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Perspective

Deconstructing the 4-h rule for access to emergency care and putting patients first

Ian Scott[1,3] MBBS, FRACP, MHA, MEd, Associate Professor, Consultant General Physician

Clair Sullivan[1] MBBS (Hons), MD, FRACP, Codirector Clinical Service Improvement, Consultant Endocrinologist

Andrew Staib[1] MBBS, FACEM, Codirector Clinical Service Improvement, Deputy Director Emergency Medicine

Anthony Bell[1,2] FACEM, MPH, FRACMA Director Emergency Medicine, Associate Professor

[1]Collaboration for Emergency Admissions Research and Reform (CLEAR), Princess Alexandra Hospital, Ipswich Road, Woolloongabba, Qld 4102, Australia. Email: clair.sullivan@health.qld.gov.au; andrew.staib@health.qld.gov.au; Anthony.Bell@health.qld.gov.au

[2]Royal Brisbane and Women's Hospital, Bowen Bridge Road, Herston, Qld 4129, Australia.

[3]Corresponding author. Email: ian.scott@health.qld.gov.au

Abstract. Evidence suggests improved outcomes for patients requiring emergency admission to hospital are associated with improved emergency department (ED) efficiency and lower transit times. Factors preventing timely transfers of emergency patients to in-patient beds across the ED–in-patient interface are major causes for ED crowding, for which several remedial strategies are possible, including parallel processing of probable admissions, direct-to-ward admissions and single-point medical registrars for receiving and processing all referrals directed at specific speciality units. Dynamic measures of ED overcrowding that focus on boarding time are more indicative of EDs with exit block involving the ED–in-patient interface than static proxy measures such as hospital bed occupancy and numbers of ED presentations. The ideal 4-h compliance rate for all ED presentations is around 80%, based on a large retrospective study of more than 18 million presentations to EDs of 59 Australian hospitals over 4 years, which demonstrated a highly significant linear reduction in risk-adjusted in-patient mortality for admitted patients as the compliance rate for all patients rose to 83%, but was not confirmed beyond this rate. Closely monitoring patient outcomes for emergency admissions in addition to compliance with time-based access targets is strongly recommended in ensuring reforms aimed at decongesting EDs do not compromise the quality and safety of patient care.

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Introduction

Introduction of the '4-h rule' in the UK in 2000[1] and the National Emergency Access Target (NEAT) in Australia in 2011[2] was a response to a perceived patient safety risk resulting from delayed access to care in crowded emergency departments (EDs). Studies have reported an association between ED crowding and higher mortality,[3,4] adverse events,[5] longer hospital stays[6] and patient dissatisfaction.[7] These policies initially stipulated that 100% of UK patients and 90% of Australian patients should exit ED within 4 h of presentation. Both countries have subsequently revised their targets downward, to 95% in the UK in 2010[8] and to 80–85% in Australia in 2016.[9] Political controversy and media attention have followed the policies in both countries.

Despite considerable efforts in both countries towards achieving such targets, the evidence of improved patient outcomes underpinning the 4-h rule is limited.[10] Moreover, uncertainty persists as to the best measures of patient flow or crowding within EDs, the most appropriate access target, the clinical effects of the 4-h rule and differential effects on different patient populations. In this article, we explore these themes in reference to those patients admitted to hospital from the ED.

How to measure overcrowding in the ED and its contributory causes

Overcrowding in the ED is a complex concept and difficult to measure and validate against outcomes.[11] Patients who are discharged directly from the ED are predominantly ambulatory patients of low acuity, have a relatively smooth exit path and contribute relatively less to sustained ED overcrowding.[12] In contrast, patients who require admission to in-patient wards must navigate the complex ED–in-patient interface (EDii). This involves several phases: assessment and initial work-up of patients by ED clinicians leading to decisions to refer for admission, the referral of such patients from ED teams to the most

appropriate receiving in-patient teams, patient review by in-patient teams to finalise acceptance for admission, bed allocation and, finally, departure of patients to receiving wards. Waits may accompany each of these steps.

Research indicates that egress factors preventing timely transfers of emergency patients across the EDii to in-patient beds are the main causes for ED crowding.[13,14] For example, in one Australian study boarding time (i.e. the time spent by patients whose ED care has been completed and who are simply waiting transfer to an in-patient bed) comprised 61% of the time that admitted patients occupied ED cubicles.[15] The presence of redundant and frustrating admission policies together with inadequate multidisciplinary collaboration and poorly developed trust between ED and in-patient teams often leads to inefficient interdepartmental interactions and poor handovers. Furthermore, absence of feedback on clinical performance and patient outcomes, and an inability to unite staff behind a common goal of providing expeditious patient-centred care, all impede smooth patient transfers.[16–19]

