
Differentiating Large-scale Surge versus Daily Surge

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Abstract

This breakout session at the *Academic Emergency Medicine* 2006 Consensus Conference examined how baseline overcrowding impedes the ability of emergency departments to respond to sudden, unexpected surges in demand for patient care. Differences between daily and catastrophic surge were discussed, and the need to invoke a hospital-wide response to surge was explored.

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The *Academic Emergency Medicine* consensus conference breakout session entitled "Differentiating Large-scale Surge versus Daily Surge" was charged with defining resource requirements, responsible factors, and measurements of daily surge. In addition, the group was tasked with examining how surge capacity can be increased to manage a large-scale event and discussing the science of triage techniques during times of surge needs. The purpose of this proceedings report is to outline the discussions and findings of the group, limited as they were by time constraints. It should be

noted that, as Kelen and McCarthy state elsewhere in this issue,¹ neither this breakout group nor the general conference came to consensus on the actual nature of the relationship between large-scale surge and daily surge.

DIURNAL VARIATIONS IN PATIENT FLOW AND UNEXPECTED DAILY SURGE

Emergency department (ED) overcrowding is a nationwide problem affecting the preparedness and safety of our health care system. Its causes are myriad and its consequences far-reaching. Overcrowding can reduce health care quality by increasing the potential for medical errors, prolonging pain and suffering, and reducing patient satisfaction with services.² The effects of ED overcrowding in reducing surge capacity are intuitive but have not been quantified.

Problems with reduced surge capacity due to overcrowding are demonstrated daily in many EDs when the expected diurnal variation in patient arrivals outstrips the supply of ED beds and the ability of physicians and nurses to care for the patient load. It seems reasonable to postulate that the ability of an ED to absorb a sudden, unexpected increase in demand for services is less when the ED is already overcrowded. Surge capacity planning involves ensuring the ability to rapidly mobilize resources in reaction to such a sudden, unexpected increase in demand, regardless of baseline conditions in the ED. Because the nation's EDs are in a state of crisis due to overcrowding,³ the unfortunate reality is that strategies to accommodate surge can be tested and refined on a daily basis; a true disaster is not required.

Surge capacity may be defined as the ability of the health care system to expand care capabilities in response to a sudden, unexpected patient influx, whether this is a smaller "daily" event, such as the arrival of ten trauma

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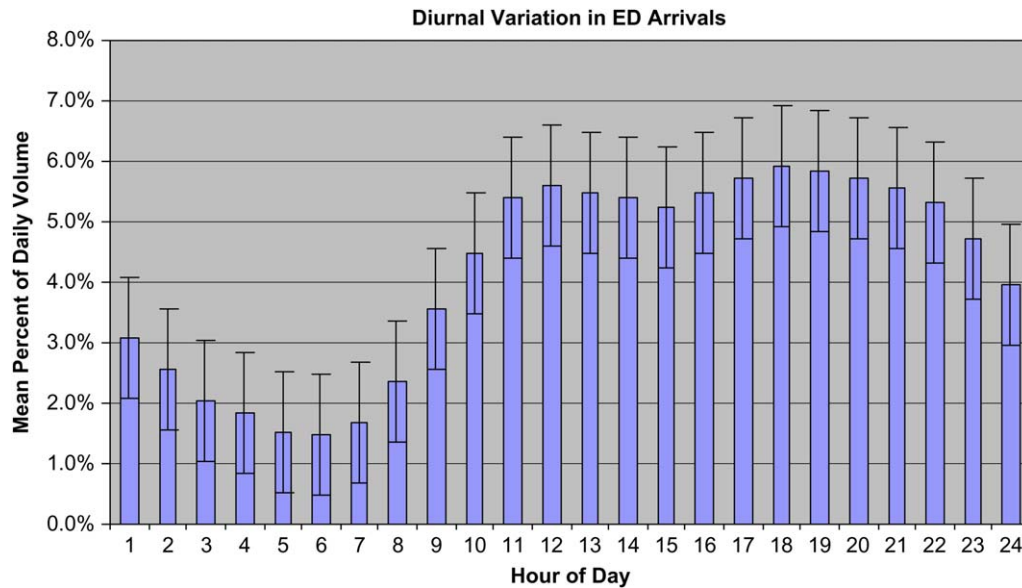


