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Emergency department utilisation by older people in metropolitan Melbourne, 2008–12: findings from the Reducing Older Patient's Avoidable Presentations for Emergency Care Treatment (REDIRECT) study

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Abstract

Objective. Older patients are over-represented in emergency departments (ED), with many presenting for conditions that could potentially be managed in general practice. The aims of the present study were to examine the characteristics of ED presentations by older patients and to identify patient factors contributing to potentially avoidable general practitioner (PAGP)-type presentations.

Methods. A retrospective analysis was performed of routinely collected data comprising ED presentations by patients aged ≥70 years at public hospitals across metropolitan Melbourne from January 2008 to December 2012. Presentations were classified according to the National Healthcare Agreement definition for PAGP-type presentations. Presentations were characterised according to patient demographic and clinical factors and were compared across PAGP-type and non-PAGP-type groups.

Results. There were 744 519 presentations to the ED by older people, of which 103 471 (13.9%) were classified as PAGP-type presentations. The volume of such presentations declined over the study period from 20 893 (14.9%) in 2008 to 20 346 (12.8%) in 2012. External injuries were the most common diagnoses (13 761; 13.3%) associated with PAGP-type presentations. Sixty-one per cent of PAGP-type presentations did not involve either an investigation or a procedure. Patients were referred back to a medical officer (including a general practitioner (GP)) in 58.7% of cases.

Conclusion. Older people made a significant number of PAGP-type presentations to the ED during the period 2008–12. A low rate of referral back to the primary care setting implies a potential lost opportunity to redirect older patients from ED services back to their GPs for ongoing care.

What is known about the topic? Older patients are increasingly attending EDs, with a proportion attending for problems that could potentially be managed in the general practice setting (termed PAGP-type presentations).
What does this paper add? This study found that PAGP-type presentations, although declining, remain an important component of ED demand. Patients presented for a wide array of conditions and during periods that may indicate difficulty accessing a GP.
What are the implications for practitioners? Strategies to redirect PAGP-type presentations to the GP setting are required at both the primary and acute care levels. These include increasing out-of-hours GP services, better triaging and appointment management in GP clinics and improved communication between ED clinicians and patients' GPs. Although some strategies have been implemented, further examination is required to assess their ongoing effectiveness.

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Introduction

The increasing demand on emergency departments (ED) is creating substantial problems for health systems around the world.[1] ED overcrowding affects the experience of both patients and clinicians, as well as the quality of care. This potentially affects health outcomes.[2] Increased numbers of patient presentations, repeat attendances and poor access to primary care services contribute to overcrowding, with older patients disproportionately represented in the ED.[3] The use of acute health services by older age groups has received much attention. In Australia, over the past decade there has been a significant increase in the volume of ED presentations, with ED attendances by older patients aged ≥70 years increasing the rate of growth of this age group in metropolitan Melbourne (Victoria) by more than threefold.[4] Of particular note is that older individuals are increasingly attending the ED for potentially avoidable general practitioner (PAGP)-type presentations; that is, with conditions that could potentially be dealt with in primary or community care settings.[5–7]

The use of emergency services by older adults presents several challenges to both patients and the health system.[8] Older patients generally suffer from multiple chronic conditions, and their evaluation and treatment often involves more resources and a complex model of care.[9,10] With an aging population, increasing ED attendances by older people could place more pressure on emergency services.

Evidence shows that the primary care sector is important in the management of older patients, before attendance at the ED. This is particularly important because ED attendance has been shown to be a major predictor of re-attendance and further complications from worsening conditions.[11] The Reducing Older Patient's Avoidable Presentations for Emergency Care Treatment (REDIRECT) study sought to identify strategies to reduce PAGP-type presentations by older patients to EDs by redirecting them to primary and community health services.[12] The aim of the present substudy was to examine ED utilisation by older adults throughout metropolitan Melbourne and to characterise the nature of these presentations for both PAGP-type and non-PAGP-type presentations.

Methods

Study population

The study involved a retrospective analysis of routinely collected data of public hospital ED presentations across metropolitan Melbourne. Data were collected for five calendar years, from 2008 to 2012, for patients aged ≥70 years. This study was approved by the Monash University Human Research Ethics Committee.

Data collection

The data source used for the study was the Victorian Emergency Minimum Dataset, which contains de-identified demographic and clinical information related to all presentations to Victorian public hospitals with 24-h EDs.[13] In the present study, all ED presentations by patients aged ≥70 years to public hospitals in metropolitan Melbourne were included. Specialist eye and ear, maternity and children's hospitals were excluded from the analysis. Population data published annually by the Australian Bureau of Statistics were used to calculate age-specific presentation rates across the study period.[14]

