Summary of a verbal brief to the inquiry into the impact of ambulance ramping and access block on the operation of hospital emergency departments in New South Wales

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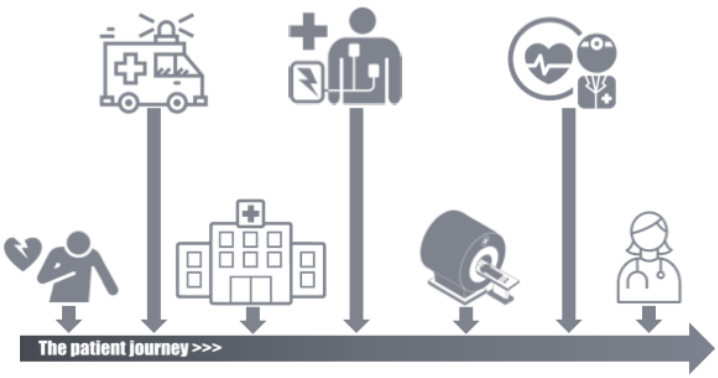
Complicated vs simple - the patient journey



Emergency departments (EDs) often act as the 'front door' to the health system, playing a unique role in the provision of safe, high quality acute medical care to everyone in the community [1]. The emergency patient journey begins at the time a patient becomes suddenly unwell, potentially with a time-dependent problem that needs urgent intervention.

They may call an ambulance, need resuscitation, investigation, definitive care and rehabilitation, but the patient journey ends when they are well, usually back in the community. These "horizontal" patients often need time-critical investigations and interventions, and cannot be managed in other settings.

Despite the patient journey being experienced by them as seamless and continuous, the health 'system' is organised into sequential silos that exchange a minimal amount of data, and often are not coordinated in their function. Even when a subsequent silo utilises data from a preceding one, there is almost always no feedback and loop closure, to increase the efficiency of the system. The NSW Ambulance Service is a separate and non-integrated silo separate from EDs, however EDs are structurally and functionally separate from all other units in the hospital.

In **2017-2018** [2], **over 8 million patients** presented to Australian public hospital EDs - an average of about **22,000 patients per day**, and **3.4% higher than 2016-2017**, and in **2020-2021** [3] presentations **rose to 8.8 million**. NSW data [4] from the **2021 final quarter** showed that in there were **763,257 ED attendances in NSW** and **320,729 ambulance responses**, the highest of any October to December quarter since 2010. Ambulances in responded to almost **9000 priority 1A cases**, an **increase of 21.3%**. In the latest available data, from **April-June 2022**, there were **793,987** ED attendances, **110,942 ATS category 2** presentations, and **only 72.5%** of ambulance patients had their care transferred to ED staff **within 30 minutes**. The proportion of patients leaving without, or before completing, treatment **increased by 67.6%** from 2019, and **only 23.0%** of patients who were treated and admitted to hospital spent less than four hours in ED.

Definitions **Access block** is the situation where ED patients who have been admitted and need a hospital bed are delayed from leaving the ED for more than eight hours [5]. **ED overcrowding** refers to the situation where ED function is impeded because the number of patients exceeds either the physical and/or staffing capacity of the ED [6]. **Ambulance ramping** is the practice of requiring paramedics to continue to care for patients rather than hand over clinical responsibility to the ED [7].

Triage is the process of risk stratification and assignment of a level of urgency and a maximum waiting time for the patient to be seen by a doctor. Australasian Triage Scale (ATS) category 1 patients need to be seen immediately, category 2 patients within 10 minutes, category 3 within 30 minutes, category 4 within 60 minutes, and category 5 within 120 minutes.

Access block surveys Australian hospital data from 2011-12 showed improvements in ED waiting times for patients **discharged from the ED**, with **78%** leaving the ED within the 4-hour target. Of patients requiring **inpatient admission** from the ED however, only **29%** left the ED within the 4-hour target.

