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Original Study

Validation of the HOSPITAL Score for 30-Day All-Cause Readmissions of Patients Discharged to Skilled Nursing Facilities



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A B S T R A C T

Keywords:

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risk stratification

Objectives: To validate the HOSPITAL score for predicting 30-day all-cause readmission rates in a cohort of medical patients discharged to skilled nursing facilities (SNFs).

Design: Retrospective cohort.

Setting: Cleveland Clinic Main Campus.

Participants: Cleveland Clinic Main Campus medicine services patients who were admitted between January 1, 2011, and December 31, 2012, and subsequently discharged to 110 SNFs within a 25-mile radius of the hospital.

Measurements: Thirty-day all-cause readmissions to any hospital in the Cleveland Clinic Health System and the HOSPITAL score.

Results: During the study period, 4208 medical patients were discharged to 110 SNFs; 30-day all-cause readmission rates were 40.9% for high-risk patients, 28.1% for intermediate-risk patients, and 15.4% for low-risk patients. Compared to intermediate- and low-risk patients, high-risk patients had more hospitalizations in the past year (3.6 vs 1.1 vs 0.8; $P < .0001$), longer hospital stays (12.0 days vs 9.9 days vs 4.9 days; $P < .0001$) and more comorbidities, including end-stage renal disease (18.5% vs 9.3% vs 2.5%; $P < .0001$), congestive heart failure (39.9% vs 33.1% vs 26.1%; $P < .0001$), chronic obstructive pulmonary disease (26.9% vs 21.5% vs 20.2%; $P < .0001$), and diabetes (46.5% vs 38.6% vs 35.3%; $P < .0001$). The c-statistic for the HOSPITAL score was 0.65.

Conclusions: Among patients discharged to an SNF, the HOSPITAL score may be used to identify those at highest risk of readmission within 30 days.

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As part of the Centers for Medicare & Medicaid Services' (CMS) readmissions reduction program, hospitals with excess readmissions are subject to stiff financial penalties.¹ Consequently, reducing readmissions is a quality improvement priority for most US hospitals. Interventions aimed at reducing readmissions often focus on transitions of care and providing additional support in the posthospitalization period. Because such interventions are often costly, hospitals would prefer to limit them to patients at high risk for readmission. At this

time, however, there is no generalized, validated risk score to predict readmission and facilitate resource allocation.

Approximately 20% of hospitalized Medicare beneficiaries in the US are discharged to skilled nursing facilities (SNFs) for postacute care,^{2,3} and 23.5% of these are readmitted within 30 days.⁴ Patients discharged to SNFs generally have more complex illnesses, lower functional status, and higher 1-year mortality rates than patients discharged to the community.^{5,6} Because they are in a monitored environment with high medication adherence, risk factors for readmission might differ between patients discharged to SNFs and those sent home. For example, one study showed that among heart failure patients with cognitive impairment, those discharged to SNFs had lower readmissions during the first 20 days, likely due to better medication adherence.⁷ There have been no prediction tools developed specifically for patients discharged to SNFs, however, and it is not

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known whether tools developed from patients discharged to home are valid predictors of readmission risk in SNFs.

There are a number of published models to predict 30-day readmissions, but most perform poorly.⁸ Using 1-year of data from a single academic medical center, Donzé et al developed the HOSPITAL score, a simple prediction model to help in allocating resources efficiently to reduce preventable 30-day readmissions.⁹ The HOSPITAL score can be easily applied to patients discharged to SNFs,¹⁰ but to date, it has not been validated. Our objective was to identify the correlation between the HOSPITAL score and 30-day all-cause readmission rates in a population of medical patients discharged to an SNF.

Methods

Study Design and Population

Cleveland Clinic Main Campus is a tertiary academic medical center with 1400 beds and approximately 50,000 admissions per year. We reviewed administrative and clinical data from a retrospective cohort of all patients discharged from the Cleveland Clinic Main Campus from January 1, 2011, to December 31, 2012. We included all patients who were discharged to an SNF during the study period. Our main outcome measure was 30-day all-cause readmissions to any hospital in the Cleveland Clinic Health System (CCHS), including the main campus and eight regional community hospitals. Study patients were followed until January 30, 2013, in order to capture 30-day readmission for patients who were discharged on December 31, 2012. Because we did not have access to readmission data from non-CCHS facilities, to improve the sensitivity of our outcome, we excluded patients who were discharged to SNFs beyond a 25-mile radius from the main campus, where they may be more likely to utilize a non-CCHS facility for acute hospitalization. We also excluded patients discharged to non-CCHS hospital-based SNFs, which may refer readmissions to their own hospital system (Figure 1).

