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Planning for the future: Emergency department presentation patterns in Tasmania, Australia

Claire Morley^{a,b,*}, Jim Stankovich^a, Gregory Peterson^{a,c}, Leigh Kinsman^{b,d}

^a Health Services Innovation Tasmania, Australia

^b School of Health Sciences, University of Tasmania, Australia

^c School of Medicine, University of Tasmania, Australia

^d Tasmanian Health Service North, Australia

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ABSTRACT

Background: Emergency department crowding and associated adverse outcomes are major issues in health care systems worldwide. The Australian government has highlighted the need to analyse emergency presentations to inform system redesign.

Objective: To describe the profile of emergency department presentations by Tasmanian residents to emergency departments over four years, and examine regional variations.

Method: A retrospective analysis of emergency department data for Tasmania's public hospitals over four financial years, 2010–11 to 2013–14, was undertaken. Descriptive statistics were used to identify patterns in Tasmanian state-wide emergency presentations, as well as disparities between Tasmania's three regions (South, North and North-West). Regression analysis was undertaken to test if changes were significant.

Results: State-wide presentations increased by 3.4% (139,352–144,130) over the four years. Regional variations included an increase in presentations of 16% in the South, 5.1% in the North and a decrease of 3.9% in the North-West. Per capita presentations were consistently lowest in the South and highest in the North-West. The South recorded a significant increase in per capita presentations of those aged 75 and over ($p = 0.001$), increasing at a rate of 12.5 per 1000 residents per annum (95% CI 5.8–19.2).

Conclusion: There is regional variation in emergency demand and utilisation in Tasmania. The results indicate that recent increases are predominantly occurring in the South, including in the elderly, and the reasons for this warrant further investigation.

1. Introduction

Increased presentations to Emergency Departments (EDs) contributing to crowding, and its associated adverse outcomes, are major issues in Australia and around the world [1,2]. Unfavourable outcomes of ED crowding include prolonged length of stay in ED for both high and low acuity presentations [3], and increased in-patient mortality [4–6]. Australia experienced a 21% increase in demand for care at public hospital EDs over the five financial years to 2013–14 [7]. The increase in ED presentations is not simply explained by the national population growth rate and aging of the population [8].

Research investigating the probability of an individual's attendance at an ED has highlighted particular groups whom are more likely to attend. In Australia, those living in outer regional, remote and very remote areas, as well as those living in lower socio-economic areas, are more likely to visit an ED than those living in major cities and areas of

higher socio-economic advantage [9]. Older Australians have also been highlighted as being over represented in EDs [9].

These drivers of ED utilisation are particularly relevant in Tasmania where all of the state is classified as either regional or remote [10]. In 2013–14, 34% of Tasmanians were classified as residing in either outer regional, remote or very remote areas, compared to 11% for Australia as a whole [10]. In addition, 32.9% of Tasmanians live in the most disadvantaged quartile of the Socio-Economic Indexes for Areas (SEIFA) index [11]. Of all Australian states and territories, Tasmania has the highest proportion of people aged over 65 years, accounting for 16.8% of the state's population in 2014 [11]. In Australia, both the Commonwealth and Tasmanian governments have highlighted the importance of identifying and analysing sources of ED presentations as a major priority [7,12].

The aim of this study was to describe the profile of presentations to Tasmanian EDs, including regional variations, over four financial years,

* Corresponding author at: Faculty of Health, University of Tasmania, Private Bag 34, Hobart, Tasmania 7000, Australia.
E-mail address: claire.morley@utas.edu.au (C. Morley).

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2010–11 to 2013–14. The data would provide information regarding demographics of ED users, acuity and time of presentations, mode of arrival, and discharge destination.

2. Methods

2.1. Study setting

Tasmania is Australia's most Southerly and only Island state with a population of 514,800 (2014) [10]. Between July 2012 and July 2015 Tasmania's acute healthcare system operated as three separate Tasmanian Healthcare Organisations (THOs). These THOs were serviced by four public hospital EDs; Launceston General Hospital (LGH) in THO North, North West Regional Hospital (NWRH) and Mersey Community Hospital (MCH) in THO North-West and Royal Hobart Hospital (RHH) in THO South. Each hospital offers 24 h a day ED services.

2.2. Study design

A retrospective analysis of ED presentations to Tasmania's public hospitals over four financial years (2010–11 to 2013–14) was undertaken. The study was approved by the Tasmania Human Research Ethics Committee (application number H13948).

Data for all patients attending the four public hospital EDs in Tasmania were provided by the Tasmanian State Department of Health and Human Services (DHHS). The DHHS data contains de-identified demographic, administrative and clinical information pertaining to all ED presentations.

