

BMJ Open Statewide retrospective study of low acuity emergency presentations in New South Wales, Australia: who, what, where and why?

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ABSTRACT

Objective: The present study aims to use a statewide population-based registry to assess the prevalence of low acuity emergency department (ED) presentations, describe the trend in presentation rates and to determine whether they were associated with various presentation characteristics such as the type of hospital as well as clinical and demographic variables.

Design and setting: This was a retrospective analysis of a population-based registry of ED presentations in New South Wales (NSW). Generalised estimating equations with log links were used to determine factors associated with low acuity presentations to account for repeat presentations and the possibility of clustering of outcomes.

Participants: Patients were included in this analysis if they presented to an ED between January 2010 and December 2014. The outcomes of interest were low acuity presentation, defined as those who self-presented (were not transported by ambulance), were assigned a triage category of 4 or 5 (semiurgent or non-urgent) and discharged back to usual residence from ED.

Results: There were 10.7 million ED presentations analysed. Of these, 45% were classified as a low acuity presentation. There was no discernible increase in the rate of low acuity presentations across NSW between 2010 and 2014. The strongest predictors of low acuity ED presentation were age <40 years of age (OR 1.77); injury or musculoskeletal administrative and non-urgent procedures (OR 2.96); ear, nose and throat, eye or oral (OR 5.53); skin or allergy-type presenting problems (OR 2.84).

Conclusions: Low acuity ED presentations comprise almost half of all ED presentations. Alternative emergency models of care may help meet the needs of these patients.

INTRODUCTION

Emergency departments (EDs) were designed to triage and manage acutely unwell and injured patients.^{1 2} Over the past

Strengths and limitations of this study

- Large statewide data set of all emergency department presentations with low acuity presenting problems.
- Use of standard definition for low acuity consistent with current Australian Institute of Health and Welfare.
- Study period is 5 years.
- Will inform and support development of alternative models of urgent healthcare.
- Used presenting problem rather than final diagnosis.

few decades, demand for use of EDs has increased disproportionately to population changes.^{3–5} As a result, they have evolved to serve many functions, including the management of ambulatory care patients, a safety net for the socially disadvantaged, a gateway to subspecialist clinics, as well as an entry point for hospital admission.² A substantial proportion of patients presenting to ED are now classified as low acuity presentations—those that are semiurgent or non-urgent according to the validated tools such as the Australasian Triage Scale (ATS).^{6 7} Estimates of the proportion of non-urgent or semiurgent presentations in ED range from 40% to over 60%.^{3–5} This has raised concerns regarding service provision in EDs and the sustainability of current models of emergency care.

Many of these low acuity presentations have been characterised in the literature as ‘inappropriate’ or ‘general practice’ presentations.^{8 9} The definition and identification of ‘inappropriate’ presentations vary in the literature and have been a source of ongoing controversy as have their significance to overall ED operations.¹⁰ The reasons found to be associated with these presentations

include access to general practitioners (GPs), convenience and self-reported perceptions of urgency.^{8–9} Although it has been consistently reported that these low acuity presentations as a whole do not contribute to excess length of stay or overcrowding in EDs,¹⁰ they do, however, impact on resourcing and the efficiency of the models of care currently used and their relevance continues to be debated in the media.¹¹

Nevertheless, given that the majority of patients presenting to ED are classified as low acuity, it would seem vitally important to examine the demographic and clinical characteristics of these types of presentations. To the best of the authors' knowledge, this has not been done on a population level in Australia. By using such a large data set with ATS categories, presenting problem and hospital-level data, these results should be transferable to EDs outside New South Wales (NSW). Doing so would assist in developing models of care that promote a more efficient use of EDs, urgent care centres and general practice facilities within an integrated health system. Examples of these may include minor injury clinics, telemedicine and hospital in the home.

The objective of this study was to use a statewide population-based registry to assess the prevalence of low acuity ED presentations, describe the trend in presentation rates and to determine whether they were associated with various presentation characteristics such as the type of hospital as well as clinical and demographic variables. This information can inform health policy debate and provide evidence for the current controversy regarding appropriate ED utilisation.

