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A Profile of Elderly Fallers Attending the Emergency Department and Their Patterns of Healthcare Utilisation

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A thesis submitted to the School of Postgraduate Studies, Royal College of Surgeons in Ireland in fulfilment of the requirements for the Degree of Master of Science by Research

October 2016

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Candidate Thesis Declaration

I declare that this thesis, which I submit to RCSI for examination in consideration of the award of a higher degree (Masters of Science by Research) is my own personal effort. Where any of the content presented is the result of input or data from a related collaborative research programme this is duly acknowledged in the text such that it is possible to ascertain how much of the work is my own. I have not already obtained a degree in RCSI or elsewhere on the basis of this work. Furthermore, I took reasonable care to ensure that the work is original, and, to the best of my knowledge, does not breach copyright law, and has not been taken from other sources except where such work has been cited and acknowledged within the text.

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My boyfriend, Neil, whose support and patience allowed me to achieve this goal, thank you.

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List of Abbreviations

ADL	Activity of Daily Living
AGS	American Geriatric Society
AMAU	Acute Medical Assessments Unit
BGS	British Geriatrics Society
CARTS	Community Assessment of Risk and Treatment Strategies
CFS	Clinical Frailty Scale
CGA	Comprehensive Geriatric Assessment
CI	Confidence Interval
ED	Emergency Department
EFU	Emergency Frailty Unit
ELSA	English Longitudinal Study on Ageing
EMS	Elderly Mobility Scale
EU	European Union
FOF	Fear of Falling
GP	General Practitioner
HSE	Health Service Executive
ISAR	Identification of Seniors at Risk
ISCP	Irish Society of Chartered Physiotherapists
MDT	Multidisciplinary Team
NAI	Network Assessment Instrument
NCPOP	National Clinical Programme for Older People
NEADL	Nottingham Extended Activities of Daily Living

NICE	National Institute for Health and Care Excellence
OARS	Older Americans Resource and Services Social Resource Scale
OPA	Out-Patient Appointment
OT	Occupational Therapy
PAS	Patient Administration System
PHN	Public Health Nurse
PIM	Potentially Inappropriate Medication
PIP	Potentially Inappropriate Prescribing
RCT	Randomised Controlled Trial
RISC	Risk Instrument for Screening in the Community
RR	Relative Risk
SD	Standard Deviation
SGS	Specialist Geriatric Service
SGT	Specialist Geriatric Team
START	Screening Tool to Alert doctors to Right Treatment
STOPP	Screening Tool for Older Person's Prescriptions
TILDA	The Irish Longitudinal Study on Ageing
TUG	Timed Up and Go test
UK	United Kingdom
US	United States

SUMMARY

Introduction: Falls are the commonest reason why an older person presents to the Emergency Department (ED) in Ireland and can account for 20-40% of attendances (Aminzadeh and Dalziel 2002). As the population ages it is anticipated that the incidence of falls will increase (Barrett et al, 2011). A profile of the elderly faller could identify the healthcare services in which this population relies on.

Aims and Objectives: The aims of this study were to profile a sample of elderly fallers attending the ED of an Irish hospital. The objectives of the study were to examine prevalence and circumstances of these falls, to describe the socio-demographic and health profile of these patients and to document the healthcare utilisation among the sample.

Methods: This was a cross-sectional, observational study in which 93 participants were recruited at discharge from an Irish ED. A demographic profile along with healthcare utilisation was determined from the ED chart and Patient Administration System (PAS). Participants completed a questionnaire to determine the presence of frailty, a falls profile, and level of social support available.

Results: The mean age of participants was 76.5 years of age. Recurrent falls were noted in 46% of the sample. Polypharmacy was identified in 43 (55.8%) participants. Twenty (21.5%) participants belonged to a vulnerable social network type. Just over half (52.7%) of participants were identified at risk of decline. Seventeen (18.3%) of the 93 participants had a previous visit to the ED in the previous six months. High healthcare follow up was noted with 89.2% of participants referred to either community services or out-patient appointments.

