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The influence of cognitive factors on reported in-hospital fall accidents among elderly patients

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Acknowledgment

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Through the work with both the In-Hospital Fall Project and this thesis I've increased my knowledge of the mechanisms and consequences of fall accidents among elderly, both within and outside the hospital. This work has enhanced my knowledge within the field of research and quality improvement measures which I will use in my future work as an occupational therapist.

I would like to thank my great supervisors Jorunn Lægdheim Helbostad and Beatrix Vereijken who have given me a better understanding of this field of research, but also shown patience and given me motivation in this project. I would also like to thank my collaborators at the County Governor of Sør-Trøndelag, senior advisor Ingrid Karin Hegvold and assisting county medical officer Inger Williams for support and trust in me in this project.

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Content

Abstract

Background: In-hospital falls among elderly represent a major problem for both the patient and the hospital. It can lead to serious physical injuries requiring surgery, prolonged rehabilitation, psychological trauma, fear of new falls, dependency in daily activities, and even death. In-hospital falls are one of the most common adverse events reported by hospitals both internationally and nationally. One of the most prominent risk factors for falls is cognitive impairment. The incidence of falls in older people with cognitive impairment is found to be twice as high as in cognitively intact people. The aim of the study was to map and describe the relations between cognitive impairment and fall related injuries, functional decline in terms of mobility level, assistance in ADL (Activities of Daily Living) and place of residence, and survival rate among elderly inpatients with a reported fall accident.

Methods: The project was conducted as a retrospective descriptive study, based on medical records of elderly patients, 75 years and older, all with an in-hospital fall accident reported as an adverse event in 2009. The patients were categorized in the following groups; Cognitive Intact (CI), Mild Cognitive Impairment (MCI) and Dementia.

Results: There were no significant differences between the groups of cognitively intact patients, patients with mild cognitive impairment and dement patients with respect to time of fall. Cognitive intact patients sustained both fewer injuries and fewer fractures after an in-hospital fall compared to patients with mild cognitive impairment and patients with dementia, but the results were not statistically significant. More demented patients admitted from their home were sent to a nursing home at discharge, compared to the other two groups ($p=0.03$). There was also a non-significant trend for cognitively impaired patients to have a larger decline in mobility level and increase in helping needs from hospital admission to discharge than for those being cognitively intact. No significant relation was found between cognitive impairment and one-year mortality, though the results found that more cognitively impaired patients died earlier after the in-hospital fall compared to cognitive intact patients.

Conclusion: Cognitive impaired patients' have more reported in-hospital falls compared to cognitively intact patients, and they experience a larger functional decline during hospitalization. Overall elderly patients with reported in-hospital falls are a vulnerable and frail patient group which show poor outcomes after hospitalization in terms of high mortality and functional decline regardless of their cognitive state. Additional studies with more accuracy in the categorizing of cognitive state, using valid and reliable diagnostic methods are needed.

Sammendrag

Bakgrunn: Fall hos eldre innlagt i sykehus representerer en stor utfordring ikke bare for pasienten, men også for sykehuset. Det kan føre til alvorlige fysiske skader som kan medføre operasjoner, langvarig rehabilitering, psykologiske traumer, redsel for nye fall, avhengighet i daglige aktiviteter og død. Fall under innleggelse i sykehus er den hyppigst rapporterte avvikshendelsen både internasjonalt og nasjonalt. En av de fremste/viktigste risikofaktorene for fall er kognitiv svikt. Forekomsten av fall hos eldre med kognitiv svikt er dobbelt så høy sammenlignet med fall hos kognitivt friske mennesker. Målet med denne studien var å kartlegge og beskrive sammenhengen mellom kognitiv svikt og fall-relaterte skader, funksjonstap i forhold til mobilitet, hjelp i ADL (Activities of Daily Living) og bo-situasjon, samt overlevelse blant eldre pasienter med en rapportert fallhendelse.

Metode: En retrospektiv og deskriptiv studie basert på journalopplysninger hos eldre over 75 år hvor alle hadde en rapportert fallhendelse under innleggelse i sykehus i 2009. Pasientene ble kategorisert i følgende grupper: Kognitivt intakt, Mild Kognitiv svikt og Dement.

Resultat: Det var ingen forskjeller mellom gruppene kognitivt intakt, mild kognitiv svikt og demente i forhold til tidspunkt for fallene. Kognitivt intakte pasienter pådro seg både færre skader og brudd etter fallhendelsene sammenlignet med pasienter med kognitiv svikt, men resultatene var ikke signifikante. Signifikant flere demente pasienter innlagt fra eget hjem ble utskrevet til sykehjem sammenlignet med de to andre gruppene ($p=0.03$). Det ble funnet en ikke-signifikant trend mot at kognitivt svekkede pasienter hadde større reduksjon i mobilitetsnivå og økt hjelpebehov fra før innleggelse til etter utskrivelse sammenlignet med kognitivt intakte pasienter. Ingen sammenheng ble funnet mellom kognitiv svikt og ett års overlevelse bortsett fra at flere pasienter med kognitiv svikt døde kort tid etter fallhendelsen sammenlignet med kognitivt intakte pasienter.

Konklusjon: Eldre pasienter med kognitiv svikt har flere rapporterte fall i sykehus sammenlignet med kognitivt friske, og de opplever større funksjonstap under innleggelse. Generelt er eldre pasienter med rapporterte fall i sykehus en sårbar pasientgruppe med dårlig prognose etter sykehusinnleggelse i form av høy dødelighet og stort funksjonstap uavhengig av kognitiv funksjon. Det er behov for ytterligere studier med større nøyaktighet i kategorisering av kognitiv funksjon ved bruk av valide og reliable diagnostiske metoder.

1 Introduction

Falls are common among older persons representing a major problem causing increased morbidity, mortality, and use of health care services (Rubenstein, 2006). Of the persons above the age of 65 years living in the community, approximately 30 % fall each year. For those above the age of 75, the rates are even higher. Amongst elderly hospitalized patients, fall accident occur often as well, and both research evidence and hospital admission statistics suggest that patients are at a greater risk of falling than people in the community (Healey F., 2007).

In-hospital falls amongst elderly represents a major challenge for both the patient itself and the hospital, and even for rest of the health care system. For the patient the fall can lead to serious physical injuries requiring surgery, prolonged rehabilitation psychological trauma, fear of new falls, dependency in daily activities, and even death. For the hospitals an in-hospital fall most often results in a prolonged length of the hospital stay and thereby higher treatment costs (Bates, Pruess, Souney, & Platt, 1995). Falls might also have implications for the staff who may worry that falls will be cited as a failure in the duty of care (Oliver, Hopper, & Seed, 2000).

In-hospital falls are one of the most common adverse events reported by hospitals both internationally (Healey F., 2007) and nationally (Helsetilsyn, 2008). In the period 2001 - 2007 17 % of adverse events reported to the Norwegian Board of Health Supervision were related to in-hospital falls. In the region of Mid-Norway this number was even higher in 2008, were it counted for 28 % of all reported adverse events (Helsetilsynet i Nord-Trøndelag, 2009).

There are several risk factors for falls among elderly in-hospital patients. One of them is cognitive impairment which is a term that describes different disturbances of memory, thinking and problem-solving caused by various underlying disorders, like dementia or delirium (Harlein, Halfens, Dassen, & Lahmann, 2011). The incidence of falls in older people with cognitive impairment is found to be twice as high as in cognitively intact older people. Furthermore, persons with cognitive problems are also reported to have increased risk for sustaining serious injuries after a fall (Shaw, 2002).

The focus in this thesis is on cognitive impairments amongst elderly experiencing an in-hospital fall and how this is related to severity of an injury, changes in functional ability (functional decline), length of hospital stay and mortality.

1.1 Older medical patients

International studies have found that patients above 65 years of age occupy more than two-thirds of hospital beds (Healey F., 2007). In Norway, elderly above the age of 80 years account for 4.4 % of the population, 8.1 % of the hospital patients and 21 % of the inpatient bed days (Huseby, 2012). Mean length of a hospital stay for these Norwegian elderly are 5.9 days, compared to 4.3 days overall, and most of their admissions are emergency care admissions not needing surgical treatment (Huseby, 2012).

For elderly persons, particularly for the very old, hospitalization itself is a major health risk, often followed by an irreversible decline in functional status and a change in quality and style of life (Creditor, 1993). Functional decline is defined as the consequence of physiologic changes (e.g. as decrease in muscle mass) that result from either aging, immobility or both, which can contribute to an overall weakness (Graf, 2006). This functional decline is experienced by 30 to 60 % of hospitalized older patients and may lead to dependency in activities of daily living (ADL) such as transferring, toileting, dressing, feeding and grooming (Buurman et al., 2012).

In older medical patients, geriatric syndromes such as falls and functional decline are common, and studies have found that many older patients do not return to premorbid function after a hospitalization (Lakhan et al., 2011).

1.2 Fall risk among elderly

Based on the fact that fall rates increase with advancing age, age itself is seen as one of the most important fall risk factors. Additionally, over 400 different risk factors for falls have been identified (Healey F., 2007), and these are often classified as intrinsic (personal) or extrinsic (environmental) risk factors.

The intrinsic factors refer to common demographic profiles such as age, gender, ethnicity, marital status, socioeconomic levels, and living alone. In addition, they address aspects such as previous history of falls, medical conditions, physiological and mental condition, nutritional status, and cognitive functioning. Extrinsic factors include environmental hazards (poor lighting, slippery floors, uneven surfaces, etc.), footwear and clothing, inappropriate walking aids or assistive devices, and for the in-hospital falls also the hospitalization event itself (Cozart & Cesario, 2009; Skelton D.).

