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Interaction Between Cognitive Impairment and Discharge Destination and its Impact on Rehospitalizations

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Abstract

Background—Rehospitalizations are common among older patients and cognitive function may influence rehospitalizations.

Objectives—Evaluate the impact of cognitive impairment (CI) on rehospitalization among older patients.

Design—One year longitudinal study of 976 patients, aged 65 and older, admitted intothe medical services of an urban, 340-bed, public hospital in Indianapolis between July 2006 and March 2008.

Outcome—Rehospitalizationwas defined as any hospital admission following the index admission.

Exposure—Patients were considered to have CI if they made two or more errors on the Short Portable Mental Status Questionnaire.

Confounders—Patient demographics, Discharge destination, Charlson Comorbidity Index, Acute Physiology Scores, and priorhospitalizations.

Results—After adjusting for confounders a significant interaction between CI and discharge location was found to predict both rehospitalization rate and time to 1-year rehospitalization (P = .008 and .028 respectively).CI Patients, discharged to a facilityhad a longer time to rehospitalization compared with patients with no CI (HR = 0.77 [0.58, 1.02] p=0.068, median days: 142 vs. 98), while CIpatients, discharged to home had a slightly shorter time to

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rehospitalization than those without CI (HR=1.15 [0.92, 1.43] p=0.230; median days: 182 vs. 224). These two non-significant hazard ratios in opposite directions were significantly different from each other (p=0.028).

Conclusion—Discharge destination modifies the association between CI and rehospitalizations. Of those discharged to a facility, patients without CI had higher rehospitalization rates, whereas the rates were similar between cognitively impaired and intact patients that were discharged to the community.

Keywords

Rehospitalizations; Cognitive Impairment; Discharge Destination

INTRODUCTION

Recurring hospitalizationsare common in older adults, with20% of elderly patients rehospitalized at 1 month.[1]The resulting iatrogenic events that increasepatient morbidity and mortality, and more than $17 billion dollars per year spent on these rehospitalizations[1]havepersuadedpolicy makers to require public reporting of rehospitalization ratesandto tie30-day rehospitalizations to hospital reimbursement.[2]These requirements received further support from the Affordable Care Act’s creation of the National Quality Strategy that emphasizesthreecore“Triple Aim” principles: improving the individual experience of care; improving the health of populations; and reducing the per capita costs of care for populations. Consequently, rehospitalization reduction has become a top priority for healthcare administrators.

As75% of rehospitalizations are believed to be preventable,[3] interventions to decrease inefficiencies of transitional care, enhance patient education,facilitate disease self-management and follow-up care after discharge have been employed. The results of these interventions have been inconsistent.[4] One explanation is that these interventionstarget a heterogeneous group of patients, some of whomare not high risk and do not benefit.

Several models help identify patients who are at a high risk for rehospitalization and to standardizerehospitalization risk rates between hospitals.These models share common patient-level variables including age, gender,race or ethnicity, depression, length of hospital stay, comorbidity, functional status, prior hospital admission, cognitive impairment (CI), and polypharmacy.[5-8]Few models include system-level factors such as physician practices,[9] site of care[7] and discharge destination. [10]However, a recent review concluded that most of thesemodels had poor predictive ability.[11]Moreover, few models evaluate the interplay of patient and system-level factors. Though one study [7]that analyzed the interaction of patient race/ethnicity and site of careconcluded that this interaction significantly impacted rehospitalization rates, the interplay between patient and system level factors is understudied.

Cognitive impairment (CI) is known to influence hospital utilization but its effect variesamongdifferent populations and its relationship to system level factors is unknown.[12,13]We study the impact of CI on rehospitalization rates and the influence of the discharge destination, as a potentially important system-level factor.

METHODS

We analyzed previously collected datafrom a randomized control trial that evaluated the efficacy of a clinical decisionsupport system on the quality of care forhospitalized older adults with CI admittedbetween July 1, 2006 and May 30, 2008.[14]The current study was approved by the Indiana University Institutional Review Board.

Setting

The study was conducted at Wishard Memorial Hospital (WMH), a 340-bed, university-affiliated, public,safety-net hospital with1,500 to 2,000 admissions of adults aged 65 and older each year.

