



Unintentional falls at home among young and middle-aged New Zealanders resulting in hospital admission or death: context and characteristics

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Abstract

Aim This study investigates the characteristics and contexts of unintentional falls at home among young and middle-aged adults.

Method We conducted a population-based study of individuals aged 25–59 years resident in Auckland who were admitted to hospital or died following a non-occupational fall at home (July 2005–June 2006). Information was obtained from participant or proxy interviews, and reviews of inpatient records.

Results 344 patients (including 1 death) met the study eligibility criteria representing an overall age-specific incidence rate of 54.0/100,000 (95% CI 48.6–60.1) for the 12-month period. Of the 335 cases (97.4%) interviewed, 36% fell on stairs/steps, 31% fell on the same level, 13% of falls involved ladders/scaffolding, and 11% fell from buildings/structures. Stairs or steps were involved in 43% of falls among females and 28% of falls among males. The majority of falls (81%) occurred in the individual's own home. A quarter (24%) of participants had consumed ≥ 2 drinks in the 6 hours preceding the fall, and 24% were on ≥ 2 prescription medications.

Conclusion While this study was not designed to identify the specific causes of falls, the findings reveal several important contextual factors that can be targeted to prevent fatal and serious non-fatal falls at home among this age group.

Falls are a leading cause of unintentional injury morbidity and mortality.^{1–5} In New Zealand, almost one-third of unintentional falls resulting in hospital admission or death among young and middle-aged adults occur at home.⁶ Deaths from falls at home are uncommon in this age group (in contrast to the high case fatality rate seen in older adults) but for every death there are approximately 150 inpatient admissions.⁶ These falls result in significant health and societal costs.^{6–8}

The cause of falls among older adults is well recognised as multifactorial.⁹ Important intrinsic risk factors for falls among older adults include a past history of falls; impairments in gait, balance, mobility, vision and cognition; a fear of falling; poly-pharmacy (taking two or more prescription medications); and urinary incontinence.⁹

Some intrinsic factors such as physical activity,^{2,10–12} and alcohol consumption,^{2,13,14} have been identified as being associated with both increased and decreased risk of falls in older adults. Extrinsic factors identified as playing a *potential* role in falls among older adults include footwear,¹⁵ inappropriate walking aids,¹⁶ and environmental hazards such as poor lighting and uneven or slippery surfaces.¹⁵ It is estimated that environmental factors contribute to a third to half of all home falls.^{17,18}

Despite the economic and social impact of falls among young and middle-aged adults, the majority of published studies on the epidemiology of injurious falls at home have focused on older adults. In order to develop effective prevention strategies that apply to younger adult populations, information is required on the nature and circumstances of falls in this age group. This paper describes the characteristics of the individuals and the contexts of unintentional falls at home among young and middle-aged adults resulting in death or hospital admission in Auckland, New Zealand.

Methods

As part of a population-based case-control study we prospectively recruited individuals aged 25 to 59 years, resident in the Auckland region of New Zealand, who were admitted to hospital within 48 hours of injury or died following a non-occupational fall at home (theirs or another's) from July 2005 to June 2006.¹⁹ The region includes urban, suburban and rural areas and has a population of approximately 1.3 million.²⁰ We identified eligible people through daily surveillance and case finding in the three trauma hospitals and single coroner's office in the study region.

The study was approved by the Northern Regional Ethics Committee.

Subjects were interviewed face-to-face using a structured questionnaire by trained research nurses. Proxy interviews were obtained for subjects who were too unwell to be interviewed or for those who had sustained fatal injuries. The questionnaire explored a range of known and postulated risk factors for falls identified from the literature including: lifestyle factors such as alcohol use;^{13,21} medication use;^{22,23} demographic information; temporal factors such as day, time, and season of fall;^{24,25} setting;²⁴ and footwear.²⁶ Where possible, question items were drawn or adapted from previous falls research and validated self-report measures.

The NZiDep index was used to measure the individual-level socio-economic deprivation of cases.²⁷ Inpatient medical charts were reviewed to confirm the circumstances of injury and to gather details of blood alcohol concentrations.