METHODS

Setting and design

This was a retrospective analysis of a population-based registry of ED presentations in NSW. It was undertaken as part of the Demand for Emergency Services Trend in Years 2010–2014 (DESTINY) study. NSW is the most populous state in Australia with a population of around 7.5 million people and a land area of 850 000 km².¹²

Data sources

The Emergency Department Data Collection (EDDC) Registry routinely collects patient-level data on presentations to all designated EDs in NSW. Data collection includes referral source (self-referred, general practice, specialist, nursing home), mode of arrival (self-referral, ambulance), hospital facility, triage category (Australasian triage category),^{6–7} presenting problem, mode of separation (admitted to hospital, discharged or died). Presenting problems allocated by triage nurses at the point of patient arrival to ED were categorised into broad clinical groups by the investigating team (see table 1).

Full data definitions for the EDDC are located at http://www0.health.nsw.gov.au/policies/pd/2009/PD2009_071.html.

Hospital facilities were classified according to the current Ministry of Health definitions for designation of EDs based on case-mix, staffing and specialist facilities within each hospital.¹³ In brief, these range from level 6 centres comprising tertiary-level teaching hospital which are major trauma centres (including two specialist paediatric centres), level 5 centres which are tertiary-level

Table 1 Classification of triage presenting problems and emergency department diagnoses with the most common examples contained in the data set

Presenting problem category	Presenting problem examples
Abdominal/gastrointestinal	Abdominal pain, vomiting, diarrhoea, nausea, epigastric pain, melaena
Cardiovascular/respiratory	Chest pain, collapse, syncope, palpitations, shortness of breath, cough, wheeze, pneumonia
Infection	Chest infection, fever, wound infection, cold symptoms, abscess
Injury/musculoskeletal	Road trauma, fracture, laceration, dislocation, amputation, burn, sprain, back pain, limb pain, burns, falls
Other medical symptoms	Abnormal results, weight loss, decreased input, lethargy, general pain, hyperglycaemia, febrile neutropaenia, anaemia
Neurology	Headache, seizures, postictal, altered level of consciousness, stroke, cerebral haemorrhage
Mental health	Anxiety, hallucinations, depression, suicidal, self-harm, overdose, poisoning, alcohol intoxication
Ear, nose and throat, eye, oral	Hyphaema, foreign body eye, epistaxis, toothache, tonsillitis
Administrative procedures and non-urgent reviews	Prescriptions, certificates, reviews, referrals, bloods, INR check, wound dressings
Urinary, renal	Urinary retention, dysuria, renal colic, hydrocele
Social	Social problems, acopia, homeless
Endocrine	Diabetes, hypoglycaemia
Obstetrics/gynaecology	Per vaginal bleeding, miscarriage, ectopic, batholins cyst, ovarian torsion, birth
Allergy/skin	Anaphylaxis, urticaria, rash, cellulitis, psoriasis, eczema

INR, international normalised ratio.

non-trauma centres, level 4 centres which are mainly metropolitan district-level hospitals, level 3 centres which are smaller district and general hospitals, and levels 2 and 1 centres which comprise smaller rural multipurpose and urgent care centres. Estimated residential population by age and sex were obtained from the Australian Bureau of Statistics.¹² Socio-Economic Index for Areas (SEIFA) and Index of Relative Socio-Economic Advantage and Disadvantage for each hospital location were also obtained from the Australian Bureau of Statistics and used as a surrogate marker of socioeconomic status within a particular hospital catchment area.¹² An increasing SEIFA indicates improved socioeconomic level for a given area.

Patients

Patients were included in this analysis if they presented to an ED between January 2010 and December 2014. Patients who were dead on arrival, transferred from other hospitals or were planned presentations to ED were excluded. Facilities that did not submit any data for one or more years during the study period were also excluded.