Conclusions and implications: This study described an elderly population at risk of functional decline with high healthcare needs. The findings of this study could form the basis of the development of a standardised frailty screening and intervention programme for elderly fallers attending the ED and highlights missed opportunities for frailty management.

INTRODUCTION

Elderly populations are ageing rapidly (United Nations Population Fund, 2012). The Central Statistics Office has projected an increase in the elderly population of 532,000 in 2011 to over 1.4 million by 2046. The over 80's age group is expected to increase from 128,000 in 2011 to between 470-484,000 by the year 2046 (CSO 2013). This change in demographics poses challenges for healthcare systems that need to adapt to the increasing populations' needs (Prince et al, 2015).

Falls are common in older adults. The rate of falls in community dwelling people have been reported to be as high as 30% in the over 65's and over 50% in those aged over 80 (Health Service Executive, 2008). Falls can result in injury and hospitalisation and subsequent behavioural change such as activity-restricting fear of falling (Donoghue et al, 2013). The costs of falls to the exchequer have been reported as €10.8 million annually including acute bed stay and rehabilitation bed-days costs (Cotter et al, 2006).

Frailty is a relatively new clinical syndrome defined where three or more of the following criteria are present: unintentional weight loss (10 lbs in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity (Fried et al, 2001). However there is yet to be an agreed definition for frailty along with a subsequent standard management for the condition (deVries et al, 2011). The presence of co-morbidities have been found to be a risk factor for frailty with the outcome of the syndrome being disability (Fried et al, 2001). Co-morbidities have been associated with increased healthcare utilisation, including emergency hospital admissions (Smith et al, 2016). This study will profile the elderly faller, detailing their falls history, identifying the presence of fear of falling, presence of polypharmacy along with the presence of frailty.

Falls are one of the most common reasons why the elderly attend the Emergency Department (ED), this population are over-represented in the ED setting (Aminzadeh and Dalziel 2002). In 2010, there were 9,484 ED attendances of over 65's to an Irish hospital. The older adult is more likely to attend the ED, with longer stays and are at risk of more adverse outcomes after discharge. Increasing age, functional impairment, recent ED use, living alone and lack of social support have been identified as risk factors these adverse outcomes (Aminzadeh and Dalziel 2002). There is no definitive care pathway for elderly

fallers attending the ED in Ireland. Comprehensive Geriatric Assessment (CGA) has been defined as 'multidimensional interdisciplinary diagnostic process focused on determining a frail older person's medical, psychological and functional capability in order to develop a coordinated and integrated plan for treatment and long term follow up.' (Rubenstein et al, 1991). CGA has been found to have favourable effects for elderly patients including an increased likelihood of remaining in their own homes, and a decreased likelihood of deterioration (Ellis et al, 2011). There has been a noted lack of research conducted for CGA interventions in elderly being discharged from the ED (Conroy et al, 2011) however in a pre-post cohort study of CGA within the ED readmission rates fell in those receiving CGA (Conroy et al, 2013). This study will document the use of the ED and healthcare referral patterns for the elderly faller to the community and to out-patient appointments.

Chapter 1: Literature Review

1.0 An ageing population

Populations around the world are rapidly ageing. It is predicted that by 2050 the world's population over 60 years of age will double from 11% to 22%. By the same year global population will consist of 400 million people aged over 80 years (*WHO* 2014). Data from the Central Statistics Office (2012) shows the population of Ireland increased by 15.2% to 4.59 million persons over the period 2003- 2012. The report indicates that Ireland had the highest percentage increase in population between 2001 and 2011 in the European Union (EU) while eight EU countries experienced population decline over the same period. Life expectancy at birth for males in Ireland in 2010 was 78.7 years, 2 years higher than the EU average, while female life expectancy at birth in 2010 was 83.2 years, 0.6 years higher than the EU average. There were 535,393 over 65's in Ireland in 2011. This number is expected to increase to 796,484 by 2021, representing 14.1% of the total population. It is estimated that by 2041, the over 65 years' age group will further increase to 1.4 million, approximately 22% of the overall Irish population (McGill 2010). The greatest increase will occur in the over 80's with this number expecting to double between 2011 and 2031.