Statistical analysis

All patient presentations were examined according to demographic and clinical factors, including age group, sex, length of stay, type of visit, patient's usual accommodation, socioeconomic status, source of referral to the ED, principal diagnosis, procedures or investigations undertaken and destination or status on departure from the ED. Due to the large and varied number of principal diagnosis codes (International Classifications of Diseases 10th Revision Australian Modification (ICD-10-AM)), diagnoses were aggregated into diagnostic groups (see Supplementary Material). Socioeconomic status was approximated by linking the patient's residential postcode with an associated Index of Relative Socioeconomic Disadvantage (IRSD).[15] Presentations were categorised according to whether they could be classified as PAGP-type presentations. The definition for PAGP-type presentations, defined in the National Healthcare Agreement and used by the Australian Institute for Health and Welfare (AIHW), is where the 'Type of Visit' is listed as 'Emergency' and the patient: (1) was allocated a triage category of 4 or 5; (2) did not arrive by ambulance or police or correctional vehicle; and (3) was not admitted to the hospital, was not referred to another hospital or did not die.[16]

Temporal characteristics of month, day of week and hour of presentation were compared between 2008 and 2012 for PAGP-type and non-PAGP-type presentations. Annual age-specific presentation rates per 1000 people were calculated for both

PAGP-type and non-PAGP-type attendances. All analyses were conducted using Stata version 13 (StataCorp LP).

Results

Between 2008 and 2012 there were 744 519 ED presentations across metropolitan Melbourne by patients aged ≥70 years, of which 103 471 (13.9%) were classified as PAGP-type presentations (Table 1). Males were slightly more likely to make PAGP-type presentations (47.7%) than non-PAGP-type presentations (45.6%), and over half (51.7%) the PAGP-type presentations were by patients residing in areas of high socioeconomic status (Quintiles 4 and 5 of the IRSD scale). Within the study population, significant differences were observed across age groups, with patients aged 70–74 years visiting more for PAGP-type presentations (34.3%) as opposed to non-PAGP-type presentations (20.8%). ED length of stay (LOS) was lower for PAGP-type compared with non-PAGP-type presentations (median 2.9 vs 6.2 h respectively).

There was a 12.7% increase in the total number of presentations over the 5-year study period, with 140 560 presentations (398 per 1000 population aged ≥70 years) in 2008 rising to 158 423 in 2012 (407 per 1000 population aged ≥70 years). Population growth of 10.1% was observed for this age group over the same period. There were 20 893 (14.9%) PAGP-type presentations to the ED in 2008, reducing to 20 346 (12.8%) presentations in 2012, a decrease of 2.6%. The overall rate of PAGP-type ED presentations decreased from 59.2 per 1000 population aged ≥70 years to 52.2 per 1000 population aged ≥70 years over the 5-year study period.

The majority of PAGP-type presentations to the ED were made by patients living in the community (96.2%), with far fewer presentations by residents of aged care facilities (1.7%). In most cases the PAGP-type presentations were initiated by the patients themselves or by family or friends, accounting for 88.4% of referrals. A general practitioner (GP) or other medical officer was responsible for only 9.4% of referrals for such presentations. Of PAGP-type presentations to the ED, 89.7% concluded with the patient returning home, a much higher proportion than for non-PAGP-type presentations (23.2%). At ED discharge, 58.7% of patients with PAGP-type presentations were referred back to a GP or local medical officer after discharge. Only 8.5% PAGP-type presentations were referred to another hospital out-patient service or an external service, such as an Aged Care Assessment Service, for ongoing care.

Table 2 shows the most commonly diagnosed conditions across the study period. External injuries represented 13 761 (13.3%) of presentations, predominantly open wounds of extremities (5132; 40%). Skin or tissue disorders (9199; 8.9%) were the second most common presentation group, followed by presentations for urinary tract problems (6149; 5.9%). Patients that suffered external injuries were significantly more likely to be referred back to a GP or local medical officer compared with patients with other diagnoses (64.4% vs 57.9% respectively; $P < 0.001$). There were 8868 (9.4%) PAGP-type presentations that resulted in no diagnosis being recorded.

The most common investigations or procedural interventions associated with PAGP-type presentations are summarised in Table 3. A large proportion of presentations involved no specific medical treatment, with 63 284 (61.2%) having no investigation or procedure recorded. The most common procedures conducted were X-rays (11.3%), venepuncture (11.2%) and undefined procedures (8.4%). Drugs were administered in 8.4% of presentations, and intravenous catheters were inserted or managed in 8.2% of PAGP-type presentations.

Figure 1 shows the seasonal variation of presentations across the study period. PAGP-type presentations were fairly stable across all months of the year, with a peak in presentations during the December–January period and the lowest number of presentations occurring in February.

Figure 2 shows the distribution of presentations across days of the week. A peak in presentations occurred on Monday, with presentations decreasing towards the middle of the week, with another increase over Friday and the weekend.

Significant variability was also observed in the time of presentations (Fig. 3). Periods of high demand for EDs were observed, with PAGP-type presentations peaking around 1100 hours before slowly decreasing through the rest of the day. A significant number of presentations occurred 'after-hours', with 23 866 (23.1%) presentations occurring between 1800 and 2400 hours. This pattern remained largely unchanged across the study period and was consistent across the week (including weekends). Presentations for external injuries were more likely to be 'after-hours', with 21.6% occurring after 1800 hours, as opposed to 17.1% for other reasons for presentation ($P < 0.001$).

