EVALUATION OF OUTCOMES OF ELDERLY PATIENTS AT 3 AND 15 MONTHS POST HIP FRACTURE

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SUMMARY

The aim of this study was to observe the functional abilities of hip fracture patients at two time points post hip fracture.

Falls and fractures are a major concern for the elderly population as they can result in decreased functional abilities and more dependence to complete activities of daily living within the community.

The use of valid, reliable and sensitive outcome measures is essential to observe functional abilities over time and assess the risk of falls in the future. Eighty-one patients consented to participate in this study with thirty three participating in the early assessment group; these patients were assessed at three and 15 months. For the 81 subjects, the average age was 81 years with a standard deviation of 8.00 years (60 - 96 years). The average age of the 33 subjects was 81 years (sd 8.00, range 65 – 94). A range of measures assessing movement, strength, balance, endurance and extended activities of daily living were applied.

The types of fracture, surgery, length of stay to surgery, types of anaesthesia used, surgical approach used, pain reported, discharge plan from the acute hospital, length of stay were reviewed in both the acute hospital and rehabilitation facility.

At three months the mean Berg balance score was 39.16 (sd12.98, range 18 - 56) and 15 months 38.44 (sd 14.04; range 11 -55) but no significant differences were found (p>0.05).
The mean Timed Up and Go score was 29.90 (sd 18.99; range 0 – 69.18) at three months and 27.27 (sd 18.76; range 0 – 66.38) at fifteen months but no significant differences were found (p>0.05).

The mean six minute walk test scores for the early assessment group were 165.84m (sd 85.34; range 0 – 359.20) at three months and at 15-months 193.72m (sd 110.98; range 0 – 384.69), the change was not significant (p>0.05).

At three months the right hand dynamometry mean score was 25.56 (sd 13.57; range 0 - 65) lbs and left hand mean score was 25.48 (sd 10.88; range 6.00 – 46.00) lbs. At fifteen months the right hand dynamometry score was 23.80 (sd 12.67 range 8.67 – 59.33) lbs and left hand dynamometry score was 25.48 (sd 8.47; range 11 – 37.67) lbs. No significant differences were found in grip strength (p>0.05).

The mean pre-fracture Nottingham Extended activities of daily living (NEADL) score was 47.61 (sd 13.14; range 18 - 63) while at three months the mean score was 32.55 (sd 17.26; range 3 – 63) and at fifteen months was 39.45 (sd 18.45; range 1 - 63). Significant differences were found between pre fracture and 3 months (p<0.05) and pre fracture and 15 months (p<0.05).

In conclusion, no significant functional improvements were observed after 3 months despite significant in-patient input (compared with other countries) and further physiotherapy/ rehabilitation input post discharge. Therefore, the findings from this study highlight the need to re-evaluate the current model of care for elderly post hip fracture patients.
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<td>Assistance</td>
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<td>BBS</td>
<td>Berg Balance Scale</td>
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<td>BMD</td>
<td>Bone Mineral Density</td>
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<td>Cm</td>
<td>Centimetres</td>
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<tr>
<td>CN</td>
<td>Clinical Nutritionist</td>
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<tr>
<td>CNS</td>
<td>Clinical Nurse Specialist</td>
</tr>
<tr>
<td>CRU</td>
<td>Community Re-ablement Unit</td>
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<tr>
<td>DCS</td>
<td>Dynamic Cortical Screw</td>
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<tr>
<td>DHIS</td>
<td>Dynamic Hip Screw</td>
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<tr>
<td>DNA</td>
<td>Did Not Attend</td>
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<tr>
<td>FWB</td>
<td>Full Weight Bearing</td>
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<tr>
<td>GA</td>
<td>General Anaesthesia</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<td>Ind</td>
<td>Independent</td>
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<tr>
<td>ICC</td>
<td>Intraclass correlation</td>
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<td>lbs</td>
<td>Pounds</td>
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<tr>
<td>LHD</td>
<td>Left hand dynamometry</td>
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<td>LTC</td>
<td>Long term care</td>
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<td>MAT</td>
<td>Mobilise as tolerated</td>
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<td>Max</td>
<td>Maximum</td>
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<tr>
<td>Min</td>
<td>Minimum</td>
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<tr>
<td>MRC</td>
<td>Medical Research Council</td>
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<td>MSW</td>
<td>Medical Social Worker</td>
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<td>NEADL</td>
<td>Nottingham Extended Activities Daily Living</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>NWB</td>
<td>Non-weight bearing</td>
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<tr>
<td>OT</td>
<td>Occupational Therapist</td>
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<tr>
<td>Post-op</td>
<td>Post operation</td>
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<tr>
<td>PHN</td>
<td>Public Health Nurse</td>
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<tr>
<td>Physio</td>
<td>Physiotherapist</td>
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<tr>
<td>PWB</td>
<td>Partial weight bearing</td>
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<tr>
<td>RCT</td>
<td>Randomised Controlled Trial</td>
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<td>Rehab</td>
<td>Rehabilitation</td>
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<td>Resp</td>
<td>Respiratory system</td>
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<td>Right hand dynamometry</td>
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<tr>
<td>RIP</td>
<td>Rest in Peace (Died/Dead)</td>
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<td>ROM</td>
<td>Range of movement</td>
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<tr>
<td>RZF</td>
<td>Rollator zimmer frame</td>
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<tr>
<td>sd</td>
<td>Standard Deviation</td>
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<tr>
<td>SLT</td>
<td>Speech and Language Therapist</td>
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<tr>
<td>SOOB</td>
<td>Sit out of bed</td>
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<td>s/v</td>
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<td>THR</td>
<td>Total Hip Replacement</td>
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<tr>
<td>TTWB</td>
<td>Toe Touch Weight Bearing</td>
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<td>TUAG</td>
<td>Timed Up and Go</td>
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<tr>
<td>Tx</td>
<td>Treatment</td>
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<tr>
<td>WBAT</td>
<td>Weight Bear as tolerated</td>
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<tr>
<td>w/c</td>
<td>Wheelchair</td>
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<tr>
<td>w/s</td>
<td>Walking stick</td>
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INTRODUCTION

Falls are one of the most common and serious problems facing the elderly (van Helden, 2007). It is expected that the percentage of people over 65 years of age in Ireland will increase from 11% (468,000) to 18% (over 1 million) over the next 25 years. This will have important medical, social and personal implications for the prevention, treatment and management of falls and fractures. One fifth of those who fall will sustain a serious injury with the most serious injury being a hip fracture. In Ireland, approximately 2,800 patients are admitted to acute hospitals with a hip fracture each year. Of those who survive the hip fracture, less than 50% return directly home and over 20% require long-term care (HSE, 2008).

Most elderly people are unaware of their risk of falling, and neither recognises risk factors nor reports these issues to their physicians. Hence, preventative measures are overlooked with risks becoming evident only after the injury or disability has occurred (Panel on Fall Prevention, British Geriatric Society and American Geriatric Society, 2001). Falls often result in serious injuries such as hip fracture (Peeters, 2007). Hip fractures are the leading cause of morbidity and mortality in the elderly (Dodds, 2009). Recovery after hip fracture is universally accepted as being poor with few regaining their pre-injury level of mobility or function (Cameron, 2005).

A recent national audit of falls and bone health in the United Kingdom (UK) reported that two-thirds of non-hip fracture patients who attended hospital emergency departments were not admitted to hospital and therefore were less likely to receive a physiotherapy assessment and secondary prevention of future falls. This was due to the lack of local pathways or protocols for falls assessment and management. However, 74% of hospital trusts reported that they had an integrated falls service but only 51% reported routinely screening older people attending emergency departments. The audit found that physiotherapists were well placed to be able to identify those at risk of future falls and to instigate an assessment process throughout the patient’s journey in a range of different healthcare settings (Goodwin, 2010).
Without appropriate services such as physiotherapy, individuals may ultimately experience less successful outcomes, which may, in the long-term require more expensive institutional and medical services that would not otherwise have been required, if services were accessed earlier along the continuum of care (Landry, 2009).

Most studies on hip fracture patients have been limited to the assessment of mortality or the use of questionnaires to gain an understanding of the older person’s functional abilities following their fracture in the short-term. The aim of the study was to describe the functional outcomes of a group of elderly hip fracture patients over a 15-month time period using objective functional assessments.
1. LITERATURE REVIEW

1.0 Introduction

Falls rank high among one of the most serious clinical problems faced by older adults and are a major contributor to immobility and nursing home placement. About 40% of ≥ 65 year olds living at home, will fall at least once each year, and one in 40 will require hospitalisation (Rubenstein, 2006). In Ireland, one third of fall-related hospitalisations and three quarters of fall-related deaths are in people aged 65 years and older (Carey, 2005). The pathogenesis of falls is multi-factorial including impairments of gait, muscle strength, visual acuity, cognition, chronic disease and use of psychotropic medications (Peeters, 2007). The number of people in Western Europe over the age of 50 years will have increased by 45% from 1990 to 2025 (Kirke, 2002; Gullberg, 1997). Coincident with this increase in the older population will be the increased risk of falls and related complications such as hip fractures (Gullberg, 1997).

Hip fractures are more common in people over 75 years due to slower reflexes and the loss of ability to break the fall using the upper limb (Rubenstien, 2006). Their needs are uniquely challenging as they are associated with poor clinical outcomes, functional and walking disabilities that put them at increased risk of further falls (Cogan, 2010; Bentler, 2009; Kirke, 2002; Hall, 2001). Following the fall and /or fracture there may be a decrease in activities of daily living which leads to further deconditioning and weakness increasing the risk of further falls (Rubenstein, 2006). Tinetti (1997) suggested that the assessment of activities of daily living and intervention might be a beneficial complement to usual post-fracture rehabilitation.

Despite improvements in hip fracture management, including advances in operative techniques and implant technology, the outcome of rehabilitation often falls short of expectations with the patients unable to regain pre-fracture level of independence and function (Koval, 1994). This review will present the causes of falls and fractures in the elderly population and how they affect their functional abilities and activities of daily living. The different methods used for measuring functional outcomes and activities of daily living will be discussed.
1.1 Epidemiology of Falls

The recent Health Service Executive (HSE) National Strategy on Falls and Fractures in Ireland (2008) reported that the incidence of an older person being treated for an injury is 10%, with approximately 75% of these resulting from falls and 2-3% requiring hospital admission. A fall has been defined as ‘an event which results in the person coming to rest on the ground or lower level’ (Todd and Skelton, 2004). Annually, it has been reported that about 30% of persons over the age of 65 years will fall at least once and 15% will fall at least twice (Peeters, 2007). ‘Trips’ and ‘stumbles’ should also be recognised as another event which older people may use to describe as an event that they perceive as less important than a fall, that can result in an injury. These terms have been defined as:

- A trip is ‘an unintentional movement that maintained standing height where the person had to grasp or touch something or someone to prevent falling’.
- A stumble is ‘an unintentional movement from standing height where the person kept their upright position without catching hold of something or someone’ (Hall et al, 2001).

Recurrent falls (more than one fall) are usually associated with increased age, being female, caucasian, reporting fair or poor health, and increased limitations in activities of daily living (Shumway-Cook, 2009; Miller, 2009). Skelton (2005) reported that people who have two or more falls have poorer outcomes, with approximately 27% of those having three or more falls requiring admission to hospital, nursing home or having died within one year. Indicators of falls post hip fracture are related to an individual’s pre-fracture level of mobility (with an increased risk if using a mobility aid), history of falls, poorer balance, slower gait speed, and greater decline in activities of daily living (Shumway-Cook, 2005). A number of risk factors for falls and hip fracture have been reported and can be categorised as intrinsic and extrinsic risk factors.

1.1.0 Intrinsic Risk Factors for Fall

The intrinsic risk factors that have been identified relate to impaired gait pattern in 20-40% of older people (≥ 65 years), decreased postural control, body-orienting reflexes, decrease in normal sensory input (vision, proprioception, and vestibular
system), decrease muscle strength and tone, decrease in free mobility of the joints and decreases in stepping height which impairs the person’s gait pattern ability and ability to avoid a fall from an unexpected slip or trip (Rubenstein, 2006). Falls are not limited to those particular intrinsic factors but also to other specific dysfunctions of the nervous, muscular, circulatory and respiratory systems and from simple deconditioning following a period of inactivity.

Falls due to dizziness can be a non-specific symptom and may reflect problems as diverse as cardiovascular disorders, hyperventilation, orthostasis, drug side effects, anxiety or depression. Orthostatic hypotension is defined as a drop of over 20mmHg of systolic blood pressure between lying and standing and has 10 – 30% greater prevalence among normal elderly people living at home. It can stem from several factors such as autonomic dysfunction, hypovolaemia, low cardiac output, Parkinsonism, metabolic and endocrine dysfunction and medications. Orthostatic drop may be more pronounced in the morning, because the baroreceptor response is diminished after prolonged recumbancy (Rubenstein, 2006).

‘Drop attacks’, defined as a sudden fall without loss of consciousness or dizziness, have in the past been implicated in 1 to 10% of falls. Whereas syncope or sudden loss of consciousness, usually results from decreased cerebral blood flow or metabolic factors causing 2 to 10% of falls (Rubenstein, 2006). Diabetes can cause hypoglycaemic syncope, lower limb neuropathy resulting in impaired mobility, peripheral artery disease, orthostatic hypotension, as well as other symptoms resulting from the side effects of diabetic medications (Krauss, 2005; Corsinovi, 2009). Schwartz (2002) found that women with diabetes who were not taking their insulin had increased their risk of falling more than once by 85% compared to non-diabetic women even though the side effects of insulin can cause fainting and dizziness.

Patel (2008) reported that the prevalence of Type 2 Diabetes is 6.5% in the over 75 year olds and though bone mineral density (BMD) was elevated, they were unable to determine if poor bone quality or other factors related to diabetes increased risk of fracture in this group. The study did report that peripheral neuropathy impairs ankle strength and balance recovery and is common in 30-50% of people with Type 2 Diabetes Meillitis (DM), 11% of those with impaired glucose intolerance and 7% of
those who are normoglycemic. Another noted intrinsic factor that can contribute to the risk of falls is genito-urinary disease resulting in urgent or frequent toileting needs (Evans, 2001; Corsinovi, 2009).

1.1.1 Extrinsic Risk Factors for Falls

The extrinsic factors that have been associated with falls have included walking on uneven surfaces; performing activities at an elevated height (such as changing light bulbs or hanging curtains); poor footwear; poor lighting; inadequate handrails on the stairs and elsewhere; slippery floors and loose objects on the floor including loose mats (Kanis, 2008). Suggested countermeasures include installation of carpets with slide protection; installation of extra handrails above the bathtub; removal of high carpet edges, loose electric cables, removal or avoidance of slippery surfaces; and having sufficient lighting (Krüger, 2010).

Medications such as sedatives/hypnotics; anti-arrhythmic agents, diabetes medications and narcotic analgesics are other extrinsic factors that may increase the risk of falls within 24 hours of administration (Krauss, 2005) as they can alter alertness and balance (Kanis, 2008). Benzodiazepines and anti-depressants have been associated with a 51 to 54% increase risk of falling in women compared to non-users. Those who reported falls increased their risk by 1.2 to 1.6 times due to the side effects of these medications resulting in sedation, dizziness and/ or postural hypotension. These effects are noted especially within the first few hours after intake; in the morning; or when used in combination with other medications or alcohol use (Mets, 2010; Allain, 2005; Ensrud, 2002). Anticonvulsants were found to increase the risk of one fall by 75% and for those with a previous fall history they were 3.4 times more likely to fall at least once. There was no evidence to show that narcotic use was associated with falls (Ensrud, 2002).

Panula (2009) study found that anticholinergics (drugs for Chronic Obstructive Pulmonary Disease (COPD), urinary incontinence, typical antipsychotics, tricyclic antidepressants and other anticholinergics) are commonly used in men (20%) and women (22%). The half-life of these medicines and their tendency to accumulate in the system makes patients sensitive to drug interactions and adverse effects. Increased permeability of the blood brain barrier means psychotropic and anticholinergics can have increased effect on the central nervous system. Cognitive
disorders were reported as 3 to 6 times higher in hip fracture patients than in other elderly hospitalised patients and can affect activities of daily living. The use of sedatives, antipsychotics and potent anticholinergics has been reported as 46% in men and 56% in women with hip fractures. Woolcott’s (2009) meta-analysis on the impact of nine medication classes on falls in the elderly found that sedatives, hypnotics, antidepressants and benzodiazepines demonstrated a significant association with falls. Whereas there was no association found for antihypertensives, diuretics, beta blockers, neuroleptics / antipsychotics, narcotic analgesics or non-steroidal anti-inflammatory drugs (NSAIDs).

Panel on Falls Prevention, American Geriatric Society (AGS) and British Geriatric Society (BGS) guidelines (2001 & 2011), report a combination of factors that result in falls such as decreased mobility, poor vision, cognitive impairment, history of falls, use of walking aids, decreased muscle strength and joint range of movement, impaired ADLs, depression, >80 years of age. Fear of falling, osteoporosis risk, urinary incontinence, low grip strength, Parkinson’s disease, Diabetes Mellitus, high blood pressure, orthostatic hypotension, vestibular and proprioceptive issues, sedatives, decreased coordination and endurance, function and integration issues, or living in a nursing home as being a risk factor for falls/fractures (Close, 1999; Nitz, 2004; Peeters, 2007; van Helden 2007). Additionally polypharmacy is cited as a factor, though the definitions vary — with some defining polypharmacy (>6 medications) while in other studies >3 medications indicates polypharmacy (Van Nieuwenhuizen, 2010; Kanis, 2008).

1.2 Epidemiology of Hip Fractures

The world-wide incidence of hip fractures is increasing more rapidly than would be expected as a result of projected increases in the elderly population and is expected to rise to 2.6 million by 2025 and 4.5 million by 2050 (Gullberg, 1997; Beringer, 2006). In 2000 there were an estimated 620,000 new hip fractures in men and women aged 50 years or over in Europe (Johnell, 1995). Hip fractures occur in 86% of patients over 65 years of age (Braithwaite et al, 2003). Van Helden (2006) showed that the incidence of a fall within three months after a clinical fracture was 18.5% in women and 6.5% in men and of these 11.9% resulted in a new fracture. In measuring the incidence at two years 45.7% of hip fracture patients have reported further falls
(Kirke, 2002). Pearse (2003) showed that 12% of patients with hip fracture had a second hip fracture with a significant further impact on patient's mobility and social independence.

The risk factors for hip fractures in the elderly include postural instability, quadriceps weakness, history of falls and fractures, decreased bone mineral density (BMD), increased age, female gender, caucasian, hormonal and dietary factors (decreased calcium intake), poor health status, inactivity, impaired walking, poor vision, psychoactive drug use, high caffeine intake, gonadal insufficiency, thyroidectomy, gastric resection, pernicious anaemia, chronic bronchitis, Parkinson’s disease, nullparity, COPD, Type 2 Diabetes Mellitus, maternal hip fracture, tall women, and smoking (Sherrington, 2003; Poor,1995; Cauley, 2009; Wilson, 2006; Taylor, 2004; Nguyen, 2005; Cummings, 1995).

Mortality rates one year after hip fracture has been recorded between 14 to 36% with increased mortality within the first four to six months post-fracture (Koval, 1994). Where epidemiology studies have shown increased mortality rates between six to 12 months after injury. Mortality rates was associated with advanced age, poorly controlled systemic disease, psychiatric illness, institutionalisation, operative management before stabilisation of coexisting medical conditions, post-operative complications, and male gender. However, some studies have shown no differences between genders (Jamal, 2010; White, 1987; Koval, 1994).

The one year mortality rate among elderly people after a hip fracture is 20% with a significant proportion admitted to nursing homes and approximately half having permanent limited physical functioning (Wilson et al, 2006). While the Epidos study showed a mortality rate in hip fracture patients at one year as high as 14% to 36%, with almost 40% occurring within the first 6 months, and the rates being four times higher for women. The study concluded that this was attributable to the fact that they may have had more clinical and functional problems that put them at risk of hip fractures in the first instance (Empana et al, 2004). A two-year study on hip fractures in Ireland reported a mortality rate of 16% at year one and 23.6% at year two for women (Kirke, 2002). The mortality rate at six months ranged between 17.5% and 22% (Orosz, 2004; Tinetti, 1997) and at one year the rates ranged from 17.4%, 20%, 33.1%, respectively (Lin, 2004; Craik, 1994; Rosell, 2003). A two-year Swedish
study by Rogmark (2002) reported a one-year mortality rate of 13% and 21% at two years with males having the higher mortality rate.

A few hip fractures will occur without a fall (Cameron, 2010). This can be a consequence of osteoporosis in older persons. Each standard deviation decrement in bone mineral density (BMD) is associated with a two to three fold increase in fracture risk (Albourgh, 2005). Osteoporosis is defined as a ‘systematic skeletal disease characterised by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture’ (Kruger, 2010). Osteoporosis is poorly understood and under-diagnosed as a result of lack of epidemiological data and insufficient methods for investigation which along with the silent development of the disease has led to its under-recognition in clinical practice (Siris, 2001). The different stages: stage one (osteopenia) induces a pathologic decrease in BMD with or without symptoms; second stage induces an alteration of bone mass and bone fragility (which has to do with the spatial distribution and intrinsic materials that constitute the bone); third stage (severe osteoporosis) with the occurrence of one or more fractures (Cooper, 2010). The National Strategy on Falls and Fractures in Ireland (2008) reports that there are approximately 300,000 people with osteoporosis in Ireland with 1 in 3 women and 1 in 5 men over 50 years of age affected by this condition.

