

ORIGINAL RESEARCH

Trends and characteristics of short-term and frequent representations to emergency departments: A population-based study from New South Wales, Australia

Michael M DINH,^{1,2} Saartje BERENDSEN RUSSELL,^{1,3} Kendall J BEIN,¹ Dane CHALKLEY,¹ David MUSCATELLO,⁴ Richard PAOLONI² and Rebecca IVERS^{5,6}

¹Royal Prince Alfred Hospital, Sydney, New South Wales, Australia, ²Discipline of Emergency Medicine, The University of Sydney, Sydney, New South Wales, Australia, ³School of Nursing, The University of Sydney, Sydney, New South Wales, Australia, ⁴School of Public Health and Community Medicine, University of New South Wales, Sydney, New South Wales, Australia, ⁵The George Institute for Global Health, The University of Sydney, Sydney, New South Wales, Australia, and ⁶School of Nursing and Midwifery, Flinders University, Adelaide, South Australia, Australia

Abstract

Objective: The objective of this study is to describe the trends and characteristics of short-term and frequent representations to EDs in New South Wales, Australia.

Methods: This was a retrospective analysis of a linked population-based registry of ED representations in New South Wales, conducted as part of the Demand for Emergency Services in Years 2010–2014 project. Trend analysis of unplanned representations to ED within 3 days of discharge from ED, readmission to an in-patient unit within 30 days of index in-patient admission from ED and demographic data and trends for frequent and very frequent ED presenters is discussed.

Results: A total of 10 798 797 ED presentations were identified from 4 188 283 individual patients. Within 1 year, 48.9% of ED presentations had a previous presentation, and 4.9% had represented within 3 days of a previous presentation. The readmission rate within 30 days was 2.8%, the proportion of frequent (representing 5212 [0.1%] individual patients) and very frequent representations (representing 1186 [0.03%] individual patients) were 1.7% and 1.0%, respectively. The

overall rate of representations within 3 days has decreased from 5.1% in 2010 to 4.7% in 2014 ($P < 0.001$). The rate of readmissions within 30 days has increased from 2.4% in 2010 to 3.1% in 2014 ($P < 0.001$).

Conclusions: In this population-based study, short-term representations were highest in the infant patient population, in-patient readmission rates were highest in the elderly and very frequent representations to ED were characterised by middle-aged patients with mental health or drug and alcohol related presentations.

Key words: emergency department, frequent presenter, population, representation.

Introduction

EDs are largely designed to manage acute episodic medical illness and injury. However, a small but important, proportion of patients return to EDs unexpectedly and sometimes repeatedly.¹ Estimates of unplanned short-term representations to EDs within 72 h range from 1–5%, but these can vary according to definitions used.¹ A single centre from Australia found that

Key findings

- Representations to EDs are common depending on the time since index presentation.
- Short-term representations have decreased slightly in NSW since 2010 but readmissions from ED within 1 month have increased.
- Very frequent representers to EDs are characterised by middle-aged patients with mental health or drug and alcohol related diagnoses.

around 37% of unplanned representations were preventable.² Representations have been associated with increased adverse events in hospital,³ and a US study using population linked data over 5 years revealed a representation rate of 8.2%, with representations costing more, relative to the index visit to ED.⁴

For these reasons, rates of unplanned representations are considered proxy markers of quality of ED care delivery, with lower representation rates reflecting higher quality of care and better access to follow-up specialist or primary care.¹ Surveys of ED have found that primary reasons for representations from a patient perspective were uncertainty about their clinical condition and convenience of care. Single centre studies of representations are limited by the proportion of patients who represent at other hospitals or limited time frames that do not allow more informative analyses of annual representation

Correspondence: Mrs Saartje Berendsen Russell, Royal Prince Alfred Hospital, Missenden Road, Camperdown, Sydney, NSW 2050, Australia. Email: saartje.berendsenrussell@sswahs.nsw.gov.au

Michael M Dinh, MBBS, Emergency Physician; Saartje Berendsen Russell, MEd, Clinical Nurse Consultant; Kendall J Bein, MBBS, Emergency Physician; Dane Chalkley, MBBS, Emergency Physician; David Muscatello, PhD, Senior Lecturer; Richard Paoloni, MBBS, Emergency Physician; Rebecca Ivers, PhD, Director.