Discussion

The present study examined the use of ED services in metropolitan Melbourne by older people aged ≥70 years, who comprised 9% of the Greater Melbourne population during the period 2008–12.[14] During the 5-year study period, 13.9% of presentations by this age group were identified as PAGP-type presentations. External injuries, led by wounds and injuries consistent with falls, were the most common reason for PAGP-type presentations. Nearly 59% of all patients were referred to a medical officer or GP for continuing care.

In common with previous studies, the present study shows that PAGP-type presentations made a sizable contribution to overall ED demand by this age group. Using a slightly different definition for PAGP-type presentations (Category 4 or 5, excluding patients who were admitted to hospital, transported by ambulance, referred by a GP or treated in the ED for more than 12 h), Freed *et al.*[17] found that 10.2% of ED presentations by patients aged ≥65 years could be classified as such. Analysis of ED data by Nagree *et al.* from three Perth hospitals estimated PAGP-type presentations (using the AIHW definition) to be between 25% and 26.4%.[18] Using the AIHW definition, the estimate of 14.5% in the present study was below the 25% calculated by Nagree *et al.*,[18] but this may be explained by the focus on older people in the present study. In contrast, rural EDs have been shown to have much higher rates of PAGP-type presentations using the same AIHW definition (55.1–58.4%), although unique challenges to GP access exist in this setting.[19]

Overall growth in ED presentations was found to exceed wider population growth in the >70 years age group. Coupled with an aging population, this implies that strategies are needed to deal with this excess demand.[20] Although the number and rate

Table 1. Characteristics of presentations made by older adults to public hospital emergency departments (excluding specialist maternity and eye and ear hospitals), metropolitan Melbourne (Victoria), 2008–12, by potentially avoidable general practitioner (PAGP)-type presentation status (*n* = 744 519)

Data are presented as *n* (%) or as the median [interquartile range]. Source: Victorian Emergency Minimum Dataset. All predictors are significant with $P < 0.001$. ED, emergency department; LOS, length of stay; GP, general practitioner

Characteristic	PAGP-type presentation[A] (*n* = 103 471; 13.9%)	Non-PAGP-type presentation (*n* = 641 048)
Patient gender		
Male	49 305 (47.7)	292 549 (45.6)
Female	54 166 (52.3)	348 499 (54.4)
Age (years)		
70–74	35 436 (34.3)	133 615 (20.8)
75–79	29 658 (28.7)	150 878 (23.5)
80–84	22 419 (21.7)	159 973 (25.0)
≥85	15 958 (15.4)	196 582 (30.7)
ED LOS (h)	2.9 [1.6–4.5]	6.2 [4–9.7]
Patient's usual accommodation		
Private residence	99 536 (96.2)	521 750 (81.4)
Residential aged care facility	1786 (1.7)	90 928 (14.2)
Other	954 (0.9)	11 334 (1.8)
Unknown	1195 (1.2)	17 036 (2.7)
Socioeconomic status quintiles[B]		
1 (most disadvantaged)	10 346 (10.0)	64 688 (10.1)
2	19 928 (19.3)	119 494 (18.6)
3	13 978 (13.5)	88 099 (13.7)
4	34 164 (33.0)	209 024 (32.6)
5 (least disadvantaged)	19 382 (18.7)	132 863 (20.7)
Source of referral to ED		
Self, family or friends	91 427 (88.4)	546 464 (85.2)
Local medical officer	9726 (9.4)	38 391 (6.0)
Other	2318 (2.2)	56 193 (8.8)
Destination or status on departure from ED		
Left 'at risk'	9999 (9.7)	6308 (1.0)
Died or dead on arrival	0 (0.0)	6308 (1.0)
Admitted to a hospital facility	0 (0.0)	463 643 (72.3)
Discharged home	92 791 (89.7)	148 715 (23.2)
Discharged to residential care facility	654 (0.6)	12 013 (1.9)
Other	27 (0.0)	136 (0.0)
Referral for continuing care		
Review in ED	6405 (6.2)	5688 (0.9)
Out-patients	11 552 (11.2)	11 810 (1.8)
Local medical officer (includes GP or doctor)	60 769 (58.7)	117 375 (18.3)
Specialist health practitioner	4670 (4.5)	6527 (1.0)
Other hospital or external service	8823 (8.5)	481 798 (75.2)
No referral	10 005 (9.7)	15 813 (2.5)
Other	828 (0.8)	1057 (0.2)
Unknown	419 (0.4)	980 (0.2)

[A]PAGP-type presentation to the ED was defined according to the definition utilised by the AIHW.[16] Specifically, PAGP-type presentations to public hospital EDs in principle referral and specialist women's and children's hospitals (Peer Group a) and large hospitals (Peer Group B) are presentations where the patient: (1) was allocated a Triage Category of 4 or 5; (2) did not arrive by ambulance or by police or correctional vehicle; and (3) at the end of the episode was not admitted to the hospital, was not referred to another hospital and did not die.