A third category is "Exposure to risk" which some authors define as an intrinsic factor and others as a third main category of risk factors (Skelton D., 2004). This factor refers to the person's activity level, were the exposure to falls increases with increasing activity level.

The most common causes for falls among elderly living in a variety of settings are 1) environmental related, 2) gait/balance disorders or weakness and 3) dizziness or vertigo (Rubenstein, 2006).

A widely used definition of a fall both in national and international studies is the PROFANEs recommended definition from 2005: "A fall is an unexpected event in which the participants come to rest on the ground, floor, or lower level" (Lamb, Jorstad-Stein, Hauer, & Becker, 2005). This definition covers a wide range of fall events as for example falls due to a stroke or fainting. The PROFANE definition is used to define the term fall-accident in both the study which this thesis is based upon and in this thesis.

1.3 Risk factors for in-hospital falls

International studies have found a fall incidence for in-hospital falls of between 4 and 12 per 1000 bed days (Oliver et al., 2000). The risk of falling among hospitalized older adults is higher within the first 3 days of admission (Ferrari, Harrison, & Lewis, 2012; Oliver, 2004). During these first days of hospitalization, patients go through a transient period of risk associated with acute illness.

Different studies have sought to document risk factors for in-hospital falls and the factors that consistently emerge in these studies include gait instability, agitation, urinary incontinence, a

history of falls and prescription of drugs like sedatives and hypnotics (Lord, Sherrington, Menz, & Close, 2007).

1.4 Cognitive function among elderly

1.4.1 Cognitive impairment

There is a high prevalence of cognitive impairment amongst elderly people. A study in England found a prevalence of Cognitive Impairment higher than 18 % in those aged 75 years and above (Rait et al., 2005). Cognitive impairment is not a single diagnosis, but a symptom which may be due to different causes such as dementia, delirium, head injury, depression or schizophrenia (Wyller, 2011). Dementia, mild cognitive impairment and delirium, are the most commonly used terms used to describe cognitive impairments among elderly admitted to hospitals, apart from the more specialized geriatric departments. These terms are more detailed explained below.

1.4.1.1 Dementia

The term describes a set of symptoms that include decreased intellectual functioning that interferes with normal life functions. It is usually used to describe people who have two or more major life functions impaired or lost, such as memory, language, perception, judgment or reasoning, and they may lose emotional and behavioral control, develop personality changes and experience reduced or lost abilities for problem solving (Charles Patrick Davis). There are different types of dementia, where Alzheimer's disease is the most common of these, counting for 60 – 70 % of all cases (Wyller, 2011).

The prevalence of dementia increases strongly with age. Dementia is rare among people below 70 years, while among elderly aged 90 years and older probably one out of three is affected (Wyller, 2011).

1.4.1.2 Mild cognitive impairment

Mild cognitive impairment (MCI) is a syndrome with several different definitions, and internationally there is disagreement in how to define this concept (Wyller, 2011). The most used definition is the Mayo Clinic's definition which says that MCI is an intermediate stage

between the expected cognitive decline of normal ageing and the more pronounced decline of dementia. This will involve problems with memory, language, thinking and judgment that are greater than typical age-related changes (http://www.mayoclinic.com/health/mild-cognitive-impairment/DS00553). A person with MCI will be aware that his/her memory or mental function has "slipped", and family and close friends may also notice a change, but in general these changes will not interfere notably with the persons daily life activities.

In adults older than 65 years old, the prevalence of MCI in population-based epidemiological studies ranges from 3 % to 19 %. For some persons with MCI, their cognitive state remains stable and a few returns to normal over time, but more than half progress to dementia within 5 years (Gauthier et al., 2006).

1.4.1.3 Delirium

Delirium is a common clinical syndrome characterized by reduced attention and acute onset of cognitive dysfunction. Delirium as a medical term was first used to describe mental disorders which occurred during fever or head trauma. Today delirium is used to describe a transient, reversible syndrome that is acute and fluctuating, and occurs in the setting of a medical condition (Fong, Tulebaev, & Inouye, 2009).

The prevalence of delirium amongst patients admitted to hospital medical departments ranges from 14 % to 24 %, but incidence of delirium arising during a hospital stay ranges from 6 % to 56 % (ibid). After a hip-fracture the incidence is 40 % to 50 % (Wyller, 2011), and among elderly patients admitted to an intensive care unit the delirium can reach as high as 70 – 87 % (Pisani, McNicoll, & Inouye, 2003).

1.5 Cognitive impairment and fall risk

Falls among older people with cognitive impairment and dementia are major causes of morbidity and mortality. Both conditions are identified as independent risk factors for falls and these findings are consistent across populations living in the community, in hospitals and in residential or nursing homes (Shaw, 2002). Studies have found that hospitalized older patients with cognitive impairment have more than a threefold risk of falls compared with patients without cognitive impairment (Harlein et al., 2011). A reason for this might be that

older people with a cognitive impairment may misperceive environmental dangers or fail to discriminate between safe and dangerous environmental conditions or activities, and consequently, they potentially place themselves more often in hazardous situations (Tideiksaar, 2010).

Studies have shown that cognitively impaired patients tend to have more severe fall injuries than cognitively intact patients (Tzeng, 2010), and cognitively impaired patients admitted to a hospital because of acute illness have greater odds for experiencing decline in their ADL functioning over 1 year compared to patients without cognitive impairments (Sands et al., 2002).

1.6 The Mid-Norway In-Hospital Fall project

As a part of its tasks the Norwegian Board of Health Supervision develop reports concerning adverse events in hospitals. As late as in 2008, 28 % of the reported adverse events reported in the health-region of Mid-Norway were related to in-hospital falls (Helsetilsynet i Nord-Trøndelag, 2009).

Based on these results, they initiated a project aimed to increase the knowledge concerning in-hospital falls in acute hospitals in Mid Norway. This 3-year project, The Mid-Norway In-Hospital Fall Project, started in 2010 with part one, the Pilot Study, which aimed to identify and map the occurrence and causes of in-hospital falls from 2007 to 2009. Part two of the project, The Journal study, was conducted in 2011 and aimed to identify fall risk factors reported in patient journals for elderly patients with a registered in-hospital fall in 2009.

1.7 The present study

In this thesis data will be used from The Mid-Norway In-Hospital Fall Project - part two; the Journal Study. The aim is to study the relation between cognitive impairment and fall related injuries, functional decline in terms of mobility level, assistance in ADL and place of residence, and survival rate among elderly inpatients with a reported fall accident.

The research questions are as follows:

- What is the relationship between cognitive state and time of fall, type and severity of injury among elderly patients with reported in-hospital falls?
- How is cognitive state related to change in function in elderly patients with reported in-hospital falls?
- What is the influence of cognitive state at hospital discharge on mortality one year after a reported in-hospital fall in elderly patients?

The hypotheses are as follows:

1. The incidence of in-hospital falls is higher amongst elderly patients with cognitive impairment compared to cognitively intact patients.
2. Elderly with cognitive impairment experience fall accidents earlier in their hospital stays than cognitively intact patients
3. Elderly fallers with cognitive impairment have more severe fall injuries than cognitively intact fallers.
4. Patients with cognitive impairment experience greater functional decline after an in-hospital fall than cognitively intact patients.

2 Methods

2.1 Design

The project was conducted as a retrospective descriptive study, based on medical records of elderly patients, 75 years and older, all with an in-hospital fall accident reported as an adverse event in 2009.

2.2 Subjects

The sample was drawn from the subjects included in stage one of the In-Hospital Fall project in the region of Mid-Norway, where all reported adverse events concerning in-hospital falls in Mid-Norway during 2007-2009 were collected and analyzed. The subset included in the present study consisted of elderly patients aged 75 years or older with a registered in-hospital fall in acute somatic hospitals in 2009.

A total of 234 patients were initially included. After excluding one patient on the basis of no information concerning cognitive status the sample consisted of 233 patients with a total of 289 reported falls. Thirty-seven of the 233 patients had two or more reported fall accidents, of whom nine had experienced fall accidents at two or more different hospital stays (figure 1).

