

OPINION

Measuring emergency physician productivity and work patterns

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Abstract

I propose a methodology to compare individual emergency physician (EP) work patterns. This is intended to generate discussion within the specialty. A work pattern graph shows individual EP productivity and, assuming the EPs case selection is similar, can be used to compare group activity. Using a simple mathematical model, an averaged calculation can be made of the number of patients needed to be seen by each treating clinician during a standard shift.

Key words: *emergency department, emergency physician, productivity.*

Introduction

Long waiting times in the ED are frustrating for patients and are associated with worse outcomes and longer inpatient admissions.¹

EDs in Australasia use a triage score to allocate a ‘time to be seen by’ target based on a patient’s presentation and assessment of urgency. Measurable variables for individual patients in ED are triage score (as a measure of urgency) and length of stay (LOS). LOS is measured from time of arrival to discharge home or admission to an inpatient unit. Some activities in ED have a fixed time for completion but the time to be seen by a treating clinician – although directed by the triage system – depends on competing demands made on clinical staff. There are many factors that affect ED productivity² and the present paper is

focused on just one. Emergency physician (EP) productivity is one component of ED productivity.

ED staffing is normally a fixed variable determined by rosters created before the clinical shift. Although the number of clinicians on duty at any one time in ED can be matched to predictable patterns of attendance for any given institution (Fig. 1), there is limited ability to respond to surges in attendance.

The speed that ED patients are seen is influenced by the urgency of the patient’s needs, room availability, competing demands on the clinician’s time and the number of other patients waiting to be seen. The latter is also influenced by the number of clinical staff on duty, their seniority and ability to make decisions.

To some extent, the ‘flow of patients’ through ED is like a river – where the volume is the number of patients passing through and the flow achieved by there being no barrier to out-flow. Flow and occupancy in ED will increase during the day as input exceeds output. Either increase the volume (heavy rain) or obstruct outflow (dam the river) and the banks burst and cause flooding. The ED equivalent to flooding is overcrowding which occurs when the number of patients entering exceeds the ability of staff to discharge or admit them.

Emergency physician clinical productivity

Clinical productivity is a variable which is often overlooked when

examining ED flow and is ‘the elephant in the room’. Patients quite reasonably assume that care will be delivered to a high standard and this is achieved by medical colleges such as the Australasian College for Emergency Medicine setting standards for training and achieving specialty status by examination. During training, ‘quality of care’ is correctly the focus rather than productivity. Once appointed as an EP, productivity becomes an important factor in the relationship the EP has with colleagues and their employer. In the USA, EP productivity is a key performance indicator – they must be ‘productive’ to stay employed.

In Australia and New Zealand ED attendances do not generate hospital revenue so the flow of patients through ED is a ‘quality’ issue.

Context

ED is a finite reservoir. Once ED is at capacity, either patients must be seen more quickly (increased productivity) or improved flow must be achieved by discharge or admission. By default, an ED will have patients leave without treatment because of long waiting times and ‘did not wait’ rate is a common quality measure. EDs cannot close their doors in the way that a full ward or unit can decline further admissions when at capacity. The consequences of ED overcrowding are dire and use of corridor space or holding patients in ambulances (ramping) are some of the worst examples.

If there is a fixed number of patients seen in ED over a 24-h period and the staffing number and skill-mix are also fixed, clinician productivity becomes a critical factor in the flow of patients through ED.

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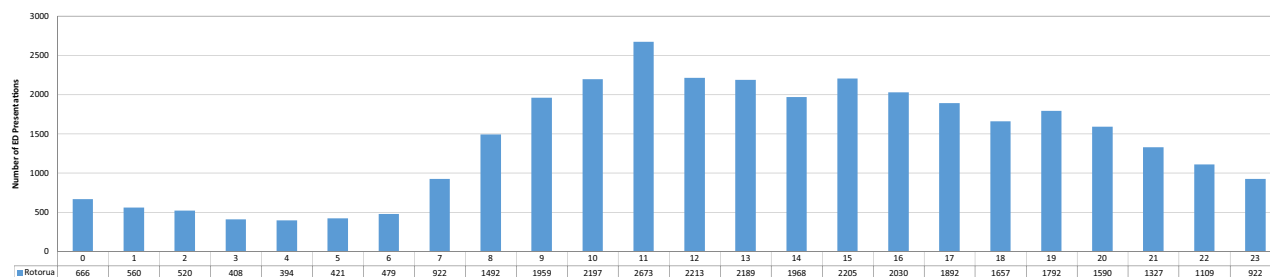


Figure 1. ED presentations by arrival hour – Rotorua 2022.

