



Circumstances and consequences of falls in residential care: the New Zealand story

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Abstract

Aims To describe the circumstances and consequences of falls in long-term residential care homes in New Zealand.

Methods A study followed 14 residential care facilities over 18 months and recorded all falls experienced by 680 residents (97% participation rate). The number and characteristics of falls are described according to the timing, activities, direction, and severity of falls. Predictors of injury are examined using regression techniques.

Results 271 residents sustained 954 falls, 63% of which resulted in injury. The rate of falls increased in the afternoons especially in rest homes. Environmental hazards were involved with 15% of falls. Falling in the dining room was associated with fewer injuries, and falling from a standing height, and to the side, were independently associated with major injury such as hip fracture.

Conclusion The timing and circumstances of observed falls and their subsequent injuries is useful information for healthcare planners, and staff involved in the care of older people living in long-term residential care settings.

Older people living in residential care facilities are frail, have a high prevalence of co-morbidities and age-related impairments, and are prone to falls^{1,2}—this combination makes even a simple fall particularly dangerous.³

A high proportion of falls result in injuries, with as many as 25% of falls resulting in lacerations, fractures, and the need for hospital care.³ Non-injurious falls also have a negative impact on residents, with as many as 75% of fallers experiencing loss of confidence and/or a fear of further falls (with a consequent loss of physical activity and function).⁴

The problem of falls in residential care facilities warrants attention because falls are common and distressing for both residents and their carers. Recent research indicates that factors related to the environment,⁵ and to nursing or services provision, could place older people at risk of falls. Among less mobile residents, accidental falls have been found to occur around equipment use or during the 'transferring process'.⁶ Descriptions of the time and place of fall occurrences, and the consequences of falls among this frail population are rare in the literature.

This study reports falls sustained in a cohort of residential care facilities in the Auckland region. Risk factors related to resident characteristics are reported elsewhere.⁷ This paper describes the fall events, circumstances, and timing under which they took place as well as the consequences of the falls in terms of injury and health services utilisation.

Association between characteristics and timing of falls and injury were investigated. An understanding of the nature of falls is an important step in preventing falls among residents in long term residential care.

Methods

Selection of rest homes—In the greater Auckland (New Zealand) region, a random selection was made of rest homes or low-level dependency facilities and private hospitals or high level dependency facilities (as defined by New Zealand Ministry of Health criteria) using random number tables. Rest homes residents who require assistance with most instrumental activities of daily living and at least two basic activities of daily living, can usually ambulate to some degree and feed themselves. In private hospitals or high-level dependency facilities, residents require assistance with most activities of daily living and usually need daily nursing care. Written informed consent was obtained from managers and residents in the selected homes. The Auckland Ethics Committee approved the study.

All the participating homes agreed to undertake falls monitoring within their homes for the study duration (18 months) starting in December 1999. Half of the study homes (n=7) participated in a fall prevention intervention that began on 28 April 2000. As the intervention may have had an impact on fall incidence rates in intervention homes,⁸ falls occurring during the intervention period in intervention homes are excluded. This paper reports all falls that occurred during the 5-month period prior to the intervention as well as falls occurring in control group homes for the 12 months of the intervention period (18 months in total).

Study variables—After enrolment, information was collected about each resident's medical diagnoses, medications, and previous falls, from the resident's medical record. Information listed on the summary sheet as being a diagnosis, problem, or disability was considered a 'diagnosis' for the purposes of this study. Functional status was recorded by the registered nurse or lead nursing assistant. This was measured by a validated scale developed in Sheffield,⁹ found to be reliable, and then used in the New Zealand Long Term Care Survey.^{10,11}

The composite scale comprises three level scales. One of the validated level scales, self care (mobility, dressing, feeding, bathing, and toileting) was used in this study. Composite scales for mobility (transfers, mobility within the home, and ability on stairs) and behaviour (needing night care, social behaviour, memory, wandering, and awareness) were constructed. Each scale is the summed score of its items, rating the resident as independent, able to do self care with a little help, or needing considerable help. Information was also sought concerning staffing levels using a structured interview with the home's management staff, and this was expressed as the ratio of total staff (nursing and nursing assistants)/total residents.