[B]Socioeconomic status quintiles were generated using the Australian Bureau of Statistics (ABS) SEIFA 2011 Index of Relative Socioeconomic Disadvantage deciles (ranked within Australia) and the Statistical Local Area (SLA) code for the usual place of residence of the patient.[15] The most disadvantaged socioeconomic status group represents areas containing the 20% of the population with the most disadvantage; the least disadvantaged socioeconomic status group represents areas containing the 20% of the population with the least disadvantage.

of total presentations by older people increased between 2008 and 2012, PAGP-type presentations decreased from 59.2 to 52.2 per 1000 population aged ≥70 years. This reduction could reflect initiatives that have been introduced by both ambulance and primary health care services, including increased availability of after-hours care from GP clinics and locum services, which, along with improvements in the management of older people in primary care setting, have been found to reduce ED utilisation.[21,22]

Table 2. Most common diagnosed conditions for potentially avoidable general practitioner (PAGP)-type presentations, 2008–12 ($n = 103\,471$)
Source: Victorian Emergency Minimum Dataset

Diagnosis group	No. patients (%)
External injury	13 761 (13.3)
Skin or tissue disorder	9199 (8.9)
Urinary tract problem	6149 (5.9)
Respiratory	5720 (5.5)
Follow-up and convalescence	4428 (4.3)
Gastrointestinal	3658 (3.5)
Back problem	2960 (2.9)
Sprains and strains	2767 (2.7)
Abdominal pain	2320 (2.2)
Eyes and ears	2182 (2.1)
Circulatory disorder	1789 (1.7)
Other	48 538 (46.9)

Table 3. Procedures conducted for potentially avoidable general practitioner (PAGP)-type presentations, 2008–12 ($n = 103\,471$)
Source: Victorian Emergency Minimum Dataset

Procedure	No. patients (%)
No investigation or procedure	63 284 (61.2)
X-Ray	11 663 (11.3)
Venepuncture	11 540 (11.2)
Other investigations and procedures	8697 (8.4)
Drug administration	8684 (8.4)
Peripheral intravenous catheter	8526 (8.2)
Head injury observation	6456 (6.2)
Electrocardiography	5303 (5.1)
Full ward test urine	4118 (4.0)
Dressing	3623 (3.5)
Random blood glucose test	2759 (2.7)

The patterns of PAGP-type presentations across the months and day of week reflect potential issues around the availability of GP services for older patients. The increase in PAGP-type presentations over the December–January period may be a consequence of GPs being on leave during the summer holiday period. In addition, the pattern also supports the established relationship between periods of high ambient temperature and increased utilisation of emergency services by older patients.[23,24] An increase in presentations on Mondays, particularly in the morning, reflects both the difficulties that older patients face in accessing primary care services over the weekend, as well as issues around appointment availability on a Monday morning.[25] Strategies to address this include GP super clinics, improved triaging by GP receptionists and dedicated aged care practice nurses.[26,27]

Patients making PAGP-type presentations were younger, with over half from a higher socioeconomic background. Although this could potentially result from the population composition across Melbourne, previous studies have found a similar association between socioeconomic status or related proxies and ED utilisation.[28,29] The majority of patients also attended the ED from their own home, as opposed to an aged care facility. In particular, the lower percentage of aged care facility patients in the PAGP-type group most probably reflects the fact that these patients generally arrive by ambulance and were excluded from the present analysis based on our definition of PAGP-type presentations.[30] The tendency to be discharged home instead of admitted to hospital, combined with a shorter LOS compared with other non-PAGP-type patients, indicates a lower level of resource utilisation by this group. This is supported by the fact that just over 61% of presentations had no associated investigations or procedures performed. However, this finding may be the result of otherwise uncoded activity being performed (e.g. assessment examinations and provision of advice, issuing of prescriptions etc.). This feature alone does not necessarily indicate severity or

