

Falls and fall risk among nursing home residents

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Fall and fall risk among nursing home residents

Aim and objectives. The aim of this study was to identify risk factors for falls in older people living in nursing homes.

Background. Impaired cognitive function and a poor sense of orientation could lead to an increase in falls among those with impaired freedom of movement. Many accidents occur while an older person is walking or being moved.

Method. The study was carried out over four years (2000–2003) and 21 nursing home units in five municipal homes for older people in Stockholm, Sweden, participated. A questionnaire was sent to staff nurses, including questions on fall risk assessments, falls, fractures, medication and freedom-restricting measures, such as wheelchairs with belts and bed rails. The data were aggregated and not patient-bound. The study covered 2343 reported incidents.

Results. There was a significant correlation between falls and fractures ($r = 0.365$, $p = 0.004$), fall risk and use of wheelchairs ($r = 0.406$, $p = 0.001$, safety belts ($r = 0.403$, $p = 0.001$ and bed rails ($r = 0.446$, $p = 0.000$) and between the occurrence of fractures and the use of sleeping pills with benzodiazepines ($r = 0.352$, $p = 0.005$). Associations were also found between fall risk and the use of anti-depressants ($r = 0.412$, $p = 0.001$).

Conclusion. In clinical practice, patient safety is very important. Preventative measures should focus on risk factors associated with individuals, including their environment. Wheelchairs with safety belts and bed rails did not eliminate falls but our results support the hypothesis that they might be protective when used selectively with less anti-depressants and sleeping pills, especially benzodiazepines.

Key words: drugs, falls, injury prevention, nursing, old people, physical restraints

Introduction

The majority of older people in Sweden live in their own homes. Most of them are healthy and manage without formal help (Torres 2001). However, help is available for those who need it. For many, ageing implies a decline in activity and poorer health, leading to a dependency on others in daily life (Sjögren & Björnstig 1991). Therefore, older people who reach the age of 80 and above usually apply for a place in a municipal nursing home where they feel more secure (Hansebo 2000, Fonad *et al.* 2006). Many older adults suffer from chronic diseases, including neurological problems (Jorgensen *et al.* 2002), cardiac diseases, visual and cognitive impairment (Robins Wahlin 1999), which require treatment. This results in impairments in their functional ability and physical strength (Thorslund & Parker 1995). A decline in cognitive functions (Robins Wahlin 1999) and functional ability can increase the risk of injurious falls. Gill *et al.* (2000) state that environmental factors are the primary reason for falls. Impaired cognitive function and a poor sense of orientation often lead to an increase in falls among those with impaired freedom of movement (Hill *et al.* 1999). Many accidents occur while an older person is walking or being moved (Berg *et al.* 1997). The effects of medication can also contribute to falls (Hill *et al.* 1999).

In Sweden, the use of medication has increased during the past 10 years. Nine per cent of the population are aged 75 years and above, yet this group consumes approximately 25% of all medication (Giron *et al.* 1999). Older adults are more likely to be on multiple medications and to experience drug–drug interactions (Lantz 2002). On average, they consume 6–10 different types of medication per person (Giron *et al.* 1999). Several studies (Schmidt *et al.* 2000, Gurvich & Cunningham 2000) have focused on nursing home residents, as they are generally older and in poorer health compared with other groups of older people. Furthermore, older people are more sensitive to side effects of medication (Fastbom 1998, Forsell & Winblad 1998).

Tinetti *et al.* (1994) believe that the risk of fall incidents can be significantly reduced when factors such as a high-intake of medicine and the use of sedatives are modified

(Leipzig *et al.* 1999a & Leipzig *et al.* 1999b). A high-medicine intake and interaction with other medication can increase the risk of falls (Fastbom 1998). Furthermore, Fastbom (1998) notes that some types of neuroleptic drugs can cause drowsiness, hallucinations or paranoia, especially among people with dementia. This further increases their risk of falling (Lantz 2002). Patients are often restrained for reasons that remain unclear and more often as a matter of routine rather than as a reaction to a specific situation. These actions are often justified by concerns for patient safety or behaviour control (Cohen-Mansfield *et al.* 1993). In this context ‘a physical restraint’ is defined as a mechanical appliance that inhibits an individual’s freedom of movement, including devices such as wheelchairs, bed rails and belts.

