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Older people presenting to the emergency department after a fall: a population with substantial recurrent healthcare use

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ABSTRACT

Objectives To document patient characteristics, care pathways, healthcare use and costs of fall-related emergency department (ED) presentations by older adults.

Participants and methods All fallers aged ≥70 years, presenting to the ED of a 450-bed metropolitan university hospital in Sydney, Australia (1 April 2007 through 31 March 2009) were studied. Data were collected from the ED electronic information system, ED clinical records and the hospital electronic information system database. Population estimates for 2008 for the local areas served by the hospital were used to estimate ED presentation rates.

Results Of 18 902 all-cause ED presentations, 3220 (17.0%) were due to a fall. Among fallers, 35.4% had one or more ED presentations and 20.3% had had one or more hospital admissions in the preceding 12 months. Fall-related ED presentation led directly to hospital admission in 42.7% of the cases, the majority of which (78.0%) received acute care only (length of stay—14.4 days for men and 13.7 days for women) and the remaining cases underwent further inpatient rehabilitation (length of stay 35.6 days for men and 30.1 days for women). After hospitalisation, 9.5% of patients became first-time residents of long-term care facilities. All fall-related ED presentations and hospitalisations cost a total of A$11 241 387 over the study period.

Conclusions Older fallers presenting to the ED consume significant healthcare resources and are an easily identifiable high-risk population. They may benefit from systematic fall-risk assessment and tailored fall-prevention interventions.

INTRODUCTION

The prevention of falls among older people is an urgent public health challenge in Australia and internationally. At least one-third of people aged ≥65 years fall once or more annually.[1] Falls can result in injuries, a loss of confidence and a subsequent reduction in activity levels and community participation. Falls are also associated with a threefold increase in the risk of being admitted to a residential aged care facility (RACF) after adjusting for other risk factors.[2]

Falls and resultant fractures have a major impact on older individuals and also on their carers, health services and the community. This impact will grow substantially in the near future owing to the increased proportion of older people in the population. The proportion of Australians aged ≥65 years is predicted to increase from 13% (1.1 million people) in 2010 to 23% (8.1 million people) by 2050.[3] By 2051, the Australian total annual health costs from fall-related injury will increase almost threefold to $1.4 billion.[4]

The emergency department (ED) is a critical point of access to healthcare as it is used by many older people who have had a fall. Previous studies have attempted to examine the characteristics and outcomes of older people presenting to the ED after a fall,[5–7] and one study conducted in the UK showed that older people presenting to the ED with a fall represented 20% of all attendees and 14% of all hospitalisations in people aged ≥65 years.[6] There is, however, limited information about how patients move through the healthcare system, and the type of care they receive after a fall-related ED presentation. There is therefore a need for more detailed data on patient characteristics, including discharge destinations, healthcare use and costs associated with fall-related ED presentations in order to quantify the impact on healthcare resource use and plan for the development of effective interventions and prevention programmes.

The aim of this study is to document the characteristics of older fallers presenting to the ED, describe their transition through the hospital system and to estimate associated costs.

PARTICIPANTS AND METHODS

Data and analytical methods

The study sample included all fallers aged ≥70 years, presenting to the ED of a 450-bed metropolitan university hospital in Sydney, Australia between 1 April 2007 and 31 March 2009. A fall was defined as "unintentionally coming to the ground or other lower level" and fallers were defined as "patients in whom a fall was a contributing factor to the ED presentation". Given the overlap between falls and syncope, people who might have collapsed were not excluded from the analysis. Sociodemographic, patient activity and coding information were collected from the ED electronic information system and the hospital administration system database while detailed clinical information was collected from daily review of the ED medical records. The following data were obtained from the ED electronic information system electronically and through daily review of the ED medical records: patient ID, age, gender, day and time of presentation, usual place of residence, length of time spent in the ED, discharge destination and number of ED presentations and

Table 1 Fall-related annual emergency department (ED) presentation rate by age group and gender