Outcome

The outcomes of interest were low acuity presentation, defined as those who self-presented (were not transported by ambulance), were assigned a triage category of four or five (semiurgent or non-urgent) and discharged back to their usual residence from ED. This was based on the current Australian Institute for Health and Welfare (AIHW) definition for potentially avoidable 'general practice' type presentations.¹⁴ We sought to describe presentation rates, presenting problem types, predictors of low acuity presentation and length of stay.

Statistical analyses

Univariate statistics were used to compare those with low acuity presentation and those who were not.²³ The χ^2 tests were used to compare categorical variables. Generalised estimating equations (GEEs) with log links were used to determine factors associated with low acuity presentations to account for repeat presentations and the possibility of clustering of outcomes among different levels of hospital. To simplify analyses and account for potential shifts in triage practice over the years, only those presentations during 2014 were modelled excluding those with missing presenting problem data. ORs and CIs were corrected for multiple comparisons using Bonferroni correction. Given the very large sample sizes, effect sizes denoted by ORs were a priori defined as a strong effect (lower 95% confidence limit of OR >1.50 or <0.67) or a weak one (upper 95% confidence limit of OR <1.50 or >0.67). Analyses were conducted on SAS Enterprise Guide V.4.23.

RESULTS

Patient population

There were 11.8 million ED presentations during the study period. When planned ED presentations, those who were dead on arrival, transferred from another hospital or presented to a facility with incomplete data during the study period were excluded, there were 10.8 million presentations analysed. Of these, the mean age was 39.0 years (SD 26.6) and 51.3% were male. In total, 1 511 820 cases (14.0%) had missing presenting problem entries. A total of 45% ED presentations were classified as a low acuity presentation. [Table 2](#) summarises the baseline demographic and clinical characteristics of low acuity and non-low acuity presentations.

Trends

The highest rate of low acuity presentations per 1000 population was in the paediatric patient population, with a decline in rates with increasing age observed ([figure 1](#)). Overall, there was no discernible increase in the rate of low acuity presentations across NSW between 2010 and 2014. There was a 1.50% increase per annum in low acuity ED presentations in those over 80 years of age and a 1.02% per annum increase in those aged 0–9 years.

Clinical characteristics

Low acuity presentations were associated with those under the age of 40 years, injury/musculoskeletal; ear, nose and throat (ENT)/oral/eye; skin/allergy or administrative-type presenting problem categories. A higher proportion of low acuity presentations presented during business hours (08:00–17:59 h) and on weekends. Increasing SEIFA categories were associated with a higher proportion of low acuity presentations, except for the highest SEIFA categories. Limb injuries and lacerations were the most common low acuity presenting problems across most age groups except in those aged 0–9 years where fever, rash and cough were the most common.

Predictors of low acuity presentation

After multivariable GEE modelling (see [table 3](#)), the strongest predictors of low acuity ED presentation were age 10–19 years (OR 1.77, 95% CI 1.74 to 1.80) compared with 40–59 years; injury or musculoskeletal administrative and non-urgent procedures (OR 2.96, 95% CI 2.91 to 3.00); ENT, eye or oral (OR 5.53, 95% CI 5.38 to 5.68); skin or allergy-type presenting problems (OR 2.84, 95% CI 2.75 to 2.92) compared with abdominal/gastrointestinal.

SEIFA categories, designation of ED, hours of presentation and sex had weak associations with low acuity presentations after adjusting for all other variables.

Within different health districts, multiple hospitals with different ED designation level occur within close proximity to each other. Presentations to level 5 or 6 EDs were strongly associated with reduced odds of low

Table 2 Comparison of low acuity ED presentation versus other ED presentations in New South Wales 2010–2014

