.41</td>
<td>63.3</td>
<td>0.45</td>
</tr>
<tr>
<td>Syncope</td>
<td>141</td>
<td>79.4</td>
<td>0.34</td>
<td>0.34–0.34</td>
<td>80.2</td>
<td>0.39</td>
</tr>
<tr>
<td>Dehydration</td>
<td>296</td>
<td>66.5</td>
<td>0.31</td>
<td>0.31–0.31</td>
<td>68.5</td>
<td>0.36</td>
</tr>
<tr>
<td>Acute kidney injury</td>
<td>316</td>
<td>65.2</td>
<td>0.28</td>
<td>0.28–0.28</td>
<td>68.4</td>
<td>0.35</td>
</tr>
<tr>
<td>Community-acquired pneumonia</td>
<td>89</td>
<td>70.1</td>
<td>0.24</td>
<td>0.24–0.24</td>
<td>72.1</td>
<td>0.30</td>
</tr>
<tr>
<td>Enteritis</td>
<td>182</td>
<td>82.3</td>
<td>0.22</td>
<td>0.21–0.22</td>
<td>83.2</td>
<td>0.28</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>88</td>
<td>82.2</td>
<td>0.21</td>
<td>0.21–0.22</td>
<td>82.9</td>
<td>0.29</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>127</td>
<td>75.3</td>
<td>0.27</td>
<td>0.27–0.27</td>
<td>76.8</td>
<td>0.33</td>
</tr>
<tr>
<td>Gastrointestinal bleeding</td>
<td>174</td>
<td>77.2</td>
<td>0.18</td>
<td>0.18–0.18</td>
<td>78.8</td>
<td>0.23</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>138</td>
<td>82.6</td>
<td>0.18</td>
<td>0.18–0.18</td>
<td>83.6</td>
<td>0.24</td>
</tr>
</tbody>
</table>

NOTE: Non–community-acquired pneumonia (respiratory infections and inflammations), stroke (intracranial hemorrhage and stroke with infection), urinary tract infections (kidney and urinary tract infections age >17 years with CC), syncope (syncope and collapse with CC), community-acquired pneumonia (simple pneumonia and pleurisy age >17 years with CC), congestive heart failure (heart failure and shock), arrhythmias (cardiac arrhythmias and conduction disorders), acute kidney injury (kidney failure), enteritis (esophagitis/gastroenteritis age >17 years with CC), gastrointestinal bleeding (gastrointestinal hemorrhage with CC), and dehydration (nutritional and miscellaneous metabolic disorders). Enhanced model includes demographic and clinical variables other than the Charlson variables. Abbreviations: CC, complications or comorbidities; CI, confidence interval; DRG, Diagnosis Related Group; OR, odds ratio.

| 182 (enteritis), 138 (arrhythmia), 127 (CHF), and 89 [community-acquired pneumonia], the adjusted odds ratio was 0.18 to 0.24 (a ≥76% reduction in the adjusted likelihood for being discharged home). In contrast, DRGs 14 (stroke), 79 (non–community-acquired pneumonia), and 320 (UTI) had adjusted odds ratios of 0.41 to 0.46 (a <60% reduction in the adjusted likelihood for being discharged home). Including additional covariates other than the Charlson criteria resulted in higher odds ratios and better model fits, but had the same dichotomy of dementia effect odds ratios (Table 3). The proportion of hospitalizations with disposition correctly predicted by the Charlson comorbidities alone ranged from 59.4% to 82.6% (Table 3). All models predicted a greater proportion of cases than expected by chance alone, with models also including non-Charlson covariates showing modestly better fits (Table 3). Dementia had the lowest odds ratio associated with home discharge among all the Charlson comorbidities for all DRGs studied. Collinearity of predictor (independent) variables was demonstrated only in DRG 88 (COPD) and in DRG 127 (CHF) with the respective COPD and CHF Charlson variables. Removing these variables from the respective predictor models in those DRGs did not change the odds ratio associated with dementia (data not shown). Performing nominal regression excluding patients transferred to acute facilities slightly improved model fit but did not significantly change the odds ratios (data not shown).