	Men			Women			Total		
Age group, years	N* (%)	Population	Rate/1000	N* (%)	Population	Rate/1000	N* (%)	Population	Rate/1000
70–74	82 (18)	2383	34.41	104 (14)	2581	40.29	186 (15)	4964	37.47
75–79	97 (22)	1942	49.95	144 (19)	2559	56.27	241 (20)	4501	53.54
80–84	115 (26)	1489	77.23	184 (24)	2085	88.25	299 (25)	3574	83.66
85+	152 (34)	899	169.08	332 (43)	2041	162.67	484 (40)	2940	164.63
Total	446 (100)	6713	66.44	764 (100)	9266	82.45	1210 (100)	15979	75.72

*Presentations from Randwick and Botany local government areas only (estimated from subset presenting to ED for which postcodes were available).
The overall presentation rate differed significantly between genders (p=0.0002).

hospital admissions to the same hospital in the previous 12 months. The following data relating to fall-related hospitalisations were obtained from the hospital administration system: length of stay (LOS), diagnosis-related group (DRG), admitting specialty, type of care (acute and rehabilitation), discharge destination and 4-week readmission status.

Population census data for the year 2008, published by the New South Wales Department of Planning,[8] were used to estimate the denominator in the rate of ED presentations. The estimates represented the two local government areas served by the hospital (Randwick and Botany Bay, with a combined area of 58 km^2).

Age-specific, fall-related ED presentation rates were calculated per 1000 people for the two local government areas served by the hospital.

Descriptive statistics were based on a per-patient or per-case basis. The proportions of patients who had multiple ED presentations and hospital admissions in the 12 months before their first fall-related ED presentation were calculated on a per-patient basis. All other descriptive statistics were calculated on a per-case basis, and stratified by age group and gender.

Costs were calculated by applying New South Wales average cost estimates to relevant patient or case counts. To compute fall-related ED costs, the average cost estimate for an ED presentation (A$380)[9] was multiplied by the total count of fall-related ED presentations. To calculate acute care hospital costs, the Australian refined (AR)-DRG weights were applied to the appropriate DRG codes in each case of fall-related hospitalisation.[9] The average cost per weighted Australian National Sub-Acute and Non-Acute Patient activity unit (AN-SNAP) for 2006–7,[9] was obtained to estimate costs for those who received inpatient rehabilitation in addition to an acute hospital admission.

Subgroup comparisons were assessed with χ^2 tests for cross-tabulation tables and group t tests using SPSS (V.18 for Windows; SPSS Science).

Ethics approval was obtained for the study from the South East Sydney and Illawarra Area Health Service (Northern Network) Human Research Ethics Committee.

RESULTS

Rate of fall-related ED presentations

In the 24-month period, there were 88 530 presentations to the ED, of which 18 902 (21.4%) were people aged ≥70 years. The mean age of the study population was 80.8 years (SD 6.73) and women made up 54% of the sample. People living in the community comprised 87% of the presentations, with the remaining 13% of cases presenting from a long-term care setting—that is, RACFs.

A fall contributed to 3220 (17.0%) ED presentations, representing 2703 individuals. This indicated that one in every six older ED attendee was a faller and equates to an average of 4.4 cases presenting to the ED per day. In comparison with ED presentations for other causes, the fall cases were older (82.5±6.9 vs 80.5±6.7 years, p<0.001), more often female (63.2% vs 52.3%, p<0.0001) and more often living in RACFs (18.4% vs 12.4%, p<0.001).

The rate of fall-related ED presentations increased with age and differed between genders (table 1). There was an exponential increase in presentation rate with age in both genders. In comparison with the youngest age group (70–74 years), the presentation rate in the oldest group (85+ years) was five times higher in men and four times higher in women. Annual presentation rates were higher in women than in men for patients younger than 85, while for patients aged 85+, the pattern was reversed and the rate became slightly higher in men than in women.

