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ACCESS BLOCK AND OVERCROWDING: A LITERATURE REVIEW

**Prepared for the
Australasian College for Emergency Medicine (ACEM)**

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EXECUTIVE SUMMARY

Access Block and Emergency Department (ED) Overcrowding are well defined phenomena that have been described as the most serious issue confronting EDs. This paper provides a summary of the current evidence on the subject from around the world. In addition to the following evidence, one must always remember that this problem is associated with a large amount of human suffering that is preventable.

The review has found that Australia is playing a key role in this field. It is important to understand what has been done to reduce or prevent deleterious consequences amongst patients who suffer extended delays in ED awaiting admission to hospital. This document concludes with a summary of the key points of evidence and solutions.

The key points are:

1. The review reports on 27 factors that have been described and documented in the literature as associated with access block and overcrowding. These include health system, demographic and clinical factors. They are having a major impact on the primary healthcare system, patients, their families, health professionals and the whole community.
2. It has been estimated, by different authors and methods, that there is a 20% - 30% excess mortality rate every year that is attributable to access block and ED overcrowding in Australia. This equates to approximately 1,500 deaths (at 2003 levels of access block) per year, which is similar to the road toll.
3. There is clear evidence that the main cause of access block and ED overcrowding is a combination of major increases in emergency admissions and ED presentations with almost no increase in the capacity of hospitals to cope with the demand. Between 2002 and 2007 the rate of available beds in Australia was reduced from 1998-99 levels from 2.65 beds per 1,000 population to 2.4 in 2002, and has since remained steady between 2.5-2.6 per 1,000 population. In the same period, the number of ED presentations has increased over 38%, from 4.1 million to 6.7 million. When compared with 1998-99 rates, the number of available beds in 2006-07 is very similar (2.65 vs. 2.60 beds per 1,000) but the number of ED presentations has almost doubled from 3.5 to 6.7 million.
4. The most vulnerable individuals affected by access block and ED overcrowding are those who due to their medical conditions require unplanned admissions to hospital. The most common groups include: the elderly, particularly those with chronic and complex conditions; people arriving by ambulance; people visiting EDs after hours or on week-ends; children and parents of young children; mental health patients; drug and alcohol patients; nursing home patients; people without social support; patients with medical conditions exacerbated by seasonal changes; people with painful conditions; the undiagnosed critically ill; seriously-ill patients who leave without being seen by a doctor; and patients who are inappropriately discharged from hospital in order to increase bed availability.
5. Access block and ED overcrowding impact on ED staff, resulting in work-related stress and decreased staff satisfaction. Many staff choose to decrease their clinical hours in emergency medicine, thus exacerbating workforce problems.
6. Theoretical models such as queuing theory and patient flow have increased our understanding of the problem, and have been partially successful in predicting bed capacity needs. However, we are still a long way away from a unified and integrated system.
7. There is clear evidence that occupancy rates in most urban public hospitals are greater than 85%. When occupancy rates exceed 85%, regular bed shortages and periodic bed crises are expected. If average bed occupancy rises to 90% or more, access block crises are routinely

expected. Spare bed capacity is essential for the effective management of emergency admissions and to have surge capacity.

8. The literature has clearly demonstrated that some interventions work, especially multifaceted interventions aimed at improving ED services and other hospital services simultaneously. Alternatives to admission have been successful in managing existing resources. Increasing staff capacity during night shifts has also had some level of success. Other patient flow interventions have improved decision making processes. Interventions that have been successful in reducing ED waiting times have also been successful in reducing rates of people leaving without been seen.
9. Several studies have demonstrated that the interventions they have developed have had some short term success; but they have not been able to sustain the changes over time. It is very clear that unless the overall bed capacity of the system is addressed, none of these interventions will solve the problem.
10. Access Block has been described as an illness. Some interventions have been quite successful in treating some 'symptoms' of access block such as 'time delays', 'patient flow', 'Did Not Wait rates' (DNW) and 'seasonal variations'; but as long as the fundamental cause remains, sooner or later the symptoms will reappear.
11. It has also been clearly demonstrated that some interventions to reduce ED attendances do not work. Diversion of low acuity (i.e. 'GP') presentations and use of telephone services to decrease ED presentations do not work to reduce access block and ED overcrowding. Also, some researchers have suggested increased co-located after hours GP services to reduce ED presentations, but these have been unsuccessful in Australia.
12. Most of the evidence in the literature has focused on the magnitude and causes of delays in EDs. However, there is little information on integrated and targeted innovations and little research has been undertaken in the areas of bed management, innovations to reduce delayed discharges and pain management.
13. There is an absence of consistent outcome measures and definitions, which make it difficult to combine study results and assess their generalisability and external validity.
14. There is also a clear need for robust, longitudinal data collections and trend data on hospital indicators such as available bed rates, occupancy rates (hospital and ED), DNW rates, total access block hours, access block mortality data, etc. Annual reports from both State and Federal governments need to be consistent and comparable from year to year. For example, the 2006, 2007 and 2008 *State of Our Hospitals* reports, present a different baseline rate for the 1998-1999 year when compared with the 2005 report.

In summary, there are not enough available beds to meet demand. This results in access block and ED overcrowding. This is associated with significant mortality and human suffering. It has been proven that GP patients do not cause access block or ED overcrowding and persistence of this belief is detrimental to finding real solutions. Access block has a huge impact on the health system but can be addressed by increasing the capacity of the system, most directly by increasing available beds (at all levels of care). Key performance indicators should be developed with agreed nationwide criteria, implemented and collected at all levels. This is an issue that requires national leadership from all levels of government, professional organisations and academia. Only when all stakeholders agree that the problem is systemic and hospital-wide can solutions be implemented.

PURPOSE AND AUDIENCE

The purpose of the review is to provide a pre-reading document for the ACEM Access Block Solutions Summit to be held on 12 September 2008, so that attendees develop some understanding of the issues prior to the day.

The audience for this review includes emergency physicians, medical practitioners, decision makers, politicians, professional association representatives, researchers, educators, consultants, media and members of the general community.

SCOPE AND METHODS

The review focuses on national and international studies exploring issues surrounding the concepts of access block and overcrowding, policy changes and alternatives for access block in ED.

Two different internet engines were used to cover both the published and the non-published literature. *Medline* was used for the published literature and *Google* for the unpublished papers and websites. Description of methods used for searching and selecting research papers, including key word and MESH terms strategy and on-line databases accessed is described below.

A search in Medline using the key word *Access Block* identified 41 articles on access block and the key word *Overcrowding* identified 1,037 articles. A second search using the key words *Access Block* or *Crowding* or *Overcrowding* identified 5,533 articles. Of these, 77 were related to Australia, 78 to UK and Ireland, 312 to USA and 171 Europe (excluding UK), and 62 to Canada. Table 1 shows results by country.

Table 1. Medline Search Conducted in July 2008

Key Word	Australia	Canada	USA	UK & Ireland	Europe (not UK)	* All papers
Access block (AB)	21	1	-	-	-	41
Crowding (C)	38	47	242	59	127	4,720
Overcrowding (O)	30	21	108	29	55	1,037
** (AB)+(C)+(O)	77	62	312	78	171	5,533

* This column does not include in the search strategy "country" as key word.