**DISCUSSION**

We found that dementia diagnosis has a significant negative impact on the likelihood of discharge to home for all the common acute medical conditions prompting hospitalization. The magnitude of this association varied significantly among DRGs. We
demented patients may have been increasingly treated in the nonhospital setting, avoiding hospitalization.

Medically unnecessary hospitalizations have been the focus of initiatives by the Centers for Medicare & Medicaid Services, and include the readmission reduction program and the recovery audit program’s prepayment review demonstration. Several of the DRGs with stronger dementia effects on discharge disposition have been targets of these programs, including CHF, community-acquired pneumonia, and COPD in the former, and GI bleed, enteritis, and syncope in the latter. The findings of the current study demonstrate that the presence of dementia strongly influences discharge disposition more in certain diagnostic categories. Although disease severity, care access, preventative measures, or provider behavior may have affected the outcomes, the findings raise the distinct possibility that dementia care could have driven admission patterns differentially. Increased awareness of the influence of dementia on hospitalizations and hospitalization discharges is important not only for clinicians but also for the payors, who may penalize (through denial of hospitalization reimbursement) acute-care facilities motivated to provide support to dementia patients who are unable to receive adequate care in the community. Furthermore, related to this issue is the Medicare policy that disallows reimbursement for SNF transfer admissions unless preceded by a 3-day acute-care hospitalization. Hospitals often face a dilemma of whether to admit patients and keep them hospitalized for the requisite period of time to allow for SNF care to be provided, or to deny this option to patients by discharging them sooner (or not admitting them at all).

Demented persons are frequent visitors to emergency departments, and often the impairment in fundamental activities of daily living is immediately apparent to the nurses and physicians caring for them. How does hospital staff come to grips with the potential conflict between duty to the patient and financial solvency of the institution? When dementia is the chief concern but not an acceptable indication for admission (eg, clinical indication for inpatient care), a search for a reimbursable DRG may ensue, and this could contribute to the variability of dementia comorbidity’s impact on hospital discharge disposition noted in this study.

This study has strengths in that the data are sampled in a manner that allows national estimates to be made. Although administrative data, such as the NIS, have limitations in coding accuracy/variability, important quality factors influencing relevant outcomes in the United States have been quantified using the NIS. Because the data were deidentified and sampled rather than being complete, readmissions could not be assessed. Readmission is an important measure of the effectiveness of comprehensive geriatric care models and patient-centered care. It is possible that more readmissions for the same patient in the same year could have accounted for some of the trend findings. Furthermore, readmissions for the same patient in a given year could have impacted on the time-related dementia prevalence calculations used. Changes in coding practices also could have impacted the dementia prevalence trends noted.

This study utilized comorbidities that have been typically used to characterize inpatient mortality. The focus of this study, however, was not on mortality but on home discharge. The use of multinomial logistic regression instead of binomial logistic regression was based on the intention to examine home discharge using skilled nursing facility discharge as a reference but also incorporating—and accounting for—other significant dispositions in the model such as death and other institutional transfers. Quan et al., used the C statistic to describe and compare a mortality prediction model fit with the Charlson versus other comorbidity indices in national datasets. This statistic, however, is not used in multinomial logistic regression. Thus, it is difficult to compare the present modeling with the published models based on mortality (as a dichotomous outcome). The logistic regression models generally showed highly significant predictor effects for all predictor variables utilized (including dementia), but with a variable degree of correct prediction of disposition.

We originally hypothesized that hospitalized patients with dementia would require care in settings other than home at discharge, based on various key clinical and demographic factors, and that dementia comorbidity would display similar adjusted predictor effects for various common DRGs. Our findings of greater dementia-associated odds ratios for particular DRGs suggest a more complex and variable dementia role in certain types of hospitalization, and that there are potential limitations in using Agency for Healthcare Research and Quality prevention quality indicators, developed for the purpose of tracking hospitalization data to assess quality and access to community-based medical care.

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References