Accepted 28 March 2016

rates and changes over time. Few population-based studies of short-term and frequent ED representations have been performed in Australia.⁵ A study of linked ED presentation data from seven Perth hospitals analysed groups of frequent ED attendees and found that the group of frequent reattenders (between five and 19 presentations per year) were likely to be more urgent than other ED patients.⁶

The reasons for representations are complex and multi-factorial. They may, for instance, be related to short-term clinical changes, specific instructions from the treating clinician to return for review, access to follow-up primary or specialist care, adequacy of in-patient discharge planning and demographic and social issues.^{7–10}

Using record linkage of a presentation-level ED patient database with itself to obtain patient-level information, we sought to characterise and describe trends across three distinct types of ED representations that reflect the complexity of ED representations. These were representations within 3 days among ED discharges, in-patients readmissions within 30 days of index in-patient admission from ED and frequent ED representations. Building a demographic and clinical profile of these patients will identify and highlight gaps in care in particular groups of patients who utilise EDs.

Methods

Setting and design

This was a retrospective analysis of a linked population-based registry of ED presentations in New South Wales (NSW), conducted as part of the Demand for Emergency Services in Years 2010–2015 project. 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.

Database

The ED Data Collection Registry routinely collects patient level data on presentations to 115 designated EDs in NSW. Data collection includes, referral source (self-referred, General Practice, Specialist and Nursing Home), mode of arrival (Ambulance or other),

hospital facility, presenting problem and mode of separation (admitted to in-patient unit within a hospital, or discharged from ED). Triage categories were defined by the Australasian Triage Scale (ATS) (1=immediately life-threatening, 2=imminently life-threatening, 3=potentially life threatening, 4=potentially serious and 5=less urgent). ED diagnoses were categorised into broad clinical groups based on Systematized Nomenclature of Medicine - Clinical Terms and ICD-10-AM codes. Full data definitions for the ED data collection are located at http://www0.health.nsw.gov.au/policies/pd/2009/PD2009_071.html.

The recording unit of the database is the ED presentation rather than the patient, so multiple records can occur per patient. Using privacy-preserving, probabilistic record linkage, we obtained a patient-level dataset to permit recognition of representations. The probabilistic record linkage was based on name, address, date of birth and gender; if perfect or rule-based matches did not occur, then match degree was assessed based on a probabilistic threshold where probability of 0.75 or greater represents a match. Records with match probabilities between 0.25 and 0.75 were clerically reviewed. Lower probabilities were considered non-matches.

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 in from another hospital or were planned representations to ED were excluded. Data from EDs with incomplete or missing data during 2010–2015 were also excluded.

Outcome

The outcomes of interest were unplanned representations to ED within 3 days of discharge from ED, readmission to an in-patient unit within 30 days of index in-patient admission from ED and frequent ED presentations, defined as cases with 15–29 ED presentations over the preceding year, representing the top 2.5% of presentation frequencies per person per year and very frequent representations, defined as cases with more than 30 ED presentations per year representing the top 1% of presentation frequencies per person per year.

