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AAEM POLICY PAPER

EMERGENCY DEPARTMENT CROWDING: PAST, PRESENT, AND FUTURE DIRECTIONS

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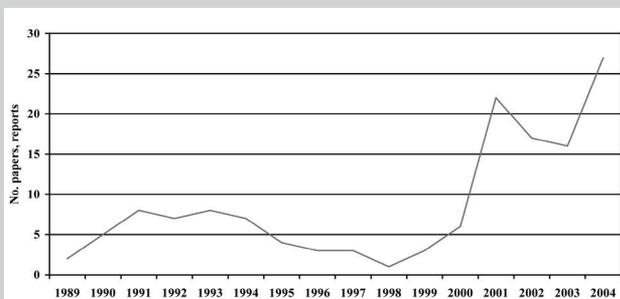
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INTRODUCTION

The medical literature has become crowded with papers about emergency department (ED) crowding. In the 17 years since crowding was first described,^{1, 2} over 120 papers and reports discussing the subject have appeared in peer-reviewed journals (Fig. 1). The rapid growth in the number of papers discussing ED overcrowding, or crowding, does not include the many news stories that have appeared in print and broadcast media discussing the same topic.

Figure 1. Number of papers and reports on ED crowding, 1989-2004. Used with permission from Reference 5.

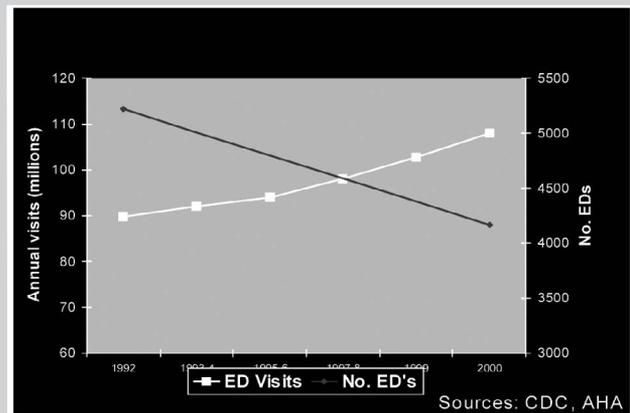


The recent report on US emergency care by the Institute of Medicine (IOM) has refocused attention on the problem.³ The IOM's report, which cites growing visit volumes, hospital closures, financial pressures, and operational inefficiencies as the prime drivers of crowding, unambiguously calls for an immediate end to crowding, through financial, regulatory, and operational measures. The impact of this landmark report remains to be seen, but it offers a powerful indictment of the persistence of crowding in US emergency care.

Despite the prominence that ED crowding has assumed in recent years as a medical and policy issue, only minimal progress has been made in its amelioration. One is reminded of Mark Twain's adage: "Everybody talks about the weather, but nobody does anything about it."⁴ The causes of ED crowding are numerous and well-documented: fewer hospitals with EDs nationwide, increasing numbers of patients, nursing shortages, growing numbers of uninsured patients, declining reimbursement, medicolegal challenges for on-call specialists, and

excess numbers of admitted patients being held in EDs. Figure 2 contrasts trends in the growth in ED visit volume with the decline in the number of EDs.

Figure 2. Number of EDs and patient volume, 1992-2000. Used with permission from Reference 5.



The origins of ED crowding extend back nearly 20 years. Crowding represented the convergence of several forces; two recent reviews of the topic, in addition to the IOM report, provide additional detail.^{3, 5, 6} Passage of the Emergency Medical Treatment and Active Labor Act in 1985 mandated EDs to provide a medical screening examination and stabilization for all presenting patients, irrespective of ability to pay. Coupled with growing uninsurance among Americans, these two forces served to increase ED utilization. Throughout the 1990s, annual visit volumes to U.S. EDs grew rapidly, while hospitals (and their EDs) closed. From 1992 to 2001, annual ED visit volume rose 23% from 89.8 million to 110.2 million.^{7, 8} Concurrently, EDs were closing: from 5169 in 1988 to 4037 in 2002 (see Figure 1).⁹

Although ED crowding is related to ED volume, an ED can be busy without being "crowded." Crowding refers to a condition when the demand for ED services exceeds the available supply.¹⁰ Crowding is thus (in part) a function of patient volume, patient acuity, physical space, and numbers of on-duty staff. Additional factors such as throughput efficiency and the ability to move admitted patients to beds on inpatient units affects whether crowding occurs. As noted by the IOM, crowding "blocks access to emergency care, induces stress in

providers and patients alike, and can lead to errors and impaired quality of care.³ With this report, along with the accepted role of EDs as a vital component of the nation's health care safety net,^{3, 11-14} ED crowding has become an important policy issue in American medicine.