	Low acuity N=4 861 930	Other N=5 936 867
Male (%)	2 567 815 (52.8)	2 970 479 (50.0)
Age (years)		
0–9	1 059 281 (21.8)	804 060 (13.5)
10–19	752 898 (15.5)	510 622 (8.6)
20–39	1 480 492 (30.4)	1 303 873 (22.0)
40–59	921 649 (19.0)	1 225 014 (20.6)
60–79	519 312 (10.7)	1 251 690 (21.1)
80+	128 223 (2.6)	836 821 (14.1)
Presenting problem		
Abdominal/gastrointestinal	443 371 (9.1)	844 791 (14.2)
Cardiovascular/respiratory	242 013 (5.0)	1 274 850 (21.4)
Injury/musculoskeletal	1 555 071 (32.0)	1 070 655 (18.0)
Fever/infection	215 518 (4.4)	228 080 (3.8)
Neurological	103 409 (2.1)	376 087 (6.3)
Other medical symptoms	419 002 (8.6)	520 181 (8.8)
Mental health/toxicology	58 686 (1.2)	284 351 (4.8)
Administrative, non-urgent procedures, blood tests and prescriptions	255 879 (5.3)	55 301 (0.9)
Genitourinary	93 813 (1.9)	136 733 (2.3)
Obstetrics and gynaecology	56 623 (1.2)	62 095 (1.1)
Skin and allergy	245 322 (5.1)	138 023 (2.3)
Ear, nose and throat/oral/eye	446 122 (9.2)	136 784 (2.3)
Social	11 663 (0.2)	10 604 (0.2)
Missing	715 488 (14.7)	796 332 (13.4)
ED designation		
Levels 1 and 2	390 954 (8.0)	205 424 (3.5)
Levels 3 and 4	2 250 625 (46.3)	2 242 456 (37.8)
Levels 5 and 6	2 220 351 (45.7)	3 488 987 (58.8)
Hours of presentation		
08:00–18:00	2 634 383 (54.2)	2 980 750 (50.2)
18:00–23:59	1 666 326 (34.3)	2 010 453 (33.9)
00:00–07:59	561 221 (11.5)	945 664 (15.9)
Day of presentation		
Weekend	1 588 124 (32.7)	1 700 094 (28.6)
Location of hospital		
Metropolitan area	2 486 761 (51.2)	3 910 795 (65.9)
SEIFA category		
850–900	170 646 (3.5)	178 776 (3.0)
901–950	654 091 (13.4)	730 629 (12.3)
951–1000	2 633 973 (54.2)	3 052 293 (51.4)
1001–1100	1 230 201 (25.3)	1 617 190 (27.2)
>1100	173 019 (3.6)	357 979 (6.0)

p Values all <0.001.

ED, emergency department; SEIFA, Socio-Economic Index for Areas.

acuity presentations compared with level 1 or 2 EDs (OR 0.44). Similarly, age >80 years compared to reference age 20–39 years (OR 0.18), was strongly associated with reduced odds of low acuity presentations as were cardiovascular/respiratory (OR 0.42), mental health/toxicology (OR 0.38) or neurological (OR 0.64) presentations compared to abdominal/gastrointestinal presentations.

DISCUSSION

This study was undertaken to describe the characteristics of low acuity presentations across NSW. The results demonstrated that low acuity presentations account for

almost half (45%) of all ED presentations, which is consistent with previous studies using the same definition of low acuity presentation.⁵ There was no appreciable trend observed in low acuity presentations, with only a slight increase in those aged 0–9 years and those >80 years.

Although there is no significant increase in the rate of low acuity presentations in any particular age group in the study period, there remain significant implications in regard to the impact on ED workload, resource management, healthcare service and delivery as well as some contribution to ED overcrowding and efficiency of ED processing.

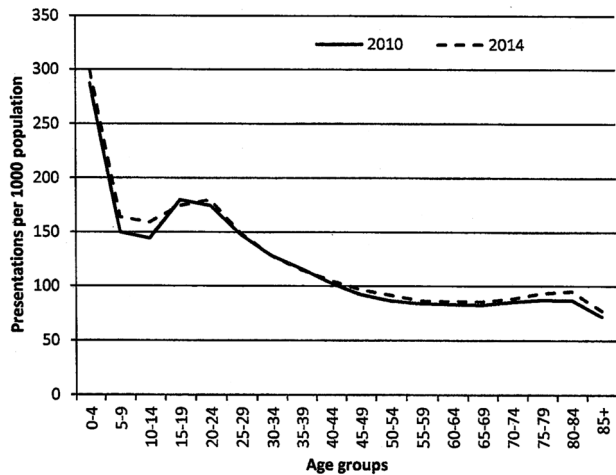


Figure 1 Rate of low acuity emergency department presentation per 1000 population.

