BASELINE INDICATORS FOR MEASURING PROGRESS IN PREVENTING FALLS INJURY IN OLDER PEOPLE

Annaliese M Dowling [1], Caroline F Finch [1,2]

1 NSW Injury Risk Management Research Centre, University of New South Wales

2 School of Human Movement and Sport Science, University of Ballarat

Address for Correspondence:

Professor Caroline Finch

School of Human Movement and Sport Science

University of Ballarat

Mt Helen, Victoria, 3353, Australia

Ph: +61 3 5327 9878

Fax: +61 3 5327 9478

Email: c.finch@ballarat.edu.au

Acknowledgements

This project was funded by a research grant from the NSW Department of Health. C Finch was supported by a National Health and Medical Research Council Principal Research Fellowship. The hospitalisations and deaths data were accessed via the NSW Department of Health's Health Outcomes Indicators Statistical Toolbox (HOIST).

Abstract (239 words)

Objective: Over recent years, there has been increasing attention given to preventing falls and falls injury in older people through policy and other initiatives. This paper presents a baseline set of fall injury outcome indicators against which these preventive efforts can be assessed in terms of monitoring the rate of fall-related deaths and hospitalisations.

Methods: ICD-10-AM coded hospital separations, Australian Bureau of Statistics (ABS) mortality and ABS population data were used to determine the rate of fall-related injury mortality and hospitalisations occurring in people aged 65+ years in New South Wales (NSW), Australia over the six-year period from 1998/99 to 2003/04, inclusive.

Results: Baseline trends for one fatality and five separations-based metrics are presented. Overall, fall mortality rates increased over the six years, with higher rates in males. Falls hospitalisation rates also increased slightly, with higher rates in females. The rates of hip fracture and pelvic fracture hospital separations generally declined over the six years and were highest in females. The level of unspecified and missing information about the place where falls occur increased by 1.5%.

Conclusion: Baseline trends in fall injury outcome metrics highlight the severity and frequency of fall injuries before wide scale implementation of the "Management Policy to Reduce Fall Injury Among Older People in NSW".

Implications: Future use of these metrics will help to evaluate and monitor the progress of falls prevention in older people in NSW. They could also be adopted in other jurisdictions.

Keywords: falls injury, fracture, older people, health indicators

Introduction

Falls and fall injuries, particularly in people aged 65+ years, are a major public health issue in many countries because of their potential to impact heavily on quality of life and level of independence (1-3). Hip fracture, for example, has been linked to increased morbidity and mortality in persons aged 65+ years, as well as rising health care costs (4). Pelvic fractures, although less common than hip fractures, also have the potential to impact significantly on the health care system (5). With ageing populations in many Western countries, increasing demands will be placed on healthcare delivery systems due to falls and fall injury and so there is an urgent need for falls injury prevention in older people (6).

The importance of falls prevention in New South Wales (NSW), Australia was recognised in 2005 with the release of the state government's "Management Policy to Reduce Fall Injury Among Older People in NSW" (7). This policy encompasses a multi-strategic approach across the health sector, acute care and residential institutions and the community to reduce the incidence of fall-related injury in people aged 65+ years. Ongoing policy development and implementation requires information on the health status of individuals targeted by that policy (8). For this reason, it will be important that the impacts of the "Management Policy to Reduce Fall Injury Among Older People" are monitored to ensure that it is appropriately targeted, is meeting its goals, new issues are identified as they emerge and that health expenditure to support the policy is fully justified.

A range of metrics, or indicators, is needed to fully inform and evaluate health policies, including those relating to outcome measures (i.e. the incidence of the health outcome of interest) and process indicators relating to implementation and uptake issues. Routine health sector data can provide valuable information for monitoring outcome measures through the monitoring of key health, in this case falls injury, metrics (9). Such indicators need to accurately reflect trends in the incidence of injury-related mortality and morbidity measured via direct or indirect means (10), and should also be definable according to anatomical or physiological injury (9, 10). For incidence estimation and trend monitoring, it is also important that the data used in metrics is readily available, easily accessible, representative of the population being targeted and largely independent of changes in health system delivery. In contrast, indicators to reflect the effect of changes in health system delivery factors need to be able to measure these. In either case,

indicators to influence policy should ideally focus on the most serious injuries which have the potential to negatively impact on the quality of life for the individual (9, 10) and the health care delivery system.

