Health system costs of falls of older adults in Western Australia

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Abstract

The aim of this study was to determine the health system costs associated with falls in older adults who had attended an emergency department (ED) in Western Australia. The data relating to the ED presentations and hospital admissions were obtained from population-based hospital administrative records for 2001–2002. The type of other health services (eg, outpatient, medical, community, ancillary and residential care), the quantity, and their cost were estimated from the literature.

In adults aged 65 years and above, there were 18 706 ED presentations and 6222 hospital admissions for fall-related injuries. The estimated cost of falls to the health system was $86.4 million, with more than half of this attributable to hospital inpatient treatment. Assuming the current rate of falls remains constant for each age group and gender, the projected health system costs of falls in older adults will increase to $181 million in 2021 (expressed in 2001–02 Australian dollars).

The economic burden to the health services imposed by falls in older adults is substantial, and a long-term strategic approach to falls prevention needs to be adopted. Policy in this area should be targeted at both reducing the current rate of falls through preventing injury in people from high-risk groups and reducing the future rate of falls through reducing population risk.

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What is known about the topic?

Falls are a common cause of injury for older people, and the total costs have been estimated in a range of $1–$2 billion each year in Australia. Health system costs have been estimated at $500 million per year.

What does this study add?

Health system costs arising from falls in people over 65 years in Western Australia are estimated at nearly $90 million each year, a figure which will more than double by 2021 if nothing changes.

What are the implications?

This study provides a benchmark against which the costs and benefits of proven falls-prevention programs could be assessed, and a measure of the need to reduce the incidence of falls as the population ages.

FALLS IN ADULTS over the age of 65 are a common event with one in three expected to fall each year (Tinetti, Speechley & Ginter 1988; Lord et al. 1993; Campbell et al. 1990; Dolinis, Harrison & Andrews 1997). Of those who fall, 20 % will require medical attention (Reinsch et al. 1992; Tinetti & Williams 1997), most commonly for neurological injuries (Luukinen et al. 1999), soft tissue injuries or fractures (Campbell et al. 1990; Masud & Morris 2001). The repercussions of this on the health system are considerable, accounting for 69% of all trauma-related hospital admissions (Kent & Fildes 1994) and almost 4% of hospital admissions in Western Australia (WA) for people of 65 years and over (unpublished data, Data Linkage Unit, WA Health Department).

From an economic perspective, the impact of falls in older adults has the potential to be large, yet few studies have examined these costs in detail, especially in recent years. Those which have vary considerably in their scope and the types of costs included, thus providing quite different estimates of the costs of falls injuries in older adults. One of the earliest of

these studies was that of Fildes et al. (1994), which calculated the cost of falls in Australia for 1990 at $1954 million. These costs were calculated using an incidence-based approach, which assesses the lifetime cost of injuries sustained in a given year. Mathers and Penm (1999) estimated the health system costs of falls injuries in Australia in 1993–94 at $406.4 million. Their study used a prevalence-based approach to costing, which calculates the total cost of injury in a given year, regardless of when the injuries were sustained. For the same year, Watson and Ozanne-Smith (1997) calculated the lifetime costs of injury (ie, incidence-based) in Victoria as $199.3 million. Moller (1999) used the cost estimates produced by Watson and Ozanne-Smith together with Australian figures on the incidence of injury to estimate lifetime costs of injury in Australia of $1083 million in 1995–96. Subsequent work on the projected health system costs related to falls suggested a cost in 2001 of $498 million for Australia and $42 million for Western Australia (Moller 2003). Hall and Hendrie (2003) produced prevalence-based costs of falls injuries for WA of $287 million in 1999; however, their study was limited to hospital costs and the first 3 months post-fall.

The aim of this population-based study was to estimate the health system costs resulting from falls in older adults who presented to any Emergency Department (ED) in WA in the 2001–02 financial year. A prevalence-based approach was adopted so costs reflect the total annual burden of falls on the health system. Health system costs included hospital treatment, ambulance transport, medical and allied health consultations, community nursing, domiciliary services, equipment and home modifications, pharmaceuticals, diagnostic tests and residential care. Using assumptions of no change in age-specific falls rates, projections were made of the cost of falls in older adults in 2021.

Methods

Study design and data sources for obtaining cases

Two groups of cases were included in this study:

- People who had fallen and presented to the Emergency Department (ED) with an injury and had an admission to either a short-stay or inpatient ward. Within this group some would have been transferred to other hospitals and some would have re-admissions.
- People who presented post-fall to the ED and did not require hospital admission.