Figure 1. Percent of daily emergency department census arriving by hour of day, with 95% error bars. These data were drawn from 13 emergency departments.⁹

patients from a bus crash, or a larger-scale or catastrophic event, such as a major earthquake. (Elsewhere in this issue, Asplin et al. define daily surge as “the ability to respond to a sudden, unexpected surge in demand using only the daily operating resources of the hospital. If a disaster response plan is activated or additional resources are required beyond those that are normally available for operations, the surge in demand has exceeded the threshold of daily surge capacity.”⁴) The predictable daily flow of patients is evident as a characteristic diurnal curve (Figure 1). The ability of the ED to react to an unexpected surge in demand for service thus varies based on time of day, with there likely being greater surge capacity in the early morning, when ED census and arrival rates are typically low, and lower capacity in the evening, when census and arrival rates are high.

Many factors other than the sheer volume of newly arrived patients contribute to ED crowding, such as length of stay, acuity, and need for inpatient services. These variables do not exist independent of one another, and simple statistics such as daily volume or patient arrivals per hour provide incomplete information. Patient-hours may be a more accurate measure of service demand because both volume and length of stay are accounted for. For example, patients whose emergency evaluation has been completed but who are awaiting inpatient beds continue to consume ED resources and reduce the ability of the ED to care for newly arrived patients. Surge may thus be determined by the volume of patients with emergent needs, with the complexity of cases involved playing a role in resource depletion.

The Institute of Medicine recently released a report that focused on three areas of emergency care: the prehospital care system, emergency departments, and pediatric emergency care.^{3,5,6} Capacity statistics that were cited indicate that an increasing demand for service, coupled with dwindling capacity, is stretching the system to the breaking point. For example, the number of ED visits increased by 27% from 1993 to 2003, from

90 million to 114 million, although the population increased by only 12%. During the same period, 425 EDs closed and the number of hospital beds decreased by 200,000. As a result, many EDs are overcrowded and cannot provide the timely care required by patients with serious illness or injuries. Many patients must wait hours for a physician and days for a hospital bed due to overcrowding, which, in turn, leads to ambulance diversion. Because of the capacity crisis, the emergency care system lacks surge capacity to address large disasters or disease outbreaks.

To meet the demands of surge and increase capacity, methods must be found to improve hospital efficiency and patient flow to the inpatient setting. To use the full capacity of hospitals in different catchment areas, there must be coordination and regionalization of the emergency care system with accountability for each component of the system. The Institute of Medicine study recommends that states and hospitals establish emergency health systems coordinated regionally to direct patients and help prevent overcrowded EDs. In addition, the study recommends that Congress allocate resources to reimburse hospitals for uncompensated emergency care and to fund the establishment of a network to provide regional care to address the issue of surge capacity. EDs that remain overcrowded on a daily basis are ill equipped to handle a large spike in patient volume due to large-scale surge and disasters or even a relatively small surge, as might occur after a “routine” multiple-casualty event.

CATASTROPHIC SURGE

A large-scale public health emergency has the potential to result in great numbers of human casualties; however, disasters are highly variable in the pattern of surge that is produced. While it is tempting to think of surge following disaster as a single spike in volume, some natural disasters such as floods and hurricanes may produce

sustained increases in demand for services where the surge is sustained over weeks, months, or years.⁷ The dividing line between unexpected daily surge and large-scale catastrophic surge may not always be clear, and the two probably exist on a continuum and not as two separate entities. Recent events, such as Hurricanes Katrina and Rita and the potential threat of an avian influenza pandemic, may have resulted in a shift in efforts away from preparation for smaller surge events that are experienced on a daily basis in our nation and toward preparation for much less frequent large-scale disasters. It is worth noting that the patient care requirements may be disproportionate to the number of patients, based on the type of surge event. For example, detonation of a “dirty bomb” may result in an overwhelming surge in resource needs despite a relatively low number of patients if resources to manage radiologic contamination are limited, even if the number of actual patients is not large.