A substantial proportion of patients had multiple ED presentations and hospitalisations to the same hospital in the 12 months before their index fall presentation (table 2). Overall, 35.4% of the fallers had one or more previous ED presentation,

Table 2 Number of emergency department (ED) presentations* and hospital admissions to the same hospital in the 12 months preceding the index ED presentation

	ED presentations in past 12 months, N (%)			Hospital admissions in past 12 months, N (%)		
	Men	Women	Total	Men	Women	Total
0	569 (59.0)	1170 (67.7)	1739 (64.6)	740 (76.8)	1403 (81.3)	2143 (79.7)
1	200 (20.7)	322 (18.6)	522 (19.4)	141 (14.6)	217 (12.6)	358 (13.3)
2	97 (10.1)	123 (7.1)	220 (8.2)	52 (5.4)	65 (3.8)	117 (4.4)
3	43 (4.5)	54 (3.1)	97 (3.6)	16 (1.7)	23 (1.3)	39 (1.5)
4	26 (2.7)	26 (1.5)	52 (1.9)	8 (0.8)	11 (0.6)	19 (0.7)
5+	29 (3.0)	34 (2.0)	63 (2.3)	7 (0.7)	6 (0.3)	13 (0.5)
Total	964 (100.0)	1729 (100.0)	2693 (100.0)	964 (100.0)	1725 (100.0)	2689 (100.0)

*ED presentations from all causes.
Missing data in relation to past ED presentations (n=8).
Missing data in relation to past hospital admissions (n=12) and gender (n=2).

Table 3 Emergency department occupancy time (in hours) for the fall-related cases by age and gender

	Men		Women		Total	
Age group	Mean	SD	Mean	SD	Mean	SD
70–74	8.30	6.84	7.36	6.25	7.77	6.53
75–79	9.17	7.14	7.66	6.08	8.27	6.56
80–84	8.83	6.61	8.75	7.65	8.79	7.26
85–89	9.67	6.77	9.19	6.56	9.36	6.64
90+	10.36	7.12	9.08	6.51	9.38	6.68
Total	9.17	6.88	8.53	6.73	8.76	6.79

and 20.3% had one or more previous hospital admission. More men than women had previous ED presentations and hospital admissions. Compared with patients presenting to the ED for all causes, fallers were more likely to have had one or more hospital admissions in the previous year ($p<0.001$).

The average ED occupancy time for fall-related cases was 8.8 h; it was higher for men (9.2 h) than for women (8.5 h) and increased with age for both genders (table 3).

Overall, only half (50.2%) of fall cases were discharged directly to their previous place of residence following the ED visit. While the majority (81.4%) of fall-related ED cases lived at home at the time of the fall, less than half (49.1%) returned directly home from the ED (table 4). Most of the cases residing elsewhere at the time of the fall lived in RACFs (97.1%) and 55.0% of them returned directly to their original place of residence after ED presentation (table 4). Patients had a decreasing likelihood of returning directly to their original place of residence with increasing age ($p<0.0001$). A total of 1525 (48.1%) fall-related ED visits resulted in a hospital admission, with the majority of cases (n=1354, 42.7%) admitted to the co-located acute hospital, and an additional 171 (5.4%) to other hospitals. Overall, 0.3% of fallers died in the ED.

Hospitalisations after fall-related ED presentations

Among the 1354 fall-related hospital admissions, data were available for 1329 cases. Data were missing for 25 cases admitted to the emergency medical unit (an extension of the ED run by the emergency doctors) and subsequently discharged. The majority of hospital admissions were to the departments of geriatric medicine (43.6%) and orthopaedic surgery (36.9%). LOS was comparable in both departments: 14.8 days in acute geriatric medicine and 13.4 days in orthopaedic surgery ($p=0.127$). The most commonly recorded principal ICD-10 diagnoses were *"S00-T98—Injury, poisoning and certain other consequences of external causes"* (51.8%) and *"Z00-U99—Factors influencing health status and contact with health services"* (17.2%). Fractures made up 532/1329 (40%) of the hospitalisations with fracture of the hip/femur constituting 49% of all fractures.

Of the 1329 hospitalised cases, 1036 (78%) received acute care only, while 293 (22%) received additional rehabilitation care. The mean LOS in the acute care only group was 14.4 days for men and 13.7 days for women ($p=0.40$). The mean LOS for those who received acute and rehabilitation care was 35.6 days for men and 30.1 days for women. Overall, 13.4% of cases were re-admitted to hospital within 28 days of discharge.

