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## Next day discharge rate has little use as a quality measure for individual physician performance☆

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### ABSTRACT

**Introduction:** Emergency Department (ED) physicians' next day discharge rate (NDDR), the percentage of patients who were admitted from the ED and subsequently discharged within the next calendar day was hypothesized as a potential measure for unnecessary admissions. The objective was to determine if NDDR has validity as a measure for quality of individual ED physician performance.

**Methods:** Hospital admission data was obtained for thirty-six ED physicians for calendar year 2015. Funnel plots were used to identify NDDR outliers beyond 95% control limits. A mixed model logistic regression was built to investigate factors contributing to NDDR. To determine yearly variation, data from calendar years 2014 and 2016 were analyzed, again by funnel plots and logistic regression. Intraclass correlation coefficient was used to estimate the percent of total variation in NDDR attributable to individual ED physicians.

**Results:** NDDR varied significantly among ED physicians. Individual ED physician outliers in NDDR varied year to year. Individual ED physician contribution to NDDR variation was minimal, accounting for 1%. Years of experience in Emergency Medicine practice was not correlated with NDDR.

**Conclusion:** NDDR does not appear to be a reliable independent quality measure for individual ED physician performance. The percent of variance attributable to the ED physician was 1%.

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## 1. Introduction

Hospital admissions contribute to around one-third of healthcare expenditures in the United States. [1] Higher payments are received by hospitals for short inpatient stays compared to similar treatment in an outpatient setting. [2, 3] In fiscal year 2014, Centers for Medicare and Medicaid Services (CMS) implemented a policy that inpatient stays less than two midnights are subject to audit by Medicare auditors. Although CMS guidelines state that the decision to admit the patient is up to the clinical judgement of the physician, the CMS Medicare Benefit policy manual recommended that physicians use 24 h or an overnight stay as a benchmark for a patient's need for hospital admission. [4, 5]

According to the American Hospital Association's Recovery Audit Contractors Trac survey in 2011, one day hospital stays may be considered medically unnecessary and challenged by Medicare reimbursement. [6, 7] In addition, The American College of Emergency Physicians states that medical necessity of short inpatient hospital stays are monitored by hospital staff and Emergency Department (ED) physicians are asked to be aware of the potential for short stay denials. [8] In an effort to reduce healthcare costs, quality measures of patient care that predict appropriateness of hospital admissions and length of stay, including admission of patients who are discharged within one day, continue to be evaluated by policymakers. Guterman et al., reported that ED physician admission rates are highly variable and are not correlated with quality measures, such as fifteen-day and thirty-day ED returns. [9] Further investigations are needed to determine appropriate quality measures for ED physicians.

ED physicians' next day discharge rate (NDDR), the percentage of patients who were admitted from the ED and subsequently discharged within the next calendar day was hypothesized as a potential marker for unnecessary admissions. It was also hypothesized that less experienced ED physicians might be more likely to have a high NDDR. The objective

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of the project was to determine if NDDR has validity as a measure for quality of individual ED physician performance. We determined attributes to NDDR, identified predictors, and investigated the portion of variation in NDDR attributable to individual ED physicians.

## 2. Methods

This study was reviewed and approved by the local institutional review board as non-human subjects research. Data was analyzed retrospectively from a 500 bed tertiary care teaching hospital with 70,000 patient visits per year and an average 20% admission rate. There are no short-stay observation units at the hospital. Variability in individual ED physician's NDDR was analyzed by creation of a funnel plot for the 2015 data. The funnel plot was utilized due to its ability to adjust for differences in sample size (varying number of ED patients admitted by each physician) as well as to separate expected from unexpected variation. 95% control limits were used to identify outliers. Funnel plots for 2014 and 2016 were created to assess individual ED physicians' consistency from year to year. Thirty-six attending Emergency physicians, who primarily see high acuity patients, were included in the funnel plot analysis and represent all Emergency physicians at the hospital during the three years of the study. Yearly variability in NDDR was analyzed by individual ED physician, overall NDDR average, and by Z-scores. Z-score was calculated by (individual physician's Raw Score – Mean) / Standard Deviation and represented the number of standard deviations from the mean. NDDR was normally distributed for 2014, 2015, and 2016 by Anderson-Darling test.

To further investigate factors contributing to NDDR, a mixed model logistic regression was built using Proc GLIMMIX in Statistical Analysis System (SAS) version 9.4 (SAS Institute Inc., Cary, NC, USA). In 2015, there were 12,597 total hospital admissions. An indicator variable was included for each individual physician with 10 or more patient visits. Additionally, individual physicians who had fewer than 10 patients were collapsed into a single group. A separate category was also included for patients not having an Emergency physician. The logistic regression model was setup with the dependent variable being length of stay (=1 versus >1), and potential predictors including age, sex, day of admission (weekday versus weekend), new diagnosis at admission or no new diagnosis at admission, specific diagnoses, the unit to which the patient was admitted, severity of illness, and risk of mortality. The severity of illness and risk of mortality were determined by the nationally standardized All Patient Refined-Diagnosis Related Groups (APR-DRG). [10] The indicator variable for Emergency physician was included as a 'subject' effect in the 'Random' statement (as a random effect) in the model. Statistically significant factors used in the model to predict NDD were retained using backward elimination (Tables 1–2). As opposed to building a prediction model, the goal was to include various factors in the model to control for the varying mixes of patients that would be expected to be seen by the different physicians. The impact of individual ED physician on NDDR was evaluated while adjusting for other predictors based on logistic regression data. To validate the model and assess consistency of the results, data from 2014 (11,491 total hospital admissions, 40 physicians with 10+ patient visits) and 2016 (12,418 total hospital admissions, 50 physicians with 10+ patient visits) were similarly analyzed by logistic regression. In order to assess the relationship between NDDR to other quality metrics, correlation coefficients were calculated to examine the correlation between physician NDDR and their 3-day ED return and readmission rates and 7-day and 30-day readmission rates in 2015.

