

The Relationship Between the Follow-up to Discharge Ratio and Length of Stay

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Hospital medicine groups are held accountable for quality and operational performance metrics within health care systems. The overall impact of hospitalist care on one such performance metric, the average length of stay (ALOS), is well described and is associated with decreases in ALOS and cost compared with nonhospitalists.¹⁻⁴ To this end, ALOS is often used as a measure of operational efficiency when measuring individual hospitalist performance.

However, fragmentation is inherent to the hospitalist staffing model. Multiple providers often care for a single patient during a hospital stay, in turn making it difficult to accurately attribute performance metrics at the provider level.⁵ Studies have demonstrated that the majority of patients cared for on a hospital medicine team will be cared for by more than 1 provider during their hospitalization.⁶ In this staffing model, quality and operational performance metrics are often assigned based on the attending of record at the time of discharge or admission. Additionally, no industry standard attribution methodology for assigning ALOS exists. Recently, Herzke et al demonstrated that meaningful metrics at the provider level can be developed using billing data when multiple providers care for a single patient during their hospitalization.⁷ Hospital medicine leaders have sought measures of individual efficiency for throughput and propensity for discharge. One method for measuring these metrics at the provider level is utilizing billing data. The relationship between hospitalist-level billing data for subsequent daily “follow-up” encounters to discharge encounters (F:D ratio) to ALOS is not known.

We assessed the relationship between the F:D ratio and ALOS to determine the strength of the correlation at the hospitalist group level and the impact of hospitalist experience on the F:D ratio. We then provide a practical application of the F:D ratio to managing ALOS at the individual hospitalist provider level.

METHODS

The Cleveland Clinic Indian River Hospital is a 330-bed nonprofit tertiary care hospital with admissions performed during the day by a dedicated hospitalist admitting team and overnight by the

ABSTRACT

OBJECTIVES: Average length of stay (ALOS) is used as a measure of the effectiveness of care delivery and therefore is an important operational measure when evaluating both the hospitalist group and individual hospitalist performance. No metric within the control of the individual hospitalist has been identified to support the individual hospitalist's contribution to the hospitalist group's ALOS goals. This study's objective was to evaluate the correlation between the follow-up to discharge ratio (F:D ratio) and ALOS and assess the relationship between F:D ratio and hospitalist experience.

STUDY DESIGN: We systematically evaluated the relationship between hospitalist-level billing data for daily inpatient follow-up encounters and discharge visits (F:D ratio) and the attributed ALOS across consecutive hospitalist encounters at a tertiary care center.

RESULTS: Over the study period of 10 quarters from 2017 to 2019, there were 103,080 follow-up or discharge inpatient encounters. The mean (SD) provider F:D ratio and ALOS were 3.94 (0.36) and 4.45 (0.24) days, respectively. The mean (SD) case mix index (CMI) was 1.68 (0.04). There was a strong linear relationship between the F:D ratio and both ALOS and CMI-adjusted ALOS ($r=0.807$; $P=.014$; and $r=0.814$; $P=.001$, respectively). The mean (SD) F:D ratio for hospitalists with 1 year or less of experience compared with those with more than 1 year of experience was 4.23 (0.80) vs 3.88 (0.39), respectively ($P=.012$).

CONCLUSIONS: A strong linear relationship exists between the F:D ratio and ALOS. Additionally, the F:D ratio improves with experience. Provider-level billing data applied as the F:D ratio can be used as a hospitalist management and assessment tool.

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hospitalist nocturnal medicine service. All patient encounters included in the study were by a hospitalist attending without house staff. Encounters seen exclusively by an advanced practice provider were also excluded from this analysis. Hospitalists at the Cleveland Clinic Indian River Hospital are scheduled on rotating 7-day blocks with 7 days off between each scheduling block. All hospitalist encounters within the Department of Hospital Medicine of the Cleveland Clinic Indian River Hospital between January 1, 2017, and June 30, 2019, were consecutively enrolled.