Tools and models used to estimate the risk of fragility fractures have been developed such as the Markov Model and fracture risk assessment tool (FRAX™). The Markov model has been used to estimate the risk of fragility fracture predicting that 35% of 50 year old women will sustain a vertebral deformity, 18% a hip fracture, and 17% a wrist fracture in their remaining lifetime (Chrischilles, 1991). The fracture risk assessment tool (FRAX™) was developed with WHO (World Health Organisation) as an assessment algorithm that aims to predict the risk of hip and other osteoporotic fractures and includes additional independent clinical risk fractures such as: age, gender, body mass index, prevalent fractures, and family history (Kanis, 2008). There are two types of hip fracture: intracapsular (femoral neck fracture/ subcapital fracture) and intertrochanteric fractures. The strongest predictors of intertrochanteric fractures were decreased BMD and poor health status. Therefore, those who presented with this type of fracture tended to be older thinner women, gained less weight since the age of 25, were more likely to report a previous fracture, had a
maternal history of hip fracture, were less likely to consume alcohol, were never pregnant, had surgical menopause, lower grip and quadriceps strength, slower walking speeds, compromised vision as measured by contrast sensitivity and near depth perception, and lower BMD than women without hip fracture (Cauley, 2009). Rosell (2003) found that women with intertrochanteric fractures had poorer functional recovery and were twice as likely to die as those with femoral neck fractures.

Cauley et al (2009) evaluated 462 female subjects (65 years and older) from four different areas across America. There was a twofold increased risk of stable intertrochanteric fracture and 2.4 times increased risk of unstable intertrochanteric fractures with each five year increase in age. Functional outcomes were best for those who experienced an undisplaced femoral neck fracture and worst for those with unstable intertrochanteric fractures. Older age, slower walking speed, and lower BMD were independently associated with increased risk of unstable intertrochanteric hip fractures. Subjects’ pre-injury function was an independent predictor of functional outcome or mortality, rather than fracture type.

Protective factors for hip fractures were reported in the Mediterranean Osteoporosis Study (Medos) study which looked at the risk in European women across six countries. It found that exposure to sunlight, a high degree of recreational physical activity, long duration of fertile life, consumption of tea, and moderate consumption of alcohol in men (by stimulating the release of calcitonin) decreased the risk of hip fracture (Johnell et al, 1995). Poor (1995) showed that obesity and hip fractures have an inverse relationship by one of three possible mechanisms; increasing the load on the skeletal system; altering sex steroid metabolism (protecting against age related bone loss) and by acting as a shock absorber to dampen energy delivered to the proximal femur in the event of a fall.

1.3 Patient Outcomes after Hip Fracture

Recovery after a hip fracture is universally accepted as being poor with the majority of people not regaining their pre-injury level of mobility or function (Cameron, 2005). Despite improvements in patient care, operative techniques and implant
technology the outcomes post hip fracture fall short of expectations, which is to return to the pre-morbid level of function (Koval, 1994). There are a number of studies that have examined functional outcome in hip fracture patients. These have addressed access to community services, how many availed of social supports, and levels of mortality. Within these studies the methodologies employed have varied from self-assessment to observational study design. Balance, motor coordination and endurance were each predictive of return to functional status but are often not considered in the routine assessment of patient’s following a hip fracture (Craik, 1994).

Eighty-three percent of patients with hip fractures reached independent ambulation at some stage between hip surgery and one year later. Success depends on careful follow-up during rehabilitation rather than on the initial nature of the surgical repair (Barnes, 1987). Long-term follow-up studies on hip fracture have been difficult due to high mortality rates and the high attrition rates in the different studies. Functional ability of hip fracture subjects has been shown to be poor prior to hip fracture and continues to deteriorate more rapidly due to the natural ageing process and related comorbidities (Heikkinen, 2005).

Better functional recovery has been predicted by good pre-fracture baseline, pre-morbid mental state, being female, pre-fracture mobility and function, and lack of comorbid disease (Marottoli, 1992; SIGN, 2002).

A previous study by Magaziner (1990) who had observed 536 hip fracture elderly patients and found that 86.5% could walk independently; 70.4% could carry out ADLs and 33.9% could complete IADLs independently pre-fracture only 53.9%, 39.8% and 14% could carry out these activities independently at one year post hip fracture.

Marottoli (1992) reported that at baseline (pre-fracture) 86% of patients could dress independently versus 49% at 6 months; 90% could transfer independently versus 32% at 6 months; 75% could walk across a room independently versus 15% at 6 months; 63% could climb a flight of stairs versus 8% at six months; and 41% could walk a half mile versus 6% at six months. Magaziner (1990) noted that most hip fracture patients do not regain their former levels of mobility and activity. Pre-fracture walking ability on level ground was 93.2%; transfer independently 91.3%,
climb stairs 74.8% while at one year only 70.9%, 63.6% and 49% could do the same activities. Ability to walk outdoors independently before fracture was 73.8% pre-fracture and 58.2% post fracture and 27.3% couldn’t walk outdoors (Lin et al, 2004).

Barnes (1987) reported that at one year post hip fracture, 81% of trochanteric fractures and 69% of femoral cervical fractures were independent ambulators. At the time of discharge, 80% of patients went home and 20% were discharged to long-term care facilities (non-ambulators). Those who became independent mobilisers had 39 visits to physical therapy and those who didn’t averaged 63 visits. The length of stay in hospital for independent ambulators averaged 58.5 days and dependent ambulators averaged 77.5 days. Pre-fracture evidence of a lower extremity contracture and/ or poor hip abductor strength as well as the presence of lower limb contractures resulted in poor ambulatory recovery of independence due to its role of maintaining pelvic stability during the stance phase of gait (Barnes, 1987). Tolo (1999) who followed 100 patients found that at 8 months, most subjects were close to their pre-fracture functional abilities with only 71% reporting outdoor mobility slightly lower than the 80% of patients who could do so pre-fracture and 50% could do ADLs independently.

The Rosell (2003) study reviewed functional outcomes of patients aged 50 years and older, admitted with hip fractures, at one year post fracture. It found that 66.9% of subjects were alive at one year following the injury with mortality rates greater for those from nursing homes. Of those admitted from their own home, 68.7% had returned to their homes at one year. The mean loss of function (the ability to perform basic and advanced ADLs) was 21.2%. The pain scores at one year were described for 186 survivors, grade 1: 32.2% had no pain; grade 2: occasional and slight pain (27.3%); grade 3: pain in walking and occasional analgesia (26.3%); grade 4: pain on activity, frequent mild analgesia (7.6%); grade 5: constant but bearable pain, stronger analgesia (1.6%); grade 6: constant pain, frequent strong analgesia (0%); unable to assess (4.9%). Other factors considered were outdoor mobility, 50% of patients were housebound prior to fracture and this increased to 64% post fracture for the survivors. Mobility was also reduced, with 38% requiring a frame. Kirke (2002) found that hip fractures was associated with a changes in residence with 27% of those who had lived on their own or a relative’s home pre-fracture residing in a nursing home at two years’ post-fracture.
1.4 The Impact of Cognitive impairment on Falls and Hip fractures

Patients with cognitive impairment have a three-fold increased risk of falling and a three to four fold increased risk of severe falls-related injury, such as hip fractures, and a three-fold risk of fall-related mortality (Hauer, 2010). Cognitive impairment and dementia are also major considerations, both in terms of risk of hip fracture and recovery from hip fracture (Cameron, 2010). Moderate to severe cognitive impairment is associated with poorer functional gains and reduced capacity to learn or benefit from physiotherapy and increased the likelihood of being discharged to a nursing home (Horgan, 2003). Al-Ani (2010) found that pre-fracture motor function rather than cognition was an important predictive factor for motor gain after hip fracture in patients reviewed at 4 and 12 months post fracture. However, it should be noted that all functional information (i.e. walking) was gathered from proxies and no valid and reliable functional outcome measures were used. Another limitation identified in the study was that it didn’t consider the cognitive status of the proxy to give reliable feedback. Whereas, patients with mild to moderate cognitive impairment, due to dementia, may benefit from greater extent from a rehabilitation program post hip fracture than those who don’t or have severe cognitive impairment (Cameron, 2005).

Delirium is a disturbance of consciousness and cognition, with rapid onset, fluctuating course and underlying causation (Siddiqi, 2007). Hip fracture patients should be routinely assessed using cognitive assessments as the overall prevalence of post-operative delirium is 43 to 61% (Holmes, 2000). A Cochrane review suggested that geriatric consultation and prophylactic low dose Haloperidol may reduce the incidence, severity and duration of stay in hip surgery patients with delirium (Siddiqi, 2007). Givens et al (2008) evaluated the impact of delirium on functional recovery after hip fracture, cognitive impairment, and delirium had their strongest effect on 1 month outcomes.

1.5 Healthcare Utilisation and the Economic Impact of Falls and Fractures

With societal changes and loss of traditional carers it is important to find the most optimal forms of high quality affordable care for hip fracture patients (Cameron,
Hall (2000) reported that hip fracture subjects require more help with everyday tasks, socialise less, and walk more slowly and with diminished balance and confidence when compared with their non-fracture peer group, which was reflected in their functional measurements. These lifestyle modifications lead to increased frailty and fracture risk and increased dependence on general practitioner (GP) services. Roe (2009) who reported increased reliance on formal services after a fall highlighted the consequences of a fall affecting activities of daily living and independence.

In the U.S. the estimated lifetime cost for a hip fracture is $81,300 including initial hospitalisations, subsequent hospitalisations, rehabilitation facilities, nursing facilities and home care (including the costs associated with family friends assisting in care) (Braithwaite, 2003). According to the HSE National Strategy on Falls and Fractures (2008) about 2 to 3% of older persons who are injured require about 12.7 days in hospital. About 80% of patients who are admitted with hip fracture are over 75 years and have an average length of stay of 18 days. However, less than one third go directly home and the costs are approximately €12,500 per patient with the estimated cost for inpatient treatment for hip fractures of around €35 million. Seventy-eight percent of Irish acute hospitalisations in 2002 were females, of whom 68% were 75 years of age or older, with 84% attending for fractures and 50% of these admitted with a hip fracture. The overall estimated cost of hospitalisation was €10.6 million with hip fractures accounting for €7.4 million (70% of total costs). Fifty-six percent (56%) of those presenting with hip fracture were transferred to a nursing home and incurred additional costs (Carey, 2005).

Another Irish study by Cotter (2006) showed that the total number of acute hospital beds occupied for fall-related admissions was 8,771, of which 26 were intensive care beds. The mean length of stay was 10.8 days but 15.3 days for a hip fracture. The total cost of inpatient acute hospital stay was €7.46 million (€850 per day per acute bed day). A further 6,220 rehabilitation bed days was consumed by patients with an associated cost of €2.9 million. It is estimated that the cost of treating a single fracture is €14,339 with the average length of stay in hospital of 15.3 days (HSE, 2008). The overall inpatient costs for fall related injuries, for elderly patients admitted to hospital in Ireland, are estimated at €59 million and hip fractures at an estimated €35 million (HSE, 2008). These figures do not take into account other
indirect costs such as premature death, morbidity or disability as a result of illness and other factors such as lost leisure time and unpaid activities of the patient and carer (Gannon et al, 2007).

In 1983 the adoption of the Prospective Payment System in the United States lead to decreases in length of stay in hospital for a hip fracture and the halving of patients discharged directly home. The costs associated with the delayed transition to a nursing home facility were attributed only for those individuals with new ADL deficits after hip fracture (Braithwaite, 2003). The cost analysis of alternative discharge plans for hip fracture patients in the Netherlands found that there was little difference in the costs in having been treated within the acute hospital or transferred to nursing homes. Reasons given were that all diagnostic procedures had to be completed before discharge and the fact that they would have relatively more intensive nursing needs than other people in the nursing home. The same costs were being shifted from the acute hospital to the nursing home (Polder et al, 2003).

Braithwaite et al (2003) study suggested that hip fracture was associated with substantial mortality, morbidity and economic costs. Hip fracture results in a 25% reduction in life expectancy and for 17% of these people, their remaining life will be spent in a nursing facility. They found that the hip fracture costs were $81,300 but included lifetime costs such as nursing facilities and homecare expenses. The estimated healthcare costs in the first 6 months after a hip fracture would be $26,900. In this study the rate of long-term institutionalisation was 13%, permanent ADL deficits 50%, and 6 month mortality 17% in 1997 in the US. It is thought that widespread implementation of strategies such as anti-resorptive, hormonal, physical and dietary supplemental therapies could reduce the number of fractures by as much as 40% and costs by $19 billion.
1.6 Fall and Fracture Prevention and Rehabilitation Programmes

Rehabilitation has been described as a goal-oriented and time-limited process aimed at enabling an impaired person to reach an optimum mental, physical and/or social functional level (United Nation, 2003; Cameron, 2005). Whitehead (2003) recommended that rehabilitation should be clinically focused on impairments that lead to slowed gait and falls such as lower limb strength and fall prevention strategies. Intensive physical training has been shown to improve strength and functional performance in older persons but this type of training is not used due to potential risk of training-induced musculoskeletal, cardiac and circulatory problems. Gates (2008) found that appropriate high intensity interventions that provide direct action to address falls risk factors may be more effective than interventions that provide information and referral.

A randomised placebo controlled trial showed that strength, functional performance and fall-related emotional state improved with this type of training but that it needs to be long-term treatment because of detraining effects over time (Hauer, 2002). Penrod et al (2004) identified that physiotherapy may be more effective if delayed until several weeks after surgery when the patients are past the immediate post-operative complications and have regained important cognitive abilities with resolution of short-term post fracture depression and are better able to tolerate and benefit from physical rehabilitation. It was identified that the timing of balance and strength retraining is most effective when the participants are just at the critical threshold where daily home tasks are at the limits of the person’s ability (Campbell, 2007).

During the acute and sub-acute rehabilitation stage after hip fracture, patients are most likely to engage in short distance gait training up to a maximum of 45 meters and active exercise for half an hour to two hours per day. This contributes to net deconditioning during the recuperative period (Mangione, 2005). A Cochrane review of mobilisation strategies after hip fracture (Handoll and Sherrington, 2007) identified just 13 trials involving 1,065 participants and concluded that there was insufficient evidence to establish the effectiveness of the various interventions used. There has been one study published since the review (Mosely et al, 2009) in which 150 hip fracture patients undergoing inpatient rehabilitation were randomised to high
(60 minutes per day) or low (30 minutes per day) dose therapy with no difference being shown at 16 weeks post fracture. The longer term outlook is very unclear with two other studies to date (Hauer et al, 2002) involving 28 patients followed for 6 months and 25 patients followed for 6 months (Tsauo et al, 2005) being underpowered to adequately address this research question.

The Scottish Intercollegiate Guidelines Network (SIGN) (2009) reported on two types of rehabilitation following hip fracture: a) early supported discharge team in which patients admitted from home who post operatively are mentally alert, mobile and medically stable are identified for early rehabilitation; b) geriatric-orthopaedic rehabilitation units, which are multidisciplinary inpatient rehabilitation teams, that would look after the frailer more dependent patients.

Chudyk (2009) reported that the clinical pathways for rehabilitation should involve post-operative management monitored by a geriatrician, with high frequency physiotherapy (PT) and occupational therapy (OT) this was associated with increased recovery of mobility. The pathways proposed included PT and OT on the rehabilitation wards, treadmill gait retraining, PT plus quadriceps training, weight-bearing exercises and neuromuscular stimulation. An outpatient setting could combine aerobic and progressive resistance training, along with a combined strength and functional training programme, within a homecare rehabilitation setting to obtain improved mobility. It was noted that it was found to be difficult to determine best practice for the rehabilitation of hip fracture patients as methods and measures for characterising rehabilitation interventions and settings were not well standardised.

Criak (1994) reported that patients were still doing the same exercises that they were given at discharge at their 6 month follow-up, due to lack of follow-up in the community to progress their exercises and functional mobility to improve ADLs.

1.7 Falls and Fracture Prevention Strategies

The prevention of new fractures should be a part of post fracture treatment (van Helden et al, 2007). Modern surgery for hip fractures is well established, and the effective prevention of falls is the key to preventing disability and death (Skelton, 2005). Hip fracture prevention should be expanded beyond the improvement of bone
mineral density (BMD) to include falls prevention as a primary component. Fallers have a 1.5 fold increased risk for hip fractures. It is reported that by the age of 70+, 35% of men and 52% of women are reported to have fallen at least once in the previous 12 months. In this study subjects with a prior fracture fell more often, had lower quadriceps strength and poorer postural sway. The association is mediated through fall related factors. It was suggested from the results of this study that by comparing multiple risk factors with BMD measurements this could greatly improve the sensitivity and predictive value for hip fractures (Nguyen, 2005).

Fall prevention services require two approaches: a) services for individual patients referred for specialist management, and b) community programmes directed at populations of elderly people living in the community and at risk of falling (Campbell, 2007). Exercise programmes need to be evidence-based, which means that they must be individually prescribed, involve progressive strength, and balance training of at least 10 weeks (or 50 hours) duration. Only 38% of the National Health Service (NHS) hospitals are known to provide exercise programmes based upon the FaME or Otago programme (Goodwin, 2010). Of the studies that looked at falls prevention, only those which involved strength and balance retraining (using the Otago exercise programme) targeted at high risk groups prevented the greatest number of falls at the lowest incremental costs (Davies, 2010).

Close et al (1999) showed that a structured interdisciplinary approach to the management and prevention of falls was effective in routine service settings. This is supported by Chang (2004) who indicated that while exercise has been shown to be effective in reducing falls, that there is still no clear evidence for the independent effectiveness of environmental modifications or education programmes. No studies have investigated falls prevention programs in day hospitals and whether they are effective (Masud, 2006).

In relation to environmental changes, fall prevention programmes tend to recommend lifestyle changes such as restricting outdoor activities (despite falls having occurred indoors) or having an escort for those activities, to avoid repositioning furniture and to use equipment such as grab-rails, body worn alarms, zimmer frames or sticks (Roe, 2009). These restrictions themselves may increase
fracture risk, due to the restriction of exercise, gait, muscle strength and increasing fear of falling in the elderly.

Among the other recommendations to be included in falls prevention programmes were footwear assessments. Of those people admitted to hospital with a hip fracture 33% wore slippers, 68% wore shoes with flexible heel counters and 2% wore high heels at the time of fracture (Sherrington, 2003). According to Menz et al (2006) there were no significant differences between structural footwear characteristics and falls which occurred either indoors or outdoors.

A recent Cochrane review by Gillespie et al (2010) on the role of hip protectors in preventing hip fractures in older people, demonstrated limited evidence for their effectiveness. Though hip protectors have been shown to have a marginally significant effectiveness on hip protection in frail older people in nursing homes they didn’t reduce the incidence in ambulant community dwelling older people. The main issues identified with the hip protectors were skin irritation, abrasion and local irritation as well as decreased compliance and adherence. Cameron et al (2003) conducted a two year randomised controlled trial of women and the use of hip protectors and prevention of hip fractures. While the study was under powered due to the investigators being unable to recruit the required numbers, there was no significant difference in the reduction of falls or rate of hip fractures between the two groups. The authors concluded that the use of hip protectors in all high risk community living older people was not justified and that hip protectors were ineffective for falls occurring in a backwards direction.

In a review of hip protectors by Cowling (2004) compliance with wearing hip protectors among all 9 studies was variable with decreasing levels of compliance the longer the studies continued. Indeed seven of the studies examined were completed on nursing home residents of which the results for two studies were inconclusive and the results for both community studies indicated that hip protectors were ineffective. This study did indicate that there was some difficulty with formal meta-analysis of the data due to the varied methods used in the studies and definitions of compliance used by authors.

A longitudinal cross-over study by Blalock (2010) assessed four types of hip protectors on community dwelling older person’s volunteers at risk of falls. 70.3% of
subjects reported concerns regarding comfort, convenience, fit or appearance. The most common concerns were the hip pad shells being too hard; being too tight; not easy to pull on and off; 16.7% reported that they felt protected; 10.9% reported concerns about appearance. 67.2% reported that no one had either encouraged or discouraged them from wearing them.

Recently, Cameron (2010) evaluated hip protectors in patients recruited from hospital and community groups. Participants were then randomised into control, no cost (subjects were fitted and received three pairs of hip protectors), and combined intervention groups (free hip protectors and education). The community combined group had greater compliance at 62%, but this fell to 40% at 6 months. However, the main findings focused on the subjects report of how uncomfortable, hot and unappealing the hip protectors were rather than on their effectiveness.

1.7.0 The Impact of Hip Fracture on Fear of Falling

Fear of falling is not only an acute outcome that results from falling it is likely the recognition of being at risk, both of falling and of the adverse outcomes that can result from falls (Zijlstra, 2007; Friedmann, 2002). Psychological factors such as fear of falling, self-efficacy, perceived control and coping strategies are thought to be important in the recovery from a hip fracture (Gillespie, 2010). The anxiety and prevalence of falling is 12% to 65% in non-fallers and 29% to 92% in fallers (Jorstad, 2005; Vellas, 1997). Even those who reported a fall at baseline but who did not report fear were still at a higher risk of expressing fear of falling then were the non-fallers 20 months later. It is not an acute outcome but likely the recognition of being at risk, both of falling and of the adverse consequences that results from falls (Friedman, 2002). Even Robertson (2002) found that fear of falling increased in participants of a falls prevention program who had no previous falls.

A study by Roe et al (2009) which reviewed older people who had fallen reported that on reflecting on the cause of their fall that they restrict their activities to reduce their risk of falling. Some stated no longer going outdoors or only if accompanied while others reported increased dependence on mobility aids, and railings. Some people moved furniture, rugs, and made everyday objects easily accessible, replaced old slippers or moved their beds downstairs to avoid the risks associated with stairs.
However, in many cases the changes were initiated by family without the patient being consulted.

A key measure of patient’s ability to return home after hip fracture is the ability to perform basic activities of daily living and instrumental activities of daily living. Most of the recovery of functions in activity of daily living has been achieved by four to six months after the fracture (Heikkinen, 2005). Factors that predict recovery of ability to perform activities of daily living include younger age, absence of pre-existing dementia and involvement in a social network. A study by Jamal (2010) showed that of those who were independent with these activities prior to hip fracture, only 50% regained that independence at 6 months post fracture with 35% requiring some help and 15% being totally dependent. Eighty-percent (80%) of those who lived at home prior to the hip fracture returned home within one year, with 82% achieving independence with ADLs (Craik, 1994). Sixty-percent of patients reported that they required assistance with ADLs post fracture while others report an independence level of 30-40% (Cooper, 1997; Koval, 1994).