The Health and Medical law in Sweden (1982:763) places certain requirements on the medical organizations that provide health and medical care. The law stipulates that adequate staffing, premises and equipment must be available to provide care that is safe and of high-quality. Given the relation between age and multiple diseases, impaired functional ability, cognitive decline and a greater use of psychotropic medication, we were interested in whether any of these factors were connected with falls. We addressed two questions related to the issues discussed. Firstly, was there a connection between falls and fall risk among patients in older care caring settings? Secondly, was there an association between falls and fractures among patients with physical restraints and an intake of psychotropic medication?

Aim

The aim of the study was to identify the risk factors for falls in older people living in nursing homes.

Methods

Setting

This study was carried out over a period of four years (2000–2003) and 21 nursing home units in five municipal homes for older people in the Stockholm area in Sweden

participated. The study covered reported incidents over these four years, which were aggregated and thus not patient-bound. The total number of reported incidents was 2343 from the group of older patients. The investigated group consisted of 743 males and 1908 females from 40–105 years of age (Mean = 72.5) with diagnosis of somatic illnesses, dementia or both.

Development and construction of the questionnaire

A questionnaire was developed to measure quality indicators from the National Board of Health and Welfare in Sweden (The National Board of Health and Welfare 1996). 'Quality indicators' measure and reflect quality in specific parts of the healthcare service; they are intended to be used as a basis for organizational development, to make improvements in care and also to measure and report on the status of healthcare quality (Berwick & James 2003, Stockholm County Council 2004). Five senior community nurses designed a questionnaire, directed at nurses working in the nursing homes included in the study. The questionnaire is based on the following quality indicators: fall risk assessments, falls and fractures. Freedom-restricting measures, such as wheelchairs with belts and bed rails, which were considered to affect the frequency of falls, were also recorded. The questionnaire asks for the number of patients on medications e.g. sleeping pills and sedatives with benzodiazepines, as well as the number of fractures and use of belts and bed rails. There were a few questions with just yes or no answers. The term 'psychotropic drugs' refers to neuroleptics, sedatives, sedatives with benzodiazepines, sleeping pills, sleeping pills with benzodiazepines and anti-depressants.

Measurement of balance, fall risk assessment, falls and physical restraint

Balance is an operational construction that can be evaluated using various methods. It most often refers to the ability not to fall (Winter 1995) and is a necessary requirement for human beings to maintain their posture. Impaired ability to balance can consequently be a contributing factor leading to fall risk. In this study fall risk was defined as when the patient risks losing her or his balance. For patients with somatic diseases, Berg's Balance Scale (Berg *et al.* 1989) was used to assess fall risk. Tasks include balance activities such as sitting, getting up, transferring, reaching, picking up an object from the floor, turning around in a full circle, stepping and standing on one leg. A therapist carries out these investigations. The

scale has been validated for patients who could walk by themselves without assistance.

Fall risk assessment is used on every patient 14 days after he or she arrives at the nursing home unit. For patients who suffer from dementia diseases and are wheelchair-bound, a balance scale instrument constructed by the senior community nurses is used. The scale has been validated for wheelchair-bound patients with dementia diagnoses. This instrument focuses on basic activities of daily living and comprises nine activities. The instrument includes the following items: medication, walking with a stick/sticks, a walking frame or crutches, aggressive behaviour or restlessness, earlier recorded fall incidence, defective vision, sensitivity impairment and lowered perception ability. This fall-risk scale was developed during the pilot study period in 1998 and has been used from then onwards.

A fall was defined as landing on the ground or floor, or falling and hitting an object such as stairs or a piece of furniture by accident (Jensen *et al.* 2002). A sustained injury was recorded when a patient received a fracture (Jensen *et al.* 2002). A fall injury, e.g. serious hip fracture, was defined according to The Abbreviated Injury Scale (1990).

A physical restraint was defined as a mechanical appliance that inhibits a patient's freedom of movement (Stillwell 1991, Karlsson *et al.* 1997). Examples of restraints include belts, special chairs and bedside rails. No matter what the purpose and effect of a particular item is, these are to be considered as physical restraints. In every case where an item is used to restrict movement it is a restraint. In this context, physical restraints such as wheelchairs, bed rails and belts are included.