The Cost of Injury Database and the WA Data Linkage System were used to identify and obtain de-identified individual data on the first group of cases. A chain of records was created for each individual, consisting of all their hospital records including transfers and re-admissions. Records associated with the fall were identified. The data included demographic variables (age, gender, residential postcode), hospital related information (date of admission and discharge, length of stay, hospital location — eg, metropolitan or rural — residence admitted from, and discharge destination) and injury-related variables (diagnosis related group (DRG), diagnosis and injury codes). Patients who remain in the General Holding ward of the ED generate a hospital morbidity record and thus were counted as having a hospital admission and given a DRG-based hospital cost the same as any other hospital admission.

For the second group, individual information was unavailable. The Emergency Department Incident System (EDIS) was used to ascertain the total number of people who presented at the ED with a fall-related injury and of these the number who were discharged home or to residential care, transferred to another health facility, or died within the ED. These patients did not generate a hospital admission record. The data contained in EDIS covers the three WA teaching hospitals and three non-teaching hospitals on the outskirts of Perth. The information from these hospitals on patient numbers and characteristics was extrapolated to all hospitals in WA based on the proportion of WA ED attendances presenting at EDIS hospitals.

Inclusion criteria

For inclusion in this study cases had to meet the following criteria:

- Presented to any ED in WA after a fall. Fall-related presentations were identified based on having

either a presenting problem code indicating a neurological fall or a keyword of 'fall' or 'fell' in the free text description of the presenting problem.
- Date of presentation between 1 July 2001 and 30 June 2002.
- Aged 65 years or older.
- If admitted to hospital, the injury coded as

→ a primary external cause of 'accidental fall' (external cause code W00.0 to W19.9) *and* the principal diagnosis coded as an injury (diagnosis codes S00.0 to T98.3 inclusive) or care involving rehabilitation procedures (Z50); or

→ a primary external cause of 'exposure to unspecified factor' (includes accident not otherwise specified and exposure not otherwise specified) (external cause code X59) and a diagnosis coded as a fracture.

The use of alternative definitions for the hospitalised patients was examined to determine the impact on the number of cases, resource usage and costs. The alternatives evaluated were:
- Excluding cases with the principle diagnosis of care involving rehabilitation procedures (Z50).
- Including cases with an injury code in any of the diagnostic fields.
- Including all cases coded as an external cause of 'accidental injury' no matter what the diagnosis codes.

Assigning costs to health system resources

The assignment and source of costs for each resource is provided in Box 1. Where the cost assigned was not for the 2001–2002 year it was adjusted appropriately using the health price index (Australian Institute of Health and Welfare 2002). In the case of ED presentations and hospital admissions the cost of events was directly measurable. For other resources, however, the cost of the event had to be estimated from the sources indicated.

Measuring the volume of health system resources used

In order to calculate the total cost for each health service, the volume of the resources used had to be estimated. As explained above, data were obtained for ED presentations and inpatient admissions.

Ambulance transport

Forty eight per cent of patients presenting in the ED were assumed to have arrived by ambulance if they lived in the community and none were assumed to have required an ambulance home from the ED or hospital (Hall & Hendrie 2003). People living in residential care were assumed to require an ambulance to and from the ED or hospital, and people moving to residential care from the community after their fall were assumed to require an ambulance.

Non-inpatient, medical, allied health services and pharmaceuticals

This study relied on administrative data and thus the individual follow-up of patients for non-inpatient care had to be estimated from alternative sources. Mathers and Penm (1999) provided Australian figures of health service utilisation relating to accidental falls by age group for the following items: hospital admissions, non-inpatient occasions of service, GP services, specialist services, prescriptions and allied health consultations. This study assumed that the relationship between the number of each of the health services utilised by fallers of 65 years and older and the number of fall-related hospital admissions for this group had remained constant between 1993–94 and 2001–02 and was the same for WA as Australia. The Mathers and Penm ratio of the number of each health service utilised to the number of fall-related hospital admissions was calculated for each health service for the 65 years and older group by gender. These ratios were then multiplied by the number of fall-related hospital admissions by gender in 2001–02 to obtain an estimate of the volume of each of the health services used by fallers of 65 years and above.