In Australia the Statistical Area-level 2 (SA2) code is the base spatial unit used to collect statistics. Collectively the SA2s cover the whole of Australia without gaps or overlaps (average population 10,000) [13]. Patients' places of residence were assigned to one of Tasmania's three regions, South, North or North-West (NW) using SA2 codes. This excluded presentations to Tasmanian EDs by non-Tasmanians, indicating only patterns of ED usage by Tasmanians. Similarly, in sub-group analyses of presentations in a particular region, only residents of that region were counted.

All patients who present to an ED in Australia are assigned one of five possible categories of the Australian Triage Scale (ATS) [14]. ATS 1 represents the most urgent or highest acuity group with ATS 5 representing the least urgent or lowest acuity group. For ease of comparison in this study, triage categories were grouped into ATS 4 and 5 (low acuity presentations (LAPs)) and ATS 1–3 (high acuity presentations).

Data were coded to identify patients who attended the ED in the out-of-hours period. Using a definition applied by Primary Health Tasmania (PHT) [15], out-of-hours included before 8am and after 6 pm on Monday to Friday, before 8am and after 12 pm on Saturday, and all day on Sunday and public holidays.

2.3. Data analysis

Data were obtained for four financial years, July 1st 2011 to June 30th 2014 inclusive. Descriptive statistics were used to compare changes in mode of arrival to the ED, urgency of presentation, in-hours versus out-of-hours attendance and discharge destination. Linear interpolation was applied to annual population estimates obtained from the Australian Bureau of Statistics (ABS) [16] to estimate quarterly populations. These figures were used to calculate per capita presentations for the state as a whole and for each of the three regions by five-year age bands. Linear regression analyses were undertaken to test whether changes in per capita presentations were statistically significant ($p < 0.05$). Data were analysed using R version 3.1.2 and Microsoft Office Excel 2013.

3. Results

3.1. Absolute numbers of presentations to Tasmanian EDs by Tasmanians

The data set initially comprised 580,456 presentations. After excluding presentations by non-Tasmanians, the final data set number was 563,649 (2.9% excluded). Presentations to Tasmanian EDs increased from 139,352 to 144,130 (3.4%) from the first year of the study period (2010–11) to the last (2013–14). Over this time the number of patients presenting to the ED who were subsequently admitted to hospital increased by 23% (29,887–36,807), while ambulance arrivals increased by 11.5% (34,689–38,672). In the four years, high acuity presentations increased by 6.8% (57,558–61,490) while LAPs increased by 1% (81,403–82,242). Presentations in the out-of-hours period remained relatively stable, with 54% of all presentations occurring during this time in the both the first and last years of the study (data not shown).

3.2. Regional patterns

When the data were disaggregated into regions, different patterns emerged (Table 1). Presentations in the South increased each year of the study and recorded a 16% increase over the four-year period, with increases observed across all five-year age bands. Presentations in the North decreased in the second year (2011–12) but recorded an overall increase of 5.1% between the first and final years. Changes in the North-West varied over the study period, and the region recorded an overall decrease in presentations of 3.9%.

The South recorded increases across all levels of acuity with the greatest increase (25%) for LAPs. The North recorded increases of 5% across both high and LAPs, and the North-West recorded an increase in high-acuity presentations (14%) and a comparative decrease in LAPs (–14%). Whilst all regions recorded an increase in ambulance presentations, particularly in the South (20%), the proportion of ED patients arriving by ambulance varied greatly between regions: 35% in the South, 25% in the North and 20% in the North-West in 2013–14.

Thirty-three per cent of all presenters in the South in 2013–14 were subsequently admitted, an increase of 24% over the study period. The proportion of presentations resulting in admission in the North and the North-West equated to approximately one-fifth of all attenders, with increases over the period of 26% and 28%, respectively (Table 1).

3.3. Per capita presentations

When examining per capita presentations, different patterns emerged for each region (Fig. 1). Although absolute numbers of presentations in the North-West fell over the time period, this region consistently saw greater per capita presentations across all age groups than the other two regions. Residents in the North consistently presented at a greater rate than residents in the South.