Data collection

The data collection included the number of incidents, which means that the unit of analysis was bound to the number of incidents. The questionnaires were completed during one week in October, each year. The questions were sent to each nursing home unit, where the supervisor chose one staff nurse, who then was responsible for the supervising the data collection. Each year 21 staff nurses answered the questionnaires, except in the year 2000 when there were 20 nurses.

Data analysis

The association of fall risk, falls and medication; falls in relation to fractures: falls and wheelchair-bound situations; and falls and bed rails was investigated.

To find a possible connection between the dependent variables and the explanatory variables a series of correlations, based on Pearson's correlation analysis, were calculated. A 95% level of significance ($p = 0.05$) and a 99% level of significance ($p = 0.01$) were used to show the verified differences between the different data. Bivariate regression analyses were performed to calculate correlations between falls and fall risks assessments at a 95% level of significance.

Ethical consideration

The study was approved by the Ethics Committee at Huddinge University Hospital, Karolinska Institutet, Sweden, number 2006/1412–31/4.

Results

The distribution of the reported fall risks, falls and fractures to the level of nursing home unit is shown in the Table 1.

Table 1. Aggregated data for registered fall risks and incidents of falls and fractures in the 21 nursing home units.

Falls and fractures are significantly correlated ($r = 0.365$, $p = 0.004$), which indicates that there is a linear dependence

Table 1 Aggregated data for registered incidents, falls and fractures in the nursing home units, 2000–2003

Unit	Incidents $n = 2343$ (%)	Falls $n = 2263$ (%)	Fractures $n = 80$ (%)
1	72 (3)	64 (89)	8 (11)
2	12 (1)	8 (67)	4 (33)
3	55 (2)	51 (93)	4 (7)
4	19 (1)	16 (84)	3 (16)
5	51 (2)	48 (94)	3 (6)
6	8 (0)	7 (88)	1 (13)
7	32 (2)	31 (97)	1 (3)
8	8 (0)	8 (100)	0 (0)
9	211 (9)	205 (97)	6 (3)
10	186 (8)	184 (99)	2 (1)
11	241 (10)	235 (98)	6 (2)
12	197 (9)	193 (98)	4 (2)
13	35 (2)	32 (91)	3 (9)
14	26 (1)	26 (100)	0 (0)
15	49 (2)	45 (92)	4 (8)
16	74 (3)	58 (78)	16 (22)
17	333 (14)	329 (99)	4 (1)
18	263 (11)	260 (99)	3 (1)
19	310 (13)	304 (98)	6 (2)
20	143 (6)	141 (99)	2 (1)
21	18 (1)	18 (100)	0 (0)

between the two (Table 2). It stands to reason that the vast majority of fractures in nursing homes arise from falls. The use of sleeping pills containing benzodiazepines ($r = 0.341$, $p = 0.007$) and fall was found to be correlated. Looking further at the correlation, there was no significant correlation between other measures and falls (Table 2).

However, fractures and the use of sleeping pills containing benzodiazepines ($r = 0.352$, $p = 0.005$) were correlated.

Significant correlations were found between fall risk and the use of wheelchairs ($r = 0.406$, $p = 0.001$), bed rails ($r = 0.446$, $p = 0.000$) and safety belts ($r = 0.403$, $p = 0.001$). Furthermore, there was a correlation between fall risk and the use of anti-depressants ($r = 0.412$, $p = 0.001$, see Table 2).

There was a significant correlation between wheelchair and the use of bed rails ($r = 0.777$, $p = 0.000$), belts ($r = 0.416$, $p = 0.001$) and medication with sleeping pills ($r = 0.289$, $p = 0.024$) and anti-depressants ($r = 0.295$, $p = 0.021$).

There was a significant correlation between the use of bed rails and the use of belts ($r = 0.534$, $p = 0.000$) and the use of all medication.

The use of belts and the use of neuroleptics ($r = 0.485$, $p = 0.000$), the use of sedatives ($r = 0.350$, $p = 0.006$), the use of sedative with benzodiazepines ($r = 0.405$, $p = 0.001$) and the use of anti-depressants ($r = 0.290$, $p = 0.024$) were correlated. This could indicate that the patients may have multiple medications (Table 2).