Statistical analyses

Descriptive statistics were used to describe rates and characteristics of representations to ED by age group. Given the likely and considerable overlap between various groups of

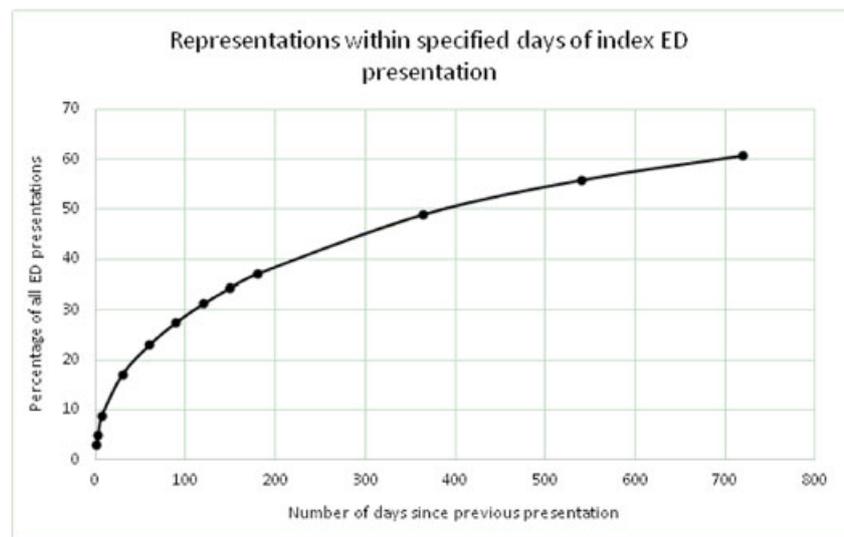


Figure 1. Percentage of total presentations who have represented by number days since previous presentation.

representations, statistical tests were not conducted to compare the different outcomes. Cochrane Armitage trend tests were used to compare overall readmission rates with the 5 year study period. Analyses were conducted on SAS Enterprise Guide version 6.1 (SAS Institute, Cary, NC, USA). Given the number of repeat representations expected in the dataset, the unit of analysis in this study was ED presentation rather than individual cases. Estimated residential population for NSW by age and sex were obtained from the Australian Bureau of Statistics.

The study was approved by the NSW Population Health Services Research Ethics Review Committee.

Results

A total of 10 798 797 ED presentations were identified from 4 188 283 individual patients. Figure 1 shows the percentage of ED presentations with a previous presentation as a function of the number of days since the previous presentation. In summary, 48.9% of ED presentations had a previous presentation within 1 year, and 4.9%

had represented within 3 days of a previous presentation. The readmission rate within 30 days was 2.8%, the proportion of frequent (representing 5212 [0.1%] individual patients) and very frequent representations (representing 1186 [0.03%] individual patients) were 1.7% and 1.0%, respectively. The overall rate of representations within 3 days has decreased from 5.1% in 2010 to 4.7% in 2014 ($P < 0.001$). The rate of readmissions within 30 days has increased from 2.4% in 2010 to 3.1% in 2014 ($P < 0.001$).

Age specific rates of ED representations

Figures 2–5 demonstrate the age specific rates of ED representations within 3 days, readmissions within 30 days and frequent and very frequent representations. The rate of readmissions within 30 days increased with advancing age, 69.2 readmissions per 1000 population per annum in those aged 85 years and over compared with 11.0 per 1000 population in those aged 60–64 years. There was a 6.2% per annum increase in readmission rates per year in those over 85 years of age. Representations within 3 days were highest in the 0–4 year age group (29.4 representations per 1000 population) with lower rates across all other age groups. Rates of frequent ED representations (15–29 presentations per patient per annum) were again highest in the elderly (18 representations per 1000 population per annum) with an increase observed in all adult age groups between 2011 and 2014. Very frequent representation rates (≥ 30 presentations per patient per annum) peaked in the 40–44 year age group (6.0 per 1000 population per annum).