3.4. Acuity of presentations

When comparing per capita presentations by level of acuity (Figs. 2 and 3) there was further evidence of regional variation. LAPs in the South increased across all age groups (Fig. 2a), with significant increases seen in all age-bands under 60 years ($p < 0.005$). LAPs in those aged under 60 years in the South increased at a rate of 9.9 per 1000 residents per annum (95% confidence interval 7.1–12.7). Conversely, there was a statistically significant decrease in LAPs across the majority of age bands in the North-West (Fig. 2c). High-urgency presentations in the North-West increased at a significant rate in almost all age groups between ages 10–54 years (Fig. 3c). The South recorded increases in high-urgency presentations in some of the older age bands (Fig. 3a). The North recorded increases of 5.4% and 5% in high (Fig. 2b) and low (Fig. 3b) acuity presentations respectively.

Table 1
Comparison of regional Tasmanian ED usage by residents of each region, 2010–11 to 2013–14.

	South (%)			North (%)			North-West (%)		
	2010–11	2013–14	% Change	2010–11	2013–14	% Change	2010–11	2013–14	% Change
Population	252 805	256 338	1.4	143 369	143 695	0.2	113 990	113 897	-0.1
Total number of Presentations	42 712	49 539	16	39 302	41 306	5.1	48 917	47 026	-3.9
ARRIVAL MODE									
Emergency Amb.	14 275 (33)	17 113 (35)	20	9 345 (24)	10 226 (25)	9.4	8 687 (18)	9 208 (20)	6.0
“Walk-ins”	27 202 (64)	31 306 (63)	15	29 636 (75)	30 652 (74)	3.4	39 931 (82)	37 380 (79)	-6.4
TIME OF DAY									
In Hours	17 866 (42)	20 947 (42)	17	17 332 (44)	18 243 (44)	5.3	23 035 (47)	21 618 (46)	-6.1
Out-of-Hours	24 846 (58)	28 591 (58)	15	21 970 (56)	23 063 (56)	4.9	25 882 (53)	25 408 (54)	-1.8
AUSTRALIAN TRIAGE SCALE									
1	309 (0.7)	366 (0.7)	18	122 (0.3)	130 (0.3)	6.6	131 (0.3)	169 (0.4)	29
2	3 915 (9)	4 820 (10)	23	2 688 (7)	2 788 (7)	3.7	2 674 (5)	3 756 (8)	40
3	16 385 (38)	16 819 (34)	2.6	13 453 (34)	14 221 (34)	5.7	14 316 (29)	15 659 (33)	9.4
4	16 605 (39)	20 236 (41)	22	21 454 (55)	20 890 (51)	-2.6	25 442 (52)	23 787 (51)	-6.5
5	5 316 (12)	7 106 (14)	34	1 475 (4)	3 175 (8)	115	6 352 (13)	3 647 (8)	43
ATS 1–3	20 609 (48)	22 005 (44)	6.8	16 263 (41)	17 139 (41)	5.4	17 131 (35)	19 584 (42)	14
ATS 4 & 5	21 921 (51)	27 342 (55)	25	22 929 (58)	24 065 (58)	5.0	31 494 (65)	27 434 (58)	-14
ED DISCHARGE DESTINATION									
* Non-admitted	29 317 (69)	32 980 (67)	12	32 583 (83)	32 827 (79)	0.7	41 412 (85)	37 390 (79)	-10
# Admitted	13 395 (31)	16 559 (33)	24	6 719 (17)	8 479 (21)	26	7 505 (15)	9 636 (20)	28

* Departed without being admitted, dead on arrival, did not wait, left at own risk.