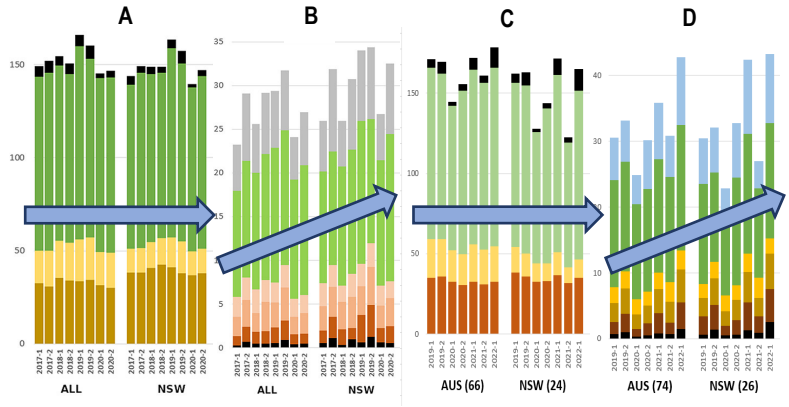
Surveys of all 130 Australian and 19 New Zealand EDs undertaken by the Australasian College for Emergency Medicine on a twice-yearly basis.

June 2017 – 2019…[8]

- mean daily ED presentations **increased by 11.4%.**
- number being treated **rose by 27.7%**
- those experiencing **access block** (waiting for an inpatient bed; in ED more than 8 h) **rose by 46.1%**

June 2019 – 2022…[9]

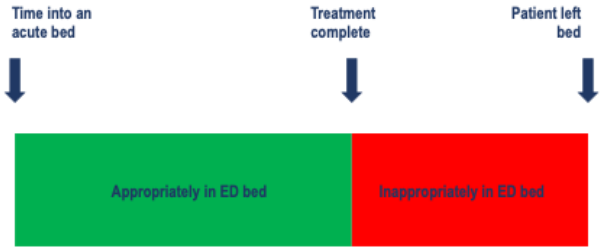
- **worst crowding ever recorded** in Australian EDs
- caring for patients waiting for beds represented **more than 40% of ED workload**
- **156 patients** identified in 45 hospitals with a dangerously long ED time of **more than 24 hours**



A and C show ED attendance from 2017-2019 and from 2019-2022; B and D show levels of access block over the same periods

The COVID-19 pandemic 10,157,316 cases in Australia, with 14,749 deaths[10]; 3.5 million cases and 5,232 deaths in NSW. Survey March – April 2020 [11] – **128 (39%) of doctors experienced at least one sickness episode**; episodes totalled 1,240 days, equating to a sickness absence rate of 9.1%. Rates varied between departments and grades; high levels of sickness were seen in medicine and both **adult and paediatric emergency departments** with the lowest levels seen in intensive care. Almost one in five doctors did not feel safely protected at work during the COVID-19 pandemic [12].

Lost Bed Capacity (LBC) LBC defined as time spent in an ED bed **after they were ready to depart the ED** [13].



LBC definition as time between treatment complete and actual time of leaving the bed

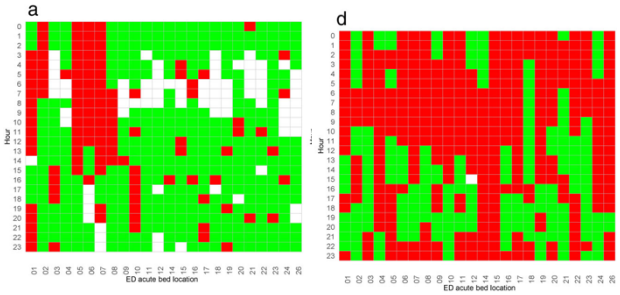
The LBC concept was developed to precisely describe hour-to-hour ability to care for patients in the presence of inappropriate bed occupancy.

Development of dynamic LBC heatmap allows the isolation and investigation of specific beds and associated patient groups such as mental health, and to identify the impact of particular external factors on our departmental capacity.

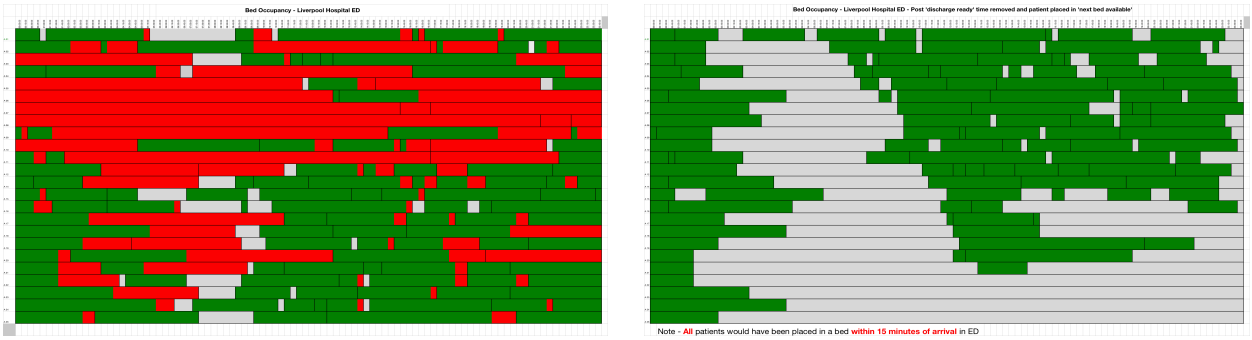
After a patient was discharge-ready, a significant difference remained in time spent in ED between **'admitted – ward' (72 min**) and **'admitted – critical care' (110 min)**, in comparison to the **discharge group (1 min)**.

