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The HOSPITAL score as a predictor of 30 day readmission in a university affiliated community hospital

Robert Robinson

Introduction

Hospital readmissions are common, expensive, and a key target of the Medicare Value Based Purchasing (VBP) program. Risk assessment tools have been developed to identify patients at high risk of hospital readmission so they can be targeted for interventions aimed at reducing the rate of readmission. One such tool is the HOSPITAL score that uses 7 readily available clinical variables to predict the risk of readmission within 30 days of discharge. The HOSPITAL score has been internationally validated in large academic medical centers. This study aims to determine if the HOSPITAL score is similarly useful in a moderate sized university affiliated hospital in the midwestern United States.

Materials and Methods

All adult medical patients discharged from the SIU-SOM Hospitalist service from Memorial Medical Center from October 15, 2015 to March 16, 2016, were studied retrospectively to determine if the HOSPITAL score was a significant predictor of hospital readmission within 30 days.

Results

During the study period, 998 discharges were recorded for the SIU-SOM Hospitalist service. The analysis includes data for the 963 patients who were discharged alive. Of these patients, 118 (12%) were readmitted to the same hospital within 30 days. The patients who were readmitted were less likely to have a length of stay greater than or equal to 5 days (45% vs. 59%, $p = 0.003$) but were more likely to have been admitted to the hospital within the last year. A receiver operating characteristic evaluation of the HOSPITAL score for this patient population shows a C statistic of 0.762 (95% CI 0.720 - 0.805), indicating good discrimination for hospital readmission. Kaplan-Meier analysis of 30-day readmission free survival showed a significant ($p < 0.001$) increase in the risk of readmission in patients with a HOSPITAL score of 5 or more.

Discussion

This single center retrospective study indicates that the HOSPITAL score has good discriminatory ability to predict hospital readmissions within 30 days for a medical hospitalist service at a university-affiliated hospital. This data for all causes of hospital readmission is comparable to the discriminatory ability of the HOSPITAL score in the international validation study (C statistics of 0.72 vs. 0.762) conducted at considerably larger hospitals (975 average beds vs 507 at Memorial Medical Center) for potentially avoidable hospital readmissions. Higher risk patients, identified as having a HOSPITAL score of 5 or more, clearly show an increased risk of hospital readmission within 30 days.

Conclusions

The internationally validated HOSPITAL score may be a useful tool in moderate sized community

hospitals to identify patients at high risk of hospital readmission within 30 days. This easy to use scoring system using readily available data can be used as part of interventional strategies to reduce the rate of hospital readmission.

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Introduction

Hospital readmissions are common and expensive, with nearly 20% of Medicare patients being readmitted to a hospital within 30 days of discharge at an overall cost of nearly 20 billion US dollars per year (Jencks, Williams and Coleman 2009). Because of this high frequency and cost, hospital readmissions within 30 days of discharge are a target for health care cost savings in the Medicare Value Based Purchasing (VBP) program. The VBP aims to incentivize hospitals and health systems to reduce readmissions through reductions in payments to hospitals with higher than expected readmission rates (Centers for Medicare and Medicaid Services, 2016). Because of the VBP initiative, health care organizations are investing considerable resources into efforts to reduce hospital readmission. Identifying patients at increased risk of hospital readmission can be accomplished with a variety of assessment tools that range from multidisciplinary patient interviews to simple screening tools using a handful of variables (Kansagara et al, 2011; Silverstein et al., 2008; Smith et al., 2000). These tools use risk factors such as age, ethnicity, socioeconomic status, severity of illness, previous hospitalizations, and other factors to predict who is likely to be readmitted.

The easy to use HOSPITAL score is one such screening tool. The HOSPITAL score uses 7 readily available clinical predictors to accurately identify patients at high risk of potentially avoidable hospital readmission within 30 days. This score has been internationally validated in a population of over 100,000 patients at large academic medical centers (average size of 975 beds) and has been shown to have superior discriminative ability over other prediction tools (Kansagara et al, 2011; Donze, Aujesky, William and Schnipper, 2013; Donze et al, 2016).