Low acuity presentations were most commonly associated with injury (presumably minor) and musculoskeletal-related presenting problems across all ages. They were strongly associated with other presenting problem types, namely ENT/eye and oral; administrative and non-urgent procedures (prescriptions, certificates, blood tests, catheter changes); and skin or allergic-related presentations. A relationship was observed with age, with younger patients more likely to have a low acuity presentation, suggesting that alternative paediatric urgent care may be warranted. Studies in the UK demonstrated that parents preferred ED care over alternatives even when the presenting problem was non-urgent, as they understood what services were available in ED (such as radiology) and they trusted the staff that were trained in child health.^{15 16} Many parents had considered or seen a GP prior to an ED presentation but either could not get an appointment or could not be managed in that setting, resulting in an ED attendance regardless.¹⁶ Furthermore, Mathison *et al*¹⁷ demonstrated a strong correlation between low spatial density of primary care and non-urgent ED utilisation, which is an important factor for NSW given its large size.

Time of day, day of the week and socioeconomic indices were only weakly associated with low acuity presentations in our study. Our findings are much higher than those reported by Nagree *et al*,¹⁸ however, that study only analysed data from tertiary-level hospitals.

Whether these patients constitute ‘GP presentations’ is likely to remain controversial. The drivers of these presentations are multifactorial and thought to be a combination of perceived individual clinical need and health system-related factors such as cost and access to alternatives such as GPs.^{19 20} Compounding the problem is the lack of an agreed definition for GP presentations to ED.¹⁸ While the AIHW definition used in this study may overestimate the prevalence of low acuity presentations, and under-represent the proportion of low acuity problems that are complex, identical criteria have also

been used in a Canadian study to define low complexity.¹⁰ Alternative definitions of low acuity have been proposed incorporating consultation times of less than an hour and specific presenting problem types in consultation with the Australasian College of Emergency Medicine.¹⁸ Measuring accurate consultation times, however, remains problematic with factors such as ED role delineation, models of care, clinical designation and data collection abilities likely to affect consultation times. There is also an implicit assumption in the literature that EDs are ideal places for complex low acuity presentations, and that GPs can only manage certain diagnoses, neither of which has been substantiated.¹⁸

Another point of contention appears to be the significance of these types of presentations, given that growth in ED presentations over the past decade appears to be related to higher acuity presentations. Aboagye-Sarfo *et al*,³ for instance, demonstrated a 4.6% per annum increase in ED presentations in Western Australia, which was attributed to a rise in rate of presentations with more urgent needs. Other studies, however, demonstrate that this increase in higher acuity is almost entirely attributable to an increase in presentations in the elderly,⁵ who present to ED with more urgent problems (such as cardiovascular and respiratory symptoms) and who are less likely to be discharged from ED, and this appears to be consistent with the findings of this study. Nevertheless, given that almost half of ED patients are low acuity, EDs need either internal or external models of care to manage this volume without impacting the overall function of the ED.

The study has a number of important implications, including the identification of patients and presenting problem types that may be amenable to alternative models of care rather than conventional ED care. First, from a health provider perspective, alternative models of care have been studied within EDs, including minor injury or ‘fast-track’ units staffed by nurse practitioners and GPs managing non-urgent problems either in collocated clinics or within EDs themselves.^{21–23} In the UK, external urgent care centres have been introduced to try to alleviate the pressure on EDs with varying utilisation.²⁴ A Cochrane review of three observational studies comparing GPs and emergency physicians managing non-urgent presentations reported that GPs ordered fewer blood tests and X-rays but that the overall quality of evidence was weak.²² Similarly, there is paucity of evidence relating to nurse practitioners with respect to cost-effectiveness and quality of care, although several studies have shown improved patient satisfaction in minor injury unit settings.²³ It may be that factors associated with non-urgent presentations are outside the control of hospitals themselves. A study investigating variations in potentially avoidable ED presentations found that socioeconomic factors, particularly employment status, accounted for over 70% of the variation, with a further 15% explained by hospital factors and access to GPs.²⁵ In contrast, this study only demonstrated a weak

