Entry overload, emergency department overcrowding, and ambulance bypass

D M Fatovich, R L Hirsch

Objectives: To describe an experience of emergency department (ED) overcrowding and ambulance bypass.

Methods: A prospective observational study at Royal Perth Hospital, a major teaching hospital. Episodes of ambulance bypass and their characteristics were recorded.

Results: From 1 July 1999 to 30 June 2001, there were 141 episodes of ambulance bypass (mean duration 187 min, range 35–995). Monday was the most common day with 39 (28%) episodes. Entry block alone was the most common reason bypass was activated (n=38, 30.4%). The mean number of patients in ED at these times was 40 (occupancy 174%), including nine in the corridor, seven awaiting admission, and 14 waiting to be seen. Episodes attributable to entry block were typically preceded by a presentation rate of ≥10 patients per hour for ≥2 hours (OR 6.2, 95% CI 4.3 to 8.5). Mid-afternoon to early evening was the most common time for activation. Ambulance bypass is increasing in frequency and duration.

Conclusions: Entry overload resulting in entry block results from overwhelming numbers of patients presenting to the ED in a short space of time. Entry block impairs access to emergency care. Unless something is done in the near future, the general public may no longer be able to rely on EDs for quality and timely emergency care. A “whole of system” approach is necessary to tackle the problem.

Overcrowding in the emergency department (ED) is the most serious issue confronting EDs in the developed world. This results in ambulance bypass, a situation whereby an ED instructs the ambulance service to divert ambulances elsewhere, and hence bypass the nearest ED. The reason for this is because it is unsafe for more patients to attend. This is a situation occurring in many countries, and one that is deteriorating. Overcrowding in ED is caused by a complex web of interrelated issues that have been previously reported and are summarised in boxes 1 and 2. The definition of terms used in this paper are in box 3. The typical reason for ED overcrowding is “exit block” from the ED. Exit block is now termed “access block”—that is, the patient is denied access to an inpatient bed. The prime reason for access block is simply a lack of acute inpatient beds.

However, ED overcrowding may also be attributable to “entry block”—that is, entry to the ED is (functionally) blocked. With entry to the ED, inflow may be so great (entry overload) that ED overcrowding results, regardless of the number of beds available in the hospital.

The only control that an ED has over inflow is ambulance attendance, achieved by effecting ambulance bypass. At our ED, 42% of all attendances arrive by ambulance. Therefore, ambulance bypass represents an effective mechanism for “turning off the tap”, allowing time to “catch up”, and thereby ensuring patient safety within the ED.

In Perth in the 1990s, ambulance bypass was almost unheard of. In the past few years, it has unfortunately become commonplace. Despite this being an international phenomenon, little has been published from Australia on this subject. This paper reports our experience with ambulance bypass.

Box 1 Causes of overcrowding in the emergency department (ED)

1 Increased complexity and acuity of patients presenting to the ED
2 Overall increase in patient volume
3 Lack of beds for patients admitted to the hospital
4 Financial incentives favour elective surgery over emergency admissions
5 Avoiding inpatient hospital admission by intensive assessment and treatment in the ED
6 Delays in service provided by radiology, laboratory, and ancillary services
7 Shortage of nursing staff
8 Shortage of administrative/clerical support
9 Shortage of physical space within the ED
10 Shortage of junior medical staff
11 Problems with language and cultural barriers
12 Medical record documentation requirements
13 Difficulty in arranging follow up care

Box 2 Effects of overcrowding in the ED

1 Patient safety at risk—that is, compromised clinical care
2 Prolonged pain and suffering
3 Staff may leave because of the incredible demands placed on them
4 Long waits and dissatisfaction of patients
5 Ambulance bypass
6 Decreased clinical productivity and effectiveness
7 Violence
8 Negative effect on teaching and research
9 Miscommunication because of increased volume
10 Medicolegal sequelae
11 Inability to evacuate in an emergency, for example, fire
METHODS

Study location
Royal Perth Hospital (RPH) is a major teaching hospital and is the largest hospital in the state of Western Australia. Perth is the capital city and has a population of 1.4 million. Prior to 1999, ambulance bypass was extremely rare. The ED has an annual census of some 55,000, with an admission rate of 44%. There are 23 cubicles in the ED. In the period 1996–2001, attendances have increased by 14% and admissions by 16%. In the same time frame, hospital bed numbers have been reduced by about one third. Staffing numbers for the ED ranged from 5–13 doctors and 10–18 nurses, at any one time.

