Ladders revisited

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ABSTRACT

Objective: To describe the epidemiology of falls from ladders in a state-wide population.

Design and setting: Retrospective review of data from the the Victorian State Trauma Registry and the Victorian Emergency Minimum Dataset on patients presenting to public hospital emergency departments (EDs) with injuries due to a fall while climbing a ladder, from 1 July 2001 to 30 June 2005.

Main outcome measures: Overall trends in the incidence of ladder-related ED presentations, and in cases of major trauma, trends according to age, and trends according to activity at the time of the fall.

Results: 4553 patients presented to EDs after falls from ladders in Victoria during the study period; 160 patients had injuries classified as major trauma. There has been a significant rise in the number of presentations to EDs following falls from ladders in Victoria, with a marked increase in the number of cases involving patients aged over 50 years and those climbing ladders outside of paid working conditions. Deaths occurred predominantly in the elderly after falls from heights above 1 metre.

Conclusions: Despite knowledge of the dangers of falls from ladders, there has been a significant increase in the number of patients presenting to hospitals after ladder falls. Middle-aged to elderly patients undertaking unpaid work account for this increase. A targeted public health initiative is required to curb this trend.

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The first major report of falls from ladders as a significant cause of mortality and morbidity was published in 1981.[1] Single-centre studies in Australia[2,3] and overseas studies[4-7] have all concluded that falls from ladders result in significant mortality and morbidity, demanding focused injury prevention efforts. Understanding the epidemiology of falls from ladders is crucial for developing targeted prevention strategies with the greatest potential for reducing incidence.

Our aims were to describe the epidemiology of falls from ladders resulting in serious injury across a state-wide population (Victoria, total population about 5 million), and to identify priority groups for future targeting of prevention strategies.

METHODS

Over the 4 years from 1 July 2001 to 30 June 2005, we performed a retrospective review of all Victorian patients who had an injury after falling from a ladder that was serious enough to warrant presentation at an emergency department (ED) or classification as major trauma.

Data on all patients who presented to the ED of a Victorian public hospital after a fall from a ladder during the study period were obtained from the Victorian Emergency Minimum Dataset (VEMD). It is estimated that more than 80% of ED presentations are included in this dataset.[8] Data on injured patients classified as major trauma were obtained from the Victorian State Trauma Outcome Registry and Monitoring (VSTORM) Group database. Inclusion criteria for the VSTORM database have been previously described,[9] and include any of the following: death due to injury; an Injury Severity Score > 15; urgent surgery; or an intensive care unit stay of more than 24 hours requiring mechanical ventilation. VSTORM collects data on all major trauma cases for Victoria, and data quality checks are performed against other databases including Victorian Admitted Episode Data, Death Registry and Hospital databases. All VSTORM cases were admitted through the ED. In both datasets, ladder-related falls were identified by the inclusion of the word "ladder" in the text narrative of the injury event and "fall" as the recorded cause of injury.

Demographic, injury and outcome data for all patients were obtained from the datasets for analysis. Summary data provided by the VEMD included demographic information, activity at the time of injury, cause of injury, and disposition from the ED. Data extracted from VSTORM included patient demographic information, activity at the time of injury, cause of injury, injury details and in-hospital mortality. An injury was classified as work-related if the activity at the time of injury was recorded as doing paid work for salary, bonus or other types of income, but excluded voluntary work. A low fall was classified as a fall from a height of 0 to 1 metre above the ground.

Stata (StataCorp, College Station, Tex, USA) was used for all analyses. Population estimates for Victoria were obtained from the Australian Bureau of Statistics.[10] Descriptive statistics were used to summarise the profiles of ED presentations and major trauma cases. Population-based incidence rates (95% CIs) were calculated for each 12-month period based on the total population at the end of June 2002, 2003, 2004 and 2005. A Poisson regression model was used to test for a dose–response effect of increasing incidence over the 4 years by assuming a linear increase in the logarithm of the rate with increasing calendar years. The incidence rate ratio (IRR) and 95% CIs were calculated; a P value < 0.05 was considered significant.

RESULTS

During the study period, 4553 patients presented to Victorian public hospital EDs with injuries from falling from a ladder. Of these, 160 patients were classified as major trauma cases on the basis of VSTORM inclusion criteria. Box 1 shows the profile of ladder-related falls presentations to EDs and cases classified as major trauma. The vast majority of patients presenting to EDs and sustaining major trauma from ladder falls were men.

Presentations to the ED for ladder falls were most common in the 50–59-years age group (Box 1). Forty per cent of ED presentations, and 70% of major trauma cases involved people aged 50 years or more. A fall from a height greater than 1 metre was the most common mechanism of injury, accounting for 59% of ED presentations and 91% of major trauma cases. About 20% of ladder-related falls resulting in ED presentations and major trauma occurred while people were working for income. Over a quarter of people presenting to EDs after ladder-related falls (1191; 26.1%) were admitted to hospital (this excludes ED short-stay admis-

sions). Overall, there were 16 deaths (0.3% of people falling from ladders) and all were related to a fall from a height of over a metre (Box 1).