A review of injuries in Australia concluded that hip, pelvic, wrist, forearm, arm, collar bone fractures were common outcomes of injurious falls in older people (11). Hip and pelvic fractures are amongst the most severe of falls injuries and, because they require hospitalisation for more than one day (4, 5), are well represented in hospitalisation data. However, the rate of overall fall-related morbidity is difficult to ascertain from hospitalisation data as patients with less severe injuries (such as wrist fractures) generally do not die, nor are they frequently admitted to hospital for more than one day (12, 13). In choosing falls injury metrics based on Australian hospitalisation data, it is important therefore to restrict data to injuries requiring admission to hospital for more than one day, because these are the most severe injuries and less subject to variations in hospital admission policies. This restriction would also avoid any potential for there to have been significant variations in coding and classification practices associated with these less severe injuries.

Most of the policy initiatives, and actions implemented by practitioners in response to them, are aimed at preventing falls as a precursor to falls injury. Fall indicators therefore need to indicate the rate of falls in older people. Unfortunately, at the time of this study, there is no appropriate routine source of information about overall falls incidence and metrics based on falls injury need to be used as a proxy for overall falls rates. Over 90% of hip fractures and 75% of pelvic fractures in older people are admitted to hospital (13) and so proxy falls indicators based on hospitalisations for these fractures would be appropriate. However, as fewer than 33% of fall-related wrist factures in older people lead to hospitalisation (13), there would be little value in having a falls indicator based on this fracture type.

In 2007, one of the authors (CF) led a discussion session on “Falls indicators - scoping and needs assessment” during the “National meeting on the development of indicators associated with fall injury prevention” that was organised by NSW Health. The meeting was attended by national falls prevention coordinators and others with an interest in the topic. During the session, discussion ensued around the role of selected falls injury metrics in providing some information

about the incidence of falls associated with injuries serious enough to lead to death or hospitalisation (see Table 1 for a summary of the workshop discussions). As hospitalisation rates depend on hospital admission policies, some of these metrics could also give an indication of some health system delivery factors, such as improvements in inpatient care, changes in outpatient management, etc. Another system factor is the quality and completeness of routinely-collected ICD-coded hospitalisation data, as this is necessary for the identification of falls injury cases and some factors associated with falls incidents such as the place of the fall.

This paper presents a baseline set of falls injury outcome metrics against which the "Management Policy to Reduce Fall Injury Among Older People in NSW" could be evaluated and monitored. The indicators were chosen specifically to assess and monitor the frequency of fall-related deaths and hospital separations in people aged 65+ years in NSW, but could also be applied to other health jurisdictions and smaller areas, such as area health services.

Methods

Six metrics of fall-related injury (Table 1) in people aged 65+ years were chosen based on the availability and properties of existing hospital separation and mortality data for NSW. In addition, consideration was given to the known good properties of injury indicators relating to case definition, severity of injury, case ascertainment and representativeness of the population (10, 14).

<Insert Table 1 about here>

Death data were obtained from the ABS calendar-year mortality collection for 1997 to 2002. The International Classification of Diseases 10th revision (ICD-10-AM) (15) codes used to identify fall-related deaths are W00-W19, from the principal cause of death as well as all contributing and underlying causes.

Hospital separations data were obtained from NSW Health Inpatient Statistics Collection (ISC) using the Health Outcomes Indicators Statistical Toolbox (HOIST) of the NSW Department of Health for the six-year financial calendar period 1998/99 to 2003/04. Diagnoses and external cause codes were coded according to the ICD-10-AM. All fall-related hospital separations were identified solely on the basis of an external cause code indicating a fall: W00-W19 (15). The ISC has an admitted episode structure and case selection strategies were adopted to reduce the

likelihood of double counting of falls injury incidents (16, 17). Hospital transfers and statistical discharges data were removed to eliminate the possibility of over-inflating the number of fall-related deaths whilst hospitalised by counting the fall-related injury more than once. Day-only stays were also excluded because these cases were likely to be of low severity and are more likely to reflect changes in hospital admission policies rather than changes in either fall or fall injury incidence. Deaths whilst hospitalised were indicated within the ISC for both same day admission and separation cases, as people may have died at the start of their hospitalisation episode. The ICD-10-AM principal diagnosis codes S72.0-S72.2 were used to identify hip fractures and codes S32.3-32.5, S32.81, S32.83 and S32.89 were used to identify pelvic fractures. Place of injury ICD codes were only available from the 2000-01 financial year onwards.

Population denomination data was obtained from the Australian Bureau of Statistics (ABS). Direct standardisation was used to adjust for population across time. The ABS estimates of the NSW residential population at June 2001 were used as the standard population. Annual age-standardised rates were calculated per 100,000 NSW residents aged 65+ years.