The mechanism of falls was coded using the International Classification of Diseases (ICD) ICD-10-AM external cause of injury codes.²⁸ For reporting purposes the fall related codes were further grouped as follows: falls involving stairs or steps (W10), fall on the same level (W01-01.2, W03-09, W18-other fall on same level), fall from building or structure (W13), fall involving ladder or scaffolding (W11-12), and other falls (W14-tree, W17 – other fall 1 level to another, W19 – unspecified fall).

Chi-squared tests were used to test for differences in proportions. All analyses were undertaken using STATA version 8.²⁹

Results

A total of 344 patients admitted to hospital met the study eligibility criteria representing an overall age-specific incidence rate of 54.0 per 100,000 (95% CI 48.6–60.1) for the 12-month period. Interviews were completed for 97.4% (n=335) of the eligible people. Eight cases (2%) declined to participate, and there was one missed case. The median age of patients was 47 years (interquartile range: 38 to 54), and 53% of cases were females (Table 1).

The ethnic distribution of cases was similar to the ethnic distribution of this age group in the Auckland Region.³⁰ Almost 61% of patients had no socioeconomic deprivation characteristics based on the NZiDep index. No regional NZiDep figures are available however Salmond et al estimate 50.7% (95% C; 45.5 – 56.0) of New Zealand adults have no deprivation characteristics.²⁷

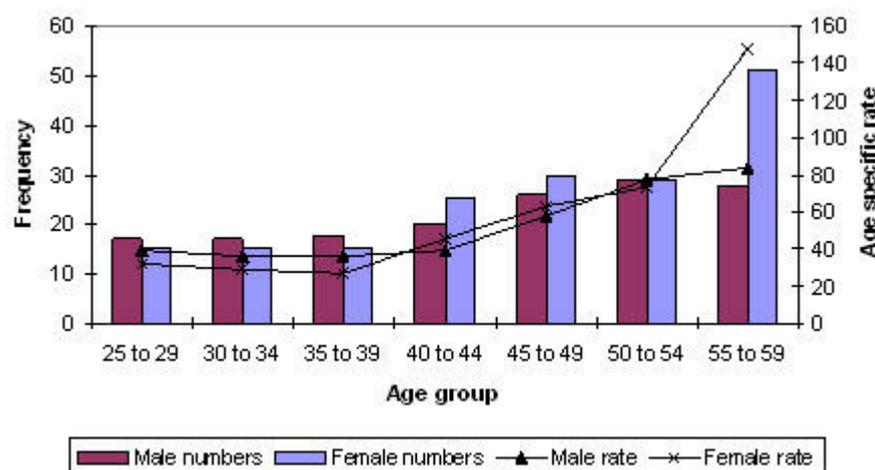
Table 1. Characteristics of study participants admitted to hospital following an unintentional fall at home among 25–59 years olds, New Zealand, 2005–2006 (n=344)

Characteristics	Frequency (%)
Gender	
Male	161(46.8)
Female	183(53.2)
Age group	
25–29	33(9.6)
30–34	33(9.6)
35–39	35(10.7)
40–44	47(13.7)
45–49	58(16.9)
50–54	58(16.9)
55–59	80(23.3)
Ethnicity	
NZ European	219(63.7)
Maori	39(11.3)
Pacific	30(8.7)
Other	56(16.3)
Socioeconomic status (NZiDep*)	
1: No deprivation characteristics	196(60.7)
2: 1 deprivation characteristic	52(16.1)
3: 2 deprivation characteristics	39(12.1)
4: 3–4 deprivation characteristics	14(4.3)
5: 5 or more deprivation characteristics	22(6.8)

*NZiDep: New Zealand Deprivation Index.

The hospitalisation rates were higher among males, until about 40 years of age when the pattern reversed and the rate became higher among females (Figure 1).

