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Growth in Western Australian emergency department demands, 2007-2013, is due to people with urgent and complex care needs

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ABSTRACT

Objectives

To determine 1) the magnitude of the increase in Emergency Department (ED) demand in Western Australia (WA) from 2007-2013, and 2) whether primary care type patients seeking care in ED is the main reason for the increase.

Methods

We conducted a population-based longitudinal study examining trends in ED demand, stratified by area of residence, age group, sex, Australasian Triage Scale (ATS) category and discharge disposition. The outcome measures were annual number and rate of ED presentations. We calculated average annual growth, and age-specific and age-standardised rates. We assessed the statistical significance of trends, overall and within each category, using the Mann-Kendall trend test and ANOVA. We also calculated the proportions of growth in ED demand that were attributable to changes in population and utilisation rate.

Results

From 2007 to 2013, ED presentations increased by an average 4.6% annually from 739,742 to 945,244. The rate increased 1.4% from 354.1 to 382.6 per 1,000 WA population ($p=0.02$ for the seven-year trend). Most increase occurred in metropolitan WA, age 45+ yrs, ATS 2 and 3, and admitted cohorts. About three-quarters of this increase was due to population change (growth and ageing) and one-quarter due to increase in utilisation.

Conclusion

Our study reveals a 4.6% annual increase in ED demand in WA in 2007-2013, mostly due to an increase in people with urgent and complex care needs, and not a 'demand transfer' from primary care. This indicates that a system-wide integrated approach is required for demand management.

INTRODUCTION

Emergency department (ED) services across developed countries face continuous and significant challenges with increasing demand [1-3]. ED performance is further compromised by workforce shortages, scarce resources and facilities [4] resulting in overcrowding, access block, longer waiting time and length of stay [3, 5, 6]. These affect quality of care and pose a threat to patient safety [7].

Many government reports [8-11] and peer reviewed articles [2, 12] have attempted to evaluate trends and reasons for the growth. A report in 2007 by the New South Wales Department of Health in Australia found that the growth of ED demand was consistent across all states and the key drivers were the ageing population and 'demand transfer' from primary care to ED, i.e., patients who would be better treated in the primary care setting are seeking care at ED. These are defined as patients who did not arrive by emergency vehicle and were categorised into triage categories 4 or 5 and not admitted to a ward [9].

To our knowledge, no study has analysed the recent trend and characteristics of ED demand, especially around the Global Financial Crisis (GFC) when macro- and micro-economic environments have changed dramatically. Locally, the mining boom of the last decade in Western Australia (WA) helped prevent Australia experiencing negative economic growth during the GFC and made WA the fastest growing state in Australia, in both population and its economy [13]. These would have had an impact on ED demand. A detailed understanding of the change in ED demand and its contributors over time will provide the data to inform health policy and practice and therefore to improve services.

The purpose of this study was to analyse the recent trend and characteristics of ED presentations in WA. Our hypotheses were that: 1) ED demand increased significantly over the study period, and 2) the main reasons for it were population growth and ageing, as well as 'demand transfer' from the primary care sector.

METHODS

Study setting

WA occupies the western third of the Australian continent and is the largest state in Australia with a total land area of over 2.5 million square kilometres - more than ten-times that of the United Kingdom. Its population in 2013 was 2.5 million and 78% of the population resided in Perth, the capital city [14].

The health system in WA is typical of Australia. Public health services are administered by state and local governments. The services are concentrated in Perth where nearly 2 million population is served by public EDs at four large central metropolitan hospitals (one exclusively paediatric), three smaller outer metropolitan hospitals, and two privately administered public hospitals. In addition, there is one private hospital ED. In non-metropolitan areas of WA, the population is served by 73 small public hospital EDs, with six being regional hospitals.

Study design and data source

We conducted a population-based longitudinal study to assess trends of WA state-wide public hospital ED presentations from 2007 to 2013, and stratified by area of residence, age group, sex, Australasian Triage Scale (ATS) category [15] and discharge disposition. Data were obtained from the WA Emergency Department Data Collection (EDDC) database, one of the core databases routinely collected and managed by the WA Department of Health for statutory purposes. It covers all ED presentations to all hospital EDs in WA except the only one private hospital ED. We chose 2007 as the starting year because of concerns over the data coverage and completeness in the two privately administered public hospital EDs before 2007.