Results

Figures 1-6 depict the baseline trends in the selected fall injury metrics.

Death as a direct or indirect result of a fall is the most severe outcome of a fall-related injury. Figure 1 shows the age-standardised rate of fall-related deaths per 100,000 populations in people aged 65+ years in NSW by gender. Over the six years, the age-standardised falls injury mortality rate increased in all groups and was consistently higher in males.

<Insert Figure 1 about here>

The age-standardised rate of fall-related hospital separations per 100,000 NSW resident population aged 65+ years is shown in Figure 2. Overall, there was a slight increase in the age-standardised overall fall-related injury hospital separations over the six years. Females were significantly more likely to be hospitalised for a fall-related injury than males.

<Insert Figure 2 about here>

The proportion of fall-related hospital separations resulting in death for people aged 65+ years was relatively stable in females, and overall, and declining in males (Figure 3). Males are

significantly more likely to die whilst hospitalised for a fall-related injury than females, but these proportions are relatively small in both sexes.

<Insert Figure 3 about here>

Figure 4 shows the age-standardised rate of fall-related hip fracture hospital separations per 100,000 NSW resident population aged 65+ years. The rate of fall-related hip fractures has generally been decreasing.

<Insert Figure 4 about here>

The annual age-standardised rates of hospital separations for fall-related pelvic fractures per 100,000 NSW resident populations aged 65+ years has been relatively stable in recent years and highest in females (Figure 5).

<Insert Figure 5 about here>

A key item of information for prevention of falls and the targeting of intervention programs is knowledge about where falls occur. In hospitalisation and other ICD-coded data, this is determined from the "place of injury code" and the usefulness of this information depends on how well it is recorded. Figure 6 shows the proportion of all falls hospital separations (in people aged 65+ years) for which there was a missing or unspecified place code. This proportion has increased by 1.5% over four years.

<Insert Figure 6 about here>

Discussion

This paper provides a baseline fatality metric for 1997 to 2002 and five baseline separations-based metrics for the period 1998/99-2003/04 against which the outcomes of the "Management Policy to Reduce Fall Injury Among Older People in NSW" could be assessed in the future. Falls have previously been shown to be the leading external cause of hospitalisations in NSW in the 10 years to year 2000 (18) and to be more costly than any other single cause of injury (19). The reasons for the overall trends in the age-standardised rates for this baseline period are not known. One possibility for some of the increasing trends may be that there is an increasing likelihood of deaths and hospitalisations being attributed to falls. Alternatively, with the ageing population, there may more people with increased frailty and complex patterns of various co-morbid and chronic

health conditions that place them at a higher risk of falls and fall-related injury. A further, but unlikely, possibility could be an increased likelihood of admission following a fall-related injury.

Falls have been shown to be associated with both overall deaths and fall-related deaths through injuries sustained from the fall itself or from complications from the fall injury or its treatment (20, 21). It is likely that the number of fall-related deaths in the ABS data is under-reported due to inadequacies and conventions in the coding used on the death certificates (22).

There has been debate in the literature about the value of using non-fatal injury indicators when there is imperfect data to support them (9, 23). We agree with the leading international authors that such indicators should still be developed and used (9) but that they should undergo validation in the future (23). Our most general non-fatal injury indicator (i.e. falls hospital separations) is similar in intent to that chosen for New Zealand (23), although the New Zealand indicator was based on a definition of serious injury in an attempt to remove the effects of likely health service delivery trends. Despite our attempts to reduce the effect of health service delivery changes in NSW, by restricting the indicator to day only stays and removing repeat admissions, etc, there is still the possibility that our indicators could be biased by health system changes. There would be some benefit for Australia and New Zealand to agree on similar indicators in the future.

Previous work has questioned the use of indicators based on hospitalisation data unless they are based on a subset of pre-determined severe injuries, usually determined on the basis of a threat to life scale (24) which would select many, but not all, hip-fracture cases. Whilst our hip and pelvic fracture separations-based metrics may capture most, but not all cases, because not all such fractures are hospitalised (13), they are still valid indicators of falls and falls injury that should be monitored for health policy and health care funding purposes. Notwithstanding this, the ongoing quality and usefulness of such metrics will need to be assessed to ensure that they are not subject to changes in admission policies and improvements in out-of hospital management over time.