Community nursing, domiciliary services, equipment and diagnostics tests

Hall & Hendrie (2003) provide the only published figures for the utilisation of community nursing, domiciliary services, equipment and home modifications and diagnostic tests for fallers aged 65 years and over. The average number of community services provided and domiciliary services used was calculated for their study population of 79 fallers. Each patient who presented at the ED, excluding those in residential care, was assumed to utilise this

average number of community nursing, domiciliary services, equipment and diagnostic tests.

Residential care

The Mathers and Penm (1999) study was also used as the basis for calculating the number of high-level residential care beds with utilisation attributable to falls. The assumption was made that Mathers and Penm's ratio of the number of beds in high-level residential care facilities attributable to falls to the total number of Australians 65 years and above had remained constant between 1993–94 and 2001–02 and that this ratio was the same for WA as for Australia. The Mathers and Penm ratio was applied to the WA population of 65 years and above in June 2002 (Australian Bureau of Statistics 2002) to obtain an estimate of the number of high-level residential beds attributable to falls in WA in 2001–02. This calculation was made separately for males and females.

Data analysis issues

The hospital morbidity records for the cases were identified and analysed using SAS Version 8.2 (1999–2001). The data relating to ED presentations were obtained from EDIS in tabular form. The volumes of all items of health services included as health system costs were entered into an Excel

1 Costing of health system resources

Item	Cost per unit 2001–2002	Source
Hospital inpatient episodes*	Variable depending on DRG code and hospital type: mean cost of $7300 per admission (minimum and maximum costs of $860 and $63 100 respectively)	Commonwealth Department of Health & Ageing 2002a
Emergency department presentations†	Teaching hospital: $328 per presentation Non-teaching hospital: $262 per presentation	Information Services, Royal Perth Hospital
Hospital outpatient services	$109 per occasion of service	Metropolitan Health Service Board 1999
Ambulance transport	Emergency: $437 per trip Non-emergency: $248 per trip	Hall (1999)§
General practitioner consultations	$29.45 per visit	Commonwealth Department of Health & Ageing 2002b
Specialist consultations	$113.20 per visit	Commonwealth Department of Health & Ageing 2002b
Allied health consultations	$38.00 per visit	Hall & Hendrie 2003
Community nursing	Registered nurse visit: $60.40	Hall &Hendrie 2003
Domiciliary services	Personal care assistant visit: $27.80 Meal: $5.30 per meal Home help/garden service visit: $14.90	Hall & Hendrie 2003
Equipment and home modifications‡	Average cost $65.00 per faller	Hall (1999)§
Pharmaceuticals	Average cost $7.70 per prescription	Hall (1999)§
Diagnostic tests	Average cost $1.34 per faller	Hall (1999)§
High-level residential care bed	Bed rate per annum: $38 685	Productivity Commission 2003

*Includes only the cost of those discharged directly home from the Emergency Department

†Includes the emergency and general holding ward cost of those admitted to either the general holding ward or to hospital

‡Equipment includes shower chairs, over the toilet seats, commodes, walking aids, rails and shower hoses including cost of installation

§Average cost for 3 months post-fall

spreadsheet for analysis. Total costs for each health service were estimated by multiplying the volume of health services used by the cost per unit of each service (Box 1). All costs are in 2001–02 financial year Australian dollars.

Age and gender specific rates of ED presentations and hospital admissions were calculated based on the WA population of 65 years and above in June 2002 (Australian Bureau of Statistics 2002). Projections of future health service utilisation and corresponding costs for 2021 were made based on the ABS population projections Series B (Australian Bureau of Statistics 2003). This series provides a mid-point estimate of likely population changes. The assumptions used in making these projections were that the current rate of falls by age group and gender remained constant between 2001–02 and 2021, no changes occurred in treatment patterns, and treatment costs remained the same.

Results

Number of cases and the use of health system resources

Emergency Department presentations

The number of fall-related attendances at an ED anywhere in WA in 2001–02 was estimated as 18 706 (Box 2). Females accounted for 70% of fallers presenting at ED, and the rate of falls presentations per 10 000 population increased with rising age. The cumulative incidence in 2001–02 of falls requiring ED attendance in the population aged 65 years and above was 8.9%. This calculation was based on the number of ED presentations, each of which does not represent a different person as the same person may present twice at ED as a result of the same fall or twice or more for separate falls.

