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Original Study

Hospital Readmission From Post-Acute Care Facilities: Risk Factors, Timing, and Outcomes

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A B S T R A C T

Objectives: Hospital discharges to post-acute care (PAC) facilities have increased rapidly. This increase may lead to more hospital readmissions from PAC facilities, which are common and poorly understood. We sought to determine the risk factors and timing for hospital readmission from PAC facilities and evaluate the impact of readmission on patient outcomes.
Design: Retrospective analysis of Medicare Current Beneficiary Survey (MCBS) from 2003–2009.
Setting: The MCBS is a nationally representative survey of beneficiaries matched with claims data.
Participants: Community-dwelling beneficiaries who were hospitalized and discharged to a PAC facility for rehabilitation.
Intervention/Exposure: Potential readmission risk factors included patient demographics, health utilization, active medical conditions at time of PAC admission, and PAC characteristics.
Measurements: Hospital readmission during the PAC stay, return to community residence, and all-cause mortality.
Results: Of 3246 acute hospitalizations followed by PAC facility stays, 739 (22.8%) included at least 1 hospital readmission. The strongest risk factors for readmission included impaired functional status (HR 4.78, 95% CI 3.21–7.10), markers of increased acuity such as need for intravenous medications in PAC (1.63, 1.39–1.92), and for-profit PAC ownership (1.43, 1.21–1.69). Readmitted patients had a higher mortality rate at both 30 days (18.9% vs 8.6%, $P < .001$) and 100 days (39.9% vs 14.5%, $P < .001$) even after adjusting for age, comorbidities, and prior health care utilization (30 days: OR 2.01, 95% CI 1.60–2.54; 100 days: OR 3.79, 95% CI 3.13–4.59).
Conclusions: Hospital readmission from PAC facilities is common and associated with a high mortality rate. Readmission risk factors may signify inadequate transitional care processes or a mismatch between patient needs and PAC resources.
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Medicare's change to a prospective payment system for hospitals in the 1980s, coupled with the rise of managed care in the 1990s, resulted in dramatic declines in hospital lengths of stay. This led to increased clinical instability of patients being discharged, and therefore a significant rise in discharges to post-acute care (PAC) facilities (including skilled nursing and rehabilitation facilities).[1–4] The average hospital length of stay has continued to decline and the number of hospitalized patients discharged to PAC facilities has continued to rise since that time, increasing nationally by nearly 50% between 1996 and 2010.[5] PAC is now the most rapidly growing area in Medicare spending[6,7]; spending on care in PAC facilities alone totaled $30.4 billion in 2012.[7]

However, significant quality gaps, including hospital readmission rates that currently exceed those of discharges home, continue to exist in the provision of PAC facility care.[8] The Office of the Inspector

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General recently reported that 22% of all hospitalized Medicare beneficiaries discharged to PAC facilities experienced an adverse event resulting in harm during their PAC stay (most commonly hospital readmission). Moreover, 60% of the adverse events were considered preventable with better care processes, such as enhanced medication reconciliation and improved patient monitoring.[9] PAC facilities with higher readmission rates also have lower rates of patients returning to the community.[10] Reducing the rate of readmissions from PAC may hold significant promise for aligning improvements in the quality of care of older adults with reduced health care costs.[11,12]

However, little is known about risk factors for readmission from PAC facilities, the timing of readmission, or the impact of readmission on patient outcomes. Although risk factors for hospital readmission from home have received national attention,[13] comparatively little is known about risk factors for readmission from PAC facilities, and these factors may be quite different due to a dissimilar patient population and care setting. Identifying timing of and risk factors for readmission may provide insight into underlying causes and key areas for future interventions to target.[14–16] For example, early readmissions may reflect inadequate transitional processes of care between the hospital and PAC facility or a mismatch between patient needs and PAC facility resources. Late readmissions may reflect inadequate PAC care processes or resources to identify and treat a worsening condition. We sought to determine the risk factors and timing for hospital readmission from PAC facilities and evaluate the impact of readmission on patient outcomes.

Methods

Study Design and Setting

This was a secondary analysis of the Cost and Use and Access to Care modules of the Medicare Current Beneficiary Survey (MCBS), a prospective nationally representative cohort of the Medicare population sponsored by the Centers for Medicare and Medicaid Services. During 2003 to 2009, a mean of 11,879 beneficiaries per year were surveyed 3 times annually for a maximum of 4 years (Access to Care modules); these surveys were matched to Medicare claims data (Cost and Use modules). The MCBS uses a rotating-panel design, adding approximately one-quarter of the cohort annually. The MCBS uniquely allows the ability to follow survey respondents longitudinally across care settings, including movement into and out of the hospital and PAC facilities, combining survey, claims, and nursing home (including Minimum Data Set [MDS]) information. The 2009 data were the most recent available, and were chosen to maintain continuity with a single MDS version (2.0 was implemented in 2002; version 3.0 in 2010).