Origins of Crowding: Early reports of ED crowding addressed the increasing numbers of patients in urban areas suffering from substance use, homelessness, HIV/AIDS, and mental illness.^{2, 15} An influential 1993 report by the General Accounting Office attributed the growing volume of ED visits to these social and behavioral disorders. The report pointed out that many of these patients were uninsured or had Medicaid, and were using the ED for nonurgent conditions.¹⁵ This report focused attention on nonurgent, or "inappropriate," visits by uninsured and underinsured patients as an important cause of ED crowding. More recent work has challenged the idea of these "inappropriate" visits, noting that most of these visits are made by patients with important comorbidities or who are unable to see their primary care providers.¹⁰

In 2003 the Government Accounting Office reported that, in contrast to its 1993 study, the single greatest cause of crowding was the prolonged presence in the ED of patients already admitted to hospital, for whom no inpatient bed is available.¹⁶ These "boarders," or "holds," consume substantial amounts of resources and labor. They also pose an important opportunity cost in ED efficiency, because they prevent staff from treating the next patient, or bringing in a new patient from the waiting area. Along with ambulance diversion, boarding was recognized by the IOM as an important and unacceptable consequence of crowding.

RECENT INTERVENTIONS: HALLWAY ADMISSIONS, URGENT MATTERS, JCAHO

The last half decade has seen real progress in addressing crowding, involving combinations of policy, administrative, and clinical initiatives. This activity arose in part because of the 2001 "Expert Meeting on ED Crowding and Ambulance Diversion," convened by the US Department of Health and Human Services,¹⁷ and an important new initiative from the Robert Wood Johnson Foundation. These activities have met with some success: for example, episodes of ambulance diversion (closing an ED to arriving ambulances) became less fre-

quent in 2002-2003 than in previous years.¹⁸

Hallway admissions: In 2000, the New York State Department of Health issued a directive to all acute care hospitals in the state, allowing the placement of admitted ED patients in "hallway" spaces of inpatient wards, if an inpatient room was unavailable.¹⁹ Anecdotal evidence suggests this directive has allowed some hospitals in the state to alleviate ED congestion, with no apparent adverse clinical outcomes.

Urgent Matters: In 2002, the Robert Wood Johnson Foundation created a national program office to develop strategies to alleviate ED crowding, and to assess its impact on the health care safety net. The program, Urgent Matters (www.urgentmatters.org) funded 10 US health care systems and a community partner for each to design and test a crowding intervention. Results indicate that a variety of hospital-wide policies can reduce diversion and improve ED throughput, including greater attention to inpatient discharge planning, faster turnaround from radiology and laboratory services, and greater coordination of care among EDs within a geographic region. A particularly promising strategy is the "smoothing" of elective admissions, which allows for more efficient use of inpatient beds. A pilot study at Boston Medical Center, based on the work of Litvak, demonstrated a reduction in the surgical stepdown unit in inpatient nursing hours per patient per day from 8.66 to 8.16, allowing patients boarding in the ED to go to inpatient beds more quickly.^{6, 20} This contributed to a reduction in the number of hours spent on diversion.

Joint Commission on the Accreditation of Health-care Organizations: In 2004, the Joint Commission (JCAHO) issued an important new guideline on crowding (available at www.jcaho.org). The guidelines recognize the link between crowding and quality. Although the guidelines do not call for hospitals to have explicit policies to alleviate crowding, they do call for hospitals to have plan for surge capacity in place, and to provide a level of service to boarded patients comparable to that which they would receive on an inpatient unit. The IOM report calls for strengthening of the JCAHO standards that address ED crowding, boarding, and diversion, and note that the guidelines promulgated were weaker than those initially proposed, because of pressure from the hospital industry.³

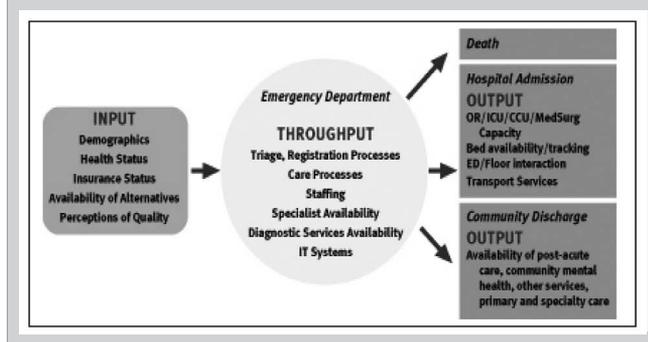
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Conceptual Model: Input/Throughput/Output Model: A conceptual model of ED crowding developed by Asplin et al. has become a standard tool to analyze causes of the phenomenon.²¹ This model, seen in Figure 3, describes a series of factors that contribute to ED crowding at various points in patient throughput. The three domains, Input, Throughput, and Output, correspond to their “sites of action.” The model considers crowding to be the consequence of the interplay of these three sets of factors: greater input (numbers and/or acuity of arriving patients), inefficient throughput (ED operational processes), and diminished output (“downstream” obstacles to moving patients out of the ED).