Demographic and clinical characteristics

Table 1 describes the characteristics of the four different groups of representations. Representations within 3 days of ED discharge were associated with lower acuity presentations (69.8% in triage category 4 and 5), particularly minor procedure and administrative presentations. Readmissions within 30 days were associated with higher

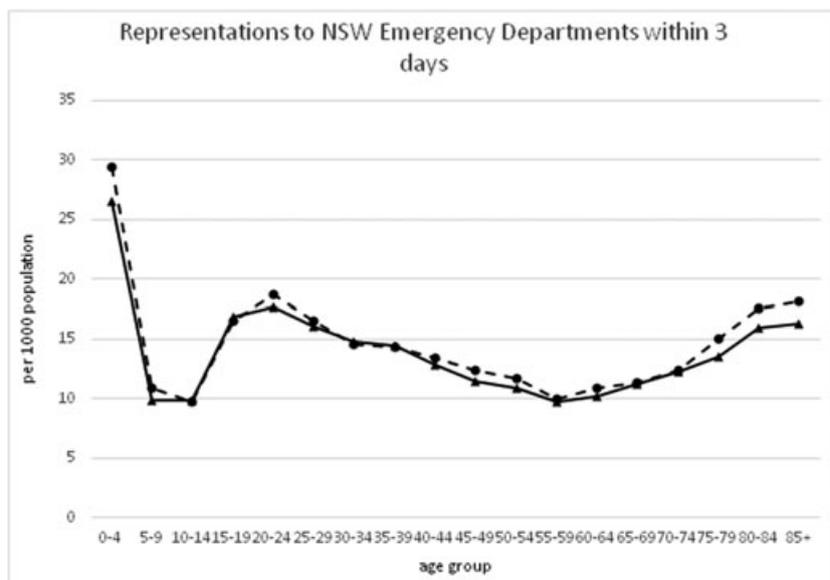


Figure 2. Representations to New South Wales EDs within 3 days of ED discharge by age and year. (—▲—), 2010; (---●---), 2014.

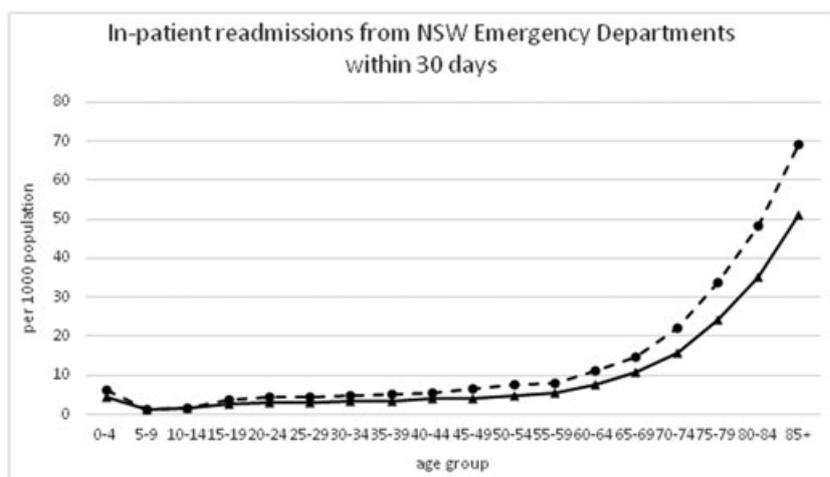


Figure 3. Readmissions to in-patient unit within 30 days of EDs admission in New South Wales by age and year. (—▲—), 2010; (---●---), 2014.