Falls—A one-page standardised falls surveillance form was developed for staff use, and completed for each fall that occurred. All fall forms were faxed or posted to the research centre and read by an independent researcher using a standard definition of a fall: '*unintentionally coming to rest on a lower level*'.¹² Falls not meeting this definition were excluded. Reporting of falls was audited by a visit to the home and by a hand search of the medical record and incident reports to identify unrecorded falls. Falls records were audited for duplicate reports of the same fall event.

Information sought included:

- Time and date of fall,
- Whether the fall was witnessed,
- Location within the facility or outside,
- Whether the resident was wearing hip protectors, and
- Whether environmental hazards or restraints were involved.

Activity at the time of the fall was recorded and included:

- Whether the fall occurred while the resident was on their feet, or from a lower level such as bed chair or toilet,
- Whether walking, turning, or stretching, and
- The direction of the fall.

Space for a written description of the fall was also provided. Fall-related injuries were documented, as was the type of medical attention required.

Injuries were categorised into minor, moderate, and major injuries:

- *Minor injuries* included: bruises, skin tears, haematomas, and the need for a routine doctor visit.
- *Moderate injuries* included: sprains, lacerations including steri-strips and sutures and the need for an urgent doctor visit.
- *Major injuries* included: joint dislocation, fractures, radiological examination, an Accident and Emergency Department visit, and hospital admission.

Injury categories such as mild, moderate, or severe were created for each fall. To make these categories mutually exclusive, the most severe injury sustained was used to decide the most appropriate category. For example, major injuries were not classified as moderate or mild, even if a skin tear was sustained during a fall resulting in fracture.

Analysis—As there was a potential intervention effect, all falls occurring during the intervention period in intervention homes were excluded⁸. Descriptive statistics were used to describe circumstances and frequencies of falls and injuries by level of care using SPSS.¹³

To describe the timing of falls, a rate of falls was calculated. This was the number of falls occurring per hour (averaged over 2-hour periods) per person, using 648 persons as the number enrolled over the study period, for the overall rate. To calculate fall rates for rest homes, the number of falls was divided by the number enrolled from rest homes. This process was repeated for high-level dependency residents in private hospitals. To adjust for the variable amount of time residents were observed (and the falls being accrued over 18 months), rates were then divided by the average number of days residents were enrolled (overall and for each of the dependency levels), multiplied by 3650 and expressed as falls/hour/10 resident years occurring during each 2-hour period. Graphs are presented in the Results showing distribution of fall rates by level of injury severity over 24 hours.

For this analysis, falls occurring while standing, walking, stretching were combined into one variable 'on feet'. Falls occurring at a lower level such as '*a fall on/off bed, chair, or toilet*' and '*transferring on/off bed, chair, or toilet*' were combined to create a variable '*fall from a lower level*'. All falls that were described as a slip, trip, trip over object, or having a hazard involved were coded as involving 'a hazard'.

To establish relationships between fall circumstances and level of injury, logistic regression models were constructed with an injurious fall as the dependent variable. Independent variables were: location, activity, direction of fall, presence of restraints, presence of hazards, and time of day (categorised into 2-hourly time units).

As there are many patient characteristics that predict falls, the following variables were controlled for in the models: level of dependency (type of home), gender, presence of a diagnosis of dementia, number of medications, number of diagnoses, and previous falls. As falls were not independent (for example, several falls occurred in many residents), the model was adjusted for clustering by resident using STATA 7.0 software. An exposure term was included in the models—the variable indicating follow-up time in days for each individual in the trial.

Results

Study population—the residential facilities

Of a possible 206 residential care homes in the Auckland region, 27 rest homes (low level dependency homes) and 13 private hospitals (high level dependency homes) were excluded as being too far from the study centre. Of the remaining 121 rest homes and 45 private hospitals, 14 were randomly selected. One declined to participate and another was randomly selected yielding a 93% response rate. Overall these facilities contained 25 units consisting of 9 rest home units, 9 private hospital units, 6 secure units for those with psychogeriatric disorders, and 1 unit for disabled young people.

Study population—the residents

At baseline, 18 residents (out of a possible 648 residents) in the homes refused to participate, thus yielding a response rate of 97%. Before surveillance began, 10 residents died and 3 were transferred from these homes. Data on the functional status and health of these 13 residents were not available.