Table 3 Predictors of low acuity ED presentation using multivariable generalised estimating equations

	Adjusted OR	95%CI
Age category		
0–9	1.77	1.74 to 1.78
10–19	1.77	1.74 to 1.80
20–39	1.52	1.50 to 1.54
40–59	(ref)	
60–79	0.56	0.55 to 0.57
80+	0.19	0.18 to 0.19
Male	0.96	0.95 to 0.97
Presenting problem		
Abdominal gastrointestinal	(ref)	
Cardiovascular/respiratory	0.42	0.41 to 0.43
Injury/musculoskeletal	2.96	2.91 to 3.00
Neurological	0.64	0.62 to 0.66
Other medical	1.88	1.84 to 1.92
Mental health/toxicology	0.38	0.37 to 0.40
ENT/oral/eye	5.53	5.38 to 5.68
Administrative/non-urgent procedures	9.28	8.93 to 9.65
Genitourinary	1.55	1.50 to 1.60
Social	2.02	1.86 to 2.20
Obstetrics and gynaecology	1.35	1.29 to 1.41
Skin/allergy	2.84	2.75 to 2.92
Infection/fever	1.34	1.30 to 1.38
Hours of presentation		
08:00–17:59	(ref)	
18:00–23:59	0.88	0.87 to 0.89
00:00–07:59	0.76	0.75 to 0.77
Day of presentation		
Weekend	1.10	1.09 to 1.11
ED designation		
Level 1 or 2	(ref)	
Level 3 or 4	0.68	0.66 to 0.69
Level 5 or 6	0.44	0.43 to 0.45
SEIFA category		
850–900	(ref)	
901–950	1.04	1.00 to 1.07
951–1000	1.11	1.08 to 1.14
1001–1100	1.32	1.28 to 1.36
>1100	1.17	1.13 to 1.21

All $p < 0.001$.

ED, emergency department; ENT, ear, nose and throat; SEIFA, Socio-Economic Index for Areas.

association with surrogate markers of socioeconomic status, as well as time and day of presentation, suggesting that access to GPs may play only a minor role in these low acuity ED presentations. Given the time-sensitive nature of GP availability, promoting alternative programmes in Australia like the national bulk-billed after-hours doctor home visit needs further evaluation as to its impact on ED use.²⁶

Second, from a health system perspective, given the substantial proportion of low acuity presentations to ED, health policy initiatives to mitigate low acuity ED demand may need to be reconsidered. Various strategies, including co-payments, telephone triage and co-located GP clinics, have been employed to curb low acuity presentations to ED. On the one hand, telephone triage and co-located general practice clinics have had

negligible impacts on overall ED attendance rates.^{8 22} On the other hand, Selby *et al*²⁷ reported on the effects of a US\$25–\$35 co-payment in California in 1992 and found a 15% decrease in non-urgent presentations associated with the co-payment. There was no apparent increase in mortality or unplanned hospital admissions reported in that study. Similarly, a comprehensive programme consisting of public health education, financial disincentives including a co-payment, improved access to GPs and redirection of non-urgent cases to other urgent care clinics resulted in a decline in non-urgent presentations from 57% to 18% over 12 years in Singapore.²⁸ In addition, the overall rate of growth in ED presentations fell from 5.5% to 2.1% after the intervention.²⁹ However, these results have not been replicated in other settings. It would also be difficult to implement these

health policy changes without political and scientific consensus, particularly when issues around access to EDs remain highly sensitive. Studies of patient preferences of health provider (emergency or GP) seem to indicate that the decision is largely based on the perceived urgency of the presenting problem.^{30 31} At the very least, the results underscore the importance of coordinated policy responses to the problem of ED demand, and that these solutions are likely to take time.

