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The Four Hour Rule: The National Emergency Access Target in Australia

Time to Review

Systematic Literature Review Appendix A

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Contents

Introduction

This literature review was commissioned by the Queensland Department of Health (DOH), following the 2014 Queensland Clinical Senate (QCS) meeting. It was undertaken by members of the Collaborative for Emergency Admission Research and Reform (CLEAR) under the governance of the Queensland Emergency Department Advisory Panel (QEDSAP) and the Statewide General Medicine Services Network (SGMCN) with the support of the Queensland DOH Clinical Access and Redesign Unit (CARU).

Search strategy

In collaboration with a medical librarian from the Princess Alexandra Hospital – University of Queensland Library, the authors developed and applied a search strategy to PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Embase, Scopus, PsychINFO, Cochrane Library of Systematic Reviews and Google Scholar in an effort to identify all scientific articles in both peer-reviewed and non-peer reviewed journals and the grey literature that were published or available on-line between January 1, 1990 and December 31, 2014. Additional studies were identified by searching the reference lists of retrieved papers. Search terms were "Emergency Department", "Communication", 'crowding', 'overcrowding', and 'NEAT'. The full search string is detailed in Table 1.

Environment	Issue	Metrics
Emergency, Emergency Medicine, Emergency Department, Accident and Emergency, Emergency Room, ED, Emergency Service	Crowding, Overcrowd*, NEAT, National Emergency Access Target, Four hour rule, 4 hour rule,	LOS, length of stay, mortality, rapid response, quality indicators, boarder, emergency boarding, boarder patients, access block, patient outcomes, morbidity, diversion, ambulance diversion, congestion, discharge

Table 1. Search strings used in PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Embase, Scopus, PsychINFO, Cochrane Library of Systematic Reviews and Google Scholar

The search was not only limited to studies published as original primary research articles but included secondary references such as narrative or systematic reviews or editorials, anecdotal or opinion pieces. Papers were limited to full-text papers written in English.

Study selection criteria and data extraction

Both qualitative and quantitative studies were eligible for inclusion. Studies were included if they provided data or evidence of experience that addressed issues pertaining to NEAT, the four hour rule and/or access block in the emergency department. Studies were excluded if they were not available in English. Titles and abstracts of all retrieved articles were screened for relevance by a single author

(BG), and final selection of studies for inclusion in the review were made by consensus between BG, CS, AS and Christine Dalais (Librarian). Data was extracted from included studies and entered into a standardised database for analysis.

Assessment of study quality

Methodological quality and the standard of reporting of results of each study were assessed using GRADE methods for assessing quality of evidence for scientific papers [1].

Data synthesis

Of 6567 scientific articles screened for inclusion, a total of 563 articles were considered potentially relevant for inclusion in the final review and underwent full text review. After excluding duplicate papers, articles with insufficient information on participants, interventions/indicator, comparators or outcomes and papers which failed to meet inclusion criteria, 120 remained. An additional 32 grey literature reports or papers were included that added essential background knowledge to the topic. A table providing full details of the study selection process is found in figure 1. No attempt was made to undertake a formal meta-analysis due to the heterogeneity of study interventions and outcome measures. The results and summary messages are presented in narrative form for the background behind NEAT, implementation of NEAT, ED metrics and NEAT outcomes. Interventions addressing NEAT and access block are summarised and presented as a table in Chapter 2.

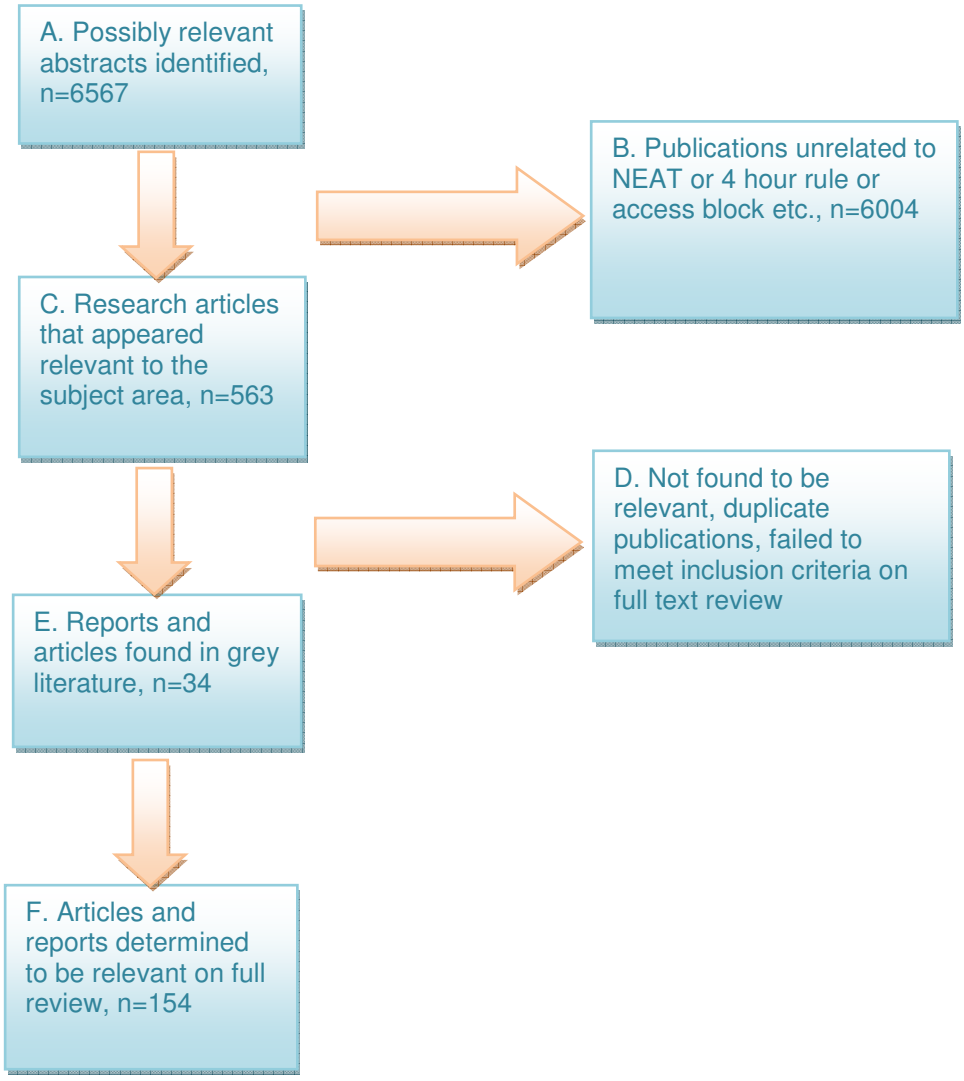

Figure 1. Literature search flow diagram.

Chapter 1: Why was NEAT introduced?

The Australian National Emergency Access Target (NEAT) was introduced in 2011 in response to mounting evidence and public concern about the quality and timeliness of care provided by hospital emergency departments (EDs) across Australia. The main issues were identified as frequent ambulance ramping and diversion, impaired access to both emergency care and inpatient beds (access block), boarding of admitted patients in ED, omissions of indicated care, and patient harm.
A substantial literature review has shown that ED overcrowding has long been associated with suboptimal clinical outcomes [2-12] and patient dissatisfaction [13-15]. In the last ten years various governments have been politically pressured to introduce solutions that respond to increasing ED demand and worsening ED overcrowding.

It has been well documented internationally that the delivery of urgent care in EDs is a key focus in public hospitals, and ED waiting times are a major item of public commentary and concern about the overall quality of health care systems[16]. These pressures have been increasingly highlighted in media reports and medical journals with reports of access block, overcrowding, long waits, boarded patients, ambulance ramping, and ambulance diversion. Canada [11, 17-24], United States [15, 25-47], New Zealand[48-50], Australia[4-9, 12, 16, 51-98] and the United Kingdom [77, 82, 99-112] have all suffered similar pressures and have had to innovate with solutions appropriate to their health care systems.

Ambulance ramping and diversion

Ambulance ramping and diversion have attracted media and political attention as being unsatisfactory manifestations of a failing emergency care system [113, 114]. Having acutely ill patients sitting in ramped ambulances waiting to be offloaded into EDs, or being redirected to other hospital EDs, are seen as direct consequences of ED access block and overcrowding. This lack of timely access to care has been associated with suboptimal clinical outcomes such as ambulance diversion and delays, long delays in medical assessment, delayed time to treatment, increased adverse events and decreased patient satisfaction [4, 11, 22, 30, 34, 36]. Ambulance diversion was becoming a frequently used stop gap solution to overcrowding and access block during the early 2000s [94], a strategy which tied up ambulances in transporting diverted patients at the expense of being able to respond to new calls. This strategy increased the risk of adverse clinical events[34, 94].

The Metropolitan Emergency Department Access Initiative (MEDAI) specifically investigated ambulance ramping in metropolitan EDs in Queensland in 2012. The MEDAI report highlighted the escalation of time lost to metropolitan ambulances whilst ramping (Figure 2)[61] and the increasing adoption by

Queensland EDs of ambulance diversion as a mitigation strategy to manage incoming demand (Figure 2).

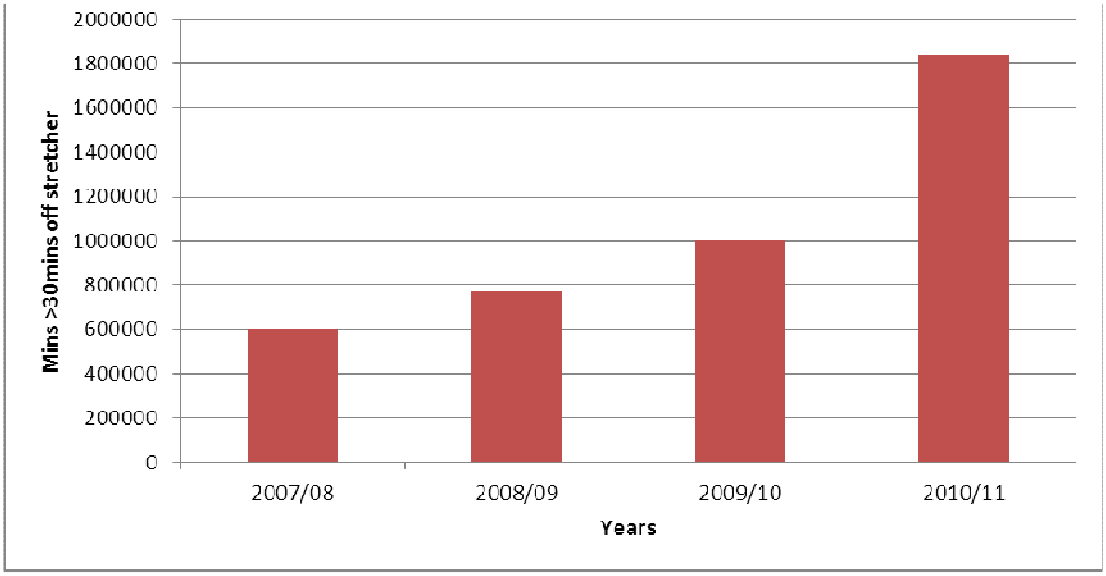

Figure 2. Lost time for Queensland Ambulance Service (QAS) associated with ramping as reflected in off-stretcher times greater than 30 minutes

Lowthian et al. found that the likelihood of arriving by ambulance rose with increasing age, with a twofold increase for patients age >/= 85 years. Patients over 60 years of age were also more acutely unwell with longer lengths of ED stay and more likely to require admission[88]. In the US, increasing use of ambulance diversion and subsequent increased ambulance transport time impacted adversely on patient care, especially for patients with chest pain [11] and those requiring treatment for acute myocardial infarction (AMI)[22].