Fall surveillance began with 617 consented residents in December 1999 and continued until the end of April 2001. Residents admitted into the homes until November 2000 (n=63) were enrolled in the study. During the study period (18 months), 128 residents died (20%), and 83 (12%) residents were transferred to another residential facility or discharged home. Fall surveillance data was collected on a total of 680 residents. Table 1 shows demographic, health and functional status information on the residents.

Table 1. Patient characteristics in a sample of residential care residents

	Secure units	Private hospitals (n %)	Rest homes (n %)	Total (n %)
Residents	95	196	358	649
Gender, female	63 (66%)	137 (69%)	262 (73%)	483 (71%)
Age m (SD)	83.2 (7.7)	81.6 (14.3)	84.2 (8.7)	83.3 (10.5)
Ethnicity, Caucasian	72 (88%)	146 (85%)	242 (84%)	460 (84%)
Diagnosis of dementia	78 (83%)	95 (55%)	131 (38%)	305 (50%)
Previous fall	60 (64%)	86 (49%)	196 (57%)	343 (56%)
Total medications† m (SD)	5.3 (3.0)	5.8 (3.1)	5.7 (3.1)	5.7 (3.1)
Total diagnoses † m (SD)	4.6 (2.1)	5.0 (2.1)	4.8 (2.1)	4.8 (2.1)
Self care score 1-24* m (SD)	6.1 (4.2)	5.3 (3.3)	12.1 (3.3)	9.2 (4.8)
Mobility score 1-12* m (SD)	4.7 (3.9)	3.0 (2.5)	8.2 (2.6)	6.2 (3.7)
Behavioural score 1-20*m (SD)	8.8 (4.4)	11.6 (5.8)	17.3 (3.8)	14.4 (5.7)
Days observed mean (SD)	140 (96)	309 (174)	217 (167)	232 (170)
Died during follow up (18m)	28 (29%)	55 (28%)	43 (12%)	128 (20%)

SD=standard deviation; m=mean; n=demographic and health data available on 652 residents only; *self care, mobility, and behavioural score were calculated from subscales of the dependency questionnaire (higher score means higher level of function); †diagnoses and medications established from the summary sheet in the medical record and medication chart.

The falls

During the 18 months of surveillance, 2,021 falls forms were faxed to the study office. Of these, 32 were excluded as the fall was described as being due to an epileptic seizure—this yielded a total of 1,989 fall forms. Falls occurring in intervention homes during the intervention period were excluded, leaving 954 falls included in this analysis.

Using residents as a denominator, 271 of 680 residents (40% of all residents) sustained one or more falls and 218 (32% of all residents, 80% of fallers) had an injurious fall; 183 (67% of fallers, 27% of all residents) sustained a minor injury; 66 (24% of fallers, 9.7% of all residents) sustained a moderate injury; and 39 (14% of fallers, 5.7% of all residents) sustained a major injury.

Using falls as the denominator (rather than residents), 605 of the 954 falls (63%) resulted in some form of injury. Self-reported falls totalled 271 (28%). Most fall-related injuries were minor (46% of falls), with 12% of falls being of moderate severity and 44 falls resulting in major injury (5% of falls). About one-third of falls were routinely assessed by the GP and 5% resulted in an urgent visit. One-quarter of falls resulted in skin tears and 20% bruises. Of the major injuries, hip fractures were the most common fracture (n=12) with 36 falls resulted in a radiological examination (4%). The details of injuries sustained from falls and treatments provided is described in Table 2 .

Table 2. Falls and injuries in a cohort of 680 residential care residents over an 18-month period

