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Ladder-related fall injuries

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Key findings

- 3,486 injury incidents due to a fall from a ladder resulted in admission to hospital in the year to 30 June 2005
- Four fifths of ladder-related injury incidents involved males
- The rate of injurious falls from ladders in 2004–05 was 18.5 per 100,000 population
- Age-standardised rates of injurious falls from ladders were highest for older people; for males aged 65 years and older this rate was 73.9 per 100,000 and for females aged 65 years and older this rate was 18.4 per 100,000
- Injuries to the elbow and forearm, knee and lower leg and injuries to the head were the most common principal diagnoses to result from ladder-related falls
- Two-thirds of hospitalised injury incidents due to falls from ladders resulted in fractures
- Most ladder-related injurious falls occurred in the home
- Ladder-related injury incidents resulted a mean length of stay of 5.3 days per case and contributed 20,279 days of acute hospital care
- Additional separations containing a W11 external cause code (e.g. separations principally attributed to rehabilitation procedures) contributed a further 8,065 hospital bed-days in 2004–05
- The number of ladder-related injurious falls is increasing, particularly for persons aged 60 years and older
- The rate of ladder-related injurious fall incidents is also increasing for Australians aged 60 years and older

Ladder-related fall hospitalisations 2004–05

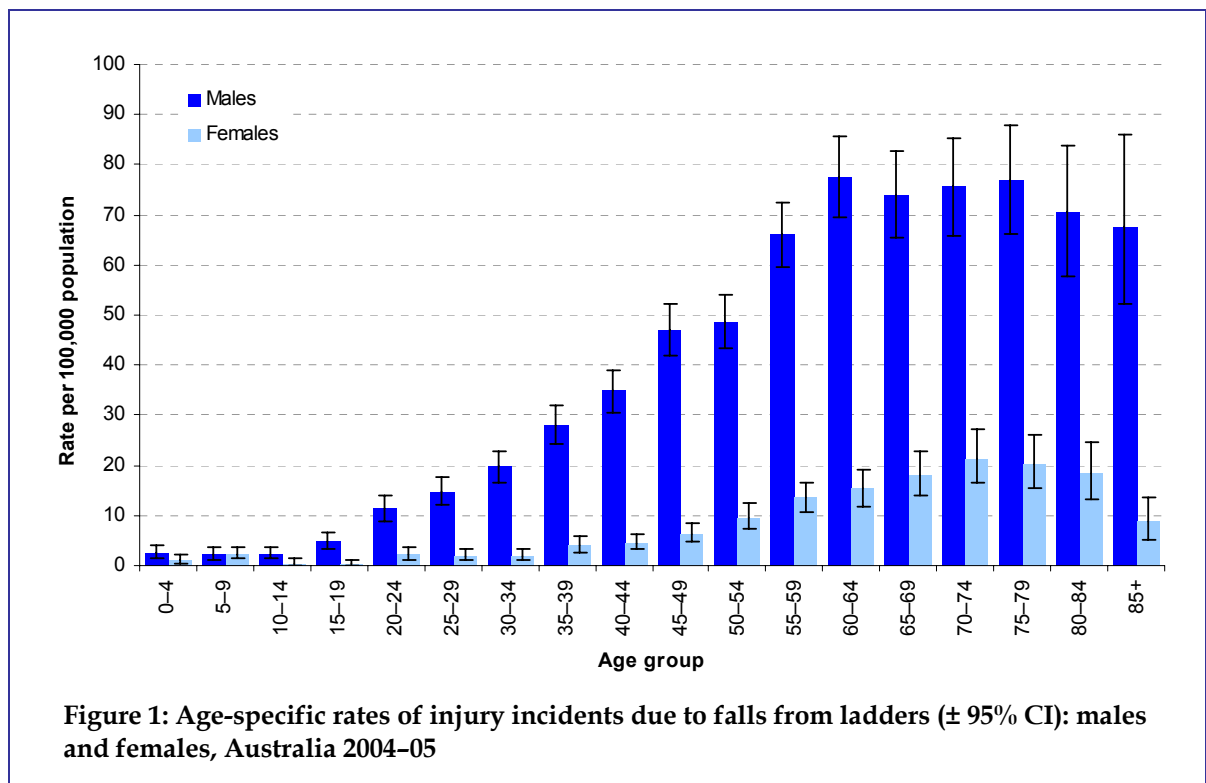
Falls from ladders contribute a substantial number of emergency department presentations and admissions to Australian hospitals each year (e.g. Cassell & Clapperton 2006). This report examines the nature of hospitalised injuries due to falls from ladders for the 2004–05 financial year. Here, ladder-related injuries have been defined as those admitted patient episodes that have a leftmost external cause of W11 (fall from ladder) and a principal diagnosis in the range S00–T75 or T79 (injuries and poisonings likely to have been sustained in the community). Applying these criteria, 4,744 episodes of care due to injuries sustained in falls from ladder were identified as separating from hospital in the period 1 July 2004 to 30 June 2005.

Injury incidents due to falls from ladders

National Hospital Morbidity Data is not person-linked and, due to inter-hospital transfers and readmissions, the number of separations/episodes of hospital care meeting the selection criteria overestimates the number of actual events that resulted in serious ladder-related injury. To estimate the incidence of injurious falls from ladders, records stating a mode of admission of ‘transfer from another acute hospital’ were omitted from the dataset. This adjustment estimates that there were 3,846 falls from ladders which resulted in serious injury in the 2004–05 year. The age-standardised rate of these injurious fall events was 18.5 per 100,000 population.

Ladder-related injury incidents by sex and age

Four-fifths of injury incidents due to falls from ladders in 2004–05 involved males (82.9%, n=3,187). Accordingly, males had a relatively high age-standardised rate of ladder-related injuries; 31.5 per 100,000 population. The age-standardised rate of injurious falls from ladder that involved females was only 6.1 per 100,000.



Males had a higher rate of ladder-related injuries than females for every age-group except the 5–9 years group (Figure 1). Illustrated by the 95% confidence intervals, age-specific rates of injurious falls from ladders for males were significantly higher than those for females from the age of 15 years. For both males and females, the rate of ladder-related injury incidents increased with age. The incidence of ladder-related injuries was highest in late adulthood, ages 60–84 years, and decreased only slightly for people of the oldest age groups. For people aged 65 years and older, the age-standardised rate of hospitalised injuries due to falls from ladders was 43.4 per 100,000 population (males 65+: 73.9 per 100,000; females 65+: 18.4 per 100,000).