The three possible places of discharge from the ED were to return home (either their own, family/friends, or residential care), be admitted to hospital, or death. This study found that about 70% of the fallers presenting at an ED were discharged home and the remainder were admitted to hospital. There were seven recorded deaths of fallers in EDIS, which when extrapolated to all hospitals in WA suggested around 22 deaths in an ED due to falls .

Inpatient hospital episodes

The number of hospital admissions of people aged 65 years and above for fall-related injuries was 6222 in 2001–02 (Box 2). Some people had more than one admission during 2001–02, with 4349 people accounting for the 6222 admissions. Of the admissions, about 92% had a primary diagnosis of an injury, 4% had a fracture diagnosis and 4% were admitted for rehabilitation procedures. The majority of the hospital admissions were of female patients

2 Number and rate of emergency presentations and hospital admissions

		Age groups (years)					
		65–69	70–74	75–79	80–84	85+	Total
Emergency Department presentations							
Males	Number	820	918	1082	1073	1719	5612
	Rate per 10 000	270	345	559	1034	2427	598
Females	Number	940	1379	2148	2741	5886	13 094
	Rate per 10 000	300	486	902	1678	3667	1130
Total	Number	1760	2297	3230	3814	7606	18 706
	Rate per 10 000	286	417	749	1428	3287	892
Hospital admissions							
Males	Number	192	246	332	333	512	1615
	Rate per 10 000	63	92	172	321	723	172
Females	Number	276	461	800	1051	2019	4607
	Rate per 10 000	88	162	336	643	1258	398
Total	Number	468	707	1132	1384	2531	6222
	Rate per 10 000	76	128	262	518	1094	297

Rate per 10 000 = Age-specific rates

3 Number and cost of episodes of care for falls in older people 2001–2002 composition of health system costs

	Number			Cost ($000)	
Item	Male	Female	Total	Total	% total
In-patient hospital treatment	1615	4607	6222	45 400	52.5
High-level residential care beds	60	140	200	7900	9.1
Hospital outpatient services	12 300	50 500	62 800	7500	8.7
Emergency Department presentations	5612	13 094	18 706	5000	5.8
Allied health consultations	44 900	68 200	113 100	4600	5.3
Ambulance trips	2800	6500	9300	4000	4.6
Specialist consultations	6900	23 600	30 500	3500	4.1
Personal care assistant visits	25 500	59 600	85 100	2200	2.5
General Practitioner consultations	20 100	56 100	76 100	2200	2.5
Community nurse visits	9400	21 900	31 300	1900	2.2
Other domiciliary services	21 100	49 200	70 300	600	0.7
Prescriptions	16 200	36 900	53 100	400	0.5
Other*	–	–	–	1200	1.4
Total	–	–	–	86 400	100

* Includes equipment and laboratory costs

(74%). Box 2 suggests that 35% of females presenting at an ED were admitted to hospital compared with 29% of males, however, these percentages overestimate the admission rate as some rehabilitation cases will not have presented to an ED before being admitted. The proportion of people admitted to hospital increased as age increased. The rate for females was almost double the male rate in every age category except the youngest (65–69 year) category. The cumulative incidence of falls requiring hospital admission in the population 65 years and above was 3.0% in 2001–02. Using the age-specific rates of death from accidental falls in people aged 65 years and above produced by Cripps and Carman (2001), an estimated 93 people in WA would have died as a result of a fall in 2001–02.

Other resource utilisation

A range of other health system resources at outpatient departments and in the community was used to provide treatment and long-term care to older adults after a fall. Box 3 shows the estimated number of units of these resources. Almost half of the patients who attended the ED arrived by ambulance. The two most commonly used professional services were those provided by allied health professionals and by GPs. There were also a significant number of visits to hospital outpatient services; these patients would have seen a variety of health care providers in a variety of settings, such as a plaster clinic after a fracture or in rehabilitation. Care provided by personal care assistants, mostly through community nursing care agencies, was the second most commonly used service. Registered nurses would have attended patients in need of higher-level services, such as those requiring wound care or assistance with medications. Males were more likely to visit an allied health professional post-fall than females who fell, whereas females were more likely to visit a specialist consultant or have an outpatient visit provided. This may be due to underlying patterns of injury, such as the pathogenesis of fractures for males and females.