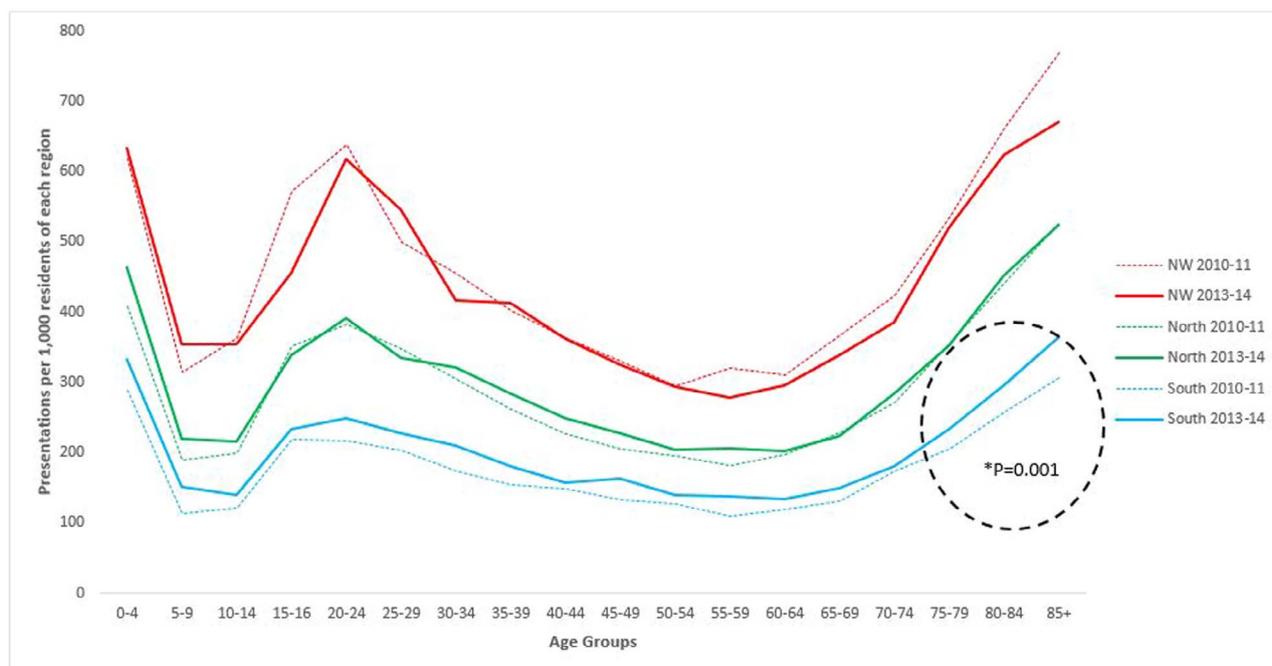
Admitted, referred to another hospital for admission, died in ED.

3.5. Increased presentations in the South

Total presentations in the South increased across all age bands; however, presentations of those aged 75 and over increased at a significant rate ($p = 0.001$) (Fig. 1). Regression analysis of per capita presentations versus time found that presentations of those aged 75 and over in the South, between 2010–11 and 2013–14, increased at a rate of 12.5 per 1000 residents per year (95% confidence interval 5.8–19.2).

In 2013–14, 68% of presenters to the RHH aged 75 and over were admitted, versus 29% of those aged less than 75 (OR 5.2, 95%

confidence interval 4.9–5.5) (Table 2). The higher proportion of admissions in the older age group was consistent each year of the study. Similarly, the mean length of stay for those age 75 and over was consistently longer than for younger presenters. This remained the case regardless of the outcome of the presentation (Table 2). In 2013–14 patients aged 75 years and older spent over 36,000 h in the RHH ED (data not shown).



* Significant increase in per capita presentations of those aged 75 and over in the South

Fig. 1. Per capita presentations to Tasmanian EDs by residents of each region; 2010–11 and 2013–14.