We included all hospitalizations in the MCBS that occurred among beneficiaries who were age 65 or older and community-dwelling before hospitalization (n = 15,608 hospitalizations), and were discharged to a PAC facility after hospitalization (n = 3612). Records missing essential data elements were excluded (n = 366 with incomplete PAC facility admission MDS information). PAC facilities were defined as skilled nursing and rehabilitation facilities. Acute inpatient rehabilitation facilities, long-term acute care hospitals, assisted living facilities, swing beds in rural hospitals, and long-term care nursing homes (without skilled care) were excluded. Patients were eligible to be included for more than one hospitalization as long as their hospital-PAC facility episode ended 30 days before the next hospitalization; our results are therefore a visit-level rather than patient-level analysis. However, we analyzed only the first readmission during the same PAC facility stay (whether the patient returned to the same PAC facility after hospital readmission or not). Our study was approved from the Colorado Multiple Institutional Review Board.

Analysis of Timing of Readmission

Our primary outcome was readmission during the PAC facility stay. For those readmitted, we identified the day of readmission, with day 0 reflecting the day of discharge from the hospital to the PAC facility. We report day of readmission as a histogram, calculating summative rates for days 0 to 7, days 0 to 14, and days 0 to 30. We also calculated rates of readmission during these periods of the PAC stay so as to display year-on-year trends. For all analyses, we included PAC stays up to 150 days, the longest stay in our cohort (97% of stays were $<$100 days).

Risk Factor Analysis

To identify factors associated with readmission, we began by identifying variables in the MCBS that have been linked to complex care transitions in PAC facilities[17] or to hospital readmission in patients discharged home (rather than PAC).[13,18] These included the following patient-level variables contained in Medicare claims data: patient age (dichotomized as $<$80 or $\geq$80 years), race (categorized as white vs nonwhite), number of hospitalizations in the 6 months before the hospitalization that precipitated the PAC facility stay, degree of medical comorbidity using the Charlson-Deyo method (using diagnoses present within the previous year),[19] payer source (whether dual-eligible with Medicaid as a payer), and primary hospital discharge diagnosis, aggregated from ICD-9 codes into Agency for Healthcare Research and Quality's Clinical Classification Software categories.[20] We added 2002 MCBS data to allow calculation of previous hospitalizations and Charlson-Deyo comorbidity score for patients hospitalized in 2003. We also used 2 measures that were calculated at the time of PAC facility admission as a part of the MDS: cognitive impairment using the Cognitive Performance Scale[21] and Barthel Index (a functional status measure incorporating activities of daily living and mobility).[22,23]

We also examined facility-level factors using Medicare claims data, including the number of physician visits a patient received in the PAC facility, the PAC facility length of stay, percentage of the facility's beds that were certified by Medicare, ownership of facility (for-profit vs nonprofit, including government), number of residents in the facility, and cost of the facility stay.

We then evaluated the patient's active medical conditions and treatment at the time of admission to the PAC facility using MDS data. These included whether the patient had an invasive device (ie, intravenous catheter, feeding tube, indwelling urinary catheter), an active medical condition or symptom at the time of PAC facility admission (ie, dyspnea, dehydration, edema, fever, pain, hallucination, internal bleeding, aspiration into the lung, pressure ulcers, or vomiting), was receiving advanced care at the PAC facility (ie, chemotherapy, dialysis, intravenous medications, monitoring of fluid balance, ostomy care, inhaled oxygen therapy, tracheostomy care, or transfusions), how many different medications the patient received in the past 7 days, and receipt of a high-risk medication captured in the MDS (defined as an antipsychotic or an antianxiety/hypnotic medication). None of the variables had more than 3.3% missing data.

We used χ^2 or Fisher exact tests for univariable comparisons of categorical variables and *t*-tests or Wilcoxon rank-sum tests for parametric and nonparametric continuous variables, respectively, comparing those readmitted with those not readmitted.

We initially included significant factors ($P < .05$) from the univariable analysis in a multivariable Cox proportional hazards regression model with readmission as the outcome. This model accounts for potential patient-level clustering. We compared those readmitted and not readmitted using a time-to-event analysis, plotting the cumulative hazard function as survival and Kaplan-Meier curves and censoring for death, the end of PAC stay, or 150 days postdischarge. Survival