



Emergency department and hospital crowding: causes, consequences, and cures

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Overcrowding with associated delays in patient care is a problem faced by emergency departments (EDs) worldwide. ED overcrowding can be the result of poor ED department design and prolonged throughput due to staffing, ancillary service performance, and flow processes. As such, the problem may be addressed by process improvements within the ED. A broad body of literature demonstrates that ED overcrowding can be a function of hospital capacity rather than an ED specific issue. Lack of institutional capacity leads to boarding in the ED with resultant ED crowding. This is a problem not solvable by the ED and must be addressed as an institution-wide problem. This paper discusses the causes of ED overcrowding, provides a brief overview of the drastic consequences, and discusses possible cures that have been successfully implemented.

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Capsule Summary

What is already known

A growing body of literature demonstrates that emergency department overcrowding can be a function of hospital capacity rather than an emergency department specific issue.

What is new in the current study

This paper discusses the causes of emergency department overcrowding, provides a brief overview of the drastic consequences, and discusses possible cures that have been successfully implemented.

INTRODUCTION

In the emergency department (ED), multiple medical services, providers, and ancillary staff must work together to triage, diagnose, and treat medical problems ranging from the benign to the life threatening. Since its inception, the ED has been negatively affected by overcrowding, defined by the American College of Emergency Physicians as a situation in which "...the identified need for emergency services exceeds available resources for patient care in the ED, hospital, or both."¹ Countless studies and interventions have been targeted at improving flow through the ED, especially in high volume EDs, where overcrowding can lead to patient safety issues. Efforts to improve patient flow have often met with very limited success. Why? Although the problem of overcrowding is most visible in the ED, it is strongly associated with boarding of admitted patients due to inadequate hospital capacity. This problem cannot be overcome by process improvements limited to the ED nor by diverting low acuity patients, since they do not address the underlying problem caused by boarding.^{2,3} Boarding reflects an institution-wide lack of capacity, thus suggesting that the better term is hospital overcrowding.

The ED is the gateway to the hospital. In the United States, a total of 131 million ED visits resulted in 14.5 million admissions (11%) in 2012, of which 13% were admitted to a critical care unit.⁴ In South Korea, of the 4.97 million ED visits recorded in the 2012 National Emergency Department Information System, 995,326 resulted in admission (20%), of which 14% were admitted to an intensive care unit.⁵ The scope of practice in Emergency Medicine is expanding to include prolonged observational stays, more complex diagnostic workups, and increased critical care and intensive care within the ED. As this occurs, the strain of an overcrowded department is becoming more evident each day as patients spend more and more hours in the ED receiving definitive care and diagnostic workups for conditions that were previously the domain of the inpatient services.

CONSEQUENCES

ED overcrowding has true costs and has real consequences, in both patient care and the cost of medicine. Overcrowding causes delays in care for all patients, including the critically ill, 10% of whom wait more than one hour to see a physician according to the Centers for Disease Control and Prevention.⁶ A 2009 study found that serious complications increased 3-5 fold in acute coronary syndrome patients who presented at times of overcrowding.⁷ A 2012 study showed that ED crowding increased 28-day mortality rate in community acquired pneumonia patients.⁸ ED

boarding has been demonstrated to increase total hospital length of stay (LOS) by at least one day, with the longest boarders having increased LOS of 3 days.⁹⁻¹⁸ Boarding increases the number of patients who leave without being seen, including those with serious illnesses.^{19,20} Boarding also increases the incidence of medical errors and reduces the quality of care that can be provided by overwhelmed staff.²¹⁻²³ This reduced quality of care has been demonstrated in delays in care of asthmatics,²⁴ patients requiring antibiotics for pneumonia,²⁵⁻²⁷ and adults needing pain relief.^{28,29} ED boarding of admitted patients causes inefficiency within the department, leading to lost revenues from walkouts and diversions, increased LOS and loss of revenues from emergency medicine admissions.^{14,30-33} Most importantly, boarding in the ED is directly related to increases in 10- and 30-day mortality.³⁴⁻³⁶ Reducing boarding and improving hospital capacity leads to lower overall mortality rates.^{37,38}