This change in the structure of population will have implications such as increased demand on healthcare and long term care systems (Barrett et al, 2011). With improvements in medical technology and greater a focus on health promotion targeted at the elderly, life expectancy continues to grow. However, long term or chronic conditions such as diabetes, stroke, and chronic obstructive pulmonary disease become more prevalent with ageing placing more demands on health care services and on the subsequent cost to the exchequer (Prince et al, 2015). Those living longer may be more susceptible to greater disability in old age from their chronic conditions and need for long term care which will continue to challenge the health system (Prince et al, 2015). Demographics of the increasing ageing population show a female heavy population at risk of functional and mental decline with increasing dependence on emergency healthcare systems (Aminzadeh and Dalziel, 2002). The ageing Irish population has also seen increases in those living alone for example in 2011, 158,600 persons aged 65 and over were living alone compared with 143,500 in 2002 (CSO 2011). Living alone has been found to be a factor in loneliness which in turn can affect mental health and well-being (Treacy

et al, 2004). Social isolation in turn has been reported as a predictor of morbidity and mortality, with the more socially isolated experiencing higher rates of mortality than the less socially isolated (Berkman and Syme, 1979). Population ageing is predicted to have significant implications on healthcare systems globally with the burden of disease coming from the disability associated with chronic conditions. Long term care costs therefore are projected to outweigh health expenditure and so supply will need to respond to demand (Prince et al, 2015).

1.1 Ageing and frailty

Ageing is an "inevitable and extremely complex, multifactorial process characterised by the progressive degeneration of organ systems and tissues" (Nigam et al, 2012). Normal ageing can result in a progressive decline in physical and mental function and can result in an increased risk of adverse events such as immobility, disability, and functional dependence. The process of sarcopenia can contribute to lower limb weakness seen in the elderly population. Sarcopenia has been defined as a progressive process involving a reduction of 3-8% of lean muscle mass per decade after the age of 30 (Baumgartner et al, 1998). It is believed that this process can affect 30% of over 60's and 50% of people aged 80 and over. This reduction in muscle mass can contribute to lower limb weakness and in turn affecting balance and gait both of which have been identified as risk factors for falls (NICE 2013). Sarcopenia along with impaired balance, vision and cognition are considered to be intrinsic risk factors or in other words the result of advancing age.

Frailty is a term used to describe an older person with non-specific health problems. The older person can have one of the following features including but not exclusive of a cognitive impairment, a fragility fracture, Parkinson's disease, recurrent falls or be a resident in long-term care setting (Thompson et al, 2015). Frailty is considered highly prevalent in the older population and associated with adverse health outcomes. It has been defined as a clinical syndrome in which three or more of the following criteria were present: unintentional weight loss (10 lbs in the past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity (Fried et al, 2001). It is considered to be an independent predictor of risk of adverse outcomes such as falls, hospitalisations, disability and death (Ensrud et al, 2008). Frailty has also been described

as “decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes” (Campbell and Buchner, 1997). It is considered a progressive condition as with ageing, with similar traits that are seen in chronic conditions such as increasing dependency, worsening quality of life and premature mortality (Harrison et al, 2015). Harrison et al (2015) suggests frailty should be considered as a long-term condition in order to adopt similar management approaches that are seen in chronic conditions, as at present there is no definite or consistent management for frailty. This could include preventative and proactive interventions and models of care. Stuck et al (1999) conducted a systematic review of the literature on the risk factors for functional decline in the community dwelling elderly population. Fourteen risk factors were identified for functional decline in late life. These included functional limitation, high medication use, low physical activity, falls and low level of social activity or support. Strength of evidence was varying for the risk factors, with low physical activity, poor self-rated health, and low frequency of social contact rated as having high evidential strength, using a definition devised by the authors. The authors recommend screening the elderly for multiple risk factors for functional decline which may result in adequate planning for health care services.