Self-reports of fear of falling and self-efficacy have produced similar results with respect to validity, sensitivity to change, and responsiveness as do functional assessments. Numerous studies have concluded that self-report and performance-based measures offer distinct but complimentary information about function, suggesting that in some trials, the inclusion of both approaches to functional assessments might offer the most comprehensive assessment of function in the older person (Latham, 2008).

Zijlstra (2007) reported that there were significant associations between activity avoidance and higher age, female gender, fair and poor perceived general health and multiple falls. Glass (1999) observed that an active elderly person was less likely to die than those who were less active. Social and productive activities were observed to have equivalent survival advantages compared with fitness activities. This suggests that activities that entail little or no physical exertion may be beneficial as well.

Factors that were reported to be predictors of recovery of function in daily activities are younger age, absence of pre-existing dementia (post-operative delirium) and greater contact by patients with his or her social network (Koval, 1994). Tinetti
(1997) showed that having a home rehabilitation program focused on physical therapy to improve impairments and a functional program of helping subject achieve independence with ADL showed improvements over the two to six months post hip fracture. Recovery of ADL and IADL after fracture has been shown to be correlated with the pre-fracture level of ADL and IADL (Lin, 2004).

1.8 Summary of Review

The risk of falls and fractures is increasing with the increasing ageing population in Ireland. There is very limited evidence available on the clinical pathway for hip fracture patients throughout the hospital stay, from the initial assessment of functional abilities with outcomes measures, cognitive status, the activities of daily living, social circumstances, mortality rates, and access to services post discharge and long-term outcomes.

Knowledge of the positive and negative predictors of outcome after hip fracture is needed to guide treatment, and plan discharge and decide on the appropriate use of healthcare resources. Studies assessing the factors affecting functional outcomes after hip fracture are limited to date (Jamal, 2010). The aim of this study was to evaluate functional outcomes in elderly patients following a recent hip fracture over a 15-month period.
2. METHODOLOGY

2.0 Aim

The aim of the study was to evaluate outcomes of elderly patients following hip fracture at 3 and 15 months post fracture.

2.1 Research Objectives:

- To provide a profile of the subjects following hip fracture including baseline living circumstances; surgical management; and other demographic information (n=81).
- To describe the inpatient management of the subjects and the outcomes of hip rehabilitation both in the acute and non-acute services (n=81).
- To describe the functional changes after hip fracture over the two time periods (n=33).
- To describe health service utilisation for the group of elderly hip fracture subjects during the period of 15 months post fracture (n=33).
- To document other issues for this hip fracture group including the prevalence of pain, fall prevention strategies (e.g. mobility devices) and fracture prevention (e.g. Hip protectors) strategies (n=33).

In total 81 subjects consented to participate in the study and thirty-three were randomised to the Early Assessment Group for further physical assessment. Of the 33 subjects who attended the 3 month assessment only 26 subjects from this group attended the 15 month assessment. The information for the larger group (n=81) was collected from the subject’s medical charts and hospital computer databases. The objectives for both groups are described above.

2.2 Study Design

This was a prospective observational study.
2.3 Sample

Eligible subjects were identified and recruited from a larger randomised controlled trial (RCT) being carried out by a Bone Health Clinical Nurse Specialist (CNS) in the Department of Medicine for the Elderly (MEDEL). Eligible subjects were men and women, 60 years of age or older, and were attending an orthopaedic inpatient surgical ward at St. James’s Hospital with a hip fracture while completing their inpatient rehabilitation programme. As part of this larger RCT study, subjects were randomised to an early (approximately 3 months after hip fracture) or standard (approximately 6-9 month post fracture) bone health assessment by a bone health CNS. Both groups were then reviewed at 15-months post hip fracture for their final assessments.

Those patients attending the early assessment group only, who required or were considered to benefit from further physiotherapy intervention, were given the option of attending the day hospital for 6 to 7 weeks intervention as normal routine service. If the subject declined to attend the day hospital they were then given the option of community physiotherapy referral. Subjects who attended the day hospital were assessed prior to their discharge from this service at week 7 or 8. The research physiotherapist had no involvement in the day hospital intervention. The outcomes of patients in the early assessment group are described in this study; they were assessed at 3 and 15 months following hip fracture.

If subjects were eligible for inclusion they were approached regarding participation in the study before being discharged from the hospital. The following inclusion and exclusion criteria were applied:

2.3.0 Inclusion Criteria

- Subjects who sustained an upper femoral hip fracture as a result of a fall.
- Subjects aged 60 years and older.
- Male or Female.
- Able to give consent themselves or from their next of kin.
• Without severe cognitive impairment, an ability to understand commands, good
cognitive function – MMSE > 16 (Magaziner, 2000).

2.3.1 Exclusion Criteria

• Subjects with hip fracture unrelated to a fall (road traffic accident or pathological
fracture).
• Previous hip fracture or hip surgery (hemiarthroplasty, open reduction internal
fixation (ORIF) to the same hip.
• Subjects under 60 years.
• Unable to give consent.
• Unable to understand simple commands, poor cognitive function (MMSE < 16)
• Severe neurological co-morbidity (e.g. Stroke or Parkinson’s disease), which
would affect their ability to perform the assessments.

2.4 Sample Size

Assuming a standard deviation of 7.4 for a change in Berg Balance Score, based on
previous research by the investigators in a similar population (Horgan et al, 2009),
an alpha of 5% and a power of 80%, a sample size of 27 would be required to show a
four point difference in Berg balance scores as significant.

2.5 Ethical Considerations

An application for ethical approval for the larger randomised control study was
submitted to the St. James’s Hospital/Adelaide and Meath hospital incorporating the
National Children’s Hospital (AMNCH) Medical Research Ethics Committee and
was approved in March, 2008 (Appendix 1). An amendment was made to the
original application to incorporate this observational study in June, 2008 (Appendix
2). The amendment was approved in July, 2008 (Appendix 3).

All subjects received an information sheet (Appendix 4) which explained the details
of the study and what was involved. They were asked to give informed consent
(Appendix 5) and sign a consent form prior to being discharged from hospital. Each subject was advised that the study would not interfere with their treatment and that they were free to withdraw at any stage. All data was treated in a confidential manner and no patient was identifiable. Subject ID codes were used on all data sheets. Data was stored in a secure server file on a password protected database. All data was managed and stored in accordance with the Data Protection Act Guidelines (2003). Data files will be stored for seven years from the commencement of the study.

2.6 Procedure

Subjects were recruited while they were inpatients on an acute surgical orthopaedic ward in St James’s Hospital. A comprehensive medical assessment was completed by the Ortho-geriatric Registrar and Clinical Nurse Specialist at the first visit. Once the subject met the study inclusion criteria, consent was obtained either from the subject or their next of kin within the following week.

2.6.0 Baseline Assessments

Baseline information on all subjects consenting to participate in the study was obtained from their medical charts. Demographic data was collected including age, cognition, type of hip fracture, surgical procedure, baseline mobility, footwear, leg length discrepancy, medications, length of stay in the acute hospital, number of physiotherapy sessions while an inpatient, access to the multidisciplinary team, discharge destination, length of stay in rehabilitation, pain, falls history, hip protectors, living situation, functional abilities and social support. Cognitive function was assessed by the Clinical Nurse Specialist using the Mini Mental State Examination (MMSE) (Appendix 6).
2.7 Details of Assessments Conducted at 3 and 15-Months

2.7.0 Functional Range of Movement of the Lower Limbs

Functional range of movement of both lower limbs was measured with the subject lying on a treatment plinth. Most subjects were unable to lie completely flat on the plinth so were in a half-lying position. A goniometer was used to measure hip flexion, abduction, knee flexion and extension. With hip flexion the subject was asked to ‘bring their knee up towards their chest’; for hip abduction they were asked to ‘slide their leg out to the side’; with knee flexion they were asked to ‘bend their knee and bring the heel of their foot as close to their bottom as they could’; for hip extension the subjects were asked to ‘stand holding onto the plinth and keeping back straight and to bring leg behind them as far as they could manage without compensatory measures such as forward trunk flexion’ (Norkin, 1985; Anderson, 2000). If required the physiotherapist could passively guide the limb into the position desired and then back to the original position and then would ask the subject to reproduce the movement themselves before measuring.

Ankle dorsiflexion/plantarflexion was measured with the subject sitting on the edge of the plinth and feet resting on a wooden step. The step was moved so that the foot was placed along the edge of the step so that the goniometer arm could sit alongside the fifth metatarsal head. The leg was placed into the correct alignment by the study physiotherapist and then the subject was asked to ‘lift toes off the step’ or ‘lift heel off the step’. If the subject had difficulty with the instruction the therapist would demonstrate the position required using their own foot or would position the subjects foot into the position they wanted and get the subject to repeat that movement from the starting neutral position (Norkin, 1985; Anderson, 2000).

Rothstein (1983) found that intra-tester reliability for knee flexion/extension and inter-tester reliability was high except for knee extension ($r = 0.57$ to $0.80$). Ellis (1982) reported a 1% to 5% error for intra-tester reliability measurement and a 5 to 10% error for inter-tester reliability measure for hip range of motion. Higher inter-tester reliability has been found for upper limb movements rather than lower limbs (Boone, 1978). Reliability is dependent on a host of factors such as the joint motion that is being measured, methods of application, and variation among patient types so
it is important to have standardised testing (Gajdosik, 1987). Validity of goniometric measurements is dependent on a number of factors including pain, muscle strength, oedema etc. Validity of the movement depends on the content validity of the movements being measured. Errors have been found when measuring knee flexion especially within the first 15 degrees due to rotation at the knee joint resulting in the movement of goniometric bony landmarks rather actual knee flexion (Gajdosik, 1987).

### 2.7.1 Hand Dynamometry (Grip Strength) Assessments

Muscle strength was assessed using the SAEHAN® Hydraulic Hand Dynamometer (Saehan Corporation, Masan, Korea). It displayed both the grip force in pounds and kilograms. The same dynamometer was used for all testing. Subjects were seated in a chair and asked and/ or facilitated into the standard test position, with the shoulder adducted, neutrally rotated with the elbow flexed to 90 degrees and the forearm and wrist in a neutral mid-position. They were instructed to squeeze the dynamometer using standard verbal reinforcement ‘Harder...Harder...Relax’ as described by Mathiowetz (2002). The test was repeated in each hand three times and the average score was recorded (0

The hand dynamometer used had its own operation manual with the average performance of subjects grip strength for ages 6 to 75+. The means and standard deviations for hand grip strength for subjects 60 to 75+ as the reference guide in this study (Appendix 7 A study by Belooseskey (2010) showed that handgrip strength post hip fracture is highly correlated in both genders and can predict with 69% accuracy motor functioning 6 months later.

### 2.7.2 Leg length

Leg length measurements were taken with the patient lying supine on the treatment plinth and by measuring the distance from the anterior superior iliac spine (ASIS) at the origin of the Sartorius on the inferior portion of the ASIS down along the antero-
medial aspect of the thigh, patella, and lower leg to the medial malleoli using a tape measure. This was completed for both lower limbs. The technique was repeated twice on both legs to improve the validity in accordance with guidelines recommended by Beattie (1990). This technique was used to describe the prevalence of a leg length difference, as this may result in limitations of activities.

Measuring lower limb length discrepancy was found to have high validity and inter-tester reliability when compared between two testers and radiographic evidence (Intraclass Coefficient (ICC) =0.99; r=0.98) (Gogia, 1986). This was supported by Hoyle (1991) who reported an ICC of 0.90 to 0.95 for intra-rater reliability and 0.98 to 0.99 for inter-tester reliability. Whereas, Beattie (1990) found an ICC of 0.77 when comparing tape measure with radiographic evidence for leg length discrepancy. Leg length discrepancy measurements using a tape measure was found to be unreliable if the difference was 6.4 mm or less and more reliable when the difference was greater than 17.7 mm (Nichols, 1955). Other issues that can affect reliability of the measurements could be the inability to palpate the anterior superior iliac spine (ASIS) on an obese individual or in those with knee or hip flexion contractures (Gogia, 1986).

2.7.3 Berg Balance Scale

Functional balance performance was assessed using the Berg Balance Scale (BBS) (Berg et al, 1989). The BBS (Appendix 12) is a 14-item performance-based instrument intended for the assessment of balance. Each item is scored on a five-point ordinal scale (0-4). Higher scores are awarded for independent performance. The maximum score is 56. The equipment required for testing includes a stopwatch, standardised chair with armrests, plinth, slipper, step and tape measure. The smaller equipment was easily transported throughout all locations used while larger equipment was standardised throughout all locations used in the study.

The Berg Balance Scale is commonly used in clinical practice to assess functional balance performance. The cut-off scores established for the Berg are as follows: > 45 - safe and independent mobilisers; 36 to 44 - safe mobilisers with a mobility aid; < 35 - 100% risk of falls (Berg, 1992).
The reliability, validity and sensitivity of this scale have been established (Berg et al 1992). It has good inter-rater reliability for individual items on the scale in a sample of geriatric patients with range of balance impairments. The inter-rater reliability for individual items ranged from intraclass correlation coefficient (ICC) 0.71 – 0.79 and for total score ICC = 0.98 (Berg, 1989). It is significantly correlated (0.81) with the Timed Up and Go test (TUAG) (Hatch, 2003). It has high test-retest reliability and inter-rater reliability in older residents in supported accommodation (Berg, 1995).

Hall et al (2001) showed that the Berg Balance Scale was a useful predictor of falls. This was supported by another study which showed that the Berg Balance Scale was able to identify fallers from non-fallers in a group of older people and discriminate multiple-fallers from single-fallers (Chiu, 2003). Shumway-Cook (2005) used the Berg Balance Scale as one measure to predict the risk of falls following hip fracture in community dwelling older people. The normative BBS values that have been used by the Australian Physiotherapy Association (APA, 2005) were used as a reference (Appendix 9, Table 4).

2.7.4 Timed Up and Go (TUAG) Test

The ‘Timed Up and Go’ (TUAG) test measures functional mobility and involves recording the time (in seconds) that it takes an individual to rise from a standardised armchair, walk 3 metres to a line drawn on the floor and return to the chair (Podsiadlo and Richardson, 1991). The TUAG was used as it encompasses transfers, mobility and turning which are tasks that are used for home ambulation (Gorgon, 2007).

In a sample of community-dwelling older adults, the mean TUAG times for each decade have been established (Appendix 9, Table 3). Kristensen et al (2009) found no difference between male and females for TUAG scores; those with a high pre-fracture functional level required 11 seconds less to perform the TUAG compared those with a low pre-fracture level; those with intertrochanteric fractures required on average 7 seconds more to perform the TUAG, compared with patients with cervical fractures; and finally, those requiring the use of a walker took on average 15 seconds more to perform the task compared with a patient on crutches. The mean time with a
walker was 47.6 seconds and with a rollator the average score was 35.1 seconds. Kristensen (2007) demonstrated that a TUAG score of more than 24 seconds was a significant predictor for falls within 6 months after hip fracture.

The TUAG test has very high inter-rater reliability (ICC =0.98) and high retest reliability (ICC=0.97) in community dwelling older adults (Steffen, 2002). Test-retest was only moderate (ICC=0.56) in a large study of elderly people (Rockwood, 2000).

There is a significant and strong correlation with the Berg Balance Scale (0.81) (Hatch, 2003; Berg 1992). The TUAG can correctly identify fallers (87% sensitivity) and non-fallers (87% specificity) in community dwelling older adults (Shumway-Cook, 2000; Hill, 1999).

All subjects were instructed to sit with their back resting against the back of the chair and arms resting on the armrests of the chair (46 cm). The subjects’ mobility aids were placed within safe reach (walking stick resting against chair/ frame in front of them, with brakes applied if a 4 wheeled rollator frame). They were instructed: “On the command ‘ready-go’, I want you to get up out of the chair (using your hands) and walk the 3 metres up to and around the yellow cone placed on the floor, and then return to the chair and sit down, walk at your normal pace.” The time (in seconds) was measured from the seated position (back against the back rest) with the stopwatch started on the command “go” and stopped again when the seated position was regained. The research physiotherapist provided close supervision and verbal cueing during the test but no physical assistance was given. Verbal cueing was given only if needed (Kristensen, 2007; 2009; 2010). The type of walking aid used during the test was also documented.

2.7.5 Six Minute Walk Test (6MWT)

Endurance was assessed using the Six Minute Walk Test (6 MWT) (0). The researcher conducted the 6 MWT on the main hospital corridor. A trundle wheel was used to accurately measure the distance for the test. Measurements were recorded in metres. The normative values for the 6 Minute Walk Test for community dwelling older people have been described, (Appendix 9, Table 1) patients were instructed to
walk as quickly as they could for 6 minutes along the corridor. If they needed to rest they could stop either in the sitting or standing position. The study research physiotherapist walked beside or behind the participant with the trundle wheel and stop watch. The research physiotherapist would make intermittent standardised statements and would report the time elapsed. Heart rate, blood pressure, oxygen saturation and Borg rating of perceived exertion was recorded pre, post and 5 minutes post. Once the 6 minutes was finished the physiotherapist documented the distance recorded (in metres) from the trundle wheel. The 6 Minute Walk Test has been shown to have high retest reliability (ICC 0.93 to 0.95) in community dwelling older people and frailer older subjects (Simonsick et al, 2000; Harada et al, 1999; King et al, 2000). The 6 Minute Walk Test has been shown to measure overall mobility in older persons (Lord and Menz, 2002).

2.7.6 Nottingha...nd Activities of Daily Living (NEADL)

The Nottingham Extended Activities of Daily Living (NEADL) index is an instrumental Activities of Daily Living (ADL) scale, and was established as a postal questionnaire to monitor patients after stroke rehabilitation in the community. It assesses 22 activities within four categories: mobility (e.g. ‘do you walk over uneven ground?’), kitchen activities (e.g. ‘do you do the washing up?’), domestic activities (e.g. ‘do you do a full clothes wash?’) and leisure activities (e.g. ‘do you go out socially?’). Each item has four responses such as ‘Able, Able with difficulty, able with help, unable’. These are dichotomised into ‘independent or not independent’ for scoring. It is a simple, self-administered questionnaire, which can be completed by the patient in approximately 10 minutes (Harwood, 2002; Green, 2001; Lincoln, 1992).

The NEADL (Appendix 1 is specifically designed for postal surveys which make it easy and inexpensive to use. The 22 items increases the sensitivity of the scale compared to other measures of ADLs. It is useful to measure patient’s progress after discharge from hospital (Lincoln et al, 1992). The test-retest difference was 0.1 and 1.2 ± 7.4 (score range 0 – 22) and the reliability coefficient was 0.97 for the total scores using the likert-type scoring method. A ceiling effect has been noted for
patients who were undergoing hip replacement surgery for osteoarthritis (Harwood, 2002).

The subjects completed the questionnaires during their hospital assessment visit or at home and then posted them back in a self-addressed envelope. The NEADL has been found to be valid in measuring activities of daily living in stroke patients (Gladman, 1993). The coefficients of reproducibility (0.85 – 0.86) and scalability (0.75 – 0.81) were within the normal limits supporting the validation of the NEADL questionnaire (Lincoln, 1992).

2.7.7 Lower Limb Strength

Lower limb strength was assessed using the manual muscle testing incorporating the Medical Research Council (MRC) scale for muscle testing (Anderson, 2000; Kendall, 1983) (Appendix 16). All of the strength tests were carried out in a chair with good back support as this was the position that most subjects found comfortable. Initially the research physiotherapist asked the subjects to demonstrate their active range of movement in the chair with respect to hip flexion/extension, knee flexion/extension, hip abduction/adduction, ankle dorsiflexion and plantarflexion. As subject’s demonstrated their active range of movement the therapist noted the mid-range of movement. When testing the therapist applied resistance throughout the range of movement but noted the strength at the mid-range of active movement. This testing procedure was completed twice.

Cuthbert (2007) reported that clinical experience and expertise has been highlighted as a factor when discussing the reliability of Manual Muscle testing. An 82% to 97% agreement has been reported for inter-examiner reliability and a 96% to 98% for test retest reliability. An ICC of 0.63 to 0.98 has been found for individual muscle groups and 0.57 to 1.0 when combining individual muscle groups. Manual muscle testing has been shown to have excellent convergent and discriminant validity in patients with post-polio syndrome and validity with low back pain.
2.7.8 Service Utilisation

Hospital re-admissions and length of stay in the acute hospital were documented from the hospital computer patient administration system (PAS) system at both 3 and 15-months post hip fracture (n=81).

Subject’s length of stay in secondary rehabilitation centres was obtained by contacting relevant staff at both Clontarf Rehabilitation Unit (n=22) and the Cois Ceim Unit (n=11). A total of 33 subjects from all 81 subjects who consented to participate in this study went to these two rehabilitation centres.

Information regarding access to services such as: general practitioner, community physiotherapist, public health nurse, was obtained from the subjects during their 3 and 15-month follow-up assessment visits (n=33).

All subjects identified as requiring further physiotherapy input or orthotist review for falls risk factors were given the option of attending the Robert Mayne Day Hospital or Community Physiotherapy/Private physiotherapy. Other falls risk factors such as visual acuity, osteoporosis risk factors, malnutrition, and etc. were assessed and referred to appropriate services by the CNS as part of the larger RCT.

2.8 Standardisation and Equipment

All equipment used in the study except for chairs and plinths were standardised and used in the different assessment locations by the research physiotherapist. All three month assessments were completed in the mornings. The 15-month assessments were carried out on various days in mornings and afternoons. All assessments were completed by the research physiotherapist.

2.9 Statistical Methods

All descriptive statistics (e.g. mean, standard deviations, ranges) relating to the demographic details of subjects such as medications, types of fractures, length of stay etc., were calculated using Microsoft Excel 2007.
Means and standard deviations for the different functional outcomes and activities of daily living questionnaires were analysed using the statistical package R 2.12.1. All normally distributed data at the two time points were analysed using the paired t-test and all non-normally distributed data were analysed using the dependent two group Wilcoxon Signed Rank test. These tests were used to determine the significance of inter-group differences. Normalcy of data was tested by using visual analysis of distribution graphs, histograms and Normal Q-Q plot. The alpha level was set at 0.05 for all tests.