In summary, as the numbers of fall-related injury and death are anticipated to increase dramatically in Australia due to demographic shifts alone over the next 20 years, it is especially crucial to have developed fall-related injury indicators to monitor both the number and rate of these injuries over time. Ongoing use of the metrics presented in this paper would facilitate the ongoing

monitoring and evaluation of fall-related morbidity and mortality injuries in persons aged 65+ years in NSW. Ideally, the impact of any implemented polices and associated strategies will prevent many falls and falls injuries and corresponding declining trends in some key indicators to be documented. Whilst the baseline data relates specifically to the NSW state-wide context, the indicators themselves could be applied to other health jurisdictions (e.g. other states or area health services) where there is a need for data on falls and falls injury.

References

1. Lamb S, Jorstad-Stein E, Hauer K, Becker C. Development of a common outcome data set for fall injury prevention trials: the Prevention of Falls Network Europe consensus. JAGS. 2005;53:1618-1622.
2. Department of Health and Ageing. The National Falls Prevention for Older People Initiative. Canberra: Australian Government. 2005.
3. Marks R, Allegrante J, Ronald MacKenzie C, Lane J. Hip fractures among the elderly: causes, consequences and control. Ageing Res Rev. 2003;2:57-93.
4. Boufous S, Finch C, Lord S. Incidence of hip fractures in NSW: are our efforts having an effect?. MJA. 2004;180:623-626.
5. Boufous S, Finch C, Lord S, Close J. The increasing burden of pelvic fractures in older people, New South Wales, Australia. Injury 2005; 36:1323-1329.
6. Finch C, Hayen A. Governmental health agencies need to assume leadership in injury prevention. Inj Prev. 2006;12:2-3.
7. NSW Department of Health. Management Policy to Reduce Fall Injury among Older People: Detailed Strategies and Performance Requirements 2003-2007. Sydney: New South Wales Department of Health; 2003.
8. Mathers C, Murray C, Ezzati M, et al. Population health metrics: crucial inputs to the development of evidence for health policy. Population Health Metrics. 2003: Available from: http://www.pophealthmetrics.com/content/1//6.
9. Lyons R, Brophy S, Pockett R, John G. Purpose, development and use of injury indicators. Int Journal Inj Control Safety Prom. 2005;12:207-211.

10. Cryer C, Langley J, Jarvis S, Mackenzie S, Stephenson S, Heywood P. Injury outcome indicators: the development of a validation tool. Inj Prev. 2005;11:53-57.

11. Cripps R, Carman J. Falls by the elderly in Australia: trends and data for 1998-2001. Adelaide: Australian Institute of Health and Welfare; 2001.

12. Boufous S, Finch C, Close J, et al. The epidemiology of hospitalised wrist fractures in older people, New South Wales, Australia. Bone. 2006;39:1144-1148.

13. Boufous S, Finch C, Close J, et al. Hospital admissions following presentations to emergency departments for a fracture in older people. Inj Prev. 2007;13:211-214.

14. Cryer C, Langley J, Stephenson S. Developing valid injury outcome indicators: A report for the New Zealand Injury Prevention Strategy. Dunedin: University of Otago; 2004.

15. National Centre for Classification in Health. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM). 3rd Edition: Sydney. 2002.

16. Brophy S, John G, Evans E, Lyons R. Methodological issues in the identification of hip fractures using routine hospital data: a database study. Osteoporosis Int. 2006;17:405-409.

17. Boufous S, Finch C. Estimating the incidence of hospitalised injurious falls: Impact of varying case definitions. Inj Prev. 2005;11:334-336.

18. Lord S, Sherrington C, Menz H. Falls in Older People. Risk factors and strategies for prevention. UK: Cambridge University Press; 2001.

19. Potter-Forbes M, Atkin C. Injury costs! A valuation of the burden of injury in New South Wales 1998-1999. NSW Injury Risk Management Research Centre, University of New South Wales, Sydney; 2003.

20. Richmond J, Aharonoff G, Zuckerman J, Koval K. Mortality risk after hip fracture. J Ortho Trauma. 2003;17:53-56.

21. Roche J, Wenn R, Sahota O, Moran C. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. BMJ. 2005;331:1374.

22. Hindmarsh D, Hayen A, Finch C, Close J. Relative survival after hospitalisation for hip fracture in older people in New South Wales, Australia. Osteoporos Int. 2009; 20:221-229.

23. Cryer C, Langley J. Developing valid indicators of injury incidence for "all injury". Inj Prev. 2006;12:202-207.

24. Cryer P, Jarvis S, Edwards P. How can we reliably measure the occurrence of non-fatal injury? Int J Inj Control & Safety Prom. 1999;6:183-191.