Median daily time each bed spent in **'empty'**, **'before discharge ready'** and **'after discharge ready'** states were **1.04%**, **60.59%** and **38.54%**.

LBC as **a percentage of total available bed capacity** on 4 sampled days was **21.18%, 11.46%, 48.09% and 64.76%**.



Overall LBC for an ED of 26 beds over 24 hours; red blocks denote LBD, green blocks denote patients appropriately in beds.



LBC by beds (each line is a specific bed); when admitted LBC patients were removed, potentially useable bed spaces became apparent. All patients would all be placed in a bed within 15 minutes.

Effects of access block

- Delayed time-critical interventions and increased complications (more heart attacks)
- Increased medical error
- Less frequent / less adequate pain control
- Prolonged hospital length of stay > increased costs per stay
- More legal actions and complaints
- Severe problems with staff turnover and burnout

A systematic review of 102 published studies [14] confirmed the negative consequences of ED access block including **poorer patient outcomes**. The majority of identified **causes** related to the **number and type of people attending ED** and **timely discharge from ED**, whereas reported **solutions** focused on **efficient patient flow within the ED**. **Whole-of-system initiatives** to meet timed patient disposition targets, as well as extended hours of primary care, demonstrated promising outcomes. The review identified increased presentations by the **elderly with complex and chronic conditions** as an emerging and widespread driver of crowding.

Furthermore, an Australian study [15] showed that in almost **12000** admissions through ED, over **900** experienced access block (7.7%). Their average hoospital length of stay (LOS) was **4.9 days** in those who experienced access block, compared with **4.1 days** in the no-block group. In other Australian research [16], presentation during access block was associated with **increased in-hospital mortality at 10 days**, causing about **13 deaths per year**. Compared to patients waiting less than six hours for hospital admission, **in-hospital mortality increases by 67%** for patients **waiting more than 12 hours** for hospital admission [17].

Facts

Beds The total number of acute public hospital beds decreased by approximately 1/3 between 1983 and 2009-10, from **6.2 beds to 4.8 per 1,000** [18]. Between 1995 and 2006 alone, total bed numbers fell by 3.2% and by 11% per 1,000 population, the fall being due to an **18% reduction in public beds**, however over the same period, ED presentations **increased by over 38%**, from 4.1 million to 6.7 million. By 2018 there were 2.6 beds per 1000 population [19], however by **2018** this had dropped to **2.53 beds per 1000 population** [20].

Deferred demand In the context of the **absolute bed shortage** described above, not only have Australian ED attendances grown from **3.5 million in 1999** to **8.8 million in 2021**, but the proportion of patients **older than 65** has grown subtantially. Average life spans have increased dramatically due to better prevention , and healthier lifestyles and more effective medications have resulted in significant falls in rates of heart attacks and strokes. Frail and 'very old' patients aged 75 years and over suffer from chronic conditions and other co-morbidities, then experience multi-system failures that are complex and time-consuming to diagnose and treat. Patients aged **over 85** more frequently have **multiple co-morbidities** [21], present with **more complex cases** [22], and are **admitted more frequently**.

Between 1993 and 2001, the population aged **over 75 increased by 36%** [16], but hospital separations in this group **increased by 89%**. Bed utilisation, or number of days in hospital, rose by 23%, and multi-day hospital stays increased by 42%. Over the next three decades, the number of older persons worldwide is projected to **more than double**, reaching **over 1.5 billion in 2050**, with the demand for bed-days driven by increasing age increasing from **70-130%** [23], and the proportion of bed-days devoted to older people increasing to **over 70%**.