There is scope to further explore the impact of socioeconomic status on presentation patterns at the individual level rather than the hospital SEIFA which our study did. Higher SEIFA hospitals may have more capacity to manage low acuity presentations and higher SEIFA individuals may not object to small co-payments for low acuity visits, and this could be explored.

LIMITATIONS

The study evaluated 5 years of data, so it is difficult to be conclusive about trends observed in this study. A number of important factors were not available, which may have improved analysis, including postcode of residence, country of origin and primary language spoken at home. Other factors such as the number of GPs per 1000 population in a given area may have allowed better estimates of the role that access to GPs plays in determining rates of low acuity presentations. Given that only one presenting problem could be coded per presentation, a further limitation exists as, in clinical practice, patients may present with more than one symptom, which could improve the predictive value of our model. It is unclear whether using final diagnoses would have changed the overall findings of the study. Given that the driver of the study was to identify patients with low acuity presentations before assessment in ED, it was deemed more relevant in this context to analyse initial presenting problems indicated by triage nurse assessments. While we used the current national AIHW definition for low acuity presentations, we acknowledge that this definition remains controversial and that some low acuity presentations may not meet the definition as the ATS mandates higher triage categories for severe pain or distress and other low acuity problems might require an admission again excluding patients from the definition.

CONCLUSION

In conclusion, 45% of ED presentations in NSW were patients self-presenting with a semiurgent or non-urgent presentation and discharged home from ED. There was no trend observed in these low acuity presentations over 5 years. These presentations were strongly associated with younger age, and certain presenting problem types such as minor injury, musculoskeletal, ENT and non-urgent procedures. Further research is needed into whether these may be amenable to alternative emergency models of care or other health policy initiatives designed to reduce overall demand for EDs and address

whether these efforts would be beneficial or used successfully.

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Contributors MMD was involved in literature search, figures, study design, data analysis, data interpretation and writing. SBR was involved in literature search, study design, data analysis, data interpretation and writing. KJB was involved in study design, data analysis, data interpretation and writing. DRC and DM were involved in study design, data analysis and writing. RP was involved in study design and writing. RI was involved in study design, data interpretation and writing.

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REFERENCES

- Gonzalez Morganti K, Baufrman S, Blanchard J, *et al*. *The evolving role of emergency departments in the United States*. Santa Monica, CA: Rand Corporation, 2013.
- Schuur JD, Venkatesh AK. The growing role of emergency departments in hospital admissions. *N Engl J Med* 2012;367:391–3.
- Aboagye-Sarfo P, Mai Q, Sanfilippo FM, *et al*. Growth in Western Australian emergency department demand during 2007–2013 is due to people with urgent and complex care needs. *Emerg Med Australas* 2015;27:202–9.
- Lowthian JA, Curtis AJ, Jolley DJ, *et al*. Demand at the emergency department front door: 10-year trends in presentations. *Med J Aust* 2012;196:128–32.
- Dinh MM, Bein KJ, Latt M, *et al*. Age before acuity: the drivers of demand for emergency department services in the Greater Sydney Area. *Emerg Med J* 2015;32:708–11.
- Hodge A, Hugman A, Varndell W, *et al*. A review of the quality assurance processes for the Australasian Triage Scale (ATS) and implications for future practice. *Australas Emerg Nurs J* 2013;16:21–9.
- Ebrahimi M, Heydari A, Mazlom R, *et al*. The reliability of the Australasian Triage Scale: a meta-analysis. *World J Emerg Med* 2015;6:94–9.
- Carret ML, Fassa AG, Kawachi I. Demand for emergency health service: factors associated with inappropriate use. *BMC Health Serv Res* 2007;7:131.