In Western Australia, ambulance ramping was shown to directly correlate with access block in ED (Figure 3), which provided impetus for the introduction of the the 4 hour access target in that state.

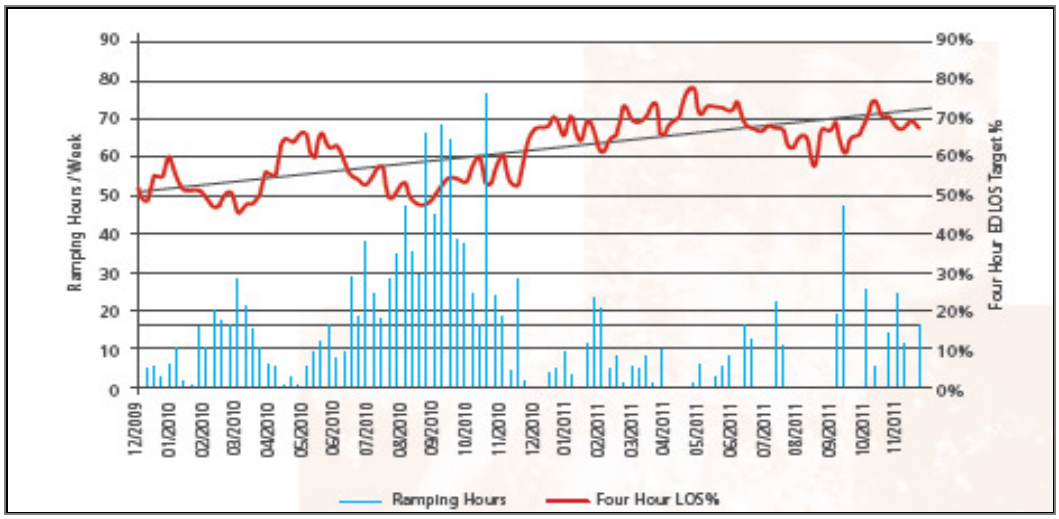

Figure 3. Ramping hours matched against ED 4 hour performance at Sir Charles Gardiner Hospital in Perth

Access Block and Overcrowding

Access block is defined as a delay in transferring admitted patients from the ED to inpatient beds[5], often the result of lack of bed availability within a crowded hospital (Figure 4). This delay leads to congestion or overcrowding in ED as new patients arrive (Figure 4), which in turn poses a threat to the quality of care provided to both resident and incoming patients, manifesting as increased mortality[91], treatment delays[115], prolonged pain[37], and more patients [5]leaving the ED without appropriate medical review[34, 46, 116].

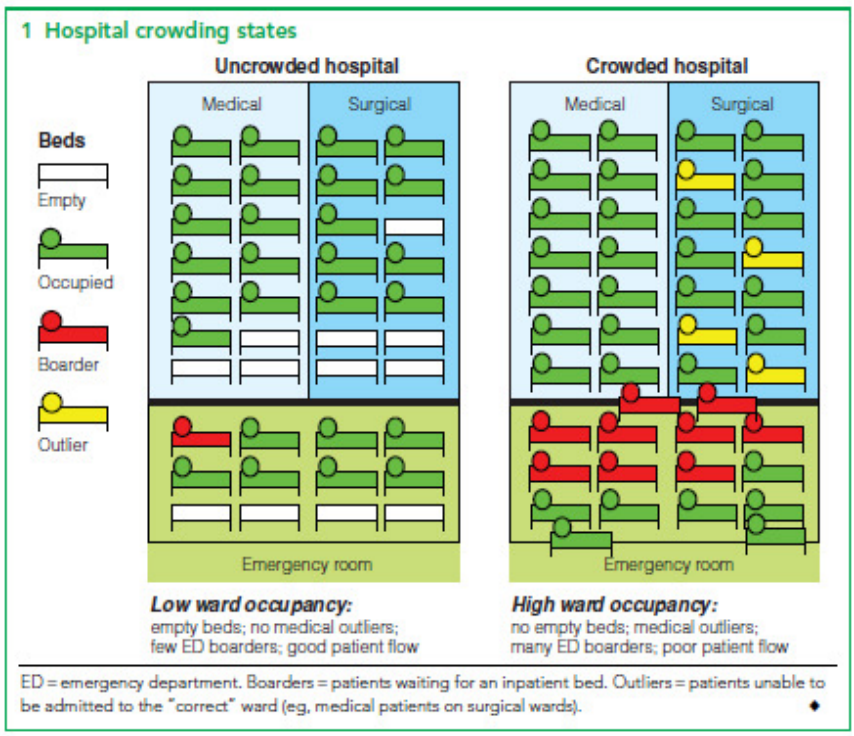

Figure 4. Hospital crowding states [12]

Access block was such a significant issue in Australian hospitals that the Australian College of Emergency Medicine hosted an "Access Block Summit" in 2008, which included guests such as the Federal Minister for Health [84]. The summit came to two major conclusions:

- Access block for admitted patients is the principal cause of ED overcrowding, and is mainly the result of a systemic lack of bed capacity throughout the health system, not the inappropriate presentation by patients who could and should have attended a general practitioner; and
- Overcrowding is most strongly associated with excessive numbers of admitted patients being kept in the ED, rather than patients being discharged from ED, and hence the principal causes of, and solutions for, overcrowding in ED lay outside the ED.

These conclusions were informed by investigations which demonstrated associations between ED overcrowding and numerous other factors such as the occurrence of epidemics, increased numbers of non-urgent care presentations or admissions, staff shortages, shortages of inpatient beds, declines in capacity of inpatient services, ageing population and decreased nursing home capacity, and declines in availability of general practitioner services for acute presentations, especially after-hours. [13, 34, 116].

However, many of these associations were contested by other researchers. Richardson et al (2009) disputed what they saw as several myths surrounding causes of, and solutions for, ED access block (Figure 5). In particular, they questioned whether surges of non-urgent presentations to EDs caused access block on the basis that such patients constituted an insignificant workload in most EDs, accounting for less than 3% of all costs or resources in ED, and rarely required admission or even use of a trolley. Richardson warned that strategies aimed at this patient group would not address the key problem of excessive numbers of admitted patients requiring unavailable inpatient beds [92].

4 Summary of the myths and facts about emergency department (ED) overcrowding

The myths	The facts
• "Inappropriate" or "general-practice-type" patients cause overcrowding	• Overcrowding is largely the result of patients being admitted but remaining in the ED awaiting suitable inpatient beds
• Overcrowding is the result of an excess number of patients arriving and waiting to be seen by a doctor	• Patient attendances at EDs have increased, but the number of patients waiting to see a doctor in Australasian EDs remains smaller than the number waiting for an inpatient bed
• The time patients spend in the ED is now excessive because staff take too long in investigating and treating them	• There has been little change in the time taken to assess and treat ED patients, but some increase in waiting time because ED staff and resources are being used to care for inpatients, and a large increase in waiting time for inpatient beds
• Telephone advice lines and collocated general practitioner services reduce ED attendances	• Telephone advice lines and collocated GP services have little or no effect on ED attendances
• Overcrowding can be reduced by building larger EDs	• Increasing ED size is associated with increased overcrowding
• The causes of overcrowding lie within the ED	• The causes and the solutions to overcrowding lie outside the ED
• Overcrowding does not influence patient outcomes	• Overcrowding has serious adverse effects on hospital processes, quality of care, and patient outcomes, including mortality

Figure 5. Summary of myths and facts about ED overcrowding (adapted from Richardson et al, reference [92])

Specific Clinical Consequences of ED Overcrowding

Overcrowded EDs have adverse clinical consequences for particular patient groups:

Vulnerable Elderly Patients requiring Complex Care

Biber et al. [117] and McCarthy et al [115] both found elderly patients were significantly more likely than younger patients to endure an extended ED LOS. The former study included patients aged >70 years and found longer ED stays applied to both trauma and non-trauma patients. Biber et al. inferred that the greater co-morbidity burden of elderly patients, their lower (more serious) mean triage score, and a greater dominance of medical as opposed to non-medical problems explained the longer LOS, although their LOS calculations did not specifically adjust for age.

In Canada, Ackroyd-Stolarz et al. demonstrated (after adjustment for age, gender, pre-existing co-morbidities, admission to an ICU, having a surgical procedure, hospital LOS, illness acuity and severity) that older patients (>65 years) with prolonged ED LOS, compared with older who did not have a prolonged ED LOS, were associated with increased risk of any single adverse event (AE) (OR 1.03, 95%CI 1.004 – 1.05), a medication related AE (OR 1.04, 95% CI 1.10 to 1.08) and the occurrence of multiple AEs (OR 1.05, 95% CI 1.02 – 1.09). Subsequently Ackroyd-Stolarz et al. found that the cohort of elderly patients who had at least one AE incurred a significantly longer inpatient stay compared to elderly patients who did not suffer an AE (20.2 vs 9.8 days, $p<0.00001$)[17]. After adjustment for pre-existing co-morbidities using validated coding algorithms developed by Quan et al. [118], it was demonstrated that for every hour spent in the ED, the odds of experiencing an AE in-hospital increased by 3% (OR 1.03, 95% CI 1.004 to 1.05).

Prolonged time to investigations and treatments in ED

Much of the care involving acutely ill patients in EDs requires timely instigation of investigations and treatments if optimal patient outcomes are to be achieved. Several investigators have evaluated the impact of ED overcrowding on time-sensitive indicators of acute care.

Schull [22] was the first to demonstrate a direct correlation with increasing levels of crowding in the ED, ambulance bypass and increasing median time to thrombolytic drug administration in patients with AMI, as measured by the door to needle time (DNT). This time was 40, 45, and 47 minutes in conditions of none, moderate, and high network crowding, respectively ($P <0.001$)) [22].

Pines [119] demonstrated that measures of ED crowding showed an association with poorer performance on timely antibiotic administration in patients with community acquired pneumonia (CAP), but no effect on the DNT for AMI. These researchers suggested improving ED throughput, reducing

boarding times for admitted patients, and reducing chest x-ray turnaround times for improving pneumonia care [119]. The same group also found ED overcrowding to be associated with delays in, and non-receipt of, antibiotics for patients admitted with CAP [120].Similarly Fee et al found that, as ED patient volume increased, patients with CAP were less likely to receive timely antibiotic therapy[121]. Similar findings were also reported by Kennebeck et al. in neonates in 2011 who noted the correlation of increased time to antibiotic in ED for ED boarders or when the ED was experiencing overcrowding or access block[38]. However, it must be noted that time to treatment can be a poor measure of quality of care in the case of CAP in that prompt administration of antibiotic therapy does not guarantee that this therapy is appropriate or even warranted [122].