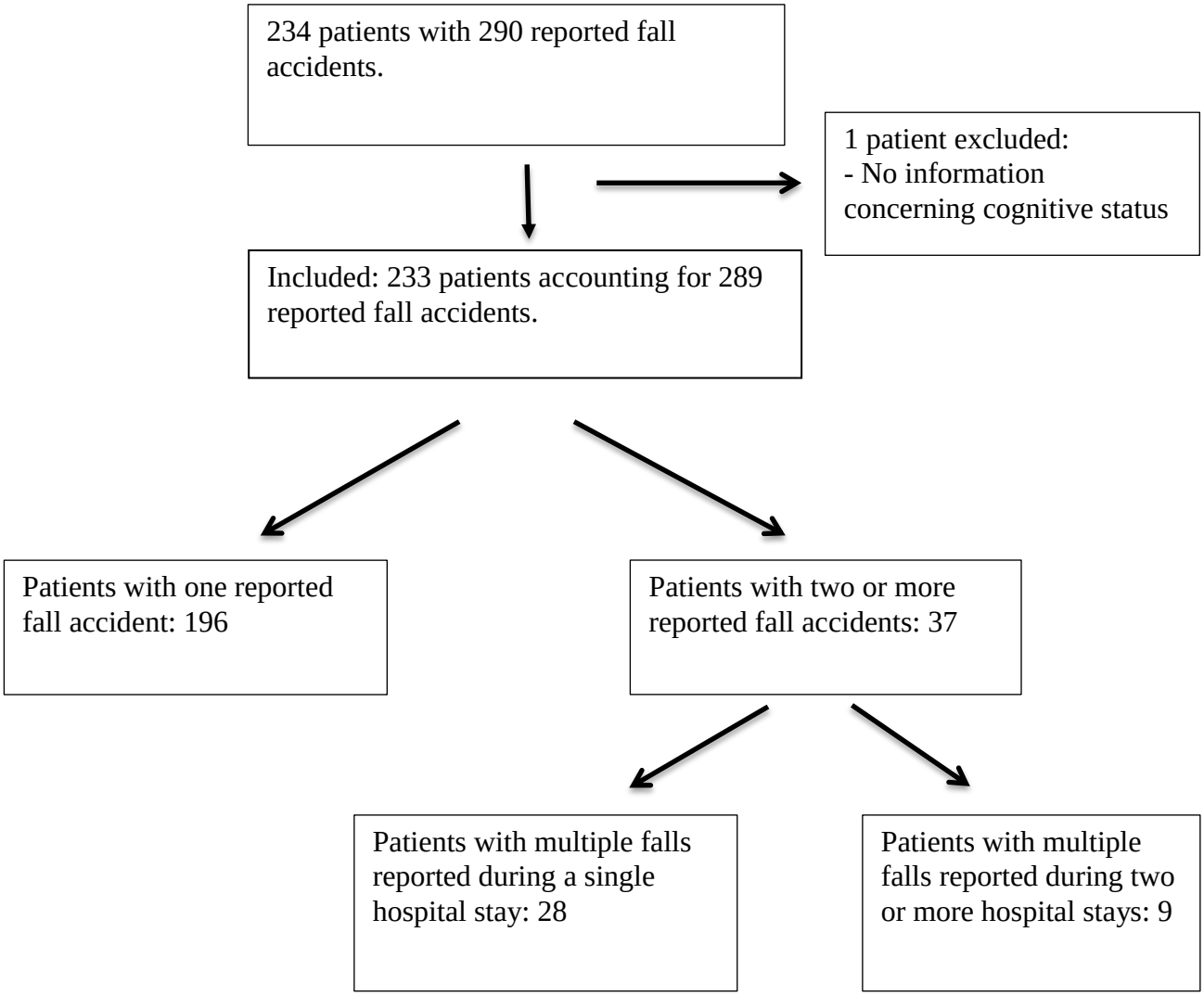

Figure 1: Overview of patient flow in the study.

This resulted in the sub-samples presented in table 1 where the groups typed in bold letters represent all included patients and the total amount of fall accidents. The sub-samples typed in cursive represent deceased patients and numbers of falls excluding these deceased patients.

Table 1: Sub-samples

Number of patients with reported fall accident	**233**
Deceased patients during hospital stay	*17*
Total amount of reported fall accidents	**289**
Amount of reported fall accidents excl. falls from patients deceased during hospital stay	*270*
First fall accident per patient per hospitalization	**243**
First fall accident per patient per hospitalization excl. falls from patients deceased during hospital stay	*226*

The subjects included in the study came from all hospitals in the Health Region of Mid-Norway. This health region serves a population of about 660.000 inhabitants and acute somatic care is provided by 8 hospitals. As seen in table 2 the majority of patients (76 %) came from St. Olavs Hospital. This uneven distribution reflects both differences in hospital size with regards to number of hospital beds, and reporting culture between the different hospitals. An earlier study (Uleberg, Helbostad, & Sletvold, 2010) on in-hospital falls showed that St. Olavs Hospital HF had a fall rate of 1.33 falls per 1000 bed days while the other hospitals fall rate varied between 0.17 and 0.52 falls per 1000 bed days, likely to reflect differences in routines for fall reporting than actually differences in fall rates.

Table 2: Distribution of included patients per hospital.

Hospital	**No of subjects**	***(%)***
St. Olavs Hospital HF		
• St.Olavs Hospital (Øya)	163	*70*
• St.Olavs Hospital - Orkdal sykehus	14	*6*
Helse Nord-Trøndelag HF		
• Levanger Hospital	6	*2.5*
• Namsos Hospital	1	*0.5*
Helse Sunnmøre HF		
• Ålesund Hospital	30	*13*
• Volda Hospital	11	*4.5*
Helse Nordmøre og Romsdal		
• Kristiansund Hospital	2	*1*
• Molde Hospital	6	*2.5*
Total	**233**	

2.3 Procedures

Data were collected from the patient's electronic medical records, Doculive. A form (see attachment 1) was developed which contained questions concerning different patient variables we wanted to collect from the medical records: patient demography; reason for (diagnosis), and type of hospital admission (acute, elective); medical condition; function; cognitive state and the doctor's evaluation of the patient's general condition by admission.

2.4 Outcome variables

Fall history (earlier falls), functional level, place of residence, injuries and survival is seen as dependent variables while cognitive state is the independent variable.

2.4.1 Earlier falls

The medical records from doctors, nurses, physiotherapists and occupational therapists were reviewed to find any evidence for earlier falls either at home/outside of hospital or in hospital, one year prior to the registered in-hospital fall. Earlier falls were registered as number of falls in hospital or as number of falls at home/outside hospital.

2.4.2 Functional level

The patient's functional level was assessed as the patients' need of assistance in daily activities, and the patient's mobility level as described in text fields in the medical record. Functional level was reported for; last month before admission, day of the in-hospital fall (prior to the fall), and by discharge from the hospital.

The patient's needs of assistance in daily activities prior the hospitalization and by discharge was assessed in terms of use of public health services, and categorized as independent, weekly help (help once or several times a week or help once a day) and daily help (help several times a day). The patients' need of assistance in ADL the day of the reported fall accident was categorized as independent, in need of help or no info.

A patient who came from and/or was discharged to a nursing home was categorized as needing daily help. In some medical records it was indicated that the patient received help from close relatives several times a day, but as long they did not receive any public health service they were categorized as independent.

Mobility level was categorized in terms of the patients' need of mobility aids; walking independently (without support and walking aids), using walking aids (cane, crutch or walker) or dependent walking (need of personal support during walk or using wheelchair).

2.4.3 Place of residence

The included patients' place of residence were assessed at admission and at discharge, and categorized as own residence (including care dwelling home), nursing home, or either rehabilitation institution, DMC (district medical center) or local hospital (another hospital).

2.4.4 Cognitive state

The patient's cognitive state was registered at admission and at discharge based on information described by doctors, nurses or other health workers. The patients were categorized in three different groups;

- Cognitively intact (CI)
- Mild Cognitive Impairment (MCI): Cognitive impairment without dementia (described or indicated in the medical record that the patient had an cognitive impairment in one form or another)
- Dementia (cognitive impairment with a dementia diagnose).

Acute delirium during hospital stay was registered. Patients admitted with an acute delirium were categorized in the group Cognitive impairment without dementia.

2.4.5 Injuries

The medical records were searched for information concerning injuries following the in-hospital falls. Type of injury was categorized as fractures, cuts, soft tissue injuries, luxations, dislocations, distortions, contusions, concussions and other injuries. The fractures were divided into groups according to location, and the cuts divided according to need of sewing or not.

2.4.6 Survival

Survival was registered one year after the first reported in-hospital fall incident and measured as time in days from in-hospital fall to death up to one year (365 days after the fall. Information on whether the patient was alive after one year was obtained from the National

Registry (Folkeregisteret) in Norway. Access was granted by the Norwegian Board of Health Supervision (Helsetilsynet).

2.5 Data analysis

Statistical analyses were performed in IBM SPSS Statistics 20 while figures were developed by use of Microsoft Office Excel 2010. The results will be presented in counts, percentages and means (SD). The Students t-test will be used to assess statistical differences between genders for the variables age and length of stay while binary logistic regression will be used to measure any correlation between cognitive impairment and mortality. Odds Ratio will be calculated to measure the association between cognitive impairment and change in functional decline. Analyses on survival using Kaplan-Meyer statistics will be performed on all included patients (n=233) and registered from the patient's first reported fall on the last hospital admission in 2009. Significance level is set to 0.05.

In the analyses, patients with a registered fall at more than one hospital stay are counted as a new patient per new admission. This gives a total amount of 243 patients which will be used in the majority of the data analyses. Data will also be analyzed in relation to all reported fall accidents (289) where this is statistically appropriate.

Cognitive state is registered both at admission and at discharge. The registered cognitive state at discharge will be used in all of the statistical analyses except on analyses of type of admission.

In some of the analyses the groups MCI and Dementia will be collapsed and compared with the group of CI patients.

2.6 Ethics

The study was evaluated by the Regional Committees for Medical and Health research ethics (REC) and classified as a quality control study that could be conducted without further approval.

3 Results

3.1 General demographic characteristics of the subjects

Of the 233 included patients, 55 % were women. Mean age was 84.7 (SD 4.8) years. The men were on average slightly younger, with a mean age of 84.3 years, compared to 85.0 years for the women. However, this difference was not significant (t= -1.18, p=0.241). More than 2/3 of the women lived alone at admission, compared to 1/3 of the men.

3.1.1 Cognitive state

At admission 73 % of the patients was registered having a cognitive impairment ranging from mild cognitive impairment to a diagnosed dementia. Of the patients still alive at discharge this rate had increased to 76 %, in which the group of patients described with a diagnosed dementia had risen from 27 % to 39 % (table 3).

Table 3: The patients' cognitive state at admission and discharge.

