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Comparative emergency department resource utilisation across age groups

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Abstract

Objectives. The aim of the present study was to assess comparative emergency department (ED) resource utilisation across age groups.

Methods. A retrospective analysis of data collected in the National Non-admitted Patient Emergency Department Care Database was undertaken to assess comparative ED resource utilisation across six age groups (0–14, 15–35, 36–64, 65–74, 75–84 and ≥85 years) with previously used surrogate markers of ED resource utilisation.

Results. Older people had significantly higher resource utilisation for their individual ED episodes of care than younger people, with the effect increasing with advancing age.

Conclusion. With ED care of older people demonstrated to be more resource intensive than care for younger people, the projected increase in older person presentations anticipated with population aging will have a magnified effect on ED services. These predicted changes in demand for ED care will only be able to be optimally managed if Australian health policy, ED funding instruments and ED models of care are adjusted to take into account the specific care and resource needs of older people.

What is known about the topic? Current Australian ED funding models do not adjust for patient age. Several regional studies have suggested higher resource utilisation of ED patients aged ≥65 years. Anticipated rapid population aging mandates that contribution of age to ED visit resource utilisation be further explored.

What does this paper add? The present study of national Australian ED presentations compared ED resource utilisation across age groups using surrogate markers of ED cost. Older people were found to have significantly higher resource utilisation in the ED, with the effect increasing further with advancing age.

What are the implications for practitioners? The higher resource utilisation of older people in the ED warrants a review of current ED funding models to ensure that they will continue to meet the needs of an aging population.

Additional keywords: aging, health funding and financing, health policy, health systems.

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Introduction

Current emergency department (ED) funding models in Australia do not adjust funding based on the age of the patient. The models of ED funding used in Australia include: (1) activity-based funding, based on urgency-related groups (URGs), which are determined by five factors[1] (episode end status, type of visit, triage category, sex and diagnosis code) and have been demonstrated to be good predictors of cost (55.32% trimmed for

outliers);[2] and (2) block funding,[1,3] which is predominantly applied to smaller hospital EDs, based variously on historical funding levels or activity.

However, the Independent Hospital Pricing Authority (IHPA) has acknowledged that the 'impact of the age of the patient on costs should be considered in an emergency care classification in the medium term'.[4]

Age has been demonstrated in several local and international regional studies to be correlated with cost of ED care.[2,5] These studies were limited by being based on assessment of ED presentations from relatively small geographic areas. Furthermore, the age groups used in the studies defined increased age as ≥65 years and did not explore whether there are differences in cost or resource utilisation between the young-old (65–74 years), old-old (75–84 years) and oldest old (≥85 years).

In order to better inform Australian health policy and facilitate the development of funding models and models of healthcare that deliver optimal acute health care, an understanding of the comparative effect of age on ED resource utilisation at a national level is essential. In addition, it is unclear from prior studies whether the effect is homogeneous among those aged ≥65 years, or whether the effect is magnified with further increase in age.

Objectives

The aim of the present study was to determine the comparative resource utilisation for Australian ED attendances across the age groups of 0–14, 15–35, 36–64, 65–74, 75–84 and ≥85 years, using previously used surrogate markers of ED cost.

Methods

Study design

A retrospective analysis of data collected in the National Non-admitted Patient Emergency Department Care Database (NNAPEDCD) was undertaken. The NNAPEDCD is a national database administered by the Australian Institute of Health and Welfare (AIHW) that describes episode-level presentations to public EDs across Australia. The research team purchased de-identified data across 15 data elements from the AIHW. The data elements provided were determined by availability, data integrity and consent of state data custodians. State data custodians provided stipulations on data elements to be provided, their format, use and reporting. The data custodians further required that no comparative state-level data be published. The University of Queensland Medical Research Ethics Committee granted ethics approval for this study.