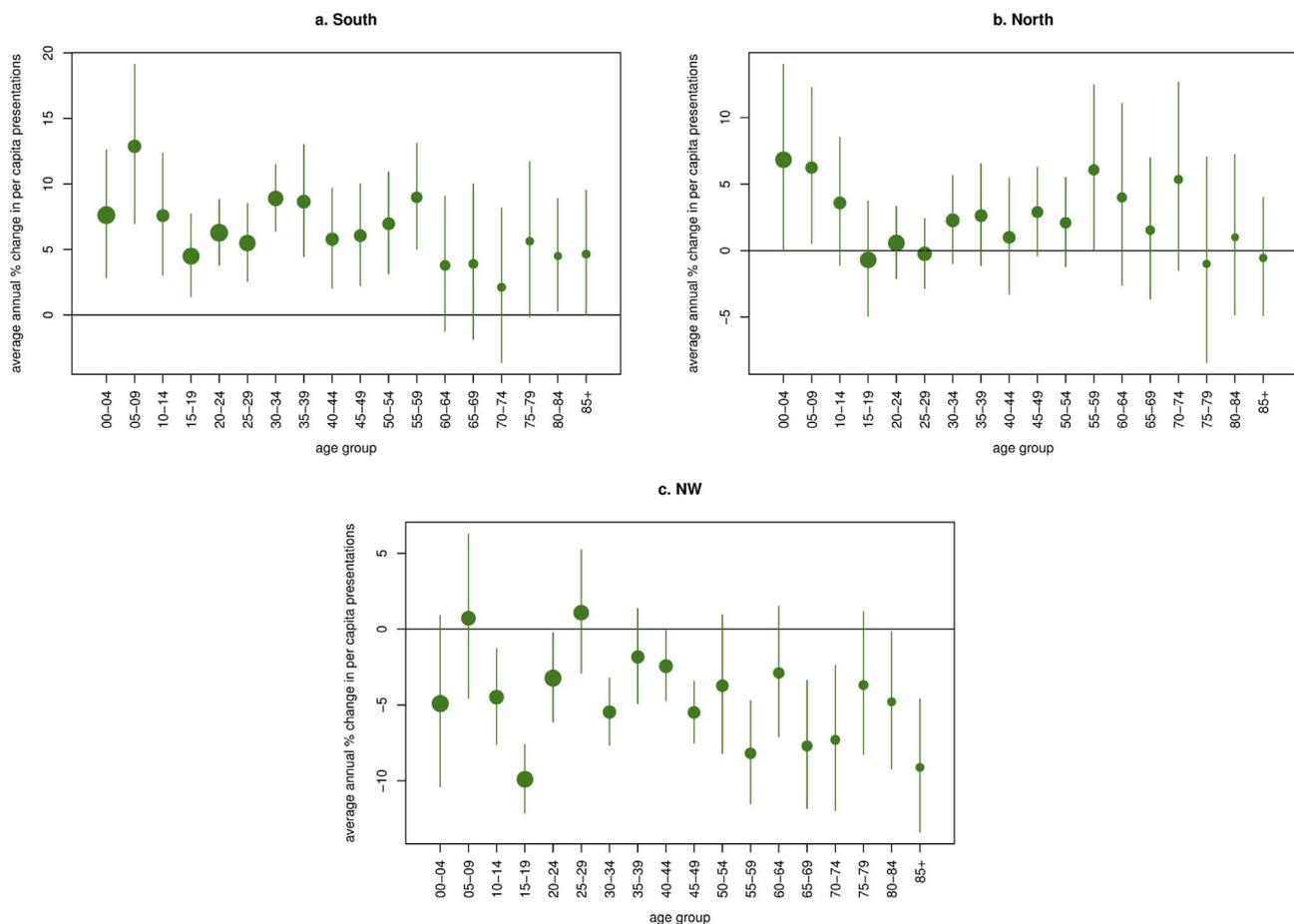


Fig. 2. Annual average percentage change in per capita presentations of *low acuity* patients to Tasmanian regional EDs, 2010–11 to 2013–14: a. South, b. North, c. NW. # Australian Triage Categories 3 & 4 combined. The size of the dots donate the actual numbers of presenters in that age group in 2013–14.

4. Discussion

The main finding of this study was the widespread variation in ED usage between Tasmania's three regions. This result can be further divided into three main points. Firstly, residents in the state's North-West present to the ED at a much greater per capita rate than the other two regions, and at a rate greater than the national average [7]. Secondly, in terms of increased presentations, the majority of the increases were in the South of the state. Finally, although presentations in the South of the state increased across all five-year age-bands, there was a significant increase in presentations of those age 75 years and older, across all triage categories.

When considering state-wide ED presentations in the four years under study, there were sizable increases in the proportion of patients arriving by ambulance, presenting with high acuity conditions and being subsequently admitted to hospital. This finding in itself depicts a significant threat to existing ED resources.

4.1. Per capita presentations in the North-West

Residents of the state's North-West presented to ED at a per capita rate of up to 2.5 times that of the South. This large disparity in regional per capita presentations has continued, even allowing for the overall drop in presentations in the North-West. North-West Tasmania is the most rural part of the State, and this is a potential explanation for the high per capita rates of presentation in this region. Callen and colleagues, who undertook a survey of attendees at a rural Australian hospital, highlighted patients' perspectives that rural EDs are an important alternative to primary care, particularly in the after-hours period [17].

Similarly, a previous study undertaken by Cheek and colleagues in NW Tasmania concluded that providing low-acuity care in parallel with more acute services may be the best service model to meet the needs of rural communities [18]. Cheek's suggestion may have been related to the reduced availability of GPs in this rural area. The most recent GP census in Tasmania showed that the North-West had the highest number of patients per full time equivalent GP in the state (1389 people), which was also higher than the national average (1214 people) [19].

The high per capita ED presentations in this region has been reported before [20], with researchers speculating that the EDs in North-West Tasmania 'act as GP super-clinics'. However, here we present a new finding, that there has been a recent decrease of 14% in LAPs in this region, while high acuity presentations have increased by 14% with a corresponding increase in admissions. This finding suggests that rather than using the EDs as GP clinics, residents of the North-West are changing how they utilise the service and are starting to reserve presentations to the ED for more serious conditions. An investigation into what has led to this change in healthcare-utilisation behaviour is warranted. Future research could involve an exploration of changes in local healthcare service provision as it is possible that changes in access to alternative forms of healthcare has led to the recent reduction of LAPs to the EDs in this region.