Figure 3. The Input-Throughput-Output Model (reproduced from the Urgent Matters web site, www.urgentmatters.org).



Measures of ED Crowding: A persistent difficulty in studying ED crowding remains the lack of a criterion standard and consensus definition of the phenomenon.²² Proposed markers of ED crowding have included: a transfer time of admitted patients from the ED to an inpatient bed of greater than 4 hours;^{23, 24} all ED beds filled > 6 hours/day;²⁵ patients placed in hallway beds > 6 hours/day;²⁵ physicians feeling so rushed that they may make errors;²⁶ 10 or more patients/day who have waited > 10 hours to see the emergency physician;²⁶ and having > 30% of ED beds filled with admitted patients awaiting an inpatient bed.²⁵ Many of these measures are ED-specific, and do not account for variation in ED size, visit volume, acuity, and staffing capacity.

An additional challenge in the quantification of crowding is whether the variables that might comprise this measure are the same as those needed to measure surge capacity, i.e. a health care system's ability to treat

patients from a mass casualty incident. A working group formed at the 2006 *Academic Emergency Medicine* Consensus Conference on surge capacity is drafting guidelines that will address this issue.

An ideal measure of ED crowding would:

- have the same meaning across EDs of different sizes;
- allow clinicians, researchers, and administrators to measure and compare the impact of various interventions to alleviate crowding;
- be reproducible and accurate;
- consist of data elements that are continuously measured by existing information systems.
- be programmable into an ED's electronic patient tracking system, so that it could be calculated passively and used in real-time.

Several measures of ED crowding have been proposed. Most have been derived and tested at single institutions, thus limiting their generalizability. All of them incorporate components of the Input/Throughput/Output model. None have been prospectively validated, and none have yet been used as real-time measures of crowding by programming them into the ED's clinical information system.

Emergency Department Work Index (EDWIN):

EDWIN incorporates pertinent components of the Input/Throughput/Output model—patient number and acuity, numbers of physicians on duty, and bed availability—into a single omnibus index.²⁷ In a single-institution study, EDWIN correlated well with nurse and physician assessments of crowding, and was higher when the ED was on diversion. It correlated weakly with a composite measure of quality of care that included the numbers of 72-hour returns who were admitted, radiology overreads of ED x-ray interpretations, and quality improvement cases. EDWIN's ability to be programmed into patient tracking software as a real-time measure of crowding provides an opportunity to directly study the relationships between ED crowding and adverse events, including medical error and deviations from evidence-based standards of care. In a recent six-ED study, EDWIN correlated well with ED length of stay for admitted patients, ambulance diversion and left without being seen rates, although it was outperformed on the latter two measures by ED occupancy rate.²⁸

National ED Overcrowding Study (NEDOCS): This five-question instrument was developed at eight academic EDs. It has been validated by comparison to charge nurse and attending physician assessment of crowding.²⁹ The five components of NEDOCS are: (1) number of ED patients divided by number of ED beds (2) number of admitted patients in ED divided by number of hospital beds (3) number of ED patients receiving mechanical ventilation (4) longest admit time for any ED patient, and (5) waiting area time of the last patient placed in an ED bed. Points are assigned for each of these conditions and summed. A nomogram then converts this point total to the NEDOCS score, which is scaled from 0-200. This score showed good agreement with nurse/physician assessments of crowding. NEDOCS has been shown to correlate with the probability of a patient leaving without being seen.³⁰

Recent data suggest that EDWIN and NEDOCS provide comparable assessments of crowding, when measured against physician and nurse perceptions.³¹ NEDOCS holds promise as a useful measure of crowding, but the incorporation of the number of ventilated patients may limit its utility as a real-time crowding measure, calculated passively by patient tracking software.

Boston ED Workscore: Epstein et al. developed a score that incorporates the ESI triage score, nursing staffing, the number of patients in the waiting room, the number of boarders, and the number of treatment beds.³² The score was found to predict diversion with 86% sensitivity and 80% specificity. EDWIN performed slightly less efficiently on the same data set than the Boston score, which has not been validated at other sites.