Variables

The characteristics of those presenting to the ED were assessed by age, gender, time of day of presentation, acuity of the ED presentation as assessed by the Australasian Triage Scale[6] and episode end status (or status of the patient at the end of the ED episode of care). As a requirement of state data custodians, all visits to EDs from July 2006 to June 2011 were stratified by age group. The age groups used were based on the groupings that fulfilled study requirements and were broadly consistent with the age ranges defined by both the National Health Data Dictionary[7] and by demographic projections of Australian Bureau of Statistics (ABS) as follows:[8] 0–14 years, children; 15–35 years, young adults; 36–64 years, adults; 65–74 years, young-old; 75–84 years, old-old; and ≥85 years, oldest old.

Comparative resource utilisation of ED presentations by age group was determined by assessing the following previously documented surrogate markers of ED resource utilisation: (1) arrival to the ED by ambulance;[9] (2) Australasian Triage Scale category;[6,10] (3) hospital admission rate;[11] and (4) length of stay in the ED.[12]

Statistical methods and analysis

All analyses were performed using IBM® SPSS® version 22.0.

Demographic and resource utilisation profiles of patients presenting to the ED were assessed across the entire dataset, using descriptive statistics, with results reported for individual age groups. Continuous variables are expressed as the mean with 95% confidence intervals of the means; categorical data are presented as percentages. Group differences in continuous variables were compared with two-tailed *t*-tests (or analysis of variance (ANOVA) for multiple comparisons) where distribution was normal, and with the Kruskal–Wallis test for non-parametric variables. The Pearson Chi-squared test was used to assess group differences for categorical variables. For all comparisons, $p < 0.05$ was considered significant.

Results

There were 28 708 035 ED episodes of care in 187 hospitals (plus the hospital/s of the single territory contributing data without hospital identifier/s) reported during the study period. All Australian states and territories contributed data, with 77.1% of contributed data being from eastern mainland states; this distribution of data matches the population distribution.

Demographic profiles

Demographic profiles of patients presenting to EDs in Australia for each age group are shown in Table 1. Most ED presentations (41.3%) were by people in the 15–44 years age group, with those aged ≥65 years representing 18% of total ED presentations from 2006–07 to 2010–11.

Overall, the proportion of presentations by females and males were similar. However, among the oldest old (≥85 years), the proportion of female presentations was significantly higher than that of males (62.9% vs 37.1% respectively; $P < 0.001$).

Unscheduled emergency presentations accounted for 97.5% of all ED activity from 2006–07 to 2010–11, with older people

Table 1. Number of Australian emergency department presentations by age and gender for financial years 2007–11

	Females	Males	Unknown	Total
Age (years)				
0–14	2 810 680	3 622 389	246	6 433 315
15–44	5 924 365	5 917 435	846	11 842 646
45–64	2 477 654	2 783 505	516	5 261 675
65–74	939 491	1 078 545	137	2 018 173
74–84	1 047 921	986 432	102	2 034 455
≥85	702 903	414 763	105	1 117 771
Total (%)	13 903 014 (48.4)	14 803 069 (51.6)	1952 (0.0)	28 708 035

no less likely than younger people to be an unscheduled emergency presentation ($P < 0.001$).

Resource utilisation

Assessment of resource utilisation by patients of each age group using surrogate markers of mode of arrival, Australasian Triage Scale, ED length of stay and ED disposition status is summarised in Table 2.

The most common mode of transport to the ED overall was walking, private transport, public transport or other community transport, which accounted for 75.7% of ED presentations across the entire dataset. However, those aged ≥65 years were the only age group in whom the most common mode of transport to the ED was ambulance, with 54.2% of those aged ≥65 years arriving by ambulance, compared with 16.5% of those aged 0–64 years ($P < 0.001$). This effect size increased significantly with further increases in age (40.3% of those aged 65–74 years, 57.5% of those aged 75–84 years and 73.5% of those aged ≥85 years arriving by ambulance; $P < 0.001$).

Most ED presentations overall were assigned a triage category of 4 (semi-urgent). However, older people were the only age group where the most common triage category was 3 (urgent), assigned in 39.8% of those aged ≥65 years, with the elderly overall having the highest proportional urgency of care of all age groups ($P < 0.001$). The proportion of patients within each age group assigned a triage category of 1 increased with increasing age (0.3% in those aged 0–14 years to 1.6% in those aged ≥85 years). The proportion of patients within each age group assigned a triage category of 2, peaked in the 65–74 years age group.