Another commonly used process measure is time to analgesia. Hwang et al were the first to specifically explore the relationship of crowded emergency departments and the treatment of pain in older patients with hip fracture [123] in 2006. This study found that at times of greater than 120% bed capacity was significantly associated with a lower likelihood of documentation of pain assessment ($p=0.05$), longer times to pain assessment ($p=0.01$), and delays in analgesia administration. In 2008, Hwang et al. found that periods of increased patient crowding resulted in increased time to pain assessment, increased time to analgesia medication ordering ($p<0.0001$), time to analgesia medication administration ($p<0.0001$) and fewer people receiving any analgesia [37].

When testing the association between crowding and outcomes of patients presenting with severe pain, Pines et al. (2008) found that non treatment of pain was independently associated with waiting room numbers (OR 1.03 for each additional waiting patient; 95% CI 1.04 to 1.06; OR 1.18 for each 10% increase in occupancy; 95% CI 1.15 to 1.21) and delay in pain medication from room placement (OR 1.02 for each waiting patient, 95% CI 1.01 to 1.03; OR 1.06 for each 10% increase in occupancy, 95% CI 1.04 to 1.08)[124].

In a pilot study Chu et al. were unable to demonstrate an association between access block and time to parenteral opioid analgesia in emergency patients presenting with renal colic [125]. When Mills et al. explored the effect of ED crowding on the non-treatment and delay in treatment for analgesia in patients who had acute abdominal pain they found increasing delays in time to analgesia from triage were independently associated with all their four crowding measures, comparing the lowest to the highest quartile of crowding (total patient-care hours RR = 1.54, 95% confidence interval [CI] = 1.32 to 1.80; occupancy rate RR = 1.64, 95% CI = 1.42 to1.91; inpatient number RR = 1.57, 95% CI = 1.36 to 1.81; and waiting room number RR = 1.53, 95%CI = 1.31 to 1.77)[126].

On multivariate analysis Mitchell et al. found that factors associated with delay to analgesia included advanced age (Hazard Ratio (HR) 0.35, P = 0.006), language other than English (HR 0.55, P = 0.010), lower triage acuity (HR 0.20, P = 0.000) and delay to pain assessment (HR 0.16, P = 0.000) and those with higher pain scores received analgesia more quickly (HR 1.12, P = 0.003). However they found no significant association was found between workload and time to analgesia.

Pines et al. had consistent findings from previous studies where non-treatment of severe pain was independently associated with waiting room number ([OR] 1.03 for each additional waiting patient; 95% [CI]1.02 to 1.03) and occupancy rate (OR 1.01 for each 10% increase in occupancy; 95% CI 0.99 to1.04). Increasing waiting room number and occupancy rate also independently predicted delays in pain medication from triage (OR 1.05 for each waiting patient, 95% CI 1.04 to 1.06; OR 1.18 for each 10% increase in occupancy; 95% CI 1.15 to 1.21)[127].

The Contribution of Boarding Patients to ED Overcrowding

Boarders are patients in ED who have completed their episode of ED care and are awaiting an inpatient bed. Boarders occupy cubicles in ED whilst not requiring emergency care, and as their numbers increase, the capacity of the ED to deliver emergency care to subsequent patients decreases and wait times increase [128].

Liu et al 2009 found that more than a quarter (27.8%) of boarder patients experienced an undesirable event in ED, which was more likely in elderly patients and those with more co-morbidities[41]. The most common undesirable events were omissions in ED treatments (8.6%), usual regular medications (17.9%), and pathology checks (2.6%).

Pines et al found that prolonged ED boarding times and prolonged treatment times were also predictive of lower patient satisfaction for both the ED stay and the whole hospitalization [13]). A disapproving patient perspective on boarding in ED was also reported by Vicellio et al with patients specifically preferring inpatient wards over ED boarding as they felt safer in a ward versus ED environment [15]. In a qualitative study, Horwitz found that caring for boarder patients in ED was frequently confused and potentially more hazardous as a result of ambiguous assignment of responsibility for care on the part of ED and inpatient physicians, difficulties in physically locating patients and omissions in various forms of care [35].

Chapter 2: How was NEAT Implemented?

The 4 hour rule originated in the UK and has subsequently been adopted in Australia as the National Emergency Access Target (NEAT).

Introduction of the 4 hour rule in the UK

Prior to the introduction of NEAT in Australia was the major reform of the National Health Service (NHS) in the United Kingdom (UK).In 2000, the NHS produced a pivotal report "The NHS- a plan for investment, a plan for hospital reform" [129] mandating the "Four Hour Rule Programme" (FHRP). Although Australia had certain ED benchmarks, such as access block percentage, off stretcher time, and triage category waiting times, the NHS was the first governing body to mandate the 4 hour target in emergency medicine in an attempt to decrease ED waiting times and to improve access to inpatient beds. The target set in 2000, with limited evidence base, stated that "by 2004 no-one should be waiting more than four hours in an emergency department in the UK from arrival at triage to admission, transfer or discharge", hence the phrase " the 4-hour rule".

The implementation of the UK's 4 hour rule prompted the adoption of numerous strategies to shorten lengthy stays in EDs. Cooke et al identified there was no single solution and that the key success factor was the involvement of the whole health care community and the development of emergency care systems which all supported more rapid transit through ED. [100]. In 2005 the NHS Department of Health set the FHRP target to 98%, accepting that 2% of patients needed to remain in the department for more than four hours for clinical reasons[103].
By 2008 the NHS reported in "High Quality Care for all – the NHS next stage review - final report" that the health system was to move from a focus of increasing quantity to increasing quality of care [99]. This report referred very little to the FHRP and made no point of identifying an ongoing target.

In 2010 a change in the UK government saw another shift in the provision of emergency care in the UK. On the 10th June 2010 UK Health Secretary Andrew Lansley announced in a press release that the FHRP would be abolished but included in his speech that "Waiting time targets – by focusing attention on every patient – have improved the NHS in many respects. However, in some cases they have also created pressure on staff to make inappropriate decisions that could compromise care"[130]. Eleven days after his announcement, Lansley stipulated, in a written communication to the President of the Royal College of Emergency Medicine (UK), that he would not abolish the 4 hour target as it retained

some contribution to improving quality of patient care and decided instead to reduce the target from 98% to 95% as more patients could benefit from a longer period of active treatment in ED [102]. Lansley also stated that overall the focus should shift from the target and that it would be better replaced by a new set of indicators to broaden the measurement of quality to cover effectiveness of treatment and the overall patient experience[102].

Introduction of NEAT in Australia

In Australia, Richardson et al were the first to investigate the prevalence of access block (patients remaining in the ED for longer than 8 hours) among a selection of national hospitals between 2004-2008 [80]. This study found that over one third of all patients in EDs at the time were waiting for more than 8 hours before being discharged or transferred to inpatient wards and that this proportion was increasing over time

By 2008 a group of West Australian (WA) executives including the Health Minister, President of the Australian Medical Association for WA (AMAWA), Dr Frank Daly and other senior clinicians and bureaucrats toured selected hospitals in the UK to assess the applicability of the NHS Four Hour Rule to WA Health in the hope that it may address problems they were experiencing with overcrowded EDs, cancelled surgery, ambulance ramping and adverse patient outcomes. WA delegates were advised that successful implementation of the project would require hospitals to be directed to what needed to be achieved, but not necessarily in how to achieve it [68, 79].

The expert group from WA decided, that with some differences, the UK FHRP could provide a substantial quality framework for reform that would address the problems being experienced in West Australia[68].The key differences would be:

- Financial: the UK FHRP was introduced amidst strong financial investment in the NHS, whereas WA commenced its 4 hour rule at the peak of the global financial crisis'
- Workforce configuration: NHS EDs essentially had a low number of ED physicians and high number of inpatient physicians. The opposite was true for both WA and Australian EDs; and
- Incentives: NHS applied incentives based on performance whereas this was not introduced in WA.

In a summary of the introduction of the 4hour rule in WA, Mountain highlighted that the model of the UK 4 hour rule was selected as being the only one available specifically aimed at systematically reducing ED waiting times [79]. The key objective for the implementation of the FHRP in WA was to "improve the

quality of patient care provided in the public health system by aiming to ensure the majority of patients arriving at EDs are seen and admitted, discharged or transferred within a four hour timeframe." [68].

The target for WA increased incrementally over two years from 85% to 98%. This staged introduction of the targets was first implemented at key institutions, starting with four tertiary hospitals EDs in April 2009, followed by metropolitan hospitals in stage two and then the remaining regional institutions in stage three[68] (Figure 6).

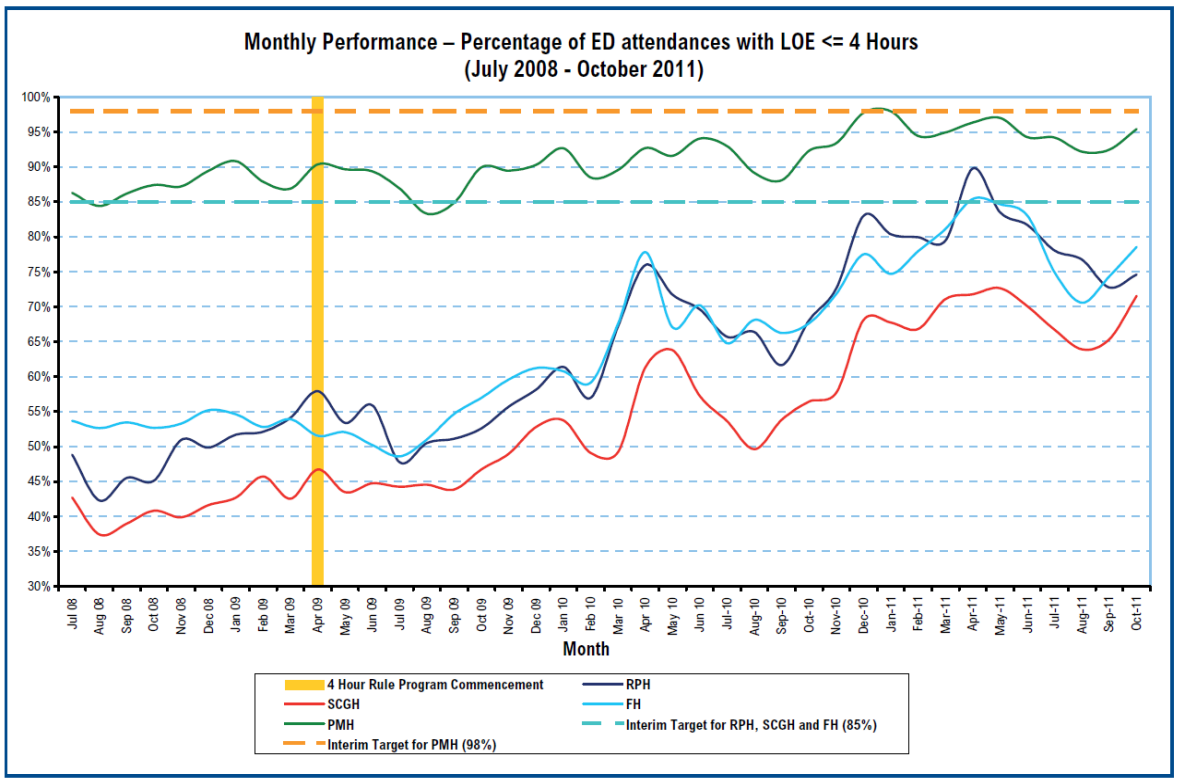

Figure 6. Implementation of the 4-hour rule program in Western Australian hospitals
(SCGH - Sir Charles Gairdner Hospital, PMH = Princess Margaret Hospital (Paediatric), RPH= Royal Perth Hospital, FH= Freemantle Hospital)

During the trial period in WA, pressures on EDs continued to build, with the number of presentations increasing by more than 4% annually, well in excess of actual population growth [16]. This unexpected additional pressure on the WA EDs forced the expert group to review the targets and reduce them to 85% in October 2010.