	Admission n=243		**Discharge n=226 ***	
	Frequency (%)	*% of ♀*	Frequency (%)	*% of ♀*
Cognitive state				
Cognitively intact	66 (27)	*50*	54 (24)	*50*
Mild cognitive impairment	111 (46)	*55*	83 (37)	*58*
Dementia	66 (27)	*56*	89 (39)	*55*

* 17 patients died during their index hospitalization and explain the lower patient count at discharge.

3.1.2 Admission type

Of the 243 patients admitted to the hospital, 94% were acute admissions, with the rest being elective admissions (table 4). A chi-square test indicated significantly more acute admissions in those cognitively impaired (MCI and dementia) compared with those cognitively intact (Pearson Chi-Square=5.536, p=.019).

Table 4: The patients' cognitive status at admission and their corresponding admission type.

	Cognitive status at admission			
	CI	MCI	Dementia	**Total**
Acute admissions	58 (88 %)	106 (95 %)	64 (97 %)	228 (94 %)
Elective admissions	8 (12 %)	5 (5 %)	2 (3 %)	15 (6 %)
Total	66	111	66	243

In 12 % of the hospitalizations one or more fall accidents were a part of the written reason for the admission. At admission, 62 % of the patients were considered to be in poor general condition by the doctor in charge of the admission, while only 16 % were considered to be in good general condition. For the rest there were no descriptions of the patients' general condition.

3.1.3 Length of hospital stay

The mean length of the hospital stay was 14.8 days (95 % CI=13.4-16.1). Men had a significant longer mean stay with 15.9 days (95 % CI=13.6-18.3), compared to 13.8 days (95 % CI=12.4-15.3) for the women (t=1.55, p=0.005) (fig.2).

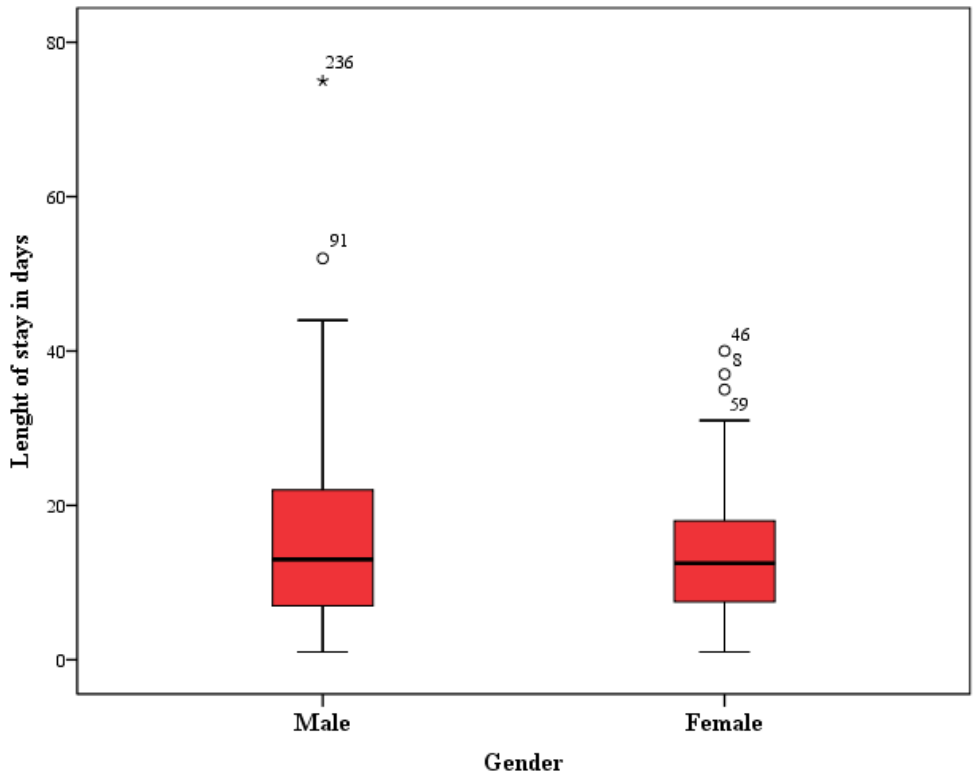

Figure 2: Length of stay (days) for men and women (box plot with means and 25-75 percentiles).

Cognitively intact patients had a mean length of stay of 14.1 days, compared to the two other groups with mild cognitive impairment and dementia that both had a mean length of stay of 15 days (p=0.870).

3.1.4 Fall-history

Nearly 2/3 (62 %) of the included patients' medical records had written documentation describing that the patient had one or more falls at home or in a nursing home in the one-year period prior to admission. The corresponding numbers for earlier in-hospital falls was 22 %.

Statistical analyses indicated a significant difference between the three groups of cognitive state, indicating more patients with cognitive impairment experiences falls either at home or outside of home in the one-year period in front of hospitalization compared to cognitive intact patients (Pearson Chi-Square=6.158, p=0.046).

Table 5: Cognitive status in relation to previous falls.

	Cognitive state at discharge			
	CI	MCI	Dementia	**Total**
Earlier falls at home				
Yes	26 (48 %)	56 (68 %)	59 (66 %)	141
No	28 (52 %)	27 (32 %)	30 (34 %)	85
Total	54	83	89	226

3.1.5 Deceased patients during hospital stay

Of the total of 233 patients, 17 died during their hospital stay in which they had a reported in-hospital fall accident. Ten of these were men, mean age was 83.8 years. Of the 17 patients, seven sustained an injury from their fall accident. Of these injuries there were 2 fractures; one pelvic fracture and one humerus fracture.

Of the patients who died during the stay, six had a cancer-disease as reason for admission and one was admitted because a hip-fracture after a fall accident at home.
Only one of the deceased patients was admitted from a nursing home, the rest came from their own residence or care-dwelling home. Four patients did not have any help from public health services prior to hospitalization, while 10 needed help several times a day.

According to cognitive function five of the deceased patients were described as cognitively intact, nine had mild cognitive impairment and three had a dementia diagnosis at admission.

3.2 Time of fall, type and severity of injury

3.2.1 Time of fall

Of the total of 289 fall incidents, 31 % occurred during the first two days, 54 % during the first 4 days and 70 % during the first week of the hospital stay (figure 3).

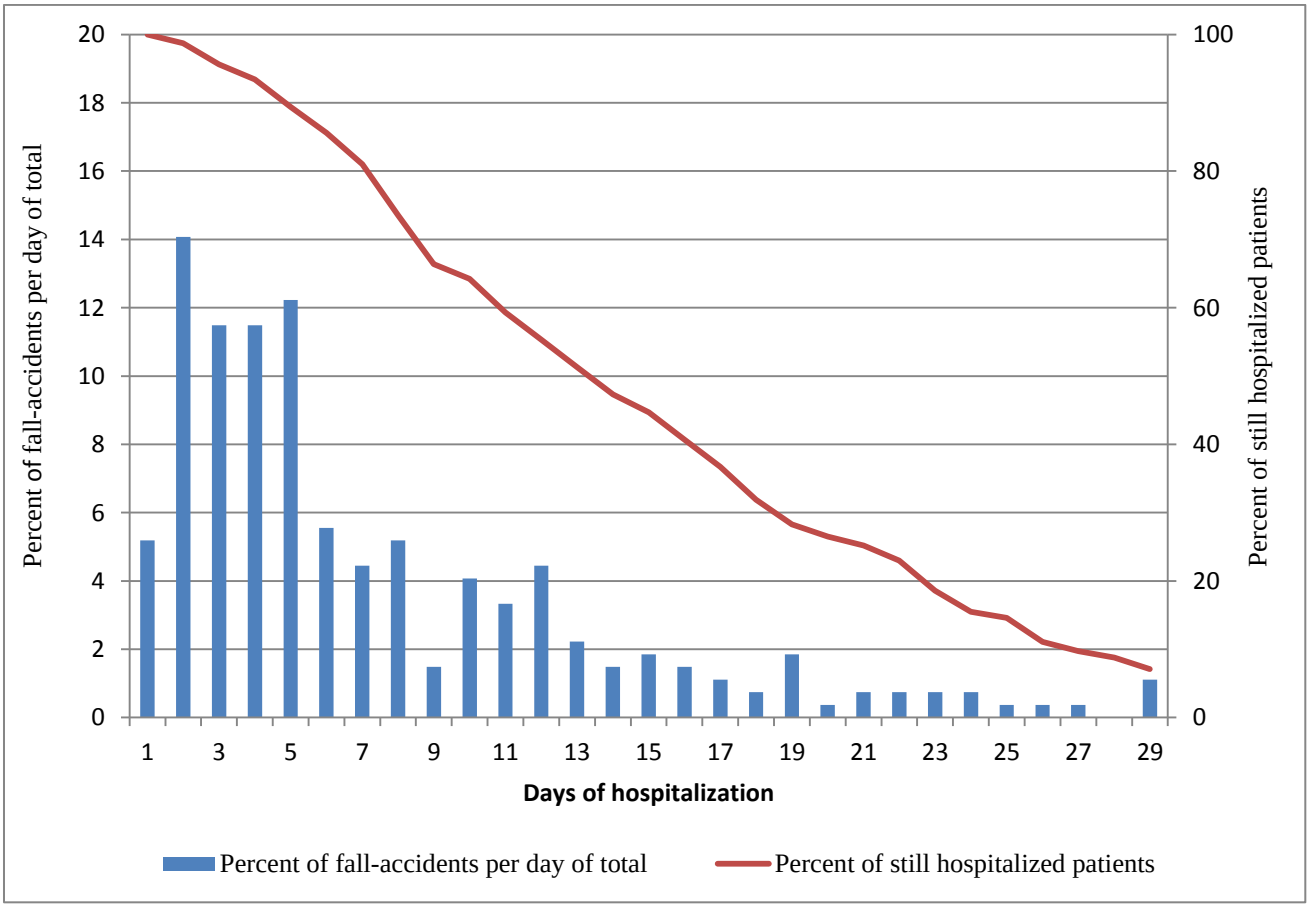

Figure 3: Overview of time of fall after admittance to the hospital in relation to percentage of patients still in hospital each of the days.