** The total is not the sum of the terms, given than some papers have more than one key word.

By looking at the results by journal, *The Medical Journal of Australia* and *Annals of Emergency Medicine* have published 52 papers each; *The Emergency Medicine Journal* and *Emergency Medicine Australasia* have published 12 papers each and the *Journal of Emergency Medicine* has published 5 papers.

This shows an exponential growth in the literature as an identical *Medline* search conducted in October 2007, in the *Medical Journal of Australia*, reported 163 articles.¹

We have compiled and reviewed 220 documents including policy reports, research papers, press releases, opinion documents (letters and editorials) and other relevant professional associations' website information. Only downloadable PDF or HTML documents were used in the review. An analysis of these papers was undertaken and the results of the most relevant documents are summarised in Tables 2 and 3.

Table 2 presents the most relevant websites, a brief description and main features. Table 3 provides brief details on each research paper including type of publication, study design, country of origin, method and outcomes. The search in Google using the key words *access block*, *outcome*, *emergency department* identified 10,900 documents. Of these, the most relevant websites are described below. It also provides a brief description of resources and papers available.

Table 2. Top websites and their features found in Google on Access Block

Website	Brief Description	Main Features
Australian Resource Centre for Healthcare Innovations (ARCHI)	Australian government initiative	Presents useful information on a wide range of projects and activities. It has a log-in facility and people can register to access member services. It has an extensive e-library and provides additional information on Access Block interventions and projects. http://www.archi.net.au/e-library/demand/access
Australasian College for Emergency Medicine (ACEM)	Information website	It provides access to several documents including references No.2 and 3. Also provides additional information on access block and overcrowding. http://www.acem.org.au/
Department of Health and Ageing	Australian government general information website	Provides fact sheets and annual reports on the state of our hospitals. The 'Publications and Statistics' section provides links to the ABS and AIHW websites. http://www.health.gov.au/
NSW Nurses Association	Professional association information website.	It provides a search engine that access several documents. A search on 'access block' provides links to several documents and press releases. http://www.nswnurses.asn.au/
NSW Health	State government general information website	No recent updates were found. It provides access only to 7 documents (press releases) related to the access block improvement program. http://www.health.nsw.gov.au/
Australian Medical Association (AMA)	Professional association information website	Provides access to press releases and position documents, including reference No. 192. http://www.ama.com.au
Victorian Government Health Information	State government general information website	The website provides useful information and PDF links about the Patient Management Task Force Project, including references Nos. 70, 176-179. It also provides access to literature reviews on bed management. http://www.dhs.vic.gov.au/
American College of Emergency Physicians	Professional association information website	Presents useful information on 'crowding' and 'boarding'. It provides up to date information on recent policies and research documents. http://www.acep.org/
Institute of Medicine of the National Academies (IOM)	U.S. federal government general Information website	Provides useful information of the Future of Emergency Care Project. http://www.iom.edu/?id=19735
The University of Warwick	U.K. university website. It provides links to the National Institute for Health Research Projects	Presents useful information on a wide range of projects and activities. It provides additional information on ED interventions and has links to Professor Cooke's publications, including reference No. 4. http://www.sdo.nihr.ac.uk/sdo292002.html
Institute for Healthcare Improvement (IHI)	Independent not for profit organisation.	Provides useful information on patient flow and emergency departments overcrowding. http://www.ihl.org/IHI/Topics/Flow/

BACKGROUND

In the last 15 years, access block and overcrowding in ED have been defined, investigated and managed in multiple ways through different initiatives across the Australian States and Territories and around the world. However, the problem is far from being resolved.

According to ACEM, "Access block" is defined as the situation where patients are unable to gain access to appropriate hospital beds within a reasonable amount of time, no greater than 8 hours and "Overcrowding" refers to the situation where ED function is impeded by the number of patients waiting to be seen, undergoing assessment and treatment, or waiting for departure, exceeding the physical or staffing capacity of the department.²

Access block is regarded as the major issue currently facing emergency medicine in Australasia. It has been linked to increased ED waiting time for medical care and leads to ED overcrowding. This overcrowding is generally accepted as a reason for decreased efficiency and quality of care, and has also been linked to adverse events.³

Although several excellent reviews have been conducted in the past³⁻⁷, the purpose of this document is to update, summarize and present the evidence in order to identify what has failed and to establish some possible solutions.

PART A: IDENTIFICATION OF THE CAUSES OF ACCESS BLOCK AND OVERCROWDING

1. What factors are known to contribute to access block in different countries?

Definition

The definition of access block has been described in terms of its duration across different countries. In Australia, as indicated before, it is 8 hours or more.^{1-3, 8-10}

In the UK it is defined as “4 hours or more in the ED from arrival to admission, transfer or discharge”.^{4, 11}

Some authors in Canada and the United States have defined the timeframe just as “within a reasonable time”. Most authors have defined it in terms of *crowding and/or overcrowding and hospital occupancy*.^{12-14, 9-11} In the United States it is also known as boarding.^{3, 15-17}

In the rest of the world, access block has also been associated with crowding and overcrowding in EDs.^{4, 11, 18}

Some researchers have also identified access block by some of its outcomes such as ambulance bypass, treating patients in non-treatment areas such as hallways and patients leaving prior to completion of medical treatment. Finally some have described it as a result of hospital occupancy at levels greater than 85%.^{3, 12, 14, 19-22}

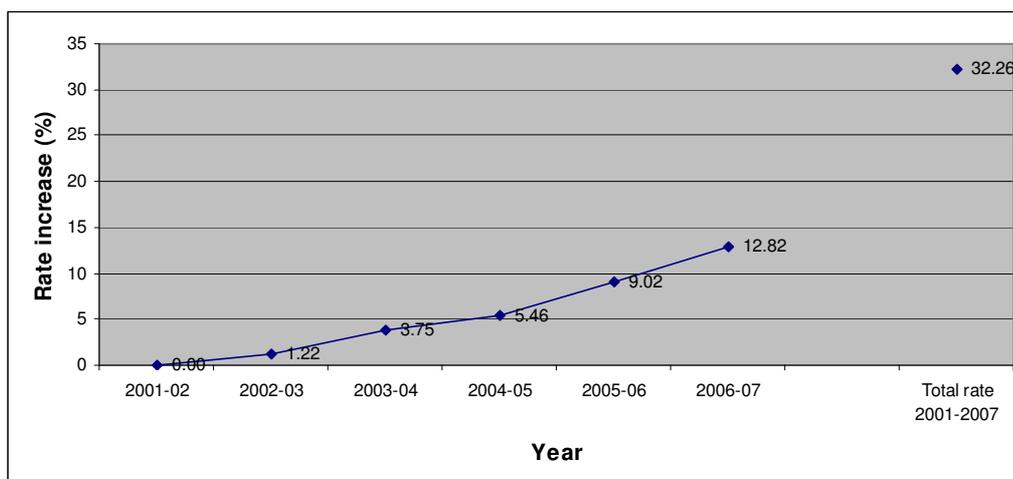
Although multiple terms have been used in different countries, there is not consensus between the Australia's and other countries' definitions.^{2-4, 8-9, 17-18, 23-26}

However, most authors agree on three things: 1) the problem is getting worse; 2) it is associated with poor outcomes and 3) there are three main categories of factors associated with the problem. These are hospital and system factors; patient or individual factors and clinical or medical factors. The following section presents a brief summary of these factors:

Hospital and System Factors

- Increased demand in hospital admissions. Hospital admissions continue to increase in the Western World since the early 1990s.^{1, 3, 9-10, 19-20, 27-28} In Australia it has increased by 32% over the last 5 years (Figure 1).