At the same time, ED pressures continued to mount on a national level and on the 20th April 2010 the Council of Australian Governments (COAG) agreed, with the exception of Western Australia, to a staged implementation of a four-hour "National Emergency Access Target". This initial plan stipulated that "95% of patients presenting to a public hospital emergency department will be admitted, referred for treatment or discharged within four hours of presentation, where it is clinically appropriate to do so". Furthermore,

the COAG supported a priority based roll out of implementation, starting with more severe triage codes to least severe triage codes. The target of 95% was to be phased in over five years and staged by triage category as follows:

1. 1st January 2011 Triage Category 1
2. 1st January 2012 Triage Category 2
3. 1st January 2013 Triage Category 3
4. 1st January 2014 Triage Category 4
5. 1st January 2015 Triage Category 5

The COAG met again on the 13th February 2011,where all Commonwealth, state and territory governments signed a Heads of Agreement on National Health Reform and the National Partnership Agreement on Improving Public Hospital Services (the National Partnership Agreement). Part of this agreement was to form an expert panel to better advise the COAG on the safest and most effective implementation for national elective surgery and emergency access targets. Three months after the meeting, the then federal Minister of Health announced the expert panel of six experts in varied fields of elective surgery, emergency medicine and hospital administration. Two months later the Expert Panel delivered their report to the COAG which included their recommendations to address the ED crisis in Australia [16]. The expert panel consulted a number of major stakeholders who raised concerns with the phasing in of the target by triage category which they concluded would not motivate the necessary reform. As an alternative, they suggested the implementation be driven over all triage categories, improving practices across the whole hospital, without a focus on one particular triage category to the detriment of another. The inclusion of the 'clinical appropriateness' caveat into the target was also seen as problematic by the expert review in regards to the difficulty of it being consistently applied, and that it could be used inappropriately simply to meet targets. Instead the panel believed that altering the NEAT to 90% and removing the clinically appropriate exception would allow for both non-clinical and clinical factors in the decision making processes while ensuring patient safety. This alteration also aimed to ensure problems linked to patient flow would be transparent and not easily masked through the routine application of exemptions.

As part of the Schedule of the National Health Reform Agreement, states were required to develop their own implementation plans and agreed to a reporting framework against performance. The Commonwealth put in place a series of funding allocations for NEAT (if performance was met), National Elective Surgery Target (NEST), ED capital and subacute beds. The NEAT funding was defined as facilitation funding from 2010 – 11 to 2012 - 13 transitioning to reward funding in 2012 – 13 to 2015 – 16[57]. These notional reward allocations were not realised in many States across multiple time periods

based on under performance against the targets. Simultaneously, at the time of NEAT introduction in Australia, concern and criticisms about the implementation of the UK four-hour target had been mounting[105, 131] centred on expressed fears around time targets undermining patient care, placing more value on time rather than patients, and potentially pressuring clinicians to make inappropriate clinical decisions. Moreover, it was argued that the four-hour target was not founded on evidence but on a belief that timeliness correlates closely with quality of care and patient satisfaction [79, 82, 97, 104].

With this in mind, the expert panel clearly differentiated the Australian adoption of the 4 hour target from the UK model, with one variation being a change in the title from the National Access Target for Emergency Departments to National Emergency Access Target (NEAT) to broaden the focus from emergency departments to the necessary whole-of-hospital change process. A phased approach towards a 90% compliance benchmark was preferred, with the expert panel acknowledging the differing circumstances between states and jurisdictions that mandated alternative implementation trajectories. However, all targets were to be set at the beginning of the 2012 calendar year with the ultimate target of 90% compliance being reached in each state by 2015.

Since the introduction of the NEAT, mean times to accessing emergency care have greatly improved (figures 7 and 8). The post-NEAT figure reached 78% across Queensland hospitals by January 2012 and Princess Alexandra Hospital, the worst performing hospital pre-NEAT nationally at 33%, reached 70% [132]. Each year since 2011, state governments have incrementally increased the target compliance rates which has been associated with a correspondingly incremental rise in achieved rates, although the latter have always tended to lag somewhat behind the former in most jurisdictions (figure 8).

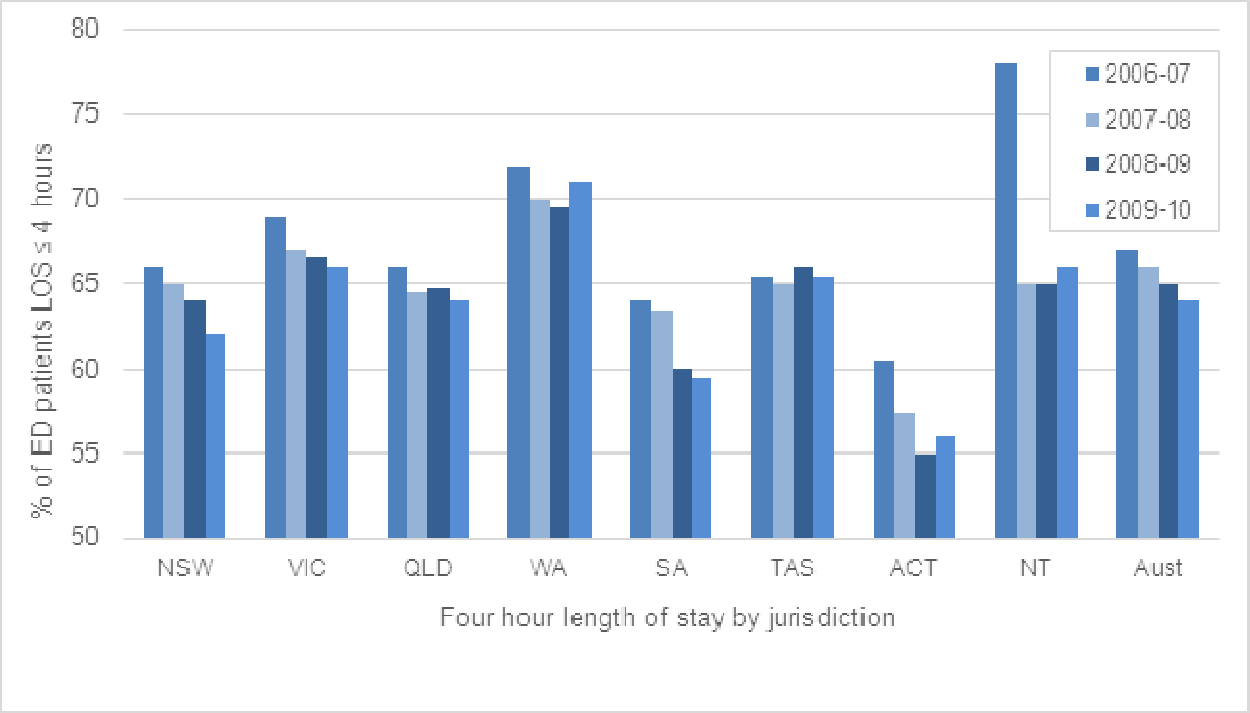

Figure 7. Four hour length of stay 2006–07 to 2009–10, by jurisdiction, prior to the introduction of NEAT (Figure taken from Expert Panel Report to COAG[16])

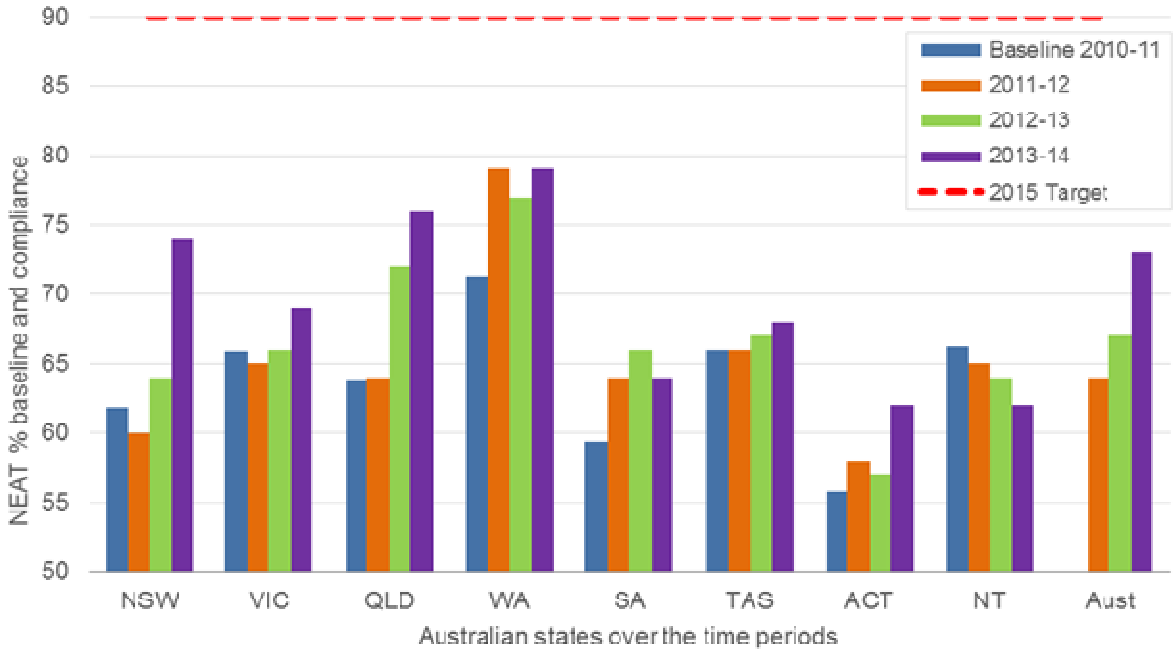

Figure 8. NEAT (Four hour length of stay) performance from 2010-2011 baseline to 2013-2014 compared to the 2015 target of 90%

With the 2015 target of 90% approaching, the Queensland Clinical Senate (QCS) met in April 2014 to consider NEAT and debate the evidence for the target and its sustainability in its current form [133]. The

QCS acknowledged the positive outcomes achieved in Queensland to date and encouraged an ongoing focus on better patient outcomes and experiences concordant with ongoing political commitments. The May 2014 Federal budget outlined the cessation of the National Partnership Agreement on Improving Public Hospital Services which included the removal of reward funding incentives from 2015 and the official end of the Expert Panel for NEAT [53]. This change in policy direction brings into sharp focus the recommendations of the QCS which include:

1. Pausing jurisdictional NEAT targets of 2014 at 83% for Queensland
2. Completion of a scientific literature review to better inform ongoing policy and targets, and in particular, to consider differentiated NEAT targets (admitted versus discharged patients) and the development of safety and quality indicators directly related to NEAT
3. Minister and Department of Health (DOH) to advocate amongst their jurisdictional peers for these recommendations to be adopted at a national level.