The mean time from admission to the first fall was 6.03 days (SD=7.2). For the group categorized as cognitively intact by discharge mean time was 6.5 days (SD=10.3), compared to the MCI group which had 6.02 (SD=6.4) days and those with dementia with 5.7 days (SD=5.6). The differences in time to fall between the groups was not significant (p=0.820).

Nearly half of the 287 falls (46 %) occurred during night. About half (51 %) of the patients categorized as cognitively intact by discharge fell during night time (table 6). This was a slightly higher percent than for the MCI group (42 %) and the dementia group (46 %), but analyses showed no statistically significance between the groups (Pearson Chi-Square=4.881, p=0.3). The results do not change after collapsing the groups MCI and Dementia and the two time-intervals day (07:00-14:59) and evening (15:00-22:59) (Pearson Chi-Square=0.837, p=0.36).

Table 6: Time of fall according to patients' cognitive state at discharge.

	Cognitive state by discharge				
	Cognitively intact	Mild cognitive impairment	Dementia	**Total**	***% of women***
Time of fall:					
07:00 – 14:59	16 (28 %)	20 (21 %)	23 (20 %)	59 (22 %)	*45*
15:00 – 22:59	12 (21 %)	34 (37 %)	41 (35 %)	87 (32 %)	*52*
23:00 – 06:59	29 (51 %)	39 (42 %)	54 (46 %)	122 (46 %)	*53*
Total	57	93	118	268*	

* Time-specified falls for deceased patients not included.

3.2.2 Type and severity of injuries

Injuries occurred in 51 % of the fall accidents (table 7). A total of 26 falls (9 %) resulted in a fracture and 32 in cuts needing sutures. 99 falls resulted in different types of contusions.

When merging the groups containing patients with MCI and dement patients, Chi-square Tests indicated a trend that patients categorized as cognitive intact sustained fewer injuries after an in-hospital fall compared to patients with some sort of cognitive impairment, but these findings were not significant (p=.318).

Patients with MCI had the highest proportion of falls resulting in a fracture (13 %). Among the patients with dementia, the proportion was 8 %, slightly higher compared to the cognitive intact patients were only 5 % of the falls resulted in a fracture. After merging the groups containing patients with MCI and demented patients, no statistical significant differences were found (p=0.279).

There was a trend for cognitively impaired patients to sustain more severe fractures (hip fractures, fractures of the femoral bone, scull-fractures) than cognitively intact patients (table 7), but the numbers are too small to do further statistical analyses.

Table 7: Cognitive state versus fall related injury.

	Total counts (%), n=289	**% of women**	**Cognitive status at discharge**			**Total (%)**
			CI	MCI	Dementia	
Falls resulting in injury						
Injury	146 (51)	54	26 (46 %)	54 (57 %)	59 (50 %)	139 (51)
No Injury/No info	143 (49)	47	31 (54 %)	41 (43 %)	59 (50 %)	131 (49)
Total	289		57	95	118	270
Falls resulting in fracture						
Fracture	26 (9)	62	3 (5 %)	12 (13 %)	9 (8 %)	24 (9)
No fracture	263 (91)	50	54 (95 %)	83 (87 %)	109 (92 %)	246 (9)
Total			57	95	118	270
Type of fracture						
Hip fracture			0	5	3	8
Other fractures lower extremities (incl. femoral bone)			0	2	1	3
Fractures of trunk and pelvic			1	2	1	4
Fractures of scull, cervical spine, facial bones			0	1	1	2
Fractures of upper extremities			2	2	3	7
Total fractures			**3**	**12**	**9**	**24**

3.3 Changes in function

Table 8 presents the results from descriptive analyses regarding the change in place of residence and functional ability from admission to discharge. The majority of the patients (84 %) lived in their own residence before admission, but the proportion of patients discharged to their own residence dropped dramatically to 19 %. More than half of the patients (57 %) needed daily help (help several times a day) prior to the hospital admission. At discharge this proportion had risen to 89 %. The number of people walking independently dropped from 25 % before admission to 8 % after discharge, while the number of people dependent on personal support or wheelchair increased from 12 % to 35 % (fig.4).

Table 8: Patient characteristics at hospital admission and at discharge, N=243.

	Admission n=243		**Discharge n=226**	
	Counts (%)	*% of* ♀	Counts (%)	*% of* ♀
Place of residence				
Own residence	205 (84)	*54*	43 (19)	*37*
Nursing home	38 (16)	*55*	133 (59)	*56*
Rehabilitation/DMC/Local hospital			50 (22)	*66*
Need of assistance in ADL				
Independent	64 (26)	*47*	8 (3)	*50*
Weekly help	34 (14)	*71*	12 (5)	*58*
Daily help	138 (57)	*54*	200 (89)	*56*
Unknown	7 (3)	*29*	6 (3)	*17*
Mobility				
Walks independently	61 (25)	*59*	19 (8)	*68*
Uses walking aids	108 (44)	*56*	111 (49)	*52*
Dependent (wheelchair and/or personal support)	29 (12)	*41*	78 (35)	*56*
Unknown	45 (19)	*51*	18 (8)	*50*

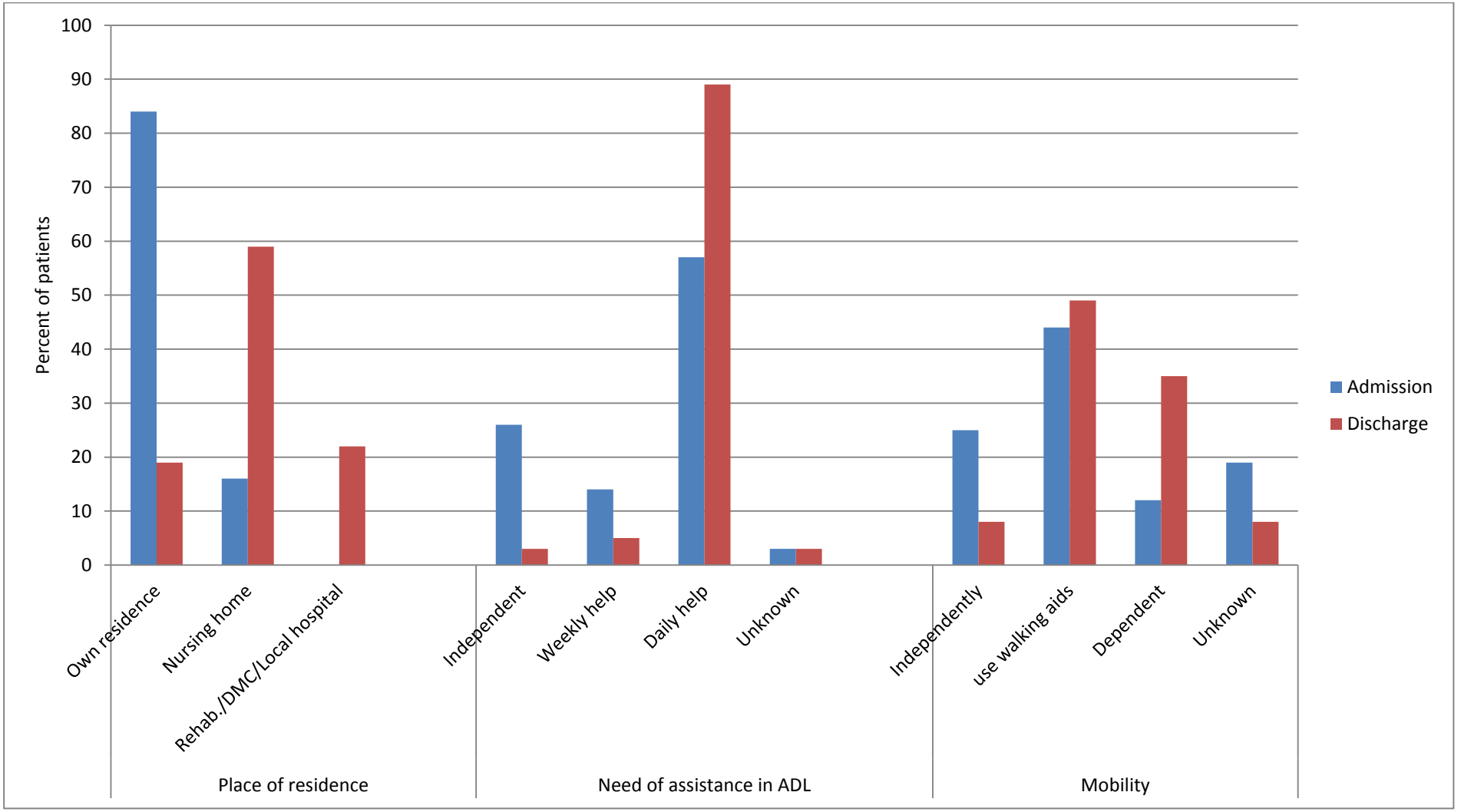

Figure 4: Overall change in residential settings, need of assistance in ADL and mobility from admission to discharge.

