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Delirium During Postacute Nursing Home Admission and Risk for Adverse Outcomes

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Abstract

OBJECTIVES—To identify the rate of delirium present during admission to postacute care (PAC) in the nursing home setting and to determine whether patients with delirium had higher risk for adverse outcomes.

DESIGN—Retrospective cohort study.

SETTING—U.S. Medicare- and Medicaid-certified nursing homes, 2011 to 2014.

PARTICIPANTS—Individuals admitted to all US nursing homes for PAC, aged ≥65 years, and without prior history of nursing home residence (n=5,588,702).

MEASUREMENTS—Minimum Data Set (MDS) 3.0 admission assessments identified delirium based upon Confusion Assessment Method (CAM) items. Robust Poisson regression was used to calculate adjusted relative risks (aRRs) with 95% confidence intervals (CIs) for death following PAC admission, and for 30-day discharge outcomes including re-hospitalization from PAC, discharge home, and functional improvement.

RESULTS—Delirium was identified in 4.3% of new postacute nursing home admissions. Mortality within 30 days of PAC admission was observed in 16.3% of patients with delirium and 5.8% of patients without delirium (aRR=2.27, CI=2.24–2.30). The rate of 30-day readmission from PAC was 21.3% for patients with delirium compared with 15.1% of patients without delirium (aRR=1.42, 95% CI=1.40, 1.43). 26.9% of patients with delirium were discharged home within 30 days of admission compared to 52.5% of patients without delirium (aRR=0.57, 95% CI=0.57, 0.58). 48.9% of patients with delirium showed functional improvement at discharge compared to 59.9% of patients without delirium (aRR=0.83, 95% CI=0.82, 0.83).

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CONCLUSIONS—Patients with delirium present upon PAC admission were at high risk for mortality and 30-day re-hospitalization and were less likely to have timely discharge to home or to improve in physical function at discharge. Early identification and care planning for individuals with delirium at PAC admission may be essential to improve outcomes.

Keywords

delirium; postacute care; nursing homes

Introduction

Delirium, an acute disorder of attention and cognition, is a common complication for hospitalized older adults, with a reported incidence of 14% to 56%.¹ Adverse outcomes associated with delirium include high health care utilization, cognitive and functional decline, morbidity and mortality.^{1,2} Delirium may persist beyond the hospital stay, with documented episodes lasting weeks to months.³ Between 3% and 16% of patients are estimated to be discharged from hospitals with delirium.⁴ Delirium at discharge may be on the rise due to the under-recognition of delirium symptoms and the pressure to shorten the lengths of hospital stay.⁵ Environmental factors such as sleep disturbance and emotional distress may also prevent delirium from resolving in the hospital.⁶ With the difficulty of preventing delirium in such cases, and because patients discharged with delirium have been reported to be at excess risk for bad outcomes,^{4,5} the study of delirium which persists from acute to transitional and postacute care (PAC) is critical.

Nursing homes are a major provider of PAC for older adults. The study of delirium in PAC, however, is limited.⁷ Prior studies have estimated delirium to be prevalent among 5.5% to 51.0% of patients admitted for PAC.⁸ Patients admitted to PAC with delirium were shown to have poorer functional recovery and to be at high risk for hospital readmission, prolonged nursing home stay, and mortality.^{9,10} These studies had several limitations, however, such as small sample size and limited geographic or clinical diversity. To our knowledge no study has examined the rates and outcomes of delirium among new PAC admissions. Thus, there is a pressing need to better characterize delirium persisting to PAC and its association with adverse outcomes.

The Minimum Data Set (MDS) resident assessment, which is administered to patients admitted to Medicare- or Medicaid-certified nursing facilities nationwide following admission and at regular intervals thereafter, was revised in October, 2010.¹¹ This new version included items representing the Confusion Assessment Method (CAM),¹² a validated, widely used instrument for identifying delirium.^{13,14} Our goal was to use these MDS based CAM ratings to estimate the rate of delirium among new postacute nursing home admissions and to determine whether patients admitted with delirium had higher rates of early mortality and 30-day readmission, as well as lower rates of within 30-day discharge and functional recovery. Because dementia is a known risk factor for delirium,^{1,6} and because distinguishing delirium from dementia can be difficult for clinical staff,¹⁵ we also examined the rate of delirium and its association with adverse outcomes in the subgroup of patients with dementia.

