Managing Patient Flow: Is High Hospital Occupancy a Root Cause of Ambulance Diversion?

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Managing Patient Flow

Inefficient patient flow through an emergency department (ED) causes long wait times, reduced patient satisfaction, and increased walkouts (that is, leaving without being seen, or LWBS). See Sidebar 1 on page 5 for a look at related Joint Commission requirements. Poor patient flow may also lead to ambulance diversion—a request by an attending physician for ambulances to transport patients to other hospitals (while continuing to accept walk-in patients). EDs may go on ambulance diversion when they reach a critical state in which the volume of patients exceeds its capacity to see and treat them.

Ambulance diversion inherently represents a failure in the mission of the ED to see and treat all patients who seek care. It imposes a burden on surrounding hospitals that receive the diverted ambulances and delays emergency care for critical patients. What’s more, by reducing patient arrivals, diversion results in fewer inpatient admissions, a lower hospital census, and foregone revenue. Ambulance diversion due to overcrowding has increased across the United States and in other developed nations over the past two decades. Reasons for this include decreased inpatient capacity, ED closures, increased ED volume, increased numbers of uninsured patients, and, importantly, boarding of admitted patients (that is, holding patients in the ED who are waiting for a bed to become available elsewhere in the hospital).1

ED Overcrowding: A Systemwide Problem?
Critical states and ambulance diversion are often attributed to ED operational inefficiencies, such as prolonged workups and delays in obtaining ancillary services.2 Administrators holding this view may believe the problem indicates poor and inefficient ED management, and therefore focus improvement efforts on ED operations rather than hospitalwide operations.

However, other research suggests that factors extrinsic to the ED—in particular, high levels of hospital occupancy—contribute to these problems. If a hospital’s occupancy is high, the ED may be unable to find beds for admitted patients, who then become “boarders” in the ED. With beds, staff, and other resources in the ED devoted to boarders, capacity for seeing new arrivals is reduced (see Sidebar 2 on page 5). We, the authors of this article, hypothesize that high levels of hospital occupancy, with reduced capacity in the ED, EDs will more often end up in a critical state and request ambulance diversion.

Gathering and Analyzing the Data
To test our hypothesis that ED diversion is associated with high levels of hospital occupancy, we examined retrospective data from a two-year period, from January 1, 2008, through December 31, 2009, inclusive. These data pertained to an urban, academic, quaternary care hospital with 757 licensed beds. The hospital’s ED has 54 staffed patient treatment spaces. The ED goes on diversion when the department’s medical staff determines that the ED is at capacity and cannot accept more patients safely via ambulance. The medical staff makes the decision based on the following criteria:

• Is the ED bed capacity at maximum?
• Is the ED nursing/technician staff maximized?
• Is hospital nursing staff maximized?
• Has a sudden influx of critically ill patients occurred?

We collected and analyzed several types of data in the course of this study, including the following:

• Hospital occupancy records: The hospital records its occupancy data daily at midnight, providing a “snapshot” percentage of all hospital beds occupied by patients.
• Diversion records: ED administrative staff documents ambulance diversion in real time. They record the number of minutes per day that the ED is on ambulance diversion status. From this we derived a binary measure of days with no diversion versus days with some diversion.

Conventional wisdom says that at 85% capacity, the hospital has limited beds for ED admissions; however, studies show that even at 80% capacity, hospital beds are limited for ED admissions.4 We chose to use the more conservative 80% value for our analysis. We compared days on which hospital occu...
pency was less than 80% against days on which occupancy was 80% or higher, and studied the difference in proportions of days on which ambulance diversion occurred. On days when hospital occupancy was less than 80%, the ED had a diversion rate of 13.2% (diversion occurred on 48 days out of 365). On days with a hospital occupancy at 80% or greater, the diversion rate reached 49.3% (diversion occurred on 180 days out of 365).

Figure 1 (on page 6) shows ambulance diversion against hospital occupancy. We chart a binary measure, using a split-variable histogram for ambulance diversion (horizontal axis) against hospital occupancy levels (vertical axis). With increasing hospital occupancy levels, the proportion of days with diversion increases dramatically. Notice that this is particularly marked at occupancy levels of 80% or greater. Figure 2 (also on page 6) shows mean daily diversion minutes as a function of hospital occupancy. We similarly see a dramatic increase in minutes of diversion occurring at hospital occupancy of 80% or greater.

The Bottom Line
These data show statistically significant and operationally meaningful correlations between hospital occupancy levels and ED ambulance diversion. The data support a hospital occupancy threshold of 80% as one at which important differences occur in associated ED ambulance diversion rates. In addition, the data demonstrate increases in daily diversion time corresponding to increases in hospital occupancy.

These findings support our hypothesis that ED ambulance diversion is not related solely to ED operational performance, but is heavily influenced by hospital occupancy rates. Supporting this conclusion, it has been demonstrated that an increase in intensive care unit (ICU) capacity in the hospital shortened ED length of stay for ICU patients and therefore decreased overall diversion hours. Our study adds ambulance diversion time as another measure of the impact of hospital occupancy on ED patient flow and performance.

ED diversion time is not simply a matter of ED performance, but reflects problems with hospitalwide operational status. This suggests that by fixing flow problems, improving efficiencies, and

Sidebar 1. The Joint Commission Patient Flow Standard

The Joint Commission addresses the issue of patient flow in Leadership Standard LD.04.03.11: "The hospital manages the flow of patients throughout the hospital." Managing patient flow throughout the hospital is essential to prevent overcrowding, which can undermine the timeliness of care and, thereby, patient safety. Effective management of systemwide processes that support patient flow can minimize delays in care delivery. Monitoring and evaluating these processes can help prevent or reduce patient flow problems.

Sidebar 2. The Risks of Boarding in the ED

When an emergency department (ED) is unable to find enough beds to accommodate admitted patients, these patients are often kept in the ED until a bed opens up. This practice, called boarding, may contribute to increased ambulance diversion. A patient is generally considered to be boarding two hours after the patient has been admitted but still remains in the ED.

Prior studies have demonstrated a strong relationship between ED boarding time and other measures of ED performance. ED overcrowding ultimately leads to increased leaving without being seen (LWBS) rates, meaning ultimately that patients have not received medical treatment. Of course, an increase in LWBS also means that hospitals are losing potential admissions and revenue. This is a serious patient safety problem, as high-acuity patients who leave the ED without being seen are at risk of adverse health outcomes. Finally, several studies demonstrate that increases in hospital occupancy lead to increased ED length of stay (and increased boarding) for both admitted patients and patients who are discharged from the ED.

References
expanding capacity throughout the entire hospital, many problems in EDs could be improved, including prolonged length of stay, LWBS, and ambulance diversion.

Future research should determine the effect on ED ambulance diversion of occupancy levels of specific types of hospital beds. Hospitals can use this information to make efforts to increase the availability of those specific beds to prevent overcrowding.

References:

Authors' Note
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Study Limitations: This study is retrospective, and examines for association between levels of hospital occupancy and ED ambulance diversion. This approach can suggest, but not establish, a causal relationship. This study did not examine occupancy levels of specific bed types.

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