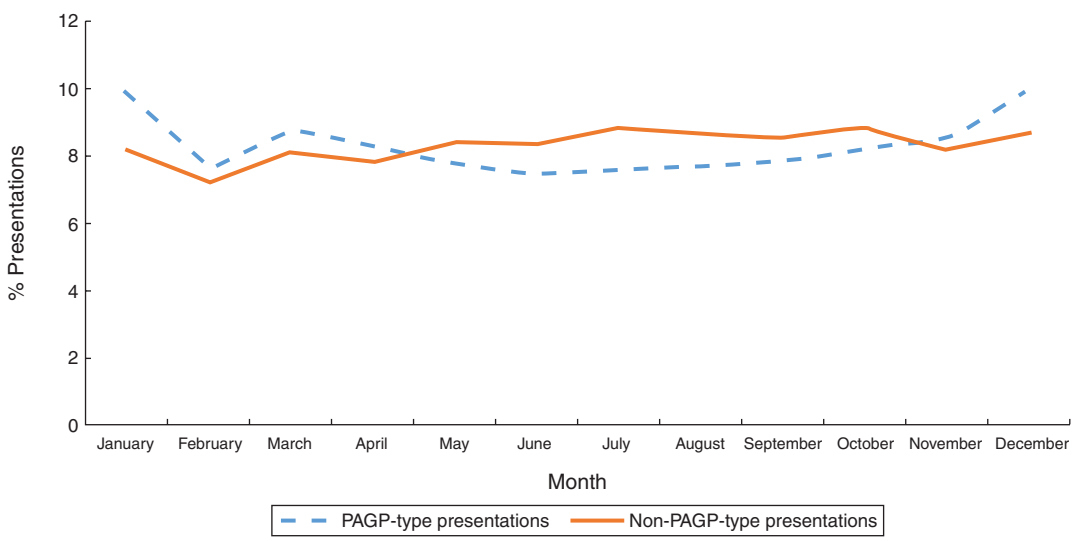

Fig. 1. Potentially avoidable general practitioner (PAGP)-type presentations made by older adults to metropolitan Melbourne public hospital emergency departments (excluding specialist maternity and eye and ear hospitals), 2008–12, by month. Source: Victorian Emergency Minimum Dataset.

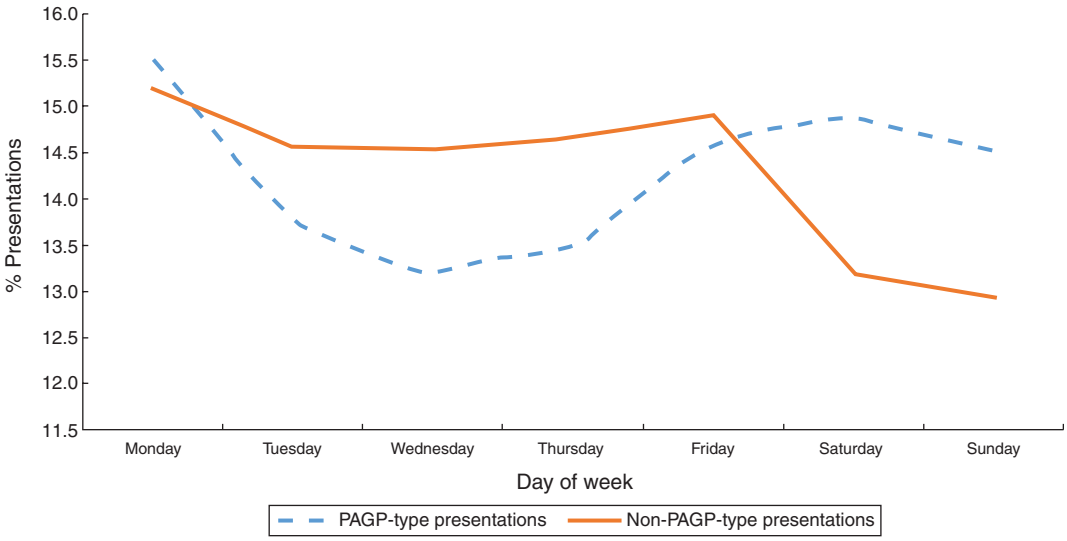

Fig. 2. Potentially avoidable general practitioner (PAGP)-type presentations made by older adults to metropolitan Melbourne public hospital emergency departments (excluding specialist maternity and eye and ear hospitals), 2008–12, by arrival day. Source: Victorian Emergency Minimum Dataset.