954 falls	Secure units (n %)	Private hospitals (n %)	Rest homes (n %)	Total [n (%) of total falls]
Falls	45	293	614	954 (100%)
Falls with any injury	36 (80)	206 (70)	361 (59)	603 (63)
Minor injuries	27 (60)	161 (55)	255 (42)	443 (46)
Moderate injuries	6 (13)	32 (11)	78 (13)	116 (12)
Major injuries	3 (6)	13 (4)	28 (5)	44 (5)
Details of injuries:				
- Bruises	14 (31)	57 (19)	123 (20)	94 (20)
- Haematomas	3 (7)	16 (5)	11 (2)	30 (3)
- Skin tears	12 (27)	85 (29)	131 (21)	228 (24)
- Abrasions	7 (16)	19 (7)	42 (7)	68 (7)
- GP visit routine	27 (60)	123 (42)	159 (26)	309 (32)
- Steri-strips	6 (13)	28 (15)	72 (12)	106 (11)
- Sutures	0	0	6 (1)	6 (1)
- Sprains	0	1 (0)	5 (1)	6 (1)
- GP visit urgent	4 (9)	12 (4)	29 (5)	45 (5)
- Hip fracture	1 (2)	6 (2)	5 (1)	12 (1)
- Other fracture	1 (2)	0	4 (1)	5 (1)
- Acute A&E assessment	1 (2)	1 (1)	8 (1)	10 (1)
- X-rays taken	2 (5)	11 (4)	23 (4)	36 (4)
- Hospital admission	2 (4)	5 (2)	12 (2)	19 (2)

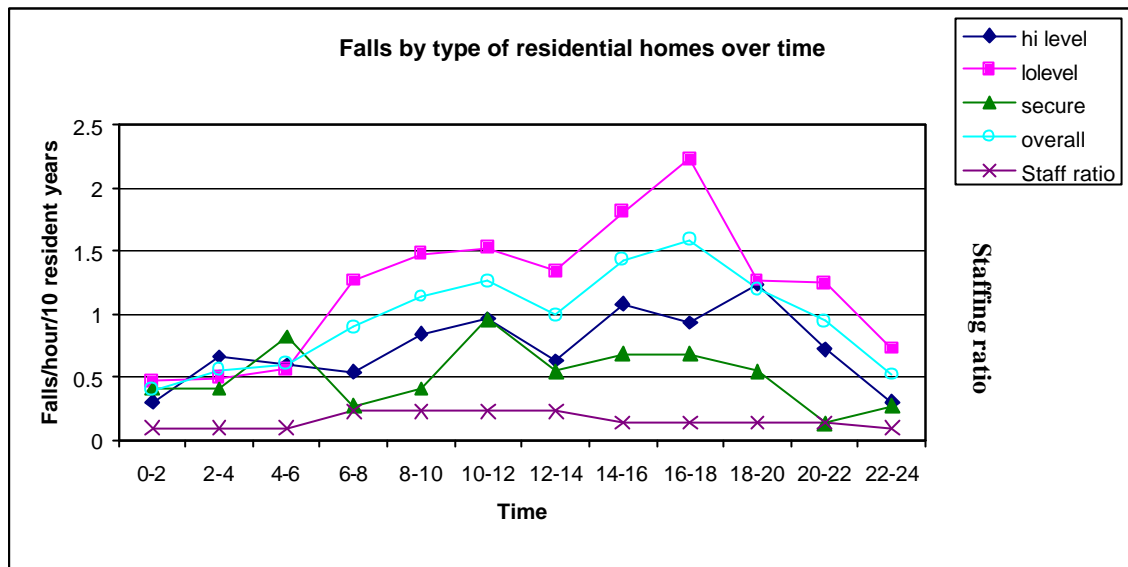
Falls were equally distributed between the days of the week with an average of 136 falls on any particular day of the week. Fall rates tended to be higher during the day when residents were active—with the highest rates observed between 4pm and 6pm (2.2 falls/hour/10 resident years). Falls were mainly contributed by residents in rest homes (Figure 1).

Using logistic regression (adjusted for time in the study, presence of dementia, self-care score, mobility score, behavioural score, age, gender, type of home, and clustering [by resident]), no 2-hour period, compared with the time period 12midnight–2am, was more likely to result in any injury.

Staffing levels in all homes were lowest at night, at intermediate levels in the afternoons, and were highest in the mornings. There was a tendency for falls rates to be higher in the afternoon when staffing ratios were intermediate.

Figure 1. Rate of falls and fall-related injury over 24 hours in a sample of residential care homes in Auckland, New Zealand by (a) type of residence and (b) severity of injury (Using logistic regression, adjusted for time in the study, presence of dementia, self-care score, mobility score, behavioural score, age, gender, type of home, and clustering (by resident)); no single 2-hour time period was more likely to result in injury)

(a) Fall rate by type of home



hi level=private hospitals; lo level=rest homes; staff ratio=staff per shift/total residents.

