

# Predictors of ED attendance in older patients with chronic disease: a data linkage study

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## Abstract.

**Objective.** Older people represent a large proportion of emergency department (ED) presentations, with multiple comorbidities a strong predictor of frequent attendance. This study examined associations between the general practice management received by older patients with chronic disease and ED attendance.

**Methods.** This retrospective study examined linked data from general practice and ED for patients aged  $\geq 65$  years who presented to a general practitioner (GP) between 2010 and 2014. Data from the computerised medical records of patients attending 50 general practice clinics in the inner east Melbourne region were linked with ED attendance data from the same region. Patients with chronic disease were identified and characteristics of ED versus non-ED attendees were compared. Poisson regression was used to explore factors associated with ED usage.

**Results.** During the study period, 67 474 patients aged  $\geq 65$  years visited a GP, with 63.3% identified as having at least one chronic condition and 21.4% of these having at least one ED presentation. Over 70% of the ED presentations in this group resulted in hospital admissions. The most common diagnoses for ED presentation were cardiovascular disorders, pain and injuries. ED attendance was associated with being aged  $\geq 85$  years (incidence rate ratio (IRR) 2.09; 95% confidence interval (CI) 1.96–2.11), higher socioeconomic status (IRR 1.49; 95% CI 1.45–1.53), having a GP management plan (IRR 1.47; 95% CI 1.43–1.52), multimorbidity (IRR 1.53; 95% CI 1.46–1.60), more frequent GP visits (IRR 1.10; 95% CI 1.05–1.15) and having a higher numbers of prescriptions (IRR 1.51; 95% CI 1.44–1.57).

**Conclusion.** This study suggests that ED presentation is associated with greater frailty and multimorbidity in patients. Further research is necessary to determine why higher rates of chronic disease management through GP management plans and more frequent visits did not mediate higher rates of presentation and the reasons behind the socioeconomic differences in ED presentation for patients in this age group.

**What is known about the topic?** Increases in the volume and rate of ED presentations by older people will markedly affect emergency and acute hospital care and patient flow as the proportion of older Australians increases.

**What does this paper add?** We used a novel and highly transferable data linkage between data collected from the clinical records of general practice patients and their associated data from ED and hospital settings and examined the relationship between GP management received by older patients with chronic disease and ED attendance.

**What are the implications for practitioners?** Increasing utilisation of GP services may not have an effect on reducing ED attendance, particularly for older patients who may experience poorer overall health.

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## Introduction

The proportion and number of older people in the Australian community are growing. In the 40 years before 2017, the number of people aged  $\geq 75$  years increased by 1.2 million (reaching 1.6 million people, or 7% of the population, in 2017).<sup>1</sup> In the next 40 years, this group is forecast to increase by 3 million (reaching 4.6 million, or 10% of the population, in 2057).<sup>2</sup> This will have an effect on health services, because the number of health conditions increases with age. Nearly 87% of Australians aged 65 years reported having at least one of eight major chronic conditions (e.g. heart disease, diabetes), with over 60% suffering from two or more conditions.<sup>3</sup> The management of multiple conditions in older people can be complex, and integrated approaches to care delivered within the community are recommended to avoid unplanned hospitalisations.<sup>4</sup> However, despite these recommendations older people are disproportionately represented among emergency department (ED) attendees, contributing to approximately 20% of presentations<sup>5</sup> and increasing at an average annual rate of 6.1%.<sup>6</sup> As the proportion of older Australians increases, the increase in the volume and rate of ED presentations by older people will markedly affect emergency and acute hospital care and patient flow.

Primary care plays a critical role in reducing the progression of chronic disease.<sup>7</sup> General practitioners (GPs) are the main conduit for integrated care in the Australian health system, and are increasingly managing patients with chronic diseases of increasing complexity. As a result, several initiatives designed to improve coordinated management of these patients have been implemented, often through specific Medicare Benefit Schedule (MBS) items. Currently, patients who have a chronic medical condition and complex care needs can be managed under a GP management plan (GPMP; MBS Item 721) and team care arrangement (TCA; MBS Item 723). Both can be developed at most once every 12 months, with a review of the GPMP and TCA every 6 months (MBS Item 732).