3.3.1 Change in residential settings

Of those living in their own residence prior to hospitalization, significantly more patients with MCI and dementia were discharged to nursing homes compared to cognitive intact patients (Pearson Chi-Square Tests; df=4; $p<0.001$). Statistical analysis indicate that home dwelling patients with cognitive impairment (MCI and Dementia) have more than twice the risk of not being discharged to their own residence after a hospital stay with an in-hospital fall accident; OR=2.259 (95 % CI=1.095 – 4.658, p=0.027).

Table 9: Change in residential settings from admission to discharge.

	Cognitive state at discharge - Counts (%)			
	CI	MCI	Dementia	**Total**
Own residence to:				
Own residence	17 (34)	13 (17)	13 (21)	43 (22)
Nursing home	15 (30)	37 (48)	46 (73)	98 (52)
Rehab./DMC/local hospital	18 (36)	27 (35)	4 (6)	49 (26)
Subtotal:	***50***	***77***	***63***	***190***
Nursing home to				
Nursing home	4 (100)	6 (100)	25 (96)	35 (97)
Rehab./DMC/local hospital	0	0	1 (4)	1 (3)
Subtotal:	***4***	***6***	***26***	***36***
Total	**54**	**83**	**89**	**226**

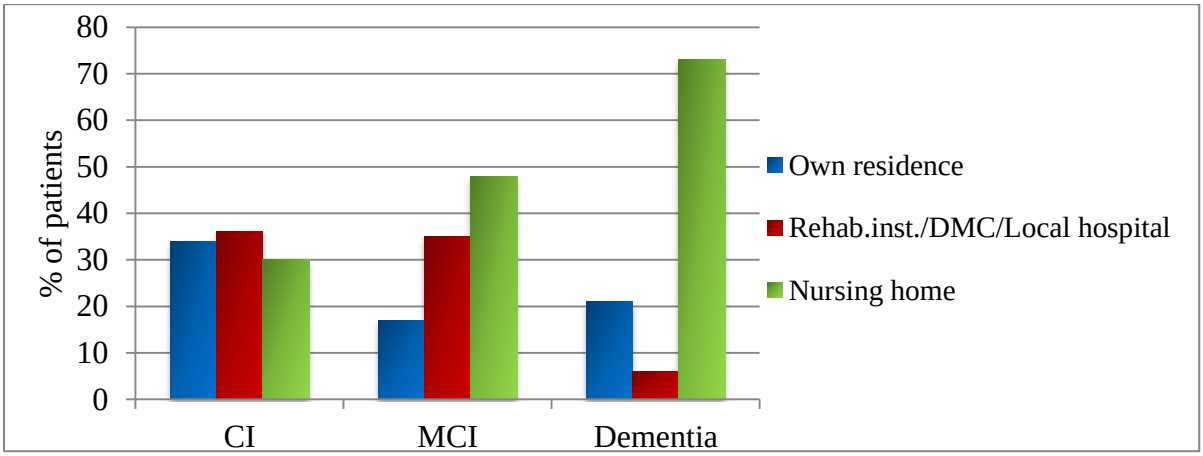

Figure 5: Residential setting by discharge for those who lived in their own residence prior to hospitalization.

3.3.2 Changes in helping needs

Of the 215 patients with complete data set describing helping needs both at admission and at discharge, 128 patients (60 %) needed daily help prior to admission. Only 56 patients (26 %) were independent prior to admission. Only 8 out of these 56 patients remained independent at discharge, while 43 (77 %) needed daily help. The numbers are too small to do statistical analyses, but interestingly none of the patients with dementia remained independent at discharge, while 20 % of the cognitively intact patients did.

Table 10: Change in helping needs from admission to discharge.

	Cognitive state by discharge - Counts (%)			
	CI	MCI	Dementia	**Total**
Independent to:				
Independent	4 (20)	4 (17,5)		8 (14)
Weekly help	2 (10)	1 (4,5)	2 (15)	5 (9)
Daily help	14 (70)	18 (78)	11 (85)	43 (77)
Subtotal:	***20***	***23***	***13***	***56***
Weekly help to:				
Weekly help	3 (30)	2 (15)	1 (12)	6 (19)
Daily help	7 (70)	11 (85)	7 (88)	25 (81)
Subtotal	***10***	***13***	***8***	***31***
Daily help to Daily help	21	42	65	128
Total	**51**	**78**	**86**	**215***

**There is complete data for helping needs at admission and by discharge for 215 patients. We lack data for 5 persons at admission and for 5 persons by discharge, none for both.*

3.3.3 Changes in mobility level

Of the 180 patients with complete data on mobility level both at admission and by discharge, 54 (30 %) walked independently prior to hospitalization. The number of patients walking independently by discharge dropped to 19 (11 %). Statistical analyses on independent mobility level compared to cognitive function could not be performed due to the low number of observations in several cells.

More than half of the patients (55 %) needed walking aids prior to hospitalization. For these, there was a trend for dementia patients to have poorer mobility level by discharge compared to cognitively intact patients (Pearson Chi-Square, p=0.115).

Table 11: Change in mobility level from admission to discharge.

	Cognitive state by discharge - Counts (%)			
	CI	MCI	Dementia	**Total**
Independently to:				
Independently	4 (33)	3(21)	12 (43)	19 (35)
Walking aids	7 (58)	6 (43)	11 (39)	24 (44)
Dependent	1 (8)	5 (36)	5 (18)	11 (21)
Subtotal:	***12***	***14***	***28***	***54***
Walking aids to:				
Walking aids	19 (76)	26 (65)	17 (50)	62 (63)
Dependent	6 (24)	14 (35)	17 (50)	37 (37)
Subtotal	***25***	***40***	***34***	***99***
Dependent to:				
Walking aids	2 (33)	0	3 (23)	5 (19)
Dependent	4 (67)	8	10 (77)	22 (81)
Subtotal	***6***	***8***	***13***	***27***
Total	**43**	**62**	**75**	**180***

**There is missing data for mobility level at admission for 45 patients and for 18 patients at discharge. There is complete information on mobility level both on admission and at discharge for 180 patients, which is used in the data analysis.*

3.4 Mortality/One year survival

Of the 233 included patients, 17 died during their hospital stay. Of the remaining 216 patients only 121 (56 %) were still alive one year later.

Table 12: Survival rate relative to cognitive state.

	Cognitive state at discharge n=216* - Counts (%)			**Total**
	CI	MCI	Dementia	
Survival 1-year after fall:				
Yes	30 (59)	47 (58)	44 (52)	121 (56)
No	21 (41)	34 (42)	40 (48)	95 (44)
Total	**51**	**81**	**84**	**216**

***For the 17 patients who deceased during hospital stay, there is no info concerning cognitive state.

As seen in table 12, the proportion of patients categorized as CI and MCI who were still alive after one year was 59 % and 58 % respectively. For patients categorized with Dementia the proportion was slightly lower, where 52 % was alive one year after the fall. Statistical analysis did not show any statistical significant differences in survival for any of the groups (Pearson Chi-Square, p=0.689), nor were there significant correlations between cognitive state and one year survival (p=0.078).

Survival analysis (table 13) and plots (fig. 6) showed that the survival curves for the three group of cognitive state demonstrated slightly different pattern. Patients categorized in the MCI and Dementia-group had a steeper curve the first quarter of the year after the fall compared to the group with CI patients, indicating that more patients with cognitive impairment died earlier after the fall accident. After approximately 170 days after the fall accident there were no differences between the groups.

Of those who died within one year, 25 % in the CI-group died within the first 105 days, while for the MCI group and the Dementia group 25 % died within 25 and 40 days respectively.

Table 13: Days of survival according to cognitive state.

	Survival Percentile		
	75	50	25
Cognitive state			
CI	105	149	183
MCI	25	77	138
Dementia	40	77	184
Overall	40	93	183

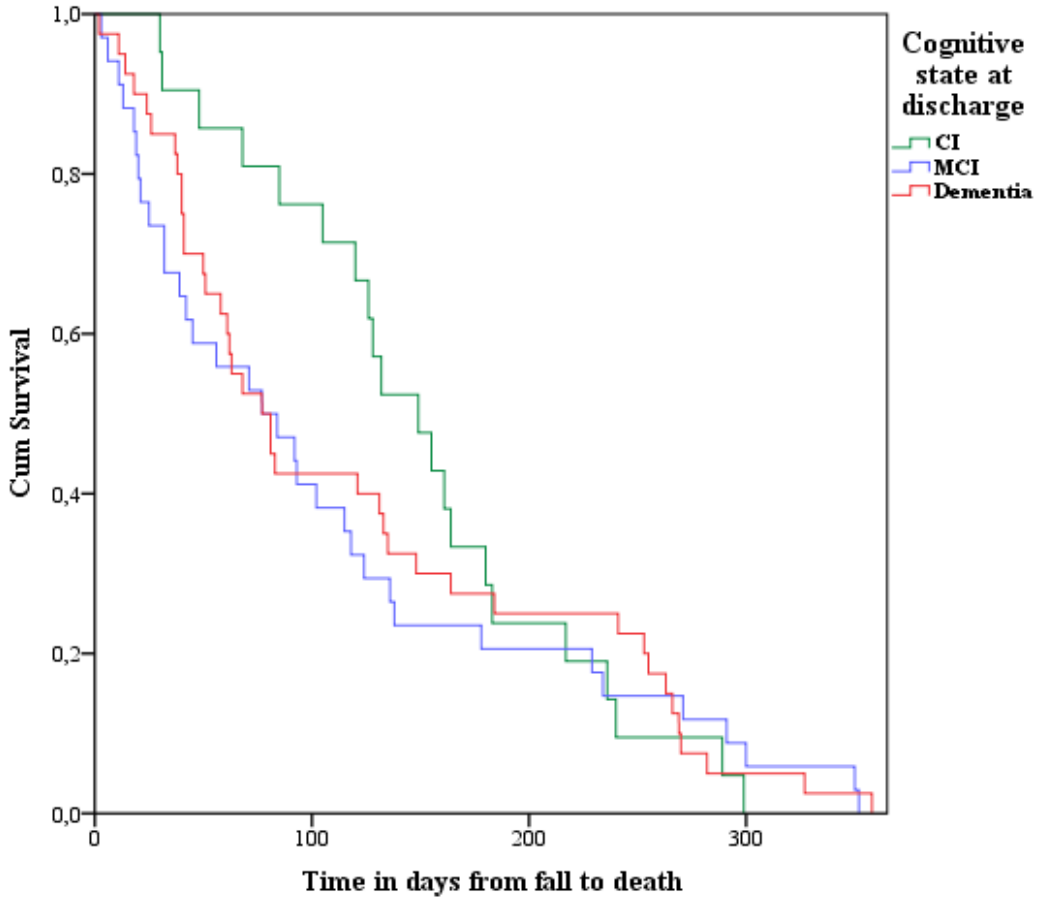

Figure 6: Survival in days from fall accident for those not surviving one year after the fall.