This study aims to determine if the HOSPITAL score is a useful predictor of hospital readmission within 30 days of discharge in a moderate sized (507 bed) university affiliated hospital.

Materials and Methods

All adult medical patients discharged from the SIU-SOM Hospitalist service from Memorial Medical Center from October 15, 2015 to March 16, 2016, were studied retrospectively to determine if the HOSPITAL score was a significant predictor of hospital readmission within 30 days.

Memorial Medical Center is a 507 bed not-for-profit university-affiliated tertiary care center located in Springfield, Illinois, USA. The SIU-SOM Hospitalist service is the general internal medicine residency teaching service staffed by board certified or board eligible hospitalist faculty. Patients for the hospitalist service are primarily admitted via the hospital emergency department or transferred from other regional hospitals with acute medical issues. Elective hospital admissions are extremely rare for this service.

Data on age, gender, diagnosis related group, length of stay, hospital readmission within 30 days, and the 7 variables in the HOSPITAL score (Table 1) were extracted from the electronic health record in a de-identified manner for analysis. Missing laboratory data (hemoglobin and sodium from the day of discharge) were coded to be in the normal range.

Patients with HOSPITAL scores of 5 or more were considered to be at high risk for readmission within 30 days.

Patients were determined to have been discharged from an oncology service if their DRG diagnosis indicated the presence of an active malignancy. This reflects local practice patterns where hospitalists often admit patients to the general medicine service for oncologists.

Table 1. HOSPITAL Score

Attribute	Points if Positive
Low hemoglobin 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 (ICD10 Coded)	1
Index admission type urgent or emergent	1
Number of hospital admissions during the previous year	
0-1	0
2-5	2
>5	5
Length of stay ≥ 5 days	2

Institutional review board review for this study was obtained from the Springfield Committee for Research Involving Human Subjects. This study was determined to not meet criteria for research involving human subjects according to 45 CFR 46.101 and 45 CFR 46.102.

Statistical analysis

The HOSPITAL score was investigated as a predictor of any cause hospital readmission within 30 days. Qualitative variables were compared using Pearson χ^2 or Fisher's exact test and reported as frequency (%). Quantitative variables were compared using the non-parametric Mann–Whitney U or Kruskal–

Wallis tests and reported as mean \pm standard deviation. Rates of survival were evaluated by the Kaplan–Meier method and compared using the log-rank test.

Statistical analyses were performed using SPSS version 22 (SPSS Inc., Chicago, IL, USA). Two sided *P*-values < 0.05 were considered significant.

Results

During the study period, 998 discharges were recorded for the SIU-SOM Hospitalist service. The analysis includes data for the 963 patients who were discharged alive (Figure 1). Of these patients, 118 (12%) were readmitted to the same hospital within 30 days.

The patients who were readmitted were less likely to have a length of stay greater than or equal to 5 days (45% vs. 59%, $p = 0.003$) but were more likely to have been admitted to the hospital within the last year (Table 2). A receiver operating characteristic (ROC) evaluation of the HOSPITAL score for this patient population shows a C statistic of 0.762 (95% CI 0.720 - 0.805, Figure 2), indicating good discrimination for hospital readmission.

Kaplan-Meier analysis of 30-day readmission free survival showed a significant ($p < 0.001$) increase in the risk of readmission in patients with a HOSPITAL score of 5 or more (Figure 3).