This literature review informs the condensed report and recommendations which will be submitted to Queensland DOH in February 2014.

Interventions to address NEAT compliance

The introduction of the NEAT mandate was accompanied by a set recommendations to ensure a sustainable change [16]. These recommendations outlined the NEAT implementation with a general sense of synthesising clinical and operational definitions, defining target trajectories, and advocating strongly for a non-negotiable “whole of hospital” approach. Within guidelines of clinically appropriate decisions, individual state jurisdictions were responsible for creating their own interventions to reach the specified targets, depending on their areas of strength and weakness.

Various demand mitigation strategies and models of care have been introduced at either workforce composition or operational model of care levels, with a gradual focus away from ED delivered to non-ED delivered models of care in order to attain NEAT. Interventions aimed at reducing ED overcrowding do so at the input (pre-hospital), throughput (internal ED) or output (ED-inpatient interface and hospital - community interface) stages. Assessment of current models of care is made difficult because cost effectiveness studies are hard to find. Research is currently under way in an Australian context by Bell et al to determine the most efficient models of care in the context of time based targets [134].

A recent review by Mason et al on innovations to reduce ED demand and crowding comprehensively outlines strategies used in a range of developed countries to decrease ED use, expand existing ED

capacity to manage the demand, and improve hospital and therefore ED flow. This review advised that any newly implemented strategy is modelled according to local requirements [135].

There have been many reforms described in the literature that address access block and decreasing time patients spend in the ED. A selection of these interventions is summarised in Table 2.

Table 2. Interventions that address access block and decreasing time patients spend in the emergency department

Details of paper	Study Aims	Study Population/ Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why?
Care Coordination Teams				
Bird S, Noronha M, Sinnott H. An integrated care facilitation model improves quality of life and reduces use of hospital resources by patients with chronic obstructive pulmonary disease (COPD) and chronic heart failure (CHF). Australian journal of primary health. 2010;16(4):326-33.	To assess hospital demand and patient health after the initiation of a **Community based** coordination team	A group of acute and community based health care providers located in the western suburbs of Melbourne formed a consortium to improve outcomes for adult patients with COPD and CHF	A team of multidisciplinary specialists and medical consultants who provided most of the care in the patients' home or in a general practitioner (GP) surgery or community-based outpatient clinic. In addition "Care Facilitators" assessed if patients recruited to the project had any unmet health care needs and provided information, advice, education for the patient to improve self-management.	**Positive** - Reductions for COPD patients in ($P < 0.05$) emergency presentations, admissions and hospital inpatient bed-days by 10, 25 and 18%, respectively. Reductions for CHF patients in emergency presentations admissions and hospital inpatient bed-days by 39, 36 and 33% respectively. COPD patients reported a significant reduction in their symptoms ($P < 0.005$) and the CHF patients reported an improvement in their overall health and quality of life scores ($P < 0.001$)
Moss JE, Flower CL, Houghton LM, Moss DL, Nielsen DA, Taylor DM. A multidisciplinary Care Coordination Team improves ED discharge planning practice. The Medical journal of Australia. 2002;177(8):435.	To assess the impact of an **ED based Care Coordination team**	Adult population included the frail elderly, those living alone, the homeless, frequent emergency department attenders, and those with complex medical or drug and alcohol problems. Single site metropolitan tertiary ED. Royal Melbourne Hospital,	A multidisciplinary Care Coordination Team (CCT) was formed to ensure that ED patients were provided with services that would facilitate their return to, or maintenance in, the community. The target population included the frail elderly, those living alone, the homeless, frequent emergency department attenders, and those with complex medical or drug and alcohol problems.	**Positive** - Rate of hospital admissions from ED decreased significantly compared with the 12-month period before CCT implementation (13 420 patients, 30.9% [95% CI, 30.5-31.3] v 14 217 patients, 32.6% [95% CI, 32.2-33.0]; P < 0.001). Surveys of staff, patients and carers, as well as community service providers, showed a high level of satisfaction with the CCT.

Details of paper	Study Aims	Study Population/ Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why?
Care Coordination Teams				
		Australia		
Corbett HM, Lim WK, Davis SJ, Elkins AM. Care coordination in the Emergency Department: improving outcomes for older patients. Australian health review : a publication of the Australian Hospital Association. 2005;29(1):43.	To evaluate the effectiveness of the care coordination (CC) program operating in the Emergency Department	ED Patients with identified complex care needs, Single site ED, Northern Hospital, Melbourne, Australia	Coordination and provision of services and programs for patients with complex care needs upon discharge from the ED back into the community. The program acts as a single point of contact for linking systems of social services, home and community services, health care and medical services and provides service to any potentially 'at risk' individual who may not otherwise be eligible for assistance under any other program	**Positive** - Statistically significant reductions in the proportion of patients presenting to the ED who were admitted to the wards ($p<0.005$), (from 20.16% down to 18.03%)
Phillips GA, Brophy DS, Weiland TJ, Chenhall AJ, Dent AW. The effect of multidisciplinary case management on selected outcomes for frequent attenders at an emergency department. The Medical journal of Australia. 2006;184(12):602.	To evaluate the effects of multidisciplinary case management (CM) on emergency department (ED) utilisation and psychosocial variables for frequent attenders at the ED	Adult frequent ED attenders who received CM at an inner urban tertiary hospital. St Vincents Hospital Melbourne, Australia	An integrated approach to intensive patient care within the hospital and the community. Multiple disciplines including medical, nursing, allied health, social work, primary health and community care, psychiatry, and drug and alcohol. This model combined hospital-based care, community and primary health care, and short- and long term CM for the study population.	**Negative** - Mean ED LOS (in minutes) of the total study population and each subgroup was unaffected by case management (297 v 300, P = 0.8) and indeed the numbers of admissions for overnight observation in ED increased (P = 0.025) Authors attributed a possible negative effect to the short time period post-intervention.

Details of paper	Study Aims	Study Population/Place /Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
Telephone Health help-lines				
Graber DJ, Ardagh MW, O'Donovan P, St George I. A telephone advice line does not decrease the number of presentations to Christchurch Emergency Department, but does decrease the number of phone callers seeking advice. The New Zealand medical journal. 2003;116(1177):U495.	To describe the effect of a pilot national telephone advice service (Healthline) on a public hospital emergency department	All patients presenting to ED Pre and post introduction. Christchurch Hospital NZ (computer and non-computer based information systems)	Introduction of a 24 hour, 7 day a week Healthline . Pre and post data were compared between ED patients interaction with Healthline in association with Healthline call log data.	**Negative** - Health-line had little effect on overall ED census and appeared to refer patients with similar acuity to the general ED census.
Sprivulis P, Carey M, Rouse I. Compliance with advice and appropriateness of emergency presentation following contact with the HealthDirect telephone triage service. Emerg Med Australas. 2004;16(1):35-40.	To examine the impact of a telephone triage service upon a typical Australasian metropolitan ED	All patients presenting to Fremantle Hospital ED, Perth Australia.	24 hour 7 days, telephone advice and triage to metropolitan Perth nurse health line.	**Negative** - HealthDirect (phone health helpline) presenters were of similar appropriateness to non-HealthDirect presenters and appear to attend the ED independent of HealthDirect advice. HealthDirect has a limited capacity to influence ED utilization or workload.
Cameron PA, Joseph AP, McCarthy SM. Access block can be managed. Med J Aust. 2009;190(7):364-8.	Observation/opinion	NA – opinion piece	Observation of a national roll out of nurse on call health line implementation	**Negative** -There is no evidence that these reduce demand for emergency services,

Details of paper	Study Aims	Study Population/Place/Setting	Intervention	Findings/Conclusion: Opinion & Why
Ambulance Diversion/Bypass				
Burke LG, Joyce N, Baker WE, Biddinger PD, Dyer KS, Friedman FD, et al. The effect of an ambulance diversion ban on emergency department length of stay and ambulance turnaround time. Annals of emergency medicine. 2013;61(3):303.	To characterize the effect of a statewide ambulance diversion ban on ED length of stay and ambulance turn-around time pre and post.	Nine Boston area EDs, 7 within the city and 2 within the neighbouring city. Including adult only and mixed EDs, no paediatric only. United States.	Area wide Ambulance diversion ban	**Positive** - No ED experienced an increase in ED length of stay for admitted or discharged patients or ambulance turnaround time despite an increase in volume for several EDs. There was an overall 3.6% increase in ED volume in our sample, a 10.4-minute decrease in length of stay for admitted patients, and a 2.2-minute decrease in turnaround time.

Details of paper	Study Aims	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
GPs in Emergency				
Cooke M, Phillips H. Employing General Practitioners In Accident And Emergency Departments. BMJ: British Medical Journal. 1996;313(7057):628-.	Observation /Opinion	NA – opinion piece	NA	**Negative** - Before accepting that the way forward is for general practitioners to work in accident and emergency departments we need evidence that this is preferable to an expansion in the number of consultants in accident and emergency medicine. Consultants have the advantage of being able to treat major as well as minor injuries.
Cameron PA, Joseph AP, McCarthy SM. Access block can be managed. Med J Aust. 2009;190(7):364-8.	A discussion/opinion of potential solutions to access block and highlighting common proposals not supported by the evidence	NA- Australian based	Literature review in combination with expert opinion and observation.	**Negative** - Makes no difference to reducing access block and inpatient beds A more important role for GPs in helping prevent hospital overcrowding is to provide care for complex patients in the home or residential care settings, thus avoiding their transport to hospital and possible inpatient admission.
Iacobucci G. All emergency departments should include	Expert opinion of hypothetical benefits	NA – UK based opinion	co-locating emergency	**Positive** - Estimated that 25% of all admissions to emergency departments are children and young

Details of paper	Study Aims	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
GPs in Emergency				
GP staff, say experts. Bmj. 2014;349:g4654.	of a GP supporting non-urgent ED presentations		departments with out-of-hours primary care	people, and we estimate that up to 16% of these could have their care effectively managed outside the hospital setting—a significant number that, if addressed, would reduce pressure on units.
Richardson DB, Mountain D. Myths versus facts in emergency department overcrowding and hospital access block. Med J Aust. 2009;190(7):369-74.	To uncover the myths and facts in what interventions positively address overcrowding in ED and hospital access block.	NA – Australian based opinion	General practitioner services in ED – literature review and expert opinion	**Negative** - Establishment of additional GP services, even bulk-billing services near hospitals, does not significantly decrease ED workload either in theory or in practice.
Bosmans JE, Boeke AJ, van Randwijck-Jacobze ME, Grol SM, Kramer MH, van der Horst HE, et al. Addition of a general practitioner to the accident and emergency department: a cost-effective innovation in emergency care. Emergency medicine journal : EMJ. 2012;29(3):192.	To evaluate the cost effectiveness of the addition of a GP to the ED in comparison to usual care	Self-referring adults >16years old at the University Medical Centre ED in Amsterdam	Employing a 3rd year trainee GP in the ED, weekday 10:00-17:00	**Positive** - Mean process time after was 69 min (SD 59) versus 93 min (SD 59) in the usual care period. This difference in process time of 24 min was statistically significant (95% CI _30 to _18).