4 Discussion

4.1 Main findings

The main objective in this study was to map and describe how cognitive impairments among elderly with in-hospital fall accidents is related to severity of fall injury, changes in functional ability (functional decline), length of hospital stay and mortality. Our study sample consisted of 233 elderly patients all with a reported in-hospital fall, of which 73 % had a cognitive impairment on admission, ranging from mild cognitive impairment to more severe cognitive impairment such as dementia. This rate increased to 76 % at discharge. There were no significant differences between the groups of cognitively intact patients, patients with mild cognitive impairment and dement patients with respect to time of fall. Cognitive intact patients sustained both fewer injuries and fewer fractures after in-hospital falls compared to those with mild cognitive impairment and patients with dementia, but the results were not statistically significant. Significantly more demented patients admitted from their home were sent to a nursing home at discharge, compared to the other two groups. There was a non-significant trend for cognitively impaired patients to have a larger decline in mobility level and increase in helping needs than for those being cognitively intact. No statistical relation between cognitive impairment and one-year mortality was found, though more cognitively impaired patients died earlier after the in-hospital fall compared to cognitively intact patients. Each of these main findings is discussed below.

4.2 Time of fall

This study investigated whether cognitive state among elderly patients with reported in-hospital falls could be related to time of fall. It was hypothesized that patients with a cognitive impairment would experience fall accidents earlier in their hospital stay compared to cognitive intact fallers, but statistical analyses found no significant evidence for this. Overall more than half (54 %) of the fall accidents in the study occurred during the first four days of hospitalization and mean time from admission to first fall was 6.3 days. There are few international studies that have focused on and quantified the mean time from hospital admission to first fall accident. More often they tend to focus on number of falls during day, evening or nightshift (Fischer et al., 2005; Krauss et al., 2005). A general observation is that older adults experience falls during the first week and after the third week of institutional stay

(Tideiksaar, 2010). This corresponds partly to the findings in this study. The overall high fall-risk in the first days after admission might explain the fact that we did not find any differences between the groups with regards to cognitive state.

This study found a higher proportion of cognitively intact patients which fell during night time (23:00 – 06:59) than cognitively impaired patients, but these findings were not significant. In a study conducted by Schwendimann et al. (2008) similar findings, though with significant differences, were reported. In this study differences were found between hospital departments according to occurrence of falls. During night time, a significant higher proportion of falls occurred in medical and surgical departments compared to geriatric departments. If we assume that more cognitive impaired patients are admitted to geriatric departments than to medical and surgical departments, our findings would correspond to Schwendimann et al.'s results.

Several reasons could explain why cognitively impaired patients fell less during night time than cognitive intact patients. In my opinion one possible explanation is that they are better monitored during nighttime than cognitively intact patients. Cognitively impaired patients do generally show a lack of memory, language and judgment, and persons with dementia might also experience motor disturbances, which together lead to an overall high risk for fall accidents (Wyller, 2011). This knowledge among staff members on the hospital ward may therefore lead to a better awareness and monitoring of cognitive impaired patients compared to cognitive intact patients, especially during night time when there is an overall high risk of fall. For restless, cognitive impaired patients' a room location close to the nurses' station might also lead to better monitoring of the patient and reduce fall accidents. Another explanation is that the attitude of the staff members with respect to caring for older patients with cognitive impairment most likely differs from geriatric departments to general medical departments leading to a better awareness of fall risk among elderly in geriatric wards (Tideiksaar, 2010).

4.3 Injury

Physical injury occurred in 51 % of all reported fall accidents (n=289), with 26 falls (9 %) resulting in a fracture. We found no significant differences in number of injuries sustained by the different groups of cognitive state. This corresponds to Vassallo et al`s. (2005) findings which also did not find any significant differences when studying the prevalence of cognitive impairment between groups of in-hospital fallers sustaining injury or not (Vassallo, Vignaraja, Sharma, Briggs, & Allen, 2005). However an interesting finding in our study was that all the 8 hip-fractures were sustained by patients with cognitive impairment. We hypothesized that cognitively intact patients would have more severe fall injuries than cognitively intact fallers. Although the numbers in this study were too small to do statistical analyses, this might suggest that patients with a cognitive impairment sustain more severe injuries. This also corresponds to Tzeng (2010) who found a statistical significant association between severity level of fall injury and cognitive dysfunction (altered mental status, confusion or dementia) (Tzeng, 2010). These findings indicate that even though cognitively impaired patients do not sustain injury more often after an in-hospital fall, the injuries sustained are more severe and therefore better monitoring to avoid fall accidents is warranted.

4.4 Functional decline

In this study functional decline was measured in terms of the patients change in place of residence, need of assistance in ADL and mobility from hospital admission to discharge. We hypothesized that patients with cognitive impairment would experience greater functional decline after an in-hospital fall than cognitively intact patients. Only a significant relation was found between cognitive state and change in residential settings. For patients living in their own residence prior to hospitalization, significantly more patients with cognitive impairment (MCI and Dementia) experienced a decline in their residential status during hospitalization, compared to cognitive intact patients. Cognitive impairment patients had more than twice the risk of being discharged to a nursing home, district medical center, rehabilitation center or another hospital than cognitively intact patients.

An explanation of the high proportion of cognitively impaired patients having an higher risk for discharge to nursing home might be that a high proportion of the sample (84 %) lived in

their own residence prior to hospitalization, and among these the proportion of cognitively impaired patients was high. In my opinion there is likely that these cognitive impaired patients were frail and had reached their threshold on whether they could manage to live in their own residence. With an added acute illness, they would not be able to return to their earlier level of function.

Only 26 % of the patients in the sample were categorized as independent in ADL prior to hospitalization. By discharge this rate had fallen to 3 %. The results demonstrated that a higher proportion of patients with MCI and Dementia needed more help after hospitalization compared to CI patients, but the numbers were too small for statistical analysis. The last measurement on functional decline in this study – change in mobility level – also showed a tendency towards greater loss in mobility level for patients with cognitive impairment compared to cognitive intact patients, but also here the numbers were too small for statistical analyses.

Earlier studies have found that cognitive impairment is associated with a high risk of functional decline during hospitalization (McCusker, Kakuma, & Abrahamowicz, 2002) (Inouye et al., 1993). In our study only an association was found between cognitive impairment and change in residential settings, but not for change in mobility and helping needs. One likely explanation on this is the high proportion of patients both having reduced mobility skills and a high degree of helping needs in front of hospitalization which led to few changes during hospitalization and too low numbers to do formal analyses. This strengthen the assumption that the older hospitalized patients experiencing an in-hospital fall consisted of patients being frail prior to hospitalization, and irrespective of cognitive state the majority of the patients experienced a functional decline during hospitalization.

4.5 Mortality

The mortality rate in this study was substantial, where a total of 48 % of the included patients died within one year after their first reported fall-accident in hospital. No significant differences were found between cognitive intact and cognitive impaired patients in relation to one year mortality. There were however found slightly different patterns in when they died

during the one year period after the first reported in-hospital fall, where more patients with cognitive impairment died within the first 100 days compared to cognitive intact patients.

Even though this study did not find any statistical relation between cognitive state and one-year mortality, earlier studies with larger patients groups have showed significantly increased mortality both during hospital stay and after one year post discharge for cognitively impaired patients (Freedberg, Dave, Kurth, Gaziano, & Bludau, 2008). In our study, mortality during hospitalization was not analyzed, but the numbers reveal that only five out of the 17 patients which died during hospitalization, were categorized as cognitively intact by admission. This gives a higher proportion of cognitively impaired patients among the patients which died during hospitalization. The study by Freedberg et al (2008) did also find that mortality associated with cognitively impaired patients was more pronounced in the period following hospitalization than during hospitalization itself. This corresponds in some respect to our findings where more cognitive impaired patients died within the first 100 days after discharge compared to cognitive intact patients.

4.6 Fallers and falls in the current study

It is likely that the fallers studied in this thesis do not reflect the true number and general characteristics of elderly in-hospital fallers. Our sample consisted of elderly patients above 75 years of age while other studies mostly investigate elderly above 65 years of age. Based on this, I mean that it is highly probably that our sample consisted of patients more frail and with increased morbidity than samples with slightly younger patients. At admission the sample consisted of patients with an overall high dependency level and low mobility level, and the proportion of cognitively impaired patients were high. Despite this, the majority of the patients lived in their own residence prior to hospitalization. As discussed earlier, these characteristics draw a picture of a group consisting of frail elderly patients which probably have reached their limit for living in their own home.