Figure 1: Frequency and rate of unintentional falls at home, by age band: among 25–59 years olds, New Zealand, 2005–2006 (n=344) (rate per 100,000)



Females in the 55 to 59 year age group had the highest hospitalisation rate (150.3 per 100,000; 95% CI 114.7–197.1), almost double that of their male counterparts (83.4 per 100,000; 95% CI 57.7–120.5). There was one death during admission to hospital and no deaths prior to admission during the study period.

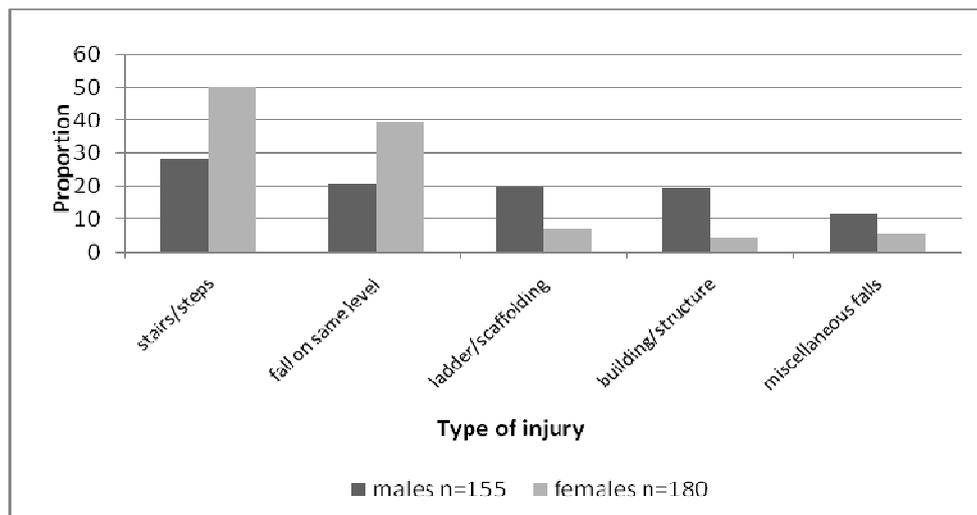
There were no significant differences in the distribution of falls by month or season but 42.0% of the admissions occurred during the weekend. Over two-thirds of falls (69.7%, n=232) occurred during the day (0700–2100). Only 9.9% (n=33) of people fell between 0200 and 0800. Time of fall frequency peaked between 1400 and 1600 (n=41), and was lowest between the hours of 0400 and 0600 (n=5). There was no statistically significant difference between the time of fall for males and females.

Over 80% of the falls occurred in the individual’s own home (n=272/335). The narrative descriptions provided by cases revealed that 36.4% (n=122) of the unintentional falls at home involved stairs or steps, 30.7% (n=103) were falls on the same level, 13.1% (n=44) involved falls from ladders or scaffolding, 11.3% (n=38) were falls out of or through buildings or structures. The remaining 8.4% (n=28) were a miscellaneous group.

There were significant differences ($p < 0.001$) in the types of falls resulting in injury among males and females (Figure 2). Falls on the same level and stair-related falls were more common among females. In contrast, males were more likely to have ladder or scaffolding related falls or fall from buildings or structures.

