

The Quality Gap: Searching for the Consequences of Emergency Department Crowding

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Emergency department (ED) crowding is an established public health concern that has received a great deal of attention in both the scientific literature and the lay press.¹⁻⁴ There is widespread and growing recognition that “ED crowding” is really a systems issue that is best addressed by implementing strategies across hospital and acute care settings.⁵⁻⁷ Acknowledging the severity of the problem, hospitals, emergency medical services (EMS) systems, provider groups, and national quality improvement organizations have begun to design and implement strategies for improving patient flow throughout the ED and hospital. Perhaps not surprisingly, many delivery systems are implementing operational changes much faster than the research agenda on ED crowding is unfolding.

We previously identified 4 areas of focus for an ED crowding research agenda: developing reliable and valid crowding measures, understanding the causes of crowding, exploring the link between crowding and the quality of care, and testing interventions to alleviate ED crowding.⁸ Of these, significant progress has been made

in measure development and understanding the causes of crowding.⁹⁻¹² However, despite anecdotes linking ED crowding with quality of care concerns,^{5,6} a large gap remains in our understanding of whether crowding adversely affects quality, and if so, what are the nature and frequency of these quality problems.

In this issue of *Annals*, Schull et al¹³ directly address this quality gap by examining the link between ambulance diversion and the timing of reperfusion therapy for acute myocardial infarction. The study’s premise was that ED crowding at an index ED affects clinical outcomes at both the index ED and neighboring EDs. Specifically, the authors hypothesized that ambulance diversion acts to redistribute patient load from more-crowded EDs to less-crowded EDs in such a way that crowding affects all of the institutions in a network that share a common ambulance system. The authors defined “network crowding” as none (0%), moderate (<60%), or high (≥60%) on the basis of the proportion of hospitals in a network that were on ambulance diversion at a given time.

The study included 3,452 patients cared for at 25 hospital EDs, comprising 10 networks whose hospitals participated in a uniform ambulance diversion system. The 25 hospitals also participated in a cardiac care unit registry that the investigators used to identify eligible patients and to determine fibrinolysis treatment times. Hospital diversion status at the time of patient registration was obtained from municipal ambulance system records. In multivariable analyses that adjusted for both patient and hospital characteristics, patients treated in EDs in networks experiencing high crowding had median reperfusion treatment times that were 5.8 minutes longer than patients treated in EDs in networks experiencing no crowding. For patients treated in EDs in networks experiencing moderate crowding, there was a nonsignificant trend toward longer reperfusion treatment times compared with patients treated in EDs in networks experiencing no crowding in the analyses that appropriately adjusted for clustering.

Many authors have identified ED crowding as an important problem for our health care system. Some have even suggested that ED crowding leads to lower quality of care, although to date the data supporting such

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claims have been based on anecdote or small case studies. The study by Schull et al¹³ is important because it is the first large-scale study to critically evaluate the impact of ED crowding on the process of emergency care. Specific strengths of the study include (1) the selection of a process outcome, timeliness of fibrinolysis, which has previously been shown to affect survival for patients presenting with ST-segment myocardial infarction; (2) the use of a systematic approach to assessing ED crowding that not only considers the impact of ED crowding at hospitals on divert but also considers the impact of ED crowding at neighboring institutions to the diverting hospital; and (3) the use of statistical techniques to account for the clustering of patients within hospitals and hospital networks.¹⁴ The authors also deserve credit for the clever way in which they linked data from disparate sources to create a data set from which to answer the study question.

Several limitations of the study by Schull et al¹³ should be noted. In their analyses, the investigators were unable to adjust for several potentially important confounding factors (eg, patient race or presenting symptoms) that have been previously shown to be associated with fibrinolysis treatment time. This is an important consideration given that the estimates of the increased treatment times during periods of crowding were attenuated after adjustment for available confounding factors. Furthermore, the analysis was limited to prespecified cut-points of 0%, less than 60%, and 60% or greater network crowding. Because of the limitations of the study design and the size of the networks, the investigators were unable to perform additional analyses (eg, with network crowding expressed as either a continuous variable or with other cut-points) that could have established the robustness of their findings.

The clinical significance of the study's results is not clear at this time. When the effects of confounding were considered, a relatively modest increase in median treatment times was noted during periods of high ED crowding (5.8 minutes), and no statistically significant increase in treatment times were reported for periods of moderate ED crowding, although a dose-response pattern does appear. It would have been valuable to know whether the increased treatment times during periods of high ED crowding were associated with increased mortality. The Managing Acute Coronary Syndromes—A Tracking Project (MACSTRAK) registry used in this study does contain data on in-hospital mortality, but unfortunately the investigators were not

provided access to the mortality data. In the Discussion section, the authors provide their estimate of the possible impact of delays to reperfusion on mortality.

The concept of network crowding is an approach that has not been formally validated. Although this approach has the potential strength of detecting interactions among hospitals across an EMS system, it may underestimate the impact of ED crowding on quality of care. Future studies of the impact of ED crowding should consider additional measures and mediators of crowding such as patient triage severity and complexity, staffed ED capacity, the total number of ED patients, and measures of hospital capacity adjusted for available staff.

One risk with the study by Schull et al¹³ is that it will be used to support preconceived notions about the effects of crowding. Those who are skeptical about the relationship between crowding and quality will argue that the small time differences are not important, and vice versa. However, it is important to remember that the “variability” of the real world is not reflected in a summary measure. The additional 5.8 minutes are not applied across the board to all patients in a crowded system. Rather, some, in fact many, patients will be unaffected, whereas a few are likely to experience large increases in time to intervention. This is borne out by an increase in the proportion of patients experiencing greater than 60 minute delays during periods of high crowding.

Although it is widely assumed that ED crowding leads to serious quality problems, we have generally lacked data to support such a contention. The current study provides evidence that the timeliness of ED care can be compromised under conditions of high ED crowding. In addition to the timeliness of care, the Institute of Medicine has identified safety, effectiveness, patient centeredness, efficiency, and equity as important dimensions of quality.¹⁵ To get a more complete picture of the consequence of ED crowding, future studies should focus on the impact of ED crowding on the quality of care measured across all Institute of Medicine dimensions for a variety of emergency conditions. To complete this research agenda, we must use a variety of research tools, including traditional quantitative methods such as those used by Schull et al,¹³ as well as qualitative research methods, patient and provider surveys, root cause analyses of adverse events, human factors engineering methods, and other innovative approaches.

Emergency providers are accustomed to fixing problems quickly. Perhaps that is one reason why the

seemingly entrenched problem of hospital and ED crowding is so frustrating—there are no magical quick fixes. And yet, the pieces of the puzzle are coming together, even if they are doing so at the agonizing speed of research. We have better measures of crowding and we understand the causes of the problem much better than we did 4 years ago. Hospitals across the country are making changes to improve patient flow and reduce ED crowding. And now we are beginning to close the quality gap and document delays in emergency care that result because of crowding. If we want to change the way our health care system operates, all of these steps are needed. If we want the system to respond more quickly, we have to build a case for urgency. There is no stronger case for these efforts than documenting how crowding undermines the safety and quality of emergency care.

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