To minimise preventable hospitalisations and provide more integrated and coordinated care, a new model of care for patients with chronic disease called Health Care Homes was recommended in late 2015.<sup>8</sup> Since 2016, this model has been trialled across Australia. Health Care Homes involves the voluntary enrolment of a patient with a main provider (usually their GP) who coordinates all aspects of their care and ensures care is flexible and team based.<sup>8</sup> A main difference with mainstream GP care is that the general practice receives block funding for each complex patient instead of a fee for service, so that emphasis can be on providing holistic care for the complex needs of the patient.

The general nature of the Health Care Home model recognises that a range of factors can influence patients' ED presentations, including GP availability, perceived immediate attention provided by hospitals, immediate access to in-patient services, perceptions of the complexity or seriousness of their health problems and affordability of care.<sup>6,9</sup> Although these factors shed light on the extenuating circumstances influencing ED presentation, there has been limited research examining the characteristics of older patients' ED presentations, particularly the relationship between the acute and primary care they receive. Undertaking such evaluation remains a challenge in Australia because there is currently a critical lack of data about the care patients receive in the general practice setting and their

subsequent utilisation of these secondary care services. The separation of service delivery, organisation of care and funding across different government levels, the multitude of private, isolated service providers and restrictions in effective communication pathways add to difficulties in understanding how patients receive and access services throughout the healthcare system.<sup>10</sup>

The limited availability of general practice data for research in Australia has also hindered the capacity to build a comprehensive picture of the interface between general practice and other healthcare services, and has restricted health services research concerned with optimising patient outcomes through more effective organisation of care.<sup>11</sup> This study addresses this knowledge gap by using data linkage between general practice data and ED presentation data to: (1) describe patients with at least one chronic condition aged 65 years who attend general practice; (2) describe the characteristics of ED presentation in these older patients; and (3) examine factors associated with higher ED attendance in this group.

## Methods

### *Study population*

This study used data linkage between general practice data collected from the computerised medical records of patients attending 50 general practice clinics in the inner east Melbourne region.<sup>12</sup> This small data source has since been superseded by an expanded dataset.<sup>13</sup> ED presentation data were provided by Eastern Health, which operates three public hospitals in the east Melbourne region.

### *Linkage process*

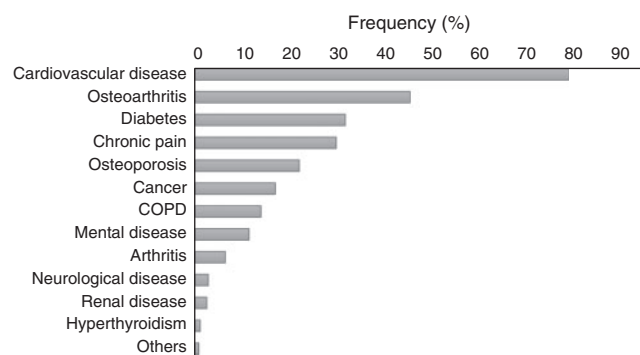
ED data were linked at the patient level to the general practice data via a statistical linkage key (SLK) for each unique patient that was generated for all general practice and ED records. A comprehensive set of SLKs was built using a unique function of GRAHNITE (Health Informatics Unit, Melbourne, Vic., Australia) for the identification of the same patients at different practices. The detailed information regarding the creation of this general practice database has been reported previously by Mazza *et al.*<sup>12</sup> We extracted data for patients who presented to a GP between 1 June 2010 and 31 June 2014 and were aged  $\geq 65$  years at the time of first consultation, and then linked these data to ED data.

### *Primary outcome*

The primary outcome in this study was the number of ED visits during the study period.

### *Key patient factors of interest*

Patients with chronic disease and having a diagnosis of at least one major chronic condition noted in their GP clinical records and/or claiming at least one MBS claim related to chronic disease (e.g. health assessment, GPMP and TCA) or care plan reviews were identified. Chronic conditions were grouped by two authors (TX and CP) and reviewed by all other authors based on the major disease categories reported by National Health Survey 2017–18.<sup>14</sup> Thirteen categories were identified: cardiovascular disease, diabetes, chronic pain, osteoporosis, cancer, chronic obstructive pulmonary disease, mental disease, arthritis, neurological disease,



**Fig. 1.** Major chronic conditions identified in patients aged  $\geq 65$  years. COPD, chronic obstructive pulmonary disease.

hyperthyroidism, osteoarthritis, renal disease and 'other' chronic conditions. Hypertension was excluded because it may have no morbidity, but we included the consequences of hypertension (i.e. cardiac failure, stroke and peripheral vascular disease).