Figure 1. Study Flow Diagram

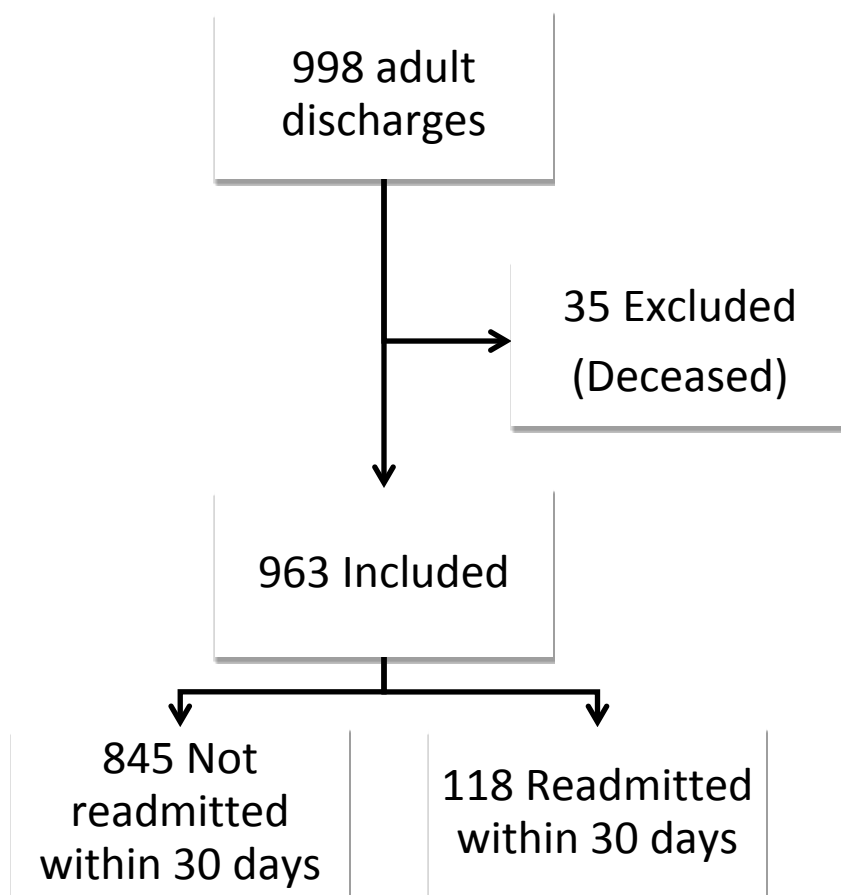


Table 2. Baseline characteristics of the study population stratified according to 30 day readmission status

Characteristic	Not readmitted within 30 days n = 845	Readmitted within 30 days n = 118	
Age, mean (SD)	63 (17.16)	64 (15.78)	P = 0.273
Female	428 (51%)	63 (53%)	P = 0.577
Urgent or emergent admission	845 (100%)	118 (100%)	
Discharge from oncology division	22 (2.6%)	4 (15%)	P = 0.622
Length of stay >= 5 days	501 (59%)	53 (45%)	P = 0.003
Hospital admissions in the last year			
0-1	435 (51%)	0	P <0.001
2-5	371 (44%)	80 (68%)	
>5	39 (5%)	38 (32%)	
An ICD10 coded procedure during hospitalization	389 (46%)	55 (47%)	P = 0.907
Low hemoglobin level at discharge (<12 g/dL)	46 (5%)	11 (9%)	P = 0.094
Low sodium level at discharge (<135 mEq/L)	461 (55%)	57 (48%)	P = 0.202