Encounters were selected based on billing data using the American Medical Association's Current Procedural Terminology (CPT). Evaluation and management charges were captured using a combination of paper billing and electronic methods until 2018, when charge capture converted to a completely electronic system. Follow-up visits and discharge encounters were identified by the Subsequent Hospital Care CPT codes 99231 to 99233 and Hospital Discharge Day CPT code 99238 or 99239.⁸ Intensive care unit encounters 99291 and 99292 were not counted. Encounters were excluded if they were associated with a hospital outpatient services CPT code, including observation services codes 99217 to 99220, office or other outpatient services codes 99211 to 99215, or same-day admission and discharge services 99234 to 99236.⁹

Multiple hospitalists caring for a single patient during a hospital stay make it difficult to assess the overall impact of an individual hospitalist on a patient's LOS. We therefore assessed the correlation between the F:D ratio and ALOS at the hospitalist group level. To do so, the number of inpatient follow-up encounters was then divided by discharge encounters to derive the F:D ratio. The ALOS was calculated based on the difference between the date of discharge and date of admission divided by the total number of inpatients discharged. To assess whether the F:D ratio was influenced by clinical complexity and resource needs, the case mix index (CMI) was used to generate the CMI-adjusted LOS.

We also hypothesized that inexperienced hospitalists, defined as physicians with 1 year or less of experience, would have higher F:D ratios compared with more experienced hospitalists. To test that, we compared F:D ratio across hospitalists with 1 year or less of experience or more than 1 year of experience. We then show a single month for individual providers to demonstrate how F:D ratio might be used in practice.

Statistical Analysis

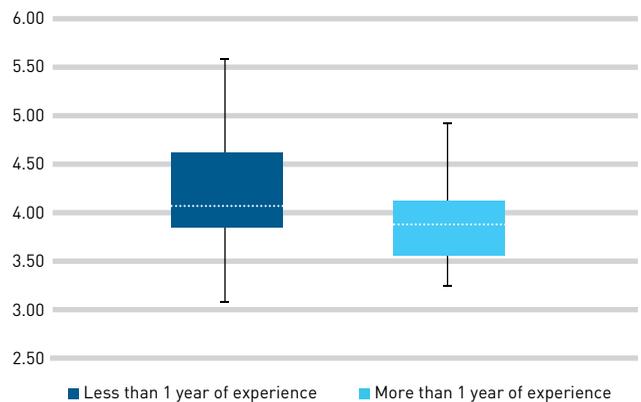
Continuous variables were compared using a Student's *t* test after confirmation of normality. Pearson *r* correlation was used to measure the strength of the correlation between the F:D ratio and ALOS. We then corrected for multiple comparisons using the Sidak correction method. Statistical significance was considered a *P* value < .05. We used the statistical program IBM SPSS for all statistical analyses.

TAKEAWAY POINTS

The majority of patients cared for on a hospital medicine service will be cared for by more than 1 provider during their hospitalization. No metric within the control of the individual hospitalist has been identified to support the individual hospitalist's contribution to the hospitalist group's overall average length of stay (ALOS). We used billing data to determine a follow-up to discharge ratio (F:D ratio) and then determine the strength of its correlation to ALOS at the hospitalist group level and the impact of hospitalist experience on the F:D ratio. We found:

- ▶ a strong linear relationship exists between the F:D ratio and ALOS;
- ▶ the F:D ratio improves with experience; and
- ▶ provider-level billing data applied as the F:D ratio can be used as a hospitalist management and assessment tool.

FIGURE 1. Box Plot Demonstrating the Difference Between the Mean F:D Ratio and ALOS for Providers With ≤ 1 Year and > 1 Year of Experience^a



ALOS, average length of stay; F:D ratio, follow-up encounters to discharge encounters ratio.

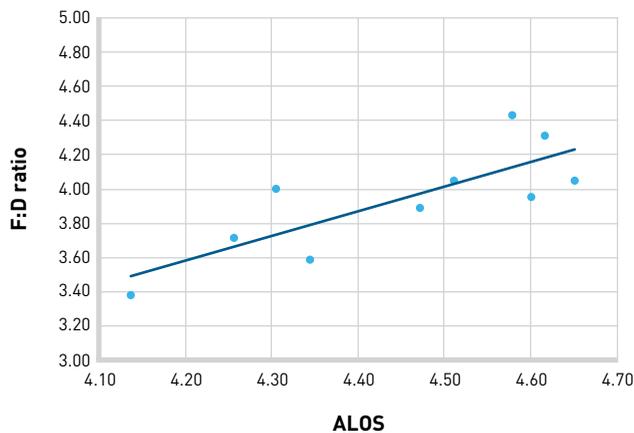
^aThe mean (SD) F:D ratio for those with ≤ 1 year of experience vs those with > 1 year of experience was 4.23 (0.80) vs 3.88 (0.39) (*P* = .012).