The results will be presented in Chapter 3.
3. RESULTS

3.0 Introduction

A total of 150 subjects who sustained a hip fracture were approached regarding inclusion in the study on an acute orthopaedic ward by both the ortho-geriatric registrar and clinical nurse specialist (CNS) in Bone Health between May 2008 and May 2009. Forty-four subjects did not wish to participate in this study, three were residents of another country or county, and 11 died. A further 11 subjects did not meet the inclusion criteria because of medical history or were newly diagnosed with cancer.

Only 81 of the 150 subjects approached (54%) were available and agreed to participate in the study. All demographic data was collected from medical charts prior to physiotherapy assessments at 3 and 15-months for these 81 subjects. At 3 months post fracture 18 subjects did not attend and 6 refused assessment. The remaining 57 subjects were randomised into the early assessment group (n=33) and the control group (n=24). Of the 33 subjects who were assessed at 3 months only 26 subjects presented for assessment at 15 months (7 subjects did not attend the 15-month follow-up or were uncontactable).

The focus of this study was the functional outcomes of those subjects who were randomised into the early assessment group. A flow diagram (Figure 3.1) outlines the flow of patients through the study.
Figure 3.1 Flow of patients through the study

150 Subjects were approached regarding participation in the study within one week after hip fracture on the acute orthopaedic ward by ortho-geriatric registrar and clinical nurse specialist between May 2008 and May 2009.

44 subjects did not consent to participate in the study, 3 were residents in another country and county, 11 RIP. 11 had current history or new diagnosis of cancer.

81 eligible and consented participants were randomised to the MOBILISE RCT groups: Early assessment (3 and 15 months) or control group (15 months). Demographic details noted.

18 subjects did not attend for appointment (Early assessment group 7 DNA’s, Control group 11 DNA’s).

6 refused assessment

Early assessment group assessed at 3 months (n=33)

*Control group assessed at 15 months (n=24)

Early assessment group assessed at 15 months (n=26)

7 subjects didn’t attend 15 month assessment. 3 refused and 4 we were unable to contact.

*The MOBILISE trial was an RCT being conducted by the Clinical Nurse Specialist and involved randomisation of patients to an early and control (usual care) groups. The focus of this study was an observational study, involving follow-up of the patients referred to the 'early' assessment group and the results are presented in this Chapter.
3.1 Baseline Characteristics of the Study Sample (n=81)

3.1.0 Average Age of Subjects Presenting with Hip Fractures (n=81)

The average age of the subjects (n=81) was 81 years (standard deviation (sd) 8.00, range 60 - 96 years). The average age was slightly higher for females 81 years (sd 8, range 60-96 years) while the average age for males was 80 years (sd 8, range 62 – 94 years). Males and females were equally represented across all four age groups and the age profile can be categorised into four age bands: 12% (60 to 69 years); 25% (70 to 79 years); 46% (80 to 89 years) and 17% (90 to 99 years).

The average age of the 33 subjects was 81 years (sd 8, range 65 – 94). The majority were female 73% (n=24) and 27% (n=9) male (Appendix 7, Table 1).

3.1.1 Baseline Living Situation (n=81)

Prior to hip fracture approximately 47% of subjects (n=38) were living alone and 45% with their family (n=37). A very small number of subjects, 7% (n=6), all of whom were female, lived in a nursing home or religious institution.

3.1.2 Summary of Baseline Characteristics (n=81)

Table 3.1 is a summary of the of the baseline characteristics of the larger study group (n=81). On average males admitted to hospital with a hip fracture have more co-morbidities, are on more medications, have longer lengths of stay between admission and operation and longer lengths of stay within the acute hospital than females.

To show similarity between the baseline characteristics of the larger study group (n=81) and the early assessment group (n=33) please refer to Appendix 7, Table 1.
Table 3.1 Summary of the Baseline Characteristics of the Study Sample (n=81)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N =</th>
<th>%</th>
<th>Mean</th>
<th>+/- SD</th>
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<th>Max</th>
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<td>Females</td>
<td></td>
<td></td>
<td>1.85</td>
<td>2.94</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td>4.00</td>
<td>11.24</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

3.2 Description of Fracture Type and Surgical Procedures (n=81)

3.2.0 Causes of Hip Fractures (n=81)

Forty-two percent of subjects (n=34) reported a slip or trip as the main cause of their fall and subsequent hip fracture. The main culprits reported for causing slips/trips were door frames, steps and kitchen tiles in their homes (Appendix 8, Table 1)

3.2.1 Description of Fracture Type and Surgical Procedures (n=81)

Forty-three percent of subjects (n=35) presented with a right hip fracture and 57% (n=46) with a left hip fracture. Fifty-six percent (n=45) were intracapsular fractures
and 44% (n=36) were extracapsular femoral fractures. A summary of fracture type and surgical procedures used are described below in Table 3.2.

Table 3.2 Baseline Summary of Fracture Type and Surgical Procedures and discharge destination (n=81).

<table>
<thead>
<tr>
<th>Types of Fractures (n=81)</th>
<th>N=</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extracapsular fractures</td>
<td>36</td>
<td>44%</td>
</tr>
<tr>
<td>Intracapsular fractures</td>
<td>45</td>
<td>56%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fixation Types Used (n=80)*</th>
<th>N=</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic Hip Screws (DHS)</td>
<td>38</td>
<td>47%</td>
</tr>
<tr>
<td>Total Hip Replacement (THR)</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Hemiarthroplasty</td>
<td>21</td>
<td>26%</td>
</tr>
<tr>
<td>Dynamic Cortical Screw (DCS)</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Intramedullary Screw</td>
<td>3</td>
<td>4%</td>
</tr>
<tr>
<td>Bipolar Hemiarthroplasty</td>
<td>12</td>
<td>15%</td>
</tr>
<tr>
<td>Long Gamma Nail</td>
<td>2</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Anaesthesia Used (n=80)*</th>
<th>N=</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal</td>
<td>48</td>
<td>60%</td>
</tr>
<tr>
<td>General Anaesthetic</td>
<td>11</td>
<td>14%</td>
</tr>
<tr>
<td>Unknown/not documented</td>
<td>21</td>
<td>26%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discharge Destination (n=81)</th>
<th>N=</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitation</td>
<td>41</td>
<td>51%</td>
</tr>
<tr>
<td>Home</td>
<td>19</td>
<td>23%</td>
</tr>
<tr>
<td>Convalescence</td>
<td>6</td>
<td>7%</td>
</tr>
<tr>
<td>Long Term Care</td>
<td>13</td>
<td>16%</td>
</tr>
<tr>
<td>Deceased</td>
<td>2</td>
<td>2%</td>
</tr>
</tbody>
</table>

*Note that one hip fracture subject was managed conservatively

### 3.2.2 Surgical Approaches Used (n=81)

The lateral surgical approach was used in 53% of subjects (n=43) (Figure 3.2).
3.2.3 Level of Mobility following Surgery (n=81)

Thirty-eight percent of subjects (n=31) were fully weight bearing following surgery. However, in 25% (n=20) of cases the post-operative mobility status was not documented and in 6% (n=5) of cases there were no post-operative notes in the charts.

Figure 3.3 Level of Mobilisation Indicated in Post-operative Instructions (n=81)
3.3 Description of In-patient Rehabilitation and Length of Stay (n=81)

3.3.0 Inpatient Rehabilitation (n=81)

All patients were referred to physiotherapy 100% (n=81); followed by medical social work 73% (n=59) and occupational therapy 32% (n=26).

Figure 3.4 Inpatient multidisciplinary management (n=81)

<table>
<thead>
<tr>
<th>Rehabilitation Type</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>81</td>
</tr>
<tr>
<td>MSW</td>
<td>59</td>
</tr>
<tr>
<td>OT</td>
<td>26</td>
</tr>
<tr>
<td>CN</td>
<td>15</td>
</tr>
<tr>
<td>SLT</td>
<td>3</td>
</tr>
</tbody>
</table>

PT Physiotherapist  MSW Medical Social Worker  OT Occupational therapist  CN Clinical nutritionist  SLT Speech and Language therapist

The majority of subjects received between 10 to 20 physiotherapy visits in the acute hospital setting prior to discharge from hospital. The average number of treatments was 18.23 (sd= 18.99) with a range of 2 to 83 physiotherapy sessions recorded. The interval between operation for hip fracture and referral for physiotherapy was 1.61 days (sd= 1.95).

3.3.1 Discharge Location (n=81)

Only 22% (n= 18) of patients were discharged home the majority 51% (n=41) of subjects were discharged to secondary rehabilitation following discharge from the acute hospital while 17% (n=14) were discharged to long-term care. A more detailed breakdown is provided in Appendix 8, Table 2.
3.4 Impairment Assessments at 3 and 15-months (n=33)

All impairment assessments were completed in the early assessment group which consisted of the 33 subjects who attended at the three month assessment. However, only 26 subjects from this group attended for the 15 month assessments.

3.4.0 Joint Range of Movement (ROM) (n=33)

Lower limb joint range of movement was recorded for patients in the early assessment group at 3 and 15 months (Table 3.3).

Table 3.3 Comparison of left lower limb range of movement for the early assessment group at 3 and 15 months (n=33)

<table>
<thead>
<tr>
<th>N=33</th>
<th>Month</th>
<th>MEAN</th>
<th>SD</th>
<th>RANGE</th>
<th>95% CI</th>
<th>df</th>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Hip Flexion</td>
<td>3</td>
<td>79.53*</td>
<td>17.81*</td>
<td>30 - 105*</td>
<td>-11.78* to -4.48*</td>
<td>22</td>
<td>t=-0.9313</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>86.35*</td>
<td>13.59*</td>
<td>60 - 123*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Hip Abduction</td>
<td>3</td>
<td>22.75*</td>
<td>8.00*</td>
<td>5 - 40*</td>
<td>-9.71* to -1.60*</td>
<td>22</td>
<td>t=-2.90</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>28.17*</td>
<td>5.79*</td>
<td>20 - 40*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Hip Extension</td>
<td>3</td>
<td>0*</td>
<td>0*</td>
<td>0*</td>
<td>0*</td>
<td>22</td>
<td>t= NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>0*</td>
<td>0*</td>
<td>0*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Knee Flexion</td>
<td>3</td>
<td>116.6*</td>
<td>22.73*</td>
<td>50 - 155*</td>
<td>-3.04* to 8.52*</td>
<td>22</td>
<td>t=0.98</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>115.9*</td>
<td>12.85*</td>
<td>90 - 135*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Knee Extension</td>
<td>3</td>
<td>-1.41*</td>
<td>4.17*</td>
<td>-20 - 0*</td>
<td>-2.50* to 1.45*</td>
<td>22</td>
<td>t=-0.55</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>-0.87*</td>
<td>4.17*</td>
<td>-20 - 0*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Ankle Dorsiflexion</td>
<td>3</td>
<td>10.78*</td>
<td>5.57*</td>
<td>0 - 20*</td>
<td>-3.60* to 1.40*</td>
<td>22</td>
<td>t=-0.91</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>11.74*</td>
<td>4.67*</td>
<td>0 - 20*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left Ankle Plantarflexion</td>
<td>3</td>
<td>21.19*</td>
<td>7.87*</td>
<td>3 - 35*</td>
<td>-3.26* to 4.40*</td>
<td>22</td>
<td>t=0.31</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>20.22*</td>
<td>7.46*</td>
<td>0 - 30*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significant differences in range of movement were found for left hip abduction between 3 and 15 months for the early assessment group only (t=-2.90, df 22, p=0.01).
Table 3.4 Comparison of right lower limb range of movement for the early assessment group at 3 and 15 months (n=33)

<table>
<thead>
<tr>
<th>N=33</th>
<th>Month</th>
<th>MEAN</th>
<th>SD</th>
<th>RANGE</th>
<th>95% CI</th>
<th>df</th>
<th>Test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Hip Flexion</td>
<td>3</td>
<td>77.50*</td>
<td>81.52*</td>
<td>18.01*</td>
<td>13.77*</td>
<td>22</td>
<td>t = 0.54</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>40 - 107*</td>
<td>50 - 105*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Hip Abduction</td>
<td>3</td>
<td>22.91*</td>
<td>28.91*</td>
<td>10.18*</td>
<td>7.06*</td>
<td>22</td>
<td>t = -2.90</td>
<td>0.01*</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>0 - 45*</td>
<td>15 - 40*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Hip Extension</td>
<td>3</td>
<td>0.69*</td>
<td>0.58*</td>
<td>7.70*</td>
<td>6.05*</td>
<td>22</td>
<td>t = 0.0684</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>-30 - 25*</td>
<td>-20 - 20*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Knee Flexion</td>
<td>3</td>
<td>116.8*</td>
<td>118.3*</td>
<td>18.98*</td>
<td>11.04*</td>
<td>22</td>
<td>t = 2.03</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>45 - 140*</td>
<td>90 - 140*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Knee Extension</td>
<td>3</td>
<td>-3.44*</td>
<td>-1.09*</td>
<td>7.01*</td>
<td>5.21*</td>
<td>22</td>
<td>t = -0.93</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>-25 - 0*</td>
<td>-25 - 0*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Ankle Dorsiflexion</td>
<td>3</td>
<td>11.19*</td>
<td>13.13*</td>
<td>6.24*</td>
<td>5.55*</td>
<td>22</td>
<td>t = -0.91</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>0 - 25*</td>
<td>5 - 30*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Ankle Plantarflexion</td>
<td>3</td>
<td>22.47*</td>
<td>22.17*</td>
<td>6.78*</td>
<td>7.36*</td>
<td>22</td>
<td>t = 0.33</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td></td>
<td></td>
<td>9 - 35*</td>
<td>0 - 30*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Again significant differences in range of movement noted for right hip abduction for the early assessment group between 3 and 15 months (t=-2.90, df 22, p=0.01).

### 3.4.1 Hand Grip Strength Dynamometry (n=33)

Hand grip strength was measured using hand dynamometry at three and fifteen months for the early assessment group. Improvement in hand grip strength was reported for 33% subjects (n=11) whose average age was 78.54 (range 65 to 96) years old and whose average improvement in strength was recorded as 8.77 (range 0 to 41) lbs.
Right hand grip strength disimproved at the 15-month assessment post hip fracture. Disimprovement in strength was seen in 39% of subjects (n=13) whose average age was 81.08 (range 74 to 91) years of age with an average decrease in strength of 8.60 (range 1.67 to 32.50) lbs. Improvement or maintenance of right hand grip strength was reported for 11 subjects (33%) whose average age was 78.54 (range 65 to 96) years old and whose average improvement in strength was recorded as 8.77 (range 0 to 41) lbs.
Improvements in left hand grip strength was seen for 42% of subjects (n=14) with an average age of 79.36 (range 65 to 96) years old by 5.48 (range 0.33 to 14) lbs. Disimprovements in left hand grip strength were seen for 36% of subjects (n=12) with an average age 79.58 (range 68 to 91) years old by 5.67 (range 0.33 to 20.67) lbs.

There were no significant differences between hand grip strength at 3 and 15 months (Table 3.5).

Table 3.5 Differences in grip strength at 3 and 15 months (n=33)

<table>
<thead>
<tr>
<th></th>
<th>Right Hand Dynamometry at 3 and 15 months post hip fracture</th>
<th></th>
<th>Left Hand Dynamometry at 3 and 15 months post hip fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Range</td>
</tr>
<tr>
<td>Initial n=33</td>
<td>25.56 lbs</td>
<td>13.57 lbs</td>
<td>0 - 65 lbs</td>
</tr>
<tr>
<td></td>
<td>11.59 kg</td>
<td>6.16 kg</td>
<td>0.76 - 23.13 kg</td>
</tr>
<tr>
<td>Final n=26</td>
<td>23.80 lbs</td>
<td>12.67 lbs</td>
<td>8.67 - 59.33 lbs</td>
</tr>
<tr>
<td></td>
<td>10.80 kg</td>
<td>5.75 kg</td>
<td>3.93 - 26.91 kg</td>
</tr>
</tbody>
</table>
The differences in right hand dynamometry at 3 and 15-months were not significant
(t= 0.7883, df=23, p = 0.439).

The differences in left hand dynamometry at 3 and 15-months were not significant
(t= -0.35, df=23, p = 0.90).

3.4.2 Lower Limb Strength Assessment (n=33)

Lower limb strength was measured at 3 and 15 months, respectively.

Table 3.6 Comparison of left lower limb strength (MRC scale) for the early assessment group at 3 and 15 months (n=33)

<table>
<thead>
<tr>
<th></th>
<th>N=33</th>
<th>Months</th>
<th>MEAN</th>
<th>SD</th>
<th>RANGE</th>
<th>95% CI</th>
<th>df</th>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Hip Flexion</td>
<td>3</td>
<td>15</td>
<td>4.60</td>
<td>0.62</td>
<td>3-5</td>
<td>-0.13</td>
<td>23</td>
<td>t = 0.81</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>15</td>
<td>4.81</td>
<td>0.40</td>
<td>4-5</td>
<td>-0.04</td>
<td>23</td>
<td>t = 1.70</td>
<td>0.13</td>
</tr>
<tr>
<td>Left Hip Extension</td>
<td>3</td>
<td>15</td>
<td>4.58</td>
<td>0.67</td>
<td>3-5</td>
<td>-0.007</td>
<td>23</td>
<td>t = 2.01</td>
<td>0.07</td>
</tr>
<tr>
<td>Left Knee Flexion</td>
<td>3</td>
<td>15</td>
<td>4.50</td>
<td>0.85</td>
<td>2-5</td>
<td>-0.14</td>
<td>23</td>
<td>t = 1.23</td>
<td>0.27</td>
</tr>
<tr>
<td>Left Knee Extension</td>
<td>3</td>
<td>15</td>
<td>4.55</td>
<td>0.72</td>
<td>3-5</td>
<td>-0.03</td>
<td>23</td>
<td>t = 1.90</td>
<td>0.09</td>
</tr>
<tr>
<td>Left Ankle Dorsiflexion</td>
<td>3</td>
<td>15</td>
<td>4.42</td>
<td>1.29</td>
<td>0-5</td>
<td>0.11</td>
<td>23</td>
<td>t = 2.6</td>
<td>0.02*</td>
</tr>
<tr>
<td>Left Ankle Plantarflexion</td>
<td>3</td>
<td>15</td>
<td>4.90</td>
<td>0.30</td>
<td>4-5</td>
<td>0.17</td>
<td>23</td>
<td>t = 3.14</td>
<td>0.01*</td>
</tr>
</tbody>
</table>

Significant differences were found for decrease in strength for left ankle plantarflexion (t = 2.6, df 23, p = 0.02) and dorsiflexion (t = 3.14, df 23, p = 0.01) for the early assessment group between 3 and 15 months.
Table 3.7 Comparison of right lower limb strength (MRC scale) for the early assessment group at 3 and 15 months (n=33)

<table>
<thead>
<tr>
<th>N=33</th>
<th>Months</th>
<th>MEAN</th>
<th>SD</th>
<th>RANGE</th>
<th>95% CI</th>
<th>df</th>
<th>Test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Hip Flexion</td>
<td>3</td>
<td>4.64</td>
<td>0.76</td>
<td>3 - 5</td>
<td>-0.40 to 0.22</td>
<td>23</td>
<td>0.60</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.55</td>
<td>0.72</td>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Hip Abduction</td>
<td>3</td>
<td>4.84</td>
<td>0.52</td>
<td>3 - 5</td>
<td>-0.19 to 0.44</td>
<td>23</td>
<td>0.83</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.72</td>
<td>0.68</td>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Hip Extension</td>
<td>3</td>
<td>4.50</td>
<td>0.68</td>
<td>3 - 5</td>
<td>-0.27 to 0.19</td>
<td>23</td>
<td>0.37</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.60</td>
<td>0.76</td>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Knee Flexion</td>
<td>3</td>
<td>4.40</td>
<td>0.72</td>
<td>3 - 5</td>
<td>-0.33 to 0.16</td>
<td>23</td>
<td>0.70</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.56</td>
<td>0.82</td>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Knee Extension</td>
<td>3</td>
<td>4.42</td>
<td>0.81</td>
<td>3 - 5</td>
<td>-0.21 to 0.46</td>
<td>23</td>
<td>0.77</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.44</td>
<td>0.92</td>
<td>2 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Ankle Dorsiflexion</td>
<td>3</td>
<td>4.29</td>
<td>1.37</td>
<td>0 - 5</td>
<td>-0.23 to 0.81</td>
<td>23</td>
<td>1.16</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.28</td>
<td>1.10</td>
<td>1 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right Ankle Plantarflexion</td>
<td>3</td>
<td>4.94</td>
<td>0.25</td>
<td>4 - 5</td>
<td>0.03 to 0.47</td>
<td>23</td>
<td>2.30</td>
<td>0.05*</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>4.64</td>
<td>0.64</td>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significant differences found for strength of ankle plantarflexors for the early assessment group at 3 and 15 months (t= 2.30, df 23, p=0.05).

3.4.3 Leg Length (n=33)

Nine percent of subjects (n=3) at 3 months were found to have had a lower limb discrepancy after their hip fracture, the discrepancy was between 0.5 to 1 inch. For two subjects the operated side was longer. At 15-months only two subjects were wearing orthotic footwear as one subject was unable to be assessed or fitted for orthopaedic footwear during that time (e.g. foot ulcer requiring dressings).