Methods

Study Sample

Our sample consists of residents aged 65 and older admitted to all US nursing homes for PAC from January, 1, 2011 to December, 1, 2014 (n=5,588,702). To capture new admissions, patients with any prior MDS admission assessment were excluded.

Delirium Classification

Delirium was identified using the CAM criteria, which defines delirium as present if a patient was reported to have demonstrated an acute change or fluctuation in delirium symptoms, inattention, and either disorganized thinking or an altered level of consciousness. The CAM algorithm has been validated against expert delirium diagnoses with high sensitivity, specificity and reliability.¹²⁻¹⁴

A version of the CAM adapted to the MDS assessment is scored at any point following the Brief Interview for Mental Status (BIMS). Before evaluating the CAM nursing assessors are instructed to determine the patient's baseline mental status using medical record review and through conversations with caregivers or staff who have interacted with the patient. The CAM is then rated accounting for the patient's baseline mental status, responses to relevant BIMS items (e.g. those concerning registration), and interactions with the assessor.

The presence of inattention, disorganized thinking, and altered level of consciousness is recorded in the responses to the following questions: 'Did the resident have difficulty focusing attention?'; 'Was the resident's thinking disorganized or incoherent?'; 'Did the resident have altered level of consciousness?' To facilitate scoring, definitions of the behavioral symptoms are provided below these questions on the MDS assessment form and are also listed in the MDS user's manual. The user's manual also includes many hypothetical examples of patients exhibiting delirium symptoms.

The delirium symptoms are rated as 'Behavior not present', 'Behavior continuously present, does not fluctuate', or 'Behavior present, fluctuates (comes and goes, changes in severity).' Acute change or fluctuation in delirium symptoms was defined to be present if any symptom showed fluctuation, or with a positive response to the question 'Is there evidence of an acute change in mental status from the resident's baseline?' This question immediately follows the symptom ratings.

Study Outcomes

We examined mortality following PAC admission within multiple time intervals including 30 days, 90 days, and 1 year. Death dates were obtained from the Centers for Medicare and Medicaid Services (CMS) Vital Status file. We additionally analyzed the occurrence of the following discharge outcomes within 30-days post admission: readmission to hospital from the PAC, discharge to home, and functional improvement. These outcomes were identified using MDS discharge assessments. For 30-day readmission, we looked for any discharge assessment within 30-days of admission that indicated a discharge status of acute hospital (item A2100). While this captures readmissions only from the nursing home, and not from

the community, prior studies have demonstrated that about 94% of hospitalizations in Medicare claims data that occurred within 30 days following the nursing home admission are linkable to nursing home MDS discharge records.¹⁶ Discharge home was indicated by the presence of a discharge assessment within 30 days of admission where the discharge status was to community (item A2100) that was planned (item A0310G).

Physical function was captured using the Activities of Daily Living (ADL) self-performance items, which include bed mobility, transfer, walking, locomotion, dressing, eating, toileting, and personal hygiene. Patients are rated as being able to do the activity independently, with supervision, with limited assistance, with executive assistance (e.g., requires weight-bearing support by staff), or being totally dependent. The ratings are assigned scores from 0 to 4 respectively, and were summarized into a composite score that has been used previously to characterize physical function.^{17,18} We calculated the difference between the composite score at admission and the score at the first discharge assessment within 30 days. Functional improvement was indicated by a positive difference.

Other Study Variables

Other covariables included age at admission, sex, race, visual or auditory impairment, comorbidity burden, terminal condition, cognitive function, and dementia status, which were all obtained or derived from the MDS admission assessment. Visual impairment was defined as present if the patient had any level of impairment in their ability to see in adequate light (item B1000). Auditory impairment was indicated if the patient could not hear adequately at any level or by use of a hearing aid (items B0200 and B0300). Comorbidity burden was captured using the Charlson Index¹⁹ which was calculated from active diagnoses listed in the MDS assessment Section I. Terminal condition was captured by MDS item J1400 (“Does the resident have a condition or chronic disease that may result in a life expectancy of less than 6 months?”). Cognitive function was measured using the MDS-Cognitive Function Scale,²⁰ which has been previously described and validated, with scores ranging from 1 (intact) to 4 (severe impairment). Patients with Alzheimer’s disease and related dementias (ADRD) were identified using the reported active diagnoses in Section I of the admission assessment.