Table 1: Selected falls injury and proxy falls metrics for New South Wales, Australia

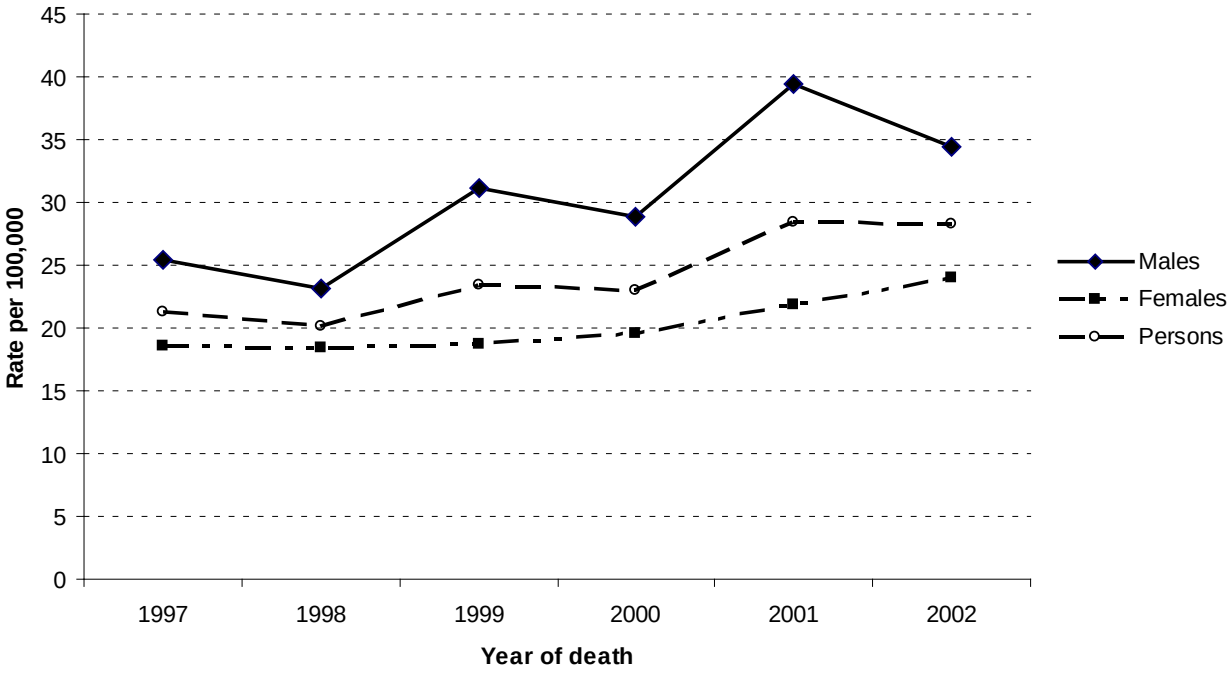
Metric	Proxy Rate of falls indicator *	Rate of falls injury indicator	Systems indicator (particular aspect of health delivery system)
Fall-related deaths	-	+	-
Fall-related hospitalisations	+/-	+	+ (admission policy)
Fall-related hospitalisations resulting in death	-	-	+ (quality of care)
Hospitalised hip fractures	-	+	+ (admission policy)
Hospitalised pelvic fractures	-	+	+ (admission policy)
Completeness of ICD-coded data with regards to place of injury	-	-	+ (quality of routinely coded data)

+: metric provides information on the indicator category; -: metric does not provide information on the indicator category; +/-: metric provides some information on the indicator category but is likely to be influenced by factors such as health service delivery changes

* these are only proxy estimates at best, because not all falls incidents lead to falls injury or to falls injury severe enough to require hospitalisation. Ideally, more definitive falls indicators would come from population surveys of older people but these are not currently available on a regular basis in NSW