Additionally the fall-rate found in the initial study (part one of the In-Hospital Fall project in the region of Mid-Norway (Uleberg et al., 2010) which the present study is built on, was found to be quite low (0.17 – 1.33 falls per 1000 bed days) compared to findings in international studies (4.8 – 7.9 falls per 1000 bed days) (Healey et al., 2008; Hill, Vu, &

Walsh, 2007). The findings from The In-Hospital Fall Project concluded with an underreporting of in-hospital fall accident for all included hospitals due to different routines and culture for documentation and reporting in-hospital fall-accidents (Uleberg et al., 2010).

I see it as highly likely that these factors contributed to the explanation of some of the unexpected findings in this study. Firstly there was a high rate of injury in this study. Physical injury occurred in 51 % of all reported fall accidents (n=289) which included all injuries ranging from minor bruises to more severe fractures and head injuries. Of the total fall accidents in the study, 26 (9 %) resulted in a fracture. International studies have found a lower injury-rate ranging from 30 to 35 % and it is estimated that 1-3 % of all in-hospital fall accidents lead to a fracture (Oliver et al., 2008; Schwendimann, Buhler, De Geest, & Milisen, 2008). It is likely that the higher injury-rate in our study might be explained by a culture where mainly falls resulting in an injury are reported as an adverse event, and there is less reporting of fall accidents where there are few or none consequences.

This fact could well explain the higher proportion of in-hospital fractures in this study, though it is more likely that the sample of frail elderly in this study lead to the higher proportion of fractures. Sterling et al. found in a study from 2001 that elderly admitted to a geriatric unit sustained more severe injuries compared to younger patients aged below 65 years of age. They also evaluated the relationship between the mechanism of fall and severity of injury and found that elderly had more severe injuries compared to younger even if the fall-mechanism were the same (Sterling, O'Connor, & Bonadies, 2001).

As for the high injury rate there were also found a high mortality-rate in this study. In contrast patients admitted to hospital after a stroke one year mortality was found to be 15.6 % (Bohannon & Lee, 2003), for elderly patients admitted on basis of a severe fall-related fracture the corresponding number was found to be 25.3 % (Coutinho, Bloch, & Coeli, 2012), and for elderly patients with a hip-fracture studies have found a one-year mortality ranging from 15 – 30 % (Finnes et al., 2013). In my opinion it is likely that the choice of age-range (patients older than 75 years of age) could contribute to the higher mortality rate found in our study compared to other studies.

4.7 Methodological considerations

As discussed earlier the sample used in this study probably do not reflect the general characteristics of the total population of elderly with in-hospital falls in the region due to an under-reporting of fall accidents. I believe it is highly probable that most of the falls which led to more severe consequences (injuries) for the patient was reported, while falls without any complications or consequences for the patient were not. This led to a high proportion of injurious falls in this study, which had an impact on the results both on mortality and functional decline. Based on this, the results cannot be generalized, but nevertheless I believe that the findings are important as they highlight the consequences of in-hospital falls among the oldest and most frail and vulnerable patient group admitted to hospital.

One can question the quality of information from medical records used in this study for both assessing outcome variables and the patients' cognitive state. To assess patient characteristics and their outcome variables this study was totally dependent on health care professionals taking part in the treatment of the patient to keep good medical records. There were as well no existing validated or reliable forms that could be used to collect the data, so the form used in the current study was custom developed. The questions in the form were developed on the basis of which information was relevant for this study and identifiable in the medical records. In my opinion there is rather doubtful that all relevant information concerning this study were recorded as there is individual differences in how health care workers complete medical records and what they focus especially on, both from an individually eyesight, but also based on their speciality and working field. For example a doctor working at a geriatric ward might be more aware fall and fall risk among elderly than a doctor working at the orthopaedic ward. Likewise I mean that there is a high probability that some doctors, based on their professional experience, are better in examining and revealing cognitive impairments in the elderly than others.

In this study the patients' cognitive state was based on information from their medical records, described by doctors, nurses or other health workers. Only conditions with a recorded diagnose was categorized in the Dementia group. One of the diagnostic criterion for Dementia is that the condition should have a duration of minimum 6 months (Wyller, 2011). The fact that the numbers of patients in this category increased during hospitalization, might reveal some inconsistency in the data assessment and/or the diagnostics in these patients.

In terms of the three different groups of cognitive state (cognitively intact patients, patients with mild cognitive impairment and patients with dementia), we found that the first and the last group were quite homogenous groups consisting of patients with similar cognitive state respectively. The middle group however, patients with mild cognitive impairment, appeared more heterogeneous as it consisted of patients with a wider range of severity in their cognitive impairment. This exemplified by groups of patients with only slightly indication in their patient records of having a mild cognitive impairment to patients with more severe cognitive impairment, but still without a diagnosed dementia. The influence of this latter group, would likely contribute to skewness in the performed statistical analysis due to the larger sample size compared to the other two groups.

Additionally, in this study patient sustaining delirium during hospitalization was categorized in the group of MCI, whereas most researchers and clinicians consider delirium and dementia as to separate clinical entities. Furthermore there were a low number of patients with delirium in this study, which might question the awareness off this condition among the staff treating the patient.

In this study we used the PROFANE's definition of a fall as an unexpected event in which the participants come to rest on the ground, floor, or lower level (Lamb et al., 2005). I mean it is highly questionable that all health care workers (doctors, nurses, occupational therapist and physiotherapist) have used this definition to detect fall accidents, and subsequently report the fall as an adverse event. As an occupational therapist employed by St.Olavs Hospital, I must admit that I was not familiar with this fall definition prior to this project. This might be due to little attention about this, not only for myself, but also from the hospital management.

4.8 Relevance to clinical practice

The findings from this study add new knowledge to the development of fall prevention strategies. It's important to address elderly cognitively impaired patients as a high-risk group for falls, and especially be aware of the considerable decline in function these patients might develop after a hospitalization with an in-hospital fall.

5 Conclusion

This study demonstrates that hospitalized elderly patients with reported in-hospital falls are a vulnerable and frail patient group. The results from this study confirmed earlier scientific findings in this field that elderly with cognitive impairment experiences more in-hospital falls and a have larger functional decline compared to cognitively intact patients. Overall these patients showed poor outcomes after hospitalization in terms of high mortality and functional decline regardless of their cognitive state.

Few studies have investigated the relationship between cognitive state and in-hospital falls and similar research should therefore be done with more accuracy in the categorizing of cognitive state, using valid and reliable diagnostic methods.

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7 Attachement

The Journal-study 2011 **ID nr:_____**

Gender
- ☐ Male
- ☐ Female

Date of birth: _____
Dato of fall-accident: _____
Time of fall: _____

Date of admission: _____
Department: _____
Reason for admission/Diagnosis:

_____
_____
_____

Admission type
- ☐ Elective admission
- ☐ Acute admission
- ☐ No info

Marital state
- ☐ Married/partner
- ☐ Single

Residential setting at admission
- ☐ Own residence
- ☐ Residential care home
- ☐ Nursing home
- ☐ Other:_____

General condition at admission
- ☐ Good condition
- ☐ Reduced condition
- ☐ No info

Physical condition prior to admission:

Helping needs last month:
- ☐ Independent
- ☐ Help once a week
- ☐ Help several times a week
- ☐ Help once a day
- ☐ Help several times a day
- ☐ Unknown/no info in the patient record

Mobility level last month:
- ☐ Independent
- ☐ Use cane or crutches
- ☐ Walker/high chair
- ☐ Personal support
- ☐ Wheelchair
- ☐ Unknown, other:_____

Mobility level at day of fall-accident:
- ☐ Independent
- ☐ Use cane or crutches
- ☐ Walker/high chair
- ☐ Personal support
- ☐ Wheelchair
- ☐ Unknown, other:_____

Cognitive state
Reported cognitive state at admission:
- ☐ CI
- ☐ MCI
- ☐ Dementia
- ☐ Unknown/no info

Delirium during admission?
- ☐ Yes
- ☐ No

Earlier fall-accident(s)
Reported fall-accident(s) at home last year?
- ☐ Yes
- ☐ No

Reported in-hospital fall-accident(s) last year?
- ☐ Yes
- ☐ No

Documented fall-related injuries last year: _____

Investigations/treatment/surgery after in-hospital fall:
- ☐ Medical consultation
- ☐ X-ray
- ☐ Skin suture
- ☐ Fracture – conservative treatment
- ☐ Fracture – surgical treatment

Date of discharge: _____

Discharged to:
- ☐ Own residence
- ☐ Nursing home
- ☐ Rehabilitation
- ☐ Other:_____
- ☐ Deceased during hospitalization

Physical condition at discharge:
Helping needs?
- ☐ Independent
- ☐ Help once a week
- ☐ Help several times a week
- ☐ Help once a day
- ☐ Help several times a day
- ☐ Unknown/no info in the patient record

Mobility level last month:
- ☐ Independent
- ☐ Use cane or crutches
- ☐ Walker/high chair
- ☐ Personal support
- ☐ Wheelchair
- ☐ Unknown, other:_____

Cognitive state
Reported cognitive stat at discharge:
- ☐ CI
- ☐ MCI
- ☐ Dementia
- ☐ Unknown/no info

One year survival from first reported in-hospital fall incident:
- ☐ Yes
- ☐ No **Date of death:**_____

**This is a translated version of the original form. The original form contain some more variables which was not used in this thesis*