The Journal of Emergency Medicine, Vol. ■, No. ■, pp. 1–9, 2018

0736-4679/$ - see front matter

https://doi.org/10.1016/j.jemermed.2017.12.041

ELSEVIER

Administration of Emergency Medicine

INTERPHYSICIAN DIFFERENCES IN EMERGENCY DEPARTMENT LENGTH OF STAY

Stephen J. Traub, MD,*† Soroush Saghafian, PHD,‡ Kurtis Judson, MD,*† Christopher Russi, DO,†§ Bo Madsen, MD,†§ Stephen Cha, MS,‖ Hannah C. Tolson,* Leon D. Sanchez, MD,¶ and Jesse M. Pines, MD, MBA, MSCE**

*Department of Emergency Medicine, Mayo Clinic Arizona, Phoenix, Arizona, †College of Medicine, Mayo Clinic, Rochester, Minnesota, ‡Harvard Kennedy School, Harvard University, Cambridge, Massachusetts, §Department of Emergency Medicine, Mayo Clinic, Rochester, Minnesota, ||Division of Health Systems Informatics, Mayo Clinic Arizona, Phoenix, Arizona, ¶Department of Emergency Medicine, Beth Israel Deaconess Medical Center, and Harvard Medical School, Boston, Massachusetts, and **Department of Emergency Medicine and Health Policy & Management, George Washington University, Washington, DC

Reprint Address: Stephen J. Traub, MD, Department of Emergency Medicine, Mayo Clinic Arizona, 5777 E. Mayo Boulevard, Phoenix, AZ 85054

☐ **Abstract—Background: Emergency physicians differ in many ways with respect to practice. One area in which interphysician practice differences are not well characterized is emergency department (ED) length of stay (LOS). Objective: To describe how ED LOS differs among physicians. Methods: We performed a 3-year, five-ED retrospective study of non-fast-track visits evaluated primarily by physicians. We report each provider's observed LOS, as well as each provider's ratio of observed LOS/expected LOS ($LOS_{O/E}$); we determined expected LOS based on site average adjusted for the patient characteristics of age, gender, acuity, and disposition status, as well as the time characteristics of shift, day of week, season, and calendar year. Results: Three hundred twenty-seven thousand, seven hundred fifty-three visits seen by 92 physicians were eligible for analysis. For the five sites, the average shortest observed LOS was 151 min (range 106–184 min), and the average longest observed LOS was 232 min (range 196–270 min); the average difference was 81 min (range 69–90 min). For $LOS_{O/E}$, the average lowest $LOS_{O/E}$ was 0.801 (range 0.702–0.887), and the average highest $LOS_{O/E}$ was 1.210 (range 1.186–1.275); the average difference between the lowest $LOS_{O/E}$ and the highest $LOS_{O/E}$ was 0.409 (range 0.305–0.493). Conclusion: There are significant differences in ED LOS at the level of the individual physician, even after accounting for multiple confounders. We found that the $LOS_{O/E}$ for physicians with the lowest $LOS_{O/E}$ at each site averaged approximately 20% less than predicted, and that the $LOS_{O/E}$ for physicians with the highest $LOS_{O/E}$ at each site averaged approximately 20% more than predicted.**

☐ **Keywords—Emergency Department; length of stay; provider differences**

INTRODUCTION

The practice patterns of individual emergency physicians, differ in multiple ways, including the rate of utilization of advanced imaging, degree of testing, and decision to admit (1–6). Another area of potential interphysician difference that has not been extensively explored is the extent to which emergency physicians differ with respect to emergency department (ED) length of stay (LOS).

ED LOS is a publicly reported metric for the Centers for Medicare and Medicaid Services, factors into national quality rankings, and serves as a driver of patient satisfaction (7). Efforts to improve ED LOS often focus on process improvements, without considering the difference in LOS attributable to personnel (8–10).

Presented, in part, at the 2016 American College of Emergency Physician Research Forum, Las Vegas, NV.