Details of paper	Study Aim	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
Fast Track / Streaming				
O'Brien D, Williams A, Blondell K, Jelinek GA. Impact of streaming "fast track" emergency department patients. Australian Health Review: A Publication of	Observational pre and post intervention of fast track introduction	All ED patients of a 500 bed metropolitan tertiary adult teaching hospital , Perth, Western Australia	Junior ED Dr and RN rostered to work exclusively in the fast track area (3 cubicles and one chair – ambulant only patients) with ED consultant supervision.	**Positive** - 18% relative reduction for LOS for all discharged patients (Mean LOS reduced by 41 mins.). Time to be seen by a Dr reduced by 20.3%.

Details of paper	Study Aim	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
Fast Track / Streaming				
the Australian Hospital Association. 2006;30(4):525.			ATS Cat 3,4,5. 2 week training period for triage nurses to identify appropriate patients for FT FT operated 0900-2200 weekdays and 0930-1800 on weekends over 12 weeks.	Relative reduction of 37% in the mean number of patients who DNW. No difference was observed in admitted patients. No p values given
Kelly A-M, Bryant M, Cox L, Jolley D. Improving emergency department efficiency by patient streaming to outcomes-based teams. Australian Health Review : A Publication of the Australian Hospital Association. 2007;31(1):16.	To analyse ED patient flow processes using a task analysis and lean thinking approach.	All ED patients presenting to a 300-bed, community teaching hospital. Western Hospital, Melbourne, Australia.	Two teams "likely to be admitted" and "likely to be discharged" each led by ED physician and senior nurse. Teams operate between 8am -10pm every day of the week.	**Positive** - There was an 8.4% increase in the hours of care delivered between the study periods, indicating a significant increase in ED workload despite there being no increase in patient presentations Ambulance bypass reduced by 55% (95% CI 38%- 68%; p<0.001)
King, D. L., et al. (2006). "Redesigning emergency department patient flows: application of Lean Thinking to health care." Emergency medicine Australasia 18(4): 391	To describe the outcome of an application of concepts form Lean Thinking in establishing streams for patient flows.	All ED patients presenting to Flinders medical centre ED (a metropolitan tertiary hospital- 50, 000 presentations per year at time of publication). Adelaide. South Australia (SA)	Experienced triage nurses assigned patients into tow streams at time of triage. Patients streamed into "A-team" – patients likely to be admitted. Or "B-Team" – Patients likely to be discharged. This was applicable to all ED patients with the exception of ATS cat 1 patients who were taken straight to a resuscitation area.	**Positive** - Percentage of patients who waited at least 8 hours for a bed dropped slightly but not significantly. Mean time spent in ED for all patients dropped (5.8-5 hours, p<0.001), and for admitted patients dropped 8.5-7 hours (p<0.000). Authors state monitoring of adverse incidents did not identify any incidents of concern with regard to patient safety. Staff feedback was "greater sense

Details of paper	Study Aim	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
Fast Track / Streaming				
				of patient safety" and "greater sense of control".
Shetty, A., et al. (2012). "Senior Streaming Assessment Further Evaluation after Triage zone: a novel model of care encompassing various emergency department throughput measures." Emergency medicine Australasia : EMA 24(4): 374-382.	To assess the impact of a new model of care, the Senior Streaming Assessment Further Evaluation after Triage	All ED patients presenting to Westmead Hospital ED (850-bed tertiary adult hospital with level 1 trauma service), Sydney, Australia.	An amalgamation of front-of-house initiatives, senior assessment, early streaming, bedside registration, time critical interventions. Seven days 10am -6pm	**Positive** - Time to physician KPI improved from 72.5% to 84.1%. ED length of stay dropped most significantly for Australasian Triage Scale categories 3 and 4 (14.3% and 11.8%, *P*-values <0.001). These results were achieved despite worsened access block and hospital bed-occupancy rates during the intervention period (+3.9% and +6.7%).
Asha, S. E. and A. Ajami (2013). "Improvement in emergency department length of stay using an early senior medical assessment and streaming model of care: A cohort study." Emerg Med Australas**25**(5): 445-451.	The aim of the present study was to determine if a model of care called Senior Assessment and Streaming (SAS) would increase the proportion of patients achieving NEAT.	All patients who presented to St George Hosptial ED, (a tertiary referral centre – with approximately 65,000 ED presentations per year). Sydney, Australia	Stable, ambulant patients considered to have problems that early consultant-level assessment was likely to improve processing efficiency were streamed through a dedicated clinical area staffed by an ED physician, intern and nurse. Friday –Monday 12:00-1800hrs	**Positive** - NEAT on days with SAS was 15% higher compared with days without (odds ratio, 1.15; 95% confidence interval [CI], 1.07–1.24; $P < 0.001$).

Details of paper	Study Aims	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
Geriatrician in the ED				
Jones, S. and P. Wallis (2013). "Effectiveness of a geriatrician in the emergency department in facilitating safe admission prevention of older patients." Clin Med**13**(6): 561-564.	To assess the effectiveness of a geriatrician in the emergency department in facilitating safe admission prevention of older patients	All patients >65 years were screened and some younger patients were included if their presenting complaint was relevant to the specialty, eg. Parkinson's disease. Birmingham Heartlands Hospital Emergency Department , UK median age of 85 (range 58 to 105)	ED geriatrician worked 5.5 clinical shifts in ED in collaboration with a previously established team of occupational and physiotherapists to provide support to the ED.	**Positive** - ED geriatrician was able to facilitate the discharge of 543/848 (64%) of the patients seen and to facilitate the direct admission to elderly care wards of 174/305 (57%) of those who were admitted, compared with virtually no direct admissions to elderly care wards from the ED pre-intervention.

Details of paper	Study Aims	Study Population/Place/Setting	Intervention	Findings/Conclusions: Opinion positive or negative and why
Nurse Journey /ED Flow Coordinator				
Lees, L. and J. Ferreday (2003). "The role of a flow coordinator in an emergency assessment unit." Nurs Times **99**(32): 32-34.	Initial evaluation of a patient-flow coordinator to the Emergency Assessment Area	All patients in the GP Emergency Assessment Area for the Birmingham Hospital, UK	Introduction of a nurse led patient-flow coordinator who promoted smooth seamless flow of patients through emergency to admission or discharge, by progress-chasing, updating and liaising with all ED staff.	**Positive** - Improvement of 4 hour compliance from 72% to 96%. Qualitative experience of patient and carer improved.
Asha, S. E. and A. Ajami (2014). "Improvement in emergency department length of stay using a nurse-led 'emergency journey coordinator': a before/after study." Emerg Med Australas **26**(2): 158-163.	To determine if a nursing role called the 'Emergency Journey Coordinator' (EJC) improved NEAT through resolving delays in patient processing.	Patients in the ED of a tertiary referral centre (65,000 ED presentations per annum). St George Hospital, Sydney, Australia	An additional senior nurse on shift to focus on early identification of delays in patient processing and assisting in solving them to promote timely disposition for patients. Seven days from 14.30 to 23.00 to meet peak demands.	**Positive** - NEAT after the EJC role started was 64.4% compared with 59.6% before, an absolute improvement of 4.9% (95% confidence interval [CI] 4.0–5.8, $P < 0.001$). Admitted NEAT was 38.1% after the EJC role started compared with 32.5% before, an absolute improvement of 5.6% (95% CI 4.1–7.1, $P < 0.001$). For patients discharged, NEAT was 80.2% after the EJC role started compared with 74.6% before, an absolute improvement of 5.6% (95% CI 4.7–6.6, $P < 0.001$).
Murphy, S. O., et al. (2014). "Does an ED Flow Coordinator Improve Patient Throughput?" J Emerg Nurs **40**(6): 605-612.	To assess the impact of a senior nurse ED flow coordinator	All ED patients at an urban academic medical centre, Kansas Hospital, United States.	An additional "charge nurse" position specifically empowered to affect patient throughput in the emergency department. Seven days from 09.00 to 21.30 hours.	**Positive** - Decreased length of stay by 87.6 minutes (P=.001) and lowered "left without being seen" rate by 1.5% (P=.002). Monthly hospital diversion decreased from 93 hours to 43.3 hours (P=.008)

Chapter 3: Should we use a time based target to assess care?

The NEAT compliance rate is a process metric, reflecting the time it takes to deliver the healthcare rather than the quality of the care. Process metrics examine healthcare performance in delivering care rather than actual outcomes for the patient [136]. The advantage of process measures is that they are easy to measure, often visible in real-time, relatively objective, transferable across sites, and often under the direct control of clinicians [136].

Just focussing on the time target alone however has led to several problems, as evidenced in the NHS[82, 89, 103-106, 109, 110, 112, 137]. Nor has any research or empirical validation been available, before or after the mandate, to confirm that four hours was the correct target in terms of effective and safe health care delivery [104].

NEAT is only a time-based process measure of healthcare quality

Kelly et al highlights that although a10-minute reduction in total treatment time may not seem important to an individual patient, when achieved for 40 patients per day, it adds up to 400 minutes (ie. more than 6 hours) of additional cubicle availability at the level of the ED [64]. Certain patient groups may be more likely to experience reduced LOS in ED as a consequence of 4 hour rules. In the UK, Mason et al [131] found a significant surge of elderly patients being discharged home or admitted to the wards within the last 20mins of the 4 hour period . This was an hypothesis – generating study only in predicting a negative outcome amongst the elderly, but with no proven association with calculated risk

Liew et al [87] and Richardson [97] were the first Australian authors to highlight the direct correlation between LOS in ED and an increased inpatient LOS, with the former study quantifying the increased inpatient LOS for increasing EDLOS (Figure 9) .

ED LOS (hours)	Mean Inpatient LOS (Days)
< 4 hours	3.73 days
4-8 hours	5.65 days
8-12 hours	6.6 days
>12 hours	7.20

Figure 9. ED LOS correlation to Mean Inpatient LOS

Care can become focussed on the process of care delivery rather than outcomes. Examples of this exclusive focus on process rather than outcomes include moving of patients prematurely from ED to other areas of the hospital, in order to "stop the clock" (eg clinical decision units, inpatient beds, and short stay wards). Although all of these facilities may have value in improving a patient's care, the motivation for their utilisation should be based on improved care and patient outcomes, not the improvement they confer on NEAT compliance rates.