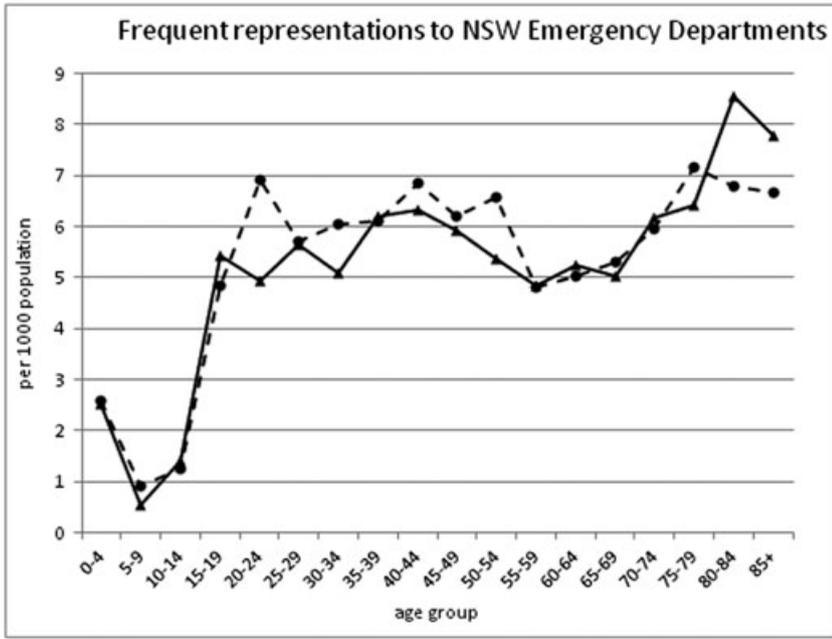


Figure 4. Frequent representations (15–29 presentations per person per annum) to New South Wales EDs by age and year. (—●—), 2011; (---○---), 2014.

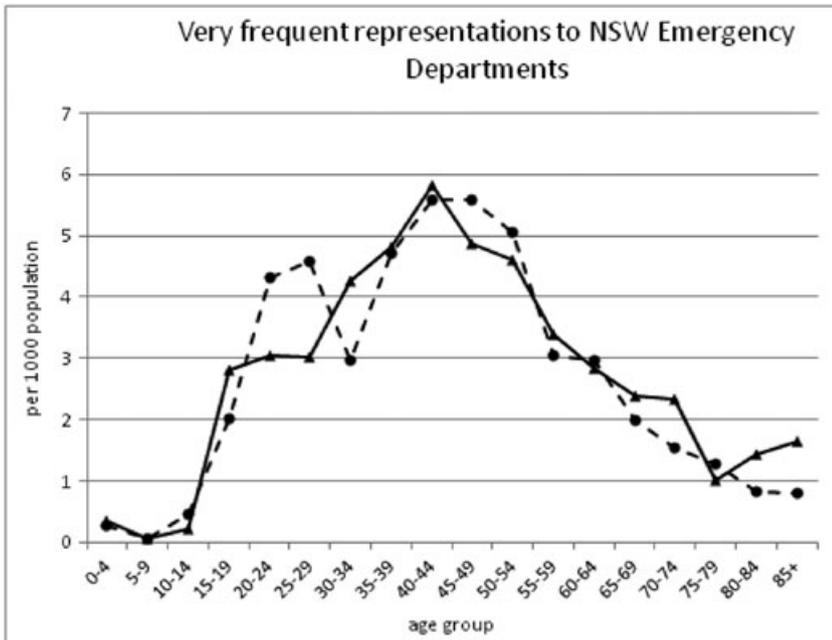


Figure 5. Very frequent representations (≥30 presentations per person per annum) to New South Wales EDs by age and year. (—●—), 2011; (---○---), 2014.

acuity presentations (71.2% in triage category 1, 2 or 3). Frequent representations were also associated with higher acuity and higher proportion of cardiovascular/respiratory, other medical and mental health

presentations. Very frequent representations were characterised by a much higher proportion of mental health (17.3%), drug and alcohol related presentations (7.3%) and proportion of Indigenous ED presentations (12.8%).