The nature of ladder-related fall injuries

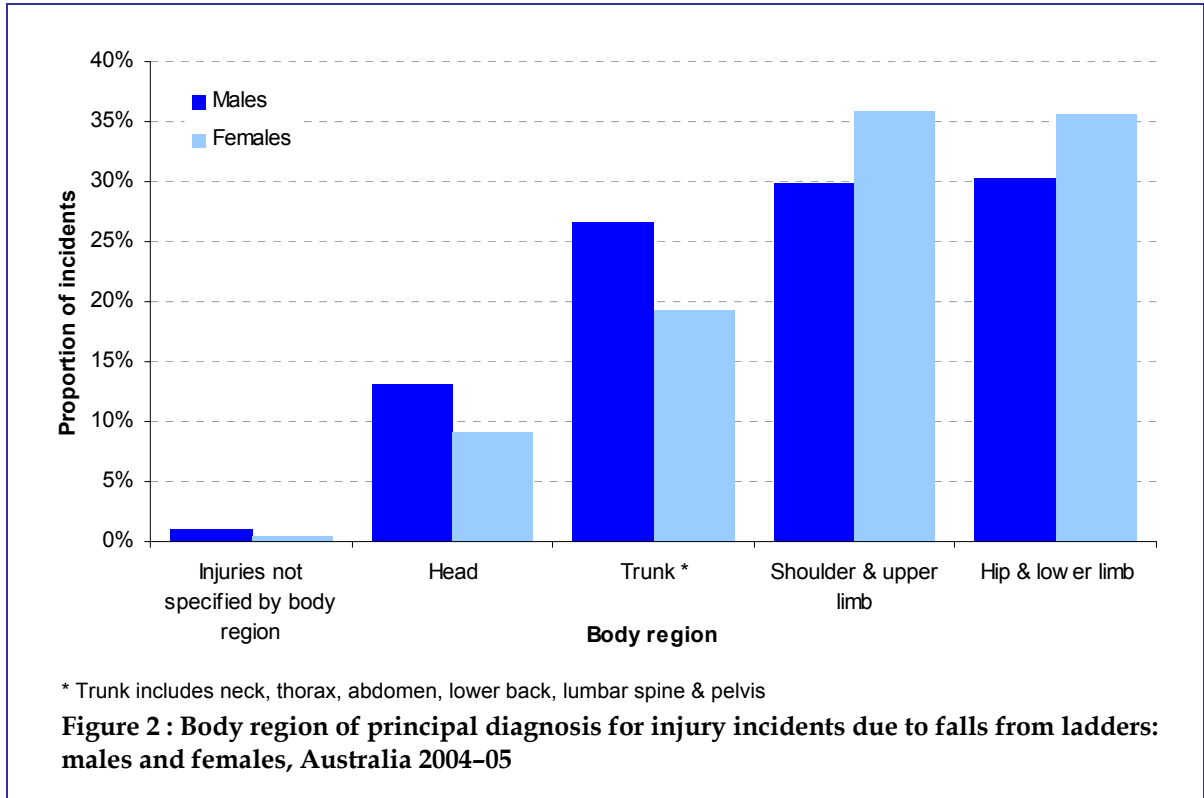
The injuries caused by falls from ladders were diverse (Table 1). Injuries to the elbow and forearm were common (19.1% of incidents, n=736), as were injuries to the knee and lower leg (16.4% of incidents, n=631). Males and females had slightly different patterns of ladder-related injuries. A higher proportion of falls from ladders resulted in injuries to the thorax for males than for females (12.7% vs. 8.0% respectively) and males sustained a higher proportion of injuries to the wrist and hand than females (5.0% vs. 1.1%). Conversely, a much higher proportion of ladder-related injury incidents resulted in injuries to the elbow and forearm for females (27.6% vs. 17.4% in males) and females sustained a higher proportion of injuries to the knee and lower leg than males (21.1% vs. 15.4% respectively).

Table 1: Principal diagnosis groups for ladder-related injury incidents: males, females and persons, Australia 2004–05

Principal diagnosis	Males	Females	Persons
Injuries to the head	414 (13.0%)	60 (9.1%)	474 (12.3%)
Injuries to the neck	44 (1.4%)	5 (0.8%)	49 (1.3%)
Injuries to the thorax	405 (12.7%)	53 (8.0%)	458 (11.9%)
Injuries to the abdomen, lower back, lumbar spine & pelvis	394 (12.4%)	69 (10.5%)	463 (12.0%)
Injuries to the shoulder & upper arm	229 (7.2%)	46 (7.0%)	275 (7.2%)
Injuries to the elbow & forearm	554 (17.4%)	182 (27.6%)	736 (19.1%)
Injuries to the wrist & hand	159 (5.0%)	7 (1.1%)	166 (4.3%)
Injuries to the hip & thigh	156 (4.9%)	46 (7.0%)	202 (5.3%)
Injuries to the knee & lower leg	492 (15.4%)	139 (21.1%)	631 (16.4%)
Injuries to the ankle & foot	311 (9.8%)	49 (7.4%)	360 (9.4%)
Injuries involving multiple body regions	* (0.1%)	* (0.2%)	* (0.1%)
Injuries to unspecified parts of trunk, limb or body region	* (0.6%)	* (0.3%)	20 (0.5%)
Effects of foreign body entering natural orifice	* (0.0%)	* (0.0%)	* (0.0%)
Certain early comps of trauma	8 (0.3%)	0 (0.0%)	8 (0.2%)
Total	3,187	659	3,846