4.2. Increases in the South

Another regional variation identified is the increase in presentations in the South of the state compared to a decrease in the North-West and a modest increase in the North. The increase in the South equated to an

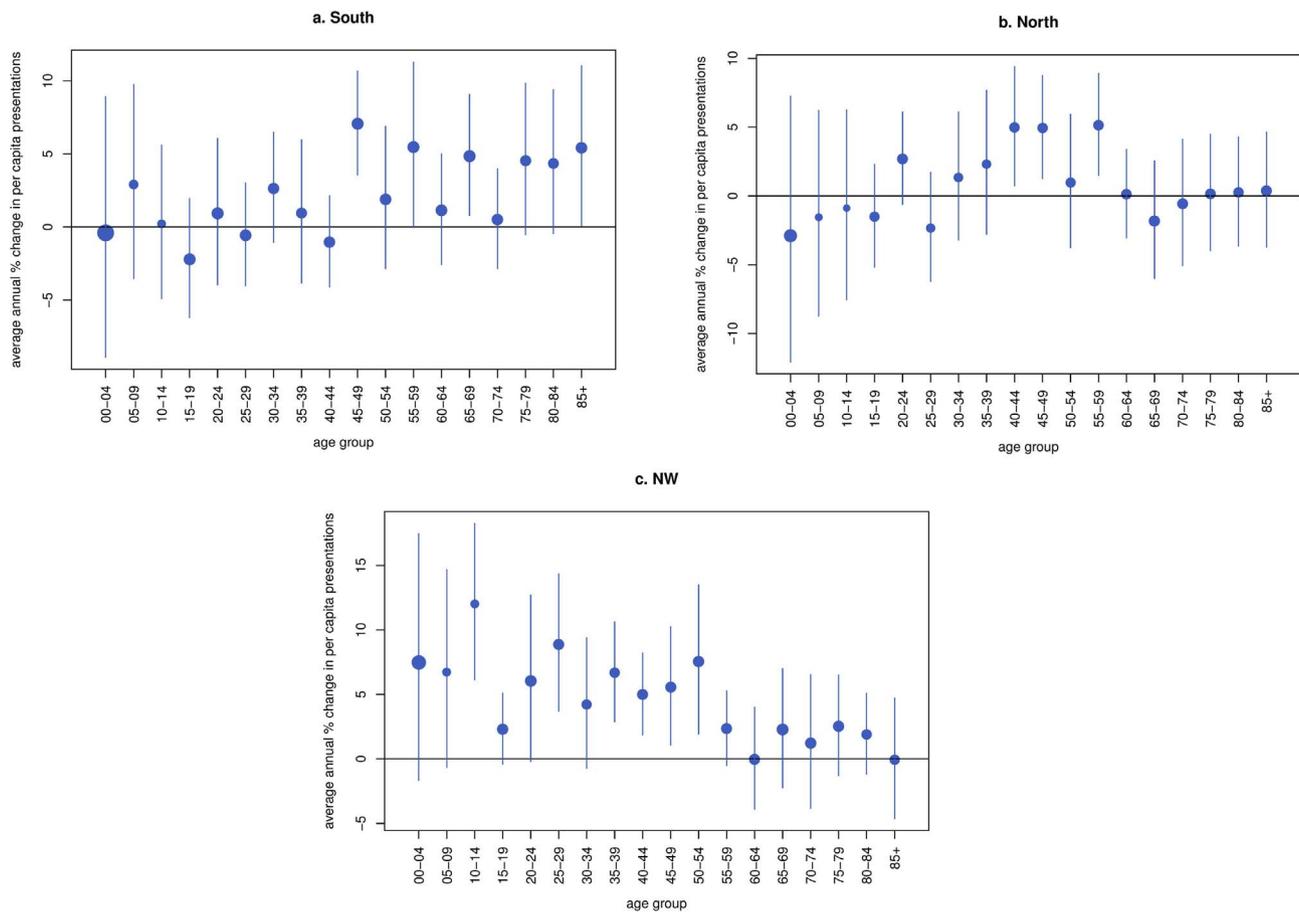


Fig. 3. Annual average percentage change in per capita presentations of [#]high acuity patients to Tasmanian regional EDs, 2010–11 to 2013–14: a. South, b. North, c. NW. [#] Australian Triage Categories 1, 2 & 3 combined. The size of the dots donate the actual numbers of presenters in that age group in 2013–14.

Table 2
Comparison of [#]LOS in the South between patients aged < 75 years and patients aged ≥75 years.