Data Collection

For each patient, we collected the following data from CCHS administrative data and electronic medical records: demographics (age, race, sex); hemodialysis status; hospital service; details of the index admission (diagnosis-related group [DRG]); Medicare severity diagnosis-related groups (MSDRGs); weight; principal diagnosis code; procedure codes; admission date; discharge date, length of stay and postacute care provider; and comorbidities from encounter diagnosis

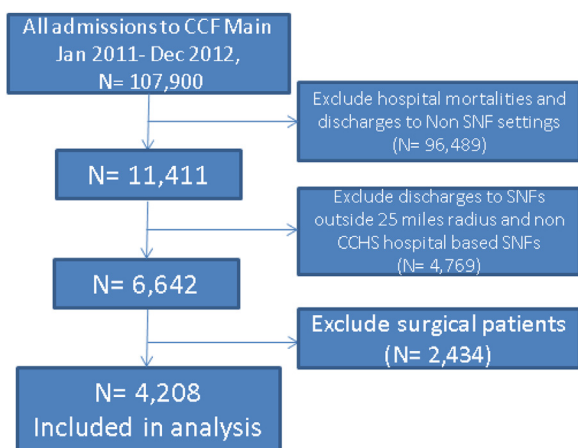


Fig. 1. Study flow.

Table 1
HOSPITAL Score¹

Attribute	Points
Low hemoglobin level at discharge (<12 g/dL)	1
Discharge from an oncology service	2
Low sodium level at discharge (<135 mEq/L)	1
Procedure during hospital stay (any ICD-9-CM coded procedure)	1
Index admission type: nonelective	1
Number of hospital admissions during the previous year	
0	0
1-5	2
>5	5
Length of stay \geq 5 days	2

0-4 points, low risk; 5-6 points, intermediate risk; \geq 7 points, high risk.

and problem lists (myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular accident, dementia, chronic obstructive pulmonary disease, connective tissue disorder, peptic ulcer disease, diabetes mellitus, chronic kidney disease, hemiplegia, leukemia, lymphoma, solid tumor, liver disease, and acquired immune deficiency syndrome).

The six components of the HOSPITAL score as well as their point values appear in Table 1. For lab values, we obtained the last value in the electronic medical record for each index admission. Oncology service designation, procedures during the index hospitalization, and whether the admission was elective were based on administrative data. Observation patients and outpatient same-day surgeries were not considered to be admissions. The original HOSPITAL score was derived to predict potentially avoidable readmissions, which were identified through a computer algorithm that uses ICD-9 codes to exclude unavoidable admissions. However, it was not feasible for us to differentiate avoidable from unavoidable readmissions, nor does CMS make this distinction in assigning readmissions penalties. Therefore, we used 30-day all-cause readmissions as our main outcome measure. For patients with multiple admissions, each admission was counted as a separate index hospitalization. The Cleveland Clinic Foundation Institutional Review Board approved the study.

Statistical Analysis

HOSPITAL scores were calculated using the published point system, and each patient was assigned a score from 0 to 13. Patients with 0 to 4 points were considered low risk, 5 to 6 points were intermediate risk, and 7 or more points were high risk, based on the work by Donzé et al.⁹ The c-statistic was used to assess the models' discrimination power. All analysis was performed by JMP 10.0.0 (SAS Institute, Inc.) and open source software R version 3.0.2¹¹ packages including Hmisc, dplyr, and base.

Results

We identified 119 SNFs within a 25-mile radius of the hospital. Of these, six did not receive any referrals. Three non-CCHS hospital-based SNFs were excluded, leaving a total of 110 SNFs. Among 110 SNFs, two SNFs were part of CCHS. Between January 1, 2011, to December 31, 2012, there were 4208 discharges from the Cleveland Clinic Main Campus Medicine Services to these SNFs (Figure 1). Patients' mean age was 71.6 years, 45.9% were African American, and 48.2% were Caucasian. Just over half the patients were female, and the primary payer was mostly Medicare (Table 2). The all-cause 30-day readmission rate was 30.9%. Patients at low risk of readmission (HOSPITAL scores from 0 to 4 points) had a readmission rate of 15.4% (146/946). Patients at intermediate risk (HOSPITAL

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