Figure 1 highlights the discharge destination, acute and rehabilitation LOS and 28-day readmission rates for the hospitalised cases. Before admission to the co-located hospital, 82.6% of cases (n=1084) were residing at home. After the admission, the majority of these cases (68.9%, n=747) were discharged back home, 11.5% (n=125) were discharged to an RACF, 12.6% (n=136) were transferred to another hospital or to a hospice and 5.5% (n=60) died in hospital. Among cases who resided in RACFs before admission (n=222), 82.4% (n=183) were discharged back to the RACF, 9.5% (n=21) were transferred to another hospital or to a hospice, and 8.1% (n=18) died in the hospital. Discharge destination was not recorded in four cases and information on initial place of residence was not available for 16 cases.

Fall-related costs

After assigning the average cost (A$380) of an ED presentation, the total cost of all fall-related ED presentations in the 24-month study period was A$1 223 600. Based on DRG cost weights, the average cost per hospitalised faller A$9347 (SD A $6638). Acute-care only cases cost on average A$8959 (SD=A $7721). Costs differed by discharge destination (table 5). The total hospitalisation cost (for the 1070 people with available

Table 4 Place of discharge stratified by age for individuals who presented to the emergency department after a fall

Place of discharge, N (%)							
Age group	Back to original residence	Admitted to co-located hospital	Admitted to other hospital	Emergency placement*	Died	Other	Total
Usual place of residence: Home							
70–74	277 (59.3)	162 (34.7)	21 (4.5)	0 (0.0)	0 (0.0)	7 (1.5)	467
75–79	328 (56.9)	212 (36.8)	18 (3.1)	2 (0.3)	1 (0.2)	15 (2.6)	576
80–84	299 (46.6)	299 (46.6)	37 (5.8)	1 (0.2)	2 (0.3)	4 (0.6)	642
85–89	241 (42.3)	267 (46.8)	51 (8.9)	3 (0.5)	2 (0.4)	6 (1.1)	570
90+	124 (37.7)	172 (52.3)	26 (7.9)	5 (1.5)	1 (0.3)	1 (0.3)	329
Total	1269 (49.1)	1112 (43.0)	153 (5.9)	11 (0.4)	6 (0.2)	33 (1.3)	2584
Usual place of residence: Other							
70–74	12 (52.2)	9 (39.1)	1 (4.3)	0 (0.0)	1 (4.3)	0 (0.0)	23
75–79	34 (61.8)	18 (32.7)	2 (3.6)	0 (0.0)	1 (1.8)	0 (0.0)	55
80–84	79 (55.2)	59 (41.3)	4 (2.8)	0 (0.0)	0 (0.0)	1 (0.7)	143
85–89	99 (57.6)	67 (39.0)	4 (2.3)	1 (0.6)	0 (0.0)	1 (0.6)	172
90+	100 (51.0)	89 (45.4)	7 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	196
Total	324 (55.0)	242 (41.1)	18 (3.1)	1 (0.2)	2 (0.3)	2 (0.3)	589

*Emergency placement refers to temporary or permanent placement in a nursing home for social or care reasons (and no acute medical problems).
Missing data in relation to place of discharge for individuals initially residing at home (n=33).
Missing data in relation to place of discharge for individuals initially residing elsewhere (n=14).