INEFFECTIVE INTERVENTIONS

With the major cause of ED overcrowding identified as a bottleneck of admitted patients waiting for an inpatient bed and a lack of hospital capacity, it is clear why the interventions targeted at ED flow have been only minimally effective. Diverting non-urgent patients has shown little difference in terms of flow, and is a patient safety issue as many "non-urgent" patients will eventually require hospital admission.^{39,40} Expanding ED capacity does little to reduce time to admission but rather increases the capacity for boarded patients, further straining an already overwhelmed staff.⁴¹⁻⁴³ While additional staff from the inpatient unit can help relieve the strain on the ED nursing staff, boarded patients still create space constraints limiting the capacity of the ED to see new patients.⁴⁴

CURES

In order to truly address the problem of ED overcrowding, we must address the problem of hospital capacity. Viccellio et al.⁴⁵ identified four major areas that must be targeted to improve hospital capacity and decrease ED boarding: smoothing of elective admissions, early discharge, weekend discharge, and full capacity plans.

Smoothing elective admissions

While the variability of emergency medicine admissions is uncontrollable, studies over time have shown that it is highly predictable based on time, season, and epidemiology,⁴⁶⁻⁴⁸ resulting in a smooth pattern of admissions without a great deal of variability from day to day. The remainder of hospital admissions are elec-

tive scheduled admissions which, historically, have been scheduled early in the week to suit the needs of specialty practices that tend to follow a more regular schedule of working hours. In fact, studies from *The Journal of Hospital Medicine* and *the Annals of Surgery* have demonstrated that elective surgical admissions can vary by a factor of 3 between weekdays.^{49,50} These large variations in elective admissions create a bottleneck early in the week, resulting in elective patients competing directly with ED patients for intensive care unit (ICU) and floor beds. Given the spikes in elective admissions early in the week, "smoothing" these admissions and evenly distributing them across the week would improve hospital bed capacity and, therefore, improve ED flow by decreasing boarding.⁵¹⁻⁵⁴

In 2003, Boston Medical Center, with a volume of 120,000 ED visits was faced with overcrowding, boarding, and diversion. Their overcrowding assessment found that the variability in elective admissions drove ED boarding. Boston Medical Center then smoothed admissions across the week for each destination—step down unit vs. ICU vs. regular floor bed—to maximize operating room efficiency.^{45,55} The results were impressive: ambulance diversion decreased; LOS decreased by 45 minutes; waiting room time decreased by 20 minutes; cancelled procedures dropped by 99.5%; and ICU and step down unit variability decreased by 55%, all while seeing more patients than the year prior.^{45,55}

Early discharge

As the volume within the ED increases throughout the course of the day, the volume of patients being admitted to the hospital increases. Without the early discharge of inpatients, newly admitted ED patients become ED boarders. A focus on early discharge before noon has been demonstrated to improve the flow of the ED by decompressing the number of ED boarders prior to the time the ED is at its busiest.⁵⁶⁻⁵⁸ In 2011, NYU-Langone Medical Center was faced with increasing patient volume and patient acuity. Metrics identified that admitted patients arriving on the floors after 1 p.m. remained in the hospital 0.6 days longer than those that arrived before 1 p.m. Throughout 2011, less than 10% of patients were discharged before 12 p.m., preventing admitted ED patients from moving to the floor. This often delayed initiation of necessary tests and interventions such as social services, case management, and consults, leading to an increased length of stay.^{45,59,60} NYU-Langone Medical Center launched the Discharge Before Noon Challenge (DBN) in March of 2012. Multiple causes of late discharge were identified, including patient desire to stay for meals, wait for transportation, or discuss final recommendations with their care team. The initiative involved all healthcare workers within the hospital, from the chief of medicine and nurs-

ing staff to the clerks and transporters. It was made clear to the health care team that discharging patients earlier in the day was in their best interest, allowing patients time during the day of discharge to establish home care, obtain durable medical equipment, and obtain prescription medications. In order to achieve early discharges, major institutional changes were implemented: health care team members' roles were clarified; checklists were designed; and geographical wards were created to streamline communication between nurses and physicians.^{45,60} With geographic wards, the health care team functioned as one team in one area, allowing for interdisciplinary rounds involving physicians, nurses, social workers, and case managers. Patients were notified of their plan of care and those patients identified as possible discharges the next morning were prioritized for testing and consults. Three months after the DBN initiative began, the discharge before noon rate increased from 5% to 30%. Over five years, that rate increased to 42%. The DBN initiative did not increase readmission rates, and decreased the observed to expected LOS by 0.8 days.⁴⁵