Figure 1. Relative increase of acute hospital overnight separations 2001-2007

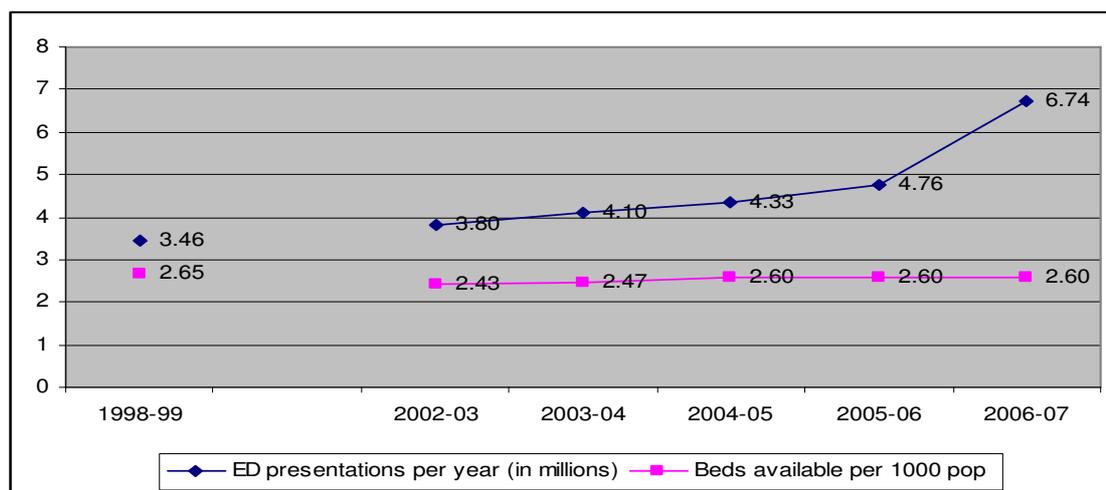


- Inpatient bed shortages. According to several sources, since the 1990s, there has been a decline of 15% to 30% in the number of inpatient beds across all major hospitals in Australia.^{3, 14, 19-20, 23, 27}

According to the *State of Our Hospitals* reports, in Australia, in the last 5 years of available data, the national rate of available beds per 1,000 population have remained steady, while the average number of ED presentations per year have increased dramatically (see Figure 2). When compared with 1998-99, the number of available beds in 2006-07 is very similar but the number of ED presentations has almost doubled from 3.5 to 6.7 million.²⁹

It is also important to note that, the 2006, 2007 and 2008 reports present a different baseline 1998-99 rate when compared with the same data reported in the 2005 report (2.9 vs. 2.65 beds per 1,000). It is reported that some inconsistencies may be due to differences in the way weighted populations are calculated.²⁹

Figure 2. Australian trends in ED utilisation and bed availability (2002-2007)



- According to *State of Our Hospitals Reports* in Australia, the rate of presentations per 1,000 population have increased dramatically from 202 ED presentations in 2003-04, to 208 in 2004-05, to 223 in 2005-06 to 311 in 2006-07. There were 1.98 million more presentations to Australian EDs in 2006-2007 compared to 2005-2006 financial year.²⁹
- As a result of the increase demand and bed shortages, occupancy rates in most hospitals are greater than 85%, which is considered the maximum level for efficiency.^{1, 3-4, 12, 22, 27-34}
- Cancellation of elective surgery. This has been found to have an important effect on hospital capacity and the way operating rooms are used. For example, decreased capacity may increase cancellations, or more cancellations may increase hospital capacity, or more elective surgery may reduce capacity to admit emergent patients. In any way, all these possibilities need further exploration. However it is clear that cancelations are associated with funding arrangements.^{3, 12, 30}
- Treating patients in non-treatment areas. Patients located on trolleys and in non-treatment areas such as ED corridors and waiting rooms, not only block egress through corridors and contravene WorkSafe regulations, but also affect patient satisfaction and disrupt patient care.^{15-16, 20, 35}
- Ambulance bypass or diversion is the situation where ambulances can not deliver patients to the closest hospital due to ED overcrowding. It has been identified especially in urban areas as one of the most serious issues in the Western World which affects the clinical effectiveness of all hospitals. Access block and overcrowding has also resulted in extended delays either at the scene (when multiple vehicles are required) or taking greater transport time.^{4, 19-21, 23, 36-46}
- Financial costs, the federal-state divide and funding arrangements. The problems with the Australian funding arrangements are two fold. Firstly, they encourage an emphasis on elective surgery with no links to emergency medicine/ acute care key performance indicators. Secondly, the payment to hospitals and healthcare providers are rigid and relate to the payment of

inpatient versus outpatient care.^{1, 3, 27, 30, 47-49} In the United States, the costs associated with access block (boarding) are quantified in terms of the loss of revenue caused by loss of treatment capacity.^{4, 32, 50}

- Workforce shortages. Australia is facing a severe workforce shortage at all levels, but mainly medical and nursing. Researchers have also reported some concern about the declining GP workforce and its impact on EDs particularly relating to management of chronic complex conditions. This problem is also affecting other developed countries. Training is also an issue in that it may not reflect a team-based multidisciplinary approach required for managing older co-morbid patients. In recent years, it has been reported that both State and Federal governments have spent money to increase bed numbers but there has been insufficient staff to open more beds. This is also reflected in decreased staff satisfaction and work-related stress leading to further staff losses.^{3-4, 14, 19-20, 23, 27, 51-62}
- Decline in nursing home capacity. There were 78,000 people in nursing homes across Australia and about 81,000 in hostel care in 2006. A decline in nursing home capacity across Australia has been recognised and the capacity of nursing homes to manage illness has been questioned. As a result, elderly patients spend more time in hospital beds, waiting for nursing home placements. It has been estimated that incidence rates of institutional aged care double for each 5-year interval from the age of 60 years with our population ageing rapidly over the next 20-30 years.^{1, 3, 63-73}
- Reduced surge capacity in case of terrorist or epidemic events. Since 2001, planning for terrorist attacks and large scale disasters have required the preparation and activation of multiple levels of capacity from the health care facility level to the federal level. However, it has been indicated that disaster planning is not a high priority for health care facilities. In addition, surge capacity is limited by access block and overcrowding and it has been reported that Australasian public hospitals do not meet US hospitals benchmarks for mass casualty incidents.⁷⁴⁻⁸⁰
- Access block and overcrowding have also been associated with increased return rates of hospital readmissions, return visits to the ED, and inappropriate follow up care (discharge planning) leading to even more pressure on EDs and hospitals.^{28, 53, 63, 65-66, 81-82}