Discussion

This was the first comprehensive analysis of representations to EDs using state-wide registry data in Australia. The major findings were that almost half of all ED presentations had at least one previous presentation within a year; the rate of representations within 3 days was highest in the infant population; in-patient readmissions within 30 days was highest in the elderly and that very frequent representations were characterised by middle-aged patients with a much higher proportion of Indigenous or mental health related presentations. This was the first major state-wide study of ED representations undertaken in NSW. The findings were consistent with a single centre study from Sydney,² which also found a representation rate of 4.9%; however, the present study has accounted for representations to other facilities (occurring in 18.7% of representations within 3 days in this study). Although previous studies have dichotomised frequent versus non-frequent ED presenters, the present study has demonstrated that frequent and very frequent presenters have very different clinical and demographic profiles consistent with Jelinek *et al.*⁶

These findings have important implications relating to ED care and point to a number of areas for improvement in the health care system in general. First, there are many factors associated with the relatively high 3 day representation rates in the infant population, including the preponderance of conditions such as febrile illness, bronchiolitis and minor head injuries that require short-term clinical reviews and paediatric follow-up processes that may occur in EDs as unplanned representations. Few studies have investigated interventions designed to reduce short-term representations. In a small interview-based study, factors associated with short-term representations included uncertainty about clinical condition and insufficient follow-up instructions.¹¹ An adult study investigating a multifaceted intervention including improved discharge planning advice and access to follow-up clinic was able to demonstrate a significant reduction in short-term representation rates in a subgroup of ED patients.¹²

TABLE 1. Clinical and demographic characteristics of different types of representations EDs

	Total <i>n</i> = 10 787 797 (%) only	Representations within 3 days <i>n</i> = 535 079 presentations	In-patient readmission within 30 days <i>n</i> = 297 283 presentations	Frequent representers (15–29 per annum) <i>n</i> = 5212 individuals, 186 238 presentations	Very frequent representers (30+ per annum) <i>n</i> = 1186 individuals
Age (years)					
0–9	17.3	90 696 (17.0)	15 864 (5.3)	267 (5.1)†	17 (1.4)†
10–19	11.7	62 222 (11.6)	11 311 (3.8)	616 (11.8)†	105 (8.9)†
20–39	25.8	167 045 (31.2)	40 134 (13.5)	1645 (31.6)†	485 (40.9)†
40–59	19.9	117 111 (21.9)	56 259 (18.9)	1418 (27.2)†	416 (35.1)†
60–79	16.4	71 799 (13.4)	95 085 (32.0)	967 (18.5)†	140 (11.8)†
80+	8.9	26 206 (4.9)	78 630 (26.5)	299 (5.7)†	23 (1.9)†
Male	51.3	281 813 (52.7)	151 906 (51.5)	2811 (53.9)†	674 (56.8)†
Indigenous	4.6	33 456 (6.3)	10 963 (3.7)	478 (9.2)†	102 (8.6)†
Metropolitan	59.2	292 387 (54.6)	216 205 (72.7)	106 258 (57.1)	75 711 (68.3)
Ambulance arrival	23.7	84 786 (15.9)	171 159 (57.6)	81 654 (43.8)	55 173 (49.8)
Triage category					
1	0.6	1120 (0.2)	5432 (1.8)	1386 (0.8)	535 (0.5)
2	9.8	24 858 (4.7)	65 004 (21.9)	22 227 (12.0)	11 567 (10.5)
3	31.3	135 381 (25.4)	141 112 (47.5)	64 438 (34.7)	34 425 (31.2)
4	45.1	233 708 (43.8)	77 633 (26.1)	72 302 (38.9)	41 987 (38.0)
5	13.3	138 753 (26.0)	8044 (2.1)	35 517 (13.7)	22 003 (19.9)
Level					
6	28.1	140 643 (26.3)	115 986 (39.0)	53 166 (28.6)	39 816 (36.0)
5	24.7	131 396 (24.6)	84 224 (28.3)	46 540 (25.0)	28 204 (25.5)
4	20.0	105 878 (19.8)	47 854 (16.1)	33 788 (18.1)	16 827 (15.2)
3	21.6	123 321 (23.1)	43 147 (14.5)	43 379 (23.3)	21 607 (19.5)
2	5.1	29 953 (5.6)	5840 (2.0)	7746 (4.2)	3910 (3.5)
1	0.5	3888 (0.7)	233 (0.1)	1386 (0.9)	371 (0.3)
Diagnostic category					
Abdominal/ gastrointestinal	12.2	70 000 (13.1)	52 911 (17.8)	25 880 (13.9)	14 026 (12.7)
Cardiovascular/ respiratory	16.5	58 565 (11.0)	89 191 (30.0)	30 874 (16.6)	15 667 (14.2)
Other medical	8.2	46 124 (8.6)	31 270 (10.5)	19 280 (10.4)	12 850 (11.6)
Fever/infection	4.1	24 457 (4.6)	13 183 (4.4)	3596 (1.9)	921 (0.8)
Injury/ musculoskeletal	28.1	111 975 (20.9)	30 358 (10.2)	26 190 (14.1)	13 452 (12.2)
Neurological	4.8	20 223 (3.8)	22 789 (7.7)	12 458 (6.7)	6372 (5.8)
Mental health	3.1	25 736 (4.8)	13 667 (4.6)	22 965 (12.3)	20 199 (18.2)
Toxicological/ Drug and alcohol	1.5	8275 (1.6)	6331 (2.1)	10 799 (5.8)	8425 (7.6)
ENT/Oral/Eye	6.8	38 570 (7.2)	4132 (1.4)	5986 (3.2)	2145 (1.9)
Administrative/ pathology/minor procedures	3.7	51 550 (9.6)	2827 (1.0)	10 726 (5.7)	8366 (7.6)
Genitourinary	3.7	22 146 (4.1)	16 806 (5.7)	7195 (3.9)	2839 (2.6)
Social	0.5	3657 (0.7)	1604 (0.5)	2361 (1.3)	2354 (2.1)
Obstetrics/ gynaecology	2.0	16 080 (3.0)	4253 (1.4)	2301 (1.2)	614 (0.6)
Skin/allergy	4.9	37 721 (7.1)	7962 (2.7)	5627 (3.0)	2505 (2.3)
Admission rate	27.2	127 552 (23.8)	NA	58 557 (31.4)	24 747 (22.4)