Moreover, if the measure of time is to dominate as the performance metric, then more resources and processes must be potentially directed towards maximising the accuracy of this metric. The recent Queensland Audit Office Report into Emergency Medicine measures highlighted the potential inaccuracies in the time measures recorded by the current patient information and management system[138]. The use of time as a measure in isolation, or for that matter, the use of any measure in isolation, is more likely to lead to "gaming" or less stringent and standardised interpretations of the measure to make an institution more likely to meet the target.

NEAT is a Threshold Target

The NEAT is a threshold target in that a certain proportion of patients need to meet the time target. It does not matter if a patient stays in an ED 4hrs and 1 minute or 12 hours; both do not meet the target. There is no delineation of the "tail" of patients not meeting the target who have very long stays in the ED. This may create a perverse incentive to direct clinical and process priority to patients who can still potentially meet the 4-hour target at the expense of patients who have already "breached" the target and whose care is consequently sidelined despite this being potentially contrary to clinical need.

Total NEAT compliance measures two very clinically different streams of patients within a single metric

The NEAT is a gross or composite measure of several different processes. In most Queensland ED's approximately 70-75% of patients presenting to that ED are discharged, and approximately 25-30% are admitted to a hospital or short stay ward. The processes required to discharge a patient from ED within 4 hours are relatively small in number, low in complexity, and largely within the control of the ED itself. As such, most hospitals have been able to achieve NEAT compliance in the order of 85-90% for their ED discharged patients[139]. In addition this patient group tends to be younger, less unwell and have better outcomes than the cohort of patients admitted to hospital. One paper does however suggest an increased risk of mortality in the higher acuity group discharged from ED after 6 hours, with evidence of mortality in the lower acuity patient group discharged from ED reflecting an even smaller statistical

magnitude of risk [19]. In contrast to this cohort, patients admitted to hospital are more unwell, require more complex clinical care with greater integration and optimisation of more hospital processes, and are more likely to experience adverse clinical outcomes dependent on their care. This patient group consistently has a lower NEAT compliance than the discharged group with the average NEAT compliance for Queensland for 2013/14 being 52.9% [139]. This means that a hospital that discharges 75% of their ED patients with a 90% NEAT compliance can achieve an overall (i.e. all-patient) NEAT compliance of 80%, while still only achieving a 50% NEAT compliance for all admitted patients (including short stay ward admissions). In other words, an improvement of 1% NEAT compliance in the discharged, low acuity patient stream is equivalent to three times as much as an improvement of 1% NEAT compliance in the admitted stream of very sick patients. This disproportionateness may skew organisational and clinical priorities by encouraging a focus on improvement in the discharged patient stream, when the sickest and most vulnerable patients are in the admitted stream.

As a result, there are several Queensland Hospitals who are achieving average overall NEAT compliance figures of 75-80%, while only admitting 30-40% of their patients to an inpatient or short stay ward within 4 hours. These hospitals tend to be smaller hospitals with lower overall admission rates. The larger tertiary hospitals with higher admission rates who have a higher admission rate are thus disadvantaged in the overall NEAT measure. This has consequence in that the only patients for whom direct evidence of benefit from NEAT exists are those who are admitted [6, 91] and yet most clinical redesign efforts to aimed at achieving high overall NEAT compliance have focussed on NEAT compliance for discharged patients.

Patient focussed measures for assessing the quality of emergency care

The disadvantage of process metrics used in isolation (like NEAT) is that they do not assess the consequence of the process in terms of patient-important clinical outcomes. In the case of NEAT, the assumption is that faster care is better care with demonstrable patient benefit in the majority of cases. However it is not actually the time taken to deliver care, but other factors that are important in care delivery which also contribute to the quality of the care delivered. Patient experience is another important aspect of assessing the impact of clinical redesign efforts such as NEAT [18, 140]. Evidence on patient experience and NEAT is currently lacking. One of the primary concerns about NEAT is the balance between efficiency and patient safety [89]. In particular whether shorter ED stays may lead to increased adverse events such as death and cardiac arrests during the early stage of hospital admission. Sullivan, Staib et al [128] have shown that monitoring direct patient outcomes drives reform and improvement in access to emergency care.

Chapter 4: Has NEAT provided benefits for patients?

There is no doubt that overall the introduction of the NEAT and the reduction of overcrowding and access block has improved access to emergency care in Queensland and other jurisdictions [62].

Benefits of NEAT

In Queensland, access to emergency care has improved significantly as measured by waiting time by triage category, ambulance off stretcher times, ambulance redirection, average ED length of stay, and access block [141]. This has been achieved despite growth in ED presentations disproportionate to population growth. There is no current data on the outcomes for patients discharged from the ED other than representation rate which was stable for the cohort reported by Sullivan, Staib et al[128].

Improved NEAT compliance has been associated with a decrease in adjusted in-hospital mortality rates in patients admitted through the ED. This finding is not unique to Queensland, having been replicated in other states and countries [6, 7, 9, 12, 19, 91, 142]. In Australia, Richardson [91] and Sprivulus et al [12] were the first to show that overcrowding in emergency departments was associated with prolonged ED LOS and increased mortality for patients admitted acutely via the ED.

Other studies, both overseas and in Australia, have confirmed a similar association. Kelman et al. (13) examined hospitals across 155 UK NHS trusts and found that, as the percentage of hospitals achieving more than 98% compliance with the less than 4 hour target increased from 1.24% to 59.4%, the mean in-hospital mortality rate for emergency admissions across all hospitals decreased from 1.17% to 0.84%. In Western Australia, Geelhoed et al. (14) studied six hospitals in Perth (three tertiary and three secondary hospitals) following the introduction of the 4 hour rule and found that improvements in access block and ED overcrowding were associated with an overall significant decrease in mortality rate from 1.12% to 0.98% in tertiary hospitals, but no impact in secondary hospitals.

Mortality

The measure of the correlation between in-hospital mortality rates and compliance rates with the four hour rule has not been consistently reported. In studies which examine this issue, it is important to define a priori the measure of mortality. Such measures include crude mortality, hospital standardised mortality ratio (HSMR), and HSMR for admitted emergency patients only (eHSMR – table 3).

Table 3. Different measures of in-hospital mortality

Mortality Measure	Description
Crude mortality	Frequency of occurrence of death in a defined population during a specified interval
Hospital Standardised Mortality Ratio (HSMR) or Standardised In-hospital Mortality Ratio (SMR)	Adjusts for factors that affect in-hospital mortality rates, such as patient age, sex, diagnosis and admission status. It then compares the actual number of deaths in a hospital with the average Australian experience (which includes all hospitalised patients, both emergency and elective)
Emergency Hospital Standardised Mortality Ratio (EHSMR)	As for HSMR but for inpatient only admitted through the emergency department

The investigation into the Mid-Staffordshire trust by Wood etal used the Standardised Mortality Rate (SMR, see Table 3.) to identify this hospital as a consistent mortality outlier - despite better than average four hour rule performance - and which served as the trigger for the investigation into its many failings in care[103]. The investigation found a surge of discharges from ED (either home or to a ward bed) would occur in the last half hour before the 4 hour clock would tick over. The investigators speculated that "gaming was introduced to avoid punitive incentives". Although the SMR for elective admissions did not indicate concerns, the higher than expected SMRs for emergency admissions were dispersed across a range of hospital units and diagnostic groups rather than just a few, emphasising systemic issues within the trust's emergency care system.

Using linked records across multiple population based health administrative databases in Ontario and deaths from a population based registry, Guttmann et al. [19] investigated the relationship between mortality at 7 days for patients discharged home from ED without being seen and length of ED stay. The risk of death increased incrementally with each additional hour of mean waiting time. The adjusted odds ratios (95% confidence interval) for death and admission were 1.79 (1.24 to 2.59) and 1.95 (1.79 to 2.13), respectively, among high acuity patients, and 1.71 (1.25 to 2.35) and 1.66 (1.56 to 1.76), respectively, among low acuity patients for mean length of stay of ≥6 hours compared with <1 hour. Interestingly, they found no increased risk of death among patients who left ED without being seen (adjusted odds ratios 1.00 (0.97 to 1.02).

Goh points out that studies reporting reductions in mortality attributable solely to the implementation of the 4 hour rule, rather than the holistic set of interventions peculiar to each hospital that aimed to reach the target, should be interpreted with caution[7]. Mitra and Cameron challenge the results of Geelhoed stating that "In advanced health systems, outcome measures should focus on risk of unexpected death, or, at least, risk of death adjusted for major predictor variables such as age, co-morbidity burden, disease severity, illness acuity and frailty [9].

Moreover, some authors have questioned the validity and reliability of the HSMR as a statistic that truly reflects quality of in-hospital care. Scott et al[143] caution that to be a reliable and trustworthy tool for monitoring quality of care within, not between, hospitals over time, the HSMR requires comprehensive and valid patient-level data, consistent admission practices and coding of admissions, robust risk adjustment, intimate knowledge of its limitations, and an ability to pinpoint potential quality problems at the level of specific units or patient populations[143]. The HSMR is not intended as a definitive report on mortality but rather as a screening tool for identifying potential safety signals.

In Canada, Berthelot et al espouse a similar view, stating that none of the mortality ratios specifically capture the outcomes of admitted patients with emergency care-sensitive conditions ie conditions in which ED management would be expected to have an influence independent of other factors [144]. Following discussions with a panel of ED experts, these authors were able to identify 37 International Classification of Diseases (version ICD-10 CA) diagnosis groups that might serve as emergency care-sensitive conditions that could be targeted in future studies in reducing inpatient mortality (Figure 9).

List of the diagnosis groups for mortality and morbidity.

Morbidity	Mortality	A41	Sepsis
		E11	Diabetes Mellitus type 2
		E86	Volume depletion
		E87	Other disorders of fluid, electrolyte and acid-base balance
		F05	Delirium, not induced by alcohol and other psychoactive substances
		G93	Other disorders of brain
		I21	Acute Myocardial Infarction (AMI)
		I24	Other acute ischemic heart disease
		I26	Pulmonary embolism
		I46	Cardiac arrest
		I50	Heart failure
		I60	Subarachnoid haemorrhage
		I61	Intracerebral haemorrhage
		I62	Other non traumatic intracranial haemorrhage
		I63	Cerebral infarction
		I64	Stroke, not specified as haemorrhage or infarction
		I71	Aortic aneurism and dissection
		J18	Pneumonia
		J44	Other chronic obstructive pulmonary disease
		J69	Pneumonitis due to solids and liquids
		J80	Adult respiratory distress syndrome
		J96	Respiratory failure, not elsewhere classified
		K26	Duodenal ulcer
		K55	Vascular disorders of intestine
		K56	Paralytic ileus and intestinal obstruction without hernia
		K57	Diverticular disease of intestine
		K65	Peritonitis
		K72	Hepatic failure
		K85	Acute pancreatitis
		K92	Other diseases of digestive system
		L03	Cellulitis
		N17	Acute renal failure
		R57	Shock, not elsewhere classified
		S06	Intracranial injury
		S32	Fracture of lumbar spine and pelvis
		S72	Fracture of femur
		T82	Complications of cardiac and vascular prosthetic devices, implants and grafts
		A04	Other bacterial intestinal infection
		C71	Malignant neoplasm of the brain
		I48	Atrial fibrillation and flutter
		J90	Pleural effusion, not elsewhere classified
		K63	Other diseases of intestine
		T81	Complications of procedures, not elsewhere classified

Figure 9. Emergency care sensitive condition ICD codes from (ICD-10CA)[144].