1.2 Elderly fallers

1.2.1 Prevalence of elderly falls

Falls are common in the community dwelling elderly population, with 33% of those aged over 65 and 50% aged over 80 falling in a one year period (Tinetti 2003). American data on elderly fallers report that 8% of people over the age of 70 will attend the ED with fall-related injuries (Sattin 1992). The Australian Institute of Health and Welfare (AIHW) report 96,385 people aged 65 and over were hospitalised for a fall-related injury, three and a half times as many cases as 45–64 year olds in the year 2011-2012 (AIHW 2016). In 2011, there were 8.7 million people over the age of 65 in the UK (Office for National Statistics 2011), and one in three elderly people fall at least once each year (Royal College of Physicians 2011). Irish data from the Irish Longitudinal Study on Ageing (TILDA 2011) report 19% of adults reported having fallen in the previous year and 7% reported two or more falls based on a sample of over 8,000 participants. The prevalence was found to

increase with age in both sexes, 18% of adults in the 50-64 years age group reported a fall, increasing to 24% of adults aged 75 and over having sustained a fall (Cronin et al, 2011).

The consequences of falls in the elderly can be severe and include hospitalisation, premature nursing home placement, social isolation and increases in morbidity and mortality (Davis and Kenny 1996).

1.2.2 Fear of falling

Fear of falling (FOF) has been identified as a risk factor for elderly falls by the National Institute for Health and Care Excellence (NICE) in its guidelines for assessment and prevention of falls in the elderly (NICE 2013). The guidelines state that the fear of falling is not limited to those post-fall, and that an anticipatory anxiety may exist in those with no history of falls. Evidence examined by the NICE guidance committee found that FOF is not a predictor of future falls but that the psychological aspects can affect mobility and social interaction. Murphy et al (2002) examined the characteristics associated with fear of falling and activity restriction of elderly community dwellers, in a cross sectional study of 1,064 participants, of which 24% confirmed a FOF with no subsequent activity limitation and 19% admitted their FOF restricted their activity. The study found that the participants with FOF and subsequent activity limitation shared similar characteristics including an age of 80 years and older ($p=0.610$), female gender ($p=0.229$), two or more chronic conditions ($p=0.007$) and depression ($p= 0.048$), distinguishing them from participants with FOF alone. The study adds to prior research on the topic of FOF which suggested that elderly people who restricted their activities had poorer physical functioning and less social support than those with FOF alone (Howland et al, 1998). Since then FOF has been associated with gait changes such as reduced speed, stride length and step width. It is thought that these changes are associated with increased falls risk however some researchers are of the thought that these changes may possibly demonstrate positive, compensatory adaptations to FOF such as increased caution in activities (Donoghue et al, 2014, Lachmann et al, 1998).

Scheffer et al (2013) investigated the risk factors associated with elderly fallers who choose to visit or not visit the ED after a fall. Fallers over the age of 65 who did not attend

the ED after a fall were age and gender matched with persons who did visit the ED post-fall (n=547). All participants completed a self-report questionnaire consisting of 44 questions to determine the characteristics of the faller, the likely causes of the fall and to identify risk factors for falling. The authors found that the mean number of modifiable risk factors in participants who did not visit the ED after a fall was 2.9, this rose to a mean of 3.8 for the participants who decided to attend the ED post-fall. Modifiable risk factors were defined as those risk factors that could be improved or removed through intervention. Fear of falling, polypharmacy, impaired vision, mood, along with osteoporosis were independently associated with visiting the ED in this study. Fear of falling was assessed by asking the question "Are you afraid of falling" and rated on a scale from 1-10, 1 representing no fear of falling and 10 representing a very large fear of falling. FOF was found to be more prevalent in the ED visiting group (n=547, 41.1% versus 17.8%, p<001) (Scheffer et al, 2013). The authors suggest that preventive strategies should be aimed at both elderly fallers who attend the ED and those who do not as this research shows that modifiable risk factors exist in both groups.