Variables and measurements

Outcome measures were the annual number and rates of ED presentations. The overall rate, and by area of residence, age group and sex, were calculated using the number of ED presentations divided by the WA estimated resident population (ERP) from the Australian Bureau of Statistics[14]. Rate Calculator software provided by the Epidemiology Branch of the WA Department of Health (Codde J. 2013. RC9.5.5.) was used to calculate the rates. The rates by ATS and disposition were calculated using the number of ED presentations in each ATS or disposition category divided by the total number of ED presentations. The WA ERP population in 2011 was used as the standard population to calculate the age standardised rate using the direct method.

Area of residence was grouped into metropolitan and non-metropolitan. Two types of age groups were used: (1) five-year age groups (0-4 yrs up to 85+ yrs); and (2) 0-14 yrs, 15-44 yrs, 45-64 yrs and 65+ yrs. Triage categories in the EDDC were based on the ATS and included: ATS 1 (critical), ATS 2 (emergency), ATS 3 (urgent), ATS 4 (semi-urgent) and ATS 5 (non-urgent). Discharge disposition was grouped into admitted, transferred and non-admitted. There were 245,605 (4.0%) presentations excluded from this study because we could not identify the underlying population to calculate utilisation rate. These comprised 243,028 non-WA residents and 2,577 WA residents who did not fall in the five ATS categories (including dead on arrival, direct admission, inpatients using ED services and unknown) or had their sex recorded as indeterminate.

Statistical analysis

We calculated average annual growth (AAG), age-specific and age-standardised rates per 1,000 WA population from 2007-2013, overall and by area of residence, age group and sex, as well as rates per 1,000 ED presentations by ATS and disposition. The rate differences between 2007 and 2013 with 95% confidence intervals (CIs) were calculated for all categories. We assessed the statistical significance of trends in ED presentations and rates over the observation period using the Mann-Kendall trend test [16]. We used

descriptive statistics and ANOVA to compare the differences in trends of ED presentations and rates within each categories.

To assess the contributions of population (growth and ageing) and utilisation rate to ED demand, we estimated the expected number of ED presentations in 2013 using the 2013 ERP population multiplied by the age-specific utilisation rate in 2007 for each of the 5-year age groups. The assumption was that utilisation rate remained constant throughout the study period. The difference between the actual number of 2007 ED presentations and the estimated number of 2013 ED presentations represents the contribution due to change in population. In addition, the difference between the estimated number of 2013 ED presentations and the actual number of 2013 ED presentations represents the contribution due to change in utilisation rate.

All analyses were performed using R software (version 3.1.0; CRAN, R Project for Statistical Computing).

This study was approved by the Human Research Ethics Committees of the WA Health Department (ethics registration number: 2014/16).

RESULTS

The number of ED presentations in WA increased significantly from 739,742 in 2007 to 945,244 in 2013 ($p < 0.01$ for the 7-year trend), being an AAG of 4.6% (Table 1). This exceeded the population growth (3.3%). During the same period, the age-standardised utilisation rate increased by 1.3% from 354.1 to 382.6 per 1,000 WA population ($p = 0.02$). The highest growth was in metropolitan WA, the 45-64 and 65 years and older age groups, ATS 2 and 3, and the admitted cohorts. The lowest growth was in non-metropolitan WA, the less than 15 years age group, ATS 4 and non-admitted cohorts (Table 1). The only decrease occurred in ATS 5 by 4.1% annually (Table 1).

Area of residence, age group and sex

The trend in the number and rate of ED presentations for all areas of residence, age and sex sub-groups increased in 2007-2013, although rates were lower in 2013 than 2012 (Figure 2). However, the magnitude of the increase was greater in metropolitan WA than non-metropolitan WA (Table 1). While the 45-64 and 65 years and older age groups had the highest growth in both the number and rate, the rate increase in the less than 15 and 15-44 years old age groups were not significant ($p=0.07$ for the 7-year trend, Table 1). The trends of ED presentations were not significantly different between males and females ($p>0.05$, Table 1).