Data collection
Up to October 2000, episodes of ambulance bypass were recorded at the time in the departmental diary. The decision to initiate bypass is made by the duty emergency physician. This judgement is based purely on safety. From mid-2000, a more formalised system was adopted, outlining specific criteria for initiating bypass (fig 4) and the data to be collected, including the time of and reason for bypass. These data were collated and analysed from 1 July 1999 to 30 June 2001. The ED has a computerised patient tracking system (HAS EDIS version 8.54, Oracle), which also records hourly patient presentations. The data were collected onto a database and analysed in SPSS (version 10).

RESULTS

In the period 1 January 1998 to 30 June 1999, there were two episodes of ambulance bypass at RPH. In the two years from 1 July 1999 to 30 June 2001, there were 141 episodes of ambulance bypass, including four days in which bypass was required twice. Hence, on average, the ED was on bypass every fifth day. The mean duration of bypass was 187 minutes (range 35–995) and this is increasing. Figures 1–4 illustrate a number of descriptions of ambulance bypass. Table 1 outlines the volume of patients within the ED when ambulance bypass was activated.
before activation, indicates a typical presentation rate of 2704 minutes, which represents 6.3% of the month. The time the bypass was activated was typically mid-afternoon to early evening, the most likely day of bypass with 39 (28%) episodes. The time of the next most common reason (19, 15.2%) was the following day. Excessive number of high acuity patients (17, 13.6%), and a combination of the two (34, 27.2%). This consisted of entry block (38, 30.4%), exit (access) block (17, 13.6%), and a combination of the two (34, 27.2%). Following this, an excessive number of high acuity patients was the next most common reason (19, 15.2%). (More than one reason was specified on some occasions). Monday was the most likely day of bypass with 39 (28%) episodes. The time bypass was activated was typically mid-afternoon to early evening, April 2001 had the largest total time on bypass of 2704 minutes, which represents 6.3% of the month.

Examination of the number of attendances in the two hours before activation, indicates a typical presentation rate of ≥10 patients per hour. This compares with an average presentation rate of 6 (SD 3.2) per hour (range 0–19), thus representing a slower increase above average. The odds ratio for initiating ambulance bypass when presentations are ≥10 patients per hour for two hours to the ED is 6.2 (95% CI 4.3 to 8.5).

Data supplied from the ambulance service reveal an increase of about 1000 patients per year being taken to RPH after the opening of a new freeway near RPH (personal communication, St John Ambulance). The proportion of ED attendances arriving by ambulance in the six months before the opening of the new freeway was 40.4%, compared with 43.6% in the six months after.

Data were also obtained on the percentage of ED patients waiting >8 hours for ward admission: 1999–2000: 7.3%, 2000–01: 12.2%, and 2001–02: 20.9%.

**DISCUSSION**

We have described “entry overload” resulting in “entry block”: overwhelming numbers of patients presenting to the ED in a short space of time. This was our most common reason for requiring activation of ambulance bypass. These data have not been previously described. The result is impaired access to emergency care.

This scenario is similar to the definition of a disaster or major incident. A health service major incident is said to exist when:

- Any occurrence presents a serious threat to the health of the community
- The health service is disrupted
- There are, or are likely to be, so many casualties that special arrangements are necessary to deal with them.

