

The Association Between Transfer of Emergency Department Boarders to Inpatient Hallways and Mortality: A 4-Year Experience

Asa Viccellio, MD

From the Department of Emergency Medicine, Stony Brook University, Stony Brook, NY.

Carolyn Santora, RN

Adam J. Singer, MD

Henry C. Thode Jr., PhD

Mark C. Henry, MD

Study objective: We developed and implemented an institutional protocol aimed at reducing crowding by admitting boarded patients to hospital inpatient hallways. We hypothesized that transfer of admitted patients from the emergency department (ED) to inpatient hallways would be feasible and not create patient harm.

Methods: This was a retrospective cohort study in a suburban, academic ED with an annual census of 70,000. We studied consecutive patients admitted from our ED between January 2004 and January 2008. In 2001, a multidisciplinary team developed and implemented an institutional protocol in which admitted adult patients boarded in the ED were transferred to hospital inpatient hallways under select conditions. We extracted data from the electronic medical record system, measuring patient demographics, ED disposition (discharge, admit to floor, admit to hallway), ED length of stay, and inhospital mortality. We report ED length of stay, subsequent transfer to an ICU, and hospital mortality of patients admitted to standard and hallway inpatient beds.

Results: Of 55,062 ED patients admitted, there were 1,798 deaths. Of all admissions, 2,042 (4%) went to a hallway; 53,020 went to a standard bed. Patients admitted to standard and hallway beds were similar in age (median [interquartile range] 55 years [37 to 72 years] and 54 years [41 to 70 years], respectively) and sex (48.2% and 50% female patients, respectively). The median (interquartile range) times from ED triage to actual admission in patients admitted to standard and hallway beds were 426 minutes (306 to 600 minutes) and 624 (439 to 895 minutes) minutes, respectively ($P < .001$). Median ED census at triage was lower for standard bed admissions than for hallway patients (44 [33 to 53] versus 50 [38 to 61], respectively, $P < .001$). Inhospital mortality rates were higher among patients admitted to standard beds (2.6%; 95% confidence interval [CI] 2.5% to 2.7%) than among patients admitted to hallway beds (1.1%; 95% CI 0.7% to 1.7%). ICU transfers were also higher in the standard bed admissions (6.7% [95% CI 6.5% to 6.9%]) versus 2.5% [95% CI 1.9% to 3.3%]).

Conclusion: Transfer of ED-boarded admitted patients to an inpatient hallway occurs during high ED census and waiting times for admission but does not appear to result in patient harm. [Ann Emerg Med. 2009;54:487-491.]

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INTRODUCTION

Background

One current challenge for emergency medicine is the problem of crowding.¹⁻³ Although first recognized in the 1980s, emergency department (ED) crowding is more problematic, as highlighted in a 2006 report of the Institute of Medicine titled

*Hospital-Based Emergency Care: At the Breaking Point.*² One of the key findings of this report was that the demand for emergency care visits increased by 26% between 1993 and 2003, from approximately 93 million to 110 million. During the same period, the number of EDs decreased by 425, and the number of hospital beds decreased by 198,000. ED crowding is now recognized as a hospital-wide problem: patients back up in the ED because they cannot be admitted to inpatient beds.¹ As

Editor's Capsule Summary

What is already known on this topic

Emergency department (ED) crowding is in part due to admitted patients who occupy beds in the ED until an inpatient bed becomes available.

What question this study addressed

Will a protocol that allows select ED patients to board in an inpatient hallway rather than the ED reduce crowding and not create unexpected risk of death or ICU need?

What this study adds to our knowledge

At this single-site urban ED, during a 4-year period more than 2,000 patients were boarded in inpatient hallways. There was no evidence that this practice harmed these patients.

How this might change clinical practice

A similar protocol could be a part of ED and hospital surge plans while longer-term solutions are created.

a result, patients are often “boarded”—held in the ED until an inpatient bed becomes available—for extended intervals, up to days. Also, ambulances are frequently diverted from crowded EDs to other hospitals that may be farther away and may not have the optimal services. In 2003, ambulances were diverted 501,000 times, an average of once every minute.²

Importance

ED crowding affects care negatively. Not only does it reduce access to emergency medical services⁴ but also it is associated with delays in care for cardiac^{5,6} and stroke⁷ patients, as well as those with pneumonia,⁸ and is associated with an increase in patient mortality.^{9,10} ED crowding has been associated with prolonged patient transport time,^{4,11} inadequate pain management,¹² violence of angry patients against staff,¹³ increased costs of patient care,¹⁴ and decreased physician job satisfaction.¹⁵

Goals of This Investigation

As a part of a crowding solution, we developed an institutional policy in 2001 in which admitted patients were transported to an inpatient hallway when standard hospital beds were not available. Although this practice was widely used in many hospitals before the advent of the specialty of emergency medicine, concerns that the inpatient hallways were unsafe for admitted patients have led to widespread objections to this policy. An internal continuous quality improvement review conducted by the inpatient nursing units failed to identify any substantive medical safety issues related to the placement of

patients in a hallway. In the current study, we describe our experience with transport of admitted ED patients to inpatient hallways during the last 4 years. We hypothesized that transfer of admitted and boarded ED patients to inpatient hallways was feasible and would not result in excess mortality or ICU patient transfers.