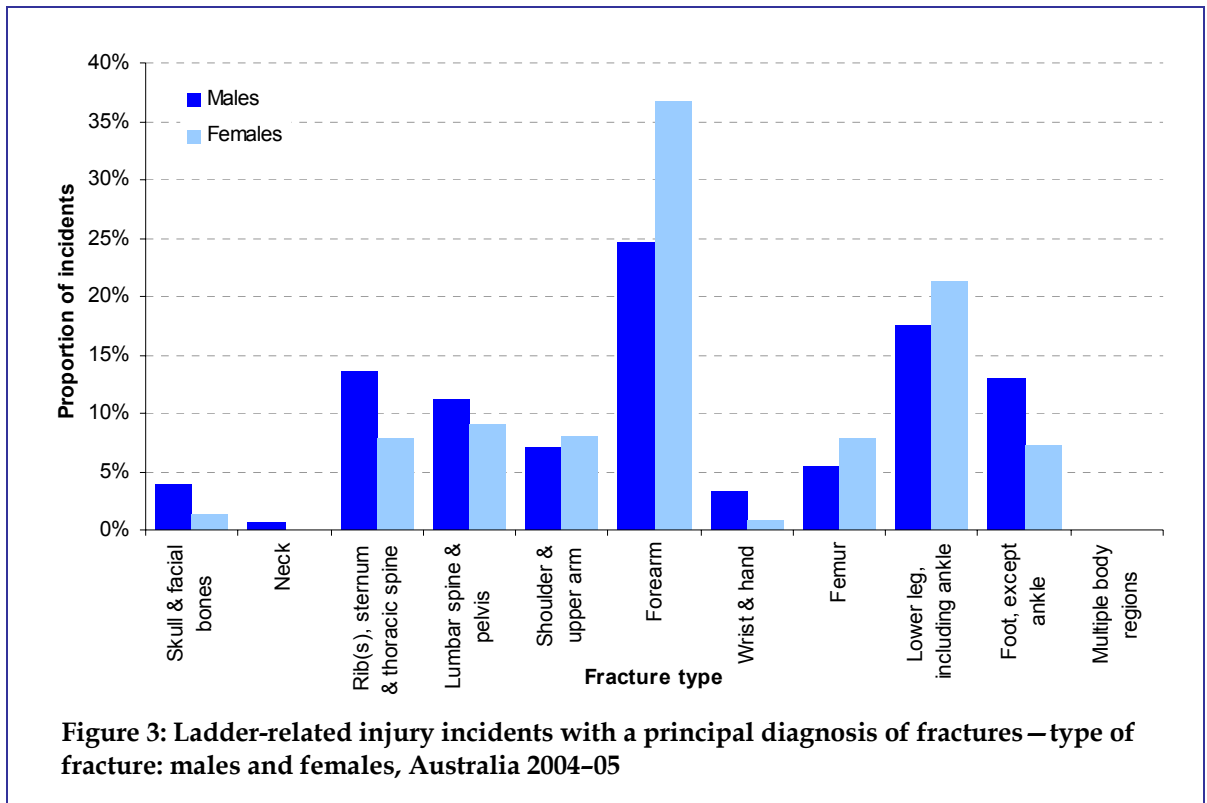
* Small cell counts (<5) have been suppressed.

The different patterns of injuries resulting from falls from ladders for males and females are also described in Figure 2. Here, it is apparent that falls from ladders by males more often result in injuries to the head and trunk regions while falls from ladders by females more often result in injuries to the limbs and hips.



Two-thirds of hospitalised injury incidents due to falls from ladders in 2004–05 resulted in fractures (66.3%, n=2,550). Most commonly this was a fracture of the forearm (S52: 26.8% of incidents with a principal diagnosis of fracture, n=683. See Figure 3). Females sustained a higher proportion of fractures than males overall (71.9% vs. 65.1% respectively).

Open wounds (7.0%, n=269) and intracranial injuries (5.7%, n=219) were also common. As expected from the results presented above, males had a higher proportion of intracranial injuries than females (6.3% vs. 2.6% respectively).



The circumstances of ladder-related injury incidents

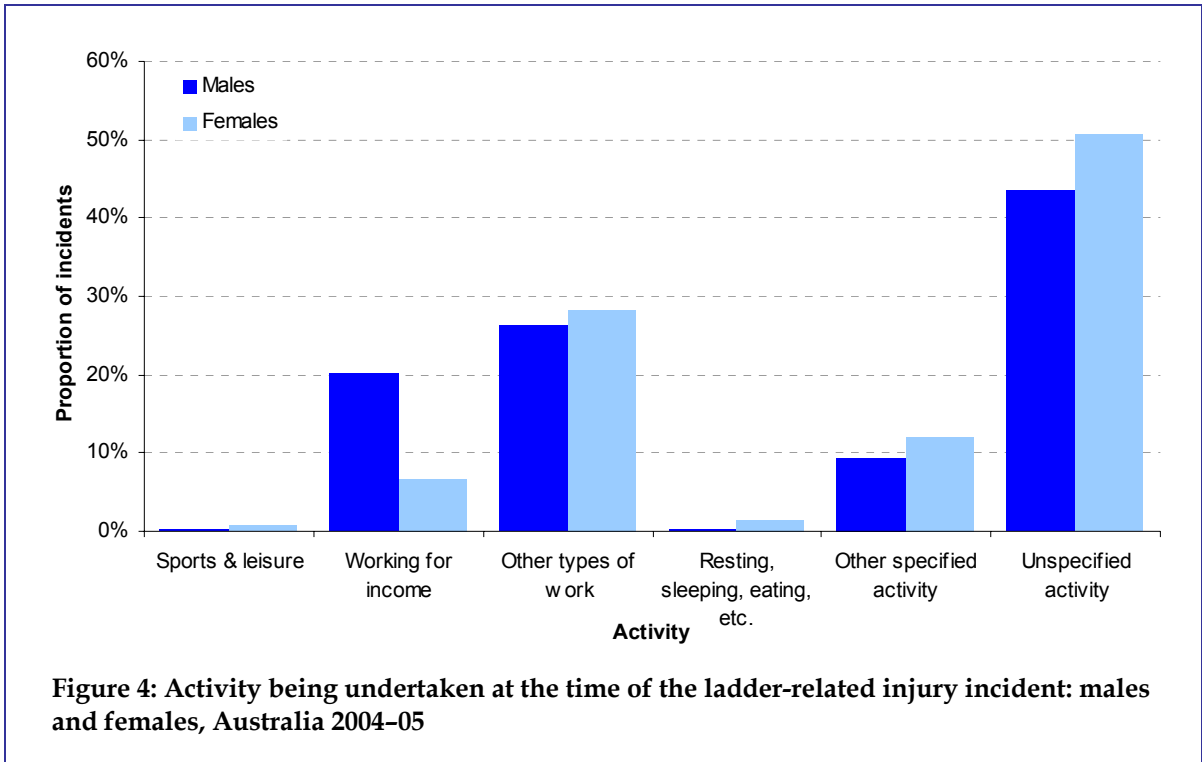
Injury incidents due to falls from ladders in 2004–05 occurred in a wide array of locations, but the most common specified place of occurrence was the home (Table 2). The proportion of injurious falls from ladders that occurred in the home was considerable for both males and females, but this proportion was higher for females (59.6%, n=393) than for males (39.8%, n=1,269). On the other hand, the proportion of ladder-related injury incidents that occurred in industrial and construction areas was higher for males (4.9%, n=156) than for females (0.9%, n=6). Relatively small proportions of cases were observed for all other place of occurrence categories described by the ICD-10-AM. Unfortunately, an unspecified place of occurrence was reported for nearly half of the ladder related injury incident separations (45.8%, n=1,760) which hampers our understanding of these injurious events. Contrary to the proportions of incidents sustained in the home, the proportion of incidents for which an unspecified place of occurrence was reported was higher for males than for females.