3.4.4 Berg Balance Scale (BBS) (n=33)

The average BBS score recorded for the initial assessment at 3 months was 39.16 (sd 12.98) and the final assessment 15-months was 38.44 (sd 14.04).
Figure 3.10 Boxplot comparison of ‘Berg Balance Scale’ scores for the early assessment groups at 3 and 15 months post hip fracture (n=33)

![Boxplot of Berg Balance Scale scores at 3 and 15 months](image)

Table 3.8 Difference between Berg Balance scores at 3 and 15 months

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>95% CI</th>
<th>T value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>39.16</td>
<td>12.98</td>
<td>18 – 56</td>
<td>-2.31 to 4.63</td>
<td>0.691</td>
<td>0.09</td>
</tr>
<tr>
<td>Final</td>
<td>38.44</td>
<td>14.04</td>
<td>11 – 55</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The differences in Berg Balance Scores at 3 and 15-months were not significant (t= 0.691, df=24, p = 0.09).

3.4.5 Timed Up and Go Test (n=33)

The average initial ‘Timed Up and Go’ (TUAG) score was 29.90 (sd = 18.99) which improved slightly between 3 and 15-months to 27.27 (sd = 18.76) (Figure 3.11).
Figure 3.11 ‘Timed Up and Go’ scores at 3 and 15-months (n=33)

![Box plot comparing TUAG scores at 3 and 15 months.](image)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>95% CI</th>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>29.90</td>
<td>18.99</td>
<td>0 – 69.18</td>
<td>-4.17 to 12.18</td>
<td>t= 1.011</td>
<td>0.900</td>
</tr>
<tr>
<td>Final</td>
<td>27.27</td>
<td>18.76</td>
<td>0 – 66.38</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.9 Differences between ‘Timed Up and Go’ scores at 3 and 15 months

The differences in TUAG scores at 3 and 15-months were not significant, (t= 1.011, df= 24, p=0.900).

3.4.6 Six Minute Walk Test (6-MWT) (n=33)

The Six Minute Walk Test measured subject’s endurance at 3 and 15 months post hip fracture. At the 3-month assessment the average score recorded was 165.25 meters (sd 85.34) which improved to 193.08 meters (sd 110.98) at the final assessment. At the 15-month assessment one subject was excluded as it was not
possible to assess the 6-MWT as the assessment was conducted in the subject’s home and there was inadequate space to administer the 6-MWT.

Figure 3.12 Six Minute Walk Test scores at 3 and 15 months (n=33).

![Graph showing comparison of 6MWT scores at 3 and 15 months.]

Table 3.10 Differences in 6 Minute Walk Test scores at 3 and 15 months (n=33)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>95% CI</th>
<th>Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>165.25</td>
<td>85.34</td>
<td>0 - 359.20</td>
<td>-45.79 to 14.76</td>
<td>t = -1.06</td>
<td>0.300</td>
</tr>
<tr>
<td>Final</td>
<td>193.08</td>
<td>110.98</td>
<td>0 - 384.69</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There were no differences between the 6 Minute Walk Test scores between 3 and 15 months post hip fracture (t = -1.06, df 23, p = 0.300).

3.4.7 Nottingham Extended Activities of Daily Living (NEADL) (n=33)

The average NEADL questionnaire was used to measure subject’s ability to carry out daily activities with higher scores indicating better abilities to do the same. The mean
pre-fracture NEADL score was 47.61 (sd 13.14). At three months most subjects reported average score was 32.55 (sd 17.26) increasing to 40.73 (sd 17.22) at 15 months. Significant differences were found between pre-fracture and three month post as well as pre-fracture and fifteen months post fracture. No significant differences were found between 3 and 15 months post fracture in activities of daily living.

Figure 3.13 NEADL scores Pre-fracture, 3 and 15 months post hip fracture (n=33)

Table 3.11 Differences in NEADL scores (n=33)

<table>
<thead>
<tr>
<th></th>
<th>N=26</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Fracture</td>
<td>47.61</td>
<td>13.14</td>
<td>18 – 63</td>
<td></td>
</tr>
<tr>
<td>3 Months</td>
<td>32.55</td>
<td>17.26</td>
<td>3 – 63</td>
<td></td>
</tr>
<tr>
<td>15 Months</td>
<td>40.73</td>
<td>17.22</td>
<td>3 – 63</td>
<td></td>
</tr>
</tbody>
</table>
Table 3.12 Comparison of NEADL scores pre-, 3 and 15 months post fracture (n=33)

<table>
<thead>
<tr>
<th></th>
<th>95% Confidence Interval</th>
<th>Test</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre fracture and 3 month NEADL scores</td>
<td>8.98 to 21.27</td>
<td>t = 5.05</td>
<td>4.36e-05*</td>
</tr>
<tr>
<td>Pre fracture and 15 month NEADL scores</td>
<td>1.03 to 13.11</td>
<td>t = 2.39</td>
<td>0.0044*</td>
</tr>
<tr>
<td>3 month and 15 month NEADL scores</td>
<td>-13.48 to -1.72</td>
<td>t = 2.64</td>
<td>0.0448*</td>
</tr>
</tbody>
</table>

There was a significant difference in NEADL score pre and 3 months post hip fracture (t = 5.05, df 32, p value = 4.36e-05) (Table 3.12).

There was a significant difference in NEADL score pre and 15 months post hip fracture (t = 2.39, df 29, p value = 0.0044) (Table 3.12)

There was no significant difference in NEADL score 3 and 15 months post hip fracture (t = 2.64, df 29, p value = 0.0448) (Table 3.12)

3.5 Health Service Utilisation

Information on readmission rates and inpatient rehabilitation post-acute hospital discharge related to the larger group (n=81). Whereas, information regarding contact with physiotherapy services, footwear, hip protectors, falls, pain, mobility, etc. was recorded for the early assessment group consisting of 33 subjects at 3 months and 26 returning for assessment at 15 months post fracture.

3.5.0 Contact with Physiotherapy Services post Hip Fracture (n=33)

At 3 months post hip fracture approximately 24% (n=8) of subjects were seen by physiotherapists either in the community, outpatient service or day hospital, and at 15 months this increased to 46% (n=15). The unknown group are those who reported no contact with physiotherapy services at 3 months and did not attend the 15 month assessment (Figures 3.15).
At the time of the three month assessment ten subjects were identified as requiring further physiotherapy input. Six subjects were referred to the Day Hospital and two subjects were referred to community physiotherapy post their 3 month assessment. Two subjects were still inpatients at the time of 3 month assessment and still receiving on-going physiotherapy at the time.

At 15-months subjects reported the greatest contact with the General Practitioner (67%, n=22) followed by the Public Health Nurse (42%, n=14), 42% (n=14) physiotherapy services, 30% (n=10) Occupational therapists and 18% (n=6) Social Worker.

3.5.1 Access to Secondary Rehabilitation (n=81)

Subjects were referred to two secondary rehabilitation facilities after discharge from the acute hospital.
- Clontarf Orthopaedic Hospital is a fully equipped rehabilitation unit where subjects are seen daily during their admission.
- The Cois Ceim Unit (step down unit) with a limited physiotherapy service of 3 half days per week with very limited access to equipment or a gym.

Subjects who attended Clontarf spent an average of 24 (sd 10.42) days in rehabilitation while those in Cois Ceim Unit spent 45.18 (sd 31.08) days in rehabilitation (Table 3.13).

Table 3.13 Destination and Length of stay for Secondary Rehabilitation

<table>
<thead>
<tr>
<th>Length of stay in rehab</th>
<th>Clontarf (n=22)*</th>
<th>Cois Ceim (n=11)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>24 (10.42)</td>
<td>45.18 (31.08)</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>8-50 days</td>
<td>2-98 days</td>
</tr>
<tr>
<td><strong>Destination post rehab</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Home</strong></td>
<td>17 (77%)</td>
<td>10 (90%)</td>
</tr>
<tr>
<td><strong>Hospital</strong></td>
<td>4 (18%)</td>
<td>1 (9%)</td>
</tr>
<tr>
<td><strong>Long term care</strong></td>
<td>1 (5%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

*Unable to identify the lengths of stay for 4 people who were reported to have gone to Clontarf on discharge from St. James’s Hospital.

3.5.2 Readmission Rate within 15-months (n=81)

During the study period 21 subjects had further hospital admissions post hip fracture with 5 being readmitted twice. Also, it was noted that 2 subjects had died during that time period with one subject readmitted to hospital within 12 months with a second hip fracture.

3.6 Analysis of Footwear, Hip Protectors, Pain and Falls post Hip Fracture (n=33)

All footwear, hip protectors, pain and falls post hip fracture was completed for the early assessment group which consisted of the 33 subjects and the 26 subjects who returned for assessment at 15 months.
3.6.0 Footwear (n=26)

A comparison of the type of footwear worn by the 26 subjects who attended both the 3 and 15 month assessments is outlined in Appendix 7, Table 2. Fewer subjects were wearing shoes with no fixation at 15 months post hip fracture and no subjects were wearing high heels. Moccasins and walking shoes were the most common footwear worn at 3 months whereas the court shoe was more common at 15 months.

3.6.1 Use of Hip Protectors (n=33)

Four of the 33 subjects (12%) reported wearing hip protectors at the time of the incident which resulted in their hip fracture. During the study period only one person was prescribed hip protectors.

3.6.2 Pain post Hip fracture (n=33)

The average pain score recorded on the Visual Analogue Scale was 2.48 (sd 3.24) at three months and 1.12 (sd 2.47) at fifteen months post fracture. Hip fracture patients reported pain post fracture as causing limitations in functional activities. Significant differences were noted for pain (t=75.5, df 25, p=0.0304)

3.6.3 Falls reported post Hip Fracture (n=33)

Ten subjects (30%) reported having two or more falls over the 15-month time period while one reported a single fall. Of those that reported falling eight reported injuries ranging from bruising and lacerations (n=5), bump on the head (n=2) and Colles fracture (n=1).
The causes of the falls were described as follows ‘knee giving way, trip over step, falling backward, being knocked down by another person/object (pram), slip on a well-polished floor in respite home, dizzy spells, leg caught in blanket (in hospital bed), poor safety awareness, dual tasking, dog pulling on the leash, and alcohol related falls.

3.7 Mobility Status (n=33)

All mobility status information was completed for the early assessment group which consisted of the 33 subjects and the 26 subjects who returned for assessment at 15 months.

3.7.0 Outdoor Mobility (n=33)

Fifty one percent of subjects (n=17) did not use outdoor mobility aids prior to hip fracture while 30% used walking sticks (n=10) and 27% (n= 9) used outdoor rollator frames at 3 and 15 months post fracture, respectively (Figure 3.17 and Figure 3.18). Twenty-one percent of subjects (n=7) did not attend for 15 month reassessment.
Figure 3.17 Use of Outdoor Mobility Aids (n=33)

Figure 3.18 Level of Mobility Assistance Required Outdoors
Eighty-five percent of subjects (n=28) reported independent indoor mobility with or without mobility aids outdoors pre-fracture. Independence with mobility started to decrease gradually from 78% (n=26) at 3 months to 64% (n=21) at 15 months post hip fracture (Figure 3.18).

### 3.7.1 Indoor Mobility (n=33)

Sixty-seven percent of subjects (n=22) did not use any mobility aids indoors prior to hip fracture. However, forty-two percent of subjects (n=14) used a rollator zimmer frame at 3 months and at 15 months was a fairly even split between no mobility aids for 27% (n=9), walking stick 21% (n=7), and rollator zimmer frame 18% (n=6) (Figure 3.19).

Figure 3.19 Use of Indoor Mobility Aids (n=33)

![Indoor Mobility Usage](image)

A hundred percent of subjects (n=33) reported independence with indoor mobility pre-fracture. This is reduced to 90% (n=30) at three months and 70% (n=23) at 15-months post hip fracture. However, the reduction at 15 months is due to the number of subjects that did not attend for final assessment.
3.7.2 Stairs (n=33)

Fifty-eight percent of subjects (n=19) reported using stairs prior to hip fracture (Figure 3.21). At 3 months post fracture 55% (n=18) reported not using stairs while at 15-months the number of subjects reporting that they did not use the stairs and using the stairs was even at 33% (n=11) and 30% (n=10), respectively

Figure 3.21 Stair Usage over the 15-month time period (n=33)

3.7.3 Transfers and Bed Mobility (n=33)

Though the majority of subjects were independent with transfers increasing dependence was noted between three and 15 months post hip fracture. Seventy-nine percent of subjects (n=26) were independent with transfers at 3 months decreasing to
67% at 15 months for lying to sitting transfers (Figure 3.32). Regarding sitting to lying transfers 85% (n=28) were independent but again at 15-months 64% (n=21) were able to carry out this task independently. Independence with sit to stand transfers reduced from 88% (n=29) at 3 months to 61% (n=20) at 15-months post fracture.

Figure 3.22 Level of assistance required for transfers at 3 and 15 months (n=33)

There was a reduction in the level of independence in bed mobility, 79% (n=26) were able to complete the task independently at 3 months while at 15-months this had reduced to 67% (n=22) at 3 months post fracture (Figure 3.23).
Figure 3.23 Bed mobility at 3 and 15-months \( (n=33) \)

The results will be discussed in Chapter 4.
4. DISCUSSION

4.0 Introduction

The aim of this study was to evaluate the functional outcomes in elderly subjects following a recent hip fracture over a 15-month period. In addition the subjects’ pre and post-fracture functional and mobility levels, access to community services, physiotherapy services, pain levels, and hip fracture management were described.

Demographic information such as age, length of stay, medications, surgical procedures, rehabilitation reflective of information gathered from the larger group (n=81). Information regarding functional outcomes, pain, health care utilisation was gathered from the smaller early assessment group (n=33) at 3 and 15 months.

4.1 Description of Groups

The average age of the 81 subjects who consented to participate in the study was 81 years (sd 8) and the range was 60 to 96 years of age, with males and females equally represented across all four decades. The average age of the 33 subjects who participated and were evaluated at 3 months was 81 years (sd 8) the range was 65 to 94 years. The average age of 80 years is consistent with most other hip fracture studies and concurs with the incidence data and risk of falls and fracture in an older age group (Handoll, 2008). The average age was marginally higher for females (81 years) compared to males (80 years) which coincides with the younger male to older female age profile seen by Hommel (2008).

There was a higher female to male ratio in the 81 consenting subjects (3.5:1) than in the larger 150 person recruitment group (2.4:1). The change in ratios from the recruitment group to the study group had the effect of more closely matching the male to female subjects within the study to that of the broader gender balance of hip fracture patients (4:1) (Handoll, 2008; Parker, 2010). The ratio for the group who completed the three and fifteen month assessments adjusted slightly to be (2.7:1) with more females than males.

Polypharmacy (taking greater than 3 or 4 or more medications) has been identified within the Falls Prevention Guidelines as one of the extrinsic factors resulting in falls
in the elderly (van Nieuwenhuizen, 2010; Panel on Falls Prevention, AGS and BGS, 2011). Corsinovi (2009) reported that a larger number of administered drugs were found in fallers (5.63±2.50) than non-fallers (3.03±3.38). The average number of medications being used by subjects in this study is 5.94 with more medications being taken by males (6.58) than females (5.74). Ninety percent (n=73) of subjects were on medications at the time of hospital admission with a hip fracture. Their categorisation as a high risk group for falls can be confirmed by the fact that 51% (n=41) of subjects were on 6 to 15 medications at the time of admission.

The majority of medications documented in this study were for circulatory system, central nervous system and analgesia, though other studies found the most common medications in hip fracture patients being for cardiovascular disease, followed by medications to reduce blood sugar levels and sedatives. The commonality found was that the majority of subjects in that study (Lin, 2004) and this were on cardiovascular medications, though the relative ratios of 43.7% and 65% (n=53) respectively are significantly different. This highlights the considerable prevalence of other co-morbidities in this group and the need to review polypharmacy as it is a risk factor for falls and may not be reviewed systematically as part of overall inpatient management after the hip fracture.

Ninety-two percent of all subjects (n=75) were admitted from home and either lived alone 47% (n=38) or lived with a spouse or relative 45% (n=37). Lin (2004) showed similar pre-fracture living circumstances, with 94.2% coming to hospital from home; 82.5% living with their family pre fracture; 11.7% living alone; 5.9% coming from nursing homes. Other studies have shown much smaller percentages of people admitted from home of 59% and 68.7%, respectively (Rosell, 2003; Saarenpaa, 2006). One reason why the number of subjects from nursing homes in this study was so low is likely related to the difficulty of getting consent from the subject themselves, and/or the next of kin thus excluding them from the study. It is also possible that follow-up assessments could have been difficult for this group and they may be reflected in the large number of patients who did not attend.

As many of the subjects were admitted from home it was expected that they would have a good pre-baseline functional level. Of subjects admitted with hip fractures, the primary reported cause reported for falling and fracturing the hips was a slip/trip
(42%). Many of the studies on hip fractures have referred to falls but not specifically to slips, trips or stumbles. This study found that what is termed a ‘slip or trip’, can result in serious injuries such as hip fractures, and is more readily reported by subjects in discussing their medical history. Hall (2001) included trips or stumbles in a study on reviewing falls risk in community dwelling older persons following a hip fracture. That study found that subjects were more likely to report these events more readily than falls because they would perceive this event to be less serious.

4.2 Fracture Management (n=81)

Hip fractures are subdivided into two main types: 1) Extracapsular fractures (trochanteric, intertrochanteric, pertrochanteric and subtrochanteric) and 2) intracapsular (subcapital and transcervical) (Handoll, 2008). In this study, 56% of fractures were intracapsular and 44% of fractures were extracapsular with the majority requiring surgical fixation, similar to what is reported in other studies (Lin, 2004; Tinetti, 1997).

In relation to the post fracture mortality rate, there were two subjects who died, of whom; one had a four part displaced intertrochanteric fracture and the other a subtrochanteric fracture. This outcome follows closely with investigations by Haentjens (2007), who found that at discharge, women with intertrochanteric fractures had a higher mortality rate and were less able to walk than those with femoral neck fractures; though at one year no difference was seen in functional outcomes between the two groups. Thorengren (2005) reported similar increases in mortality rates for trochanteric fractures at four months (14%) compared with cervical fractures (11.9%) and subtrochanteric fractures having the highest mortality (16.4%).

4.3 Hospital Inpatient Stay (n=81)

The length of stay in the acute hospital recorded in this study was 47.07 (sd 69.22) days with males reporting longer lengths of stay of up to 68.47 (sd 87.81) days and females reporting 40.52 (sd 61.84) days. The length of stay in hospital is much longer than those recorded for numerous other studies, conducted outside of Ireland, which have lengths of stay ranging from 7.2 to 21 days (Bentler, 2009; Heinkkinen, 2005; Beringer, 2006; Wiktorowicz, 2001; Hommel, 2008; Saarenpää, 2006; Lin,
2004; Tinetti, 1997). There may be a number of reasons for this, including the differences in the health service structure in various countries such as Finland, where patients have surgery in an acute orthopaedic hospital and are then transferred after a week to local acute health centre/rehabilitation units. In this hospital, the patients started their rehabilitation programme in the acute hospital. This difference in patient management means that reporting overall hospital stay, as opposed to classifying the periods of stay within acute settings versus rehabilitation settings, even within the same hospital, hinders a baseline comparison across the current literature.

The average time from admission to operation was 2.54 (sd 5.99) days. Male subjects had a longer waiting time period at 4 (sd 11.24) days and females 1.85 (sd 2.94) days. However, excluding one male subject who was treated conservatively over a period of 50 days, the male average time reduces to 1.43 days (sd 1.56), bringing it broadly in line with the larger female group. Most studies report that the average length of stay to operation was 27 hours to 3.4 days (Saarenpää, 2006; Beringer, 2006; Hommel, 2008).

Besides the attempt at conservative management other reasons for delay included subjects being too medically unstable due to coagulatory/respiratory disorders increasing risk of surgery. Previous studies have reported delays due to a variety of factors such as unavailability of operating theatres, unavailability of surgeons, anaesthesiologist or nursing staff, investigation of the subject’s preoperative medical condition, waiting for routine medical consultation or clearance, waiting for family discussion, waiting for laboratory results, waiting for stabilisation of medical problems, and late admissions (Hommel, 2008; Shiga, 2008).

The length of time from admission to operation has not been shown to result in better survival prognosis, and the relevant subjects in this study, one male and one female, each had two day delay from admission to operations, consistent with the mean. Smektala (2008) reported that elderly patients with an isolated proximal femoral fracture and a short length of stay to surgery did not have a better survival prognosis compared with longer (12-36 hours) or very long (more than 36 hours) time to surgery.
4.4 Outcomes Following Hip Fracture (n=33)

There were no significant differences observed for the functional outcomes measured in this study, namely hand grip dynamometry, Berg Balance Scale, Timed Up and Go, and the Six Minute Walk Test, used at 3 and 15-months. There were some significant changes in extended activities of daily living. Significant changes were seen for joint range of movement at the hip joint (abduction) and a decrease in muscle strength in the ankle.

Hand grip strength was found to slightly improve over the study time period but was still lower than the average score reported for this age group. Weak hand grip strength can identify those at risk of disability and holds the potential for use in the prognostication of survival among elderly people. Ling (2010) found that low hand grip strength was associated with higher rates of cardiovascular disease, lower cognitive function, depression, and ADL impairment.

In the subjects studied the average right hand grip strength recorded ranged between 11.59 kg at 3 months to 10.80 kg at 15 months whereas the average left hand grip strength ranged between 11.24 kg to 11.56 kg, respectively. Beloosekey (2010) noted that grip strength though a common measure, has only been occasionally used as an indicative measure for outcome of different aspects of hip fracture. In extending it to be used in combination with a Functional Independence Measure (FIM), at one week post-op for a hip fracture it can be used to correlate with functional outcome at 6-months. For healthy adults, the average scores recorded for hand dynamometry were broken down by gender for those ≥70 years the scores ranged between 29.4 to 31.8 kg for males and for 16.4 to 17.2kg for females (Schlüssel, 2008). Hand grip strength for those who were minimally impaired elderly frail subjects (≥ 80) the scores were 23.9 to 22.5 kg for males and 16.4 to 17.7kg for females (Shechtman, 2004). What we can observe is that hand grip strength showed a slight change over the study period, but was very poor for this hip fracture group, when compared to the frail elderly and to that of a similarly aged but healthy population.