Inclusion and exclusion criteria

Patients were eligible for enrollment if they were at least 65 years of age, hospitalized on a medical ward,and able to speak English. Patients were excluded if they were enrolled in any other clinical study or were aphasic or unresponsive at the time of screening.

The Regenstrief Medical Record System (RMRS)

This computerized system is the primary instrument for processing data and monitoring patient and physician activity for Wishard Health System.By linking with the Indiana Network for PatientCare, the system captures data on hospitalization andemergency room visits from a statewide network of hospital systems. Additionally, itpulls information from theIndiana State Board of Health for all registered patients whodie in or outside the state.

Rehospitalization

Theprimary study outcome was rehospitalization, defined as any hospital admission identified in the RMRSoccurring within 30 days and 1-year from the discharge day of the index admission.The index hospitalization was defined as the first study hospitalization when patients enrolled in the study and screened for CI.

Cognitive Screening

The presence ofCIwas based on the Short Portable Mental Status Questionnaire (SPMSQ).[15]The SPMSQ is a brief 10-item screening test with a sensitivity of 86% and specificity 99.0% for CI among medical inpatients using a score of 7 or less.[15]We chose this tool for its accuracy, frequency of use in cognitive research, and its verbal administration, which was needed for the study procedures. Furthermore, the SPMSQ scoring process adjusts for patient's educational and racial status. The urban setting of our hospital serving a large proportion of African Americans and many with low education encouraged us to use the SPMSQ instrument because we could adjust for such important demographic variables. For screening purposes, two lower cut-off points have been recommended: three errors for dementia and two errors for delirium.[15] For our trial and subsequent analyses we use a two-error cut-off to detect CI induced by both dementia and delirium. In our published paper in 2010, [16] we found that such a categorization was able to differentiate well between patents with CI and those without CI on clinically important health outcomes such as 30 days mortality rate, length of hospital stay, and hospital acquired complications.Aphysician-trained researchassistant conducted allpatient interviews and administered the SPMSQ at the time of admission.

Other Data collections

Patient demographics including age, gender, ethnicity, and years of education were collected from the RMRS and from interviewsperformedatthe time of cognitive screening. Length of hospital stay,discharge destination--home vs. facility [includes skilled nursing and acute rehab facilities] --andmortalitywere also obtained from the RMRS.Charlson comorbidity index score[17] was calculated using ICD-9 codesgathered from one year prior to admission until the time of each patent's discharge from the hospital.The Acute Physiology Score

(APS) from the APACHE III was derived from data available in the RMRS to measure the acute severity of illness.[18] While the APACHE III was developed in the ICU using data from the first 24 hours after admission, we used the worst laboratory test value during the entire hospital stay to calculate the APS.

Analysis

Baseline demographic and clinical variables are presented as percentages for binarycategorical variables, and means and standard deviations for continuous variables. Group comparisons were made byusing logistic regression for binary outcome variables; and Kaplan-Meier estimation, and Cox proportional hazards models for time to event, after controlling for relevant covariates such as age, gender, race, Charlson comorbidity index, APS score and SPMSQ at screening.We also tested the interaction between CI and dischargedestination. Interactions between variables were tested in the final model.All data analyses were performed using SAS 9.3 software (SAS Institute, Cary, NC).

RESULTS

Between July 1, 2006 and May 30, 2008, 3686 potential study participants aged 65 and older were admitted to the hospital. Six patients declined to participate in the study, whereas 2697 patients were excluded because of various reasons (admissions over the weekend (460), discharged before screening (883), previously enrolled (333), other reasons including admitted to non-medical services and unresponsive or aphasic at admission (1021)). Thirteen patients died before getting discharged. Thus, 976 patients aged 65 and older were screened for CI and then discharged from the hospital, of which 415 (42.5 %) screened positive.Six hundred and twenty patients were discharged home, while 356 patients were discharged to a facility. CI was significantly more common among patients discharged to a facilitycompared to thosethat were discharged home (60.4% vs. 32.4%; p=<0.001). Patients discharged toa facilitywere more likely to be: African American (228 (64%) vs.341 (55%), P = .005); older (mean age 77.0 years (SD8.1) vs. 73.6 years (SD6.8),P= <.001),sickeras determined by APS(26.3 (SD 14.6) vs.20.8 (SD 11.8), p= <.001); more educated (mean years of education (10.4 years (SD 2.7)vs. 10.2 years (SD 2.9), p=.032)).