105 Figure 2. Receiver operating characteristic curve of the HOSPITAL score in the study population

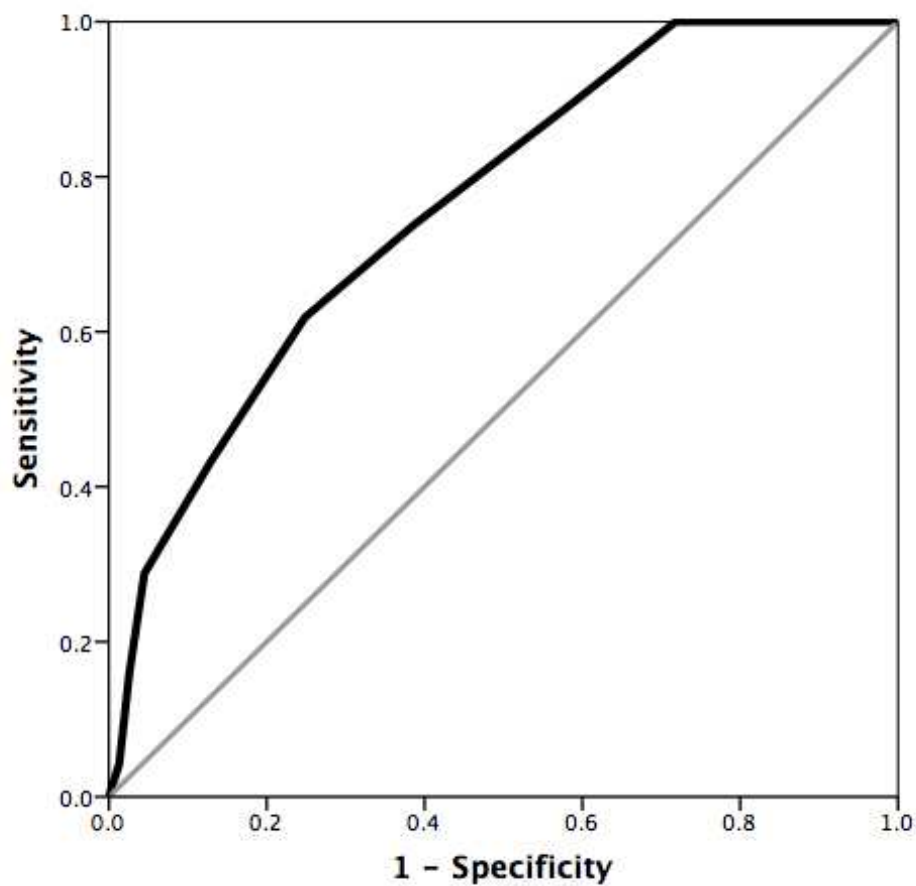
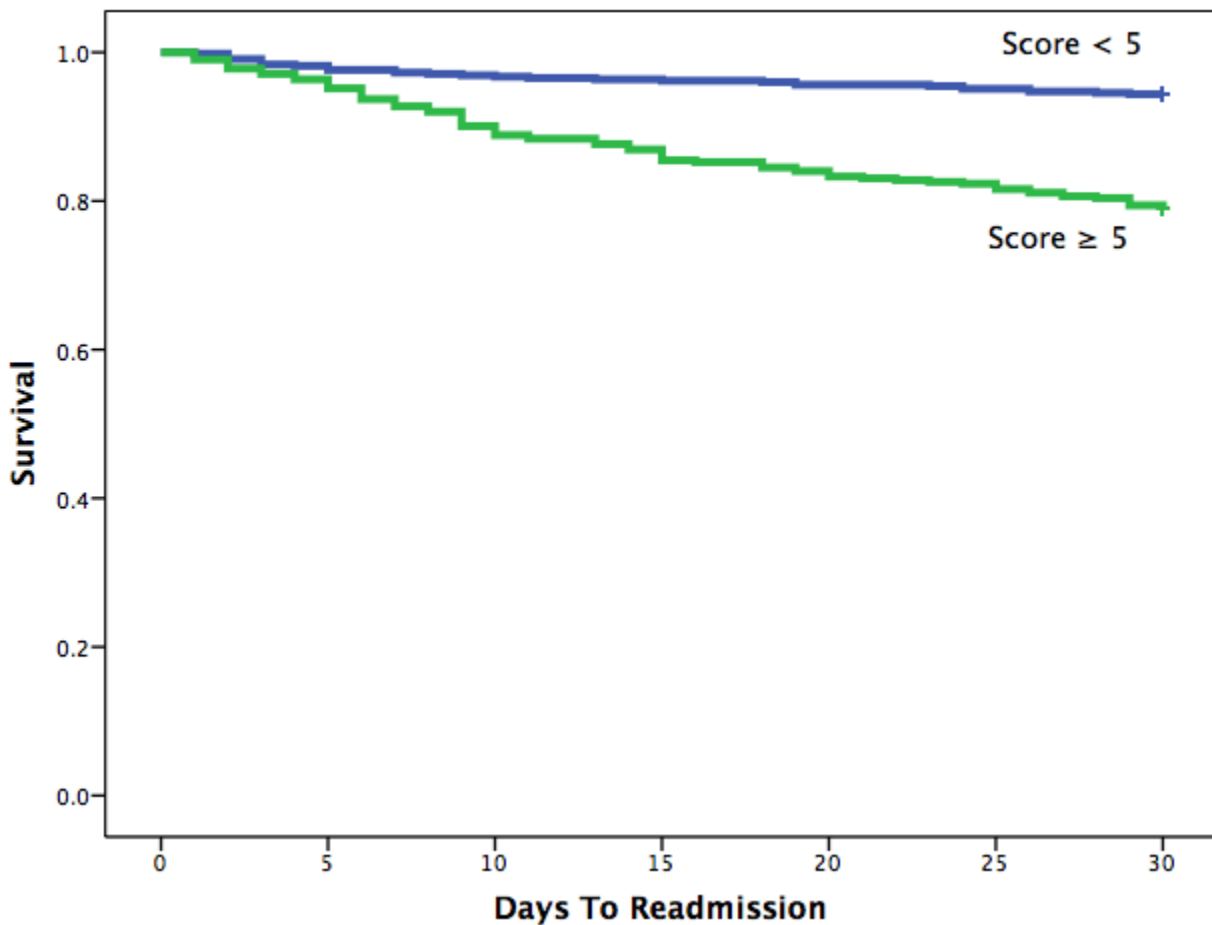