#### Risks factors for ED presentation

Risk factor-related data derived from GP data were identified and extracted for each patient, including: (1) demographic factors (age, sex, socioeconomic status (approximated using the quintile on the Index of Relative Socioeconomic Disadvantage (IRSD)<sup>15</sup>); and (2) clinical and care-related factors (MBS items for GPMP or reviews, number of GP visits per year, number of prescriptions per year during the study period and multimorbidity). Multimorbidity was determined to be the presence of one (no multimorbidity), two to three or more than three major chronic health conditions listed in the patient's clinical record. Those patients with a GPMP but no diagnosis record of a chronic disease were defined to have 'unknown' multimorbidity.

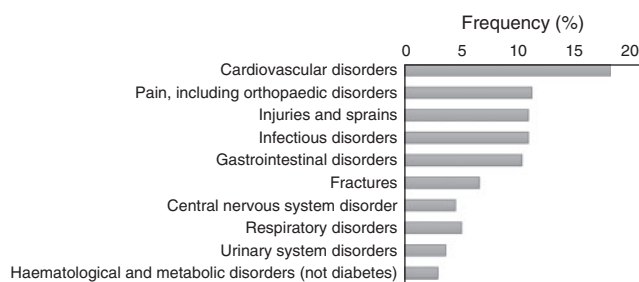
#### Statistical analysis

Descriptive analysis was used for age and sex distribution, frequency of major chronic conditions and the characteristics of ED presentations. Number of GP visits and prescriptions were examined across patients with and without ED presentations, with comparisons made using Chi-squared tests (proportions) and analysis of variance (ANOVA; mean values), with two-sided  $P < 0.05$  considered significant. The generalised linear model with Poisson distribution was used to explore determinants of ED presentation, with results presented as adjusted incidence rate ratio (IRR) with 95% confidence intervals (CIs). All data were analysed using Stata Version 13.1 (StataCorp, College Station, TX, USA).

Ethics approval for the study was obtained from the Monash University Human Research Ethics Committee.

#### Results

During the study period, 67 474 patients aged  $\geq 65$  years visited a GP, with 42 675 (63.2%) identified as having at least one chronic condition. The main chronic conditions identified were cardiovascular disease, osteoarthritis, diabetes, chronic pain and osteoporosis (Fig. 1).



**Fig. 2.** Primary diagnosis for emergency department presentation among older patients with at least one chronic condition.

Within the chronic disease group there were 9123 (21.4%) who had at least one ED presentation, compared with 3648 (14.7%) of the non-chronic disease patient group. As shown in Fig. 2, the most common types of primary diagnosis for ED presentation for older patients with chronic conditions were cardiovascular disorders, pain, injuries and sprains and infectious disorders.

Characteristics of patients with chronic conditions who did and did not attend an ED during the study period are given in Table 1. Almost 60% of patients with chronic conditions were female (5397; 59.2%). The 75–84 years age group had the highest number and proportion of ED attendance (3317; 36.4%), followed by those aged  $\geq 85$  years (3054; 33.5%). Furthermore, patients with higher socioeconomic status (a lower level of disadvantage as measured by the IRSD) had higher proportions of ED attendance than patients with lower socioeconomic status (higher level of disadvantage as measured by the IRSD; 97.1% vs 88.5% respectively). Those patients who had had a GPMP, TCA or three or more major chronic conditions also had higher proportions of ED attendance. In addition, patients who attended the ED had more GP visits (11.1 vs 8.3 visits) and were prescribed more medications (13.4 vs 10.0 prescriptions) per year than those who did not attend an ED.

Most ED presentations for patients with chronic conditions were as a result of referral by self, family and friends (18 769; 83.6%), and by patients residing in a private residence and living with others (15 709; 71%). Around 80% of ED attendances were in the Australasian Triage Scale (ATS) categories 3–5 (Table 2), and 15 865 (70.7%) of ED presentations resulted in hospital admission (either admitted to hospital or transfer), with only 5252 (23.3%) returned home.