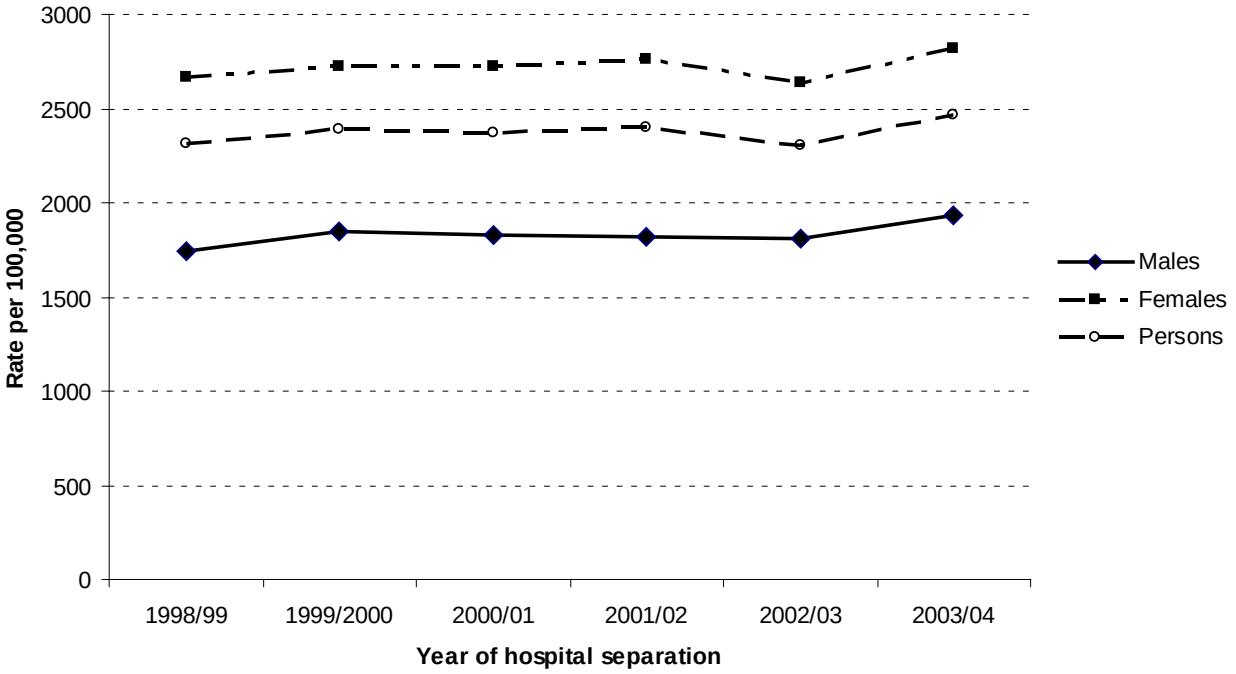
Source: this is not an empirical categorisation of metrics. Rather, it reflects the authors' notes taken during discussions that occurred during a session entitled "Falls indicators - scoping and needs assessment" during the "National meeting on the development of indicators associated with fall injury prevention" that was organised by NSW Health in 2007.

Figure 1. The number and annual age-standardised rate of fall-related deaths per 100,000 NSW residents aged 65+ years, 1997 to 2002



	1997		1998		1999		2000		2001		2002	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Males	71	25.5	68	23.1	94	31.1	88	28.8	124	39.4	115	34.4
Females	87	18.6	88	18.4	93	18.7	101	19.6	120	21.8	136	24.0
Persons	158	21.3	156	20.2	187	23.5	189	23.0	244	28.5	251	28.3

Figure 2. The number and annual age-standardised rate of fall-related hospitalisations per 100,000 NSW residents aged 65+ years, 1998/99 to 2003/04



	1998/99		1999/2000		2000/01		200102		2002/03		2003/04	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Males	5336	1743.4	5835	1848.5	5937	1825.2	6203	1817.4	6397	1809.1	7069	1931.3
Females	12848	2667.8	13567	2724.5	14035	2726.5	14716	2766.4	14359	2633.7	15788	2819.5
Persons	18184	2311.4	19402	2388.0	19972	2372.5	20919	2397.9	20756	2307.1	22858	2466.5

Figure 3. The annual proportion of fall-related hospitalisations resulting in death for persons 65 years and over in NSW, 1998/99 to 2003/04