Figure 3. Kaplan-Meier plot comparing 30-day readmission free survival of patients by HOSPITAL score



Discussion

This single center retrospective study indicates that the HOSPITAL score has good discriminatory ability to predict hospital readmissions within 30 days for a medical hospitalist service at a university-affiliated hospital. This data for all causes of hospital readmission is comparable to the discriminatory ability of the HOSPITAL score in the international validation study (C statistics of 0.72 vs. 0.762) conducted at considerably larger hospitals (975 average beds vs 507 at Memorial Medical Center) for potentially avoidable hospital readmissions (Donze 2016). Higher risk patients, identified as having a HOSPITAL score of 5 or more, clearly show an increased risk of hospital readmission within 30 days.

The study population differs from the international validation study of the HOSPITAL score in two important ways. The study hospital does not have a distinct oncology admitting service and all of the admissions during this timeframe were classified as urgent or emergent. These factors are due to the local practice environment at the study site. To partly address the increased risk of readmission in oncology patients, this study classified patients with oncology related diagnosis related group (DRG) codes to have been discharged from an oncology service.

This study has several limitations. This study is retrospective, single center, focused on medical patients, and shaped by local practice patterns (no oncology admitting service, few elective admissions). Because data is only available from the study hospital, readmissions at other hospitals will not be detected. These limitations may reduce the generalizability of these results.

The strength of this study is that the HOSPITAL score appears useable in smaller community based hospitals to identify patients at high risk of readmission. Identifying these patients for interventions targeted at reducing hospital readmissions may result in improved patient care outcomes and healthcare quality.

Conclusions

The internationally validated HOSPITAL score may be a useful tool in moderate sized community hospitals to identify patients at high risk of hospital readmission within 30 days. This easy to use scoring system using readily available data can be used as part of interventional strategies to reduce the rate of hospital readmission.

Further research is needed to determine if the HOSPITAL score is useful in other patient populations.

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