Table 2: Place of occurrence for ladder-related injury incidents: males, females and persons, Australia 2004–05

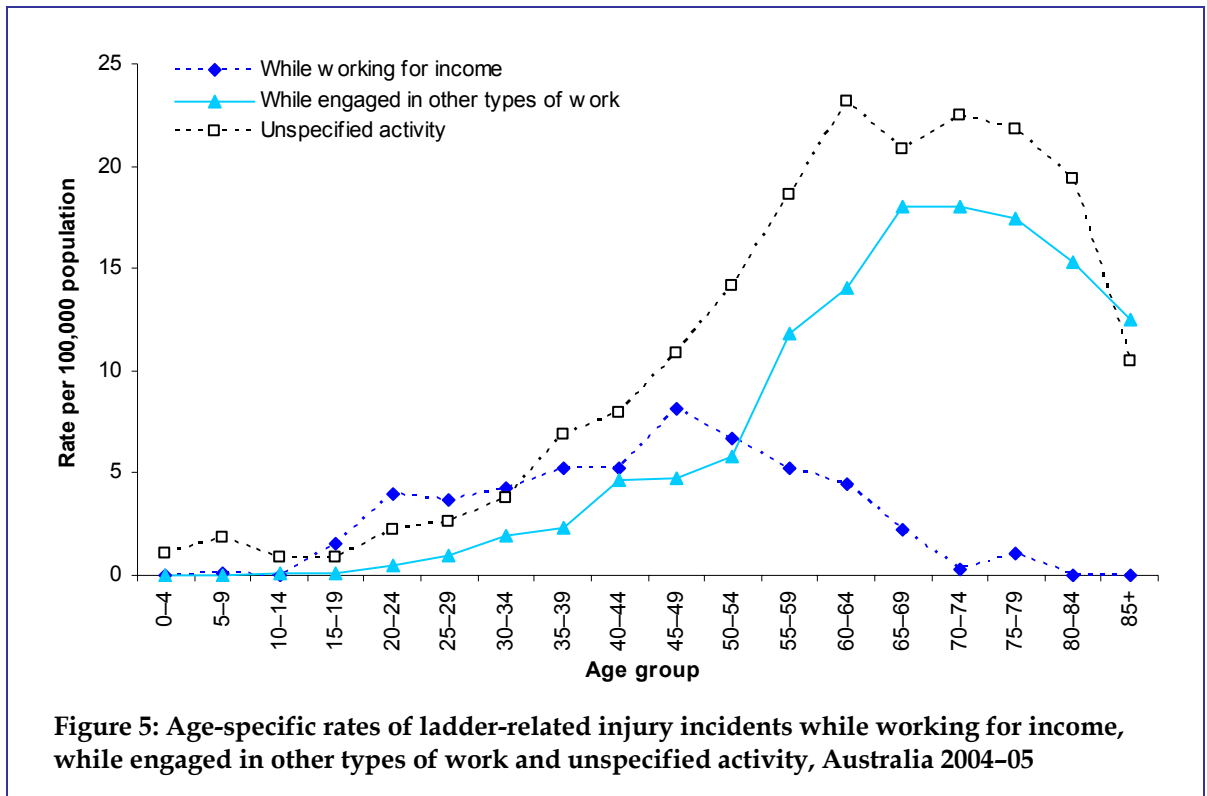
Place of occurrence	Males	Females	Persons
Home	1,269 (39.8%)	393 (59.6%)	1,662 (43.2%)
Residential institution	* (0.1%)	* (0.6%)	8 (0.2%)
School, other institution & public administration area	30 (0.9%)	5 (0.8%)	35 (0.9%)
Sports & athletics area	5 (0.2%)	0 (0.0%)	5 (0.1%)
Street & highway	* (0.1%)	* (0.2%)	* (0.1%)
Trade & service area	76 (2.4%)	16 (2.4%)	92 (2.4%)
Industrial & construction area	156 (4.9%)	6 (0.9%)	162 (4.2%)
Farm	31 (1.0%)	6 (0.9%)	37 (1.0%)
Other specified place of occurrence	70 (2.2%)	8 (1.2%)	78 (2.0%)
Unspecified place of occurrence	1,540 (48.3%)	220 (33.4%)	1,760 (45.8%)
Place not reported/not applicable	* (0.1%)	* (0.0%)	* (0.1%)
Total	3,187	659	3,846

* Small cell counts (<5) have been suppressed.

Not surprisingly then, an unspecified activity at the time of the incident was recorded for a large proportion of ladder-related injury incidents (persons: 44.8%, n=1,724. See Figure 4). Compatible with a high proportion of ladder-related injurious falls occurring in the home, the most common *specified* activity reported was ‘while engaged in other types of work’ (26.6%, n=1,022). This category includes such activities as housework, gardening and home maintenance (NCCCH 2002), tasks which would commonly involve the use of a ladder. However, the proportions of ladder-related injury incidents which occurred ‘while engaged in other types of work’ were much lower than the proportion of incidents which occurred in the home for both males and females (while engaged in other types of work: males, 26.2% of incidents; females, 28.4% of incidents). One in five ladder-related injuries requiring hospitalisation for males was sustained while working for income (20.1%, n=643) while for females, ‘while working for income’ accounted for less than one in ten ladder-related injury incidents (6.7%, n=44. While working for income for persons overall; 17.8%). A quarter of incidents sustained while working for income involved work in the construction industry (males: 27.3%, n=175; females: 25.0%, n=11).