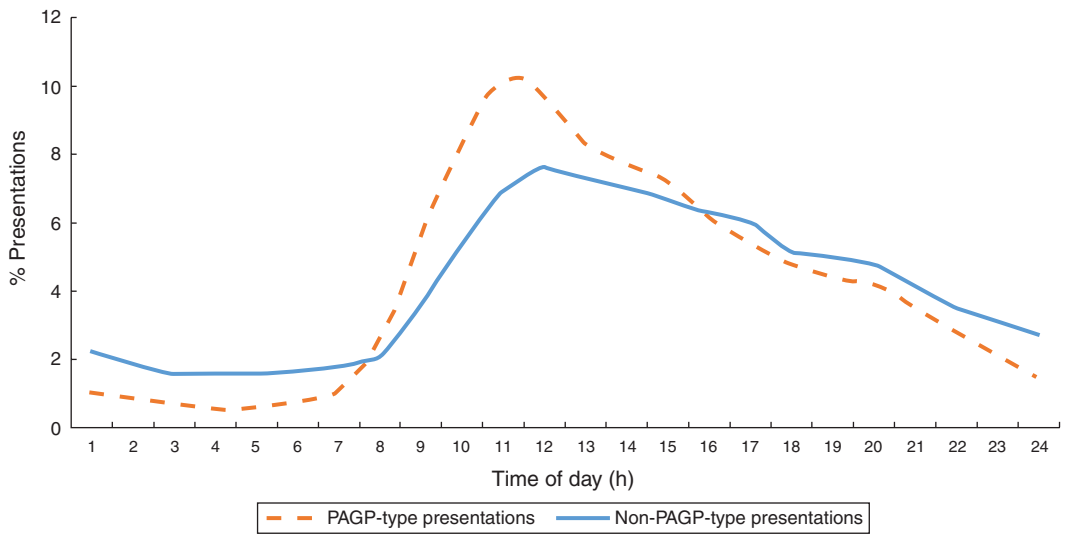

Fig. 3. Potentially avoidable general practitioner (PAGP)-type presentations made by older adults to metropolitan Melbourne public hospital emergency departments (excluding specialist maternity and eye and ear hospitals), 2008–12, by time of visit. Source: Victorian Emergency Minimum Dataset.

urgency of the presentation, but redirecting this group from the ED would serve to reduce a proportion of ED demand.[31] The large variety of presenting conditions, with over half grouped in a diverse 'other' category, indicates the degree of complexity associated with this group. The most common diagnosed conditions for PAGP-type presentations were external injuries associated with cuts and musculoskeletal injuries. Presentations for external injuries were more frequent after 1800 hours than other presentation types, potentially indicating an immediate need for treatment at the ED by this group. However, this group was referred back to a GP more often than those with other diagnoses, potentially indicating better continuity of care for these injury types. Given that X-rays were the most common procedure for this group, additional transport requirements to and from radiology facilities, a lack of availability of after-hours radiology outside the ED and patient beliefs around service availability may contribute to difficulties in managing these conditions in the community.[5]

The results of the present study indicate that there has been some improvement in reducing PAGP-type ED presentations over the 5-year period evaluated. Strategies to reduce PAGP-type presentations to the ED have generally centred on pre-emptive actions in the primary care setting, although initiatives for ED practice have also been proposed. Patient-centred

medical homes aimed at strengthening the role of care coordination by primary care physicians have been found to reduce ED use in the US setting,[32] with similar organisational structures now being trialled in Australia.[33] Dedicated practice nurses trained in the care of older patients may also improve patient care.[34] Along with walk-in clinics and community-based programs, these initiatives aim to meet the increasingly complex health needs of patients, to pre-empt any conditions requiring emergency attention and to provide alternative services to the ED setting.[35] Collocated GP clinics have been trialled, particularly as an option for after-hours patients seeking care from the ED due to GP inaccessability.[36]

Strategies within the ED have typically focused on the outpatient setting with the aim of reducing avoidable re-attendance by patients. These strategies have concentrated on issues around the development of individualised care plans, improving patient education about their own health care needs following discharge and coordination between emergency physicians and GPs.[19,37] Although 90% of PAGP-type presentations were discharged without hospitalisation, only 58.7% of patients were recorded as being referred back to their doctor at the time of discharge. This may reflect a poor communication between EDs and GPs regarding the acute episode of care that occurred and the follow-up care required.[38] The discontinuity of care experienced by both patients and clinicians between the emergency and primary care settings remains a key factor in poor coordination of patient transfer back to their GP, particularly for older patients who have complex care requirements.[39] Strategies such as the use of optimised electronic discharge summaries and automated clinician prompting may improve discharge summary rates, along with auditing and the use of quality assessment tools.[40–42]

The strengths of the present study include the temporal and clinical trends revealed from an analysis of almost 745 000 ED presentations made by metropolitan Melbourne's older population over a period of 5 years. A limitation of the study is that the AIHW definition used to identify PAGP-type ED presentations has been criticised for overestimating presentations, particularly in older patients, where using triage category as a proxy for urgency and resource requirement can be misleading.[43] However, this definition has been the standard Australian method of classifying such presentations and was therefore used in the present study for comparative purposes. Further research is needed to clarify how best to identify PAGP-type presentations.[18] The findings of the present study relate to a Victorian metropolitan population and, as such, may not be generalisable to other settings, such as rural and interstate acute care systems. Collation of information from other states of Australia is required to assess the characteristics of PAGP-type patients and their presentations at a national level.

Conclusion

The present study identified that, although decreasing over the study period, a significant number of PAGP-type ED presentations were still made by older people over the period 2008–12. Given the peak time for PAGP-type presentations is in the morning during normal business hours, initiatives to improve access both outside and during business hours may assist in reducing the burden on EDs of PAGP-type presentations by older people. Sustained presentations outside business hours may respond to recent changes to after-hours GP services, but further research is needed to assess the effects of these new initiatives in the metropolitan Melbourne setting. Lower rates of referral back to the primary care setting suggest an opportunity within the ED for redirecting older patients back to their GP for ongoing care and case management.

Competing interests

None declared.

