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Original Contribution

Length of stay in EDs: variation across classifications of clinical condition and patient discharge disposition☆,☆☆,★

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ABSTRACT

Study objective: Duration of a stay in an emergency department (ED) is considered a measure of quality, but current measures average lengths of stay across all conditions. Previous research on ED length of stay has been limited to a single condition or a few hospitals. We use a census of one state's data to measure length of ED stays by patients' conditions and dispositions and explore differences between means and medians as quality metrics.
Methods: The data source was the Healthcare Cost and Utilization Project 2011 State Emergency Department Databases and State Inpatient Databases for Florida. Florida is unique in collecting ED length of stay for both released and admitted patients. Clinical Classifications Software was used to group visits based on first-listed *International Classification of Disease, Ninth Edition, Clinical Modification*, diagnoses.
Results: For the 10 most common diagnoses, patients with relatively minor injuries typically required the shortest mean stay (3 hours or less); conditions resulting in admission or transfer tended to be more serious, resulting in longer stays. Patients requiring the longest stays, by disposition, had discharge diagnoses of nonspecific chest pain (mean 7.4 hours among discharged patients), urinary tract infections (4.8 hours among admissions), and schizophrenia (9.6 hours among transfers) among the top 10 diagnoses.
Conclusion: Emergency department length of stay as a measure of ED quality should take into account the considerable variation by condition and disposition of the patient. Emergency department length of stay measurement could be improved in the United States by standardizing its definition; distinguishing visits involving treatment, observation, and boarding; and incorporating more distributional information.

1. Introduction

1.1. Background and importance

The amount of time that a patient spends in the emergency department (ED) has become an increasingly discussed quality measure, as length of stay and ED crowding have been linked to quality of care, patient safety, and treatment outcomes [1–3]. The Centers for Medicare & Medicaid Services report publicly several measures of ED throughput including the median time from ED arrival to ED departure for patients who are admitted or treated and released [4]. The National Quality Forum has endorsed these measures as scientifically valid [5].

The length of the patient's stay in the ED may be influenced by several primary factors: the clinical condition of the patient and the need for specialized treatment [6,7]; the size and composition of the hospital staff [8]; the hospital triage and clinical decision-making processes [9]; capacity levels, particularly during peak times [10,11]; access to technologies for advanced diagnostic and treatment procedures [12,13]; and hospital disposition policies and ability to admit patients for treatment [14,15]. Various factors can contribute to the problems of extended stays in the ED due to ED boarding and observation status. Emergency department boarding occurs when a patient has been admitted to the hospital but inpatient capacity delays the transfer of the patient out of the ED. Emergency department observation occurs when a patient needs to be monitored for an extensive period to rule

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in a serious condition that leads to admission or to rule out a serious diagnosis so that a routine discharge from the ED is safe.

Many of these factors are potentially modifiable, but hospitals facing financial constraints must prioritize their responses. Previous studies have helped guide decisions about where to focus resources to improve ED services [16–18]. Unfortunately, many studies about ED length of stay use data for a single condition, a single or few hospitals, or both, which limits generalization of the results for comprehensive ED services and policies [19–22,14,23].

The National Hospital Ambulatory Medical Care Survey (NHAMCS) contains *ED length of stay*, defined as *ED arrival* (hour and minutes when the patient first arrived) minus *ED discharge* (hour and minutes when the patient left the ED) [24,25]. The National Center for Health Statistics used NHAMCS data from 2009 to analyze how *ED wait times* (from arrival at the ED to physician contact) vary by measures of ED crowding [26]. The results showed excessive wait times for patients with high-acuity conditions. These nationally representative data have not been used to analyze ED visits and their length by a complete list of clinical conditions seen in the ED; the NHAMCS sample is not designed for studying the thousands of types of clinical conditions seen in the ED, which are more suitably studied using a census of visits.

1.2. Goals of this investigation

Our primary goal for this study was to describe the length of ED stay by clinical condition and disposition of patients. Such information might be useful to hospital managers who want to compare their own ED operational length of stay to a statewide average by clinical condition and by what happened to the patient—admission, transfer, or release. Such information also should be useful to policymakers who aim to stimulate greater efficiencies in health care delivery. Our secondary goal was to explore 2 different statistics for measuring length of stay—mean and median. The former is a common statistic; the latter has been used in recent ED length of stay measures. We highlight the pros and cons of each statistic for reporting quality metrics for ED performance.