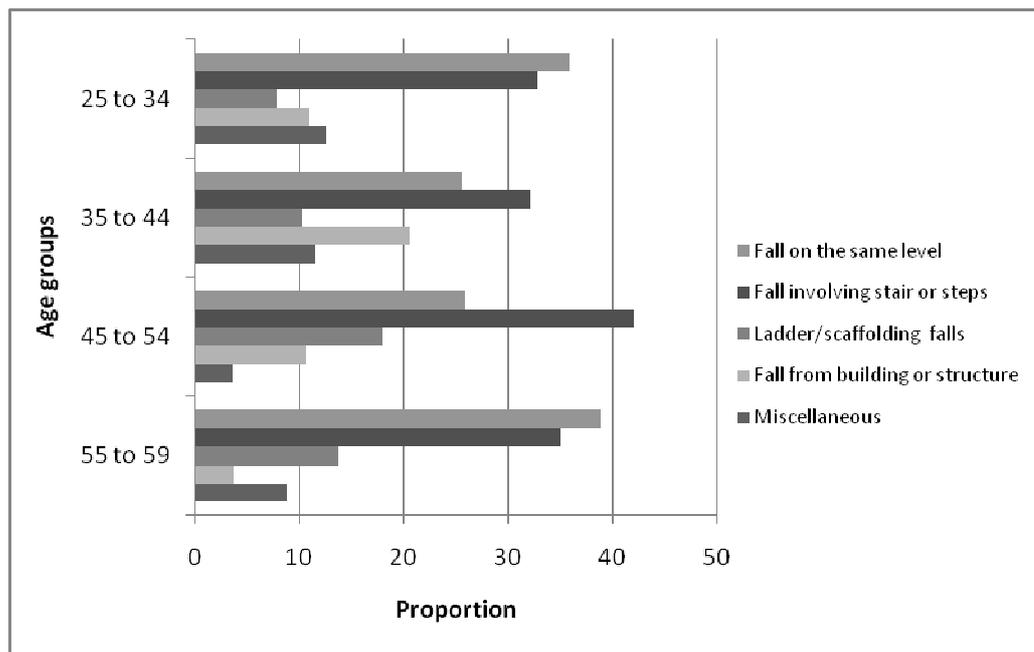
Interestingly almost two-thirds of cases who fell from ladders were stationary (i.e., neither ascending or descending) at the time of the fall (males 65.5%, females 63.6%). Of those injured as a result of falls on stairs, 82.4% (n=148) of females and 75% (n=116) of males were descending at the time of injury. Only 6.7% of males and 5.7% of females reported experiencing sensory symptoms such as light headiness, dizziness, or their legs suddenly giving way prior to their fall.

Figure 2. Distribution of type of unintentional falls at home, by gender among 25–59 years olds, New Zealand, 2005–2006 (n=335)



There were significant differences in the mechanism of injury by age group ($p=0.02$). For both the 25 to 34 and 55 to 59 year age groups *falls on the same level* were the most common type of fall. Among those aged 35 to 54 years falls involving stairs or steps were most common (Figure 3). The majority of falls from ladders or scaffolding were among those in the 45 to 54 year age group (45.5%, $n=20/44$).

Figure 3. Distribution of type of unintentional falls at home, by age among 25–59 years olds, New Zealand, 2005–2006($n=335$)



The majority of falls occurred outdoors (60.6%, $n=203$). Of these, 29% ($n=58$) occurred on stairs, 20% ($n=41$) in or around the garden, 20% ($n=42$) took place on driveways or pathways, 14% ($n=28$) involved balconies, and the remaining 16% ($n=33$) occurred on roofs, in garages or other places.

The 123 (31.9%) falls which occurred inside the home were distributed in living areas (30%), stairs or steps (29%), the bedroom (11%), kitchen (11%), and the bathroom or toilet areas (6%) while the remaining 14% took place in hallways, laundries or other places.

A quarter (25.7%, $n=86$) of cases were barefooted at the time of the fall, 19.5% ($n=65$) were wearing running or sports shoes, 14.7% ($n=49$) casual shoes, 13.2% ($n=35$) slippers, 8.1% ($n=27$) gumboots or workboots, and 4.5% ($n=15$) were in stockings or socks. There were statistically significant differences between the footwear worn by males and females at the time of the fall ($p<0.001$). Females were most likely to be barefooted (30.6%) whilst males were more likely to be in running or sport shoes (25.6%).

In one-quarter of cases the recent use of alcohol was suspected by medical admitting staff, however only 16% of cases had blood alcohol levels taken. Twenty-four percent of participants reported having consumed two or more drinks in the 6-hours preceding the fall, and a similar proportion were on two or more prescription medications, factors known to increase the risk of falls at home.