(b) Fall rate by severity of injury

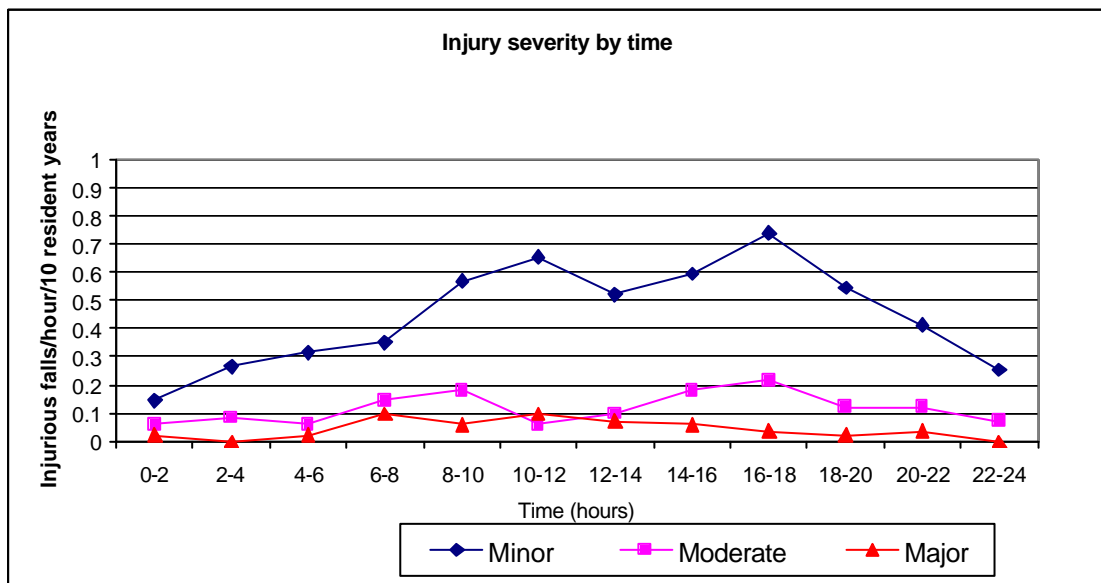
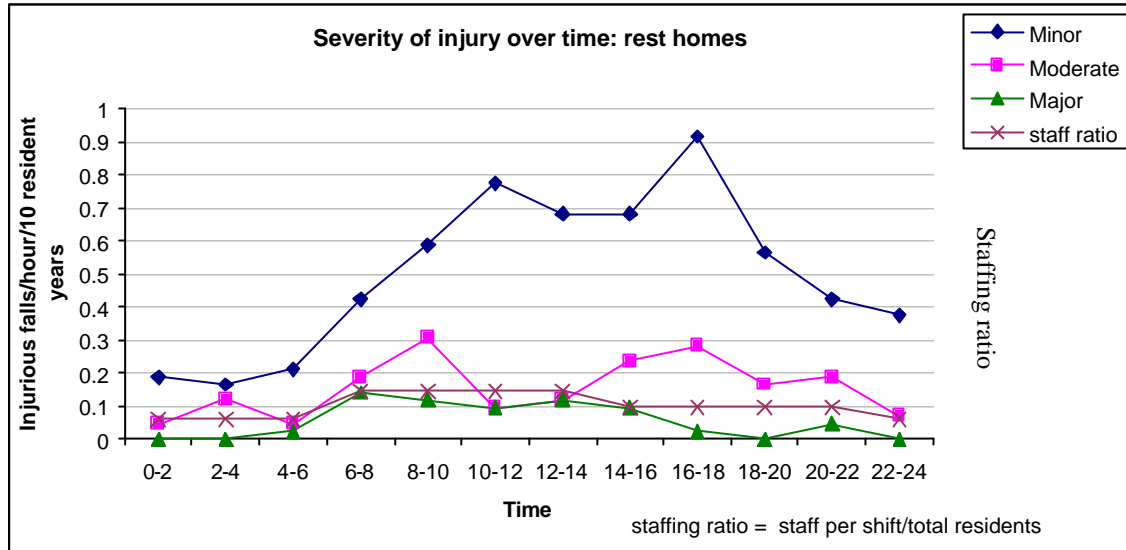
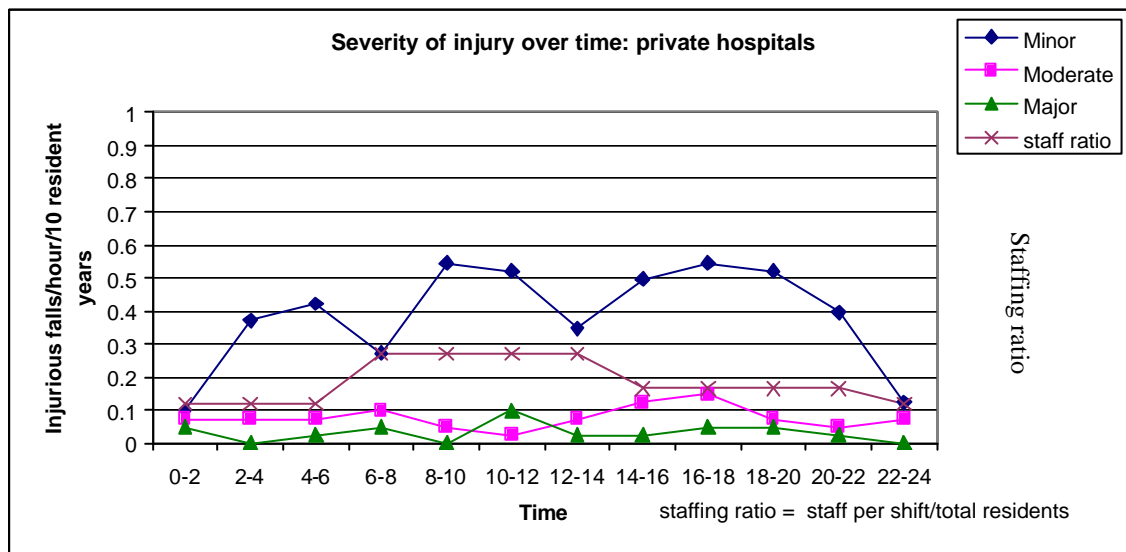