Triage and disposition

Although the majority of patients presenting to EDs were classified as ATS 4 and 5 in 2007-2013, the highest growth was in ATS 2 and 3 and the lowest in ATS 4 and 5 with ATS 1 remaining stable (Table 1). The rates in all age groups increased in ATS 2 and 3 and decreased in ATS 5 with no observed differences in ATS 1 and 4 (Figure 3).

The number of ED presentations increased across the disposition types, with the highest increase in the admitted cohort (AAG 11.1%) and the lowest in the non-admitted cohort (3.2%) (Table 1). In 2007-2013, about 20% of the patients presenting to WA public EDs were admitted (25% in metropolitan WA and 15% in non-metropolitan WA) and about 70% of these were from metropolitan WA. Metropolitan admitted patients grew by 14.1% annually while non-metropolitan rose by 5.4% (results not shown). The rate in 2007-2013 increased significantly in the admitted patients and decreased significantly in the non-admitted patients ($p < 0.01$, Table 1) and was stable in the transferred cohort (Figure 4). The rates increased in all age groups in the admitted cohort except the 10-14 years age group, increased in most age groups in transferred patients except age groups 55-59 and 75 years and over and decreased in all age groups in non-admitted patients (Figure 4).

Population change vs increase in utilisation rate

Figure 1A reports the number of ED presentations in 2007 and 2013 as well as the estimated number of 2013 ED presentations by 5-year age groups. The increases in ED presentations were predominately due to population growth in the 0-4 and 20-34 year old age groups, and about half due to population change and half due to increase in utilisation in other age groups (Figure 1A). Figure 1B shows that the rate of ED presentations increased in all age groups, except in the 0-4 and 25-34 year old age groups where the rates declined. Overall, 74.3% of the increase in ED demand was due to population change (growth and ageing) and 25.7% due to increase in utilisation rate.

DISCUSSION

Key findings

Our study revealed a 4.6% annual increase in ED demand in WA in 2007-2013. A greater growth occurred in metropolitan WA, ages 45 years and older, ATS 2 and 3, and the admitted cohorts. Exceptions were that the number of ED presentations in ATS 5 and the rate of ED presentations in ATS 4 and 5 and the non-admitted cohorts decreased. Population change (growth and ageing) explained 74.3% of the increase and the remaining 25.7% was due to an increase in utilisation.

Strengths and limitations

Many studies on ED utilisation focus on a particular area or hospital [2, 3, 12, 17] whereas our study is a population-based longitudinal study covering all public hospital EDs throughout the entire state of WA. We analysed the most recent seven years of data which included about 6 million ED presentations. Because the

WA health care system is typical of Australia, the results can be generalised to the whole of Australia. However, one could argue that the WA mining boom and its subsequent impacts on population growth and the economy do not apply to the whole of Australia. Also, non-metropolitan areas in WA are much more remote than in other parts of Australia where access to health services is limited and ED utilisation rate per capita is very high. It is also notable that 4% of the data were excluded, so one would assume that workload/utilisation is actually higher than we reported. Not all the underlying causes of the increase in ED demand were investigated due to the limitations of routinely collected data. For example, detailed clinical information and risk factors were not recorded in the database.

Interpretation

ED demand in WA increased significantly over the study period and the majority of the growth (74.3%) was due to population change (growth and ageing). Given that WA has the fastest growth rate in population of all states and territories [18], mostly within metropolitan WA (Perth, AAG, 3.5%), it is not surprising that the increase in ED demand was partly attributable to population growth and that growth in ED demand was greater in metropolitan WA than non-metropolitan WA. The population growth also partly explains why the increase in ED demand is greater in Perth (6.3%) than Melbourne (5.5%) [3]. Now that the mining boom is over and the rate of growth of the population is predicted to decline [19], it is expected that the increase in ED demand in WA that is due to population growth will reduce. This is evidenced by the decrease in ED presentations in 2013, although the decline may also be attributable to initiatives to manage ED demand or a natural random variation. Our results are consistent with a systematic review reporting that ED presentations are increasing in per capita terms as well [4]. And, contrary to our hypothesis of a 'demand transfer' from primary care, our study found that most increases in ED demand are in the older age, more urgent and admitted groups. In particular, a greater proportion (33.6%) of the admitted patients were aged 65 years and over. These findings are consistent with the previous Paxton Partners report [20] and confirm that the issue of