1.2.3 Medications and polypharmacy

Polypharmacy has been defined as the concurrent use of five or more medications and excessive polypharmacy defined as 10 or more medications (Fulton and Riley Allen, 2005). Polypharmacy has been found to be associated with functional impairment (Agostini et al, 2002), falls and fractures (Boyle et al, 2010), hospital admissions (Leendertse et al, 2008), and mortality (Richardson et al, 2011) in the elderly population. In the Irish population aged 50 years and older, 69% reported regularly taking medications (Richardson et al, 2012). This proportion increased with age, with 85% in the over 65 year olds and 90% in those over 75 years taking medications regularly. The average (median and inter quartile range) number of medicines reported in the over 50s was 2.4 (3.0) and 2 (0-4), in the over 65s was 3.4 (3.1) and 3 (1-5) and in the over 75s was 3.9 (3.2) and 4 (2-6), respectively. In the over 50s, 19% were taking five or more regular medicines (polypharmacy) and 2% reported taking ten or more. Diabetes, angina, and abnormal heart rhythm were more than twice as prevalent in those with polypharmacy compared to the general population (Richardson et al, 2012). The TILDA report on polypharmacy shows 37% of 65-74 year olds admit having a fall in the past year with this figure rising to 43% of over 75 year olds. The

results of polypharmacy can be seen in healthcare utilisation in the over 65's population, with those reporting polypharmacy constituting 31% of the population and being responsible for 51% of inpatient hospital visits, 55% of outpatient hospital visits and 41% of GP visits (Richardson et al, 2012).

The Beers criteria for potentially inappropriate medication use in older adults was created by a Geriatrician of the same name in 1991 and updated and revised by the American Geriatrics Society (AGS) in 2003 again in 2011 and in 2015. The Beers criteria consist of 34 types of medications that may be potentially inappropriate to prescribe to people over the age of 65. The list consists of medications used for 14 common health issues and recommended to be used with caution in this population. The criteria has been recommended to be used as guidance only, not replacing the clinical reasoning of the prescriber. Among the recommendations the AGS Beers criteria suggest avoiding certain types of medications that may cause side effects such as falling, a decrease in blood pressure, dizziness, blurred vision and delirium. The criteria suggest avoiding anticonvulsants, antipsychotics, benzodiazepine, non-benzodiazepine hypnotics, tricyclic antidepressants and selective serotonin uptake inhibitors in those older adults who have a history of falls or fractures (Appendix 1).

The Screening Tool of Older Person's Prescriptions (STOPP) / Screening Tool to Alert doctors to Right Treatment (START) criteria is a clinical guideline used by prescribers to prevent inappropriate prescribing in the elderly population. The aim of the tool is to provide evidence based criteria to prevent adverse drug reactions and improve medication appropriateness. A consensus panel of 18 experts created the list of STOPP criteria and START based on the best available evidence and intended to be used alongside clinical reasoning and not replacing expert knowledge (Gallagher et al, 2008) (Appendix 2). Reliability for the tools was found to be satisfactory with inter-rater reliability reported with a kappa-coefficient of 0.75 for STOPP and 0.68 for START (Gallagher et al, 2008). The STOPP criteria have been found to be more sensitive in identifying inappropriate prescribing than the Beers criteria. In a prospective study comparing the two tools on 715 acute admissions, the STOPP tool identified more patients needing admission due to Potentially Inappropriate Medicine (PIM) (Mann–Whitney $Z=-15.33$; $p<0.001$). The study reported STOPP identified 336 PIMs affecting 247

patients (35%) that presented with an associated adverse medication event, while the Beers' criteria identified 226 PIMs affecting 177 patients (25%), of whom 43 presented with an adverse drug event (Gallagher et al, 2008).