RESULTS

From January 1, 2017, to June 30, 2019, there were 176,506 hospitalist encounters billed by 34 hospital medicine physicians. Of these, 103,080 patient encounters were inpatient follow-up (*n* = 82,034) or discharge (*n* = 21,046) encounters. The mean (SD) monthly provider F:D ratio for encounters during the study period was 3.94 (0.36); ALOS, 4.45 (0.24); and CMI, 1.68 (0.04). The mean (SD) F:D ratio for hospitalists with 1 year or less of experience compared with those with more than 1 year of experience was 4.23 (0.80) vs 3.88 (0.39), respectively (*P* = .012) (Figure 1).

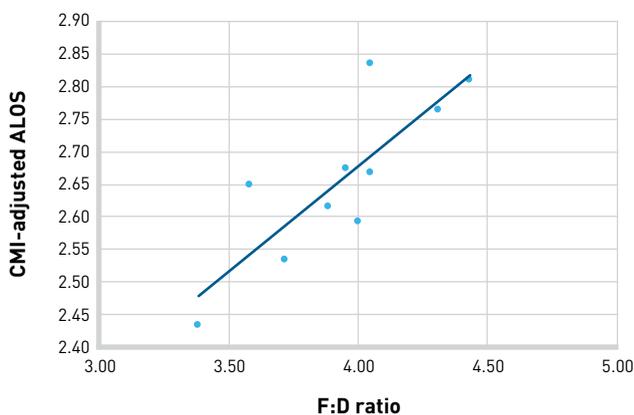
Over the study period, there was a linear relationship between the F:D ratio and ALOS (*P* = .014) (Figure 2). After adjusting the ALOS for CMI, the linear relationship remained present (*P* = .001) (Figure 3). In 2018, we instituted a change in our charge capture process. From January 2018 through June 2019, the mean (SD) ALOS was 4.41 (0.20) days and F:D ratio was 3.76 (0.25). Over this time period, the correlation between the F:D ratio and ALOS was

FIGURE 2. Scatter Plot Demonstrating the Linear Relationship Between the F:D Ratio and Unadjusted ALOS



ALOS, average length of stay; CMI, case mix index; F:D ratio, follow-up encounters to discharge encounters ratio.

FIGURE 3. Scatter Plot Demonstrating the Linear Relationship Between the CMI-Adjusted ALOS and the F:D Ratio



ALOS, average length of stay; CMI, case mix index; F:D ratio, follow-up encounters to discharge encounters ratio.

stronger ($r=0.94; P=.005$). When this correlation was CMI adjusted, the correlation was similar to before the change in charge capture ($r=0.83; P=.04$). There was no significant correlation between the F:D ratio and CMI over the study period ($r=-0.346; P=.327$).

DISCUSSION

Hospitalist care is associated with lower ALOS and cost.¹⁻³ A common challenge in hospital medicine is staffing fragmentation, whereby the majority of patients cared for by hospitalist teams will be seen by more than 1 hospital medicine provider during their hospitalization.⁶

TABLE. Comparison of the F:D Ratio With ALOS for Selected Providers^a

Provider	Month 1 (F:D ratio)	Month 1 (ALOS)
A	3.51	4.9
B	3.68	3.8
C	4.13	3.6
D	3.47	3.8
E	3.20	4.3
F	3.11	5.2
G	3.82	5.1
H	3.10	4.2
I	3.27	2.8
J	3.70	4.2
K	5.67	4.1
L	2.80	4.4
M	2.94	3.5
N	1.45	3.5
O	3.61	3.1

ALOS, average length of stay; F:D ratio, follow-up encounters to discharge encounters ratio.

^aThis table presents a practical use of the F:D ratio and how it may be used to better assess the individual provider's contribution to the ALOS. Provider A discharged 1 patient for every 3.51 follow-up encounters but had an ALOS for the month higher than most of their peers; provider B had a lower ALOS than provider A but discharged only 1 patient for every 3.68 follow-up encounters.

With multiple hospitalists often caring for a single patient during a hospital stay, it is difficult to accurately attribute performance and quality measures at the provider level.⁵ There is no previously identified predictive metric for ALOS performance that is under the control of the individual hospital medicine provider and can be influenced by experience.