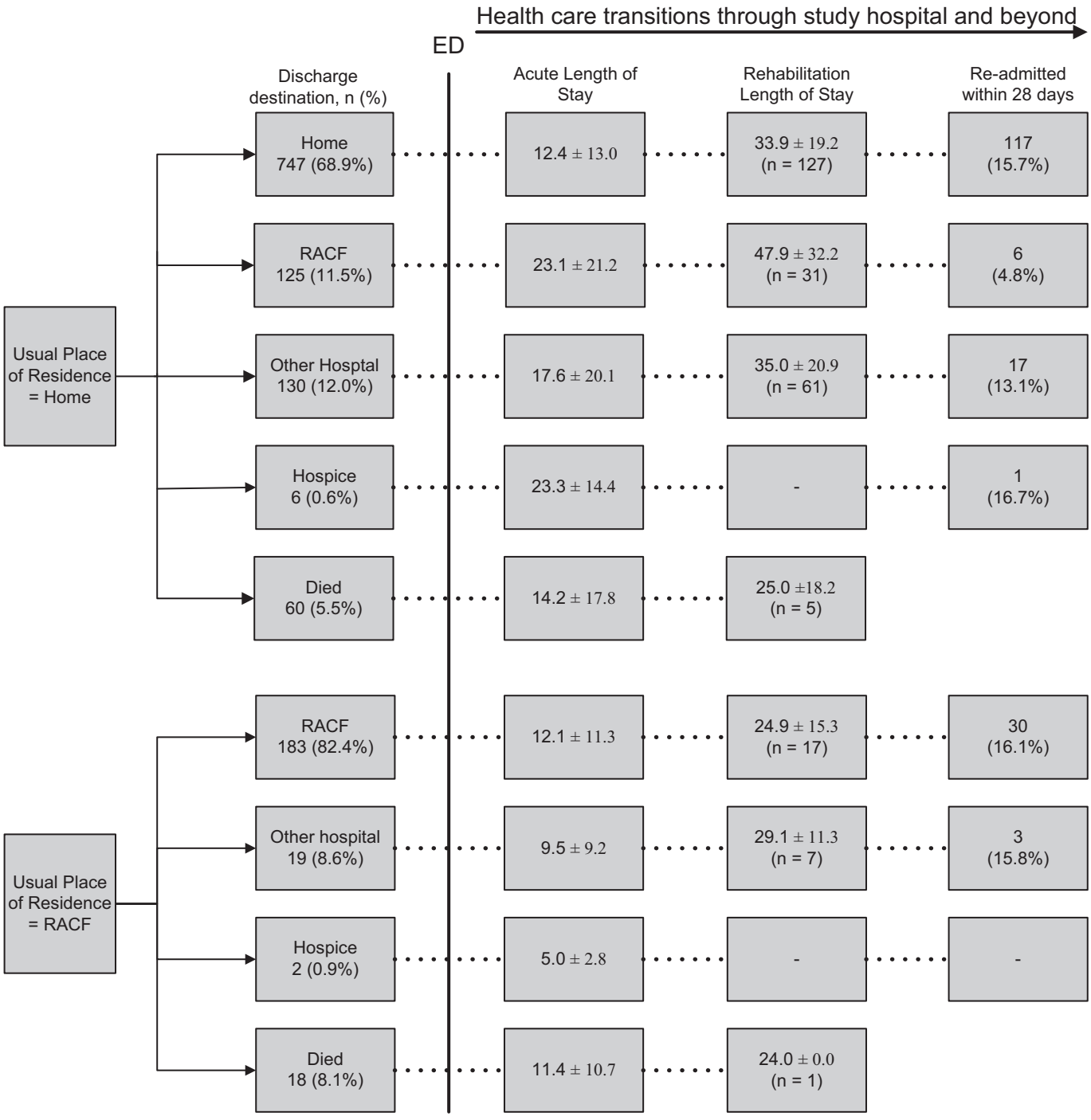

Figure 1 Care pathway for cases admitted to the co-located hospital after fall-related presentations. ED, emergency department; RACF, residential aged care facility.

DRG data) for the 24-month study period was estimated to be A$10 017 787, ED costs representing close to 11% of the total costs associated with falls.

Table 5 Cost by discharge destination

Discharge destination	Cost (A$)	SD (A$)
Home	8 280	4 987
Other hospital	9 116	6 625
RACF	10 363	5 907
Hospice	7 956	4 574
Died	14 890	17 727

RACF, residential aged care facility.

DISCUSSION

Our findings document patient characteristics and care pathways of older patients presenting to the ED after a fall, and confirm that fallers often require various transitions between departments and care settings in their journey through the hospital and healthcare system. For example, half of the ED cases were admitted to hospital, sometimes requiring both acute care and inpatient rehabilitation. After hospitalisation, nearly 10% of patients became first-time residents of long-term care facilities, indicating a loss of independence in activities of daily living. Finally, some patients died while receiving fall-related treatment.

Fall-associated healthcare resource use and attributed costs were substantial. Every sixth ED attendee aged 70 years and older was a faller, with ED staff receiving, on average, 4.4 fall cases a day. Those cases occupied the ED for an average of 8.8 h waiting for and receiving care—a period that is longer than an average shift of a medical team. Older adults are also often accompanied by a family member, which has a societal impact owing to loss of work-time or other daily activities for accompanying family members. On average, fallers occupied 37 beds (25 acute and 12 rehabilitation beds) daily at the co-located hospital, which is equivalent to 8% of its total bed count.