Bivariate regression analysis gives a regression coefficient of 6.079 ($r^2 = 0.133$, $p = 0.004$), which shows an association between falls and fractures. Bivariate regression analysis gives a regression coefficient of 2.914 ($r^2 = 0.116$, $p = 0.007$), which shows an association between falls and sleeping pills with benzodiazepines (Table 3).

Discussion

The aim of this study was to identify factors that may influence the risk of falls in nursing home units. We wanted to examine the potential risk factors for fall incidents, such as the use of bed rails, belts and wheelchairs and the use of different medications.

The data were collected between 2000–2003. The results indicate that falls are correlated with fractures and with the use of sleeping medication in nursing home residents. Carrying out fall risk assessments and the use of safety belts, wheelchairs and bed rails, could be seen as preventive factors for falls. Furthermore, we found that fracture incidents and the use of sleeping pills containing benzodiazepines were also correlated. The use of bed rails, wheelchairs and safety belts was correlated with sedative medication.

Table 2 Correlation between investigations; falls, fall risks, fractures, wheelchairs, bedrails and medications

Variable	Investigations n = 251	(%)	Falls	Fall risks	Fracture	Wheel- chair	Bed rails	Belts	Neuro- leptics	Sedatives	Sedatives with benzodiazepines	Sleep pills	Sleep pills with benzodiazepines	Anti- depression
1 Falls	n = 2263	(85)												
Sig (2-tailed)														
2 Fall risks	n = 881	(33)	0.177	-										
Sig (2-tailed)			0.172	-										
3 Fractures	n = 80	(3)	0.365*	0.079	-									
Sig (2-tailed)			0.004*	0.545	-									
4 Wheelchairs	n = 1618	(61)	0.208	0.406*	0.158	-								
Sig (2-tailed)			0.107	0.001*	0.224	-								
5 Bed rails	n = 1550	(58)	0.150	0.446**	-0.019	0.777**	-							
Sig (2-tailed)			0.250	0.000**	0.882	0.000**	-							
6 Belts	n = 735	(28)	0.015	0.403*	-0.039	0.416*	0.534**	-						
Sig (2-tailed)			0.906	0.001*	0.765	0.001*	0.000**	-						
7 Neuroleptics	n = 525	(20)	0.228	0.231	0.156	0.181	0.279*	0.485**	-					
Sig (2-tailed)			0.077	0.073	0.231	0.162	0.029*	0.000**	-					
8 Sedatives	n = 645	(24)	0.30	0.195	-0.004	0.240	0.319*	0.350*	0.653**	-				
Sig (2-tailed)			0.818	0.132	0.979	0.063	0.012*	0.006*	0.000**	-				
9 Sedatives with benzodiazepines	n = 161	(6)	0.034	0.234	0.042	0.204	0.308*	0.405*	0.628**	0.762**	-			
Sig (2-tailed)			0.795	0.070	0.749	0.115	0.016*	0.001*	0.000**	0.000**	-			
10 Sleeping pills	n = 823	(31)	0.239	0.244	0.199	0.289*	0.309*	0.182	0.605**	0.729**	0.654**	-		
Sig (2-tailed)			0.064	0.058	0.124	0.024*	0.016*	0.161	0.000**	0.000**	0.000**	-		
11 Sleeping pills with benzodiazepines	n = 390	(15)	0.341*	0.085	0.352*	0.222	0.255*	0.142	0.417*	0.372*	0.452**	0.622**	-	
Sig (2-tailed)			0.007*	0.517	0.005*	0.086	0.047*	0.276	0.001*	0.003*	0.000**	0.000**	-	
12. Anti-depressants	n = 494	(19)	0.190	0.412*	-0.122	0.295*	0.356*	0.290*	0.479**	0.422*	0.313*	0.551**	0.120	-
Sig (2-tailed)			0.143	0.001*	0.349	0.021*	0.005*	0.024*	0.000**	0.001*	0.014*	0.000**	0.358	-

*p < 0.05; **p < 0.01.