Demographic and Individual Factors

- Ageing population and high dependence of elderly patients. Aging patients are over-represented in ED attendances and they are heavy users of all health services. Lack of regular physicians for the elderly has also been identified as a factor for increased ED presentation.^{1, 3-4, 13, 63-73}
- Access block and overcrowding have been associated with seasonal changes reflecting the demand for inpatient beds. Initially these were occasional peaks in winter, but over time they started occurring in summer to the point that in some hospitals they are seen all year round. In fact, some elderly or fragile patients who are suffering from chronic cardiac and respiratory conditions tend to increase ED demand in winter and warm weather is associated with increased incidence of paediatric injuries and gastrointestinal illnesses. There is also evidence that some hospitals close their general ward beds temporarily during holiday periods.^{3-4, 31, 83}
- Patient satisfaction has been reported as an important indicator of quality of care. Multiple studies have related waiting time with overall satisfaction. Decreased patient satisfaction is linked with leaving without being seen (LWBS), minor health problems becoming more serious, delays in the treatment of pain and quality of information provided.^{4, 16, 23, 48, 53, 68, 84-87}
- It is now recognised that access block and overcrowding is a significant problem for children and their parents/custodians. It has been indicated that over 90% of children in USA are seen in general community EDs and only a minority, less than 10% are seen in paediatric EDs. Similarly, most children in Australia are seen in public adult hospital EDs rather than in paediatric EDs. A particularly serious problem in paediatric EDs is during the school holidays where beds are closed and other services are temporarily cut back. Children may be at higher

risk of medical errors due to their variability in size and the need for age-specific and weight-based dosing. It is also recognised that parents with young children are also more likely to leave without being seen.^{83, 87-89}

- Mental health patients are affected by access block and overcrowding due to delays in bed availability or safe discharge to community care. The American College of Emergency Physicians (ACEP) have reported that 79% of psychiatric patients are affected by access block in the US alone.⁹⁰ Having specialised psychiatric centres in EDs is one option but they are only justified in large EDs because they are very expensive. Violence in the ED is also associated with some mental health conditions and/or drug and alcohol abuse. It has been reported that mental health ED patients are the most psychiatrically unwell group who are suffering the most due to delayed access to an inpatient bed. Some of these patients are at risk of self-harm and suicide and may require substantial support. Non-psychiatric patients may suffer psychological distress in addition to their presenting problem. Loneliness, for example, has been identified as a predictor of emergency department use.^{4, 7, 53, 63, 91-95}
- Increased complexity, exacerbation of chronic conditions and acuity of patients presenting to ED. As the population ages, there is a growing number of patients with chronic conditions that require complex assessments and management. These patients are sometimes identified as frequent attenders. These patients are also most likely to have problems accessing adequate management in the community for their multiple problems leading to frequent ED/ hospital attendances.^{23, 53, 96-98}
- Several socio-demographic factors have been identified affecting the use of emergency departments, including the ability to read and understand health related material; religious festivities such as Ramadan for Muslims; distance from the emergency department; and perceived convenience for parents. On the other hand, ethnicity; low income; homelessness and insurance status are not important determinants for increased ED use.^{4, 99-100}
- Patients who did not wait (DNW) for treatment (in the U.S., they are called patients who leave without being seen by a medical officer or LWBS), may have an increased risk of worsening the initial condition due to delays in care, particularly the undiagnosed critically ill or the very young.^{4, 11, 33, 53, 87, 101-107}
- There has been a great debate about low acuity patients (also known as GP patients or GP workload) in emergency departments. In the early 1980s, it was suggested that the problem of overcrowding was due to inappropriate use of emergency services by those with non-urgent conditions. Recent evidence has demonstrated that the real reason for overcrowding in Australia, Canada and other countries is due to bed occupancy rates above 85% rather than increased presentation of low acuity patients to the EDs.^{3, 23, 34, 42, 44, 61, 64, 108-117}

Medical Factors

- The lack of available advanced diagnostic testing in the community may cause delays in services provided by radiology, laboratory and ancillary services.^{23, 54, 118-119}
- It is considered that EDs provide a safety net for seriously ill individuals. In those situations, time to prompt diagnosis and highly specialised medical care is crucial. Access block and overcrowding can affect timely specialist consultation for critically ill patients with time-sensitive conditions and impact or delay transfer of those patients from the emergency department to the ICU.^{45, 120-123}
- It has been established that access block and overcrowding both increase the time taken to manage patients. With increasing waiting times, patients are kept in stretchers when they should be in beds, and in chairs, when they should be in beds or stretchers. Pain relief is delayed and pain management is reduced beyond acceptable limits. Antibiotic therapy may be delayed in patients with pneumonia; and all this impacts on the overall hospital length of stay and cost.^{9, 23, 61, 68, 84, 124-128}

- There are many studies linking inadequate patient care with access block and overcrowding. Other studies have reported increased adverse events. Access block and overcrowding have also been attributed as the cause of communication errors resulting in medical errors, errors in labelling specimens or radiology request forms. Interruptions have also been associated with errors. There also has been reported an increased morbidity associated with early discharge from hospital; delayed care of myocardial infarction; delayed recognition of hyperthermia; delayed administration of antibiotics in pneumonia, use of thrombolytics, mismanagement of early pregnancy complications and many other health conditions.^{3-4, 23, 30, 45, 52-53, 57, 104, 123, 129-134} A recent well publicised adverse event in NSW, is the one reported in the NSW Government Inquiry into the RNSH miscarriage of Jana Horska (Nile Inquiry).¹³⁴
- Reluctance of government institutions to accept the need to increase bed capacity. The Nile Inquiry recommended that 'the Northern Sydney Central Coast Area Health Service (NSCCAHS) work with senior clinicians to determine if RNSH needs additional beds' (Recommendation 4, page xiii)¹³⁴; in spite of the fact that the sole reason that Ms Horska miscarried in the toilets was because the hospital was full to capacity and no bed was available for her assessment in the Emergency Department. At the time of the event there were 46 patients in ED, with all beds occupied, and 16 admitted patients waiting to go to the ward.¹³⁵
- Several authors have demonstrated a strong association between access block-overcrowding and increased mortality. This should be considered the most serious issue effecting quality and safety in public hospitals today.^{3-4, 23, 30, 52-53, 57, 104, 123, 129-132, 136-149} In the U.S., Diercks et al.¹³¹ reported an increased risk of recurrent myocardial infarction with long ED stays (OR= 1.23). In Australia, Fatovich⁴⁰ reported an incidence rate ratio (IRR)= 1.13 during ambulance diversion versus IRR=0.72 during a non-diversion period. Richardson¹⁴¹ reported a relative risk of death at 10 days of 1.34 and the majority of these cases were more urgent cases and a higher mortality rate by triage category. Sprivilis et al. also reported a linear relationship between the Overcrowding Hazard Scale and deaths within 2 and 30 days. It has also been calculated that overcrowding is associated with 120 excess deaths annually in Perth.¹⁴⁶ At the national level, this is equivalent to approximately 1,500 deaths per year, which is similar to the Australian road toll.