Older people were more likely to be admitted to hospital from the ED than younger people (55.4% of those aged ≥65 years admitted compared with 19.1% of those aged 15–44 years and 31.6% of those aged 45–64 years; $P < 0.001$). After adjusting for triage category, elderly patients still had a higher rate of hospital admission (admission rates of 33%, and 20.9% in the ≥65 and 0–64 years age groups respectively; $P < 0.001$). The effect increased significantly with further increases in age, with admission rates of 45.9%, 56.7% and 63.8% in those aged 65–74, 75–84 and ≥85 years respectively ($P < 0.001$).

Rates of referral to other hospitals for admission also increased with increasing age. Older people were significantly less likely to leave the ED without being seen or to leave against advice after commencement of treatment, with increasing age associated with a further decrease in this likelihood.

Mean lengths of stay of older people ≥65 years in the ED were significantly longer than those of younger people, 0–64 years (318 and 193 min respectively; $P < 0.001$). After adjusting for triage category, elderly patients still had a longer ED length of stay ($P < 0.001$). The mean ED length of stay increased significantly with increasing age (0–14 years, 149.92 min; 15–35 years, 195.24 min; 36–64 years, 240.01 min; 65–74 years, 286.78 min; 75– 84 years, 328.74 min; ≥85 years, 356.96 min; $P < 0.001$; Fig. 1).

Discussion

This study has confirmed that increasing age is associated with higher resource utilisation in the ED, as represented by the surrogate markers of higher assigned Australasian Triage Scale category, higher rates of arrival by ambulance, longer ED stays and higher admission rates. The findings support previously held assertions that elderly ED patients have higher-complexity care needs than their younger counterparts.[2,13] Increasing age is associated with increasing comorbidities, susceptibility to iatrogenic complications, such as delirium, and the presence of cognitive impairment, all of which are associated with increased healthcare costs.[14–16] It has been suggested previously that this higher resource utilisation may be unrelated to age, but rather reflect a general increase in resource utilisation in the years proximate to death.[17] However, age remains an easily measurable strong predictor of cost of an ED episode of care.

Currently in Australia, the predominant funding model in use for EDs is activity-based funding centred on the use of URGs. Using this model, funding is determined by five factors:[1] episode end status or disposition destination, type of visit (emergency vs scheduled), triage category, sex and diagnosis code. Although URGs have been demonstrated to be good predictors of cost,[2] there is controversy about their use of data elements that may be subject to manipulation, such as triage category.[13] In this sense, age may be considered a more appropriate measure of resource utilisation because it is not amenable to such manipulation.

The cost of an ED visit is largely accounted for by cost of labour, and economies of scale are not as evident in the ED as in other health services.[18] In addition, the finding in the present study of a higher rate of hospital admission and prolonged ED lengths of stay for older people, suggest population aging will significantly affect access block and ED overcrowding. Hence, higher rates of elderly presentations with population aging,[19] accompanied by their higher resource utilisation, can be expected to disproportionately affect ED costs as the Australian population ages.

Therefore, the findings of the present study support the inclusion of patient age as a predictor of ED costs in casemix or funding strategies; this is in keeping with previous Australian and international studies of ED resource utilisation.[20,21]

However, how age should best be incorporated into funding strategies requires further exploration. Prior casemix funding models for ED that have included age have had varied age groupings. In the Emergency Department Groups classification,[5] it was suggested three age groups, namely 0–35, 36–64 and ≥65 years, be used after consideration of principal diagnosis and disposition. The Urgency Disposition and Age groups[2] suggested four age groups (≤14, 15–34, 35–64 and ≥65 years) be used after consideration of disposition and triage. The findings of the present study that ED costs continue to increase with increasing age beyond 65 years support further exploration of funding models using age groups that incorporate breakdown of older age groups into 65–74, 75–84 and ≥85 years cohorts.