†Analysed at individual level (age reported as age at first presentation). NA, not applicable.

Second, the finding that the elderly are frequently representing and increasingly readmitted to hospital and

from EDs points to the need for improved streaming processes within the hospital system so that these patients

do not need to be repeatedly assessed in ED. These may include multidisciplinary assessment areas or wards, or

enhanced geriatric outreach services that aim to prevent unplanned hospital readmissions. Jelinek *et al.*⁶ in a study of adult frequent attendees in Perth showed that moderately frequent attendees (5–19 presentations per year) were more urgent compared with the ‘average’ ED patient. This was consistent with the findings of the present study and supported by the higher admission rate observed in this group of patients but also reflects the observation that the age specific rates of frequent representations were still highest in the elderly (Fig. 4).

Third, although only a very small proportion of total presentations, patients with very frequent representations appear to have particular needs that may not be adequately addressed by the health system, which may contribute to these high representation rates. The very frequent representation group have higher proportions of mental health and drug and alcohol related diagnoses consistent with previous studies of very high frequency attenders.¹³ There was also a higher proportion of ambulance arrivals in this group. These observations in conjunction with the lower in-patient admission rate in this group suggested that improved community case management in areas of mental health and drug and alcohol services as well as including primary care coordination and education¹⁴ may help to prevent unplanned ambulance use and representations to ED and supports the need for improved continuity and access to care for those with mental illness.^{15,16}

Limitations

This was a descriptive epidemiological study, which did not address the causes or motivations behind the representations themselves. The definitions of frequent and very frequent representations to ED vary in the literature.^{15,16} We attempted to make the definitions based on the distribution of representations per patient per year in our population based dataset, with the advantage of having data from most EDs in NSW. The data was analysed on a presentation level and individual patient levels to account for the multiple outcomes per patients and more accurately reflect the burden of

representations on ED. Our definition of readmission within 30 days will not account for those who were admitted and stayed longer than 30 days and were then readmitted after 30 days, which may be a problem in the elderly.