Statistical Analysis

The characteristics of patients with and without delirium indicated on the MDS admission assessment were summarized with standard measures including means, standard deviations, frequencies and proportions. Rates of 30-day discharge outcomes and mortality following PAC admission were calculated for patients with and without delirium at admission. The relative risk for mortality and discharge outcomes were estimated with robust Poisson regression.²¹ Regression models were adjusted for age, sex, race, comorbidity, terminal condition, and nursing home fixed effects. Analyses were repeated in the subgroup of patients with ADRD to examine whether dementia accounted for differences in outcomes associated with delirium. Data were analyzed with Stata MP 14.1 (StataCorp, College Station, TX). Null hypotheses were tested with a two-tailed alpha of 0.05.

Brown's Center for Gerontology and Healthcare Research has access to MDS data under a CMS data use agreement. The Brown Institutional Review Board approved our use of this data.

Results

From 2011 to 2014 there were 5,346,581 incident admissions to 15,915 nursing homes directly from hospital. According to CAM criteria, 242,121 (4.3%) patients were delirious based upon the MDS 3.0 admission assessment. Less than 2% of admissions were missing data from the CAM and were, therefore, excluded from analyses. The rate of delirium declined during the study time period, with a rate of 4.6% in 2011, 4.4% in 2012, 4.2% in 2013 and 4.0% in 2014.

Table 1 describes the characteristics of patients with delirium present on admission compared to those without delirium. Patients with delirium were older and less likely to be female, had higher comorbidity burden, and were more likely to have visual, auditory and functional impairment. Dementia was more common among those admitted with delirium as indicated by greater proportions of delirious patients with CFS scores of 3 and 4. The rate of terminal condition was small in this PAC sample, but was substantially higher in the delirium group.

Mortality rates for patients with and without delirium upon admission are shown in Table 2. 16.3% of patients with delirium died within 30 days of admission compared with 5.8% of those without delirium (adjusted Relative Risk [aRR]=2.27, 95% Confidence Interval [CI]=2.24, 2.30). Within 90 days of admission, 29.6% of patients with delirium died compared with 13.6% of those without delirium (aRR=1.82, 95% CI=1.81, 1.84). One year after PAC admission, 47.7% of patients with delirium versus 26.5% of those without delirium died (aRR=1.54, 95% CI=1.53, 1.54).

Thirty-day discharge outcomes for patients with and without delirium during their admission assessment are described in Table 3. For example, re-hospitalization from PAC within 30 days was substantially higher for patients with delirium; 21.3% of delirium patients were readmitted compared to 15.1% of patients without delirium (aRR=1.42, 95% CI=1.40, 1.43). Patients with delirium were also more likely to still be in the nursing home 30 days following admission. About twenty-seven percent of patients who were delirious on admission were discharged to home compared with 52.5% of patients without delirium (aRR=0.57, 95% CI=0.57, 0.58). Functional improvement at discharge was also lower in patients with delirium indicated at admission. Only 48.9% of delirious patients demonstrated at least a one-point improvement in their composite ADL score compared to 59.9% of non-delirious patients (aRR=0.83, 95% CI=0.82, 0.83).

The effect of delirium on outcomes remained strong and negative in analyses stratified by ADRD status. Delirium conferred more risk for patients without ADRD, however, than for patients with ADRD.

Discussion

Using the MDS 3.0 CAM-based assessment of delirium, we found that 4.3% of new admissions to PAC in U.S. manifest delirium. Patients with delirium at admission were more likely to be re-hospitalized within 30 days of admission, more likely to have a prolonged nursing home stay, and less likely to improve in physical function. The 30-day mortality rate was more than double that of patients without delirium; and, at 1 year following admission, patients with delirium were still more than twice as likely to have died. In the absence of dementia the associations of delirium and these outcomes were stronger. This was because patients with dementia and no delirium had higher rates of adverse outcomes than patients with neither dementia nor delirium. The effect of delirium for patients with dementia, however, remained substantial.