Table 3 Bivariate regression analyses between different variables and falls

Variable	Regression coefficient	r ²	Significance
1 Fall risks	0.718	0.031	0.172
2 Fractures	6.079	0.133	0.004*
3 Wheelchairs	0.725	0.043	0.107
4 Bed rails	0.540	0.022	0.250
5 Belts	0.098	0.000	0.906
6 Neuroleptics	1.908	0.052	0.077
7 Sedatives	0.210	0.001	0.818
9 Sedatives with benzodiazepines	0.276	0.001	0.795
9 Sleeping pills	1.435	0.057	0.064
10 Sleeping pills with benzodiazepines	2.914	0.116	0.007*
11 Anti-depressants	1.401	0.036	0.143

* $p < 0.05$.

Falls

The results showed that falls were correlated with fractures. The regressions coefficient was positive between falls and fractures. This is a natural association. Obviously, patients that fall suffer severe injuries. Disease-related symptoms can contribute to the high-incidence of falls, e.g. incontinence, orthostatic hypotension and cerebral blood flow (Jorgensen *et al.* 2002). Even if no physical injury occurs, fall victims may develop a fear of falling again and thus reduce their activities as a result. This can lead to unnecessary dependency, loss of function, decreased socialization and a poor quality of life.

Several earlier reports have shown (Forsell & Winblad 1998, Guo *et al.* 1998) that an increase in medication is linked to falls. Our data concord with those findings, as we could show correlations with use of sleeping pills with benzodiazepines. Regarding the positive regression between falls and medication with sleeping pills containing benzodiazepines, the causality is not clear. Patients might either fall because they were on medication, or the incident might precede the medication. Our results correspond with Leipzig *et al.*'s (1999a,b) findings that a high-intake of medicine and certain medications increase the risk of fall incidents because some types of neuroleptic drugs can cause drowsiness, hallucinations or paranoia. There may be several factors that contribute to an extensive use of medication in older people, one of them being that several medical conditions are treated with different drugs. Another factor is that a side effect of one kind of medication is interpreted as a new complaint, which is treated with yet another drug (Rochon & Gurwitz 1997). It may also be the case that many medical

prescriptions are not reviewed, but are simply renewed as a matter of routine. A common denominator for these factors is a lack of overview and control of older peoples' use of medication. One of the difficulties is that certain medication-related problems, side effects in particular, may be difficult to predict and discover.

An intake of psychotropic medication jeopardizes the patient's safety. Our findings show that an intake of sleeping pills containing benzodiazepines has an association with a considerable increase in fractures. Our results are in line with previous research (Johnell *et al.* 1992, Lauritzen *et al.* 1993), which has shown that an increase in medication has led to a considerable increase in fractures, both in Scandinavia and in other parts of the western world.

Fall risk

In this study, we did not find that assessed fall risk correlated with falls. A fall risk assessment is a preventive measure intended to prevent falling accidents. Being afraid of falling due to problems with one's balance can lead to a decrease in physical activity, leading to even further deterioration and a greater risk of falling. Bed rest and inactivity are signs and symptoms of orthostatic intolerance (Harper & Lyles 1988). It is considered likely that the frequency of falling is related to the accumulated effect of multiple risk factors and the use of drugs superimposed on prolonged bed rest probably increase the risk of falling in these patients. Patients with an intake of anti-depressant drugs were the only weakly significant drug-related predictor of fall risk. Use of anti-depressants has been associated with a significant increase in risk of falls or fractures in several epidemiological studies (Lipsitz *et al.* 1991, Tinetti *et al.* 1998). Depression may also be associated with impaired motor coordination and response time and thus increase the risk of falls.

Measures to prevent falls must focus on the risk factors related to each individual, including their environment and behaviour. This instrument can identify patients with an increased risk of falling and take measures to prevent falling. A fall prevention programme aims to have positive and long-term effects on gait balance and strength in older people living in nursing homes. Jensen *et al.* (2002) reported that fewer falls and fractures occurred when fall risk assessments had been performed.

Even if our study did not investigate whether fall risk assessments led to a decrease in falling, it is reasonable to assume that more risk assessments can lead to fewer falls, as the identified fall risk could be attended to. Function is a term encompassing body functions and structures, as well as

activities and participation in life situations (World Health Organization 2002). In the same way, disability is used for impairments in body functions, activity limitations or restricted ability to participate in life situations. Poor cognitive function may influence mobility function so that the patient could be afraid of falling, due to reduced visual capacity, poor vision at night, more restricted foot and toe lift during stepping, altered centering of body gravity leading to balance being lost more easily, slower responses and increased urinary frequency.