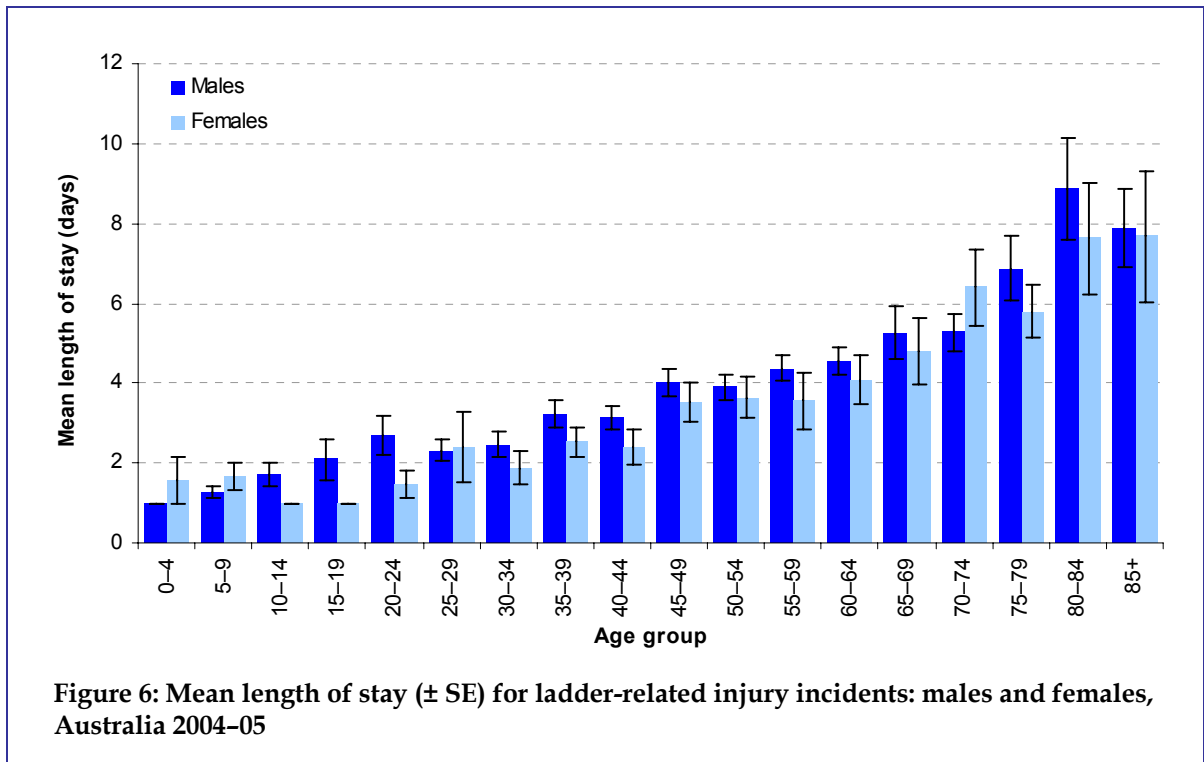


Age-specific rates of falls from ladders while working for income were relatively high from young adulthood to the age group of 65–69 years, peaking at a rate of 8.2 per 100,000 population in the 45–49 years age group (Figure 5). Conversely, rates of ladder-related injury incidents while engaged in other types of work were generally low for younger adults but began to increase markedly from the age of 55 years (as the rate of work-related falls from ladders began to decrease). The highest rate of ladder-related fall incidents while engaged in other types of work was 18.0 per 100,000 population for the 65–69 years age group. Interestingly, the rates of ladder-related falls incidents for which an unspecified activity code was reported were also very high for older adults aged 55–84 years.



Length of stay for ladder-related injury incidents

Nearly half of all ladder-related injury incidents in 2004–05 were admitted to hospital for one day or less (46.6%, n=1,792) and four out of five ladder-related injury incidents resulted in a length of stay of less than a week (81.5%, n=3,133). Accordingly, the mean length of stay observed for incident cases was quite short; 4.4 days ± 7.0 SD. Falls from ladders resulting in injuries to the trunk had the longest mean length of stay (5.71 days ± 9.5 SD) and the length of stay for ladder-related injuries to the hip and lower limbs was similar (mean 5.70 days ± 7.3 SD). Falls from ladders resulting in injuries to the shoulder and upper limb region had the shortest mean length of stay; 2.4 days ± 3.6 SD. Lengths of stay were observed to increase relatively steadily with age (Figure 6).



Mode of separation

Four out of five ladder-related injury incidents in 2004–05 were discharged from hospital back to the person’s place of usual residence (81.9%, Table 3). Twenty-two ladder-related injury incident separations (0.6%) recorded the person as having died due to the fall. This equates to a ratio of one ladder-related fatality for every 175 hospitalised incidents. Official ABS death data for the 2004–05 financial year was unavailable at the time of writing, preventing analysis of ladder-related fatal falls that did not result in a hospital admission prior to death. However, a mean of 19.4 deaths per year (range: 15–27) were coded with an underlying cause of death of W11 in the preceding five years (financial years 1999–00 to 2003–04). This suggests that the number of hospitalised fatal injuries due to falls from ladders in 2004–05 is similar to that in previous years. Nevertheless, it is possible that these figures underestimate the actual number of ladder-related deaths per year; ladder-related incidents in 2004–05 may have resulted in death prior to hospitalisation and, for the years where deaths data is available, fatal ladder-related falls may have been coded with a different underlying cause of death (e.g. W19, unspecified fall).

Small proportions of cases were transferred to residential aged care and other healthcare accommodation facilities and episodes of care for 558 ladder-related injury incidents ended with transfers to another acute hospital (14.5%).

Table 3: Mode of separation for ladder-related injury incidents: males, females and persons, Australia 2004–05

Mode of separation	Males	Females	Persons
Unknown	* (0.1%)	* (0.0%)	* (0.1%)
Transfer to another acute hospital	448 (14.1%)	110 (16.7%)	558 (14.5%)
Transfer to residential aged care	* (0.2%)	* (0.5%)	8 (0.2%)
Transfer to other healthcare accommodation	* (0.3%)	* (0.3%)	10 (0.3%)
Statistical discharge—type change	50 (1.6%)	17 (2.6%)	67 (1.7%)
Left against medical advice	* (0.6%)	* (0.6%)	24 (0.6%)
Statistical discharge from leave	* (0.1%)	* (0.0%)	* (0.1%)
Died	* (0.6%)	* (0.5%)	22 (0.6%)
Other (usual residence)	2,631 (82.6%)	520 (78.9%)	3,151 (81.9%)
Total	3,187	659	3,846

* Small cell counts (<5) have been suppressed.

The burden of ladder-related injury

Ladder-related injury incidents occupied a total of 16,845 hospital bed days in 2004–05 (Table 4). The 372 ladder-related inward transfer separations in 2004–05, previously omitted from the analysis to minimise multiple counting, utilised a further 3,434 hospital bed-days in the 2004–05 study year (a mean stay of 9.2 days \pm 24.8 SD per inward transfer). Added to the bed-days occupied by ladder-related injury incidents, the total number of bed-days occupied in Australian hospitals principally attributed to injuries sustained in falls from ladders was 20,279. This equates to a mean hospital stay of 5.3 days directly attributable to injuries sustained in ladder-related falls. These ladder-related separations accounted for 1.4% of all community injury separations in 2004–05 and 2.6% of all fall-related injury separations in this period.

Our previous analyses also omitted separations containing a W11 (fall from ladder code) but which were not principally attributed to an injury thought to be sustained in the community and/or where W11 was not the first-listed external cause. While the relationship between the fall from a ladder and the principal reasons for hospitalisation is not fully understood, many such separations are thought to relate to post-fall rehabilitation/follow-up care (Bradley & Harrison 2007) and these separations do contribute to the burden of hospital care due to falls from ladders and should be taken into consideration.