9. Ismail SA, Gibbons DC, Gnani S. Reducing inappropriate accident and emergency department attendances: a systematic review of primary care service interventions. *Br J Gen Pract* 2013; 63:e813–20.
10. Schull MJ, Kiss A, Szalai JP. The effects of low-complexity patients on emergency department waiting times. *Ann Emerg Med* 2007;49:257–64.e1.
11. Marriner C. The new problem facing one of the busiest emergency departments in NSW. *The Sydney Morning Herald*. 18 October 2015. <http://www.smh.com.au/action/printArticle?id=1001576448>
12. Australian Bureau of Statistics. Estimated Residential Population by single year of age, New South Wales, Australia [Internet]. 2015 (updated 26 March 2015; cited 15 July 2015). <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Jun%202014?OpenDocument>
13. NSW Health. *Guide to the role delineation of health services*. 3rd edn. 2002. State Health Publication No. SWS 990186. <http://www.health.nsw.gov.au/Hospitals/Pages/role-delineation-levels.aspx> Last updated 24 January 2014 (accessed 15 Aug 2015).
14. Australian Institute of Health and Welfare 2013. *Australian Hospital Statistics 2012–13: emergency department care. Health services series no. 52. Cat. no. HSE 142*. Canberra: AIHW.
15. Atenstaedt R, Evans K. Emergency departments: better safe than sorry? *Emerg Nurse* 2015;23:20–2.
16. Williams A, O'Rourke P, Keogh S. Making choices: why parents present to the emergency department for non-urgent care. *Arch Dis Child* 2009;94:817–20.
17. Mathison DJ, Chamberlain JM, Cowan NM, *et al*. Primary care spatial density and nonurgent emergency department utilization: a new methodology for evaluating access to care. *Acad Pediatr* 2013;13:278–85.
18. Nagree Y, Camarda VJ, Fatovich DM, *et al*. Quantifying the proportion of general practice and low-acuity patients in the emergency department. *Med J Aust* 2013;198:612–15.
19. Rocovich C, Patel T. Emergency department visits: Why adults choose the emergency room over a primary care physician visit during regular office hours? *World J Emerg Med* 2012;3:91–7.
20. Cowling TE, Cecil EV, Soljak MA, *et al*. Access to primary care and visits to emergency departments in England: a cross-sectional, population-based study. *PLoS ONE* 2013;8:e66699.
21. Dale J, Lang H, Roberts JA, *et al*. Cost effectiveness of treating primary care patients in accident and emergency: a comparison between general practitioners, senior house officers, and registrars. *BMJ* 1996;312:1340–4.
22. Khangura JK, Flodgren G, Perera R, *et al*. Primary care professionals providing non urgent care in hospital emergency departments. *Cochrane Database Syst Rev* 2012;11:CD002097.
23. Jennings N, Clifford S, Fox AR, *et al*. The impact of nurse practitioner services on cost, quality of care, satisfaction and waiting times in the emergency department: a systematic review. *Int J Nurs Stud* 2015;52:421–35.
24. Greenfield G, Ignatowicz A, Gnani S *et al*. Staff perceptions on patient motives for attending GP-led urgent care centres in London: a qualitative study. *BMJ Open* 2016;6:e007683.
25. O'Cathain A, Knowles E, Maheswaran R, *et al*. A system wide approach to explaining variation in potentially avoidable emergency admissions: national ecological study. *BMJ Qual Saf* 2014;23:47–55.
26. National Home Doctor Service [Internet] 2015 [cited 17 February 2016]. <http://www.homedoctor.com.au/>
27. Selby JV, Fireman BH, Swain BE. Effect of a copayment on use of the emergency department in a health maintenance organization. *N Engl J Med* 1996;334:635–41.
28. Jung H, Do YK, Kim Y, *et al*. The impact of an emergency fee increase on the composition of patients visiting emergency departments. *J Prev Med Public Health* 2014;47:309–16.
29. Anantharaman V. Impact of health care system interventions on emergency department utilization and overcrowding in Singapore. *Int J Emerg Med* 2008;1:11–20.
30. FitzGerald G, Toloo GS, Aitken P, *et al*. Public use and perceptions of emergency departments: a population survey. *Emerg Med Australas* 2015;27:336–42.
31. Harris P, Whitty JA, Kendall E, *et al*. The Australian public's preferences for emergency care alternatives and the influence of the presenting context: a discrete choice experiment. *BMJ Open* 2015;5:e006820.