Table 3 presents the odds ratios for risk factors associated with ED attendance among the study cohort. Sex and age were found to be significant predictors for ED attendance. Female patients had a 1.13-fold higher risk (95% CI 1.10–1.16) of ED attendance than male patients. Patients aged  $\geq 85$  years had a 2.09-fold higher rate (95% CI 1.96–2.11) of ED attendance than patients aged 65–74 years. Patients with a higher socioeconomic status had a 1.5-fold higher rate (IRR 1.49; 95% CI 1.45–1.53) of attending the ED than those in the lower socioeconomic group. Interestingly, compared with patients without a GPMP or TCA, those with a GPMP or TCA (IRR 1.29; 95% CI 1.24–1.34) and those who had a GPMP or TCA and associated review (IRR 1.47; 95% CI 1.43–1.52) were more likely to have attended an ED. Multimorbidity was also found to be associated with ED attendance, with patients with three or more chronic conditions

**Table 1. Characteristics and care-related factors of patients aged  $\geq 65$  years with at least one chronic condition ( $n = 42\,675$ ) by emergency department attendance in the 4-year study period**

Unless indicated otherwise, data are given as the  $n$  (%). BP, blood pressure; GP, general practitioner; GPMP, GP management plan; IRSD, Index of Relative Socioeconomic Disadvantage; TCA, team care arrangement

	ED attendance		P-value (Chi-square test unless specified otherwise)
	Yes ( $n = 9123$ )	No ( $n = 33\,552$ )	
Sex			
Female	5397 (59.2)	19 290 (57.5)	0.004
Male	3726 (40.8)	14 262 (42.5)	
Age at 2014 (years)			
65–74	2752 (30.2)	16 246 (48.4)	<0.001
75–84	3317 (36.4)	10 539 (31.4)	
$\geq 85$	3054 (33.5)	6767 (20.2)	
IRSD quintile			
1–3 (More disadvantaged)	268 (2.9)	3857 (11.5)	<0.001
4–5 (Less disadvantaged)	8855 (97.1)	29 685 (88.5)	
Care plan			
No GPMP or TCA	4812 (52.7)	21 136 (63.0)	<0.001
GPMP or TCA only	1517 (16.6)	4992 (14.9)	
GPMP or TCA and review	2794 (30.6)	7424 (22.1)	
Multiple comorbidity			
1	2676 (29.3)	12 797 (38.1)	<0.001
2–3	4093 (44.9)	13 035 (38.9)	
$>3$	1255 (13.8)	2651 (7.9)	
Unknown	1101 (12.1)	5080 (15.1)	
Mean no. (95% CI) GP visits per year	11.1 (10.9–11.3)	8.3 (8.2–8.4)	<0.001 <sup>A</sup>
Mean no. (95% CI) prescriptions per year	13.4 (13.2–13.8)	10.0 (9.9–10.10)	<0.001 <sup>A</sup>

<sup>A</sup>Analysis of variance.

having a 1.53-fold higher rate (95% CI 1.46–1.60–1.49) of ED attendance than those with only one chronic condition. Furthermore, patients who had  $\geq 10$  GP visits per year (IRR 1.10; 95% CI 1.05–1.15) or  $\geq 15$  prescriptions per year (IRR 1.51; 95% CI 1.44–1.57) had an increased risk of presenting at the ED. However, patients who had between six and 10 GP visits per year had 0.85-fold the risk (95%CI 0.81–0.88) of presenting at the ED compared with those who had fewer than five GP visits per year.

## Discussion

ED presentation in this study cohort was found to be associated with older age groups ( $\geq 85$  years), higher socioeconomic status, having had a GPMP or TCA, multiple comorbidities and increased number of GP consultations and prescriptions. Putting these results together showed that the ED users were more likely to be the oldest and sickest of the older people under investigation in this study. Because these ED users were found to already have more GP consultations and established GPMPs, we may initially assume that the majority of ED visits were appropriate. However, when we look more closely at the characteristics of these older people, we see most had cardiovascular disorders (excluding hypertension), and a significant proportion of this would be chronic heart failure.<sup>16</sup>

The rising number of unplanned presentations to hospital for older people with complex conditions that could be managed in primary care (e.g. heart failure) is of increasing concern.<sup>17</sup> These hospitalisations are classified as avoidable, because better management of the condition could be achieved by integrated

community care.<sup>17</sup> This study suggests that existing community care (incorporating GP chronic disease management initiatives) was not able to eliminate all unplanned ED presentations for chronic conditions, particularly by the oldest age group ( $\geq 85$  years).