The direct medical costs associated with ED presentations after a fall and subsequent hospitalisation totalled A$11.2 million over a 24-month period for the study hospital alone, with approximately 11% of these costs being associated with ED activity, and the remaining 89% attributed to the inpatient (acute and rehabilitation) care.

It has been suggested that the ED presentation is currently a missed opportunity for dealing with fall risk and prevention in older people, especially for patients discharged home from the ED.[10 11] Despite the availability of international guidelines for the prevention of falls (American Geriatrics Society, British Geriatrics Society and American Academy of Orthopedic Surgeons),[12] screening and assessment of risk and intervention strategies to prevent falls are still poorly implemented. For example, a Canadian study showed that the majority of community-dwelling elderly fallers presenting to the ED of a major urban tertiary care hospital were discharged directly to home without receiving any of the care prescribed by these guidelines.[10] In our study, nearly 60% of community dwellers were discharged back home after their hospitalisation. The volume of patients and associated costs in combination with existing research evidence suggest that there is significant unmet need which if addressed could deliver substantial savings to both the individual and the healthcare system.

Given the high fall prevalence and the diverse pathways following an ED presentation, fall screening needs to be well coordinated and built into healthcare practices. Effective coordination of appropriate fall-risk assessment and future fall and fracture prevention constitutes the main challenge in the care for this high-risk population. While evidence supports the role of comprehensive geriatric assessment and tailored intervention,[5 10] it is currently impractical to refer all fall-related ED presentations for further assessment in specialist 'falls clinics'. However, the opportunity to accurately target and refer appropriate patients to 'fall clinics' should not be overlooked. Effective screening tools can identify high-risk patients for subsequent referral and treatment of the underlying causes of falls.[13 14] For example, The Falls Risk for Older People in the Community (FROP-Com)[13] is a multifactorial falls risk assessment tool which may be used in time-limited situations and may serve this purpose. In addition, effective referral to specialist falls services could be achieved using risk predictors derived from the Prevention of Falls in the Elderly Trial (PROFET).[14] Both tools present a short and time-efficient way to identify patients for further assessment and tailored intervention.

Alternative options may also be considered. ED protocol may require all presenting elderly fallers with a previous fall-related presentation or hospitalisation to be referred to a specialist for fall-prevention care. Furthermore, hospitalisation offers an opportunity for identification of individuals at high risk who should be offered further assessment and intervention as part of effective discharge planning. Such strategies may reduce hospital readmissions with only marginal additional work and result in cost savings for the hospital and better outcomes for the older person.[15]

We took a system approach to studying the flow of elderly fallers through the healthcare system. However, we only considered hospital care because of the limitations of the data available. Future research should investigate a broader set of resources, including rehabilitation and other support services in the community, outpatient and GP attendance, additional medication use and the broader societal costs (informal care, lost work hours, etc). Further investigation of these topics will enhance our understanding of the total economic consequences of falls, which so far have been attributed primarily to hospital-related services.[15]

In conclusion, this is the first study to investigate the continuum of patient transitions through the hospital system after a fall-related ED presentation and to report hospital use depending on the treatment and discharge patterns. The study findings indicate that older people with a fall-related ED presentation consume significant healthcare resources. The clinical and cost burden associated with fall-related presentations is substantial and is expected to increase with demographic changes in the population.[4] There is a clear need for a systematic effort to identify patients at high risk with the intention of onward referral for more detailed assessment and intervention. Such efforts will contribute to improving health outcomes in this vulnerable population and to reducing the significant financial burden associated with fall-related healthcare provision.

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Competing interests None.

Ethics approval Ethics approval was provided by South East Sydney and Illawarra Area Health Service (Northern Network) Human Research Ethics Committee.

Contributors We attest that each named author in this manuscript has contributed to both the conception/design and/or analysis/interpretation of the project and the writing of the paper, each of us has approved the version submitted, and the content of this manuscript has not been published nor is being considered for publication elsewhere.

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