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References

1 Di Somma S, Paladino L, Vaughan L, Lalle I, Magrini L, Magnanti M. Overcrowding in emergency department: an international issue. *Intern Emerg Med* 2015; 10: 171–5. doi:10.1007/s11739-014-1154-8

2 Elder E, Johnston AN, Crilly J. Review article: systematic review of three key strategies designed to improve patient flow through the emergency department. *Emerg Med Australas* 2015; 27: 394–404. doi:10.1111/1742-6723.12446

3 Kirby SE, Dennis SM, Jayasinghe UW, Harris MF. Frequent emergency attenders: is there a better way? *Aust Health Rev* 2011; 35: 462–7.

4 Lowthian J, Curtis A, Stoelwinder J, McNeil J, Cameron P. Emergency demand and repeat attendances by older patients. *Intern Med J* 2013; 43: 554–60. doi:10.1111/imj.12061

5 Lowthian JA, Smith C, Stoelwinder JU, Smit DV, McNeil JJ, Cameron PA. Why older patients of lower clinical urgency choose to attend the emergency department. *Intern Med J* 2013; 43: 59–65. doi:10.1111/j.1445-5994.2012.02842.x

6 National Health Performance Authority (NHPA). Healthy communities: use of emergency department and GP services in 2013–14. Sydney: NHPA; 2016.

7 Canadian Institute for Health Information (CIHI). Source of potentially avoidable emergency department visits. Ottawa: CIHI; 2014.

8 Lowthian JA, Jolley DJ, Curtis AJ, Currell A, Cameron PA, Stoelwinder JU, McNeill JJ. The challenges of population ageing: accelerating demand for emergency ambulance services by older patients, 1995–2015. *Med J Aust* 2011; 194: 574–8.

9 Faulkner D, Law J. The 'unnecessary' use of emergency departments by older people: findings from hospital data, hospital staff and older people. *Aust Health Rev* 2015; 39: 544–51. doi:10.1071/AH14185

10 Lowthian JA, Curtis AJ, Cameron PA, Stoelwinder JU, Cooke MW, McNeil JJ. Systematic review of trends in emergency department attendances: an Australian perspective. *Emerg Med J* 2011; 28: 373–7. doi:10.1136/emj.2010.099226

11 Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med* 2002; 39: 238–47. doi:10.1067/mem.2002.121523

12 Mazza D, Pearce C, Lowthian J, Browning C, Shearer M, Joe A, Turner LR, Biezen R, Brijnath B. REDIRECT: Reducing older patients' avoidable presentations for emergency care treatment. Melbourne: The Department of General Practice, Monash University; 2015.

13 Victorian State Government Department of Health and Human Services Australia. Victorian emergency minimum dataset – VEMD. Victorian hospital data reports reference files. Melbourne: Victorian Government Health Information; 2014.

14 Australian Bureau of Statistics. Population by age and sex, regions of Australia – Victoria by geographical classification [ASGS 2011]. Canberra: Commonwealth of Australia; 2013.

15 Australian Bureau of Statistics (ABS). An introduction to socio-economic indexes for areas (SEIFA). Catalogue no. 2039.0. Canberra: ABS; 2006.

16 Australian Institute of Health and Welfare (AIHW). Australian hospital statistics 2012–13: emergency department care. Health Services Series no. 52. Catalogue no. HSE 142. Canberra: AIHW; 2014.

17 Freed G, Gafforini S, Carson N. Age-related variation in primary care-type presentations to emergency departments. *Aust Fam Physycian* 2015; 44: 584–8.

18 Nagree Y, Camarda VJ, Fatovich DM, Cameron PA, Dey I, Gosbell AD, McCarthy SM, Mountain D. Quantifying the proportion of general practice and low-acuity patients in the emergency department. *Med J Aust* 2013; 198: 612–15. doi:10.5694/mja12.11754

19 Allen P, Cheek C, Foster S, Ruigrok M, Wilson D, Shires L. Low acuity and general practice-type presentations to emergency departments: a rural perspective. *Emerg Med Australas* 2015; 27: 113–18. doi:10.1111/1742-6723.12366

20 Burkett E, Martin-Khan MG, Scott J, Samanta M, Gray LC. Trends and predicted trends in presentations of older people to Australian emergency departments: effects of demand growth, population aging and climate change. *Aust Health Rev* 2016; doi:10.1071/AH15165

21 Buckley DJ, Curtis PW, McGirr JG. The effect of a general practice after-hours clinic on emergency department presentations: a regression time series analysis. *Med J Aust* 2010; 192: 448–51.