Bed capacity In a sophisticated discrete-event stochastic simulation, Bagust et al stated "Risks are discernible when average bed occupancy rates **exceed about 85%**, and an acute hospital can expect regular bed shortages and periodic bed crises if average bed occupancy **rises to 90% or more**, as there will not be spare bed capacity to cope with surges in demand for admission without unacceptable delays." Evidence is clear that occupancy rates in most Australian urban public hospitals are **greater than 85%** to 90%; average occupancy is 90–95% [16]. Spare bed capacity is essential for the effective management of emergency admissions and to have surge capability.

COVID-19 The AMA stated that between 9-30 March 2020 average daily urgent emergency presentations at NSW public hospitals **fell from 2,769 to 1,909**; a decline of **31%**, then followed the same trajectory as total presentations and mostly recovered, but still finished the full 2019-20 financial year **2.4% lower** than 2018-19. One study [24] found that during the pandemic, **ED crowding increased** dramatically, but with a **decreased number of patients**, and a higher percentage with **high-acuity conditions**, because of changes in patient management that increased length of stay (LOS) and rates of access block. A gradual **age-associated increase in the COVID-19 mortality rate** has been demonstrated [25] with one study showing a **10.5% fatality ratio** for the elderly versus **0.43% for younger patients** [26]. The presence of multiple comorbidities such as diabetes, hypertension, heart disease, lung disease etc predict poor prognosis, more morbidity and higher mortality in the elderly [27].

Myths

"Primary care patients vs ATS category 4&5 patients are the same". ATS categories 4 and 5 **do not denote primary care patients**, but simply patients who need emergency department management but can have care delayed for a short time. ATS categories 4 and 5 consume **up to 4 times** and **2 times** respectively more clinician time than the average GP encounter [16], and have been found to be **admitted** at a rate of up to **20% and 10%** respectively compared with an **admission rate of just 1% in**

general practice. There is no evidence for the myth that "general-practice-type" or "inappropriate" patients lead to ED overcrowding, and these low-complexity conditions, who are suggested should be managed elsewhere, constitute an insignificant workload in most EDs. They use minimal ED resources (**less than 3%** of all costs or resources in most EDs) and although they may spend a lot of time in waiting rooms, **this does not affect overall ED function**.

Telephone advice lines, despite being popular with patients, have been shown to decrease GP consultations [28], and to decrease patients calling for phone advice [29], but **have not been shown to reduce ED workload** [30] . Trials of co-located extended hours and bulk-billing GP clinics have shown an average reduction in attendances of **one patient every two hours** while the clinics are open [31], GP models may shorten processing times for non-urgent patients, but have not proved to free up ED staff to care for the sickest patients [32], and more choice for non-urgent patients was found to be related to longer waits for emergency (category 2) patients [33].

Solutions A useful concept is to consider access block, and the resultant ambulance ramping, as a problem of either **input**, **throughput** or **output** (Table 1 [34]). Emergency departments cannot control input factors, and only some throughput and output factors.

Parameter	Contributing Factors
Input	Emergencies (both medical and surgical)
	Visit type (both urgent and nonurgent)
	Ambulance arrivals
	Number of patients
	Triage score
Throughput	Processing time
	Patients' degree of severity
	Triage and bed placement processes
	Bed availability (both in the ED and in the hospital)
	Staffing (nursing and other healthcare professionals)
	Other services (consultant and ancillary)
	Degree of access block
Output	Hospital occupancy
	Inpatient bed shortage
	Transport delay (both internal and external)
	Staffing ratios
	Inefficient care transfer process
	Inefficient patient discharge planning
	Need for higher level of care
	Inpatients' degree of severity
	Lack of home care

Another useful concept is Donabedian's **Structure, Process and Outcome** approach for evaluating the quality of healthcare [35] [36]. Outcomes are the **measure of quality care**, and the real point of a health system, however outcomes are often **challenging to measure**. Processes are the **application of clinical care**, and are **easier to measure**, however just because some process was performed **does not mean the best outcome was achieved**. Finally, structure represents the **physical attributes of a health system**, and can include not only wards, beds and staff, but also education and skills.

Changes in **structure**, such as an increase in ED size, or the addition of inpatient beds, **are essential**, however simply **adding capacity without optimising process** leads to a rapid return to the same access block and ambulance ramping problems. In this section, **process** optimisation will therefore be discussed first, followed by **structure** expansion.

Process improvement

A **whole system approach** to access block is needed, including transformational change **across the entire health system**, with the identification of **system-wide** clinical process redesign solutions that are tailored to local needs. This should involve a detailed examination of the **patient journey through the hospital**.