In addition to ladder-related fall injury incidents and inward transfers, 582 hospital separations containing a W11 external cause code were identified in the 2004–05 financial year. These separations contributed 8,065 bed-days to the total number of days of hospital care due to falls from ladders (n=28,344). The mean length of stay for these separations was much longer than that of incident cases or inward transfers (a mean of 13.9 days \pm 37.6 SD). Episodes of care involving males accounted for 80.1% of all bed-days due to falls from ladders.

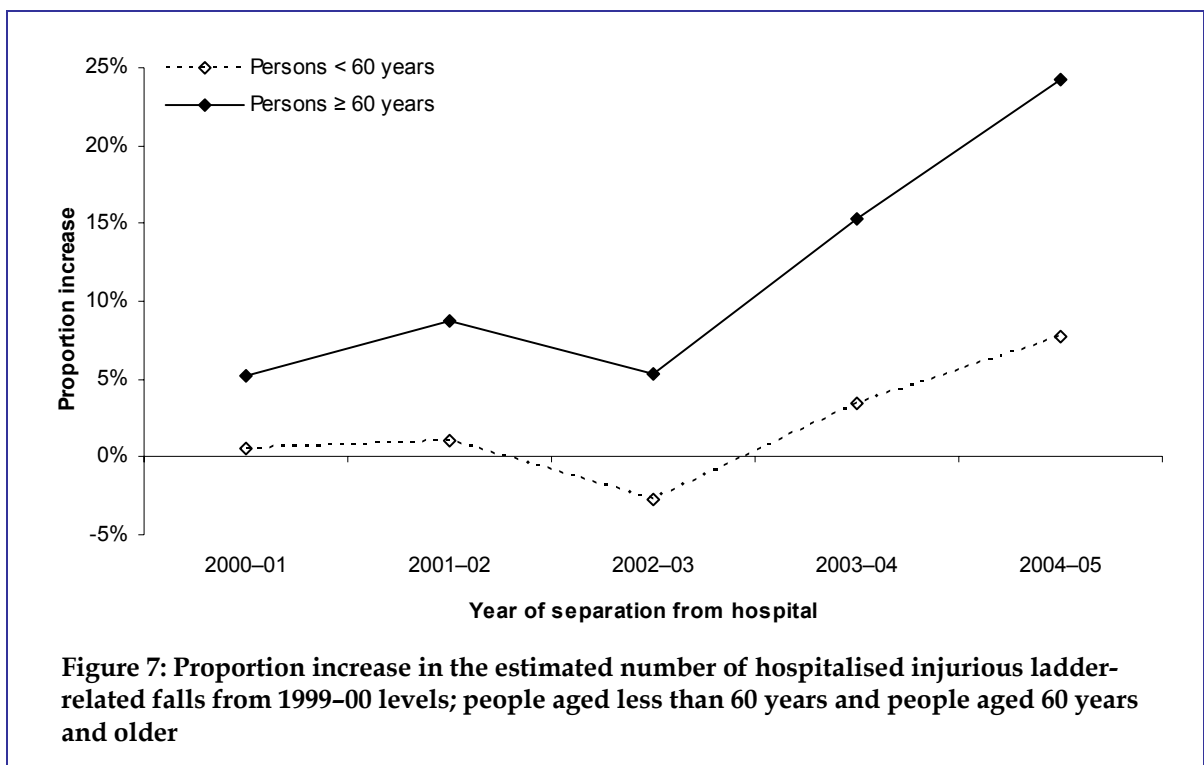
Table 4: Hospital bed-days due to falls from ladders: males, females and persons, Australia 2004–05

	Males	Females	Persons
Incident cases	13,986 (61.6%)	2,859 (50.6%)	16,845 (59.4%)
Inward transfers	2,878 (12.7%)	556 (9.8%)	3,434 (12.1%)
Other W11 separations	5,830 (25.7%)	2,235 (39.6%)	8,065 (28.5%)
Total	22,694	5,650	28,344

Trends over time for ladder-related injuries

Since 1 July 1999 all Australian hospital separations have been coded to the ICD-10-AM (NCCH 2002), allowing trends in incidence to be calculated for this six year period.

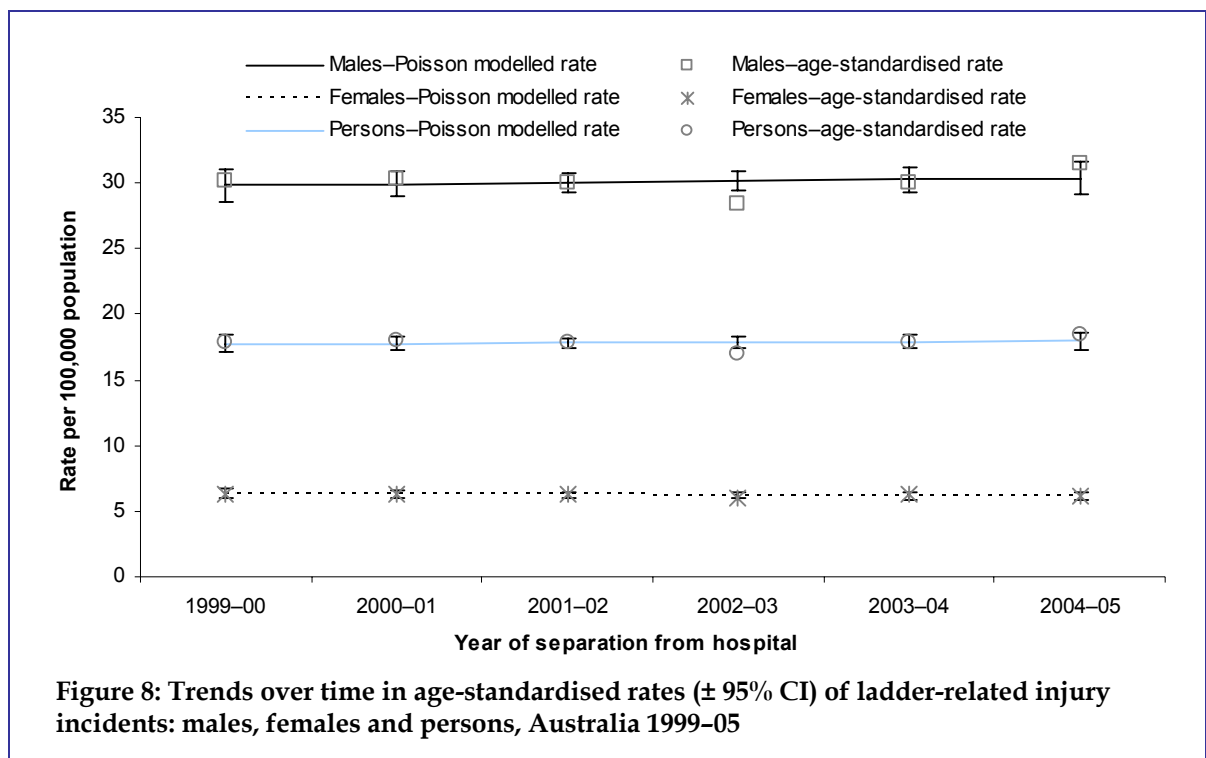
The estimated number of hospitalised fall from ladder injury cases is increasing. In 2004–05 13.9% more cases (n=3,846) were hospitalised than in 1999–00 (n=3,377). The average increase in the number of ladder-related injury incidents for the study period was 5.7% per year. The number of ladder-related injury incidents is increasing faster for males (6.0% increase in cases per year) than for females (4.2% increase in cases per year). The number of ladder-related injury incidents involving older people is increasing at a higher rate than those for younger people; the number of ladder-related incidents involving people aged 60 years and older increased by 24.2% between 1999–00 and 2004–05 while the number of ladder-related incidents involving people aged younger than 60 years increased by only 7.7% in this period (Figure 7). This is largely due to Australia’s growing older population. Since considerable further growth in the older population is anticipated, serious injuries resulting from falls from ladders will consume an increasing proportion of hospital resources in years to come unless incidence rates can be reduced.