Discussion

This study has described the characteristics and contexts of a population-based sample of unintentional falls at home resulting in hospitalisation or death. The findings highlight common settings (e.g. stairs, ladders, scaffolding), variations in the types of falls by gender, and prevalence of potential contributing factors identified in the published literature. While the falls cannot be attributed to these factors at the individual level, the distribution of these characteristics is useful for planning targeted injury prevention initiatives.

This population-based study with near complete case ascertainment and a very high response rate (97.4%) has provided a representative profile of serious falls at home that resulted in hospital admission or death. The data gathered on the setting and mechanisms of falls provide information that cannot be ascertained using the more limited coding categories in routine databases using the International Classification of Diseases.³¹

The findings must also be interpreted in light of several limitations. Difficulties in recalling information relating to the circumstances of the fall may have resulted in misclassification bias. The methods used to minimise such bias included the administration of a standardised questionnaire by trained research nurses. Although admission to hospital does not capture the full spectrum of injury severity and could be influenced by numerous extraneous factors,^{32,33} the recruitment strategy with study-specific surveillance in all trauma admitting hospitals in Auckland is expected to represent those with moderate to severe injuries following falls at home.

The use of hospital discharge data in New Zealand (cases with a principal diagnosis, primary admission, and a day stay of 1 day or more) for determining injury incidence has been shown to overestimate the occurrence of some injuries by up to 3%.³³ However, the primary hospitalisation rate for unintentional falls at home among 25 to 59 years olds of 54.0 per 100,000 identified in this study is consistent with the findings of a recent review of New Zealand routinely collected data for the region with the same criteria (52.0 per 100,000).⁶ Auckland residents admitted to hospitals outside the region were not eligible to participate in the present study which may have underestimated the numbers of hospitalised injuries of interest.

Blood alcohol concentrations (BAC) results were available for only 16% of cases in this study revealing the potential to under-estimate the importance of alcohol as a risk factor in injuries of this nature. A meta-analysis of 331 medical examiner studies in the US found fatal fall cases were less likely to be tested for BAC than deaths from motor vehicle injury, burns or fires, drowning, or poisoning.³⁴

The study has highlighted some differences between the circumstances surrounding falls at home among young and middle-aged adults compared to falls among older

adults. The majority of falls occurred outdoors—this is in contrast to falls among older adults which are more likely to occur indoors.^{35,36}

There was no seasonal variation in the distribution of falls in this study, Campbell et al in a New Zealand study of falls among community dwelling older adults found rates of falls increased during winter months among women.³⁷ Almost one-third of falls occurred at night (2100–0700) in the present study compared with 20% of falls among older adults for the same time period in the Campbell study.³⁷

The hospitalisation rate in the present study was highest among females in the 55 to 59 year age group, almost double that of their male counterparts. This is consistent with international findings that report significantly more fall-related injuries among older adult women than men.^{38 39}

This study was not designed to identify specific causes of falls but the findings reveal several important contextual factors that can be targeted to prevent fatal and serious non-fatal falls at home among young and middle-aged adults.

Keall et al in a New Zealand study investigating the association between the number of home hazards and home injury in general estimate there is a 22% increase in the odds of injury with each additional injury hazard found in the home.⁴⁰ The authors suggest that addressing hazards in the home may be an effective strategy for reducing home injury.

However a recent Cochrane review found insufficient evidence to show that such changes reduced the number of injuries in the home and recommended larger well-designed randomised controlled trials of such interventions.⁴¹ Given the large number of people injured as a result of falls in the home each year, even interventions that are of moderate success may have a significant impact at a population level.⁵

Raising public awareness of the opportunities to mitigate risks of falls at home is an important step in this process. In a recent New Zealand survey undertaken to measure people's perception of safety culture, only 49% of respondents felt that "everyone is at risk of being injured at the home".⁴²

The New Zealand National Falls Prevention Strategy launched in 2005 identifies falls in the home as a priority area.⁴³ The strategy also acknowledges that while falls among those aged 15 to 64 years are a considerable cost to the government, little is known about how to prevent falls in this age group. The findings from our study, alongside increasing attention to intervention research, signal opportunities to address this gap.

Competing interests: None known.

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