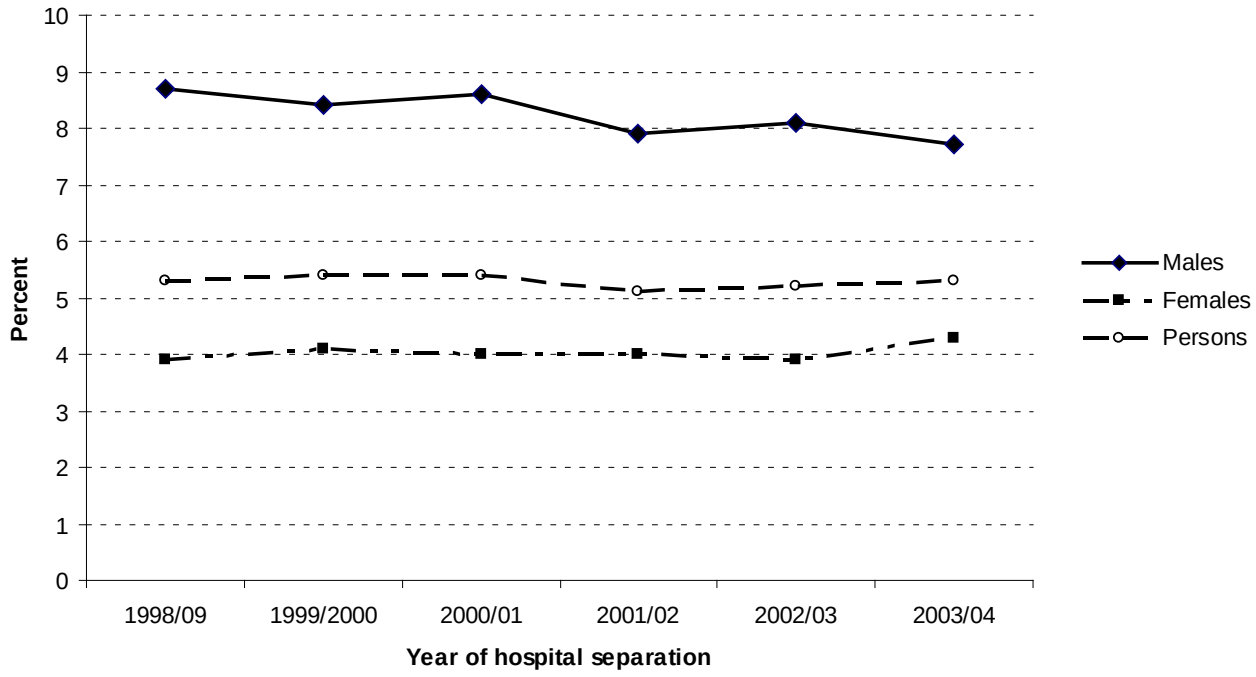
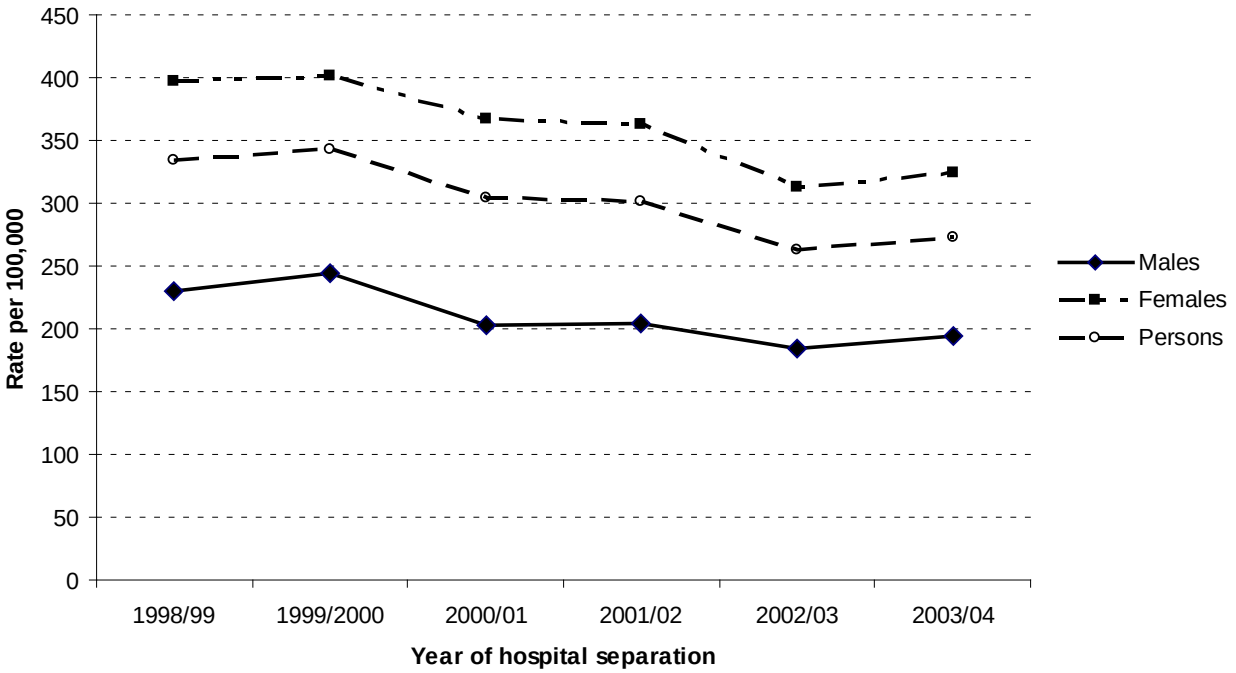
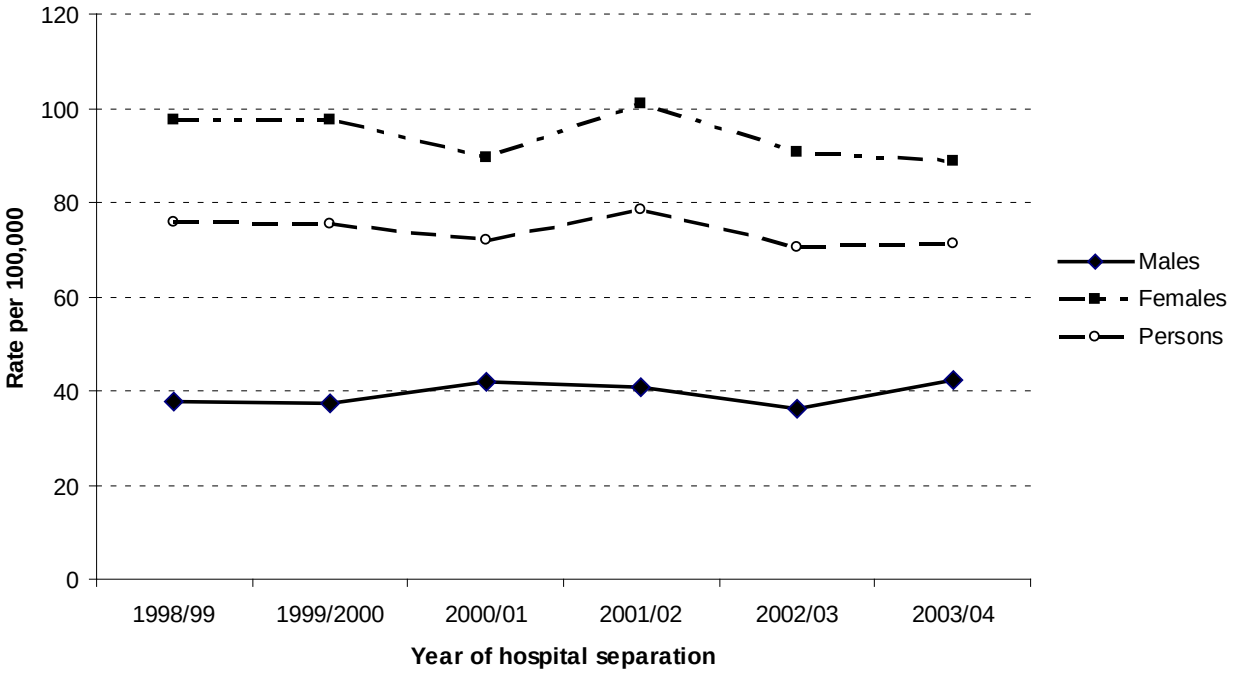


Figure 4. The annual number and age- standardised rate of fall-related hip fractures per 100,000 NSW residents aged 65+ years, 1998/99 to 2003/04



	1998/99		1999/2000		2000/01		2001/02		2002/03		2003/04	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Males	661	229.3	727	243.9	624	203.0	663	204.8	627	183.9	683	194.5
Females	1938	396.8	2034	401.0	1927	366.7	1972	362.9	1751	313.0	1871	324.7
Persons	2599	334.8	2761	342.4	2551	303.9	2635	301.9	2378	262.9	2554	273.4

Figure 5. The annual number ad age-standardised rate of fall-related pelvic fractures per 100,000 NSW residents aged 65+ years, 1998/99 to 2003/04



	1998/99		1999/2000		2000/01		2001/02		2002/03		2003/04	
	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
Males	113	37.6	113	37.4	134	42.0	135	40.6	127	36.1	152	42.1
Females	476	97.4	494	97.4	470	89.6	551	100.9	511	90.8	511	88.7
Persons	589	75.8	607	75.3	604	71.9	686	78.5	638	70.5	663	71.3

Figure 6. The proportion of falls hospitalisation cases (in people aged 65+ years) with a missing or unspecified place code