	< 75				≥ 75				Odds of admission (95% CI)
	Mean LOS Admitted	Mean LOS Discharged	Mean LOS	% admitted	Mean LOS Admitted	Mean LOS Discharged	Mean LOS	% admitted	
2010–11	9.7 h (585 min)	3.7 h (221 min)	5.3 h (320 min)	27	11.2 h (673 min)	5.0 h (301 min)	9.2 h (553 min)	68	5.6 (5.3–6.0)
2011–12	7.3 h (440 min)	3.3 h (196 min)	4.3 h (260 min)	26	8.1 h (488 min)	4.8 h (289 min)	7.0 h (418 min)	65	5.2 (4.9–5.6)
2012–13	8.0 h (481 min)	3.1 h (187 min)	4.3 h (261 min)	25	9.3 h (558 min)	4.2 h (252 min)	7.4 h (446 min)	63	5.2 (4.8–5.5)
2013–14	7.1 h (426 min)	2.9 h (176 min)	4.1 h (249 min)	29	8.9 h (532 min)	3.7 h (224 min)	7.2 h (434 min)	68	5.2 (4.9–5.5)

[#] Length of Stay.

annual average increase of 5.1%, greater than that reported by other Australian regions [21,22]. This increase was not explained by population growth, as the population of this region increased by only 1.4% over the four-year period [16]. The majority of the increase was in LAPs (25%). In fact, the majority of the increased presentations by those aged 60 years and under can be attributed to increases in LAPs by patients in this demographic (Fig. 2a).

Interestingly, Dinh and colleagues, who conducted a recent retrospective analysis of ED presentations in New South Wales, covering the five years 2010–2014, reported no increase in LAPs [23]. These researchers used a different definition of low acuity, that is, a definition used by the Australian government for potentially avoidable ‘GP-type’ presentations. As well as including patients allocated triage categories 4 or 5, it also included patients who were self-referred and who were

subsequently discharged to their usual place of residence. However, when our data were reanalysed using this alternative definition, we still found a 21% increase in LAPs in the South of Tasmania. It is possible the discrepancy lies in the number of LAPs referred by their GP to the ED in the South, as a recent investigation into LAPs in the North of Tasmania reported almost 29% of LAPs had been told to go to the ED by a doctor or a nurse [24]. Unfortunately, identifying self-referred LAPs was outside the scope of this analysis. It is worth noting that the Australian government has recently ceased reporting figures for potentially avoidable ‘GP-type’ presentations, due to the limitations of the definition [7].

While increased LAPs to the ED may not directly lead to overcrowding, studies have reported reductions in wait time and length of stay in ED for higher acuity patients by diverting LAPs away from the

ED [25], or steaming their care within the ED [26]. Therefore, it is worthwhile trying to understand the reasons patients attend the ED for non-urgent conditions. In a survey of Australian patients who attended EDs during 2013–14, 22% of respondents felt the required care could have been provided by a GP [9]. Unavailability of their GP was the reason given by 23% of these attendees, while 3% believed that the waiting time to see a GP was too long [9]. The proportion of Tasmanian respondents who reported that their GP was unavailable (15.9%) was the lowest in the country [27]. However, in 2012–13 GP type presentations (according to one definition) in Tasmania accounted for 41.9% of all ED presentations, which was substantially above the national average of 32.4% [12].

The drivers behind LAPs to the ED have been investigated in multiple studies that have reported similar contributing factors [1,24,28]. While different methodologies were used in these studies, including interviews [1,28] and surveys [24], all studies identified barriers in accessing primary care and patient perceived urgency of care as factors associated with the decision to attend the ED. Unwin and colleagues [24] concluded that providing more accessible and appropriate services could lead to a reduction in LAPs to the ED. It is feasible that providing increased access to alternative forms of care, coupled with patient education on appropriate use of services could reduce LAPs in the South. However, to identify the strategies most likely to succeed it is important to understand the specific contextual factors that have led to this sustained increase.

Therefore, future research should focus on an investigation of the specific factors that contribute to residents of Tasmanian deciding to seek treatment at the ED for low acuity conditions. It is essential that the opinions and motivations of local presenters are sought, as only they can identify the decision making processes behind their attendance at the ED, and consequently may provide insights into acceptable alternatives to ED for their specific health care needs.

4.3. Presentations by the elderly

When looking at total presentations in the South, there was a significant increase in per capita presentations of people aged 75 and over (Fig. 1). Presentations of those aged 75 years and over at the RHH represent more than 10% all ED presentations and over 22% of all admissions, with the proportion increasing each year of this study. Presentations in this age group are increasing at a rate of 12.5 per 1000 residents per year, with 68% of these presentations resulting in an admission in 2013–14. The amount of time this group spent in the RHH ED in 2013–14 is equivalent to over four ED cubicles per day being occupied by a person aged 75 years or over.