Wheelchairs, belts and bed rails

Our results showed that fall risks assessments were correlated with wheelchairs or bed rails. Therefore, the use of these might be regarded as protective or preventive strategies.

Prevention is a form of risk management which may lead to the use of more physical restraint. It is likely that the use of a wheelchair could be a protective measure against falls. Karlsson (1996) described how impaired functional capacity, caused by muscle weakness and difficulties in one's balance, frequently led to the use of a wheelchair and physical restraints, usually to prevent falling. Our study shows that wheelchair use was correlated with the use of bed rails. Patients using wheelchairs are in a physically poorer condition than active patients and therefore bed rails are used as a protective measure for these individuals.

These restraints are widely used due to the belief that they will prevent falls. But bed rails can cause injuries when the patient climbs over them and as the fall is higher they can probably cause more damage.

Physical restraints to an already agitated person increase his or her fear and could worsen behavioural symptoms. Patients who are confused or suffer from dementia are more likely to be restrained (Gallinagh *et al.* 2001, Capezutti *et al.* 2002). This hardly reflects caring and compassionate practice. In addition, restraints can lead to serious complications, including circulatory obstruction, skin tears, incontinence fractures and dislocations (Dunn 2001). These restraints should be used with care and consideration.

Implications for practice

In clinical practice the patient's safety is very important. Measures to prevent falls must focus on the risk factors related to each individual, including their environment and behaviour (Strumpf *et al.* 2001). To prevent impairment in physical function, patients should be motivated to perform physical activities. Other measures that should also be taken are the performance of fall risk analysis and the assessment of

the individual's balance ability to try out suitable aids when training balance, transfers and physical strength. It is also extremely important that patients follow the advice they are given concerning physical activities in line with their own functional ability. However, all risk assessments are precautionary measures aimed at increasing patient safety. One strategy could be to include a checklist, which would identify patients who have an especially high-fall risk.

It is difficult to find any field of activity that is completely risk-free. Physical restraints are obvious fall prevention measures. The need for bed rails and belts should be assessed on an individual basis. Nevertheless, the aim is to maintain the patient's autonomy and integrity, and we must remember that physical restraints can also cause injuries. It is impossible to prevent every single fall incident and we cannot rule out the fact that freedom-restricting measures will continue to be used in the care of the older people. Patient safety is a serious problem, as injuries can result in unnecessary pain and poorer health. They are also a burden on medical services and result in high-costs for society.

High-dosages of medication and the use of physical restraints have frequently been discussed and questioned from an ethical perspective (Moss & La Puma 1991, Strumpf & Evans 1991). Therefore, further research is needed on the difficulties associated with the staff's view of factors that influence patient safety and security.

Methodological considerations

The questionnaires were answered and collected during 2000–2003. During these four years the answers from the nurses included data from all patients who lived in the participating nursing home units. The data were based on reported circumstances and not patient-bound. Therefore, in this study we did not count individuals; instead we counted the total number of patient investigations and incidents. For example, we do not know how many times each individual had fallen; we only know the number of falls and fractures at each nursing home unit and the number of patient investigations. The data collection included the number of incidents, which means that the units of analysis were bound to incidents but not to individual patients. As the data were aggregated, individual patients could not be identified. We could not know how the reported data had been secured or if there were differences in accuracy between the reported data from different nursing home units. The method of assessing fall risks also differed regarding if the patients were demented or had somatic illness. This could cause different outcome of assessments and possibly confound the results. However, both methods have been used for a long time in our clinical

practise and we have no reason to believe that the two methods would give considerable different or confounding outcomes in the assessment of fall risk.

We are aware that the correlation coefficients in this study must be interpreted with care. The statistical correlations do not imply causation, but when the co-variations appear they still give a hint of the real causal structure and the possible relationship between the variables investigated. With clinical knowledge and experience of common causes within the field of older care, it should be possible to establish what the correct structure is.

Conclusion

In summary, the results reevaluated a correlation between falls and fractures. More falls were related to more fractures. However, fewer falls occurred among patients with wheelchairs or bed rails, which can be regarded as a result of protective measures. A higher intake of medicine was associated with an increase in fractures and thus with more serious consequences of falls which jeopardize these patients' safety. Although freedom-restricting actions cannot eliminate falls totally, our results support the hypothesis that they might be protective when used selectively together with fewer sedatives, especially benzodiazepines.