Box 2 shows the population-based rates for ED presentations and major trauma from ladder-related falls over the 4 years to 30 June 2005. Since 2001, there has been a significant increase in the incidence of falls resulting in major trauma ($P < 0.001$; IRR, 1.33; 95% CI, 1.15–1.54) and emergency department presentations ($P < 0.001$; IRR, 1.05; 95% CI, 1.02–1.08).

The incidence of ED presentations and major trauma in patients aged less than 50 years and 50 years or more is shown in Box 3. Since July 2001, there had been a significant increase in the incidence of ED presentations ($P<0.001$; IRR, 1.10; 95% CI, 1.06–1.14) and major trauma cases ($P < 0.001$; IRR, 1.41; 95% CI, 1.19–1.67) related to ladder falls in those aged 50 years or more. The rate of ladder-related falls leading to ED presentations and major trauma for those less than 50 years has not changed.

The incidence of ladder-related ED presentations and major trauma cases grouped by whether or not patients were working for income at the time of their fall over the period of the study is illustrated in Box 4. While the incidences of ED presentations and major trauma cases from ladder falls in the workplace have not changed significantly, there was a significant increase in the incidence of ladder-related major trauma ($P < 0.001$; IRR, 1.40; 95% CI; 1.19–1.65) and ED presentations ($P < 0.001$; IRR, 1.09; 95% CI, 1.06–1.12) over the 4 years of the study.

1 Profile of presentations to emergency departments and major trauma cases resulting from ladder falls in Victoria (2001–2005)

Variable	Emergency department presentations*	Major trauma
Total number	4553	160
Sex		
Male	3689 (81.4%)	152 (95.0%)
Female	843 (18.6%)	8 (5.0%)
Age (years)		
< 20	316 (6.9%)	1 (0.6%)
20–29	404 (8.9%)	4 (2.5%)
30–39	685 (15.1%)	9 (5.6%)
40–49	875 (19.2%)	23 (14.4%)
50–59	943 (20.7%)	35 (21.9%)
60–69	764 (6.8%)	40 (25.0%)
70–79	442 (9.7%)	37 (23.1%)
⩾ 80	120 (2.7%)	11 (6.9%)
Mechanism		
Fall from ⩽ 1 m	1954 (42.9%)	14 (8.7%)
Fall from > 1 m	2599 (57.1%)	146 (91.3%)
Activity at time of injury		
Working for income	851 (18.7%)	33 (20.6%)
Unpaid work†	657 (14.4%)	77 (48.1%)
Other‡	3045 (66.9%)	50 (31.3%)
Disposition		
Discharge	3220 (70.7%)§	99 (61.9%)¶
Hospital admission	1191 (26.1%)§	46 (28.7%)¶**
Death	1 (0.02%)§	15 (9.4%)¶

* Sex data missing for 21 cases; age data missing for 4 cases. † Domestic duties for which no financial benefit is intended or received. ‡ Includes leisure, sports, education. § From emergency department. ¶ From ward. ** Indicates discharge to inpatient rehabilitation. ◆

DISCUSSION

Our population-based study shows that ED presentations following ladder falls increased significantly in 2001–2005. In particular, there has been a significant rise in serious injury from ladder falls, especially in Victorians aged 50 years and over and in people using ladders for non-work related purposes. Our findings also support the results of a recent single-centre Australian study that found an increasing number of falls from ladders at home and involving the elderly.[3]

Initial public health campaigns should therefore be targeted at people aged over 50 years and the elderly using ladders in the home, whose falls lead to the bulk of ladder-related ED presentations and major trauma cases. Clearly, strategies for injury prevention in the home and for the elderly are likely to be different than in the workplace. Communicating key messages and enforcing safety standards are likely to be more difficult.

There has not been a strategic approach to prevention of injuries related to falls from ladders outside the workplace. The cause of falls in any age group is a combination of intrinsic and extrinsic factors once a person is exposed to the risk. We propose the framework shown in Box 5 (based on a National Health and Medical Research Council publication[11]) for categorising the causes of falls from ladders. Each factor in Box 5 can be used to direct strategies for preventing falls. Various programs aimed at reducing falls at home exist, and a similar approach could be used to target falls from ladders.