2. Are there any specific patient groups most affected by access block? Why?

The literature shows that the people most affected by access block and overcrowding are those who due to their medical conditions are requiring unplanned admissions to hospital.

The most common groups include: the elderly, particularly, those with chronic and complex conditions; people arriving by ambulance; people visiting EDs after hours or on week-ends; children and parents of young children; mental health and drug and alcohol patients; nursing home patients; people without social support; patient with medical conditions exacerbated by seasonal changes; the undiagnosed critically ill; seriously-ill patients who leave without being seen by a doctor; and patients who are inappropriately discharged from hospital in order to increase bed availability.

The reasons are multifactorial and complex. The most common have been associated with medical errors, adverse events, delays in medical treatment, no access to diagnostic tools or sophisticated equipment and/or inadequate case management.

3. Are there any theoretical approaches in Queuing Theory and Patient Flow that can be applied? How?

Queuing Theory (QT)

According to Braitberg,¹ ACEM³, Cooke et al.,⁴ and others, QT is a mathematical concept that relates high volume, short transaction service systems in relation to system capacity and population demand.

The variations in demand and capacity lead to occasional periods where all the demand cannot be met, causing a backlog or queue to develop.

Such theory has been used to indicate that the length of a queue and hence the waiting time for treatment is determined by the arrival rate, the treatment rate, and the balk rate. In other words, it is a function between the expected number of patients in the system, the average length of stay, and the unscheduled need.

In practice, arrival patterns are quasi-random. In some cases the demand is produced by individual patients arriving at random and some other patients arriving or leaving the system in batches or as a group.^{1, 3-4, 22, 27-30-33}

QT has been applied to many areas of health care, including managing appointments, outpatient clinics and waiting lists. It has also been used to calculate ICU bed capacity, using average number of daily ICU admissions and average length of stay.

There are other applications used in health care including the Erland Theory, which relates bed capacity to patient turn away,⁴ and the cumulative sum technique (Cusum Analysis), which tracks the cumulative sum of consecutive differences between an individual measurement and a given standard target. This technique has been found useful in the early detection of significant changes in patient flows and bed use, and in determining the appropriate number of beds required for a given rate of patient flow.³¹

Bagust et al.²² described a stochastic simulation model based on the relationship between demand and available bed capacity and demonstrated that an acute hospital can expect some risks when occupancy rates exceed 85%, and regular bed shortages and periodic bed crises would be expected if average bed occupancy rises to 90% or more. They concluded that spare bed capacity is essential for the effective management of emergency admissions.

Huang reported a model that could be divided into emergency beds and elective beds and included a day-of-week –effect that allowed the calculation of emergency bed occupancy on any day of the week.¹⁵⁰

Hospital managers have been stimulated to reduce the number of beds and increase occupancy rates to improve operational efficiency,^{1, 10-11, 17, 19, 42, 72} but this has had a negative effect when demand for hospital beds exceeds supply.

Patient Flow

This section describes several models trying to explain key factors that may drive access block using patient flow systems or bed/flow management techniques to improve the flow of patients in acute hospitals. They have been developed in different places. Some systems have incorporated tools but they are not the same in all countries.

Some modelling techniques have been used to explore the shifts in the supply and demand for ED resources. Jones et al. reported using statistical forecasting techniques to predict daily ED patient volume at three diverse hospital EDs and compared the accuracy of these methods and concluded that daily demand for ED services is characterised by seasonal and weekly patterns.^{30, 86, 151-158.}

Weiss et al.^{18, 152} developed the National Emergency Department Overcrowding Scale (NEDOCS) and used advanced statistical techniques (mixed-effects linear regression model, treating centre as a random effect) and found that overcrowding occurred in 12% to 73% of the time with a good degree of predictive validity with 86%-88% accuracy.

Rathlev et al. used a time series analysis in a retrospective review of 93,274 ED visits in 2002-2003, and found that there were three factors independently associated with the daily mean length of stay. These were the number of elective surgical admissions, the number of ED admissions, and hospital occupancy rates.¹⁵⁵

Other investigators have developed a mathematical model using the ED census to forecast ED crowding, daily surge and operational efficiency. The authors have indicated that the basic pattern of the ED census comprises input, throughput and output.¹⁵³⁻¹⁵⁴

They have also assessed four ED crowding scales; namely, the Real Time Analysis of Demand Indicators (READI), The Emergency Department Work Index (EDWIN), the National Crowding Scales (NEDOCS) and the Emergency Department Crowding Scale (EDCS) and compared the different methods. They found that the predictive abilities varied widely and were unable to recommend a unified system score.^{59, 156, 159}

A similar model was developed in New Zealand, known as the Emergency Department Cardiac Analogy Model (EDCAM).¹⁶⁰

In summary, all these models have been used to represent and adapt a variety of outcomes and to identify key points associated with overcrowding. It has been argued that these studies are difficult to conduct and rely on ambulance diversion as an outcome measure, which is only suitable for multi-ED urban centres. Besides, they have been reported not to be fully applicable in the Australian context.^{30, 161}

PART B:

EVIDENCE FOR EFFECTIVE MEASURES TO PREVENT OR RESOLVE ACCESS BLOCK

4. What measures have been used to reduce access block? Any evidence for outcomes of access block?

A systematic review conducted by Cooke et al. in the United Kingdom in 2004, indicated that most of the evidence focuses on the magnitude and causes of delays in EDs, but according to them, there is little information on innovations and little research has been undertaken in the areas of bed management, innovations to reduce delayed discharges, working practices and workforce numbers. They have also indicated the absence of consistent outcome measures and definitions which make it difficult to combine study results and assess their generalisability. For a detailed description of the interventions, please read the full report which is available on the Internet.⁴

Bagust et al.²² have indicated that interventions to avoid or alleviate the effects of rising emergency admissions can be grouped in four categories: avoiding admissions, alternatives to admission, better management of existing resources, and facilitating early discharge. Following is a list of measures that have been reported with some level of support in the literature:

- Given the complexity of the problem, there is clear evidence that in order to improve health outcomes, the best approaches are multifaceted, multidisciplinary and hospital wide.^{19-21, 63, 81, 86, 142, 163-165}
- Interventions such as developing transit lounges; observation wards; holding bays; and redesigning ED facilities improve patient flow. Initiatives, such as improving communication systems and applying learning organisation principles are also effective at improving ED patient flow.^{28, 51, 162}
- A project of the Northern Sydney Area Health Service and Australian Resource Centre for Healthcare Innovations (ARCHI) reported a number of initiatives at the Hornsby and Ku-ring-gai Hospital, including changes in the communication systems, storage redesign; reducing excess stock, and recruitment and retention of staff initiatives. Although, the project was entered in the Baxter 2006 NSW Health awards, there is no recent evidence that those strategies reduced access block and was not clear whether they made any significant difference to medical staff recruitment and retention.¹⁶²
- Other hospitals have reported varied levels of success as a result of different interventions such as changes at both ED and inpatient wards in Brisbane. Similar approaches have been implemented in Canberra, Adelaide, Sydney, Melbourne and Perth.^{19-21, 142, 163-165}
- It has been demonstrated with historical and prospective data that, when bed occupancy rates are reduced towards 85%, this allows patient transfer to the wards, which in turn, frees up EDs, so that patients who are waiting can be seen and processed, reducing ED length of stay, ambulance diversion and theatre cancellations.^{3, 31-32, 34, 166}