Health system costs of falls in older adults

The health system costs of accidental falls for people aged 65 years and above was $86.4 million in 2001–02 (Box 3). This accounted for about 1.5%

4 Health system costs of falls in older adults in 2001–2002 and projected costs for 2021 by gender and age

		Age group (years)					
		65-69	70-74	75-79	80-84	85+	Total
Cost estimates 2001–2002							
Males	Cost ($000)	2393	3200	4655	5073	8075	23 395
	% of total cost	2.8	3.7	5.4	5.9	9.3	27.1
Females	Cost ($000)	3296	5439	10 851	14 912	28 517	63 015
	% of total cost	3.8	6.3	12.6	17.3	33.0	72.9
Total	Cost ($000)	5688	8639	15 484	19 989	36 610	86 410
	% of total cost	6.6	10.0	17.9	23.1	42.4	100.0
Projected cost estimates 2021*							
Males	Cost ($000)	5229	7085	9460	12 126	23 481	57 381
	% of total cost	2.9	3.9	5.2	6.7	13.0	31.8
Females	Cost ($000)	7247	11 572	18 773	26 833	58 806	123 232
	% of total cost	4.0	6.4	10.4	14.9	32.6	68.2
Total	Cost ($000)	12 476	18 657	28 234	38 959	82 287	180 614
	% of total cost	6.9	10.3	15.6	21.6	45.6	100.0

* Expressed in 2001–02 dollars

of all health expenditure in WA. The costs attributable to females were considerably greater than costs attributable to males, reflecting the female to male ratios in the number of fallers presenting at ED and the associated higher number of hospital admissions (Box 4). Similarly, the costs rose as age increased, with the 85 years and above age group accounting for 42% of health system expenditure on fall-related injuries.

The average health system cost per ED presentation was $4619, increasing from $3232 in the 65 to 69-year age group to $5240 in the 80 to 84-year age group and then dropping to $4811 in the 85-year and above age group. Some patients have more than one ED presentation for the same fall.

Based on an estimate of the actual number of fallers, the average total health system cost per fall injury episode was $6700. This amount increased from $4800 in the 65 to 69-year age group to $7680 in the 80 to 84-year age group, then dropped to $6900 in the 85-year and above age group.

Within the over 85-year age group, the cost of a hospital admission increased from $7400 in the 85 to 89-year age group to $8000 in the 90 to 94-year and 95 and over age groups. The cost of hospital inpatient services was by far the greatest cost, accounting for 53% of overall health system costs (Box 3). The next two largest cost items were high-level residential care and hospital outpatient services. The residential care share was high, despite the relatively few beds attributable to falls injuries, because of the high annual cost of a residential care bed.

Projections of resource utilisation and health system costs in 2021

The population of WA is ageing and thus the number of falls in people aged 65 years and over is expected to increase. The projections for 2021 were based on the assumption that the gender- and age-specific rate of falls remains constant over time to 2021. Further assumptions were that injury patterns by age and gender stay the same as at present, thus the proportions presenting at ED and admitted to hospital remain constant, treatment policy relating to falls injuries does not change, and

5 Effects on resource utilisation and health system costs of alternative definitions of a fall-related injury

Alternative definitions	Number of hospital admissions 2001–02	Health system costs 2001–02 ($000)	Projected health system costs 2021 ($000)
Fall-related admission and injury as primary diagnosis	4992	73 505	153 625
Fall-related admission and injury or rehabilitation as primary diagnosis (base case)	6222	86 410	180 614
Fall-related admission and any diagnosis of an injury	7611	116 326	243 812
Fall-related admission	7619	116 465	244 162

the costs per case of treating falls by age and gender remains the same.

The number of people aged 65 years and above presenting at an ED with a falls injury is projected to double to 39 000. This will have a flow-on effect with a doubling of the number of fall-related admissions and number of hospital bed-days required to treat fall patients. Assuming no changes to hospital admissions policy and lengths of stay, 457 beds will be occupied all year round by patients 65 years and above with a fall injury. The additional bed-days for treating falls injuries in 2021 ($n = 86\,845$) translates to an additional 240-bed acute care facility to accommodate the demographic changes in the population. Further, the increase in the number of hospital outpatient services will require additional infrastructure and staff to support the extra 65 900 patient visits. There are also resource implications for community care, residential care and ancillary care with similar proportional increases in their service provision. The substantial increase in the number of resources is reflected in the projected health system costs of falls in WA in 2021 of $180 million (expressed in 2001–02 Australian dollars), compared with $86 million in 2001–02 (Box 4).