However, there are currently no universally agreed criterion measures of patient flow through EDs, despite the existence of 71 different indices.[20] Most hospitals use traditional proxy measures of ED flow, such as hospital bed occupancy (midnight occupancy as measured by bed census, a measure of ED exit block) matched against ED demand (numbers of ED attendances over the previous 24 h). These relatively static measures may not accurately reflect transit processes and dynamic bed capacity, which affects patient flow from ED to in-patient beds.[21] They may not reflect dysfunction at the EDii or lack of bed availability for patients with special needs (e.g. telemetry beds for patients with arrhythmia or isolation beds for patients harbouring multiresistant micro-organisms). We and others have shown that measures of boarding, such as boarding time for individual patients, proportion of boarding patients in ED at a given time point or total hours of boarding time (or the equivalent number of ED cubicles occupied by boarders over a specified interval), are more closely correlated with ED transit times and 4-h rule compliance than traditional measures of hospital bed occupancy and ED attendance numbers.[22,23] Therefore, such measures may be more helpful in indicating when EDs are becoming stressed and vulnerable to prolonged transit times. Instituting parallel processes of identifying patients likely to require admission, before full ED work-up, and simultaneously reserving in-patient beds for such cases may help reduce boarding times.[24] Another approach is to have closer, more balanced face-to-face relationships between ED staff and receiving in-patient teams that foster mutual understanding of the contextual constraints each faces in facilitating timely transition of patient care across the EDii and shared commitment to overcoming them.[25]

Deciding the optimal time-based access target for emergency care

Access targets that stipulate that a certain percentage of patients must leave ED within 4 h are problematic for several reasons. First, all targets selected to date, including a 100% target, have been arbitrary choices with no basis in evidence or even expert opinion.[10] Indeed, whether improved 4-h rule performance even reduces in-hospital mortality is open to question, with some Australian studies showing an association,[26,27] but UK[28,29] and US[30] studies not. However, this could be explained, in part, by the lower baseline performance in Australia in 2009 (on average 70% exiting within 8 h) compared with the UK in 2000 (77% within 4 h).[10] If there is a cause–effect relationship, it remains unclear which target represents the ceiling threshold beyond which no further gains in patient survival can be achieved. In one Australian hospital, in-hospital mortality reduced from 2.3% to 1.6% as NEAT performance rose from 32% to 72%,[26] but in another hospital where baseline NEAT was already 60% and rose to 90%, the reduction in mortality was much less (from 1.1% to 1.0%).[27] Second, compliance rates for a given target are time-based process of care metrics that assume faster care is better care, conferring benefit on most, if not all, patients in ED.[31]

However, simply focusing on the time target alone and ignoring other factors that affect quality of care can lead to poor clinical outcomes, as exemplified by the Mid-Staffordshire experience.[32] Patients can be pushed through the ED without proper evaluation or stabilisation, resulting in missed diagnoses, subsequent unexpected clinical deterioration and inappropriate transfer to less-monitored or -staffed areas of the hospital. In addition, the 4-h target does not distinguish between patients who stay in the ED for 4 h and 1 min or 12 h. Both fail to meet the target, with no delineation of the 'tail' of patients with very long ED stays. This may create a perverse incentive to prioritise clinical care for patients still within the target window at the expense of patients who have already 'breached' and whose care is consequently deprioritised, contrary to clinical need,[33] with longer waits imposing proportionately greater risk than shorter ones. Finally, complying with targets may engender gaming and data manipulation, made worse by poor standardisation and accuracy of data in many ED information systems.[34]

Despite these limitations, some form of access target is likely to remain as a quality indicator of emergency care. However, controlled trials that use different 4-h compliance rates are not feasible in determining the optimal target. Instead, aggregated observational data from large numbers of emergency admissions across different hospitals will likely serve as the means for correlating risk-adjusted in-hospital mortality with different compliance rates in attempting to find the 'sweet spot' at which previously declining mortality rates level off, or possibly increase, as the compliance rate rises towards 100%. To our knowledge, only one study has attempted such an analysis, using data from 18 685 406 individual patient stays within 59 hospitals throughout Australia over a 4-year period between 2011 and 2014, before and after the nationwide introduction of the 4-h rule.[35] That study showed the risk-adjusted mortality rate for patients admitted from the ED continued to fall in a linear manner as monthly compliance rates rose to 83% for all ED presentations and to 64% for admitted patients. Beyond these compliance rates, there was insufficient data to definitively support a further significant decrease in mortality rates. In response to these results, Queensland Health chose, in June 2016, to revise its compliance target (now renamed Queensland Emergency Access Target) to over 80%,[36] whereas Western Australia, the first Australian state to formally introduce the 4-h rule, retains a target of 90%. More research is needed to confirm whether higher targets bestow greater mortality benefit

or other service-related efficiencies, such as reduced length of hospital stay.[26] However, chasing higher compliance rates may also incur greater opportunity costs from assigning more staff and resources to the task,[37] and to date no cost-benefit analysis of different access targets has been reported.