non-urgent presentations is a myth [21]. An ageing population and the associated increase in disease prevalence and complexity (severity and comorbidity) may explain why most increases in ED demand are in these cohorts [4, 8]. The latter also explains the increase in ED utilisation rate [22]. With a predicted increase in ageing population [19], its impact on ED demand is expected to increase. ED patients have more health care needs and consume more health resources than the primary care type of patients [23]. Its implications on ED services and the health care system in general are profound. It is possible that the increase in admissions is also due to the Four Hour Rule program, in which ED patients would be either discharged or admitted within 4 hours of presentation [24].

In summary, ED demand in WA increased significantly in 2007-2013. About three-quarters of the increase was due to population change (growth and ageing) and one-quarter due to increased utilisation. With the predicted decline in the growth of the population, the impact of population growth on ED demand is expected to decline. However, the impact of the ageing population and increase in the utilisation rate are likely to become greater. This requires a system-wide integrated approach to manage ED demand. Strategies aimed only at ED or primary care settings do not address the issue.

CONCLUSION

Our study reveals a 4.6% annual increase in ED demand in WA in 2007-2013, mostly due to an increase in people with urgent and complex care needs, not a 'demand transfer' from primary care. This indicates that a system-wide integrated approach is required for demand management.

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Contributors

PAS: conception and design of the study, formulation of analysis plan, analysis and interpretation of data, writing the first draft of the manuscript.

QM: conception and design of the study, acquisition of data, interpretation of data, contributing to the draft of the manuscript, revision of the manuscript for important intellectual content, incorporating all co-authors' feedback.

FMS, LMS, DBP, DMF: reviewed and edited the manuscript critically for important intellectual content.

All authors: final approval of the submission.

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Competing interest None.

Ethics approval Only de-identified data were requested and analysed to preserve patient confidentiality. The study was approved by the Human Research Ethics Committees of the Health Department of Western Australia.

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Figure legends

Figure 1: Number and age-specific rate of emergency department presentations in Western Australia by five-year age group, 2007 and 2013

Note: # - Estimated number of 2013 emergency department presentations obtained from the 2013 Western Australian estimated resident population multiplied by the 2007 utilisation rate

Figure 2: Age-standardised rate of emergency department presentations in Western Australia by age group, sex and area of residence, 2007–2013

Figure 3: Emergency department presentations in Western Australia: age-standardised rate in 2007-2013 and age-specific rate in 2007 and 2013 by triage category

Figure 4: Emergency department presentations in Western Australia: age-standardised rate in 2007-2013 and age-specific rate in 2007 and 2013 by disposition

Table 1: Trends and characteristics of emergency department presentations in Western Australia, 2007-2013