EPs quickly learn in their training to multitask and an EP on a clinical shift will be seeing several patients at once as well as supervising the care of patients being seen by more junior staff and assisting in decision making. The other skill of the productive EP is the ability to ‘go up a gear’ and see patients faster without compromising care or safety. Experience and risk balance are factors in the ability of doctors working in ED to see patients efficiently while remaining safe practitioners. The cognitive load of task interruptions can reduce the individual productivity of an EP if they are not aware of their own metacognition (personal thinking) and use techniques to reduce the negative effects of these interruptions.³

Patient flow in ED is influenced by the number of patients seen by each clinician. The term ‘clinician’ is used to include nurse practitioner/specialists and the many nurses in ED who deliver pathways of care. Australasian College for Emergency Medicine has recommended that a trainee should be seeing one complex patient an hour and less complex patients can be seen in 30 min. If we assume there is no accumulation of patients in ED, then there is a simple rule that output must equal input.

Mathematical model

Assuming output equals input and that all clinicians seeing patients are equivalent allows for a simple equation. The number of patients (n) needing to be seen by each clinician in a given time period is the total number of patients presenting over

24-h (T) minus those who do not wait (L) divided by the available number of treating clinicians (C):

$$n = (T - L) / C.$$

An example in my department might be:

$$n = (110 - 10) / 10 = 10.$$

In order for ED to maintain a neutral balance, each of the 10 treating clinicians rostered over the 24-h period will need to see on average 10 patients during their 10-h shift.

EDs can run this basic mathematical model with their local numbers to calculate the average number of patients needing to be seen by each clinician or clinical group. The assumption is that each clinician has same shift length and nurse care can be considered as one clinical group. Local variation can be factored into the equation.

Averages do not take into consideration the variable patient load in ED at different times in the 24-h period (Fig. 1) or the variable weighting of medical staff to day and evening shifts designed to match the load. If one clinician sees less, the others will need to pick up more to maintain the balance. In training departments, the treating clinicians will discuss patients with the senior doctors who may not be able to carry the same patient load although they can compensate by experience and quicker decision making.

The other variable that many New Zealand (although less Australian) departments have is a model of care where patients referred to specialties from the community will be

directly seen by the admitting team in ED unless they are unstable and need emergency medicine intervention.

The equation can be adapted to allow for this model by deducting the average number of patients seen by other specialties. For example, if in one particular 24-h period the inpatient teams saw 10 patients collectively, n would become 9.

Although this model determines the average number of patients needed to be seen by each clinician in ED to maintain flow, it does not predict ED overcrowding which is a consequence of hospital bed block. However, the patients awaiting admission and those being seen by EPs are often competing for bed spaces in ED, so the more efficient the ED team is to see and discharge patients – the less congested the ED will be.

Work patterns

Not all EPs have similar work patterns. However, if they have comparable contracts, it is reasonable to expect the clinical workload is evenly distributed.

Differing work patterns tend to average over time as the ED medical workforce is good at regulating itself. If this does not occur and individuals on similar contracts are carrying different workloads the situation can become divisive and clinical leaders may be required to review work patterns. In the USA where EPs may be paid on productivity, this is self-regulating but in New Zealand and Australia, productivity is less apparent unless tools exist to monitor work patterns.

A graph (Fig. 2) that can be used to analyse work patterns is to plot

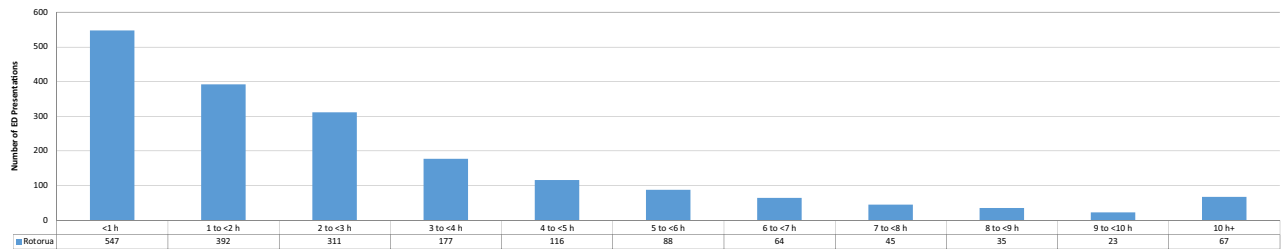


Figure 2. An example of clinician work pattern graph.

the number of patients seen, and care completed, by an individual within a series of time periods <1 h, 1–2 h, 2–3 h and so forth.

Using this graph, and applied to a selection of clinicians within a department, results emerge that can prove useful to compare different work patterns. In order to compare this graph with other clinicians, it is required to know if case selection is also similar.

If an individual clinician is seeing a selection of cases that mirror the urgency balance of the particular ED, then it is reasonable to assume that there is no personal bias to see high or low urgency patients.