RECEIVED: 8 April 2017; FINAL SUBMISSION RECEIVED: 27 November 2017;
ACCEPTED: 17 December 2017

We sought to better understand the differences in ED LOS between physicians, and describe the degree of inter-physician differences in ED LOS at five sites. We report provider-specific observed LOS and the provider-specific ratio of observed LOS to expected LOS ($LOS_{O/E}$), with the goal of characterizing and better understanding the degree of variation in ED LOS that may exist between providers.

METHODS

Study Design Settings

This was a retrospective study of routinely gathered operational data. This work was part of a quality-improvement initiative, and was identified as exempt by the Mayo Clinic Institutional Review Board.

Study Settings and Populations

EDs at five hospitals provided data for this study; all were a part of the Mayo Clinic system. None had emergency medicine training programs, although two sites (A and D) had resident physicians from multiple services rotating through the ED. These residents assisted in the evaluation of approximately 5% of patients at each of these two sites. We used the common electronic medical record (EMR; Cerner®, Kansas City, MO) in use at all sites to identify ED visits over a 3-year (January 1, 2013–December 31, 2015) period. We excluded visits that we could not associate with an individual physician, such as patients who left without being seen, patients not associated with any provider, and patients seen primarily by a nurse practitioner or physician assistant (together, NP/PA). We excluded visits for which any data point was missing, illogical (i.e., LOS < 0), or uninterpretable (i.e., disposition of "other").

All visits seen by physicians who practiced at any point during the 3-year period (and not simply those who practiced during all 3 years) were eligible for inclusion. To control for changes in the operating environment over time, which could affect the LOS results for individual physicians who entered a practice after the study period began or left it before the study period ended, we included study year as a factor in our regression analysis.

We excluded visits seen by low-volume physicians, who were identified by site medical directors as those who worked substantially less than others at that site. Site directors identified low-volume providers based on a subjective assessment, as substantial variation between sites precluded the use of global numerical criteria. Of note, at each site every low-volume provider saw fewer patients than every non-low-volume provider. We also excluded all visits with a documented LOS > 10,080 min (7 days) due to their significant impact on calculating 95% confidence intervals.

Measurements

All data were extracted from the EMR into custom Microsoft Excel® (Microsoft Corporation, Redmond, WA) operations reports for each site. One author (SJT) was responsible for data review and abstraction.

We report age in years, and gender based on patient declaration. We measured acuity as the Emergency Severity Index (ESI) score, which the nursing staff assigned. We categorized disposition as admitted, discharged (including death), transferred, or placed into ED observation status. Only one site (Site D) utilized ED observation; for those patients, LOS ended with placement into observation status. We used registration date and time to assign date- and time-based parameters. We categorized shift as day (07:00–14:59), evening (15:00–22:59), or night (23:00–06:59). We divided days of the week into Monday, Tuesday–Friday, or Saturday-Sunday based on preliminary results from regression analyses suggesting that a three-category division was appropriate. We divided season into Winter (January–March), Spring (April–June), Summer (July–September) and Autumn (October–December). We designated study year as 1, 2, or 3; these were synonymous with calendar years 2013, 2014, and 2015, respectively.

Data Analysis

For each visit, we calculated three distinct values. First, we determined observed LOS, defined as the time interval (in minutes) between ED arrival and ED checkout. Second, we determined expected LOS (in minutes) by taking the mean 3-year LOS for each site and adjusting (via a regression model) for patient age, gender, and acuity; disposition; and shift, day of week, season, and calendar year. Third, we determined the ratio of observed/expected LOS ($LOS_{O/E}$).

We then determined mean observed LOS and mean $LOS_{O/E}$ for each provider. We note that outlier values may or may not have led to each individual physician's data to qualify as being normally distributed. However, due to the use of each physician's mean value, and the properties inherent in the Central Limit Theorem, we report each site's data and the overall physician data using the descriptor "mean," and not "median."

Statistical analysis was performed with SAS version 9.3 (SAS Institute Inc., Cary, NC).

RESULTS

Characteristics of Sites and Study Subjects

There were five EDs in four states. ED characteristics appear in Table 1. There were 395,890 ED visits during