Patientswith CI were older (77.3 years (SD 8.1) vs.73.0 years (SD 6.4), p= <0.001), had higher APS (25.1 (SD 13.7) vs.21.1(SD 12.5), P=0.002) and had fewer years of education (9.7 (SD 2.8)vs. 10.6 (SD 2.8), p= <0.001). (seeTable 1).

Patients with and without CI had similar 1-year rehospitalizationrates (56.5% vs. 55.2; p=0.680) and comparabletimes to first rehospitalization (171 vs. 185 days; p=0.637). Patients discharged to a facilityhad higher 30-day rehospitalization rates than those whowere discharged home (23.9% vs. 16.6%, p=.006). In addition, they also had shorter times to rehospitalization(121 days vs.206 days; p<0.001). Allowingfor the possibility that the effect of CI on rehospitalization could be influenced by the patient’s discharge location, models were fit to predict various discharge outcomes (Table 2), with discharge destination, CI, and their interaction as predictors. The interaction between CI and discharge destinationwas significant for both rehospitalization rate at 1 year (p=0.008), and for time to re-hospitalization (0.028)(Table 2).The patterns for 30 day outcomes were similar though the interaction was not significant.

The differential effects of CI across discharge destinations on time to rehospitalization is depicted in Figure 1, which shows the Kaplan Meier curves representing the time to rehospitalization among patients based on their cognitive and discharge status. In comparison to patients with no CI, those with CI discharged to a facility exhibited a trend towards an increased time to rehospitalization (HR = 0.77 [0.58, 1.02] p=0.068, median

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days: 142 vs. 98), whereas CI patients who were discharged home had a small and non-significant decreased time to rehospitalization (HR=1.15 [0.92, 1.43] p=0.230; median days: 182 vs. 224). These two non-significant hazard ratios were significantly different from each other (p=0.028).

To explore whether the differential effects of CI on rehospitalization across discharge destination could be explained by patient characteristics, age, gender, race, comorbidity, severity of illness, and any admission in the prior yearwere added to the original proportional hazards modelfor predicting time to rehospitalization (Table 3showing the association of these characteristicswith time to rehospitalization is available online as an appendix). After adjusting for these covariates, the interaction at 1-year between discharge destination and CI was no longer significant (p=0.159) but the pattern of hazard ratios stayed the same. For those discharged to a facility, CI was associated with a decreased risk of hospitalization (HR = 0.85 [0.64, 1.14]), while CI was associated with increased risk of hospitalization for patients who were discharged home (HR=1.11 [0.90, 1.86]), although neither association was statistically significant.Results were similar when the outcome of rehospitalizations alone was substituted fora composite outcome of death or rehospitalization.

DISCUSSION

Theresults show that CI is not independently associated with 1-year rehospitalizationsand that the relationship between CI and rehospitalization is influencedby discharge destination(i.e.,there aredifferences between the times to rehospitalization between CI and non-CI patients across the discharge destinations).We additionally found no differences in the rehospitalization rates among CI and non-CI patients that were sent to the community but among those that were discharged to a facility, the rates were lower among those who had CI. The studyconfirmedthe association of rehospitalizations with previously known factors including chroniccomorbidity, severity of illness, and prior hospitalizations.[13,19]

The lack of association between CI and rehospitalization among those that were discharged to the communityin our study may initially seem unexpected given the body of literature establishing CI as a risk factor for hospitalizations.[12,13,20] Our findings may however be explained by our approach in that we analyzed outcomes of patients based on discharge destination and applied objective cognitive assessments for CI (instead of relying on documented diagnosis from the medical record). CI patients are believed to be at high risk of hospitalization due to a range of issues including the presence of complex medical illnesses that lead to and exacerbate their CI, [21]poor ability to manage chronic diseases,poor medication compliance and higher medication adverse effects,[22] and thelack of requiredsocial support.[23]Further, CI patients may receive discharge instructions that do not take into account their cognitive ability, thus placing them at higher risk for non-compliance.