Characteristics	Numbers of ED presentations [‡]			P value for trend	Rates of ED presentations per 1,000 persons*				P value for trend
	2007	2013	AAG [§] (%)		2007 (95% CI)	2013 (95% CI)	RD (95% CI) [¶]	AAG (%)	
Total population (n)	2,106,148	2,519,321	3.3		-	-	-	-	
Total ED presentations (n)	739,742	945,244	4.6	<0.01	354.1 (353.3, 354.9)	382.6 (381.8, 383.3)	28.5 (27.7, 29.3)	1.3	0.02
Presentations by area of residence (%)				<0.001#					<0.001#
Metropolitan	55.7	60.2	6.3	<0.01	255.1 (254.3, 255.8)	293.5 (292.7, 294.3)	38.4 (37.6, 39.2)	2.5	0.02
Non-Metropolitan	44.3	39.8	2.5	0.02	697.7 (695.3, 700.1)	707.8 (705.5, 710.1)	10.1 (7.8, 12.4)	0.2	0.23
Presentations by age group (%)				<0.001#					<0.001#
< 15 years	26.5	24.5	3.0	<0.02	471.3 (470.5, 472.1)	480.7 (479.9, 481.5)	9.5 (8.7, 10.2)	0.3	0.07
15-44 years	42.4	41.8	4.3	<0.01	345.3 (344.6, 346.1)	355.4 (354.6, 356.2)	10.1 (9.3, 10.9)	0.5	0.07
45-64 years	17.1	18.3	6.2	<0.01	238.6 (237.8, 239.3)	283.2 (282.5, 284.0)	44.7 (43.9, 45.5)	3.1	<0.01
65+ years	14.0	15.4	6.8	<0.01	411.5 (410.7, 412.3)	462.2 (461.4, 462.9)	50.7 (49.2, 52.2)	2.1	<0.01
Presentations by sex (%)				0.428#					0.141#
Male	51.8	50.5	4.1	<0.01	365.4 (364.2, 366.5)	387.7 (386.6, 388.9)	22.3 (21.1, 23.4)	1.0	0.04
Female	48.2	49.5	5.2	<0.01	343.3 (342.2, 344.5)	379.1 (378.0, 380.2)	35.8 (34.7, 36.9)	1.7	<0.01
Presentations by triage category (%)				<0.001#					<0.001#
1 (Immediately)	0.7	0.7	4.7	<0.01	6.5 (6.4, 6.6)	6.5 (6.4, 6.6)	0 (-0.1, 0.1)	0.0	0.50
2 (Within 10 minutes)	7.7	10.9	13.5	<0.01	77.2 (68.9, 85.4)	109.1 (100.9, 117.4)	32.0 (23.7, 40.2)	6.9	<0.01
3 (Within 30 minutes)	24.0	31.6	11.4	<0.01	240.0 (219.4, 260.6)	316.3 (295.6, 336.9)	76.3 (55.6, 96.9)	5.3	<0.01
4 (Within 60 minutes)	49.6	46.2	3.2	<0.01	496.1 (487.0, 505.2)	462.1 (453.0, 471.2)	-34.1 (-43.1, -25.0)	-1.2	<0.01
5 (Within 120 minutes)	18.0	10.6	-4.1	<0.01	180.2 (160.1, 200.4)	106.1 (85.9, 126.2)	-74.2 (-93.4, -54.0)	-6.9	<0.01
Presentations by disposition (%)				<0.001#					<0.001#
Admitted	17.5	22.8	11.1	<0.01	174.7 (159.1, 189.9)	228.0 (212.4, 243.6)	53.2 (37.6, 68.8)	5.1	0.03
Transfer	2.5	2.6	5.2	<0.01	25.2 (24.5, 25.9)	25.8 (25.1, 26.6)	0.6 (-0.1, 1.3)	0.4	0.55
Non-Admitted	80.0	74.6	3.2	<0.01	800.0 (784.5, 815.1)	746.2 (730.7, 761.7)	-53.8 (-69.3, -38.3)	-1.1	<0.01

[‡] ED presentations to all public hospitals in WA including public hospitals managed privately; ED=emergency department.

*Western Australian estimated resident populations were used for the calculation.

[§]AAG=Average annual growth, expressed as $AAG = \frac{(Vt_n - Vt_0)}{Vt_0} / n$, where Vt_0 and Vt_n were the values at the start and end of the period, and n is the period (in years) between Vt_n and Vt_0 .

[¶]RD=Rate Difference; CI=Confidence Interval.

[#]P value for Mann-Kendall trend comparison within each category.