Balance impairment has been documented as one of the causes of falls and fractures in the elderly and the Berg Balance scale is a commonly used balance assessment used in the elderly. The Berg Balance scores of the hip fracture subjects decreased
slightly over the study period from 39.16 (sd 14.48) at 3 months to 38.44 (sd 14.04) at 15 months though this was not a significant change. These scores fall between the range of scores for another hip fracture study, where the authors identified that non-fallers with average scores of 44.7 and fallers with average score of 31.0 (Shumway-Cook, 2005).

The TUAG is a simple functional assessment for risk of falls in the older person. There were no significant differences between the scores at 3 and 15 months post fracture (p>0.05). The mean scores improved from 29.90 (sd 18.99) seconds to 27.27 (sd 18.76) seconds over the time period. In a previous study those requiring more than 30 seconds to finish the test tended to require assistance with activities of daily living (ADL), while those who finished the test in less than 20 seconds tended to be independent (Podsiadlo, 1991; Siggeirsdóttir, 2002). This is consistent with the findings in this study, where they also had low NEADL scores at three months and at 15 months. However, the cut-off TUAG score between fallers and non-fallers for hip fractures is 24 (Kristensen, 2007) therefore this group, despite the improvement, were still at a high risk of falls at 15 months.

Endurance and exercise tolerance were measured to address subjects’ ability to carry out activities of daily living. Improvements were seen in the mean distance covered of 165.25 metres (sd 85.34) at three months to 193.08 metres (sd 110.98) at 15 months post fracture though there were no significant differences were observed. The distances covered were lower than those reported for community dwelling older adults of 392 to 572 metres (Steffen, 2002) and the 631±93 metres (range 383 – 820) (Troosters, 1999). Latham (2008) reported that the distances covered by hip fracture patients at 12 weeks using a mobility aid was 206.8±133.2 metres and with no mobility aid 412±122.9 metres.

Range of movement was assessed bilaterally as marked flexion deformities could be due to arthritic and muscular changes present in the joints prior to fracture; or the result of lower limb oedema and pain in lower limb post fracture (Kristensen, 2009). Significant differences were noted for hip abduction range of movement for both lower limbs between 3 and 15 months post fracture with average improvements between 22 to 28 degrees in both lower limbs.
Lower limb muscle strength was measured using the manual muscle test using the Medical Research Council (MRC) Scale for muscle testing (Kendall, 1983; Anderson, 2000). Significant differences were noted in strength for left ankle dorsiflexion and plantarflexion and right plantarflexion only. Ankle strength was weaker at 15 months, and ankle weakness can lead to impaired balance and therefore increase the risk of future falls in this population.

4.5 Post-operative Inpatient Rehabilitation (n=81)

In this study full weight bearing was indicated in 38% of subject’s post-surgical fixation for the hip fracture. The average number of treatments (typically transfers, mobility and stairs assessments) received while an inpatient was 18.23 (sd 18.99) ranging from 2 to 83 sessions. Penrod (2004) reported that having three or four post-operative physiotherapy sessions increases the patient’s chances of independent mobility at 6 months. Conversely, Handoll (2008) reported that there was insufficient evidence from a randomised controlled trial to determine the effects of early weight bearing after internal fixation of an intracapsular fracture.

4.6 Discharge Destination and Secondary Rehabilitation (n=81)

The post-discharge destination of the subjects in this study was as follows: 51% to secondary rehabilitation facilities, 23% returned directly home, and 16% went to long-term care. In a Swedish study Thorengren (2005) reported that 67.1% of patients that came from home returned to their home at 4 months; 7.7 % lived in an old person’s home, 8.9% to nursing home while 6.8% were still in the acute hospital. Heikkinen (2005) reported that only 6% of observed Finnish patients returned directly home from an acute hospital with the rest going onto rehabilitation/long-term care. According to Koval (1994) predictive factors of hospital to home discharge are younger age; independent walking before fracture and in the early post-operative period; able to perform activities of daily living; and having another person at home.
4.7 Extended Activities of Daily Living (n=33)

The NEADL score for activities of daily living showed significant differences between pre-fracture and 3 months post fracture; and pre-fracture and 15 months. At 3 months subjects reported a significant drop in their mean scores from 47.61 (pre-fracture) to 35.55 (3 months) and 39.45 (15 months). These subjects were well below their pre-fracture activities of daily living at 15 months post-fracture. Kirke (2002) showed a significant decline in activities of daily living in the two years’ post hip fracture in women. Whereas other studies reported improvements in ADLs between 4 and 6 months and minor improvements after this time period. One study reported that 50% had regained independence with ADLs at 6 months while 35% required assistance and 15% remained totally dependent (Heikkinen, 2005; Jamal, 2010). The current observations are consistent with what was reported in the latter two studies as the subjects showed improvements between pre-fracture and 3 months, and between pre-fracture and 15 months, however they did not return to their pre-fracture levels of ADL function. A review of the present study group at 24 months may have determined if they continued to exhibit the same level of significant decline seen in a two year study by Kirke (2002).

4.8 Analysis of Secondary Rehabilitation after Hip Fracture (n=81)

The average length of stay in the secondary rehabilitation facilities, Clontarf Orthopaedic hospital and Cois Ceim Unit, were 24 and 45.18 days respectively. The reason for the increased length of stay in the Cois Ceim group was due to a number of factors including limited access to all the members of the multi-disciplinary team and other social issues for the patient which would delay discharge. Clontarf Orthopaedic hospital has a daily physiotherapy service and a fully equipped physiotherapy gymnasium. However, 90% of subjects who were admitted to the Cois Ceim Unit were discharged home compared with 77% for Clontarf. This was due to the fact that a definite discharge plan had been put in place prior to discharge from the acute hospital. Subjects were also at a better physical functional level (requiring at most assistance of 1) than those who were discharged to Clontarf. It should be noted that it was not possible to identify the length of stay for four people
who were reported to have been discharged to Clontarf on discharge from the acute hospital.

4.9 Health Service Utilisation post Hip Fracture (n=33)

At 3 months post hip fracture, approximately 24% (n=8) of subjects were seen by a physiotherapist either in the community, outpatient service or day hospital, and at 15 months this increased to 46% (n=15). This meant that there were 36% (n=12) subjects who had no contact with a physiotherapist after their hip fracture. It should be noted that the researcher was reliant on the subject remembering if they were seen by a physiotherapist and they may have had some difficulty identifying differences between some professional roles, for example a physiotherapist and occupational therapist.

Other services that had been accessed in the community by the study subjects included the Community Reablement Unit (CRU) which is a two week inpatient multidisciplinary service for people in the community who are experiencing falls and are referred by their GPs. In our study there were two (8%) subjects who had been referred to this service. Another subject was attending the outpatient physiotherapy within the department after suffering a Colles fracture at 12 months post hip fracture after slipping on ice.

According to the HSE National Guidelines on Falls and Fracture (2008), of 14 local health offices that provided details of their physiotherapy services in their area, only three offered a multidisciplinary falls service; and of 10 non-acute hospitals, only two offered a multidisciplinary falls service. The other issue that arises for the community services is the presence of waiting lists for physiotherapy.

At 15 months, subjects reported that the greatest contact was with the GP (69%) followed by the PHN (50%) and physiotherapy services (46%), OT (30%) and social worker (15%). Nursing and physiotherapy contact following the fracture seemed to be slightly higher in our study than for previous studies regarding contact with health services post fracture. Wiktorowicz (2001) reported that the level of nursing contact was 25%, physiotherapy 42%, and occupational therapy 19% at 12 months. While Kirke (2002) showed that physiotherapy visits for hip fracture patients was 37.7%, PHN visits 25.7%, day centre visits 16%, meals on wheels (MOW) 17.3%, home
help (HH) 31.6%. The difference noted in Kirke’s study may be attributable to the differences regarding how the study was conducted, with physiotherapy assessment taking place as part of this study while Kirke used a questionnaire approach. Our study did not evaluate the other services available in the community reported by Kirke such as day centres, home help services (HH) or meals on wheels (MOW).

4.10 Readmission Rate (n=81)

High readmission rates are common within the first year post hip fracture due to complications following hip fracture, concurrent medical problems and low physical reserve or evolution of co-morbid conditions prior to the fracture (Teixeira, 2009; Ottenbacher, 2003; Boockvar, 2003). During the 15 month study period, 26% of subjects had further hospital admissions with 6% readmitted twice while 2% died during the time period. This was similar to the 32% readmission rate reported by Teixeira (2009). Some studies found re-operation rates of 9% to 15% between 6 and 12 months post fracture (Heikkinen, 2005; Hommel, 2008). Only one subject in our study had to have more surgery due to hip and back pain after their initial operation. Readmission rates tend to be lower in teaching hospitals (similar to this study) and the reasons identified were explained by the existence of multidisciplinary teams (including geriatricians), and studies have indicated the positive impact of orthogeriatric services for hip fracture outcomes and a significant decrease in associated readmission rates (Teixeira, 2009; Friedman, 2008; Fisher, 2006).

4.11 Secondary Falls Prevention (n=33)

Poor footwear has been studied as a contributor to falls in the elderly. Panel on Prevention of Falls in Older Persons AGS and BGS Clinical Practice Guidelines (2011) have added footwear and foot assessments as fall risk factors in its most recent clinical practice guideline for the prevention of falls in older persons. Most subjects in this study were wearing regular footwear at 15 months and not slippers as they had been at the 3 month assessment. Two subjects were wearing orthotic footwear for a leg length discrepancy, and no females were wearing high heels at 15
month post fracture. More males were wearing footwear with fixation at 15 months and heel height had reduced to less than 5 cm (except orthotic footwear). The most common footwear worn at 3 months was the Moccasin and walking shoe while at 15 months it was the walking shoe and court shoe. Footwear assessment forms such as the one reported by Menz and Sherrington (2000) have limitations such as reliability regarding sole hardness, and evaluation of the shoe to accommodate structural deformities of the foot. This study was limited to the simple categorisation of footwear type, fixation and heel height only.

Three subjects were found to have had a lower limb discrepancy post hip fracture of 0.5 to 1 inch. Footwear clinics are limited within the community so they were referred for assessment to the Orthotist. Lower leg discrepancy has several negative consequences for the patient such as sciatica, chronic back pain, hip dislocation, a limp and possibly revision surgery. It should be noted that studies on leg length discrepancy have been limited to studies on subjects who had total hip replacements for osteoarthritis and not hip fractures (Wylde, 2009; Austin, 2003; White, 2002).

Four subjects were wearing hip protectors at the time of the incident which resulted in the hip fracture. Only one additional subject presented with hip protectors at the three and 15 month assessments. This despite the fact that all subjects would have been provided with a pair of hip protectors while an inpatient, as part of routine post fracture management, after presenting in the hospital with a fracture. Blalock (2010) identified the main barriers to wearing hip protectors were comfort, convenience, appearance, fit, and protection. Only 16% reported protective benefits while 70% mentioned the barriers to wearing hip protectors. Adherence to hip protectors for subjects from the community and hospital decreased between 62% and 40% between 3 and six months (Cameron, 2010). Kannus (2000) reported that hip fracture risk can be decreased by 60% by wearing a hip protector in frail older people. They noted that the rate of other fractures in the hip protector group meant that they were no more attentive to the risks of falling compared with the control group. As this study was a large study conducted on subjects living in long-stay facilities as well as those living in the community that this study supported the benefits of wearing hip protectors.
4.12 Pain and Falls post Hip Fracture (n=33)

Pain is rarely recorded for hip fracture patients due to its subjectivity, making it difficult to study and interpret (Heikkinen, 2005), though it has an effect on function and rehabilitation. In this study, as pain decreased after four months, pain limited activities started to decrease. This finding was supported by Saarenpää (2006) who found that 32% of subjects reported no pain at 4 months.

At 3 and 15 months, two subjects reported chronic arthritic pain in the hip and back prior to the hip fracture. The recording of pain was the same across both time periods with scores ranging between 5 and 8 on the visual analogue scale.

In the subjects who reported pain post hip fracture, three had back pain, seven had hip pain and one had both back and hip pain. Those reporting pain at 3 months reported it ranging from 2 to 10 on the visual analogue scale with average pain score of 4.5. Of these, 9 patients (35%) reported no pain at 15 month review and one reported worsening pain in the hip. This was slightly higher than 32.2% reported at one year post fracture for a study by Rosell (2003). Of the 13 subjects who reported having no pain at 3 month assessment only one complained of back pain at 15 months post hip fracture.

In this study 9 subjects (35%) reported having 2 or more falls over the 15 month time frame of which 8 reported injuries ranging from: bruising and lacerations (19%); bump on the head (8%); and a Colles fracture (4%). A previous study on Irish women with hip fractures reported that only 45.7% were likely to report further falls with 11.1% being frequent fallers (3 or more falls) (Kirke, 2002). Miller (2009) reported that 41% of subjects fell once within the first 12 months post fracture with 46% reporting an injury such as bruising/bleeding, fracture, and head injury.

4.13 General Mobility Outcome after Hip Fracture (n=33)

The factors that have been reported to be associated with recovery of walking ability are younger age, male sex, absence of pre-existing dementia (post-operative delirium), and use of a cane or walker before fracture. Patients who had regained their previous level of mobility had poorer ability to walk pre-fracture than those
who did not regain pre-fracture level of walking ability (Koval, 1994). Heikkinen (2005) found that 59% of subjects at one year had retained their walking ability achieved at 4 months post fracture; 26% had improved while 14% had deteriorated. While Rosell (2003) reports that mobility of survivors was significantly reduced with 38% requiring a frame to walk and those able to walk without aids fell from 59% to 26% at one year. This reduction in mobility is matched by a reduction in level of independence in ADL.

In this study, all subjects reported being independently mobile indoors prior to hip fracture. This changed to 90% (n=30) at 3 months and 70% (n= 23) at 15 months post hip fracture. Outdoor independent mobility was recorded for 85% (n= 28) of subjects pre-fracture, with 79% (n= 26) at 3 months, and 64% (n= 21) at 15 months post hip fracture.

Lin (2004) reported that 73.8% of patients could walk outdoors independently pre-fracture, 58.2% at one year post fracture with 27.3% not able to walk outdoors. It also found that the ability to walk outdoors pre-fracture was a significant predictor of functional recovery from hip fractures. In our study only 54% were independently mobile pre-fracture and 31% did not regain their pre-fracture level of independence at 15 months. In Beringer’s study (2006) 45% of subjects reported independent mobility outdoors pre-fracture falling to 40% at 12 months. Our subjects had a poorer functional recovery of their level of independence for outdoor mobility.

Rosell (2003) reported that 60% of survivors were housebound prior to fracture and after fracture this increased to 64%. While in our study only 4% reported that they were housebound prior to fracture which increased initially at 3 months to 15% partially because some patients were still inpatients within the hospital or a nursing home, yet it decreased to 8% at 15 months. A study by Lin (2004) recommended that residences for elderly patients should be arranged on the first floor or equipped with elevators to make it easier to walk outdoors and help them to live independently. It recommended that family members should encourage independence by allowing patients to walk outdoors unaccompanied.

Study subjects who were using the stairs pre-fracture (58%) decreased at 3 months (45%) and again at 15 months (30%). The use of a stair-lift increased from 15% at 3 months to 23% at 15 months. The direction of the usage is consistent with that
reported in the literature. Guccione (1996) reported that on discharge from hospital only 13% could climb stairs prior to discharge. Lin (2004) found 49.1% could climb stairs independently at one year post fracture. Rosell (2003) reported that of 44.2% of subjects were able to use stairs prior to fracture only 31.1% were able to use them at one year post fracture.

The level of dependence with transfers lying to sitting increased slightly between 3 and 15 months post fracture from 19% to 23%, respectively. Transfers such as sitting to lying and transfers sit to stand required more assistance between 3 and 15 months post fracture. Kirke (2002) reported a 14% decrease in the ability to get out of bed and a 10.4% decrease in the ability to get up from a chair at one year post fracture compared to the patient’s pre-fracture level. In our study we did not ask patients regarding their pre-fracture abilities regarding transfers as we had with mobility. The primary transfer issue in our study seemed to be the ability to get into bed and up from a chair.

At 15 months there was a decrease in the numbers of subjects requiring assistance with turning onto right or left side (23% to 15%). Subjects had noted that turning onto operated side was uncomfortable due to a feeling of tenderness over the site of the prosthesis at 3 months. None of the literature reported specifically on bed mobility with respect to turning onto the side. However, such a study would be of benefit to those subjects who had a hemiarthroplasty whose bed mobility had been restricted for the first three months post-operation. These patients had the disadvantage of having to get up from a supine to sitting position. For these subjects, an assistive device, or assistance of another person is required in order to accomplish the task. It would be advantageous to be able to roll onto their side to get out of bed to facilitate independence with transfers after that time period.

4.14 Summary

The aim of this study was to review the functional outcomes (endurance, falls risk, balance, and hand grip strength), lower limb range of movement and strength, and activities of daily living of the hip fracture population over a 15 month period. These were the key areas addressed. The group composition was similar to that seen in
similar studies in terms of age, gender composition, and fracture type. The mortality rate, though low was aligned with that reported by Haentjens (2007). The length of hospital stay before surgery in this study was skewed somewhat by a small number of subjects who had delays for different reasons, but the time to the operation was not correlated with overall prognosis.

This study found that the length of stay within the hospital post hip fracture was longer than length of stay reported in other studies conducted outside of Ireland. There are a number of reasons for this, including the differences in the health service structure which make it difficult to do direct comparisons.

In terms of the outcome of the study group, grip strength was often measured and identified as a measurement tool for assessing falls risk, though there were limited direct correlations available for hip fracture patients. Post-operative inpatient rehabilitation was presented, though not examined in detail in terms of the efficacy of the treatment on the group.

In reviewing the discharge destinations, it was similar to some studies, but the reporting in the literature is difficult to compare due to the differences in approaches of other health systems, allied to the timescales of those studies. The NEADI. scores for the group declined over the 3 and 15 months, consistent with other studies over shorter time periods, and one over a longer period. The readmission rate for the study group was lower than that reported in other studies, though the fact that it is a teaching hospital may be a factor. In terms of secondary falls protection, the key areas discussed were those of footwear and hip protection, with the adjustment in footwear over the time period being noted. The use of hip protectors did not change significantly within the group over the course of the study. While the better the initial mobility status of the subject prior to the fracture, for indoor and outdoor mobility, the better outcome at the 15 month post-fracture stage.

4.15 Limitations of the Study

- The challenges of conducting research for this elderly hip fracture group was reflected in the level of recruitment for the study overall. There were challenges at the consent phase of the study, and in some cases, the next of kin/the person themselves did not feel capable of participating in physiotherapy assessments.
because of their age. In some instances they refused assessment after initially consenting to participate while further drop outs occurred between 3 and 15 months. Of the 150 subjects who were approached 81 had consented to participate in the study but only 57 randomised subjects attended for assessments within the larger RCT. Therefore, the numbers for the early assessment group consisted of thirty-three randomised subjects. This may have led to a healthier group of subjects attending for assessment.

- There was a long interval between the consent phase and three month assessment, it was possible that subjects may have mislaid the study details and this could have been a factor in relation to the numbers attending.

- The focus in this study was on the outcomes of elderly hip fracture patients at 3 and 15 months. While the majority of changes were not significant, the small sample size means that the study may not be generalised to the entire hip fracture population.

- Manual muscle testing using the Medical Research Council (MRC) scale was dependent on the strength of the tester and their ability to offer resistance through the available range of movement. All tests were conducted using the same testing positions among all subjects. A stationary dynamometer attached to a fixed instrument as reported by Hourican (2008) would have increased precision but was not available, and as a result the manual muscle testing of strength was used. A pilot test to review outcome measures such as leg length discrepancy, joint range of movement and muscle strength was not conducted in this study but the tests were completed with all patients adopting the same testing positions for each outcome measure using standardised techniques.

- It was difficult to ensure that subjects attended for assessments. Some subjects were still inpatients at a secondary rehabilitation unit and were unable to attend for the appointment. Others had recently returned home and were still in the process of readjusting to their home environment with a new disability. While other subjects reported that they didn’t require assessment as they were getting on well at home; some felt they couldn’t leave their home; some reported that
they had too many other hospital appointments (orthopaedic outpatient appointments, physiotherapy appointments, etc.); some were not interested in attending; or there was no response to attempts to contact via phone or letters.

- At the three month assessment the subjects were seen by the CNS for an hour followed by physiotherapy which for some subjects could have been quite tiring but all subjects were willing and able to complete all the assessments. At 15 months they were assessed by the ortho-geriatric registrar and CNS at a general outpatient clinic followed by physiotherapy assessment. However, in the case of the 15 month assessment the majority of subjects were assessed on a separate day as subjects would be too tired after waiting in clinic.

- A home visit option was offered to some subjects who were unwilling to attend the hospital for their assessments but, the home visit had an impact on the standardisation of testing procedures and the ability to complete some of the tests in particular the 6 MWT.

- This study was underpowered due to the small sample completing the 15 month assessment

4.16 Recommendations for Further Study

- The challenges of conducting research for this elderly hip fracture population was reflected in the level of recruitment for the study overall. It is likely that other models need to be considered for research and the delivery of rehabilitation, for example conducting research as part of an outreach programme.

- It is important to include several contact strategies in doing research with this group, many in this study did not wish to attend the hospital again for their follow-up assessments for a number of reasons (they didn’t feel they could leave their home; they had too many other hospital appointments, not interested in attending).
- Assessments included in a study of hip fracture outcomes need to be transferable to a home setting.

- Reduction in the number of functional outcome measures used in the assessments (Timed up and Go instead of the Berg Balance scale; or 10 metre walking test instead of 6 minute walking test; or assessment of hip strength and ROM only). A Pilot study is required to review the needs for all outcomes required.

- Conducting the study within the subjects’ community treatment settings. If done on a post-discharge basis, it would be more feasible, and were it to use a four month time period would align quite well with some of the more recent literature.