In a recent study, Sullivan, Staib et al demonstrated an association between improved compliance with the National Emergency Access Target (NEAT) – defined as discharge from ED within 4 hours of presentation - and lower all-cause mortality among patients admitted from the ED to inpatient wards of a large adult tertiary hospital [128]. As NEAT compliance improved from 32% to 62% in response to multiple interventions over a 9 month period, mean length of ED stay for admitted patients significantly reduced from 637.8 minutes to 404.4 minutes. This reduction in time spent in the ED was associated with a significant decrease in crude mortality rate for admitted patients from 2.3% to 1.0% and a fall in the hospital standardised mortality rate for emergency admissions (eHSMR) from 93 to 72. This favourable outcome was attributed to the implementation of a NEAT taskforce and multiple reforms targeting processes both within the ED and its interface with inpatients units. This evidence suggests

that monitoring the eHSMR and the unadjusted deaths of emergency admissions could be used a reasonable screening strategy to ensure that strong safety signals are not missed.

Rapid Response Rate

Patients who are admitted to the hospital from the emergency department are unwell and likely to be at risk for clinical deterioration. This clinical deterioration while an inpatient often triggers a call to the Rapid Response Team (RRT). It has been hypothesised that if care in the ED is poor or rushed, then more RRT activations may ensue to manage unstable patients and so monitoring the RRT call rate may help assess the quality of care given in ED.

Two studies from the U.S. suggest that measuring the rate of RRT activations within the first 24 hours post ED admission to be an innovative approach to measuring performance [145, 146]. Very little literature is available on the correlation of timeliness in ED and RRTs. However one Australian study found that there was no difference of length of stay in ED between the groups of patients who had their first RRT <24hrs post ED admission and patients who had their first RRT activation >24 hours post ED admission. Interestingly, patients who had their first RRT activation <24 hours post ED admission had significantly shorter length of stay as an inpatient (7 days versus 11 days, $p<0.001$) and a lower, but not statistically significant, in-hospital mortality rate (16.2% versus 21.6%)). One possible explanation is that an emergency response heightens the awareness of clinicians about the vulnerability of specific patients to clinical deterioration, resulting in increased vigilance of physiological status and prompt escalation of care to the treating unit, preventing subsequent deterioration to levels requiring RRT activation[147].

Further prospective data collection is currently underway using the ED safety dashboard to assess the utility of the RRT metric in assessing the quality of care provided in Queensland EDs [128].

Time to treatment

It is suggested that time to treatment is a patient-focussed process measure that can be useful when monitoring the access to and quality of emergency care. In 2005, two time-sensitive core quality measures were identified by the Joint Commission for Accreditation of Healthcare Organisation in the US [119]. These metrics were antibiotic administration within four hours of hospital arrival for patients with community-acquired pneumonia (CAP), and percutaneous intervention (PCI) within two hours of arrival in patients with AMI.

In recent times, evidence has emerged that the time to antibiotic measure has led to an increase in inappropriate use of antibiotics in order to meet the time target, and as a result it has been removed as a quality measure by the US Joint Commission [122].

In Victoria, Jao et al. studied which factors are associated with a high level of patient satisfaction with their pain management [148]. Surprisingly, improved time to analgesia was not associated with a high level of patient satisfaction (p=0.88). The only two variables that were significantly associated with a high level of satisfaction were receipt of: “adequate analgesia” (defined as a decrease in pain score to <4 and a decrease from the triage pain score of 2, p=0.027) and specific communication regarding pain management (p =.002). There appears to be little benefit in monitoring the time to particular treatments without coupling this time metric with clinical outcome measures.

Unplanned returned visits to emergency

One popular measure of the quality of care in ED is the rate of patients who are treated in ED, discharged and then return for an unscheduled visit within a set period of time (this varies across studies and reports). The assumption of this measure is a perception that this rate represents premature discharges (pressured by the time targets) from the first ED visit, missed diagnoses, or some other failure of their treatment or discharge plan, with an ultimate assumption that they represent with a higher acuity with worse outcomes [149].

Freeman et al. in the UK observed the impact of the 4 h target and the opening of a Minor Injuries Unit (MIU) on unplanned ED representations within 7 days of the original visit[77]. They noted an increased percentage of patients re-attending within 7 days with the introduction of the 90% target with a levelling off the reduction in representations following the implementation of the 95% targets. No statistical significance was calculated for this study nor was the introduction of the MIU clearly defined or lineated in the results, making conclusions from this study difficult to draw. The authors did reassuringly note that neither of the targets nor the introduction of the MIU had an impact on the patient mortality (a constant level of about 0.18%) [77].

Currently there is no strong evidence that patients who return to an ED unplanned after ED discharge do worse than those who do not represent, and hence this metric may not serve as a useful marker of quality of care.

Chapter 5: What Next for NEAT?

Setting a 90% by 4 hours National Access Emergency Target by 2015 was the verdict of an expert panel in 2011 following a wide ranging consultation of various stakeholders. This consultation was required because there was no sound, peer reviewed evidence base from which to derive such a policy decision. As has been evidenced in the NHS [103, 150-153], the 'no holds barred' achievement of a 90% 4 hour compliance has been difficult, unsustainable and not without significant costs which extend beyond mere finances to include potentially preventable adverse patient outcomes and staff dissatisfaction and resignations.

Indeed no Australian jurisdiction has achieved an overall 90% NEAT compliance for any significant reporting period. As the implemented process improvements help hospitals to improve their NEAT performance, they are faced with the potential situation of requiring increasingly expensive interventions for decreasing returns for increased levels of NEAT compliance.

The key message is that time-sensitive process measures must be counterbalanced with patient-sensitive measures of quality and safety of care and clinical outcomes. Princess Alexandra Hospital (PAH) has combined both types of measures in a cloud-based ED-inpatient safety dashboard in order to address anxieties about clinical care being directed inappropriately by a time measure. This dual focus enabled all staff at PAH to see an improvement in time-based NEAT compliance levels (indeed most improved results nationally in 2012-2013) in tandem with a halving of deaths among patients transferred across the ED-inpatient interface (Figure 10).

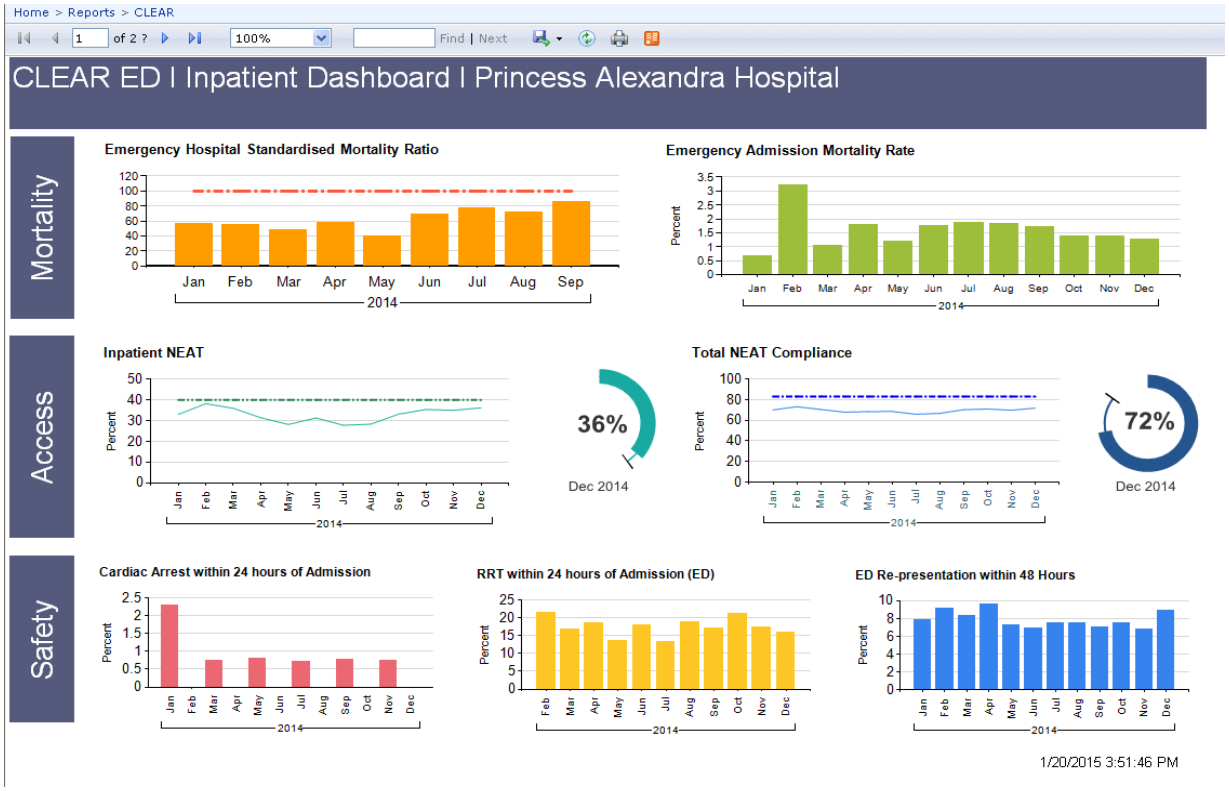

Figure 10. Inpatient Dashboard / Princess Alexandra Hospital

This coupling of NEAT compliance and patient outcomes is now being expanded using nationwide data. A collaboration among CSIRO, Health Round Table and CLEAR to undertake a big data analysis and synthesis new evidence based NEAT for national consideration.

Summary

In summary, synthesis of the currently available evidence suggests that the following guiding principles that should be considered when determining future policy direction in this area.

1. **A time based target should remain**
   A time based target is useful because it is visible at the point of care, and improvement in time based measures has been associated with improved patient-important outcome measures such as mortality;

2. **Direct measures of patient outcomes are needed in addition to time targets**
   Process measures such as a time based target should be nested in a matrix of quality metrics that are standardised and evidence based;

3. **Separating the admitted and discharged NEAT allows clinically relevant use of resources and facilitates appropriate, patient-directed clinical redesign**
   A time based target should clearly identify performance in the processes involved in the delivery of care to the most vulnerable patients. There is evidence that improved timeliness and efficiency of care of the admitted stream is associated with improved clinical outcomes. Most clinical redesign to date has focussed on the discharged stream rather than the high risk clinically vulnerable admitted stream. Focussing on inpatient NEAT will require adequate and direct monitoring of patient outcomes and appropriate resourcing; and

4. **Future target setting needs to be evidence-based**
   Future policy direction in the area of setting of emergency access performance targets should be undertaken on the basis of peer reviewed scientific evidence, rather than opinion. The areas of emergency medicine and hospital systems research have now matured to a state where generating such evidence is possible.

Further information is expected to be available to facilitate the synthesis of new targets March 2015 and a further report will be issued.

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