- The literature has described several innovative practices enabled by incentives from federal, State/Territory and hospital initiatives in Australia. It is argued that the funding method can help direct healthcare services toward community needs.^{27, 47, 49, 70, 167}
- Similarly, in the United States, the U.S. Congress has been advised to provide dedicated funding to reimburse hospitals that provide emergency and trauma care.¹⁶⁸
- It has also been estimated that a reduction to within 120 minutes waiting time could have increased ED treatment capacity by 10,400 hours per year with an estimated cost of US\$4 million in 2004-2005. Schwartz et al. calculated that the opportunity cost, in 2002, for chest pain patients in Philadelphia (USA), was US\$190 per patient waiting more than 3 hours in ED, and concluded that any initiative devoted to address this problem is highly cost-effective.^{50, 168-169}
- Other interventions to reduce hospital admissions have included chronic disease management, home support initiatives such as the hospital in the home program, specialist community care, and discharge planning.^{20, 66, 142, 159, 164, 167}
- Other initiatives that have been used to reduce access block include transit lounges, observation wards, short stay wards and holding or transit bays.^{20, 163-165, 170}
- Changes in triage systems and tools have also been used for mental health patients and people with minor injuries. Perhaps the best known is fast track for minor injuries. Fast tracking has been used to reduce waiting time and also to reduce rates of DNW patients. These have no effect on access block but do improve care for non admitted patients.^{21, 43, 66, 94, 163, 171-173}
- Many hospitals have reported that, by increasing staff capacity, they have been able to reduce ED length of stay. Some of these include increasing working hours, or employing care coordinators, community nurses, ED nurses or additional medical officers at night.^{19, 21, 33, 54, 58, 61, 66, 142, 163, 165, 167, 174-175}
- A systems approach has also been used to review patient management practices. In Victoria, a Patient Management Task Force was implemented by the Victorian Health Department. The project was developed to identify essential bed management processes and to disseminate key learning practices across the entire health system including 11 metropolitan hospitals.^{70, 176-179} In the UK, bed management has been used to improve service delivery.^{157, 180}
- It has been reported that interventions to improve access to radiology, pathology and other services can significantly reduce access block and improve patient satisfaction, in particular, those initiated by nurses.^{119, 162-163}
- Mental health patients can benefit from the co-location of psychiatric emergency services within the ED. The service improves clinical care for patients and the emergency department by using direct access to reduce access block.^{90-91, 95}
- Systematic hospital restructuring was found to increase ED overcrowding at 20 hospitals in Canada between 1991 and 2000. The authors reported that the impact of incremental reductions in hospital resources was magnified as maximum operating capacity was approached.¹⁸¹
- Bedside registration has been developed as a strategy for improving patient flow. The process consists of registering ED patients in the clinical care area, in order to reduce registration delays and allow clinical evaluations earlier. This intervention has been reported to reduce total ED time, but it was not sustainable as a single intervention.¹⁸²
- Access to GP services within the hospital has received mixed reviews. It has been considered unsuccessful in some hospitals in Australia but they have been reported to be effective in the Netherlands.^{164, 183-185}

Table 3. Summary of the evidence on access block and ED overcrowding

Reference #	Type of publication	Study design	Country	Methods/outcomes
28	Peer reviewed article	Retrospective analysis of establishing an Observation Ward (OW)	Australia	Increased admission to OW reduced admission to inpatient wards for selected DRGs. Total number of patients increased by 19% over 4 years but total number of bed days fell by 23%.
31	Peer reviewed article	24 months comparative analysis of patient flow	Australia	CuSum analysis revealed important trend changes in patient flow following changes in bed use. Over 9,500 bed-days were reduced. Results not sustainable due to excessive bed closures following intervention.
32	Peer reviewed article	Observational study using a complex organisational change intervention in multiple hospitals	Australia	Implementation of a task force for all hospitals in Victoria in 2001. 10 million dollars were allocated to the 3 month implementation program. Results: Ambulance bypass reduced by 50%. ED Waiting time reduced by 15%. Hospital in the home increased by 50%. There is no evidence that these changes have been sustained since 2001.
33	Peer reviewed article	Controlled trial with a before/after design of Staff allocation using QT	U.S.	Using QT to increase the effectiveness of ED provider staffing. An average increase of 12 pw working hours resulted in 23% decrease in DNW patient rate. QT is useful for identifying the most effective allocation of staff.
36	Peer reviewed article	Retrospective before-after study of the effects of ED expansion	U.S.	Effect of ED expansion from 28 to 53 beds to Ambulance diversion. From pre to post expansion, daily ED volume increased but ED occupancy decreased. No change in ambulance diversion time. ED expansion, by itself, appears to be an insufficient solution to improve diversion without addressing other factors.
38	Peer reviewed article	Retrospective observational study of Ambulance diversion	U.S.	Development of an ED Work score to predict Ambulance diversion. The score was significantly different during no diversion status (3.45) and diversion status (6.13). ROC curve=0.89; Sensitivity 86%, Specificity 80%.
40	Peer reviewed article	Retrospective data linkage study of mortality and ambulance by pass	Australia	There were 297 ambulance diversion periods in 2003. A 28% reduction in patient mortality for patients attending ED during ambulance bypass period was found. This implied that patients were most at risk during the pre-diversion period when ED overcrowding was at its peak.
43	Peer reviewed article	Retrospective before-after study using administrative ED data	Australia	Implementation of a pre-emptive ambulance distribution using internet-accessible ED information. Ambulance diversion fell from 1,788 hrs in 2002 to 1,138 hrs in 2003 (p<0.001). This strategy alone was not sustainable. It should have been complemented by other interventions.
50	Peer reviewed article	Retrospective descriptive analysis of waiting time	U.S.	12 months historical review of ED visits in a 450-bed hospital between July 2004 and June 2005. Estimated savings US\$4 million and 10,397 hours treatment capacity.
54	Peer reviewed article	Retrospective case-control study of the effect of an additional ED physician.	Australia	Group A (Doctor present at night) = 125; Group B (no doctor at night) =117. ED LOS was reduced by 50%. Pathology tests per patient were reduced from 5 to 3 (p<0.001). Admission rate was also reduced.
55	Peer reviewed article	Qualitative Focus Groups ESEP project evaluation	Australia	101 staff members participated in 4 groups. Factors perceived by staff as indicators of the ESEP project success were: changes in staff profile, improving patient flows, changes in admin policies and changes in work practices.
58	Peer reviewed article	6 months retrospective study in a rural ED	Australia	The presence of an emergency physician (EP) in a rural ED was assessed. 12,000 ED presentations were reviewed. The EP was present in 76% of cases. ED assessment within recommended time improved from 69% to 73% (p<0.05).