MATERIALS AND METHODS

Study Design

We performed a retrospective cohort study to determine the characteristics and outcomes of boarded ED patients transferred to inpatient hallways. Our institutional review board approved the study, with waiver of informed patient consent.

Setting

We studied patients in a single suburban, university-based, academic ED with an affiliated emergency medicine residency training program and an annual census of 70,000.

Selection of Participants

We included all patients admitted to our hospital through our ED during the calendar years 2004 through January 2008, excluding patients admitted directly to an inpatient unit from other sources.

Through a collaborative effort between the ED and the inpatient services, we developed and implemented a full-capacity protocol in 2001. The trigger for initiating the protocol was the lack of an available ED bed for the next patient. If there were admitted patients boarding in the ED, the treating physicians identified those who would be appropriate for inpatient hallway placement. Any patient requiring ICU or a step-down unit was not eligible for hallway placement. Otherwise, most patients admitted to a regular inpatient unit were eligible for hallway placement, including monitored patients (who constituted the majority of patients placed in hallways). Patients with chest pain and a positive first troponin test result are not placed in hallways. Patients in need of regular suction or high-flow oxygen were also not placed in a hallway location. Patients admitted primarily for control of seizures were similarly not eligible for inpatient hallway placement. Placement of patients in need of contact isolation was determined on a case-by-case basis. Patients with diarrhea, patients with neutropenia, patients needing respiratory isolation, and patients at risk of elopement were not placed in inpatient hallways.

After identifying the need for using the full-capacity protocol, ED staff contacted the hospital bed coordinator, who was responsible for providing bed or hallway assignment to those patients awaiting admission. Often, previously unidentified empty beds were found and patients assigned to these beds. When patients are placed in a hallway location, central monitoring, a call bell, and privacy screen are available to each patient, and a bathroom is designated for their use. The full-capacity protocol policy is available at <http://www.hospitalcrowding.com>.

Methods of Measurement and Outcome Measures

We collected demographic and clinical data from electronic medical records. Next, we determined ED disposition (discharge, admit to floor, admit to hallway), ED length of stay, in-hospital mortality, and transfer to the ICU at any time during the hospital admission. We defined the length of boarding to be the amount of time from a hospital admission bed request to leaving the ED; for this study, an ED “boarder” was defined as a patient whose boarding time was more than 6 hours.

The primary outcome was the mortality rate during the admission. A secondary outcome was the proportion of patients who required transfer to an ICU at any time during their hospitalization.

Primary Data Analysis

We present continuous data as medians with interquartile ranges or means and 95% confidence intervals (CIs) and binary data as the percentage frequency of occurrence. Data were analyzed with SPSS 16.0 for Windows (SPSS, Inc., Chicago, IL).

RESULTS

There were 55,062 ED patients admitted to the hospital and 1,798 deaths (3.3%; 95% CI 3.1% to 3.4%) overall. Of all admissions, 2,042 (4%) went to a hallway; 53,020 went to a standard bed. Patients admitted to standard and hallway beds were similar in age (median [interquartile range (IQR)] 55 years [37 to 72 years] and 54 years [41 to 70 years], respectively) and sex (48% and 50% female patients, respectively). Hallway admissions were more likely for patients arriving during the evening shift (4 PM to midnight; 4.5% of all admissions) compared with those arriving during the overnight shift (midnight to 8 AM; 3.6%) or day shift (8 AM to 4 PM; 3.1%; $P < .001$).

The median (IQR) times from ED triage to actual admission (ED length of stay) in patients admitted to standard and hallway beds were 426 minutes (306 to 600 minutes) and 624 (439 to 895 minutes) minutes, respectively ($P < .001$). Median ED census at triage was lower for standard bed admissions than for hallway patients (44 [33 to 53] versus 50 [38 to 61], respectively; $P < .001$).

In about 25% of cases, an appropriate inpatient bed was found for patients assigned to a hallway bed immediately on arrival to the inpatient unit; another 25% were placed in a room within an hour. The remaining 50% boarded on the inpatient unit approximately 8 hours before room placement (from hospital continuous quality improvement data).

In-hospital mortality rates were higher among patients admitted to standard beds (2.6%; 95% CI 2.5% to 2.7%) than among patients admitted to hallway beds (1.1%; 95% CI 0.7% to 1.7%). ICU admissions were also higher in the standard bed admissions (6.7% [95% CI 6.5% to 6.9%] versus 2.5% [95% CI 1.9% to 3.3%]).