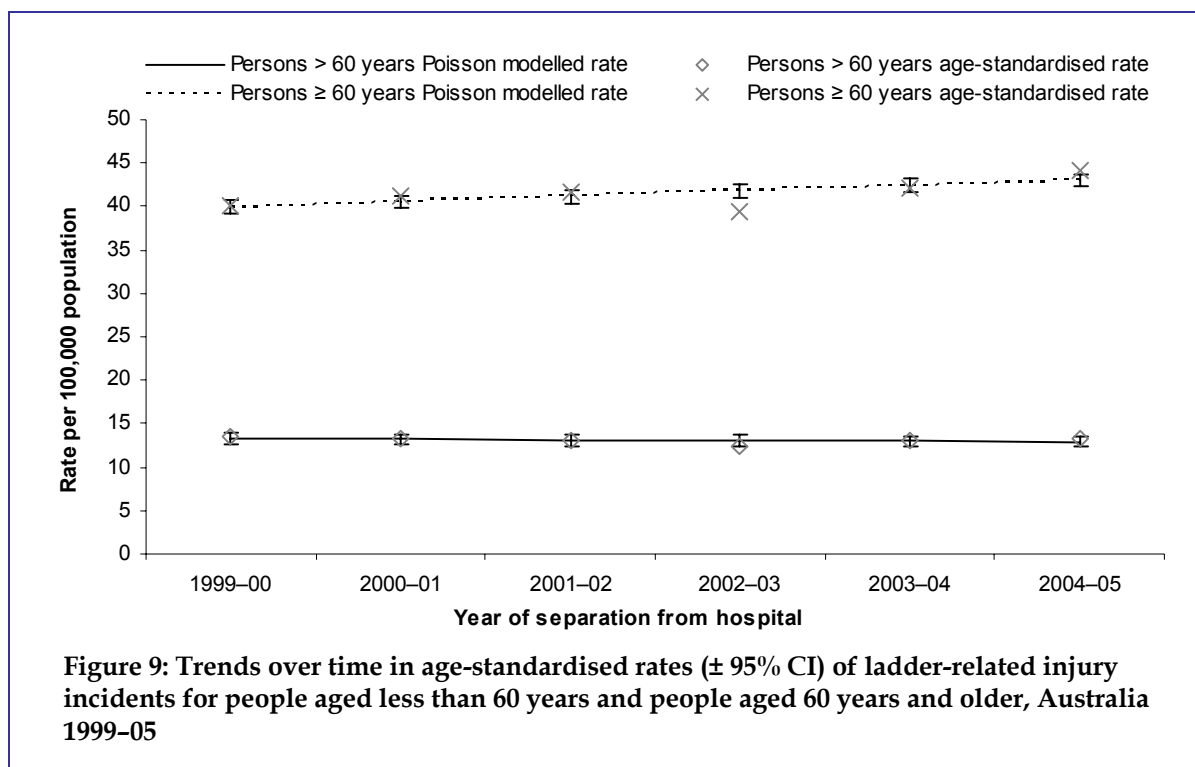


Age-standardised incidence rates of injurious falls from ladders resulting in hospitalisation have shown some indication of an upward trend, especially for males, but change is much more gradual than for the number of cases (Figure 8). Modelled using Poisson regression, the annual percentage increase in the all-ages age-standardised rate for persons over the study period was 0.2% and not statistically significant ($p=0.72$). The age-standardised rate for males increased by 0.4% annually ($p=0.61$) while the age-standardised rate for females decreased (-0.7% per year, $p=0.45$), neither reaching statistical significance.

As noted above, the annual number of ladder-related injurious fall incidents involving people aged 60 years and older is increasing more rapidly than those involving people aged less than 60 years. Similarly, we observe that the age-standardised rate of ladder-related injury incidents involving people aged 60 years and older is increasing at a greater rate than that for people aged less than 60 years (Figure 9). The age-standardised rates for people aged 60 years or older were observed to increase by 1.5% for each year of the study ($p<0.05$) while the age-standardised rate of ladder-related injurious fall incidents for people less than 60 years of age was essentially stable, with no significant trend (a 0.6% decrease in rates annually, $p=0.26$). A similar analysis was also undertaken for rates of ladder-related injury incidents involving people aged younger than 50 years compared with people aged 50 years and over, the age groups used by Mitra et al. (2007). Like that study, we found indications of an increasing trend in ladder-related injurious fall incidents for people aged 50 years and older, but it did not reach statistical significance (0.9% increase per year, $p=0.07$).

These results suggest that the risk of injurious falls from ladders has increased gradually in recent years for older Australians.





These results differ from those recently presented by Cassell and Clapperton (2006) for Victorian ladder-related hospitalisations, which suggest a higher degree of increase for the 1999–04 period (see also Mitra et al. 2007). However, these authors used broader case selection criteria than those used here and included all hospital separation records that contained a W11 (fall from ladder) code anywhere in the record (for ICD-10-AM coded data). As described above, the approach taken in this report restricted analysis to estimated *incidents* of injuries principally attributed to a fall from a ladder, excluding the multiple separations per case generated by inter-hospital transfers, injuries described as complications of medical care, separations with non-injury principal diagnoses and separations principally attributed to an external cause other than a fall from a ladder.