Time-based targets are an important tool in driving system reforms; they should, however, be seen and used as a measure of **hospital and system performance** [37]. **They are not**, and should not be, **solely an ED performance measure**. EDs function on a 24/7 basis, and patients are unscheduled, undifferentiated and unwell; the hospital system needs to function on the same basis, and implement process innovation to decrease inpatient numbers and free up beds for these patients. These should include processes for **timely discharge of inpatients (seven days a week)**, nurse **or registrar led discharge teams**, authorised to

discharge patients, implementation of **regular audits of inpatient wards**, allow **direct admission of stabilised patients** to inpatient wards from ED and rigorously apply **KPIs for inpatient team response times** to ED referrals [38].

Reform of inpatient practices are essential, including **early morning ward rounds and discharges**, effective use of **discharge and transit lounges** and improvement of **staffing practices to better meet inpatient demands**, including better alignment of **diagnostic services** such as radiology and pathology, to meet both emergency and inpatient needs. Many imaging tests are **still not available out of hours**. Funded hours for **allied health and support staff** in inpatient wards must be increased [31], beyond 'office hours', and **inpatient specialists** should be incentivised to be more available for acute patients and **available at peak acute demand periods**.

Facilities must maximise the use of existing hospital bed stock through **effective utilisation of inpatient beds** [31], and **optimised bed management strategies**, and include utilisation of **appropriate information technology** to inform live patient flow systems, and available to ED senior staff.

Structure expansion

Facilities and health districts need to **open and staff as many inpatient beds as possible,** in concert with the above **essential process improvements**, and **guarantee ongoing funding** to keep them open [31]. This is recognised as contrary to the philosophy of the past three decades, however the exponentially increasing tsunami of vulnerable elderly patients, with potential **multi-system disorders needing urgent hospital treatment**, will both demand this capacity, and **will not be amenable to community-based models of care during acute episodes**. Prevention has achieved much, particularly in deferring demand to older ages, but at the cost of **more rapid deterioration when unwell**. Increases in bed stock implemented with an **agile methodology** and using **modern technology and innovative bed patient flow and bed management practices**, could maximise capacity with the least capital expenditure. ACEM [31] has suggested that "Investment in additional resources to **increase inpatient mental health beds** and **non-hospital alternatives**, such as step-up/step-down services, short stay units, hospital in the home etc, depending on local needs", and that "**hospital in the home**, **rapid access clinics**, **home monitoring**, **outreach teams**, and properly applied **telehealth**", together with "improved access of GPs and Residential Aged Care Facilities (RACFs) to **telehealth support** and **hospital-delivered clinical support in the RACF environment**, 24 hours per day, seven days a week" would similarly be beneficial. These changes are recognised to be a longer-term solution.

Innovation

Facilities need to **maximise the use of real-time data**, on **both strategic and tactical levels**, and **model the impact** of both **structure and process changes**.

Rather than take part in expensive and lengthy natural experiments, when the impact of change is measured in months or years, recognition of the **complex adaptive system** nature of healthcare should lead to the development and use of **agent-based modelling** and **digital twins**.

These innovations are possible in 2022 and would **provide awareness of the impact of every aspect of care**, from infrastructure expansion and more senior staff availability, to weekend discharges, to the impact of ward rounds and bed readiness on ambulance queues and booked elective surgery.

Once sophisticated digital twins are built, ideally with real-time parameterisation by actual health service data, the **impact of any change may be clearly observed prior to any actual physical changes**. An agent-based modelling approach also allows real-time **cost estimation** to be calculated, and **health economic modelling** to take place.

The next logical step would be to **select a model NSW hospital or LHD**, and implement the suite of structure and process changes that had been shown to work, and to **demonstrate their use to improve patient care and system function with the most advantageous economic expenditure**.

Summary

The patient journey needs to become a seamless transition through sequential phases of care from ambulance through ED and the hospital to rehabilitation, rather than a series of expensive but disconnected non-communicating silos.

Access block and ambulance ramping are **symptoms of an underlying system disorder**, which is complex and multifactorial. Although it is **essential to implement process changes** that bring practice in line with demand, and to abandon outmoded models of care, the rapid and irreversible growth in demand will **mandate structural expansion** in order to continue to provide healthcare free at the point of care to the NSW community. Use of modern technology to **develop sophisticated digital twin simulation** will allow the demonstration of *in silico* improvements before committing to real-life change.

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