Further analyses are required to analyse the patterns of presentations to different facilities, for example, whether representation is within the same local health district and also whether representations occur in clusters over time for the very frequent representers.

Conclusion

In a population-based study, short-term representations were highest in the infant patient population, in-patient readmission rates were highest in the elderly and very frequent representations to ED were characterised by middle-aged patients with mental health or drug and alcohol related presentations.

Acknowledgements

We acknowledge the NSW Ministry of Health and the Centre for Health Record Linkage (CHeReL) for access and linkage of data. This project was funded by the New South Wales Agency for Clinical Innovation and the Emergency Care Institute (reference number aci/d14/2288).

Competing interests

None declared.

References

1. Shy BD, Shapiro JS, Shearer PL *et al.* A conceptual framework for improved analyses of 72-hour return cases. *Am. J. Emerg. Med.* 2015; **33**: 104–7.
2. Robinson K, Lam B. Early emergency department representations. *Emerg. Med. Australas.* 2013; **25**: 140–6.
3. Calder L, Pozgay A, Riff S *et al.* Adverse events in patients with return emergency department visits. *BMJ. Qual. Saf.* 2015; **24**: 142–8.
4. Duseja R, Bardach NS, Lin GA *et al.* Revisit rates and associated costs after an emergency department encounter: a multistate analysis. *Ann. Intern. Med.* 2015; **162**: 750–6.
5. Markham D, Gaudins A. Characteristics of frequent emergency department presenters to an Australian emergency medicine network. *BMC Emerg. Med.* 2011; **11**: 21.
6. Jelinek GA, Jiwa M, Gibson NP, Lynch AM. Frequent attenders at emergency departments: a linked-data population study of adult patients. *Med. J. Aust.* 2008; **189**: 552–6.
7. Akenroye AT, Thurm CW, Neuman MI *et al.* Prevalence and predictors of return visits to pediatric emergency departments. *J. Hosp. Med.* 2014; **9**: 779–87.
8. Vandyk AD, Harrison MB, VanDenKerkhof EG, Graham ID, Ross-White A. Frequent emergency department use by individuals seeking mental healthcare: a systematic search and review. *Arch. Psychiatr. Nurs.* 2013; **27**: 171–8.
9. van der Linden MC, Lindeboom R, de Haan R *et al.* Unscheduled return visits to a Dutch inner-city emergency department. *Int. J. Emerg. Med.* 2014; **7**: 23.
10. Verelst S, Pierloot S, Desruelles D, Gillet JB, Bergs J. Short-term unscheduled return visits of adult patients to the emergency department. *J. Emerg. Med.* 2014; **47**: 131–9.
11. Rising KL, Padrez KA, O'Brien M, Hollander JE, Carr BG, Shea JA. Return visits to the emergency department: the patient perspective. *Ann. Emerg. Med.* 2015; **65**: 377–386.e3.
12. Lee SH, Kim K, Kim H *et al.* Effect of multifaceted interventions on reducing return visits within 72 h after non-traumatic emergency department visits. *Emerg. Med. Australas.* 2015; **27**: 431–9.
13. LaCalle EJ, Rabin EJ, Genes NG. High-frequency users of emergency department care. *J. Emerg. Med.* 2013; **44**: 1167–73.
14. 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. *Med. J. Aust.* 2006; **184**: 602–6.
15. Cheng J, Shroff A, Khan N, Jain S. Emergency department return visits resulting in admission: Do they reflect quality of care? *Am. J. Med. Qual.* 2015; pii: 1062860615594879.
16. Trivedy CR, Cooke MW. Unscheduled return visits (URV) in adults to the emergency department (ED): a rapid evidence assessment policy review. *Emerg. Med. J.* 2015 Apr; **32**: 324–9.