- The poor functional outcomes after hip fracture for the elderly are consistent with other study findings, the next step would be an evaluation of current rehabilitation programmes and how they are accessed and delivered to ensure more optimal outcomes.
CONCLUSION

The aim of this study was to assess the functional abilities of subjects with hip fractures at two post fracture time intervals. There were slight improvements in the functional outcome measures of each test except the Berg Balance scale. The subjects in this study were identified as having a significant risk of falling at 15 months post fracture. Significant differences were noted for the NEADL between pre fracture and 3 months, and pre-fracture and 15 months. A slight improvement was seen in the NEADL between 3 and 15 months but subjects did not return to the pre-fracture baseline level of function. This study showed that the elderly hip fracture population are still at risk of falling and of sustaining future fractures.

The main finding of this study were that this population are still restricted in their ability to complete functional tasks and their activities of daily living when compared with their pre-fracture level. However, only a third of those who consented for the study presented for assessment. Though, the focus of this study was to reflect on the functional outcomes for hip fracture patients using resources that are already in place. Attending for the early assessment allowed an opportunity for us to refer for community, day hospital based physiotherapy intervention, or other services as required (e.g. Orthotist, Pain team, etc.). However, it was not the aim of this study to provide the intervention received through these services. In the context of epidemiological changes in the older population and increasing falls incidence, the area of hip fracture management requires further attention. The management of patients in this acute hospital is consistent with the delivery of acute fracture care and rehabilitation in many Irish acute hospitals. The poor outcomes of the group are also consistent with previous work but, what is apparent from this study are the methodological challenges in conducting research in this group and the need to review management following discharge from hospital. The patients in this study had on-going falls risks and a significant number were accessing on-going therapy.

No significant functional improvement was found after 3 months despite significant in-patient input (compared with other countries) and further physiotherapy or rehabilitation input post discharge. There is a need to re-evaluate the current model
of care for elderly post hip fracture patients in order to improve the effectiveness of our interventions for this cohort. In view of the ageing of society and limited healthcare budgets, it is increasingly important to conduct more research, in the form of randomised controlled trials with an economic component to evaluate the clinical and cost effectiveness of models of multidisciplinary care following hip fracture for the elderly.
Appendix 1  Medical Research Ethics Committee Approval

THE ADELAIDE & MEATH HOSPITAL, DUBLIN
INTEGRATING THE NATIONAL CHILDREN’S HOSPITAL
PALLAIGHT DUBLIN 24, IRELAND
TELEPHONE +353 1 6412000

Ms. Niamh Maher
Falls and Osteoporosis Service
Hospital 4 Top Floor
St. James’s Hospital
James Street
Dublin 8

March 12th 2008

Re: Post Hip Fracture in Older Adults: Interventions and Strategies for Improving Outcomes.

Please quote this reference in any follow up to this letter: 2008/02/06 Chairman’s Action

Dear Niamh,

Thank you for your recent submission of the above proposal to the SJH/AMNCH Research Ethics Committee. The Chair, having reviewed the proposal, has given ethical approval on behalf of the Committee.

Yours sincerely,

Daniel R. Lynch,
Secretary,
SJH/AMNCH Research Ethics Committee
Appendix 2  Amendment of Observational Study Ethical Approval Request

Falls and Osteoporosis Service
St. James Hospital
James Street,
Dublin 8
Tel: (01) 4182370
18/06/08

Mr Dan Lynch
SJH/AMNCH Research Ethics Committee

Re an amendment to the study titled: "Post hip fracture in older adults: interventions and strategies for improving outcomes. The role and function of the CNS within an elderly falls unit." - approved by REC on 28/02/08

Dear Mr Lynch,

We propose to make a small amendment to the above study. As you may recall this is a study where consenting patients who present to SJH with a hip fracture over an 18 month period will be randomised to an early assessment at 3 month post discharge or usual care with all patients being further assessed at 15 months. Any problems identified at the 3 month assessment will referred to appropriate services for further management. The aim is to see whether an early targeted assessment is more efficient in identifying problems in a timely fashion than waiting for problems to be flagged by the patient or GP as they arise (which is the current practice). As it stands the 3 and 15 month assessments will be made by a Clinical Nurse Specialist with support from a
medical registrar as appropriate. The CNS will be performing a range of cognitive, psychosocial and balance tests.

Proposed amendment: After discussion with the physiotherapy department manager (Niamh Murphy) it is now proposed that the balance assessments at the 3 and 15 month visits will be carried out by a physiotherapist rather than the CNS (the physiotherapist in question is Ms Sheila McCarthy, an employee of the hospital and the senior physiotherapist at the Robert Mayne Day Hospital which currently provides treatment to this patient grouping when relevant). No additional tests will be carried out so the length of the assessment is unchanged. If you need any further information please do not hesitate to contact me.

Yours

Niamh Maher
CNS Falls and Osteoporosis
Appendix 3  Ethical Approval of Amendment request

30 July 2008,

Re: Post hip Fracture in Older Adults: Interventions and Strategies for Improving Outcomes. The Role and Function of the CNS within an Elderly Falls Unit.

Please quote this reference in any follow up to this letter: 2009/23/06

Dear Niamh,

Thank you for your letter dated June 16 2008 in which you request ethical approval of an amendment to the above referenced study. The Vice-Chair, on behalf of the Research Ethics Committee, has given ethical approval to this request.

Yours sincerely

Daniel R. Lynch,
Secretary,
SJH/AMNCH Research Ethics Committee
Appendix 4  Patient Information Pack

Falls and Osteoporosis Service  
Hospital 4 Top Floor  
St. James's Hospital  
Dublin 8  
Tel: (01) 4162370/4284090

Study Title:  
Post hip fracture in older adults: interventions and strategies for improving outcomes.  
The role and function of the Clinical Nurse Specialist within an elderly falls unit.

Thank you once again for agreeing to participate in the study. As was previously mentioned participants are randomly assigned to one of two groups, the assessment group or the control group. You have been assigned to the assessment group, which involves a detailed assessment by myself, Niamh Maher, and a physiotherapist.

Enclosed you will find some questionnaires which we ask you to complete and bring with you on the day of your appointment.

If you have any queries please do not hesitate to contact me at the above numbers.

Thanking you once again.

Yours sincerely

Niamh Maher
PATIENT INFORMATION LEAFLET

You are invited to take part in a research study. Please take time to read the following information carefully as it should help you decide whether or not you wish to take part.

Title of study
Post hip fracture in older adults: interventions and strategies for improving outcomes.
The role and function of the Clinical Nurse Specialist within an elderly falls unit.

Why have you been chosen?
All patients attending St James’s hospital for treatment of a hip fracture will be invited to participate in this study.

Do you have to take part?
No – it is entirely your decision. But if you wish to take part, you will need to sign a consent to participate. A decision not to take part will NOT affect any future visits to this hospital.

Reason for the study
As part of a PhD in Gerontological Nursing at the University of Dublin, Trinity College, I would like to assess risk factors which may contribute to falling in patients who have had a hip fracture, their bone health status and their osteoporosis knowledge and compliance with medication. Also I hope to identify the role of the Clinical Nurse Specialist in referring these people to specialist services if they are needed.
Procedures

If you agree to take part in this study a number of test will be carried out. These tests will be conducted by myself, Niamh Maher (a clinical nurse specialist), a medical doctor and a physiotherapist. The tests which we will carry out are as following.

1. Cardiac tests: These are explained on a separate sheet.

These tests run the risk of making you feel weak or and blackout.

The Carotid Sinus Massage has a 1 in 4000 risk of resulting in a minor stroke which usually resolves. This test will be carried out only with your permission.

2. A nutritional assessment test which is a short questionnaire to help identify if you need to see a dietician.

3. A physiotherapy assessment which will incorporate the following
   - A gait assessment: This requires you to walk 5 meters and back again.
   - A timed get up and go test, which will require you to stand up from sitting and walk 13 feet and back again to the chair while the physiotherapist times you.
   - A hand grip test which will assess the strength of your hand grip
   - A balance test called the Berg Balance test.
   - An assessment of the strength of your lower legs (calves).

4. An eye test

5. A hearing test

6. A short test of your memory called a mini mental test which consists of 10 questions.

7. You will be asked to fill out a short questionnaire on your quality of life, on what you know about osteoporosis and whether or not you are taking your medication for osteoporosis.
8. You will have a DXA scan (as x-ray of your hip and spine to assess the density of your bones) if you have not already had this done when you were in hospital.

9. Blood tests will be taken.

10. A heel ultrasound will be performed to assess your risk of osteoporosis. Please wear socks/stockings to simplify this test.

11. A nail clipping of your right thumb will be taken.

Should you agree to participate, transport will be arranged to bring you to the Robert Mayne Day Hospital and home again. This assessment will take place in the Falls and Osteoporosis clinic, Hospital 4 Top Floor, St James’s Hospital. Because of the number of tests involved it is expected that it will take approximately two hours or more to complete. Lunch/sandwiches will be provided. Transport will then bring you home again about 3-3:30pm. If this time does not suit a taxi can be organised for you.

We will then ask you to return in 12 months time to complete these tests again to help us identify if there is any changes.

**Are there risks from taking part?**

It is guaranteed that your participation in the study will have no bearing on future attendances to the Bone Health Clinic in St. James’s Hospital. The information that we receive from these tests may help us give a better service in future to patients who suffer a hip fracture with particular emphasis on follow up of these patients.

The risks identified above concerning the cardiac test are the only ones foreseen at this point. The carotid sinus massage will be excluded if you do not wish to have it performed. You can still take part in all or some of the other assessments as you feel appropriate.
Benefits of participation in this study

If you participate in this study it will enable us to identify risk factors that you have which may increase your risk of falling.
Should any such risk factors be identified referral to the required specialist eg Physiotherapy, eye specialist, dietician, memory clinic etc will be made for you.
Participation in this study will lead to a more intense medical follow up post fracture.

Will taking part in this study be kept confidential?

Yes - Your identity will remain confidential. Your name will not be published and will not be disclosed to anyone outside the hospital.

What will happen to the results of the research study?

The completed research study will be submitted to the University of Dublin, Trinity College, in June 2007 as part of a PhD(Doctorate) in Gerontological Nursing. There is a possibility that the results of this study may then be published in a professional journal, or at a meeting. You cannot be identified in any report or publication. The results of the tests and information that you give in the questionnaires will not be used for any other reason or in any other study.

Who has reviewed the study?

The study has been reviewed by, the Hospital Ethics Committee, the Patient Advocacy Committee, St. James's Hospital and the School of Nursing and Midwifery Ethics Committee, University of Dublin, Trinity College.

Compensation

This study is covered by standard institutional indemnity insurance.
Nothing in this document restricts or curtails participant's rights.
Contact for further information

You may contact me at this address or telephone number below for any further information, or problems you may have with this study.

Niamh Maher,
Clinical Nurse Specialist,
Falls and Osteoporosis Clinic,
St. James's Hospital

Contact telephone number: (01) 4162370.

I will be in contact with you by phone prior to the bone health clinic appointment which you have received with this letter, to find out if you wish to participate in this study.

A decision not to participate has no bearing on this bone clinic appointment. It is important that you keep this appointment.

Thank you for taking the time to read this information sheet – I hope you will feel able to take part in this important study.
Appendix 5  Consent Form

SJH/AMNH RESEARCH ETHICS COMMITTEE.
CONSENT FORM

Title of research study:
Post hip fracture in older adults: interventions and strategies for improving outcomes. The role and function of the CNS within an elderly falls unit.

This study and this consent form have been explained to me. All my questions have been answered to my satisfaction. I believe I understand what will happen if I agree to be part of this study.
I have read, or had read to me, this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction. I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I understand that data from this study will be kept for a period of 5 years and that this material will not be used in future unrelated studies without further specific permission being obtained.
I have received a copy of this agreement

PARTICIPANT'S NAME:

PARTICIPANT'S SIGNATURE:

Date:
Date on which the participant was first furnished with this form:
Where the participant is incapable of comprehending the nature, significance and scope of the consent required, the form must be signed by a person competent to give consent to his or her participation in the research study (other than a person who applied to undertake or conduct the study). If the subject is a minor (under 18 years old) the signature of parent or guardian must be obtained:-

NAME OF CONSENTOR or GUARDIAN:

SIGNATURE:

RELATION TO PARTICIPANT:
Where the participant is capable of comprehending the nature, significance and scope of the consent required, but is physically unable to sign written consent, signatures of two witnesses present when consent was given by the participant to a registered medical practitioner treating him or her for the illness.

NAME OF FIRST WITNESS:  
SIGNATURE:

NAME OF SECOND WITNESS:  
SIGNATURE:

Statement of investigator's responsibility: I have explained the nature, purpose, procedures, benefits, risks of, or alternatives to, this research study. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

Physician's signature:
Date:
Appendix 6  Mini Mental State Examination

Mini Mental State Examination (Adapted)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Date of Birth</th>
<th>Date of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Orientation (maximum score 10)
   What is today's date?
   Can you also tell me the day of the week it is?
   And the month?
   And the year?
   What date does St. Patrick's Day fall on?
   What town or city are we in?
   Name two main streets nearby.
   What is this address?
   Who is the Taoiseach?
   Who is the President of Ireland?

2. Registration (maximum score 3)
   I now would like to test your memory.
   (Name 3 common objects: e.g. "ball, flag, tree")
   Can you repeat the words that I have said?
   "ball"  
   "flag"  
   "tree"  
   (The first repetition determines the score 0-3), but keep saying them (up to six trials) until the patient can repeat
   all three words.

3. Attention and Calculation (maximum score 5)
   Beginning at 100 can you serially subtract 7 giving me the answer every time?
   "93"  
   "86"  
   "79"  
   "72"  
   "65"  
   Alternatively
   Please spell the word "WORLD" backwards.
   "D"  
   "O"  
   "R"  
   "L"  
   "W"  

IV. Recall (maximum) score 3
   What were the three words I asked you to repeat earlier?
   "ball"  
   "flag"  
   "tree"  

V. Language and Parietal skills (maximum score 9)
   Naming
   Show the patient a wristwatch and ask "What is this?"
   "Watch"  
   Repeat for a pencil.
   "Pencil"  
   Repetition
   Ask the patient to repeat the sentence "No ifs, ands or buts."
   Correct repetition
   Reading
   Show the patient the accompanying card (in pocket), which contains the instruction "Close your eyes" and
   request the patient to do what it says.
   "Close eyes"

Writing
   Tear of this sheet and use the reverse of the page to ask the patient "Can you write a short sentence for me?"
   "Writes sentence"

3-Stage Command
   Give the patient a piece of paper and say "Take this paper in your right hand, fold it in half and put it on the table."
   "Takes in right hand"
   "Folds in half"
   "Puts it on the table"

Copying
   Again, on the reverse of page ask the patient to copy the drawing that appears there.
   "Copies drawing correctly"

Total


R446

94
Write a short sentence in the box below

Please copy the drawing
Appendix 7  Results for Early Assessment Group

Table 1 Baseline Characteristics of the Early Assessment Group (n=33)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N =</th>
<th>%</th>
<th>Mean</th>
<th>+/- SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (total)</td>
<td>33</td>
<td></td>
<td>81</td>
<td>8.00</td>
<td>65</td>
<td>94</td>
</tr>
<tr>
<td>Female</td>
<td>24</td>
<td>72.7%</td>
<td>82</td>
<td>7.00</td>
<td>67</td>
<td>92</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
<td>27.3%</td>
<td>79</td>
<td>9.00</td>
<td>65</td>
<td>94</td>
</tr>
<tr>
<td>Number of past medical conditions (total)</td>
<td></td>
<td></td>
<td>5.18</td>
<td>3.29</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td>5.13</td>
<td>3.27</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td>5.33</td>
<td>3.54</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Number of medications (total)</td>
<td></td>
<td></td>
<td>5.42</td>
<td>3.29</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td>5.04</td>
<td>3.26</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td>6.44</td>
<td>3.32</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Length of stay in acute hospital (total)</td>
<td></td>
<td></td>
<td>44.91</td>
<td>58.71</td>
<td>4</td>
<td>215</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td>31.58</td>
<td>40.36</td>
<td>4</td>
<td>177</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td>80.44</td>
<td>84.57</td>
<td>11</td>
<td>215</td>
</tr>
<tr>
<td>Length of time between admission and operation (total)</td>
<td></td>
<td></td>
<td>3.00</td>
<td>8.61</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td>1.38</td>
<td>1.76</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td>7.33</td>
<td>16.09</td>
<td>1</td>
<td>50</td>
</tr>
</tbody>
</table>
Table 2 Comparison of footwear type for those who attended at 3 and 15 month post hip fracture (n=26)

<table>
<thead>
<tr>
<th>Footwear</th>
<th>3 month Ax</th>
<th></th>
<th>15 month Ax</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males (n=8)</td>
<td>Females (n=18)</td>
<td>Total</td>
<td>Males (n=8)</td>
<td>Females (n=18)</td>
<td>Total</td>
</tr>
<tr>
<td>Athletic shoes</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Court shoes</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Slipper</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Boots</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Orthotic Rx footwear</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>High heels</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sandals</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Moccasins</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Walking shoes</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Fixation type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straps/buckles</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Laces</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>No fixation</td>
<td>5</td>
<td>7</td>
<td>12</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Velcro</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Heel Height</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2.5 cm</td>
<td>6</td>
<td>9</td>
<td>15</td>
<td>5</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>2.6 -5 cm</td>
<td>2</td>
<td>7</td>
<td>9</td>
<td>3</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>&gt;5 cm</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix 8  Demographic Details from the Larger Study Group (n=81)

Table 1 Summary of the documented causes of Hip fractures obtained from medical notes on admission

<table>
<thead>
<tr>
<th>Causes of Hip fractures</th>
<th>Number of subjects</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fell off chair while standing on it</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Falls without specific details</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Altered cognitive state (confused)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Alcohol related fall</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Moving furniture</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Bumped into someone</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>29 (35%)</td>
</tr>
<tr>
<td>Slips/Trips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slips/Trips on footpaths</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Slip/Trip on stairs or steps</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Trip</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Trip over doorframe</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Slip/trip in kitchen</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Slip on bathroom tiles</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Walking on wet floors</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Tripping over low stool or wash baskets</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tripping over towels/bedclothes on the ground</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Tripping on carpet</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tripped on metal grill on ground</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tripped on shoe on the stairs</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Slipped</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tripped while walking dog</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tripped over vacuum cleaner hose</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tripped on rough ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>34 (42%)</td>
</tr>
<tr>
<td>Transfers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting out of bed</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Getting up off couch/chair</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Missed chair while attempting to sit</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 (9%)</td>
</tr>
<tr>
<td>Collapse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collapse with loss of consciousness</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Legs giving way</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Dizzy spell</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 (9%)</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Cause not documented</td>
<td>2</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Other causes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non traumatic fracture</td>
<td>1</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>post strenuous walk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physiotherapy treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>complained of hip pain</td>
<td>1</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>post treatment session</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Details of the discharge destinations of patients once they have left the acute setting (n=81).

<table>
<thead>
<tr>
<th>Destination</th>
<th>Reason</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clontarf</td>
<td>Rehab</td>
<td>26 (32%)</td>
</tr>
<tr>
<td>Cois Ceim</td>
<td>Rehab (step down unit)</td>
<td>11 (14%)</td>
</tr>
<tr>
<td>Cartias</td>
<td>Rehab</td>
<td>3 (4%)</td>
</tr>
<tr>
<td>Peamount</td>
<td>Rehab (subject requested to go there as close to home)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Killipper/Brookeville/etc</td>
<td>Convalescence approximately 2 weeks with or without physiotherapy</td>
<td>6 (7%)</td>
</tr>
<tr>
<td>Long Term Care</td>
<td>Required more assistance and supervision than could be provided at home</td>
<td>13 (16%)</td>
</tr>
<tr>
<td>Main building in nursing home</td>
<td>Required more supervision than could be provided self catered apartment on the grounds of nursing home.</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Home</td>
<td></td>
<td>16 (20%)</td>
</tr>
<tr>
<td>Self discharged</td>
<td>Patient/ family decided to take patient home</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>RIP</td>
<td>RIP while waiting for LTC</td>
<td>2 (2%)</td>
</tr>
</tbody>
</table>
Appendix 9 Standardised Scores for Functional Outcome Measures Used

Table 1 The normative values for the 6 minute walk test for community dwelling older people (APA, 2005)

<table>
<thead>
<tr>
<th>Age</th>
<th>Females Mean distance (m)</th>
<th>Males Mean distance (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-69</td>
<td>538 +/- 92m</td>
<td>572 +/- 92m</td>
</tr>
<tr>
<td>70-79</td>
<td>471 +/- 75m</td>
<td>527 +/- 85m</td>
</tr>
<tr>
<td>80-89</td>
<td>392 +/- 85m</td>
<td>417 +/- 73m</td>
</tr>
</tbody>
</table>

(Steffen, 2002)

Table 2 Reference guide for the SAEHAN® Hydraulic Hand Dynamometer (Saehan Corporation, Masan, Korea).

<table>
<thead>
<tr>
<th>Age</th>
<th>Hand</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-64</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>Lb</td>
<td>89.7</td>
<td>20.4</td>
<td>55.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kg</td>
<td>40.69</td>
<td>9.25</td>
<td>24.99</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>Lb</td>
<td>76.8</td>
<td>20.3</td>
<td>45.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kg</td>
<td>34.84</td>
<td>9.21</td>
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<td>20.6</td>
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<td>75.3</td>
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<td>Kg</td>
<td>24.95</td>
<td>7.71</td>
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</table>
Table 3 Mean TUAG scores for community dwelling older adults for each decade (APA, 2005)

<table>
<thead>
<tr>
<th>Age</th>
<th>Females Mean time (SD)</th>
<th>Males Mean time (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-69</td>
<td>8 sec (SD=2)</td>
<td>8 sec (SD=2)</td>
</tr>
<tr>
<td>70-79</td>
<td>9 sec (SD=2)</td>
<td>9 sec (SD=3)</td>
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<tr>
<td>80-89</td>
<td>11 sec (SD=3)</td>
<td>10 sec (SD=1)</td>
</tr>
</tbody>
</table>

(Steffen, 2002)

Table 4 Normative values for the Berg Balance Scale (APA, 2005)

<table>
<thead>
<tr>
<th>Age</th>
<th>Males Mean (SD)</th>
<th>Females Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-69</td>
<td>55(1)</td>
<td>55(2)</td>
</tr>
<tr>
<td>70-79</td>
<td>54(3)</td>
<td>53(4)</td>
</tr>
<tr>
<td>80-89</td>
<td>53(2)</td>
<td>50(3)</td>
</tr>
</tbody>
</table>

(Steffen, 2002)
Appendix 10 Six Minute Walk Test

6 Minute Walk Test

Patient ID __________________

Date __________________

Equipment: Stopwatch, measured walkway, chairs, BORG RPE and Dyspnoea scale.