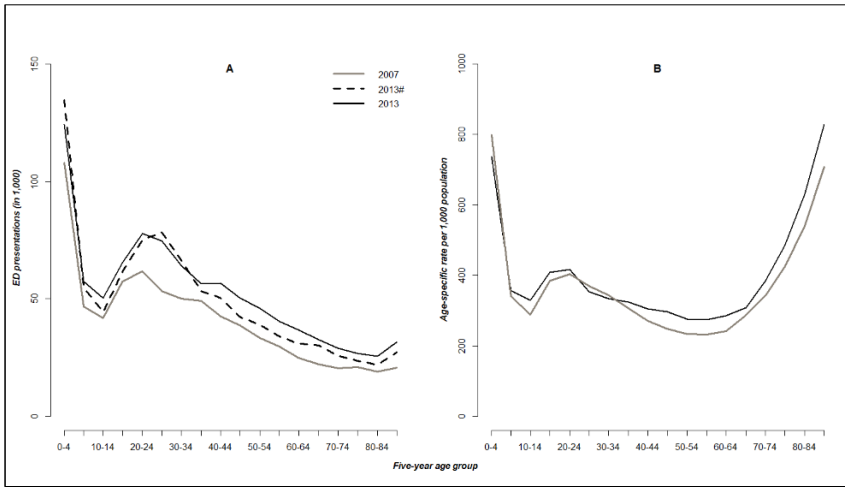


Figure 1

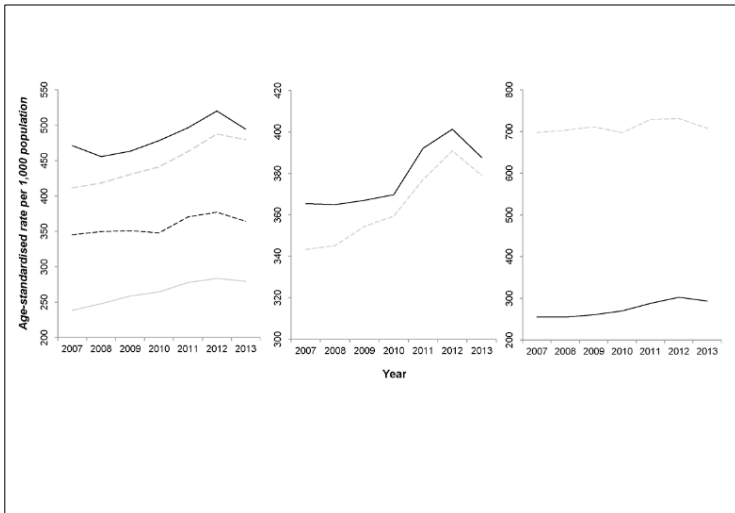


Figure 2

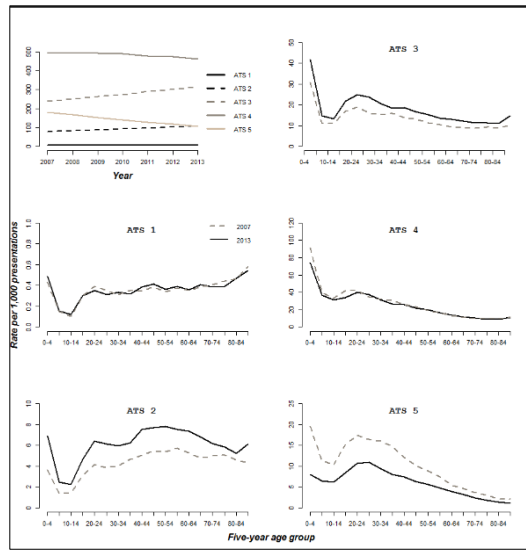


Figure 3

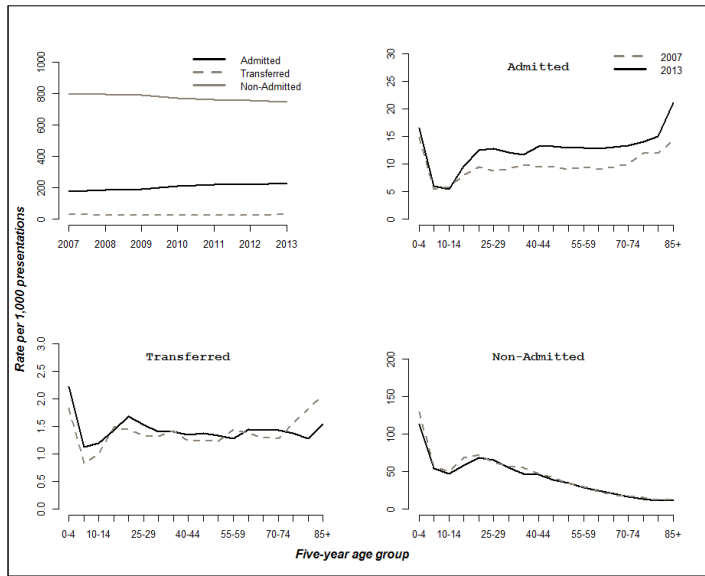


Figure 4