22 Joe A, Lowthian J, Shearer M, Turner L, Brijnath B, Pearce C, Browning C, Mazza D. After-hours medical deputising service use by older people. *Med J Aust* 2016; 205: 397–402. doi:10.5694/mja16.00218

23 Lindstrom SJ, Nagalingam V, Newnham HH. Impact of the 2009 Melbourne heatwave on a major public hospital. *Intern Med J* 2013; 43: 1246–50. doi:10.1111/imj.12275

24 Turner LR, Connell D, Tong S. The effect of heat waves on ambulance attendances in Brisbane, Australia. *Prehosp Disaster Med* 2013; 28: 482–7. doi:10.1017/S1049023X13008789

25 Dolton P, Pathania V. Can increased primary care access reduce demand for emergency care? Evidence from England's 7-day GP opening. *J Health Econ* 2016; 49: 193–208. doi:10.1016/j.jhealeco.2016.05.002

26 Garth B, Temple-Smith M, Clark M, Hutton C, Deveny E, Biezen R, Pirotta M. Managing same day appointments: a qualitative study in Australian general practice. *Aust Fam Physician* 2013; 42: 238–43.

27 Lane R, Russell G, Bardoel EA, Advocat J, Zwar N, Davies PGP, Harris MF. When colocation is not enough: a case study of General Practitioner Super Clinics in Australia. *Aust J Primary Health* 2016; doi:10.1071/PY16039

28 Lee A, Lau FL, Hazlett CB, Kam CW, Wong P, Wong TW, Chow S. Factors associated with non-urgent utilization of accident and emergency services: a case-control study in Hong Kong. *Soc Sci Med* 2000; 51: 1075–85. doi:10.1016/S0277-9536(00)00039-3

29 Carret ML, Fassa AG, Kawachi I. Demand for emergency health service: factors associated with inappropriate use. *BMC Health Serv Res* 2007; 7: 131. doi:10.1186/1472-6963-7-131

30 Arendts G, Howard K. The interface between residential aged care and the emergency department: a systematic review. *Age Ageing* 2010; 39: 306–12. doi:10.1093/ageing/afq008

31 Honigman LS, Wiler JL, Rooks S, Ginde AA. National study of non-urgent emergency department visits and associated resource utilization. *West J Emerg Med* 2013; 14: 609–16. doi:10.5811/westjem.2013.5.16112

32 DeVries A, Li CH, Sridhar G, Hummel JR, Breidbart S, Barron JJ. Impact of medical homes on quality, healthcare utilization, and costs. *Am J Manag Care* 2012; 18: 534–44.

33 Janamian T, Jackson CL, Glasson N, Nicholson C. A systematic review of the challenges to implementation of the patient-centred medical home: lessons for Australia. *Med J Aust* 2014; 201: S69–73. doi:10.5694/mja14.00295

34 Williams ID, O'Doherty LJ, Mitchell GK, Williams KE. Identifying unmet needs in older patients: nurse–GP collaboration in general practice. *Aust Fam Physician* 2007; 36: 772–6.

35 Arain M, Nicholl J, Campbell M. Patients' experience and satisfaction with GP led walk-in centres in the UK; a cross sectional study. *BMC Health Serv Res* 2013; 13: 142. doi:10.1186/1472-6963-13-142

36 Wang M, Wild S, Hilfiker G, Chmiel C, Sidler P, Eichler K, Rosemann T, Senn O. Hospital-integrated general practice: a promising way to manage walk-in patients in emergency departments. *J Eval Clin Pract* 2014; 20: 20–6. doi:10.1111/jep.12074

37 Mercer T, Bae J, Kipnes J, Velazquez M, Thomas S, Setji N. The highest utilizers of care: individualized care plans to coordinate care, improve healthcare service utilization, and reduce costs at an academic tertiary care center. *J Hosp Med* 2015; 10: 419–24. doi:10.1002/jhm.2351

38 Hunchak C, Tannenbaum D, Roberts M, Shah T, Tisma P, Ovens H, Borgundvaag B. Closing the circle of care: implementation of a web-based communication tool to improve emergency department discharge communication with family physicians. *CJEM* 2015; 17: 123–30. doi:10.2310/8000.2014.141327

39 Harvey D, Foster M, Strivens E, Quigley R. Improving care coordination for community-dwelling older Australians: a longitudinal qualitative study. *Aust Health Rev* 2016; doi:10.1071/AH16054

40 May-Miller H, Hayter J, Loewenthal L, Hall L, Hilbert R, Quinn M, Pearson N, Patel A, Law R. Improving the quality of discharge summaries: implementing updated Academy of Medical Royal Colleges standards at a district general hospital. *BMJ Qual Improv Report* 2015; 4: u207268.w2918.

41 Maurice A, Chan S, Pollard C, Kidd R, Ayre S, Ward H, Walters D. Improving the quality of hospital discharge summaries utilising an electronic prompting system. *BMJ Qual Improv Report* 2014; 03: u200548.w2201.

42 Belleli E, Naccarella L, Pirotta M. Communication at the interface between hospitals and primary care: a general practice audit of hospital discharge summaries. *Aust Fam Physician* 2013; 42: 886–90.

43 Nagree Y, Gosbell A, McCarthy S, Moore K, Mountain D. Determining the true burden of general practice patients in the emergency department: getting closer. *Emerg Med Australas* 2013; 25: 487–90. doi:10.1111/1742-6723.12163