LIMITATIONS

Our study is limited by the retrospective nature, which may have introduced selection bias beyond the inherent policy-driven bias about who is eligible for hallway placement. We could not control or measure for patient acuity and initial illness burden to better assess the differences between groups. Second, we did not collect data on the effect of our protocol on patient and staff satisfaction, which are also important elements that need to be considered when introducing a similar policy. We also did not study the effect of the full-capacity protocol on other patient-centered outcomes such as time to analgesia or antibiotics in patients with pain and pneumonia respectively. Third, our results are limited to a single center and may not be generalizable to other hospitals or settings.

DISCUSSION

According to the definition proposed by the American College of Emergency Physicians, “[c]rowding occurs when the identified need for emergency services exceeds available resources for patient care in the ED, hospital or both.”¹⁶ Asplin et al¹⁷ have proposed a conceptual model to better understand the causes of ED crowding. According to this model, ED crowding may be influenced by input factors (eg, nonurgent visits, “frequent flyers,” influenza epidemics), throughput factors (eg, use of ancillary services and testing within the ED), and output factors (eg, availability of hospital beds). Contrary to common belief, nonurgent visits and visits by “frequent flyers” are not dominant contributors to ED crowding.^{18,19} The increase in ED visits also cannot be attributed to the uninsured patients.²⁰ Whether inadequate ED staffing is a major contributor to crowding is the subject of ongoing debate.^{21,22}

More recently, barriers to admission of patients from the ED are recognized as major contributors to ED crowding.² One part of the solution is to share boarding—that is, not cluster all use to the already crowded ED—by using sites such as the inpatient ward hallways.²³ Although commonly practiced in the past and in other countries, there has been widespread resistance to boarding of admitted patients in inpatient hallways by many non-ED personnel in the United States. One of the main concerns cited by inpatient physicians and administrators is a fear that patients in hallway beds on the inpatient wards (but not in the ED) are at greater risk of poor outcomes and harm such as mortality than patients admitted to standard inpatient wards and beds.

The driving force behind adoption of the full-capacity protocol at Stony Brook was institutional, rather than departmental, with “ownership” of the problems created by boarding of admissions, and thus asking what is safest for all patients from an institutional, rather than individual unit, perspective. The adoption of the full-capacity protocol at Stony Brook has been carefully monitored through the hospital’s continuous quality improvement process. Our monitoring has failed to identify, even through anecdote, any increased or direct harm to patients from hallway placement per se. This contrasts

with well-established patient safety issues related to the boarding of admitted patients in the ED.

The results of our study demonstrate that transfer of admitted ED boarded patients to an inpatient hallway bed does not create undue patient mortality or emergency ICU upgrades. These differences in hallway patient and ED boarded mortality and ICU transfers most likely reflect a different level of acuity and complexity rather than a universal hallway benefit. Nonetheless, the results are supportive of the safety of this practice. In addition to being a safe practice, studies suggest that, when asked, patients actually would prefer to be sent to inpatient hallway beds than stay in the ED hallway awaiting a standard bed.^{24,25}

We hope that prospective, controlled trials comparing similar patients placed in rooms versus hallways on the floors would follow our efforts and better assess comparative outcomes, including global process of care, and satisfaction. In addition, more broad resource use analyses are needed that include hospital-wide (not just ED or one unit focused) nurse-to-patient ratios and nursing hours per patient. It would also be of interest to evaluate any effect of boarding patients in inpatient hallways on patients already admitted to standard inpatient beds. Given the difficulty of performing a randomized controlled trial, use of propensity scores to adjust for patient severity might also be considered in future studies.^{26,27}

The full-capacity protocol serves as a decompression valve to a busy ED, but it is not without its limitations. Only so many patients can be boarded in a hallway (at least by our policy), and substantial numbers of boarders may remain in the ED. Further research would be helpful to define the limits of the efficacy of the full-capacity protocol. The "correct" distribution of patients, including what is an appropriate maximum per inpatient unit, has not been determined.

Several studies are congruent in showing a decreased length of stay associated with moving boarded patients out of the ED.²⁸⁻³¹ However, which particular processes led to this decrease are unknown and should be defined and possibly implemented on a broader scale. For any study involving the full-capacity protocol, it is important to make the appropriate comparisons. Although comparison of care rendered to the patient in a room versus a similar patient placed in a hallway is important, the key comparison, in our experience, is the patient boarding in the ED hallway versus the hallway on the inpatient unit.

Our full-capacity protocol that allowed select inpatient hallway boarding of admitted patients from the ED was feasible and associated with acceptable patient outcomes.

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Address for correspondence: Adam J. Singer, MD, Stony Brook University, HSC Level 4, Rm 080, Stony Brook, NY 11794-8350; 631-444-7857; E-mail adam.singer@stonybrook.edu.

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