As per our results,CI patients who were discharged to facilities hadlonger times to rehospitalization than cognitively intact patients.These results are in line with a prior studythat found dementia to be a predictor of delayedrehospitalizations(Hazard ratio= 0.46; 95% CI0.24–0.80; p=0.007) infacility residents.[24]The reasons for such an association among CI patients discharged to a facility are less clear though future prospective studies may help better clarify this relationship. One possible explanation could be that CI patients who are discharged to facilities may have relatively more support in mitigating some of the risk factors for rehospitalization including medication non-compliance and poor management of complex chronic illnesses. Moreover, the fact that CI patients admitted to facilities receive less extensive evaluation than cognitively intact patients may also impact hospital transfers.[25] Another possible explanation could be that cognitively intact patients discharged to facilities may have greater complexity not fully captured in comorbidity analysis, whereas CI patients are admitted to facilities secondary to their CI and related psychosocial factors affecting their care.Discharge destination, therefore, should be included in any model that seeks to predict hospitalization or rehospitalization risk for cognitively impaired patients.

The finding that 30-day rehospitalization rates were higheramong all patients discharged to a facility versus homehas been confirmed in patients with a variety of comorbidities, but particularly amongthose with heart failure and recent joint replacements.[26,27]Though care quality at the facility may play a role, other factors also influence 30-day hospitalizations including less than ideal medical andtransitional care provided by the discharging hospital.[10]Beyond these factors, it has been observed that family, staff and provider concerns about the clinical capabilities of nursing facilities may influence rehospitalization rates. [28]

Our analyses are limited by a lack of data on facility characteristics that might have influenced rehospitalization and our data were not clustered by individual facility. Our data were also limited due to the lack of availability of data regarding emergency room visits and only included rehospitalizations where patientswere transferred to inpatient wards. Initial admissions lacked data on originating site, which will influence discharge destination and risk of rehospitalization, and for discharges we were unable to separate outcomes based upon discharge to a skilled facility versus acute rehab. Future research incorporating facility characteristics and patient originating site may helpevaluate such issues. This study was conducted in one public hospital in an urban environment with a higher percentage of African Americans, lending further question as to the generalizability of these findings. However, studies with significant minority ethnicity representation are less common in CI research, suggesting that this study is an important contribution. Thirty-day rehospitalization rates may differ at other institutions; however, our rate is similar to the 15.3% 30-day rate for Indianapolis as reported by the Dartmouth Institute.[29]

Our results have policy implications as they provide a unique perspective on the interplay between patient and system-level factors and their influence on patient rehospitalizations. Our findingswarrant further exploration of the interactionbetween CIand rehospitalization with a goal of investing resources directed to achieve greatest reduction in avoidable utilization.For example, of the patients that are discharged to a facility, cognitively intact patients may benefit from more intense monitoring and clinical supervision than is mandated by federal regulations (monthly physician visits in skilled facilities). On the other hand, for CI patients being discharged to home, more concerted planning is warranted. Indeed, more than 60% of the Medicare spending related to medical costs of CI patients is related to hospitalizations and rehospitalizations.[30] For patients that are discharged home, transitional care coaches and Advance Practice Nurses have shown to decrease costs of care.[31,32] Also, studies show that when interventions are targeted towards both CI patient and their caregivers, outcomes and costs of care improve.[33] Thus for achieving cost efficient care it will be important to employ above mentioned strategies for CI patients that are being discharged to the community.For frail patients that are discharged home, special geriatric and psychosocial models of care have shown promise to minimize crises and hospital transfers.[34] Moreover, the use of emergency rooms can be significantly decreased by the provision of formal geriatric care, and timely provision of palliative care consultation in patients with advanced CI.[35] In summary, a redesign of the acute care environment that promotes active discharge planning with focus on customized approaches derived from patient and system-level characteristics may be required.

These results show that CI is not independently associated with rehospitalizations and that this relationship is modified by site of discharge. With the renewed focus on the provision of high quality of care, improved patient experiences and efficient healthcare, administrators and policy makers are seeking evidence-based strategies for curbing rehospitalizations-- an objective and a rational surrogate of successful provision of quality care. This analysis provides unique insights regarding the interaction of twoimportantrisk factors for the rehospitalization of the elderly population,including patient cognition and the discharge destination.