This study corroborates and expands the existing literature concerning delirium persisting to PAC. Early studies linked symptoms of delirium found in the MDS 2.0 assessment to poor outcomes.⁹ The CAM instrument has been used in only two studies of delirium during PAC admission. The study conducted by Marcantonio et al. on a sample of close to 500 patients in seven PAC facilities in the Boston metropolitan area found associations between delirium present at admission screening and six-month mortality, hospital readmission, and delayed discharge to home.¹⁰ A recent study by Miu et al. demonstrated an association between delirium at admission to a single PAC facility and 90-day hospital readmission, but not for 90-day mortality.²² Our study results are consistent across a larger set of outcomes and are more generalizable given the nationwide population sample. Unlike these prior studies, which did not exclude patients with prior nursing home residence, we are able to present the rate of delirium for residents newly admitted to PAC. This study is also the first to conduct these analyses among patients with dementia.

Strengths of this study include the novel use of large-scale, national population-level data available from the MDS 3.0, including the reliable delirium diagnosis made possible by the new inclusion of the CAM. The use of Medicare vital statistics data allowed for complete ascertainment of mortality (with no censoring due to loss to follow-up), and all study variables had a missing data rate of less than 1%. The consistency of findings across study outcomes, including in subgroup analyses limited to patients with dementia, supports the robustness of our findings.

The primary limitation of this study is the seemingly low sensitivity of the MDS-based CAM diagnosis. Marcantonio et al. report a delirium rate of 15%¹⁰, which is substantially higher than the rate of 4.3% found in this study. This differential may be driven by several factors. For instance, some cases of delirium may have resolved between the admission and assessment times. It is more likely, however, that delirium diagnoses are missed by the MDS. In primary data collection studies delirium is typically identified using multiple CAM assessments spanning a short period of time. The assessment is highly standardized and each rater, usually a research assistant or nurse, receives extensive training in delirium recognition by a physician expert. It is unlikely that the MDS assessor has received such training, and there is no way of knowing how closely the protocol for scoring the CAM detailed in the MDS user's manual is followed. This study's results are still valuable, however, given that

the MDS-based CAM strongly predicts adverse outcomes in this large sample even after accounting for dementia and cognitive function. It is possible that the MDS-based CAM is more likely to identify severe cases of delirium which are apparent even during an unstandardized delirium assessment.

There are other limitations worth noting. First, the MDS admission assessment was conducted within 14 days of the date of admission to the nursing home, which limits our ability to directly link delirium to the hospital discharge. Nevertheless our study team believes that delirium present at the admission assessment is highly likely to have persisted from acute care. Second, dementia may have been underdiagnosed in this study. If undiagnosed dementia is associated with delirium then our point estimates of delirium risk may be inflated, particularly in the non-dementia sub cohort.

Residual confounding, which is a possibility in all observational studies, is another concern. While we adjusted for comorbidity burden, delirium may have been more frequent in patients with frailty, multi-morbidity, or severe illness that was not well captured by our measure. The nursing home fixed effects accounted for confounding from facility-level factors that may impact the association between delirium and PAC outcomes. Exploring the contribution of observable facility characteristics, such as quality ratings and staffing levels, to adverse delirium outcomes in PAC, however, is an important area for future research. Finally, some of our study outcomes were measured without optimal precision. For instance, patients who were discharged to home within 30-days of admission and were then readmitted to the hospital or nursing facility in the 30 day window were not captured. Despite these limitations, the highly consistent findings of the associations of delirium and the study outcomes taken together yield convincing evidence that patients with and without delirium experienced differential outcomes.

In summary, a small but significant proportion of new patients with and without dementia are admitted to PAC with delirium. These patients are substantially more likely to experience poor outcomes. With multiple studies showing dramatic differences in prognoses for such patients,^{1,2,23–25} early identification and care planning for individuals with delirium at PAC admission may be essential to improve outcomes.

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Conflict of Interest: CMK, KST, and SKI have no potential conflicts of interest. VM holds stock of unknown value in PointRight, Inc. an information services company providing advice and consultation to various components of the long term care and post acute care industry, including suppliers and insurers. PointRight sells information on the measurement of nursing home quality to nursing homes and liability insurers. VM was a founder of the company but has subsequently divested much of his equity in the company and relinquished his seat on board. In addition, VM Chairs the Independent Quality Committee for HRC Manor Care, Inc., a nursing home chain, for which he receives compensation in the \$20,000–\$40,000 range. VM also serves as chair of a Scientific Advisory Committee for NaviHealth, a post-acute care service organization, for which he also receives compensation in the \$20,000–40,000 per year range. VM serves as a Technical Expert Panel member on several Center for Medicare/Medicaid quality measurement panels. VM is a member of the board of directors of: Tufts Health Plan Foundation; Hospice Care of Rhode Island; The Jewish Alliance of Rhode Island

Author Contributions: CMK conceptualized and designed the study. Data were acquired by VM. CMK analyzed the data. CMK, KST, SKI, and VM provided critical interpretation of the data. CMK drafted the article. All authors revised the manuscript for important intellectual content and approved the final draft.