To identify a metric more under the control of the hospitalist, we assessed the correlation of ALOS with the ratio of subsequent follow-up encounters to discharge encounters, the F:D ratio. We identified a strong linear correlation between the F:D ratio and ALOS in a series of 103,080 patient encounters. The relationship remained consistent for the hospitalist group CMI-adjusted LOS. In our center, we generate individual provider F:D ratios to define the provider's contribution to ALOS both at the individual patient and cohort levels (Table).

Provider-level metrics generated from billing data have been shown to accurately assign attribution to hospitalists when more than 1 hospitalist cares for a patient during their hospitalization.⁷ In 2018, we instituted a change aimed at improving our charge capture process; over this time period, the linear correlation between F:D ratio and ALOS strengthened. However, when this was CMI adjusted, the correlation remained similar to before the change in charge capture. This intuitively makes sense: ALOS is a patient-level measure and should vary based on the CMI and clinical conditions, whereas the F:D ratio is inherently a provider-level variable. To determine whether or not this finding was clinically important, we looked at the correlation between the F:D ratio and CMI and found no correlation existed. This finding further supports

the use of the ratio as a provider-level metric not influenced by clinical complexity or resources needs. Consistent with our analysis, the F:D ratio is associated with ALOS (time or inpatient midnight days) and independent of CMI (a resource utilization and reimbursement measure).

These findings establish that (1) the F:D ratio can be used for assessing the hospitalist group overall performance as a leading indicator for ALOS, (2) processes and coaching focused on reducing the F:D ratio have the potential to also reduce ALOS, and (3) F:D ratio improves with experience and, therefore, is potentially amendable to coaching and process improvements. Methods to improve F:D ratio may also include optimizing the hospitalist patient census and removing intrinsic and extrinsic barriers to discharge that lead to unnecessary non-value-added hospital days.¹⁰⁻¹²

The F:D ratio is inherently influenced by intrinsic and extrinsic factors; one intrinsic factor is a hospitalist's level of experience. The F:D ratio has value as a management metric for hospital medicine providers. In our cohort, a significant difference existed between very early career hospitalists, defined as those with 1 year or less of experience, compared with those with more than 1 year of experience. This F:D ratio improvement with more than 1 year of experience suggests that it may be amenable to coaching or improved with an emphasis on the drivers of ALOS, such as number of consults per case, judicious use of testing and procedures in the hospital setting, and individual provider comfort with discharging patients. This finding is in keeping with those of other studies, which have demonstrated variations in practice and outcomes between early career hospitalists compared with those with more experience. In a cohort analysis of patients cared for by hospitalists with more than 1 year of experience, Goodwin et al demonstrated higher mortality among patients cared for by similarly early career hospitalists (defined as hospitalists with less than 1 year of experience).¹³ Further studies are needed to better understand the relationship between F:D ratio and provider outcomes and performance for other team-based hospital services (eg, surgicalists, laborists).

Limitations

First, our study has the limitations associated with retrospective review of a single-center database. Second, although the number of patient encounters in our study was high, the number of hospitalist providers was limited. This has particular relevance when interpreting provider characteristics, which may influence the F:D ratio. Third, extrinsic barriers to discharge such as care manager quality and efficiency, consult burden, diagnostic testing, and postacute facility availability could influence the F:D ratio. Finally, although only finalized codes were used, there is inherent risk of coding errors skewing data points.

CONCLUSIONS

A strong correlation exists between the F:D ratio and ALOS. This relationship remains strong for the CMI-adjusted ALOS. F:D ratio improves with greater clinical experience. These findings support the use of F:D ratio as a leading operational metric for ALOS that is potentially more under the control of the individual hospital medicine provider. ■

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Authorship Information: Concept and design (RDR, CMW, DMZ, JGR, DJP); acquisition of data (RDR); analysis and interpretation of data (RDR, CMW, MAP, DMZ, DJP); drafting of the manuscript (RDR, CMW, MAP, DMZ, DJP); critical revision of the manuscript for important intellectual content (RDR, CMW, MAP, JGR, DJP); statistical analysis (RDR, MAP); provision of patients or study materials (JGR); administrative, technical, or logistic support (CMW, JGR, DJP); and supervision (RDR, CMW, DJP).

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