Another problematic issue is that an all-patient compliance rate is a single composite metric that combines admitted and non-admitted patients presenting to the ED. However, these two patient groups (referred to in some countries as 'majors' and 'minors' respectively) vary markedly in clinical acuity, illness severity, intensity of management and prognosis. The ED in a small regional hospital unable to handle major trauma and other 'majors' will admit fewer patients (say 25% or less) and hence could easily achieve 80% all-patient compliance rate because most patients will be quickly assessed and discharged. In contrast, a tertiary referral hospital dealing with more acute and complex patients (i.e. many 'majors') may admit as many as 45% of patients such that even if 100% of non-admitted patients could be discharged within 4 h, all-patient compliance may remain as low as 70%.[10] This reality has consequence if reducing the in-hospital mortality of admitted patients is to become the principal rationale for the 4-h rule, when currently much clinical service redesign targets the care within the ED of discharged patients, rather than that of admitted patients at higher clinical risk.[31,34] Arguably, a single 4-h compliance rate should be separated into two rates (admitted and discharged) and different target thresholds applied to each.

Linking time-based access targets with patient outcomes

Evidence suggests 4-h rules have improved timeliness of ED care in both Australia and the UK , although their effects on patient outcomes have been less investigated. In-hospital mortality of admitted patients has been the dominant clinical outcome metric, but this single measure does not assist in identifying which patient groups gain most (or least) from 4-h rules. Knowing this may assist in targeting strategies for reducing ED transit times towards high-risk patients. Several studies have reported robust associations between ED overcrowding and mortality for patients with acute myocardial infarction,[38] trauma,[39] pneumonia[40] and critical illness.[41] Acutely ill patients presenting after-hours also incur higher mortality rates.[42,43] In a recent analysis from Princess Alexandra Hospital where 4-h compliance rates improved from 33% to 70% over 2 years, mortality rates significantly declined among elderly patients, patients with acute cardiorespiratory disease and those presenting to the ED outside normal working hours.[44]

However, mortality should not be the sole outcome measure, especially because risk-adjusted mortality measures, such as the hospital standardised mortality ratio (HSMR), are only screening tools and have been criticised as being unreliably subject to variations between hospitals in admission policies and coding practices.[45] Having said that, mortality is of central importance to both patients and clinicians, it was the metric used to indicate the potential harm imposed by ED overcrowding[2,3] and the Australian Commission for Quality and Safety in Health Care regards HSMR as a key outcome measure for within-hospital trending over time.[46] The Australian study previously mentioned[35] also used rigorously developed risk-adjustment regression models and smoothing functions to minimise between-hospital variation in coding and admission practices.

Still, other quality and safety indicators should be monitored continuously in real time in guarding against the premature exiting of patients from the ED who are at risk of subsequent deterioration. For admitted patients, these indicators may include rates of rapid response team (RRT) calls, cardiac arrests or unplanned transfers to critical care areas occurring within the first 24 h after transfer from the ED. For patients discharged from the ED, unplanned representations to the ED within the following 7 days resulting in admission is a marker of potentially suboptimal care.[47] In one study, as ED transit times decreased, rates of RRT calls for admitted patients within 24 h of transfer from the ED rose from 9 to 14 per 1000 admissions.[27] Our group has developed a digital cloud-based dashboard that displays 4-h compliance rates and patient outcomes, such as mortality and RRT calls, for emergency admissions and that is regularly updated with incoming data from different hospital feeder systems.[48] More nuanced quality of care measures may include accuracy of diagnoses, concordance of management with disease-specific guidelines, appropriateness of investigation requests and measures of patient experience. However, these require more sophisticated, prospective data collection referenced to standards and may not disclose poor quality care until sufficient data have been aggregated over a given period of time. Nevertheless, policy makers should encourage the adoption of a set of richer performance indicators to sit alongside the 4-h target and trial these in designated sites.

Conclusion

Time-based targets for emergency care have become enshrined in several national health systems, including the UK and Australia. Evidence suggests that timely care for patients requiring emergency admission to hospital is associated with better outcomes, although the ideal 4-h rule target remains uncertain. Pursuing ever shorter transit times through the ED that lack supporting empirical evidence of associated gains in patient outcomes may simply incur opportunity costs and potentially place patients at higher risk of suboptimal care. Coupling time target compliance rates with patient-important outcomes is essential in keeping patients, and not just processes and targets, at the centre of the healthcare system.

Competing interests

The authors declare no competing interests.

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