The activation of large-scale disaster response plans should result in drastic changes in patient flow, both in the ED and throughout the hospital. Such changes should include the discharge of stable inpatients and ED patients, canceling of elective operative procedures, and opening of alternative arenas of medical care. Recognizing the differences between the Monday-to-Friday daytime operations of most elective surgery and the 24/7/365 operations of the ED, there are recommendations to smooth out the surgical census by moving elective surgery to Saturdays, Sundays, and evenings, avoiding the otherwise inevitable Monday logjam of elective surgery census.⁸

While the causative factors leading to unexpected daily surge and large-scale disasters may differ, we propose that the response to both should be a gradation in how we change our everyday activities and not an all-or-nothing response. A multistep or graded response to surge likely presents the most effective and efficient method to address both unexpected daily surge and large-scale disasters, although definitions, metrics, and study of this are very limited. Each ED should identify surge measurements or metrics at which various solutions would take effect. These solutions should not be solely activated in the ED, but rather within the hospital as a whole. Many hospitals already use a “zone” or color-coding system to indicate how crowded the ED is, based on factors such as number of admitted patients boarding in the ED (and the subset of these patients bound for an intensive care unit), number of patients in the waiting room, waiting time to be seen by a clinician, and so on. Some of the potential solutions to crowding that may be invoked when a certain “zone” is reached include boarding admitted patients on other floors until their inpatient beds are ready, sending admitted patients to the floor earlier than usual, and calling in additional personnel, such as additional emergency physicians, trauma surgeons, nurses, and other consultants. These steps recognize that no ED exists in a vacuum and that the hospital must view patient safety in the ED as a primary responsibility, even during times of overcrowding and surge. While internal resources to the ED are shifted to accommodate surges, changes may need to extend beyond the ED to the inpatient setting. Boarding low-acuity patients who are awaiting discharge or laboratory results in outpatient areas may help open inpatient space

for admitted ED patients. These and other strategies require research to quantify their impact and effectiveness, both in the setting of ED crowding and in the context of surge. They also require acceptance at the level of senior hospital administration that the entire institution, not just the ED, is responsible for dealing with surge. Many of the breakout session participants noted that it is a general expectation that the majority of a surge will be absorbed and dealt with by the ED, while a small amount of “leakage” may be allowed to trickle to the operating suite, recovery areas, intensive care units, and patient floors. This perception needs to change.

RESEARCH QUESTIONS

During our discussions, the breakout group encountered a number of unanswered questions and areas needing further research. For example, it was noted that further information is needed regarding how long it takes to return the ED to baseline operations after a surge is handled. Does a “larger” response to a surge help get the ED back to baseline faster than a “smaller” response? How can we study the relative effects of various responses, and how can we determine the “best” responses (most effective, least expensive, and so on)? Most of the work in this area appears to be service-line and process work; what is the role of outcomes research? Can we shift the emphasis of this sort of research to outcomes and, if so, how?

Regarding the implementation of responses to surge, how does (or should) the clinician know that he or she is now facing a surge and should “pull the trigger” to implement ED and hospital-wide responses? For noncatastrophic events, is it possible to predict the trajectory of the ED census or make probabilistic inferences about resource demands in the near term? What are the predictor variables in an “early-warning system” for the different types of surges?

CONCLUSIONS

ED overcrowding is a daily occurrence across the nation, and it severely impedes the ability of the emergency health care system to respond to a sudden surge in the demand for services. This surge in demand may be due to large numbers of patients presenting over a brief period or due to sustained increases in volume. In addition, relatively small numbers of patients with extensive demands for complex, resource-intensive specialty services may overwhelm the system. Emergency care systems must be able to react to these three scenarios by responding to the known, predictable, daily variations in demand for services, sudden spikes in demand, or an increase in volume sustained over time, each of which requires very different strategies.

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