Figure 2. Injury severity over time in (a) rest homes and (b) private hospitals
 (Staffing ratio plotted for comparison)

(a) Rest homes



(b) Private hospitals



Injury severity varied throughout the day and differed between the type of home. For example, in rest homes, major injuries from falls were more common in the mornings whereas minor injuries occurred at a higher rate in the late afternoon. Staffing ratios may have been lower when falls with minor injury rates were highest in the afternoons. In the private hospitals and secure units (Figure 2b), falls resulting in moderate and major injuries occurred at similar rates throughout the 24-hour period.

Minor injuries occurred at a lower rate at night compared with during the day. Using logistic regression, adjusted for health and demographic factors, previous falls, time

of day and clustering (by resident) falls occurring in private hospitals OR 2.82 (CI 1.19–6.66) and secure units OR 1.59 (CI 1.02–2.48) were more likely to result in any injury compared with rest homes.

Table 3. Location and activities at the time of falls and fall related injuries in a cohort of residents living in long term residential care facilities

Total falls (n=954)	N	%	Injurious falls	
			n	%
*Not seen	729	77%	467	77%
Found on floor	441	46%	296	49%
Indoors	917	96%	571	95%
- Residents room	597	63%	378	63%
- Lounge	68	7%	44	7%
- Hallway	79	8%	41	7%
- Toilet	75	8%	51	9%
- Dining room ¹	69	7%	34	6%
- Bathroom ²	19	2%	17	3%
Outdoors³	35	4%	31	5%
Activities[†]				
- Fall while on feet	473	50%	310	51%
- Fall from low level	306	32%	187	31%
Environmental hazard implicated	142	15%	95	15%
Fall direction[†]				
- Sideways ⁴	256	27%	182	30%
- Backward	258	27%	151	25%
- Forward	121	13%	85	14%
- Straight down	24	3%	11	2%
- Direction unknown	212	22%	132	22%
- Restraints in use at time of fall	17	2%	13	2%

***Not seen** means the fall was not witnessed, and includes self report falls.

[†]Percentages do not add to 100 due to missing values.