We consider this situation of ED overcrowding to be a disaster, one now occurring daily and deteriorating. In fact, it is now possible to predict the likelihood of going on ambulance bypass, according to the presentation rate of patients to the ED: ≥10 patients per hour exceeds our ED’s physical and medical processing capacity. The opening of a new freeway near RPH in April 2000 may have contributed to this phenomenon, as ambulance access to RPH is now quicker and easier.

The mid-afternoon to early evening likelihood of ambulance bypass reflects the cumulative effect of the pattern of ambulance and patient arrivals. The increasing duration of episodes reflects the virtually non-existent flexibility and capacity of the system to respond to the increasing patient load.

Our data clearly demonstrate that ambulance bypass is a year round problem. The “winter flu” cannot explain this phenomenon, Monday was the most likely day for ambulance bypass. Problems with Monday have been previously reported. The reasons for this may include that patients may not “bother” their general practitioners over the weekend, and are therefore referred in larger numbers for emergency assessment on Mondays. Also, patients admitted to the hospital on the weekend may not be fully assessed by their team until later in the day on Mondays.

Our hospital’s medical administration have provided enormous support with increased staff and resources, as well as effective bed management. The problem, however, lies outside the hospital. We receive so many patients that our occupancy exceeds 200% at times. It is paradoxical that other departments within a hospital cannot exceed 100% occupancy, and yet the ED, which may contain some of the most seriously ill and injured, is allowed to exceed the safe level of 100% occupancy.

There are a number of factors contributing to our entry overload:

- General increase in population
- Aging population
- Illicit drug use with its attendant psychiatric and social effects
- General community expectations for instant treatment

Emergency medicine can also be termed “available medicine”

- Lack of acute beds and services in feeder hospitals (both rural and metropolitan)
- The network of roads that lead to our hospital

Obviously, a larger ED may help to overcome some of these problems. According to the Australasian College for Emergency Medicine ED design guidelines, our workload requires 60 cubicles. A department of that size would require a large increase in human and other resources, which are not available. It would also attract a greater workload, and with access block, perhaps lead to an even greater inpatient load within the ED. Our data describe our experience with ED overcrowding, and has relevance to the many undersized EDs around the world.

The fact that health systems in the USA, UK, and Canada are all suffering from similar difficulties, suggests that a profound change has occurred in the delivery of western medicine. Health care in western societies has been through a period of severe economic rationalisation, resulting in

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**Table 1** Volume of patients in ED when bypass activated

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
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</thead>
<tbody>
<tr>
<td>Number of patients in ED</td>
<td>40*</td>
<td>25–61</td>
</tr>
<tr>
<td>Number of patients in ED corridor</td>
<td>9</td>
<td>3–16</td>
</tr>
<tr>
<td>Number of patients waiting to be seen</td>
<td>14</td>
<td>2–23</td>
</tr>
<tr>
<td>Number of patients awaiting admission†</td>
<td>7</td>
<td>0–19</td>
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*This reflects a mean ED occupancy of 174% at these times. †Patients awaiting admission may be either in the corridor or in a cubicle, according to clinical needs.
ED overcrowding and ambulance bypass

Box 4 Stop gap measures for ED overcrowding

1 Ambulance diversion
2 Increasing ED capacity, with both human and physical resources
3 Reopening inpatient beds
4 Postponing elective surgery
5 Improving discharge processes

Services Plan.” This paper states that “access block is a whole of system dilemma”, and “must be adequately resolved to ensure the functionality of EDs.”

Stop gap measures (box 4) to tackle ED overcrowding, such as ambulance bypass and delaying elective surgery, may help to reduce sporadic strains on capacity, but they focus only on the most immediate problems. Specific solutions are needed to address all the causes of ED overcrowding listed in box 1. However, the most immediate solution is simply more acute hospital beds and more aged care beds. For our ED, and for all overcrowded EDs, increasing the capacity of the hospitals across the system would really make a difference.

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Conflicts of interest: none declared.

REFERENCES