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Appendix

Table 3

Proportional hazards regression results adjusted

	Hazard Ratio for Time to 1 year Rehospitalization P-value
Acute Physiology Score (APS)	1.01 (1.00, 1.01) 0.080
Charlson Comorbidity Index	1.14 (1.10, 1.17) <0.001
Age (years)	1.00 (0.98, 1.01) 0.574
Female	0.87 (0.72, 1.04) 0.116
African-American	0.97 (0.81, 1.15) 0.709
Admission Prior Year	1.29 (1.08, 1.54) 0.005

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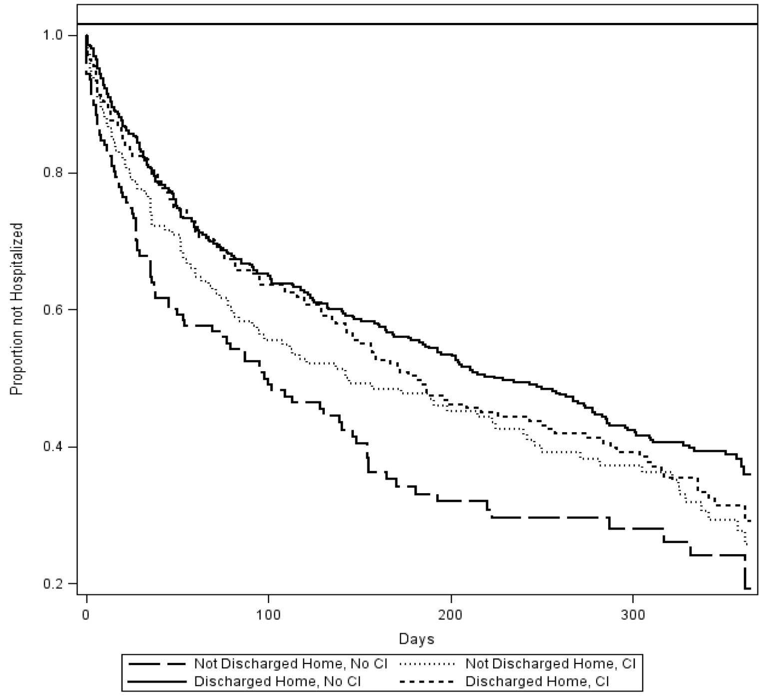

Figure 1.
Time in aysehospitalization

Table 1

Comparison of demographics by discharge destination and Cognitive Impairment

	Discharged to Facility		Discharged Home		CI	Discharge Destination
	No CI (n=141)	**CI (n=215)**	**No CI (n=420)**	**CI (n=200)**	**P value**	**P value**
% Female	69.5	65.1	69.0	69.0	0.583	0.599
% African American	61.7	65.6	56.9	51.0	0.519	0.005
Mean APS (SD)	25.0 (15.1)	27.2 (14.2)	19.8 (11.2)	22.8 (12.7)	0.002	<0.001
Mean Charlson (SD)	3.2 (2.9)	2.5 (2.5)	2.8 (2.5)	2.6 (2.2)	0.009	0.308
Mean Age (Years) (SD) *	73.7 (6.1)	79.1 (8.5)	72.7 (6.6)	75.3 (7.1)	<0.001	<0.001
Mean Education (SD)	10.9 (2.6)	10.0 (2.8)	10.5 (2.8)	9.5 (2.9)	<0.001	0.032
% Admission Prior Year	35.5	30.7	31.4	35.5	0.834	0.916

*Difference between CI and No CI is different across discharge destinations, P=0.003

CI= Cognitive Impairment; APS= Acute Physiology Score; SD= Standard Deviation

Table 2

Predicting rehospitalization by discharge destination and cognitive impairment *

	Discharged to Facility		Discharged Home		p-value of Interaction between CI and Discharge Destination as a predictor
	No CI (n=141)	**CI (n=215)**	**No CI (n=420)**	**CI (n=200)**	**P-value**
% Rehospitalization 30 days	30.5	19.5	16.4	17.0	0.063
% Rehospitalization/Death 30 days	31.2	21.4	16.9	17.0	0.124
% Rehospitalization 1 year	63.1	50.7	54.3	60.0	0.008
% Rehospitalization/Death 1 year	64.5	53.5	55.0	60.0	0.019
Days to Rehospitalization	98.0	142.0	224.0	182.0	0.028
Days to Rehospitalization/Death	96.0	121.0	219.0	182.0	0.055

CI= Cognitive Impairment

*Binary outcomes were fitted to logistic regression models and time-to-event outcomes to Cox proportional hazards model with discharge destination, CI, and their interaction as predictors