In addition, age alone does not sufficiently predict cost, and therefore appropriate covariates of cost, which are similarly not amenable to manipulation, require consideration for inclusion in funding models. Such variables may include diagnosis,[5,13] Indigenous status,[4] presenting problem[4] and investigations or procedures undertaken in the ED.[4]

The increasing cost of ED care with increasing age identified in the present study and the anticipated increase in ED presentations accompanying population aging[19] also support the need for further investment in ED avoidance and substitutive care

Table 2. Markers of resource utilisation by age for Australian emergency department (ED) presentations for financial years 2007–11

Data are given as *n* (% within age group). HCP, healthcare professional

Marker of resource utilisation	Age (years)						Total
	0–14	15–44	45–64	65–74	75–84	≥85	
Mode of arrival							
Ambulance	529 475 (8.2)	1 976 917 (16.7)	1 378 395 (26.2)	813 575 (40.3)	1 170 078 (57.5)	821 267 (73.5)	6 689 707 (23.3)
Police or correctional service vehicle	11 081 (0.2)	169 706 (1.4)	36 946 (0.7)	3552 (0.2)	1816 (0.1)	690 (0.0)	223 791 (0.8)
Walking, private transport, public transport, community transport or taxi	5 878 589 (91.4)	9 674 905 (81.7)	3 836 372 (72.9)	1 197 696 (59.3)	859 472 (42.2)	294 016 (26.3)	21 741 050 (75.7)
Unknown	14 170 (0.2)	21 118 (0.2)	9962 (0.2)	3350 (0.2)	3089 (0.2)	1798 (0.2)	53 487 (0.2)
Australasian Triage Scale							
1	20 841 (0.3)	69 703 (0.6)	44 176 (0.8)	22 976 (1.1)	27 385 (1.3)	17 513 (1.6)	202 594 (0.7)
2	311 792 (4.8)	776 418 (6.6)	687 284 (13.1)	307 843 (15.3)	299 545 (14.7)	147 088 (13.2)	2 529 970 (8.8)
3	1 982 405 (30.8)	3 424 199 (28.9)	1 709 146 (32.5)	753 670 (37.3)	828 980 (40.7)	473 845 (42.4)	9 172 245 (32.0)
4	3 380 429 (52.5)	5 732 688 (48.4)	2 098 418 (39.9)	721 795 (35.8)	727 264 (35.7)	419 944 (37.6)	13 080 538 (45.6)
5	735 771 (11.4)	1 831 364 (15.5)	716 667 (13.6)	209 291 (10.4)	148 818 (7.3)	55 743 (5)	3 697 654 (12.9)
Not stated or unknown	2077 (0)	8274 (0.1)	5984 (0.1)	2598 (0.1)	2463 (0.1)	3638 (0.3)	25 034 (0.1)
ED disposition							
Admitted to hospital	981 344 (15.3)	2 265 177 (19.1)	1 663 635 (31.6)	926 490 (45.9)	1 152 729 (56.7)	713 188 (63.8)	7 702 563 (26.8)
Discharged from ED	4 934 815 (76.7)	8 412 176 (71)	3 197 088 (60.8)	977 036 (48.4)	778 822 (38.3)	347 627 (31.1)	18 647 564 (65)
Referred to another hospital for admission	64 400 (1.0)	115 099 (1)	83 943 (1.6)	45 013 (2.2)	55 844 (2.7)	36 382 (3.3)	400 681 (1.4)
Did not wait to be attended by a HCP	394 876 (6.1)	825 782 (7)	234 274 (4.5)	48 919 (2.4)	30 088 (1.5)	9851 (0.9)	1 543 790 (5.4)
Left at own risk after being attended by a HCP but before the ED episode of care was completed	49 887 (0.8)	204 021 (1.7)	66 468 (1.3)	12 484 (0.6)	7552 (0.4)	2355 (0.2)	342 767 (1.2)
Died in ED as a non-admitted patient	438 (0.0)	942 (0.0)	1918 (0.0)	1579 (0.1)	2612 (0.1)	2224 (0.2)	9713 (0.0)
Dead on arrival, not treated in ED	1146 (0.0)	6150 (0.1)	8209 (0.2)	4242 (0.2)	4375 (0.2)	4839 (0.4)	28 961 (0.1)
Not stated or not known	6409 (0.1)	13 299 (0.1)	6140 (0.1)	2410 (0.1)	2433 (0.1)	1305 (0.1)	31 996 (0.1)