The Independent Hospital Pricing Authority (IHPA) is developing funding penalties to be applied to public hospitals for readmissions of certain clinical conditions (including heart failure) that arise from complications of the management of the condition. The rationale behind such a punishment approach is to drive the public hospital services to coordinate care with community-based services and create new treatment regimens that better manage chronic heart failure in the aged, and therefore reduce unplanned readmissions to hospital.<sup>17</sup> Therefore, better management now has a financial as well as moral driver.

A greater proportion of older people aged  $\geq 65$  years with a chronic disease had at least one ED presentation in the study period (21.4%), compared with only 14.7% without a chronic disease. Cardiovascular disease was the most common chronic health condition in this group of older adults. The chronic disease prevalence among older patients in this cohort was approximately 60%, which is lower than the 87% reported by the Australian Institute of Health and Welfare (AIHW) and other studies of Australian general practice patients, such as the Bettering the Evaluation and Care of Health (BEACH) program.<sup>18</sup> This is likely due to differences in the coding of chronic disease and the types of conditions included; for example, the present study concentrated on conditions most likely to warrant a patient having a GPMP or TCA prepared, so we excluded



**Table 2. Characteristics of emergency department (ED) presentations by patients  $\geq 65$  years with at least one chronic condition**Data are given as *n* (%). ATS, Australasian Triage Scale; GP, general practitioner

	Patients with at least one chronic condition ( <i>n</i> = 9123)
Referred by:	
Self, family, friends	18 769 (83.6)
Nurse	1919 (8.5)
Local medical officer	1327 (5.9)
Other	430 (2.0)
Type of usual accommodation	
Private residence, living with others	15 709 (70.0)
Residential aged care facility	4153 (18.5)
Private residence, living alone	2318 (10.3)
Others	275 (1.2)
ATS category	
1 (highest acuity)	211 (0.9)
2	4203 (18.7)
3	10 567 (47.1)
4	6928 (30.9)
5 (lowest acuity)	536 (2.4)
Departure status	
Admitted to a hospital facility	15 865 (70.7)
Home	5252 (23.3)
Residential care facility	750 (3.3)
Left the ED	495 (2.3)
Died or dead on arrival	83 (0.3)
Destination on departure	
Not recorded	46 642 (74.3)
Local medical officer (includes GP or doctor)	4056 (18.0)
Out-patient	830 (3.7)
Review in ED	437 (1.9)
Specialist health practitioner	412 (1.8)
Other hospital	68 (0.3)

hypertension, which was the most prevalent diagnosed chronic condition among older patients. In addition, most of the patients in the study region came from less disadvantaged areas, which may also explain, in part, the lower regional prevalence rate.<sup>19</sup> In terms of specific chronic conditions, cardiovascular disease and osteoarthritis were found to be the most common for the study cohort, which is in line with previous findings reported by the BEACH program.<sup>18</sup>

This study estimated that one-fifth of older patients with chronic conditions had presented to an ED, compared with 14.7% of patients not identified with a chronic condition. This finding supports the findings of a previous state-wide study of this older patient group.<sup>20</sup> However, over one-third of ED presentations in the present cohort were categorised as ATS 4–5 (low acuity), slightly lower than the ratio reported by the AIHW's health services (38% of ED attendances by old patients were semi- or non-urgent).<sup>21</sup> Health professionals and patients have different perspectives towards the rationale of using ED for non-urgent conditions. One Australian study found that, rather than cost and access issues, patients' perceived severity of illness and perceived quality of ED care were key drivers of presentation at an ED for treatment.<sup>22</sup> Therefore, ED attendance

**Table 3. Predictors of emergency department (ED) attendance for patients with at least one chronic condition (*n* = 42 675)**

Output from the Poisson modelling with the following variables included in the model: sex, age, socioeconomic status, care plan, multiple comorbidity, frequent of GP visit and prescribed medication. CI, confidence interval; GP, general practitioner; GPMP, GP management plan; TCA, team care arrangement; IRSD, Index of Relative Socioeconomic Disadvantage