Weekend discharge

Further variability occurs during the weekends, when the number of discharges is almost 50% less than the number of weekday discharges. The NY SPARCS (Statewide Planning and Research Cooperative System) data shows that LOS is 1.22 days shorter for medicine patients discharged on a Saturday, compared to patients discharged on Monday. Similarly, LOS increases to 2 days for surgical patients. Thus, increasing weekend discharges can increase inpatient hospital capacity, decrease ED boarding, and decrease overall hospital LOS.⁶¹ The impact of increasing weekend discharges is best demonstrated by the success of the Montefiore Medical Center (MMC) in creating an institutional focus on weekend discharges. A hospital that operates at near 100% capacity at all times, MMC implemented systems to increase the number of weekend discharges, including utilizing throughput managers responsible for the discharge process. The results were dramatic: MMC's boarding decreased from 30 patients on average to almost zero within a year; LOS decreased; revenue increased; and a 30-bed inpatient unit was closed due to increased available capacity.⁴⁵

Full capacity action plan

The previous three interventions serve to improve capacity, thus reducing boarding. However, economic factors require that hospitals run at near capacity; thus, small variations in flow can cause admitted patients to outpace the available inpatient beds.^{62,63} When capacity is exhausted, hospitals should utilize a program to handle excess admitted patients and reduce ED boarding, such as

the full capacity protocol (FCP). The FCP redistributes boarders to inpatient units; these patients are placed in available areas of the inpatient floor (hallways, conference rooms, solarium, and exam room) instead of the ED hallway. The sickest patients requiring higher levels of care continue to board in the ED until an ICU or step-down bed is available. Institution of a FCP has been extensively studied in multiple settings and has been shown to decrease wait times, reduce boarding, improve throughput, shorten overall length of stay, and improve patient satisfaction.⁶⁴⁻⁶⁸ In 2001, Stony Brook University Hospital developed a FCP in the face of ever-increasing ED boarding. During times of overcensus, a total of 9 units were asked to increase their census from 30 to 32 patients, allowing a total of 18 boarded patients to be redistributed throughout the hospital rather than left in the ED. Their protocol showed an improvement of approximately 4 hours per day in nursing hours per patient and a 0.8-day decrease in overall LOS.^{45,68} Additionally, a survey of patients who spent time boarding in ED and inpatient hallways, showed that patients preferred to board in the inpatient hallways.⁶⁵ A full capacity protocol should be extensive enough to match the need, to assure that every patient's care and attention is maximized to the best of the institution's abilities. This is not possible if all boarders are simply left in the ED.

CONCLUSION

The term "ED overcrowding", when due to boarding of admitted patients, is more accurately termed "hospital overcrowding". Over the years, multiple small process improvement projects have attempted to improve ED overcrowding, including improving nursing report, rapid bed cleaning and bed turnaround, bedside registration, hospitalists in the ED, and increasing ED bed capacity. While important interventions, these processes do not improve the fundamental problem of improving hospital capacity.⁶⁹ ED boarding is a major patient safety issue, with studies demonstrating, increased LOS, increased medical errors, increased number of patients leaving without being seen and, increased mortality in both 10- and 30-day studies.³⁴⁻³⁶

With so many grave consequences, hospitals need to attack hospital overcrowding with interventions that have been shown to be effective. Four critical actions have been identified that, when effectively implemented to a sufficient degree, significantly decrease the number of admitted patients boarding within the ED and improve all associated metrics. These critical actions include the smoothing of elective admissions, implementation of both early daily discharges and continued discharges through the weekend, all to improve capacity, as well as the development and activation of the full capacity protocol when overall hospital ca-

capacity has been exceeded. Targeting these four interventions means a focus on process improvements hospital-wide. Communication, cooperation, and compromise between the ED, inpatient and surgical services, and administrative leadership will be crucial for implementation. Change is challenging, but the demonstrated benefit through case studies show they can substantially reduce or eliminate boarding of admitted patients, enhance patient safety, improve capacity, and improve the financial health of the institution.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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