High urgency patients can take longer to treat than lower urgency patients. It will be noticeable if a clinician has a bias to see high or low urgency patients although there may be local arrangements where clinicians are employed specifically to see one group of patient (e.g. a clinician

employed specifically to see ambulatory patients). In most departments, EPs see a similar spectrum of cases. Using pivot tables to summarise large amounts of data, the results can be used to show true differences in work patterns.

Triage profile

In order to compare clinician work patterns, an individual ED will need to know what its local triage profile looks like. This will vary from department to department but the department I work in would be considered to have a typical profile (Fig. 3).

This shows the distribution of patients registered in Rotorua ED in 2022 (ED census 34 585) by triage score.

If a clinician has a similar triage profile for the same period (Fig. 4), it is reasonable to assume the clinician is not biased to see any specific triage group.

The clinician profile can be seen to closely match the department profile and would indicate that this clinician is seeing a case mix similar to the average urgency profile of the department. Although not included in this proposal – EP work pattern per triage level would provide even richer data.

Having established that a clinician is seeing a representative selection of patient urgency over a period of time it can then be reasonable to look again at the work pattern graph as a comparative tool to use alongside other clinicians with similar triage profiles. If the profile for an ED clinician is skewed towards seeing a greater proportion of higher urgency patients than the ED profile, then the work pattern graph (Fig. 2) will be flatter.

In Australasian EDs, the majority of attendances are triage 3 or 4 and this is where minor variations in work practice are seen.

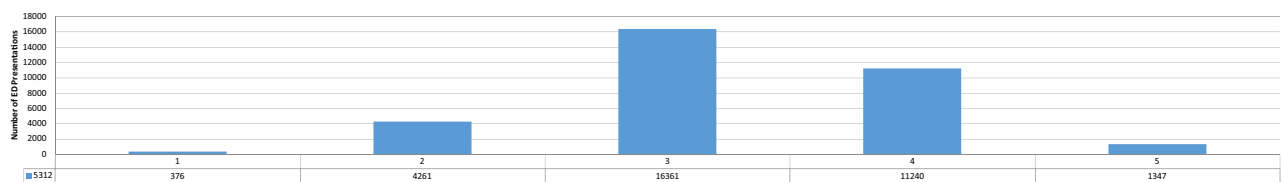


Figure 3. Departmental triage profile – Rotorua 2022.

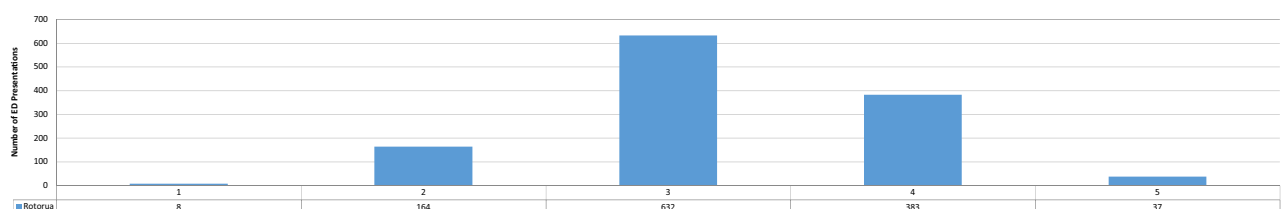


Figure 4. Clinician triage profile – sample 2022.

The literature

From a MEDLINE search of the literature using key words *emergency physician productivity* there is no prior reporting of ED clinician performance based on study of the individual work pattern using a pivot table (Fig. 2).

Strategies to measure and improve ED performance have been published² and an EP productivity index has been reported.⁴

Conclusion

The clinician work pattern graph (Fig. 2) allows for review of a clinician's productivity. Assuming the clinician's triage profile (Fig. 4) is similar to the departmental profile (Fig. 3), comparisons can be made between clinicians.

If it is assumed that roles, training, shift length and job size are similar it is reasonable to use a tool such as the clinician work pattern graph as a measure of productivity.

The model presented is best suited for internal departmental comparisons of clinician productivity.

This measure of productivity is easy to establish using data downloaded from the patient management system into a pivot table which can pull event data and show variables of time period and individual clinician treatment times.

This information can be useful for an EP to examine their own performance particularly in comparison with a peer group. The graph can also be used by clinical leaders to monitor the productivity of their workforce and inform peer feedback.

Acknowledgements

The graph shown as Figure 2 was used by *Francis Health/Deloitte* as one of the tools to examine clinician productivity. Understanding EP work patterns contributed to Rotorua ED achieving the New Zealand shorter stays in ED target of 6 h in 2018.

Competing interests

None declared.

Data availability statement

Historical graphs and Lakes DHB data were used with permission of Interim District Lead Te Whatu Ora, Lakes 2023.

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