The intraclass correlation coefficient (ICC) was calculated in SAS by dividing the covariance parameter estimate by (covariance parameter estimate + level-1 error variance). [11, 12] The ICC provided an estimate of how much of the total variation in NDD was attributable to the individual ED physician. Logistic regression determined odds ratios (ORs) and *p* values for years of experience in Emergency Medicine practice.

**Table 1**

Significant predictors for next day discharge identified in 2015 by logistic regression.

2015 predictors of next day discharge				
Effect	P-value	Odds ratio	95% CI	
No new diagnosis	<0.0001	11.442	7.377	17.75
Kidney stone	<0.0001	5.473	3.007	9.963
Appendicitis	<0.0001	3.939	2.407	6.449
Chest pain	<0.0001	3.486	2.734	4.445
Mortality risk	<0.0001	2.616	2.299	2.976
Coronary artery disease	<0.0001	2.438	1.929	3.083
Syncope	<0.0001	2.33	1.543	3.519
Transient ischemic attack	<0.0001	2.104	1.533	2.886
Severity of illness	<0.0001	1.781	1.559	2.036
Cerebrovascular accident	<0.0001	1.674	1.306	2.144
Arrhythmia	0.0009	1.652	1.229	2.221
Unit admitted to	<0.0001	1.565	1.376	1.781
7-day re-admission	0.0058	1.488	1.122	1.974
Day of the week (weekday versus weekend)	<0.0001	1.279	1.131	1.447
Sex	<0.0001	1.241	1.116	1.38
Age 65	<0.0001	0.76	0.675	0.855
Pneumonia	0.0076	0.67	0.499	0.899
Sepsis	<0.0001	0.395	0.269	0.581
Psychiatric patient	<0.0001	0.268	0.198	0.363

## 3. Results

Over the course of three years, ED physicians' NDDRs ranged from 10 to 25%. The yearly NDDR average remained near 16% all three years. In 2015, five ED physicians fell outside of the 95% control limits of the funnel plot, three with high NDDRs and two with low NDDRs (Fig. 1A). In 2014, four ED physicians deviated more than the expected variation.

**Table 2**

Significant predictors for next day discharge in 2014 and 2016 identified by logistic regression.

Effect	P-value	Odds ratio	95% CI	
2014 predictors of next day discharge				
No new diagnosis	<0.0001	6.484	4.591	9.158
Kidney stone	<0.0001	10.366	5.308	20.24
Appendicitis	<0.0001	3.164	1.873	5.344
Chest pain	<0.0001	3.156	2.477	4.021
Mortality risk	<0.0001	2.417	2.109	2.77
Transient ischemic attack	<0.0001	2.2	1.568	3.088
Coronary artery disease	0.0092	1.488	1.103	2.006
Severity of illness	<0.0001	2.38	2.077	2.728
Syncope	0.0002	2.112	1.416	3.151
Arrhythmia	0.0001	1.8	1.338	2.422
Unit admitted to	0.0003	1.28	1.12	1.462
Day of the week (weekday versus weekend)	0.0007	1.247	1.098	1.417
Sex	0.0066	1.167	1.044	1.305
Age 65	0.003	0.829	0.732	0.938
Pneumonia	0.0006	0.587	0.432	0.797
Sepsis	0.0005	0.367	0.209	0.647
Psychiatric patient	<0.0001	0.213	0.152	0.299
2016 predictors of next day discharge				
No new diagnosis	<0.0001	11.56	7.458	17.92
Kidney stone	<0.0001	5.843	3.269	10.44
Chest pain	<0.0001	4.355	3.333	5.689
Appendicitis	0.0002	2.728	1.601	4.647
Coronary artery disease	<0.0001	2.452	1.97	3.053
Mortality risk	<0.0001	2.378	2.085	2.712
Transient ischemic attack	0.0002	2.156	1.449	3.207
Cerebrovascular accident	<0.0001	2.134	1.672	2.724
Severity of illness	<0.0001	2.033	1.776	2.328
Syncope	0.0014	1.933	1.291	2.895
Arrhythmia	<0.0001	1.889	1.407	2.536
Unit admitted to	0.0174	1.184	1.03	1.362
Day of the week (weekday versus weekend)	0.0178	1.158	1.026	1.307
Age 65	<0.0001	0.756	0.671	0.852
Sepsis	<0.0001	0.392	0.253	0.607
Psychiatric patient	<0.0001	0.274	0.208	0.361

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