The NICE Clinical Guidelines for the prevention of falls recognises poly-medication as one of the many risk factor for falls, and the potential for psychotropic medications to increase an older person's fall risk. The guideline recognises the importance of prevention and lowering risk and has recommended strategies such as medication review with possible modification/withdrawal of psychotropic drugs (NICE 2013).

1.2.4 Social Network

Research has been done worldwide investigating social networks among the elderly. It is thought that a greater support network can be associated with less functional decline among this population (McCusker et al, 2000). Differences have been noted between the genders and social support, with women specifically having better emotional support (Unger et al, 1999). A lack of social support has been cited as a risk factor for adverse health outcomes in the elderly population and also as a risk factor for frequent ED visits (McCusker et al, 1991, 1997, 1998, 2000). Unger et al (1999) examined data from a longitudinal study with participants aged between 70-79 years of age to see if there were social network characteristics associated with self-reported decline in physical function (n=850). Gender, baseline functioning and income were taken into account and multiple regression analyses were completed. The authors reported the participants with larger numbers of social ties at baseline reported less functional decline (n=850, $p<.005$). Regarding gender, the association between the number of social ties and functional decline was stronger for men than for women. Women also had more emotional support ($p<0.005$) were older than men ($p<0.05$) and had less physical activity ($p<0.0005$). These results complement previous studies looking at the effects of social support on gender (Hansen et al, 1989, Berkman et al, 1993). Despite methodological differences between these studies findings show that larger social networks and the presence of social support is apparent to be more valuable in the ageing population. Greater health outcomes associated with social networks has been documented including mental well-being and less self-reported loneliness (Wang 2016, Holmen et al, 2002, Unger et al, 1999). Whilst a

weaker support network seems to be more prevalent in men and results in less favourable outcomes such as an increase in mortality. This study will profile elderly fallers presenting to the ED and identify levels of social support and networks available to this population.

1.3 The older adult and the emergency department

1.3.1 Prevalence of ED attendances

Falls are the commonest reason why an older person presents to the Emergency Department (ED) in Ireland and can account for 20-40% of attendances (Aminzadeh and Dalziel 2002) and as the population ages it is anticipated that the incidence of falls will increase (Barrett et al, 2011). In 2014, there were 44,826 attendee's in the ED of a Dublin hospital (www.iaem.ie). Nationally in 2014, 22% of all ED attendances were by those aged 65 and over, and almost 12.5% were over 75 years of age (Department of Health, 2015). These increases can be seen globally. Figures from Canada, and the USA show an increase in ED attendances of between 3-7% annually (Drummond 2002, Pitts 2006). Australia has also seen annual increases in numbers attending the ED of up to 7% (Lowthian et al, 2011). Data from an Australian population-based retrospective analysis of ED admissions showed an unprecedented rise in admissions. This study was carried out using data from the year 1999 and 2008 in Melbourne ED's. Patient presentations increased from 1999 to 2008 by 32% with the elderly population attendees doubling over that period. The data showed attendees over the age of 85 years were 3.9 times more likely to present than the 35-59 years of age population. The likelihood of admission was found to increase with age, with 61% of all attendees over 85 admitted in 2008. The report took into account population changes yet an annual growth rate of 3.6% was still observed that is not explained by population increases (Lowthian et al, 2011).