Logistic regression results (1-4), adjusted for time in the study, presence of dementia, self-care score, mobility score, behavioural score, age, gender, type of home, and clustering (by resident).

¹OR 0.54 (CI 0.33–0.88) less likely to sustain injury in the dining room

²OR 4.67 (CI 1.02–21.36) more likely to sustain injury in the bathroom

³OR 4.92 (CI 1.50–16.11) more likely to sustain injury outside

⁴OR 1.70 (CI 1.17–2.46) more likely to sustain injury falling sideways.

The location of falls, and activities noted at the time falls are described in Table 3. Nearly all falls occurred indoors (96%)—the majority of which occurred in the residents room (63%). Adjusting for resident health and functional factors and the type of home, falls sustained in the bathroom were more likely to result in injury OR 4.67 (CI 1.02–21.36). In contrast, falls occurring in the dining room (n=69) were less likely to result in injuries compared with other locations OR .54 (CI 0.33–0.88).

Only 35 falls occurred outdoors, and these were more likely to result in injury OR 4.92 (CI 1.50–6.11). A sideways fall was more likely to result in injury, OR 1.70 (CI 1.17–2.46) whereas other activities and fall circumstances were not associated with

injury. Using the same model with *major injury* as the dependent variable the following circumstances were associated with major injury: fall while on feet OR 2.36 (CI 1.22–4.52) and fall to the side OR 1.69 (CI 1.16–2.47). Falls occurring in between 4pm and 6pm were less likely to be associated with major injury OR .16 (CI 0.03–0.96).

Half of all falls, n=473 (50%), occurred while the residents were on their feet (either standing or walking). A sizeable minority (142, 15%) of falls were recorded as having a hazard involved. These included cords, steps, thresholds, bedroom clutter, mats (n=135), and dim light (n=16). These hazards resulted in falls associated with tripping over an object (n=44) and slipping on wet floors (n=37).

During the study period, 35 falls occurred with hip protectors being worn at the time. No hip fractures occurred as a result of these 35 falls whereas 12 hip fractures resulted from 917 falls occurring without hip protectors in place. Restraints were recorded as in use in 17 falls.

Discussion

Falls in residential care are a major public health concern. The purpose of this study was to describe the circumstances and injuries related to falls sustained by residents living in long-term residential homes in Auckland, New Zealand. Almost half (40%) of the residents sustained a fall during 18 months of surveillance; consistent with other studies.²

The majority of these falls resulted in injuries (63%) with 5% of all falls resulting in injuries of major severity, a higher rate for any injury but lower rate for serious falls than other studies.^{6,14} Previously, the timing of falls has not been accurately described. When residents were active during the day, they were more likely to sustain injury, and the more active residents fell more but were less likely to injure themselves.

This study identified all falls occurring in the homes, including self-reported falls. We chose to accept self-reported falls and recorded any form of injury. This is justified, as even a minor injury can result in not only decreased mobility and increased morbidity⁴ but also increased need for care. Our definition of injury categories has resulted in a higher proportion of falls being categorised as 'injurious' (63%) than in other studies which report between 40% and 60% of falls resulting in injury.^{12,15}

This paper also uses the fall as the denominator for analysis, rather than the resident, meaning that direct comparison to other studies reporting the proportion of residents injured is less appropriate.

A limitation of this study is the potential for inaccuracy of information regarding self-reported falls that were unwitnessed. These occurred mostly in rest homes, where residents have (in the main) sufficient cognition to report events.

There was no way to validate information about these unwitnessed falls. This was unavoidable as the alternative of running videotapes at all times in all locations within the homes was beyond the scope of this study.

Information about direction and location of the fall was evident to staff when the residents were found and data were recorded. Staff ratios were reported to researchers by the principal nurse manager and averaged over the three usual working-shifts, therefore losing some precision in description.

In addition, injury severity categories were arbitrary, but created after consultation with experts. As the numbers of residents in secure units was small, they were combined with those in private hospitals for the regression analyses. Almost all secure units were placed within private hospitals, thus under similar environmental and staffing conditions, and the fall rates were the most similar between these groups.