2. Methods

2.1. Study design and data sources

This is a retrospective study using data from large databases. The data were primarily from the Healthcare Cost and Utilization Project (HCUP) State Emergency Department Databases (SEDD) [27] and State Inpatient Databases (SID) [28] for the State of Florida in calendar year 2011. The SEDD represent the universe of ED visits that do not end in a hospital admission for all *community hospitals* (defined as all nonfederal, short-term, general, and other specialty hospitals, excluding hospital units of institutions). The SID represent the universe of inpatient admissions for community hospitals, including visits that started in the ED. Data are available for all payer types, including the privately insured, Medicare, Medicaid, and uninsured populations. Payer types are derived from the expected payment source on the discharge abstract. Florida is the only HCUP Partner to provide data on the timing of ED arrival and departure for all patients, including those who are admitted from the ED for an inpatient stay.

We restricted the sample to community nonrehabilitation hospitals as defined with the 2011 American Hospital Association Annual Survey of Hospitals. The Florida SID and SEDD data have the power of a census of ED visits, containing 100% of all ED visits made in that state in 2011, with diagnoses coded according to the *International Classification of Disease, Ninth Edition, Clinical Modification,* for the United States. The Florida SID and SEDD data used in this study contained more than 8.2 million ED visits among 188 community nonrehabilitation hospitals in 2011.

2.2. Methods and measurements

In Florida, ED length of stay is measured as the total time from ED arrival to ED departure. The Florida Agency for Health Care Administration Patient Data Submission Guide defines *ED arrival* as the hour on a 24-hour clock during which a patient registers in the ED for services and *ED departure* as the hour the patient was discharged from the ED. Times are to be recorded as integers of hours rather than hours and minutes, and the hour is to be recorded without rounding for minutes. Hospital personnel are instructed to record ED departure as the hour the patient physically left the ED, but we are unable to assess compliance with those instructions; it is possible that ED personnel apply these instructions differently such as the hour the ED physician issued the discharge directive rather than when the patient left the facility.

In light of the described method for recording admission and departure hours, we decided to keep records with zero lengths of stay in the analysis (4.33% of records), as they represent visits lasting less than 1 hour. For these records, we manually adjusted the length of stay time to be 0.5 hour in our data, reflecting the midpoint of the possible times.

Emergency department boarding and observation stays among ED records would skew the ED length of stay estimates beyond the typical processing of patients through the ED. Ideally, we would stratify records by such situations. However, Florida ED records do not identify boarding and observation status. To reduce the influence of these records and of obvious errors in coding of length of stay, we trimmed records with an ED length of stay greater than 24 hours (3.25% of records). We considered lengths of stay of 24 hours or less as reasonable based on a reviewer's suggestion, assuming that 24 hours might be needed by clinicians to rule out serious problems underlying presenting symptoms such as unspecified pain. The distribution of length of stay was relatively smooth with a few very high values.

To describe clinical groups, we used the principal diagnoses from inpatient stays and the first-listed ED diagnoses from treat and release visits; the 2011 Florida SEDD include up to 10 diagnoses for each record. We classified these into 285 mutually exclusive clinical groups using the Agency for Healthcare Research and Quality Clinical Classifications Software (CCS) [29], which organizes *International Classification of Disease, Ninth Edition, Clinical Modification,* diagnosis codes into clinically homogeneous groups. For each CCS category, we calculated the mean and median ED length of stay for 3 possible dispositions: ED discharge; inpatient admission; or transfer to another acute care community, nonrehabilitation hospital.

3. Results

The number of ED visits and length of stay for the 10 most common first-listed conditions among all ED visits in Florida are presented in the Table. (Results for *all* first-listed conditions are available from the corresponding author.) Conditions resulting from relatively minor injuries (eg, sprains and strains, superficial injuries and contusions, skin and subcutaneous tissue infections, open wounds of the extremities) had the shortest stays in the ED; these conditions resulted in a mean stay of 3 hours or less and a median stay of 2 hours. Conditions involving pain with nonspecific or unclear etiologies (eg, chest, abdomen, or back pain; headache, including migraine) generally resulted in mean stays of 4 hours or more and median stays of 3 hours or longer. Patients with nonspecific chest pain incurred the longest mean stays (7 hours) and median stays (4 hours) among the 10 most frequent conditions released or admitted.

Whereas the Table shows results for all ED visits, the Figure presents stratified results for patients discharged, admitted, or transferred. There were substantial clinical differences among patients released, admitted, and transferred. The 10 most frequent conditions admitted to hospitals' EDs were more life threatening than those resulting in discharge (for one example, heart failure vs sprains and strains were the most frequent admitted vs released, respectively). Furthermore, the mental condition