Contributions

Study design: EF, closely supervised by HS; data collection and analysis: EF, with supervision by HS; manuscript preparation: EF, TBRW, HS, AE.

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References

Berg K, Wood-Dauphinee S, Williams JI & Gayton D (1989) Measuring balance in the elderly: preliminary development of an instrument. *Physiother Canada* **41**, 304–11.

- Berg W, Alessio H, Mills E & Tong C (1997) Circumstances and consequences of falls in independent community-dwelling older adults. *Age and Ageing* **26**, 261–68.
- Berwick DM & James B (2003) Connection between quality measurement and improvement. *Medical Care* **41**, 30–38.
- Capezutti E, Maislin G, Strumpf N & Evans L (2002) Side rail use and bed-related fall outcomes among nursing home residents. *Journal of the American Geriatrics Society* **50**, 90–96.
- Cohen-Mansfield J, Max MS & Wernwe P (1993) Restraining cognitively impaired nursing home resident. *Nursing Management* **24**, 112Q–112W.
- Dunn KS (2001) The effect of physical restraint on fall rates in older adults who are institutionalized. *Journal of Gerontological Nursing* **27**, 40–48.
- Fastbom J (1998) The use of newer psychotropic in the treatment of psychiatric illness and disturbance in the behaviour of elderly people. *Nordisk Geriatrik* **3**, 24–28.
- Fonad E, Robins Wahlin TB, Heikkilä K & Emami A (2006) Moving to and living in a retirement home focusing on older people's sense of safety and security. *Journal of Housing for the Elderly* **3**, 46–50.
- Forsell Y & Winblad B (1998) Major depression in a population of demented and nondemented older people: prevalence and correlates. *Journal of American Geriatrics Society* **46**, 27–30.
- Gallagher R, Nevin R, McAleese L & Campbell L (2001) Perceptions of older people who have experienced physical restraint. *British Journal of Nursing* **10**, 852–859.
- Gill TM, Williams CS & Tinetti ME (2000) Environmental hazards and the risk of nonsyncopal falls in the homes of community-living older persons. *Medicine Care* **38**, 1174–1183.
- Giron MT, Cleasson C, Thorslund M, Oke T, Winblad B & Fastbom J (1999) Drug use patterns in a very elderly population. A seven-year review. *Clinical Drug Investigation* **17**, 389–398.
- Guo Z, Wills P, Viitanen M, Fastbom J & Winblad B (1998) Cognitive impairment, drug use and the risk of hip fracture in persons over 75 years old: a community based prospective study. *American Journal of Epidemiology* **148**, 887–892.
- Gurvich T & Cunningham J (2000) Appropriate drugs in nursing homes. *American Family Physician* **61**, 1437–1446.
- Hansebo G (2000) Assessment of patients' needs and resources as a basis in supervision for individualised nursing care in nursing home wards. Evaluation of an intervention study. Doctoral dissertation, Karolinska Institutet, Stockholm, Sweden.
- Harper CM & Lyles YM (1988) Physiology and complication of bed rest. *Journal of American Society* **36**, 1047–1054.
- Hill K, Schwartz J, Flicke L & Caroll S (1999) Falls among healthy, community-dwelling, older women: a prospective study of frequency, circumstances, consequences and prediction accuracy. *Australian and New Zealand Journal of Public Health* **23**, 41–48.
- Jensen J, Lundin-Olsson L, Nyberg L & Gustafsson Y (2002) Fall and injury prevention in older people living in residential care facilities. *American College of Physicians-American Society of Internal Medicine* **136**, 733–741.
- Johnell O, Gullberg E, Kanis JA & Methods Study Group (1992) The apparent incidence of hip fracture in Europe: a study of national register sources. *Osteoporosis International* **2**, 298–302.