Instruction to patient: ‘When I say ‘go’", I want you to walk up and down this walkway, doing laps. I will walk with you. Walk at a pace that you think you can maintain for 6 minutes. If you get tired, short of breath, feel chest pain, or any other symptom, we will stop and have you rest until you feel ready to go again. While you rest, we let the stopwatch run, and then when you are through resting you can continue to walk for what is left of the remaining 6 minutes. We measure the total distance that you are able to walk in 6 minutes. You can begin when I say ‘go’.

Assistive device:

<table>
<thead>
<tr>
<th>6 minute walk test</th>
<th>HR</th>
<th>Resp Rate</th>
<th>SaO2</th>
<th>BP</th>
<th>Borg</th>
<th>Distance</th>
<th>Time of rests</th>
<th>Gait deviations</th>
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<tr>
<td>Resting</td>
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<td></td>
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<tr>
<td>Post walk</td>
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<tr>
<td>5 minutes post</td>
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<td></td>
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</table>

Comments: Reason for termination of test/patient comments/ physiotherapy plan/other

____________________________________________

____________________________________________

____________________________________________

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Appendix 11 Hand Grip Dynamometry

Instructions: Elbow at 90 degrees, arm NOT resting on table, or “pinned” against chest wall.

Norms:


Right Hand: 1:_____ 2:_____ 3:_____  

Left Hand: 1:_____ 2:_____ 3:_____
Appendix 12 Berg Balance Scale

Description:
14-item scale designed to measure balance of the older adult in a clinical setting.

Equipment needed: Ruler, 2 standard chairs (one with arm rests, one without)
Footstool or step, Stopwatch or wristwatch, 15 ft walkway

Completion:
Time: 15-20 minutes
Scoring: A five-point ordinal scale, ranging from 0-4. “0” indicates the lowest level of function and “4” the highest level of function. Total Score = 56

Interpretation:
41-56 = low fall risk
21-40 = medium fall risk
0-20 = high fall risk

Criterion Validity:
“Authors support a cut off score of 45/56 for independent safe ambulation”.
Riddle and Stratford, 1999, examined 45/56 cutoff validity and concluded:
- Sensitivity = 64% (Correctly predicts fallers)
- Specificity = 90% (Correctly predicts non-fallers)
- Riddle and Stratford encouraged a lower cut off score of 40/56 to assess fall risk

Comments: Potential ceiling effect with higher level patients. Scale does not include gait items

Norms:

| Table 4. Berg Balance Scale Scores: Means, Standard Deviations, and Confidence Intervals by Age, Gender, and Use of Assistive Device |
|---|---|---|---|---|
| Age (y) | Group | N | Mean | SD | CI |
| 60-69 | Male | 1 | 51.0 | 2.5 | 50.0 - 52.0 |
| | Female | 5 | 54.6 | 5.5 | 49.5 - 59.6 |
| | Overall | 6 | 54.0 | 4.5 | 51.4 - 56.6 |
| 70-79 | Male | 9 | 53.9 | 1.5 | 52.9 - 54.9 |
| | Female | 10 | 51.6 | 1.6 | 50.0 - 53.2 |
| | Overall | 19 | 52.7 | 1.4 | 51.5 - 53.8 |
| 80-89 | Male | 10 | 41.8 | 12.2 | 36.6 - 46.8 |
| | Female | 24 | 42.3 | 5.0 | 39.4 - 45.3 |
| | No Device | 24 | 46.3 | 1.2 | 44.1 - 48.5 |
| | Device | 10 | 31.7 | 10.0 | 28.3 - 35.1 |
| | Overall | 34 | 43.0 | 6.9 | 40.4 - 45.3 |
| 90-101 | Male | 2 | 40.0 | 14.0 | 28.9 - 51.1 |
| | Female | 15 | 36.9 | 9.7 | 32.8 - 40.9 |
| | No Device | 7 | 41.0 | 4.2 | 40.0 - 40.9 |
| | Device | 10 | 31.8 | 7.6 | 28.4 - 35.2 |
| | Overall | 17 | 37.2 | 9.1 | 32.5 - 41.9 |
Berg Balance Scale

Name: ________________________  Date: ________________________

Location: ________________________  Rater: ________________________

ITEM DESCRIPTION                      SCORE (0-4)

Sitting to standing
Standing unsupported
Sitting unsupported
Standing to sitting
Transfers
Standing with eyes closed
Standing with feet together
Reaching forward with outstretched arm
Retrieving object from floor
Turning to look behind
Turning 360 degrees
Placing alternate foot on stool
Standing with one foot in front
Standing on one foot

Total  ________________________

GENERAL INSTRUCTIONS
Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time. Progressively more points are deducted if:
• the time or distance requirements are not met
• the subject’s performance warrants supervision
• the subject touches an external support or receives assistance from the examiner

Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be of reasonable height. Either a step or a stool of average step height may be used for item # 12.
**Berg Balance Scale**

**SITTING TO STANDING**

**INSTRUCTIONS:** Please stand up. Try not to use your hand for support.

(4) able to stand without using hands and stabilize independently
(3) able to stand independently using hands
(2) able to stand using hands after several tries
(1) needs minimal aid to stand or stabilize
(0) unable to stand

**STANDING UNSUPPORTED**

**INSTRUCTIONS:** Please stand for two minutes without holding on.

(4) able to stand safely for 2 minutes
(3) able to stand 2 minutes with supervision
(2) able to stand 30 seconds unsupported
(1) needs several tries to stand 30 seconds unsupported
(0) unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

**SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL.**

**INSTRUCTIONS:** Please sit with arms folded for 2 minutes.

(4) able to sit safely and securely for 2 minutes
(3) able to sit 2 minutes under supervision
(2) able to sit 30 seconds
(1) able to sit 10 seconds
(0) unable to sit without support 10 seconds

**STANDING TO SITTING**

**INSTRUCTIONS:** Please sit down.

(4) sits safely with minimal use of hands
(3) controls descent by using hands
(2) uses back of leg or arm to control descent
(1) sits independently but has uncontrolled descent
(0) needs assist to sit

**TRANSFERS**

**INSTRUCTIONS:** Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

(4) able to transfer safely with minimal use of hands
(3) able to transfer safely with definite need of hands
(2) able to transfer with verbal cueing and/or supervision
(1) needs one person to assist
(0) needs two people to assist or supervise to be safe

**STANDING UNSUPPORTED WITH EYES CLOSED**

**INSTRUCTIONS:** Please close your eyes and stand still for 10 seconds.

(4) able to stand 10 seconds safely
(3) able to stand 10 seconds with supervision
(2) able to stand 3 seconds
(1) unable to keep eyes closed 3 seconds but stays safely
(0) needs help to keep from falling

**STANDING UNSUPPORTED WITH FEET TOGETHER**

**INSTRUCTIONS:** Place your feet together and stand without holding on.

(4) able to place feet together independently and stand 1 minute safely
(3) able to place feet together independently and stand 1 minute with supervision
(2) able to place feet together independently but unable to hold for 30 seconds
(1) needs help to attain position but able to stand 15 seconds feet together
(0) needs help to attain position and unable to hold for 15 seconds
Berg Balance Scale continued.....

REACHING FORWARD WITH OUTSTretched ARM WHILE STANDING
INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)
(  ) 4 can reach forward confidently 25 cm (10 inches)
(  ) 3 can reach forward 12 cm (5 inches)
(  ) 2 can reach forward 5 cm (2 inches)
(  ) 1 reaches forward but needs supervision
(  ) 0 loses balance while trying/requires external support

PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION
INSTRUCTIONS: Pick up the shoe/slipper, which is placed in front of your feet.
(  ) 4 able to pick up slipper safely and easily
(  ) 3 able to pick up slipper but needs supervision
(  ) 2 unable to pick up but reaches 2-5 cm (1-2 inches) from slipper and keeps balance independently
(  ) 1 unable to pick up and needs supervision while trying
(  ) 0 unable to try/needs assist to keep from losing balance or falling

TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING
INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.
(  ) 4 looks behind from both sides and weight shifts well
(  ) 3 looks behind one side only other side shows less weight shift
(  ) 2 turns sideways only but maintains balance
(  ) 1 needs supervision when turning
(  ) 0 needs assist to keep from losing balance or falling

TURN 360 DEGREES
INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.
(  ) 4 able to turn 360 degrees safely in 4 seconds or less
(  ) 3 able to turn 360 degrees safely one side only 4 seconds or less
(  ) 2 able to turn 360 degrees safely but slowly
(  ) 1 needs close supervision or verbal cuesing
(  ) 0 needs assistance while turning

PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED
INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times.
(  ) 4 able to stand independently and safely and complete 8 steps in 20 seconds
(  ) 3 able to stand independently and complete 8 steps in > 20 seconds
(  ) 2 able to complete 4 steps without aid with supervision
(  ) 1 able to complete > 2 steps needs minimal assist
(  ) 0 needs assistance to keep from falling/unable to try

STANDING UNSUPPORTED ONE FOOT IN FRONT
INSTRUCTIONS: Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject’s normal stride width.)
(  ) 4 able to place foot tandem independently and hold 30 seconds
(  ) 3 able to place foot ahead independently and hold 30 seconds
(  ) 2 able to take small step independently and hold 30 seconds
(  ) 1 needs help to step but can hold 15 seconds
(  ) 0 loses balance while stepping or standing

STANDING ON ONE LEG
INSTRUCTIONS: Stand on one leg as long as you can without holding on.
(  ) 4 able to lift leg independently and hold > 10 seconds
(  ) 3 able to lift leg independently and hold 5-10 seconds
(  ) 2 able to lift leg independently and hold ≥ 3 seconds
(  ) 1 tries to lift leg unable to hold 3 seconds but remains standing independently
(  ) 0 unable to try of needs assist to prevent fall

(  ) TOTAL SCORE (Maximum = 56)
## Extended ADL

**APPENDIX**

Please tick one box only for each and every question on this page.

For these questions please record only what you have actually done in the last week or so (not what you think you could do, ought to do, or would like to do).

<table>
<thead>
<tr>
<th>Mobility</th>
<th>No</th>
<th>With help</th>
<th>On my own with difficulty</th>
<th>On my own</th>
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<tbody>
<tr>
<td>(1) Do you walk around outside?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(2) Do you climb stairs?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(3) Do you get in and out of the car?</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(4) Do you walk over uneven ground?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(5) Do you cross roads?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(6) Do you travel on public transport?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<table>
<thead>
<tr>
<th>Kitchen</th>
<th>No</th>
<th>With help</th>
<th>On my own with difficulty</th>
<th>On my own</th>
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<tbody>
<tr>
<td>(1) Do you manage to feed yourself?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(2) Do you manage to make yourself a hot drink?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(3) Do you take hot drinks from one room to another?</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(4) Do you do the washing up?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(5) Do you make yourself a hot snack?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<th>On my own with difficulty</th>
<th>On my own</th>
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<tbody>
<tr>
<td>(1) Do you manage your own money when you are out?</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(2) Do you wash small items of clothing?</td>
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<td>☐</td>
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<td>☐</td>
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<tr>
<td>(3) Do you do your own housework?</td>
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<td>☐</td>
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<tr>
<td>(4) Do you do your own shopping?</td>
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<tr>
<td>(5) Do you do a full clothes wash?</td>
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<th>On my own with difficulty</th>
<th>On my own</th>
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<tr>
<td>(1) Do you read newspapers or books?</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>(2) Do you use the telephone?</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>(3) Do you write letters?</td>
<td>☐</td>
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<td>☐</td>
<td>☐</td>
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<tr>
<td>(4) Do you go out socially?</td>
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<td>☐</td>
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<tr>
<td>(5) Do you manage your own garden?</td>
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<tr>
<td>(6) Do you drive a car</td>
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<td>☐</td>
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Appendix 14 Demographic data collection form (3 months)

Demographic data Collection form

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<td>Data Collection Form #1</td>
<td>For Intervention: _________________</td>
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<tr>
<td>Gender: Male [ ] Female [ ]</td>
<td>Subject ID ________</td>
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<tr>
<td>Age: ___________</td>
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<tr>
<td>MMSE: ___________</td>
<td>Presenting Complaint:</td>
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<table>
<thead>
<tr>
<th>Operation Notes (Date / / )</th>
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<tbody>
<tr>
<td>Incision:</td>
</tr>
<tr>
<td>Findings:</td>
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<tr>
<td>Time: Blood loss:</td>
</tr>
<tr>
<td>Post op instructions: Mobility:</td>
</tr>
</tbody>
</table>

Date of admission to Hospital: ___________ Date of Discharge: ___________ Total number of days ___________

Discharge Plan: Cois Céim/ Clontarf/Convalescence/Long Term Care/Home/ Other ______
Did you receive further physiotherapy there? ________________________________

Past Medical History:

<p>| | | |</p>
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109
Medications:

<p>| | | |</p>
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</tbody>
</table>

Social Support:

Pre Hip Fracture: Lives alone □ Lives with family □ Other □
(details)

Post Hip Fracture: Lives alone □ Lives with family □ Other □
(details)

Level of Mobility:

Pre Hip Fracture: Independent □ Assistance of: □ Supervision of: □
Presently: Independent □ Assistance of: □ Supervision of: □

Use of Mobility Aid: (Tick box if used aid and indicate the type of aid used)

Pre Hip Fracture: Indoors: □ Aid used: ______ Outdoors: □ Aid used: ______
Presently: Indoors: □ Aid used: ______ Outdoors: □ Aid used: ______

Transfers:

Lying to sit: Independent □ Assistance □
Sit to lying: Independent □ Assistance □
Sit to stand: Independent □ Assistance □

Stairs:

Pre hip Fracture: One handrail □ Two Handrails □ Stairlift □ No Stairs □
Post hip Fracture: One Handrail □ Two handrails □ Stairlift □ No Stairs □
Bed Mobility:

Rolling to the Right: Independent ☐ Assistance ☐
Rolling to the left: Independent ☐ Assistance ☐
Lying to sitting: Independent ☐ Assistance ☐

Leg Length Discrepancy:

Right leg: _____ inches Left leg: _____ inches
Orthotist referral: Yes ☐ No ☐

Footwear:

Is the patient wearing orthopaedic footwear? Yes ☐ NO ☐
What type of footwear is the patient wearing? ___________________________

Heel Height: (0-2.5 cm; 2.6-5.0 cm; >5cm) __________ cm
Type of fixation: Laces  Velcro  Straps/buckles  zips  no fixation

Pain

0........1........2........3........4........5........6........7........8........9........10
No Pain  Moderate level Pain  Excruciating pain

Where is the pain? Back ☐ Hip ☐
Details ____________________________

Did you have pain in these areas before the Hip fracture:

______________________________
### Objective Assessment:

<table>
<thead>
<tr>
<th></th>
<th>(R)</th>
<th>Power</th>
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<th>ROM</th>
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### Outcome Measures:

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<tr>
<th>PATIENT SCORES</th>
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<tbody>
<tr>
<td>BERG BALANCE:</td>
<td>69 – 69 (M: 51; F: 54.6)</td>
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<td></td>
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<tr>
<td></td>
<td>80-89 (M: 41.8; F: 42.1)</td>
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<tr>
<td></td>
<td>90 – 101 (M: 40; F: 36.9)</td>
</tr>
<tr>
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<td>60-69 (M: 8; F: 8)</td>
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<td>70-79 (M: 9; F: 9)</td>
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<tr>
<td>HAND DYNOMETRY</td>
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<tr>
<td>RIGHT: 1ST: _____</td>
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<tr>
<td>2ND: _____ 3 RD: _____</td>
<td>AVG: _____</td>
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<tr>
<td>LEFT: 1ST: _____</td>
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<tr>
<td>2ND: _____ 3 RD: _____</td>
<td>AVG: _____</td>
</tr>
<tr>
<td>NEADL</td>
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</tbody>
</table>
Falls history:

Have you fallen since discharged from hospital  Yes ☐  No ☐

If YES  How many times have you fallen?

How many times have you fallen in the last 3 months?

Causes of falls?

Have you nearly fallen or had a trip?

Did you sustain an injury after your fall? Yes ☐  No ☐

If yes give details:

Do you wear Hip protectors:  Yes ☐  No ☐

Were you wearing Hip protectors at the time of the fall: Yes ☐  No ☐

Have you ever worn Hip protectors  Yes ☐  No ☐

Details:

Health Service resource use:

Please tick if you have been seen by any of the professionals listed below in the last 3 months:

General practitioner ☐  Public Health Nurse ☐

Community Physiotherapist ☐  Community Occupational Therapist ☐

Social Worker ☐

Other intervention after discharge from St. James’s Hospital

How long did you stay in rehab?

Days ☐  Week(s) ☐  Month(s) ☐
Did you have any Physiotherapy intervention since going Home or into a Nursing Home:

As an outpatient  Yes  [ ]  No  [ ]
Community Physiotherapy  Yes  [ ]  No  [ ]

Details: ________________________________________________
Demographic data collection form (15 months)

<table>
<thead>
<tr>
<th>MOBILISE</th>
<th>Office Use:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapy Department</td>
<td>Date of Assessment: __________________</td>
</tr>
<tr>
<td>Data Collection Form #2</td>
<td>For Intervention: __________________</td>
</tr>
<tr>
<td>Final review Treatment Group</td>
<td>Subject ID __________</td>
</tr>
</tbody>
</table>

| Name:                             | Gender: Male [ ] Female [ ]          |
| Address:                          | Age: ________                        |
| DOB                               | MMSE: ________                       |
| MRN                               |                                      |
| Telephone number                  |                                      |

Social Support:

Post Hip Fracture: Lives alone [ ] Lives with family [ ] Other [ ] (details)

Level of Mobility:

Presently: Independent [ ] Assistance of: [ ] Supervision of: [ ]

Use of Mobility Aid: (Tick box if used aid and indicate the type of aid used)

Presently: Indoors: [ ] Aid used: ________ Outdoors: [ ] Aid used: ________

Transfers:

Lying to sit: Independent [ ] Assistance [ ]
Sit to lying: Independent [ ] Assistance [ ]
Sit to stand: Independent [ ] Assistance [ ]

Stairs:

Post hip Fracture: One Handrail [ ] Two handrails [ ] Stairlift [ ] No Stairs [ ]
Bed Mobility:

Rolling to the Right: Independent ☐ Assistance ☐
Rolling to the left: Independent ☐ Assistance ☐
Lying to sitting: Independent ☐ Assistance ☐

Leg Length Discrepancy:
Right leg: _____ inches Left leg: _____ inches
Orthotist referral: Yes ☐ No ☐
Footwear: Is the patient wearing orthopaedic footwear? Yes ☐ NO ☐
What type of footwear is the patient wearing?
Heel Height: (0-2.5 cm; 2.6-5.0 cm; >5cm) _____ cm
Type of fixation: Laces Velcro Straps/buckles zips no fixation

Pain

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<th>9</th>
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Where is the pain?  Back ☐  Hip ☐
Details ____________________________

Did you have pain in these areas before the Hip fracture:

______________________________
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Falls history:
Have you fallen since discharged from hospital  Yes  No
If YES  How many times have you fallen? ____________________________
How many times have you fallen? ____________________________
Causes of falls? ____________________________________________
Have you nearly fallen or had a trip? ____________________________
Did you sustain an injury after your fall? Yes  No

If yes give details:
__________________________________________________________

Check hospital admissions since fracture:
__________________________________________________________

Do you wear Hip protectors:  Yes  No
Were you wearing Hip protectors at the time of the fall: Yes  No
Have you ever worn Hip protectors:  Yes  No
Details: __________________________________________________

Health Service resource use:

Please tick if you have been seen by any of the professionals listed below in the last year:
General practitioner  Public Health Nurse
Community Physiotherapist  Community Occupational Therapist
Social Worker
Other intervention after discharge from St. James's Hospital

How long did you stay in rehab?

- Days ☐   
- Week(s) ☐  
- Month(s) ☐

Check LOS with institutions patient would have attended:

________________________

Did you have any Physiotherapy intervention since going Home or into a Nursing Home:

- As an outpatient
  - Yes ☐  
  - No ☐

- Community Physiotherapy
  - Yes ☐  
  - No ☐

Details:

________________________
Appendix 15 Visual Analog Scale (VAS)

0........1........2........3........4........5........6........7........8........9........10
No Pain Moderate level Pain Excruciating pain
Appendix 16 Manual Muscle Testing

Medical Research Council (MRC) scale for Muscle Strength

- Grade 5: Muscle contracts normally against full resistance.
- Grade 4: Muscle strength is reduced but muscle contraction can still move joint against resistance.
- Grade 3: Muscle strength is further reduced such that the joint can be moved only against gravity with the examiner’s resistance completely removed. As an example, the elbow can be moved from full extension to full flexion starting with the arm hanging down at the side.
- Grade 2: Muscle can move only if the resistance of gravity is removed. As an example, the elbow can be fully flexed only if the arm is maintained in a horizontal plane.
- Grade 1: Only a trace or flicker of movement is seen or felt in the muscle or fasciculation’s are observed in the muscle.
- Grade 0: No movement is observed.
REFERENCES


Todd, C., Skelton, D., World Health Organisation & Health Evidence Network. (2004) *What are the main risk factors for falls amongst older people and what are the most effective interventions to prevent these falls?* Copenhagen: World Health Organization.