Reference #	Type of publication	Study design	Country	Methods/outcomes
61	Peer reviewed article	Before and after study of additional ED physician in a prospective cohort of ED patients	Switzerland	Patients managed before (n=200) and after (n=160) the addition of a second physician on the shift. ED LOS decreased from 176 minutes to 141 minutes. This was statistically significant (p<0.05)
63	Peer reviewed article	RCT of unplanned admissions in the elderly	U.S.	739 patients aged 75 years and over. Multidisciplinary intervention improved health outcomes and reduced unplanned admissions.
64	Peer reviewed article	Retrospective cohort study of RCF residents	Australia	541 patients aged 65+ years were transferred by ambulance. Most patients were appropriately admitted (87%).
65	Peer reviewed article	Cross-sectional survey of complex patients	Australia	526 patients aged 55+ years. Complex patients are twice as likely to have unplanned admissions via ED.
66	Peer reviewed article	Before-after intervention	Australia	Application of a risk screening tool to (n= 2,139 elderly patients) reduced the risk of representation with the same condition by 16% and a decreased the readmission rate by 6%. The overall LOS in hospital was also reduced from 6.1 to 5.4 days.
68	Peer reviewed article	Retrospective record review of a prospective cohort study	U.S.	Elderly patients with hip fractures (158). 81% complained of pain. Mean time to analgesia = 40 mins, time to treatment = 141 mins. Of those with pain, 36% received analgesia. Substantial underassessment of pain was noted.
81	Peer reviewed article	Before-after multifaceted intervention to reduce crowding	Canada	Reported a successful reduction of ED crowding without increasing readmission rates (6.8% versus 6.6%) in 3 hospitals.
84	Peer reviewed article	Retrospective cohort review of morphine use by ED patients	Australia	Prevalence of morphine use in ED was 8%. Strong correlation between ED overcrowding and time to analgesia (r=0.56, 32% variance explained, p<0.01).
87	Peer reviewed article	Follow up cohort study of DNW patients	Australia	8.6% of ED patients DNW. 457 patients were followed up by telephone 7 days later. Waiting time delays were strongly associated with DNW. 39% felt angry about their ED experience. Young patients were more likely to leave, including parents of young children.
91	Peer reviewed article	Implementation of a new model of psychiatric service in ED	Australia	This new service attended over 72,000 presentations per year. It served a population of 260,000.
94	Peer reviewed article	Implementation of a MHTS for mental health patients in the ED	Australia	The objective was to develop a 4 triage scale for mental health ED patients. Mean waiting times were significantly reduced, and transit time was also reduced for all MHTS categories.
103	Peer reviewed article	Before-after study of multidisciplinary triage and DNW	Australia	ATS performances improved for ATS cat 2 and 3 from 75% to 81% and 56% to 78% respectively. DNW rate was reduced by 50%.
118	Peer reviewed article	Retrospective records review of X-ray use	Taiwan	112 hip fracture patients. No difference in time to take X-ray and final decision on treatment.
121	Peer reviewed article	Retrospective case-control study of patients with pneumonia	U.S.	509 ED patients and controls. ED LOS for cases was longer than for controls. Delays in transfer from ED to ICU did have a deleterious effect on trauma patients with pneumonia.
122	Peer reviewed article	Cross-sectional analytical study	U.S.	Delayed =1,036; Non-delayed =49,286. Delays in transfer from ED to ICU did have a deleterious effect on critically ill

Reference #	Type of publication	Study design	Country	Methods/outcomes
		of the critically ill		patients.
124	Peer reviewed article	Retrospective cross-sectional study of pain prevalence	U.S.	Chart review of 1,665 consecutive ED visits. 61% reported pain and for 52% it was the main reason for presentation.
131	Peer reviewed article	Secondary analysis of registry data of angina patients	U.S.	42,780 patients. 15% access block (>8hrs). No difference in mortality rates, but the rate of recurrent myocardial infarction increased among patients with access block (OR=1.23).
132	Peer reviewed article	Prospective cohort study of adverse events	U.S.	400 consecutive patients discharged home. 19% had adverse events. 12% were preventable or ameliorable. 66% of events were drug related. It was concluded that adverse events in the peri-discharge period were common.
141	Peer reviewed article	Retrospective stratified cohort study of 10 days mortality and overcrowding	Australia	Retrospective cohort of 48-wk periods in 2004-2005 comparing overcrowded (OC) versus non-overcrowded (NOC) periods. OC (n=34,377) and NOC (n=32,231). RR at 10 days= 1.34. Higher mortality rate by triage status.
146	Peer reviewed article	Retrospective data linkage of overcrowding and ED patient mortality.	Australia	Retrospective review of 62,495 ED admissions and death records. Linear relationship between Overcrowding Hazard Scale (OHS) ratio for death of 1.3 between 2 and 30 days and deaths per 1000 ED admissions of 1.9 (at 7 days) and 2.3 (at 30 days).
164	Special issue	Before-after multifaceted intervention	Australia	In 1999, a multifaceted intervention comprising structural changes, team building and clinical initiatives reduced restricted access, ambulance bypass within 6 months. Occupancy rates were maintained in excess of 90%.
166	Peer reviewed article	Comparative observational study with historical control	Australia	1,133 ED presentations during study period and 2,332 historical control group. Occupancy rates decreased from 95% to 89%. As a result ED mean occupancy rate decreased from 19 to 15 patients. ED waiting time decreased from 59 min to 37 min (p<0.001).
167	Peer reviewed article	Before-after intervention of CCT with historical control	Australia	A Care Coordination Team (CCT) to coordinate discharge planning. Rates of ED admission significantly fell from 31%, 12 months before intervention to 6%, 12 months after CCT implementation.
169	Peer reviewed article	Project Evaluation of DNW patients using statistical process charts	Australia	12 month evaluation using Statistical Process Charts. Research period: Aug 04 to Mar 05. DNW rates decreased from 10% to 5.4% Most patients with minor injuries were treated within 2 hours of presentation.
170	Peer reviewed article	Case-control study of fast-track intervention	U.S.	4,060 fast-track cases and 5,199 controls from overall sample of 35,308 paediatric patients. Estimated savings US\$ 100,000 per year.
173	Peer reviewed article	RTC on Triage Liaison Physician (TLP) in ED	Canada	A 6 week RCT of a TLP intervention randomised by shift. Overall LOS decreased by 36 minutes (4:21 vs. 4:57, p<0.001). DNW cases were reduced from 6.6% to 5.4% (a 20% relative decrease). There was no difference in the rates of ambulance diversion events.
181	Abstract	Systematic times series analysis	Canada	8,692 consecutive ED presentations. Linear increase of one DNW patient for each 2.3 min increase in mean ED waiting time.
182	Peer reviewed article	Prospective clinical records review	U.S.	Evaluation of a 6-month health line service. There was a small increase in ED attendance during the study period. They concluded that the health line had little effect on the overall ED census.
183	Peer reviewed article	Data linkage project	Australia	Implementation of 'Health Direct', a telephone triage service. Of 13,019 ED presentations, 6.5% were using this service. No differences were detected between users and non-users of the service.