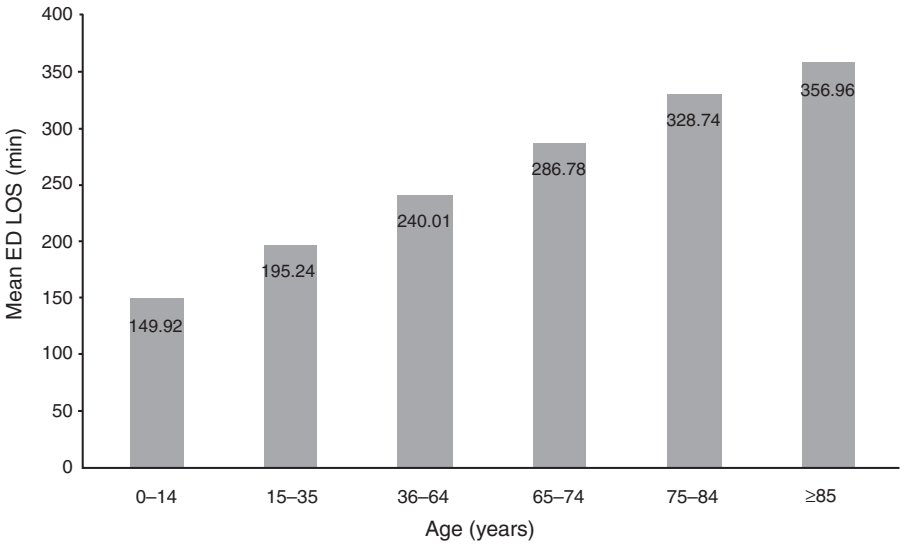

Fig. 1. Mean emergency department (ED) length of stay (LOS) by age group for Australian ED presentations for financial years 2007–11.

strategies focused on the acute health care needs of older people in order to ensure sustainability of emergency service delivery. Current funding models, with their focus on funding ED-based activity, do not incentivise health services to invest in such emergency demand management strategies.

Limitations

The data available to the research team spanned only July 2006–June 2011. Assessment of data integrity revealed that there was considerable variation in the proportion of hospitals consistently contributing data over time. For the 2006–07 and 2010–11 years, the proportion of all emergency occasions of service captured by NNAPEDCD was estimated to be 100% for public hospitals in Peer Groups A and B and 78% and 81% respectively for all other public hospitals.[22,23]

It is well recognised that many older people have chronic conditions, which affect the complexity of their acute illness;[24] no casemix information was available to researchers, thus the complexity of presentation, and therefore resource utilisation, may be understated.

In addition, residency of the older people in residential aged care facilities is unreliably captured in current ED information systems, and therefore NNAPEDCD does not report on this information. The increased dependency of this group may further affect resource utilisation.

Conclusion

The present study found that increasing age is associated with higher resource utilisation in the ED. The findings of the present study identify an imperative for the addition of age as a variable in casemix funding models. The funding strategies should further incorporate age groups that include breakdown of the ≥65 years age group into 65–74, 75–84 and ≥85 years age groups, because each of these increments is associated with a further increase in resource utilisation.

Furthermore, the sustainability of emergency services in the setting of population aging will be optimised by incentivising investment in ED avoidance and substitutive care programs and improved access to primary care for older people.

Competing interests

Melinda G. Martin-Khan and Leonard C. Gray declare that they have no conflicts of interest. Ellen Burkett is an emergency physician and clinical lead of a recurrently funded ED and hospital substitutive care program for residents of aged care facilities.

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