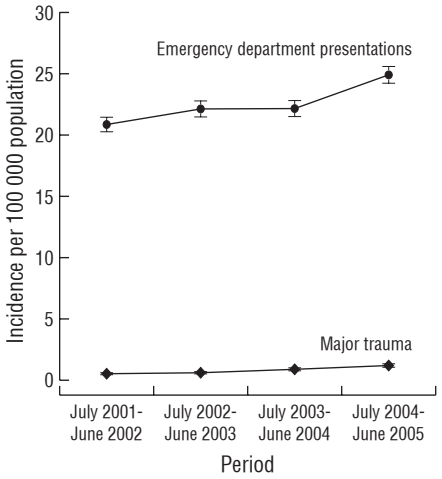
Climbing ladders at home is a risk behaviour that requires targeted modification. Home visits by occupational therapists have been used successfully to reduce low falls after hospital discharge.[12] Home environment assessments, installation of safety devices and educational programs have also been used to significantly reduce falls among the elderly.[13,14]

Risk assessment through interviews combined with feedback and counselling sessions have been successful strategies.[15] Education in small groups results in more behavioural changes than individual education.[16] A recent report on the "Stepping On" program, which included home environmental safety assessments and education in small groups to reduce the risk of falls in the elderly, showed a 31% reduction in falls in the intervention group.[17] Ladder falls differ from low falls in that most of the successful interventions for prevention of repeated low falls occur after an initial fall, which allows targeted education messages. More general educational programs could be provided through community health centres, local councils, sporting and cultural groups.

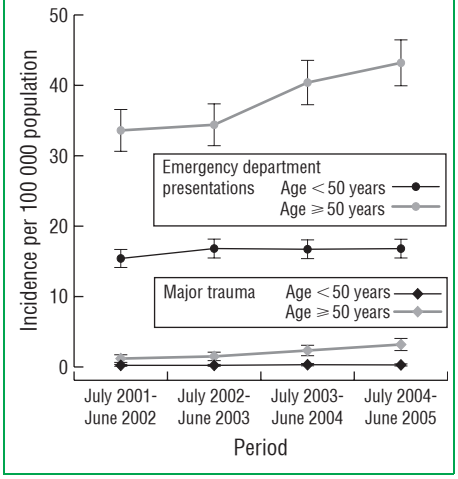
The bulk of falls from ladders involves a younger population of over-50-year-olds — whether the factors relevant to the elderly also apply to the younger age group is not known. However, there is the potential for overlap, particularly with respect to extrinsic risk and contributing factors.

The major strength of our study is its population-based nature. However, a number of limitations should be acknowledged. This study was a retrospective review. Data on patients who did not seek medical attention or who were treated privately were not available. Patients who died at the scene were also not included. Absence of these patients underestimates the mortality and morbidity from ladder falls reported in our study. Specific comorbidities of patients were not known. The reliability of triage documentation of injury descriptions was not available from the data sources,

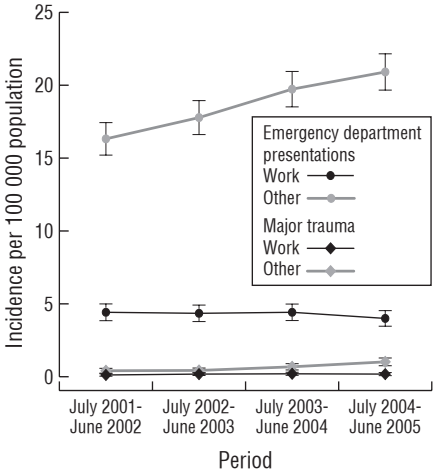
2 Incidence (95% CI) of falls from ladders leading to emergency department presentations and major trauma in Victoria, 2001–2005



3 Incidence (95% CI) of falls from ladders leading to emergency department presentations and major trauma in patients aged < 50 years and ⩾ 50 years in Victoria, 2001–2005



4 Incidence (95% CI) of emergency department presentations and major trauma related to ladder falls in Victoria (2001–2005) by activity at the time of injury



5 Causative factors in falls from ladders*

Climbing ladders

Intrinsic factors

- Age
- Obesity
- Medical
  - ➢ Drugs
    - CNS depressants
    - Postural hypotension from drugs
    - Parkinsonian symptoms from drugs
  - ➢ Alcohol

Extrinsic factors

- Activity related
  - ➢ Cleaning gutters
  - ➢ Hanging Christmas lights
- Environmental factors
  - ➢ Uneven surfaces
  - ➢ Wet surfaces
  - ➢ Electrical cords
  - ➢ Pets
  - ➢ Ladder design

*Adapted from *Falls and the older person.*[11] CNS = central nervous system. ◆

although it is likely that documentation of an easily described mechanism of injury such as "fall from a ladder" is likely to be accurate. Whether ladder-related falls were missed because of absence of documentation about the involvement of ladders in the medical record is not known.

Our study has highlighted the increased risk that climbing ladders poses to the middle-aged and elderly population. Despite general public health interventions to improve intrinsic health, and some very limited efforts at public education, injuries as a result of falls from ladders have increased. We have identified the groups at risk of falling from ladders, and this information should be used to direct research and the development of public health campaigns to prevent such falls. A well funded program with a multidisciplinary approach to prevent future injuries from ladder falls should be initiated.

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COMPETING INTERESTS

None identified.

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