Reference #	Type of publication	Study design	Country	Methods/outcomes
184	Peer reviewed article	Systematic times series analysis	Canada	10% increase in GP contacts and 9% decrease to ED attendances. Self-referral was reduced by 4%.
186	Abstract	Prospective data linkage project of DNW and ED waiting time	Australia	8,692 consecutive ED presentations. Linear increase of one DNW patient for each 2.3 min increase in mean ED waiting time.
187	Peer reviewed article	Prospective clinical records review	New Zealand	Evaluation of a 6-month health line service. There was a small increase in ED attendance during the study period. They concluded that the health line had little effect on the overall ED census.
188	Peer reviewed article	Data linkage project	Australia	Implementation of 'Health Direct', a telephone triage service. Of 13,019 ED presentations, 6.5% were using this service. No differences were detected between users and non-users of the service.

5. How successful have these measures been? And why?

Access block has been described as an illness with known morbidity and mortality rates.¹ Indeed, if we considered Access Block as a disease without a known cure, then we would be forced to treat only some of the symptoms but the fundamental condition would remain unaffected.

It has been demonstrated in the literature, that some interventions have been quite successful in treating some 'symptoms' of access block such as 'time delays', 'patient flow', 'DNW rates' and 'seasonal variations'. But as long as the fundamental cause remains, the symptoms sooner or later will re-emerge.

Hospital administrators have been encouraged to reduce the number of beds and increase occupancy rates to improve operational efficiency, but this has had a negative effect when demand for hospital beds exceeds supply.^{3, 42}

This is the case described by Burns et al³¹ where they were successful in reducing admission rates and keeping the numbers constant, but this major improvement did not eventuate because of an excessive closure of medical beds in response to the initial reduction in bed use.

Another case is described by Hammett and Robinson¹⁶⁵ at the RNSH, in Sydney, where dramatic improvements took place as a result of a multifaceted intervention in 2001. However, occupancy rates in that hospital remained in excess of 90%. Another example was also reported by Takakuwa et al. in the implementation of a bedside registration service in the United States.¹⁸²

6. Do these measures have differential impacts based on patient groups?

We cannot answer this question with the currently available evidence. Perhaps some patients may be more at risk of premature death than others due to access block and overcrowding, but the differential impact is not known.

7. What factors have been identified as barriers or facilitators to implementing these measures?

- Han et al.³⁶ demonstrated that individual initiatives such as expanding the ED capacity, in isolation, without addressing other bottlenecks in the hospital, are ineffective and insufficient to produce significant changes.
- Access to GP services within the hospital has been considered unsuccessful in some hospitals. More research needs to be done to establish what other factors may have had a counter-effect.

- The major barrier is the absence of an integrated national strategy. The American College of Emergency Physicians have indicated: “only when all stakeholders agree that the problem is systemic and hospital-wide can solutions be implemented.”(page 5)¹⁸⁹

PART C: EVIDENCE FOR NON-EFFECTIVE MEASURES TO PREVENT OR RESOLVE ACCESS BLOCK

8. What measures have been identified as non-effective?

- Reduction of low acuity attendances to ED.^{3-4, 23, 109-113}
- An after-hours GP service located within the ED in South Australia was unsuccessful because of the low numbers of suitable triage category level 4 and 5 patients.¹⁶⁴
- Policies to reduce or control overcrowding in Canada have been perceived by ED directors as largely ineffective.¹⁴ In the UK, some so called coping policies, such as early hospital discharge, have had some unintended consequences, such as the creation of incomplete episodes of care that have resulted in increases in the percentage of readmissions.¹⁹⁰
- Telephone service advice does not decrease the number of presentations to ED.¹⁸⁷
- Reduction of elective admissions per day do not reduce the ED length of stay.¹¹

9. What strategies should be discarded?

- Strategies to reduce low acuity attendance
- Co-located GP services

PART D: KEY POINTS OF EVIDENCE AND POTENTIAL SOLUTIONS

In relation to the evidence about what works and what does not work, the majority of the evidence on interventions to improve access block is retrospective or in the form of observational or descriptive studies.

The majority of the documents compiled for this review comprised professional opinions from editorials and letters to the editors of the different journals. Of the 220 papers examined in this study: 6% were analytical studies (case-control, quasi experimental designs, cohort or RCT); 21% were large multi-centre studies or data linkage studies; 26% were large descriptive studies or before-after studies from single hospitals; 9% were professional association documents or commissioned reports; 8% were cross sectional surveys of health professionals or patients; and 30% were editorials, letters, policy reports, reviews, commentaries or abstracts.

There are several studies reported in Table 3 that found some effects but they have been partially successful and of short term impact. There is an extremely wide range of possible combinations in the multifaceted interventions described in the literature.

In the future, carefully drafted research projects must be developed systematically. They should also be able to capitalise on any short term gains obtained during interventions.

Our knowledge of what elements or factors should be addressed in the long term, or how effective potential interventions are unknown. In a recent supplement published by the Medical Journal of Australia,¹⁹¹ it was concluded by the participating authors, that health services need to develop rigorous redesign as well as being able to remain flexible under periods of increased demand and limited coping capacity.

It is very clear that we need to increase the capacity of the system and obtain recognition at all levels of government. As indicated earlier, the rates of available beds at the national level has remained

between 2.5 and 2.6 beds per 1,000 population since 2002. This is compared with 1998 levels when the bed capacity was 2.65 beds per 1,000 population.

It is reported that the ageing population has placed an extra burden on ED hospitals but a recent study by Gray et al⁶⁷ demonstrated that the Australian aged population increased by 18% between 1993 and 2002, with total population growth of 10%, yet the proportion of hospital beds occupied by older patients remained stable at 47%. These trends are contrary to common perception. The authors concluded that ageing of the Australian population by itself, was not associated with an increase in the proportion of hospital beds used by older patients.

In relation to potential solutions, the Australian Medical Association¹⁹² recommends that the following infrastructure is required as a **prerequisite** for any potential solution:

- Adequate staff training
- Adequate number of beds to meet the needs of the population
- Adequate mental health and transitional care beds
- Rapid access to diagnostic radiology and pathology
- Communication with GPs on admission and discharges
- Robust, long term data collection and analysis systems
- Integrated IT systems and interface capacity with GP surgeries and nursing homes.

Finally, in relation to future research, the complexity of the problem is such that there are no single studies large enough to be capable of covering all 27 factors associated with the problem.¹⁹³

It is apparent that funding complex interventions on a short term basis are not only short-sighted in vision but inefficient and expensive to run and maintain.

In a recent review on public health research, commissioned by the National Health and Medical Research Council,¹⁹⁴ amongst the recommendations made, there are two aspects that are relevant here:

Firstly, the NHMRC and Federal Government need to provide long term funding to support skilled people emerging from short term grants. ED Research Grants should be developed with special emphasis on complex interventions to address access block and overcrowding.

Secondly, ED research funding infrastructure needs to be developed. ED researchers need to create extensive networks, obtain ethics approval for large multi-site studies, and be able to conduct and coordinate long term and longitudinal data-linkage studies at the national level.

Many researchers agree that we need a national focus as well as developing top leadership to deal with this problem from all levels of government, academia and professional organisations.

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