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Table 1

Characteristics of Patients with and without CAM Delirium during the MDS Admission Assessment, 2011–2014

Characteristic	Full Sample n=5588702	Delirium n= 242121	No Delirium n=5346581
Age - mean years (sd)	81.2 (8.3)	83.2 (8.1)	81.1 (8.3)
Female sex - n (%)	3525877 (63)	141451 (58)	3384426 (63)
Non-White Race - n (%)	965863 (17)	39310 (16)	926553 (17)
ADL at Baseline - mean score (sd) *	17.1 (4.8)	19.7 (4.6)	16.9 (4.7)
Visual Impairment - n (%)	936277 (17)	73411 (31)	862866 (16)
Charlson Comorbidity Index - mean score (sd)	2.3 (1.9)	2.6 (2.0)	2.3 (1.9)
Auditory Impairment - n (%)	1449431 (26)	89929 (37)	1359502 (25)
<u>CFS Score - n (%)</u> †			
(1) Cognitively Intact	3187305 (57)	16299 (7)	3171006 (59)
(2) Mild Impairment	1268787 (23)	45240 (19)	1223547 (23)
(3) Moderate Impairment	894479 (16)	132759 (55)	761720 (14)
(4) Severe Impairment	182939 (3)	43844 (18)	139095 (3)
Dementia - n (%)	1184377 (21)	133496 (55)	1050881 (20)
Terminal Condition - n (%)	64428 (1)	8525 (4)	55903 (1)

* ADL=Activities of Daily Living Score (range 0–28, higher=worse)

† CFS=Cognitive Function Scale

Table 2

Mortality by CAM Delirium Status in Patients with and without Dementia

Mortality Time Frame	Full Sample N=5,588,702			No Dementia N=4,404,325			Dementia N=1,184,377		
	Delirium	No Delirium	RR (95% CI)	Delirium	No Delirium	RR (95% CI)	Delirium	No Delirium	RR (95% CI)
30 days	16.3	5.8	2.27 (2.24-2.30)	20.9	5.5	2.86 (2.81,2.90)	12.6	6.8	1.81 (1.78 1.84)
90 days	29.6	13.6	1.82 (1.81 1.84)	33.7	12.8	2.15 (2.13,2.18)	26.2	16.9	1.57 (1.55 1.59)
1 year	47.7	26.5	1.54 (1.53 1.54)	49.1	24.4	1.71 (1.69,1.72)	46.6	34.8	1.35 (1.34 1.36)

Note: RR=Relative Risk. Models are adjusted for the following covariates: Age, gender, comorbidity burden, terminal illness, and facility fixed effects

Discharge Outcomes by CAM Delirium Status in Patients with and without Dementia

Table 3

30-Day Outcome	Full Sample N=5,588,702			No Dementia N=4,404,325			Dementia N=1,184,377		
	Delirium	No Delirium	RR (95% CI)	Delirium	No Delirium	RR (95% CI)	Delirium	No Delirium	RR (95% CI)
Readmission from PAC	21.3	15.1	1.42 (1.40, 1.43)	26.4	15.3	1.70 (1.68, 1.72)	17.2	14	1.29 (1.28, 1.31)
Planned Discharge Home	26.9	52.5	0.57 (0.57, 0.58)	25.9	55.1	0.52 (0.51, 0.52)	27.9	39.6	0.71 (0.70, 0.72)
Functional Improvement [‡]	48.9	59.9	0.83 (0.82, 0.83)	51.9	60.9	0.89 (0.87, 0.90)	46.2	53.3	0.87 (0.86, 0.88)

* PAC=Postacute care; RR=Relative Risk.

[‡] Defined as a positive difference between admission and discharge Activities of Daily Living (ADL) scores

Note: Models are adjusted for the following covariates: Age, gender, comorbidity burden, terminal illness, and facility fixed effects