The Heath Service Executive's (HSE) Strategy to Prevent Falls and Fractures in Ireland's Ageing Population (2008) estimate that from a population of 468,000 over 65's in Ireland, 35,000 people over 65 are treated in primary care or the ED and approximately 7,000 are admitted to be treated with falls-related injuries per year. More recent figures show sustained growth in Irish ED's with a 20% increase in the proportion of over 65's admitted in 2014 compared to the previous year (Department of Health 2015). A 4% growth in the

over 85's annually has been reported, with this population placing greater demand on ED services (Department of Health 2015).

1.3.2 Reasons for attending the ED

Older patients visit the ED more frequently than younger adults, arriving more often by ambulance, have more serious medical illness and generally have longer ED stays (Aminzadeh and Dalziel 2002). The elderly population most commonly presents to the ED with conditions including falls, delirium, coronary disease, adverse drug events and infections (Samaras et al, 2010). Reasons for attending the ED are numerous and include the need for immediate medical attention due to acute illness. Other factors however include "the availability of community services, out of hour General Practitioner (GP) services, accessibility to specialist hospital based services as well as population socioeconomic and demographic factors" (Naughton et al, 2010). Inappropriate ED admissions or non-urgent ED visits have been defined as visits for conditions that a delay of several hours would not increase the likelihood of an adverse outcome (Uscher-Pines et al, 2013). In a systematic review of 26 studies on inappropriate ED visits, the convenience of the ED due to its opening hours, referral by a GP, and negative perceptions about primary care providers were found to be the main factors of non-urgent ED use (Uscher-Pines et al, 2013). In the Irish setting, the ED is regarded as the main route to secure an in-patient bed and it has been suggested that GP's refer patients to the ED in order to bypass outpatient waiting lists (Dunne 1997).

The ED has been described as a safety net for older people and so understanding the use of heath care services along with a profile of the older people relying on these services is important for improving and providing the services needed (Siegel 2004, Felland 2008). Lowthian et al (2011) describes limited access to primary care services in particular to GP's, in developed countries such as Australia, the USA and the UK resulting in an increase in presentations to the ED. This is suggested to be caused by changes or reduction in service delivery along with the introduction of charging for primary care services e.g a co-payment to the GP. Other suggested contributing factors to the growing presentations to the ED have been cited to include the growing community awareness of certain health conditions from media campaigns and also loneliness and a lack of social support (Lowthian et al, 2011).

1.3.3 The older ED attendee

Aminzadeh and Dalziel (2002) carried out a systematic review of 14 studies examining adverse health outcomes among the elderly attending the ED. The prospective studies differed in methodology but were similar in findings, describing elderly ED attendees were at risk for adverse health outcomes such as functional decline, hospitalisation, re-admission and death in the six months after their initial ED visit. The review noted that social network or social isolation was considered in four of the 14 studies included in the systematic review of which all four studies had a shared author. McCusker (1997) set out to determine which characteristics of elderly ED attendees are associated with repeat visits in the following 90 days after an initial ED visit. Methodology included determining participants' social circumstances by questions about living arrangements e.g if living alone, and the Older Americans Resources and Services Social Resource Scale (OARS) tool was administered to establish the level of support available. This tool identifies the availability and amount of contact with friends and close support and their adequacy of contact. Results found repeat visits were significantly associated with the number of functional problems, cognitive impairment, and previous ED visits, while male gender, living alone, and number of functional problems were found to be independent predictors of repeat visits to the ED (n=167). However, reliability for the OARS tool was found to be low and validity for the tool has not been examined (Burholt et al, 2007).

McCusker (1997, 1998, 2000) continued to look at elderly ED attendees and the prediction of repeat visits in three following studies. All three studies used a screening questionnaire to identify social, physical and mental risk factors in this population. The studies were carried out in different settings, had different methodologies and sample sizes ranging from 167 to 1,620 participants. Each study reported either living alone or lack of social support or social isolation as a risk factor for adverse health outcomes.