Other Australian studies have identified presentations by the elderly as one of the factors contributing to increased ED presentations. In a ten-year retrospective analysis of all ED presentations in metropolitan Melbourne, older people (defined as aged 70 and over) were identified as being disproportionately represented in ED [29]. Similar to our study, the Melbourne study found older patients spent longer in the ED and were more likely to be admitted than younger adults [29]. A retrospective analysis of ED presentations undertaken in Sydney, Australia attributed a 36% increase in ED presentations over eleven years to be predominantly driven by the growth in acute, elderly presentations requiring hospital admission [30]. A recent Japanese study that investigated the relationship between ED length of stay (LOS) and the trend of an aging society concluded that the age of ED presenters had a significant negative effect on ED crowding, as ED LOS increased proportionately with the mean age of ED presenters [31]. Kawano and colleagues further advised that countries facing the issue of an aging population anticipate the effect this will have on ED crowding and take preventative measures to address the potential impact on the healthcare system [31].

As Tasmanian has the highest mean age of all Australian states and territories any significant or sustained growth in ED presentations of

those aged 75 and over is a major concern. Not only is the state population of this demographic forecast to continue increasing, but the burden in terms of time and resources this group place on the ED is already significant. It is important to note that as these results show an increase in per capita presentations, the issue is not simply that a greater number of older people are attending the ED, but each older person in the South is more likely to attend.

This result merits further investigation into the causes behind this significant increase in ED presentations by those aged 75 years and older. Future research could investigate whether older residents of the South are sicker than before, and therefore require more hospital admissions. Additionally, an exploration of older residents' perceptions of access to primary care may yield some insights into what is driving this increased need for emergency care.

4.4. State-wide presentations

Finally, the state-wide analysis identified increases in high acuity presentations and patients arriving by ambulance to the ED. This appears to be consistent with the increased acuity of ED presentations, demonstrated by a 23% increase over four years in the proportion of presentations who were subsequently admitted. The increase in admissions was evident across all three regions (Table 1). Indeed, the admission rate of 33% in the South in 2013–14 was higher than the Australian average for the same period (29%) [7]. A report by the Tasmanian government has previously highlighted the strain that increased hospital admissions are placing on the healthcare system [12]. This report identified Tasmanian EDs as having higher levels of access block than the national average, with 36% of all Tasmanians spending greater than eight hours in the ED, compared with 27% nationally (2012–13) [12].

Similar to the current study, Lowthian and colleagues also identified substantial increases in the proportion of ambulance arrivals, high acuity patients and ED presentations subsequently requiring an admission over a 10-year period in Victoria, Australia [21]. Increased ED presentations related to the growth in high acuity patients was also a finding of a Western Australian (WA) study that examined trends in state-wide ED presentations over seven calendar years (2007–2013) [22].

The current study adds to the growing body of evidence that high acuity patients who require admission to an in-patient bed are contributing substantially to the increase in ED presentations. This result suggests that healthcare policy needs to incorporate effective health promotion measures to keep the population healthier, and to consider whether alternative services for people with chronic diseases can reduce the need for hospital admissions. It is known that solutions to crowding in EDs lie outside of the ED itself, therefore a concerted effort to identify the causes of increased ED presentations and develop system-wide solutions that are both appropriate and acceptable to local residents is necessary.

5. Limitations

ABS population data were used to calculate per capita presentations. Therefore, the patterns of per capita presentations are reliant on these population data, which are estimates based on updates to 2011 Australian census data. Analyses of the trends in clinical diagnoses presenting to ED may be helpful in describing the profile of presentations, but was beyond the scope of this paper.

6. Conclusions

This study provides a comprehensive analysis of patterns of ED presentations by Tasmanian residents over a four-year period. The analyse highlights sizeable regional variations in patterns of ED usage which suggests that interventions aimed at reducing ED presentations

need to be based on local knowledge to ensure local issues are taken into consideration. Results also indicate that a significant proportion of the increase in ED presentations in Tasmania is related to increased presentations by those aged 75 and older in the South of the state. Further research to ascertain the drivers behind these significant changes in healthcare usage in Tasmania, including trends in the types of presenting conditions and referral sources, would provide useful insights into how best to plan for and manage future impacts on hospital resources.

Conflict of interest

None.

Ethical Statement

The study was approved by the Tasmania Human Research Ethics Committee (application number H13948).

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