Effects on resource utilisation and costs of using alternative definitions of a fall-related injury

The definition of a fall-related hospital admission adopted in this study was: the admission must have (1) a primary external cause of 'accidental fall' and a principal diagnosis of an injury (or care) involving use of rehabilitation procedures or (2) a primary external cause of 'exposure to unspecified factor (includes accident not otherwise specified and exposure not otherwise specified)' and a diagnosis code of fracture. Using this definition, the number of fall-related admissions was 6222. Excluding the cases admitted for care involving rehabilitation procedures, the number of acute admissions for falls would be 4992. Alternatively, widening the definition to include all fall-related admissions with an injury diagnosis in any of the diagnosis fields would result in 7611 admissions being fall-related, or 7619 if all admissions with an external cause of 'accidental fall' were counted. Box 5 shows the effect on resource use estimates and health system costs of using alternative definitions of a fall. Health system costs range from $73.5 million if only acute admissions are included to $116.5 million if all 'accidental falls' are counted. Similarly, the projected health system costs for 2021 range from $153.6 million to $244.2 million.

The purpose of this study was to determine the health system cost of falls in the adult population aged 65 years and above, thus all acute and rehabilitation admissions were included as fall-related. Clearly, widening the definition to include all admissions with an injury diagnosis in any field would overestimate the number of fall-related hospital episodes. The primary diagnoses of patients with an injury diagnosis in fields other than the primary field include diseases of the circulatory, nervous and respiratory systems, neoplasms, mental and behavioural disorders and diseases of the

musculoskeletal system and connective tissue. Some resources used by this group would have been as a result of their fall, thus the estimates of the costs to the health system of falls in older adults produced in this study are conservative.

Discussion

The number of fall-related presentations at an ED anywhere in WA in 2001–02 was 18 706 or 892 per 10 000 population. The number of hospital admissions was 6222. Depending on the type and severity of their injuries, these fallers had contact with a range of different health services on discharge from ED or hospital. The overall health system costs of accidental falls in older people across all these services were estimated to be $86 million. With the future ageing of the population, the demand for health services as a result of the increase in the number of falls injuries, in the absence of effective prevention and lower treatment costs, was projected to be $181 million in 2021.

It is a strength of this study that it was population-based, with cases identified from ED and hospital morbidity records. However, individual follow-up of subjects after discharge from the ED or hospital was beyond the scope of this study so the use of health services other than ED and hospital inpatient care had to be estimated from alternative sources. While this introduces some uncertainty into the results of the study, the best known sources were used as the basis for determining utilisation of health system resources by older fallers. In order to calculate the costs associated with the utilisation of health system resources, a cost per unit had to be assigned to each item of expenditure. Some items such as hospital inpatient care were easy to allocate a cost to, as DRG cost weights provide a readily available source of the cost of hospital admissions. A number of other items were more difficult to cost and, as was the case with resource use, estimates of the cost per unit of these items were made based on the best known sources.

The perspective of this study was the health system and only directly related costs were covered, therefore costs related to other sectors were not considered. Furthermore, a fall is often a very significant event for an older person, resulting in a loss of mobility and independence and a fear of further falls. Measured on an interval scale between 0 (death) and 1 (full health), life with a 'bad' hip fracture (which results in admission to a nursing home) has been valued at 0.05; with a 'good' hip fracture (maintaining independent living in the community) at 0.31, and with the fear of falling at 0.67. Using this scale, four out of five women would rather be dead (utility = 0) than experience the loss of independence and quality of life that results from a bad hip fracture and subsequent admission to a nursing home (Salkeld et al. 2000). This study did not measure loss of quality of life after a fall.

Of the studies that have examined the costs of falls in older adults in Australia, the most relevant ones with which to compare the results of this study are Moller (2003) and Hall and Hendrie (2003), since both provided prevalence-based figures of health system costs. Mathers and Penm (1999) also provided prevalence-based figures of health system costs; however, Moller used Mathers and Penm's estimates for 1993–94 as the basis for his projections of health system costs in 2001, so the latter are more useful for comparison purposes for this study. Other studies of the costs of falls injuries in older adults in Australia have calculated incidence-based or lifetime costs, which cannot be compared in order of magnitude to estimates derived using a prevalence-based approach (Watson & Ozanne-Smith 1997; Fildes et al. 1994).