It is possible that relationships between circumstances of falls and injury would be better examined in larger samples of secure unit residents separately; however, this was beyond the scope of this study. This study highlights the need for the creation and standardisation of injury severity categories, which would allow for more accurate comparisons between studies.

This paper provides important descriptive information about injuries sustained and treatments provided to a large group of residents which will be useful for health care planners, medical staff and the residential care industry. Most injuries were minor (with bruises and skin tears being most common) as confirmed in other studies.¹⁶ The doctor involved in the routine care of the resident was often involved in the management of fall-related injuries.

This study confirms the finding of peak falls times reported by less rigorous research.¹⁶ The distribution of injurious falls in a 24-hour period is intriguing. The emphasis on higher fall rates in the afternoon in rest homes is important, as this is the time of shift change. It is reasonable to assume that consideration of different ways to deliver care at these times may impact on fall rates, as (notably) the afternoon staffing ratios are lower than the mornings.

In addition, there is a trend for major injuries to occur in the mornings across all homes, a time when maximal staff is available. Mornings are a time of high activity in all homes with toileting, showering, dressing, and breakfasting. Staff often take a morning-tea break, which may make them less available to residents and potentially compounds the risk of major injury at that time. Other studies have shown that non-ambulatory residents are more likely to sustain injury associated with use of equipment and transferring⁶ and this may also be a part of the explanation of this finding. Further study is needed to establish the impact of staffing level changes on fall and injury in residential care.

Rest home residents in this study had more falls but were less likely to sustain injury than residents in private hospitals. Furthermore, rest home residents are less frail than those in private hospitals and this will protect them from injury. It must be accepted that active residents are at risk of falls and activity is important for quality of life. The trade off between level of activity and risk of falls deserves more attention in future studies.

The prevalence of falls among residents (40%) in this study is similar to other studies which report 40%–52% of residents sustained a fall.¹⁷ However, our prevalence of injurious falls is higher (23% of residents), perhaps owing to our acceptance of self-reported falls. Thus, a lower rate may have been recorded if a different study design been employed.

While falls in the dining room were less likely to result in injury, falls in the bathroom were more likely to result in injury. This provides additional information useful for planners, managers, and caregivers.

It is reassuring that, in a protected regulated environment, only 15% of falls involved a slipping or tripping hazard. While routine surveillance for such hazards may impact fall rates, it can be postulated that the majority of falls were from intrinsic factors that will require strategies to reduce individual's fall related risk factors.

Protection from fall injuries is very important. The finding that hip fractures were associated with a sideways fall, and that no hip fractures occurred from falls while residents were wearing hip protectors, further supports the efficacy of hip protectors among high-risk individuals in rest homes and private hospitals.^{18,19} This is important as an upward trend in the incidence of hip fractures occurring in New Zealand has recently been reported.²⁰

The strength of this study is that, in comparison to other studies,^{15,16} ascertainment of all falls was achieved and a large sample of residents were prospectively followed. Indeed, the information gathered and analyses techniques used (in investigation of the timing of falls) in this study are unique.

Conclusions

To date, few interventions have been shown to reduce falls among older people living in long-term residential care settings. An understanding of the timing and location of falls within homes provides useful information for healthcare providers concerning staffing levels at differing times of the day—as peaks times of falls and injury may be related to periods of high activity within residential care homes.

It is important for clinical staff to consider intrinsic risk factors for falls, as most falls did not involve environmental hazards. Protection from injury is emphasised by this study—as a sideways fall was related to serious injury and no hip fractures occurred in residents wearing hip protectors.

A variety of strategies involving interventions for individual residents and strategies (about staff, time, and locations in facilities) will be needed to reduce injury. These strategies will, in turn, need to be tested for efficacy.

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Acknowledgements: We thank the staff in the participating Auckland residential care homes (for their hard work and enthusiasm); the Health Research Council (NZ), Auckland Medical Research Foundation, and Royal New Zealand College of General Practitioners Auckland Faculty Trust (for contributing project grants); and The Commonwealth Fund (for supporting this study through a Harkness Fellowship for Ngaire Kerse).

Clare Robertson provided comments on earlier drafts of the manuscript and Elizabeth Robinson provided statistical advice.

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