	Adjusted IRR	95% CI	P-value
Sex			
Female	Reference		
Male	0.88	0.86–0.91	<0.001
Age at 2014 (years)			
65–74	Reference		
75–84	1.66	1.60–1.72	<0.001
$\geq 85$	2.09	1.96–2.11	<0.001
IRSD quintile			
1–3 (more disadvantaged)	Reference		
4–5 (less disadvantaged)	1.49	1.45–1.53	<0.001
Care plan			
No GPMP or TCA	Reference		
GPMP or TCA only	1.29	1.24–1.34	<0.001
GPMP or TCA and review	1.47	1.43–1.52	<0.001
Multiple comorbidity			
1	Reference		
2–3	1.21	1.17–1.25	<0.001
>3	1.53	1.46–1.60	<0.001
Unknown	0.98	0.93–1.03	0.369
No. GP visits per year			
$\leq 5$	Reference		
6–10	0.85	0.81–0.88	<0.001
$\geq 10$	1.10	1.05–1.15	<0.001
No. prescriptions per year			
$\leq 5$	Reference		
6–15	1.20	1.17–1.25	<0.001
$\geq 15$	1.51	1.44–1.57	<0.001

for non-urgent conditions may be more common for older patients with existing chronic conditions.

The hospital admission rate of 70% was high, indicating that the present cohort uses significant hospital resources. This emphasises the need for further studies to understand ways to reduce the overall rates of chronic disease, the morbidity associated with them and the need for emergency attendance. In the present study, belonging to an older age group was found to be associated with ED presentation. This is largely consistent with other studies that have found older age to be a risk factor for the utilisation of ED services.<sup>23</sup> However, in contrast with other studies,<sup>24,25</sup> the present analysis suggests that higher socioeconomic status could be associated with presenting to an ED. One potential explanation for this is that people with middle or high income may use EDs for convenience or preference even though they have access to other sources of non-ED care.<sup>22</sup> In the present study, the observed relationship between increasing numbers of chronic conditions and ED presentation in old patients with chronic conditions is in line with previous analyses.<sup>26</sup>

It is often argued that improved primary care services (e.g. longer GP services and improved accessibility) can reduce the

demand for ED services.<sup>6,27</sup> However, in the present study, having a GPMP or TCA (with or without an associated review) and having a higher number of consultations and prescriptions were found to be strong predictors of ED presentation. A recent review on interventions to reduce ED utilisation found conflicting evidence of the association between increased supply of primary care services and lower ED usage.<sup>28</sup> Similarly, a UK study found that GP access factors did not explain differences in potentially avoidable ED attendance patterns.<sup>29</sup> In the care of patients with chronic conditions, previous studies have found that psychological or disease factors, such as the severity or extent of related complications, can affect health care utilisation.<sup>30</sup> Therefore, increasing utilisation of GP services may not have an effect on reducing ED attendances, particularly for older patients who may experience poorer overall health. In such cases, the patients may experience improved health outcomes through social and community-based interventions.<sup>31</sup>

The strength of the present study is that it used a valuable new dataset capable of capturing the entire patient journey between the general practice and acute care settings. Data from general practice clinics in the inner east Melbourne region were linked with ED data of the same region, to date remaining one of the few such datasets in Australia. Such linkages allow for new and advanced techniques of data interrogation that promise to change models of care.<sup>32</sup> Nevertheless, the study has several limitations. Although the study examined those patients identified as living with a chronic disease, the ability to accurately identify chronic disease in the patient record can be problematic because of a variety of reasons, such as data collection practices and differing definitions. However, the practices contributing data to this platform have been participating in data and care quality improvement programs for over 10 years.<sup>33</sup> In addition, the study population represented patients from the inner eastern Melbourne region, an economically prosperous area where most patients have a higher socioeconomic status. Therefore, the results may not be generalisable to populations of lower socioeconomic status. The limitations in the findings also suggest prospects for further research. An alternative analysis could explore patients attending general practice clinics with chronic disease who did or did not receive care plans and compare the characteristics and ED attendance rates of those patients to examine whether there are any differences between those who were receiving GPMPs compared with those who were not. Those who are subject to plans are still likely to be more complex than those who are not, but such analysis may provide further understandings that could be useful for population-level GP planning.

In conclusion, this study used a novel data linkage to examine associations between GP and ED care for older patients. ED presentation was found to be associated with older age, higher socioeconomic status, the presence of a GPMP or TCA, multiple comorbidity and an increased number of GP consultations and prescriptions. Future research is needed to explore non-urgent ED attendances by old patients with chronic conditions. This may help alleviate avoidable ED utilisation and improve acute care for critically ill patients in Australia.

### Competing interests

The authors declare no competing interests.

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