- Jorgensen L, Engstad T & Jacobsen B (2002) Higher incidence of fall in long-term stroke survivors than in population controls: depressive symptoms predict falls after stroke. *Strok* 33, 542–547.
- Karlsson S (1996) Physical restraint in geriatric care in Sweden: prevalence and patient characteristics. *Journal of American Geriatrics Society* 44, 1348–1354.
- Karlsson S, Nyberg L & Sandman PO (1997) The use of physical restraints in elder care in relation to fall risk. *Scandinavian Journal of Caring Science* 11, 238–242.
- Lantz M (2002) Problems with polypharmacy. *Clinical Geriatrics* 10, 18–20.
- Lauritzen JB, Schwartz P & Lund B (1993) Changing incidence and residual life time risk of common osteoporosis-related fractures. *Osteoporosis International* 3, 1127–1132.
- Leipzig RM, Cumming RG & Tinetti ME (1999a) Drugs and falls in older people: a systematic review and meta-analysis: I. Psychotropic drugs. *Journal of American Geriatrics Society* 47, 30–39.
- Leipzig RM, Cumming RG & Tinetti ME (1999b) Drugs and falls in older people: a systematic review and meta-analysis: II. Cardiac and analgesic drugs. *Journal of American Geriatrics Society* 47, 40–50.
- Lipsitz LA, Jonsson PB, Kelley MM & Koestner JS (1991) Causes and correlates of recurrent falls in ambulatory frail elderly. *Journal of Gerontology Biological Science Medical Science* 46, 114–122.
- Moss RJ & La Puma J (1991) The ethics of mechanical restraints. *The Hasting Center Report* 21, 22–25.
- Robins Wahlin TB (1999) *Cognitive Functioning In Senescence: Influences of Age and Health*. Unpublished doctoral dissertation, Karolinska Institutet, Stockholm, Sweden.
- Rochon PA & Gurwitz FH (1997) Optimising drug treatment for elderly people: the prescribing cascade. *British Medical Journal* 315, 1096–1099.
- Schmidt IK & Fastbom F (2001) Quality of drug use in Swedish nursing homes: a follow-up study. *Clinical Drug Investigation* 20, 433–466.
- Sjögren H & Björnstig U (1991) Injuries among the elderly in the home environment. Detailed analysis of mechanisms and consequences. *Journal of Aging Health* 3, 107–125.
- Socialstyrelsens Författnings Samling (SOSFS 1996:24) (1996) *Föreskrifter om allmänna råd om kvalitetsystem i hälso- och sjukvården* (Regulations concerning general advice on quality systems in healthcare). Socialstyrelsen (The National Board of Health and Welfare), Stockholm, Sweden.
- Socialstyrelsens Författnings Samling The National Board of Health and Welfare Code of Statutes (SOSFS 1982:763) (1982) *Hälso- och sjukvårdslag* (Legislation on Health Care and Medical Treatment). Socialstyrelsen, Stockholm, Sweden.
- Stillwell E (1991) Nurses' education related to the use of restraints. *Journal of Gerontological Nursing* 17, 23–26.
- Stockholms läns landsting (2004) *Utveckling och användning av kvalitetsindikatorer i Medicinskt Program Arbete* (Development and use of quality indicators in developing Medical Programmes). Medicinskt programarbete. ISBN 91-85209-39-2. Stockholm.
- Strumpf NE & Evans LK (1991) The ethical problems of prolonged physical restraint. *Journal of Gerontologist Nursing* 17, 27–30.
- Strumpf N, Evans L & Bourbonniere M (2001) Restraints. In *The encyclopedia of elder care* (Mezey M ed.) Springer: New York.
- The Abbreviated Injury Scale (1990) *American Association for Automotive Medicine*. Morton Grove, IL.
- Thorslund M & Parker M (1995) Strategies for an aging population: expanding the priority discussion. *Aging and Society* 15, 199–217.
- Tinetti ME, Speechley M & Ginter SF (1998) Risk factors for falls among elderly persons living in the community. *New England Journal of Medicine* 319, 1701–1707.
- Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, Koch ML, Trainor K & Horwitz RI (1994) A multifactorial intervention to reduce the risk of falling among elderly people in the community. *New England Journal of Medicine* 331, 821–827.
- Torres S (2001) Understandings of successful aging in the context of migration: the case of Iranian immigrants to Sweden. *Ageing and Society* 21, 333–355.
- Winter DA (1995) Human balance and postural control during standing and walking. *Gait Posture* 3, 193–214.
- World Health Organization (2002) *Active Ageing – A policy framework*. WHO Noncommunicable Disease Prevention and Health Promotion. Ageing and Life Course Division, Geneva.