Relaxing our selection criteria to include all hospital separations containing a W11 code anywhere in the record, an annual mean of 774.5 additional ladder-related hospital separations are identified for the period 1999–05. It is important to note that these separations are likely to represent extra records associated with ladder-related injury incidents included in our estimate rather than additional cases of ladder-related falls.

Over a third of these additional separations (38.4%, n=1,846) were ladder-related injury inward transfers. A further third (34.0%, n=1,582) of these additional ladder-related separations had a principal diagnosis from Chapter XXI of the ICD-10-AM: factors influencing health status and contact with health services. As has been described previously for hospitalised falls involving older people, four particular codes from this chapter have a strong association with fall-related injuries; Z47, Z48, Z50 and Z75.1 (fall-related ‘follow-up care’ see Bradley & Harrison 2007). Together, these four codes accounted for 93.7% of the 1,582 ladder-related separations with a Z-code principal diagnosis.

Modelling using the annual rates for all hospital separations that included a W11 code demonstrated a significant increase in the rate of ladder-related hospitalisations of 1.0% per year for persons of all ages for the period 1999–05 (p<0.01). This suggests that the high rates of increase in ladder-related hospitalisations reported by Cassell and Clapperton (2006) and Mitra et al. (2007) are largely due to an increase in the number of *separations* associated with ladder-related falls rather than an increase in the rate of injurious fall *cases*.

Discussion

Falls from ladders result in a substantial number of admissions to hospital each year (Cassell & Clapperton 2006; Kent & Pearce 2006; Mitra et al. 2007). Both the number of hospitalised ladder-related injury incidents and the age-standardised rate of hospitalised ladder-related injury incidents are increasing, particularly for older Australians. Given Australia's increasing older population, serious injuries resulting from falls from ladders will place an increasing burden on hospital resources in years to come unless incidence rates can be reduced.

Information about the nature of ladder-related injurious falls may assist with the development of prevention policies and programmes. Two groups of cases are noteworthy: those occurring while working for income, and cases occurring at home, often while working, but not for income. Falls from ladders while working for income made up 10% of incidents overall. However, they accounted for 20% of incidents involving males and were prominent among cases at ages from about 20 to 50 or 60 years of age. Safe use of ladders continues to be a significant occupational health and safety issue.

Nearly 45% of injury incidents occurred in the home and high rates of falls from ladders were observed for older people (especially men) engaged in 'other types of work' (e.g. housework, home maintenance, DIY). High rates of injurious falls for which an activity was unspecified were also high for older people. These findings support suggestions that the majority of ladder-related falls may be qualitatively different to those sustained in the workplace (e.g. Kent & Pearce 2006; Mitra et al. 2007). Accordingly, prevention programmes may need to be quite different to those that have demonstrated efficacy in the work-related setting.

The findings of this analysis also suggest that ladder-related falls are qualitatively different to the majority of fall incidents involving older people. Ladder-related injury incidents chiefly involve older males whereas older females have a higher risk of serious falls more generally (Bradley & Harrison 2007). Similarly, ladder-related injury incidents result in high proportions of serious injuries to the trunk, shoulders and upper limbs whereas the prevention of fall-related injuries to the hips and lower limbs is a more pressing issue for interventions aimed at reducing falls more generally (Boufous et al. 2004; Peel et al. 2006; Bradley & Harrison 2007). Again, falls prevention programmes as currently designed may need to be refined in order to adequately address ladder-related injuries.

A point of similarity between ladder-related falls in older people and falls from all causes is that most cases of both types are reported to occur in the home (see Bradley & Harrison 2007). However, because of the difference in relative age and gender of the populations at greatest risk of ladder-related falls compared to, say, slips, trips and stumbles, prevention programmes addressing falls risk in the home generally may require additional development if they are to reduce the incidence of ladder-related injury. For example, home assessments often highlight tripping and slipping hazards, lighting and hand-rails (e.g. Clemson et al. 1996; Cumming et al. 1999; Peel et al. 2000), which may not be the greatest contributing factors to ladder-related injury. Attitudinal factors may also play a greater role in the risk of ladder-related fall injury than in other types of falls (e.g. Mwanri & Fuller 2003; Cassell & Clapperton 2006). Further, risk exposure may also be different according to gender (e.g. Driscoll et al. 2003).

As the ageing of the Australian population continues to increase the number of people at high risk of ladder-related falls injury, the currently relatively small number of ladder-related incidents is likely to grow. Further, the increasing impetus to enable older, frailer people to remain at home may compound this problem; many ladder-related falls injuries being sustained in the home whilst undertaking activities of a home maintenance, housework or DIY nature (see also Kent & Pearce 2006; Driscoll et al. 2003). This report lends weight to calls for specific attention to be given to ladder-related falls as part of falls prevention programs.

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Data issues

Hospitalised ladder-related injury analysis

Separations data from the National Hospital Morbidity Database were provided by the Australian Institute for Health and Welfare (AIHW). Hospital separations data used in this report are classified according to the Australian Modification of the 10th revision of the International Classification of Diseases (ICD-10-AM).

This study examined data for hospitalised episodes that concluded during the period from 1 July 2004 to 30 June 2005. These separations were coded to the fourth edition of the ICD-10-AM.

Incident cases were defined as those separation unit records which had:

- A leftmost external cause code of W11 (fall from ladder),
- A principal diagnosis code in the range S00–T75 or T79, and
- A mode of admission other than transfer from another acute hospital.

Incidence rates have been calculated as cases per 100,000 of the estimated resident population of Australia as at 31 December 2004, the mid-point of the year of interest. Direct standardisation was employed, taking the Australian population as at 30 June 2001 as the standard.

Ladder-related injury inward transfer separations were defined as those separation unit records which had:

- A leftmost external cause code of W11 (fall from ladder),
- A principal diagnosis code in the range S00–T75 or T79, and
- A mode of admission of transfer from another acute hospital.

Ladder-related injury incidents and inward transfers were analysed using SPSS v14.0 (SPSS Inc, Chicago, Ill, USA).

Trends analysis

Trends over time for ladder-related injury incidents were analysed for records separating from hospital between 1 July 1999 and 30 June 2005. In all years records were coded to the ICD-10-AM, but the particular editions used altered over time. However, as all editions of the ICD-10-AM code ladder-related falls similarly (i.e. W11), ladder-related injury incidents were identified using the same definition as that described above. As described in the text, additional analyses were also undertaken including separations identified as ladder-related injury inward transfers (defined above) and other hospital separations including a W11 anywhere in the record.

Rates were calculated using the estimated resident population as at the 31 December of the relevant financial year and standardised to the Australian population as at 30 June 2001. Poisson and negative binomial regression techniques were applied, as appropriate, using Stata v9.2 (StataCorp, College Station, Tex, USA).

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