Moller's estimate (Moller 2003) of the cost of falls in 2001 was $42 million, which is considerably below the $86 million presented in this study. One reason for the difference in costs between the two studies is that Moller did not take into account any increase in health care costs since 1993–94. Adjusting for the increase in health system costs raises the Moller estimate to $49 million. A second reason for the cost difference is that Moller based his calculations on 3300 fall-related hospital admissions in WA in 2001, whereas the number using the definition adopted in this study was 6222. Moller's study does not present a definition of fall-related admission. However, if Moller's estimates are adjusted upwards proportionately based on the increased number of hospital admissions in this study (ie,

multiplying his estimate of $49 million by 6222 divided by 3300) then the Moller estimate of the cost of falls injuries in older adults becomes $92 million, which is a reasonably similar order of magnitude to the findings of this study. This suggests no major qualitative differences in the unit costs of hospitalisations considered in this and Moller's study.

The extrapolation by Hall and Hendrie (2003) of the hospital and 3-month post-hospital community and personal costs associated with falls in older adults in WA was $48 million in 1999. Again, this is well below the $86 million estimated in this study. The main reasons for this difference in costs is that their extrapolation was based on 11 071 patients presenting at an ED in WA. This number of ED presentations was based on the total number of hospital admissions for falls in older adults in WA together with the finding for their study population that 53% of ED presentations were admitted to hospital. This admission rate is too high at a statewide level. It was based on a teaching hospital, which would be likely to have a higher admission rate than the average across all hospitals, and was derived from a relatively small sample of patients. Using population-based data, this study suggests an admission rate of around 30%. Reworking Hall and Hendrie's estimate based on this lower admission rate provides a total cost of hospital and 3-month post-hospital community and personal costs of $85 million, again very similar to this study's estimate of $86 million. While the Hall and Hendrie estimate includes costs to 3 months only, this difference is modest in its impact as their study shows that the use of health services reduces in successive months. Also, their study did not include the costs of residential care but did include a few costs to sectors other than the health system. The similarity in the reworked Hall and Hendrie estimate of the cost of falls and the findings of this study suggests that costs of excluded items in each study may have compensated for each other.

The costs of falls in older people are a substantial burden on the health system and will escalate over the next 20 years unless effective prevention programs are implemented. While some falls-prevention programs are currently in place, there is a need to adopt a long-term strategic approach that is evidence-based and coherent. Policy relating to falls-prevention programs should be targeted at both reducing the current rate of fall injuries suffered by people in high-risk groups and reducing the future rate of falls through a focus on population risk.

Many recent studies have evaluated the efficacy of falls-prevention programs, and several economic evaluations of falls-prevention programs have been conducted. This study provides useful information on the potential cost savings that can be obtained if falls-prevention programs are successful. Alternatively, it highlights the cost outlays needed if successful falls-prevention programs are not implemented. Given evidence on the effectiveness of falls-prevention programs, the cost-of-falls data from this study can be used to calculate the break-even point of a falls-prevention program, which is the point at which program costs exactly equal the cost savings generated from a reduction in the number of falls. Alternatively, the cost-of-falls data can be used to calculate the cost-effectiveness of falls prevention programs measured in terms of the cost per injury fall (ie, any fall resulting in one or more injuries) prevented. These types of analyses can assist in the process of planning, prioritising and allocating resources in injury-prevention programs.

The information presented in this study is also useful for planning purposes, both in the short term to identify the volume of services to be provided to treat falls injuries in older adults and the costs of providing these services, and in the longer term to prepare projections of future resource utilisation and budgetary costs.

In addition, policymakers in fall prevention and stakeholders who represent the interests of older people require information to understand how a proposed policy will impact on its target population and the problem more generally. Incidence and cost data play a useful role in advising the variety of groups in the policymaking process.

In order to obtain a better understanding of the falls problem and its resource implications, the data on the cost of falls needs to be analysed in more depth. For example, this study has not addressed the geographical distribution of falls and associated costs, nor has it examined the breakdown of falls

and falls costs by type of injury. Furthermore, while the cost of falls in this study has been compared with that found in other studies, no comparative analysis of the incidence of falls in other Australian states and territories was made to determine the relative magnitude of the falls problem across jurisdictions. Finally, the projections of resource implications and health system costs of falls injuries in older adults were made using reasonably simplistic assumptions, such as the age- and gender-specific rate of falls remaining constant over time to 2021. More sophisticated projections of the incidence and cost of falls are needed to take account of the likelihood of a healthier older population.

Competing interests

None identified.

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