Emergency Department Crowding Score (EDCS): This score was developed at eight academic EDs.³³ Like several of the other scores, the EDCS uses physician/nurse assessment of crowding as the criterion standard. By applying ordinal logistic regression to variables identified from the Input/Throughput/Output model, this study found the following variables to be independently predictive of crowding: the number of boarders, the total number of ED patients, and the number of critical care patients. Higher EDCS was associated with increased ED length of stay, mean boarding time, patients leaving without being seen, and diversion. An attractive feature of the EDCS is that it is scaled from 0-100; diversion and

patients leaving without being seen become more likely above a threshold score of 65.

Additional crowding scores have been reported from Spain^{34, 35} and Australia.³⁶⁻⁴¹ All incorporate components of the Input/Throughput/Output model, such as total numbers of visits, total daily patient care time, and numbers of patients in various zones of the ED. These scores were developed and tested at single institutions, against measures including 72-hour returns who were admitted, mortality rate, and diversion. None have been validated at other centers, none are scaled for use by EDs of different sizes, and none have been used as a real-time measure of crowding.

QUALITY AND ED CROWDING

Crowding affects the quality of care delivered in EDs, as noted in the IOM report. Studying the link between crowding and quality is an important component of the research agenda in crowding.⁴² The measures of greatest interest would address clinical outcomes, such as treatment delays for acute MI, pneumonia, and missed or delayed diagnoses. Most data reported generally reflect case reports or small case series.^{26, 42, 43} One report from 25 hospitals in Ontario, Canada noted a delay in thrombolytic times of 7 minutes for patients with acute MI during periods when 60% or more of the EDs were on diversion.⁴⁴ Two reports published in abstract form note longer times to antibiotic administration for patients with community acquired pneumonia treated during conditions of ED crowding.^{45, 46}

Mortality data: A small but growing body of evidence suggests that higher nurse/patient ratios result in higher mortality rates and adverse performance on quality measures, for inpatients, critical care unit patients, and residents of nursing homes.⁴⁷⁻⁵¹ Intriguing data recently reported from Australia have described an association between ED crowding, hospital occupancy, and inpatient mortality.⁴¹ High hospital occupancy (and resultant ED crowding) was associated with a cumulative 30 day hazard of 6 additional deaths per 1000 admitted ED patients (95% CI 4-8 deaths). This relationship needs to be explored further.

EMERGENCY CARE AS A PUBLIC GOOD: SIMILARITY TO POLICE, FIRE PROTECTION

Emergency departments should have the capacity

to care for patients with serious emergency conditions at all times. Communities depend on EDs to be available for patients who have acute problems that require time-sensitive treatment, such as trauma, acute myocardial infarction, acute abdomen, and stroke. The ED provides a key public service for communities and should be considered an essential service, akin to that provided by fire and police departments. In effect, this would extend the duty of government to subsidize emergency care. In an era marked by actual and potential disasters, both natural and man-made, such as 9/11, Hurricane Katrina, and avian influenza, this seems a reasonable policy position. In practice, it would offset the losses incurred by hospitals as a result of the unfounded EMTALA mandate.

The IOM report recognizes this enhanced governmental obligation, by calling on Congress to appropriate \$50 million to reimburse hospitals that "provide significant amounts of uncompensated emergency and trauma care for the financial losses incurred by those providing those services."³ The report also calls on Congress to increase funding for disaster preparedness and surge capacity measures.

THE FUTURE

Ultimately, solutions to ED crowding must embrace broader reforms in American health care. Crowding is intimately related to issues of access to care, efficiencies in care, financing, and resource allocation. Our hope is that the recent IOM report on emergency care, along with the renewed focus on surge capacity as a component of homeland security, will keep these issues high on the policy agenda for health care. The IOM's recommendations to address crowding include enterprise-wide operations management, greater use of information technology, enhanced reimbursement for uncompensated care, regionalization of prehospital care and critical specialty on-call services, and enhanced research in emergency care.³ The health care quality and patient safety movements offer another powerful lens for emergency physicians to focus the public's and policymakers' interest in ED crowding.^{52, 53} Let us hope that, in another 15 years, the next wave of editorials and papers about ED crowding will speak of the issue in the past tense. We do not need to follow Mark Twain's dictum; we can do something about the weather.

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AAEM POSITION STATEMENT

The practice of boarding patients in the ED is defined as holding admitted patients in the ED until a staffed, in-patient bed becomes available and this period usually lasts several hours (and sometimes days). Boarding is not in the best interest of the patient being boarded as it compromises their comfort, privacy and medical care. Boarding also delays the care of others, provokes ambulance diversion, and results in some patients leaving the waiting room before being seen by a physician. Boarding creates a significantly more stressful practice environment and contributes to professional dissatisfaction, burnout and high staff turnover. AAEM calls upon hospitals to seek options other than ED boarding to hold admitted patients. AAEM also calls upon regulating agencies to issue rules that forbid boarding.

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