1.3.4 Cost of falls

Analysis of ED attendances in 1999 in the UK showed a substantial increase of fallers with increasing age (Scuffham et al, 2003). This study searched the hospital databases of eighteen hospitals for elderly fallers in order to examine the incidence and cost of unintentional falls. The resulting cost of these attendances and admissions increased five-fold from the 60-64 year age group to the over 75's age group. The cost of inpatient

admissions was identified as the primary expense followed by the cost of long term care more commonly for those over 75 years of age. The study also found that the youngest age group of 60-64 year old fallers had better outcomes than the over 75's, with only 2% admitted from the ED following a fall compared to 23% of those over 75.

Cotter (2005) calculated the cost of fall-related admissions in an Irish hospital. Data was collected from one university teaching hospital from patients over the age of 65 and who were admitted for treatment in the years 2002-2003. Cases of syncope were excluded. Cotter (2005) reported 810 fall related admissions over this one year period with a mean length of stay of 10.8 days increasing to 15.3 days for a hip fracture episode. The cost of the acute in-patient stay was calculated at €7.46 million with a further €2.9million for rehabilitation bed days. This calculation included the cost of average medical, nursing and therapist time. It was also calculated that a typical hip fracture admission cost €14,300. This study did not calculate the cost of ED attendances for those not admitted or did it include the cost of follow up as an out-patient. A report on the economic cost of falls and fractures in the elderly in Ireland by the Irish Centre for Social Gerontology was published in 2007 (Gannon et al, 2007). This report aimed to estimate the current economic cost of falls and fractures and to estimate these costs over the next 20 years. The authors reported that one third of overall costs are accounted for by other injuries due to fall and two thirds by fractures. The authors calculated direct and indirect costs of fractures and other injuries due to falls. They estimated that fractures cost the economy €377.28 million while other injuries due to falls cost €18.12 million. Predictions of future costs were then made based on the increasing population and the current costs of falls in the elderly per year. Two scenarios were estimated for, taking inflation into account; the first scenario where there is a constant increase in falls and fractures and no national strategy in place and the second where there is an assumption of a 1% decline in disability prevalence per annum (similar to trends over the past few decades in the USA) due to medical advances and technological improvements. Both scenarios take inflation and increasing population into account and also presume that no national strategy is in place. It is estimated that in 2020, the economic burden of falls in the elderly in Ireland will range between €922 and €1,077 million.

1.3.5 Falls management

The National Institute for Health and Care Excellence (NICE) have written guidelines based on the best available evidence for assessing risk and prevention of falls in the older person (2013). They recommend that all older people in contact with healthcare professionals should be asked if they have had a fall in the past year and the characteristics and frequency be enquired about. The guidelines also recommend a multifactorial assessment that includes assessment of balance, gait, and mobility, an assessment of vision, urinary incontinence, home hazards and a medication review. This multifactorial assessment has elements that incorporate the role of physiotherapy, nursing, occupational therapy and medical doctors and should be carried out by clinicians with appropriate skills and training. The American Geriatric Society (AGS) and British Geriatric Society (BGS) clinical practice guidelines also recommend that all older adults at risk of falling should be offered an exercise programme incorporating balance, gait and strength training along with an educational component tailored to the patient (2011). Gillespie et al (2012) conducted a systematic review of the literature examining interventions for preventing falls in community-dwelling older people. The study included 159 trials with a sample of 79,193 participants. In support of the AGS and BGS guidelines the results showed multiple-component group exercise significantly reduced rate of falls (RR 0.71, 95% CI 0.63 to 0.82; 16 trials; n=3622) and risk of falling (RR 0.85, 95% CI 0.76 to 0.96; 22 trials; n=5333), as did multiple-component home-based exercise (RR 0.68, 95% CI 0.58 to 0.80; seven trials; n=951 and RR 0.78, 95% CI 0.64 to 0.94; six trials; n=714). Multifactorial interventions, which include individual risk assessment, reduced rate of falls (RR 0.76, 95% CI 0.67 to 0.86; 19 trials; n=9503), but not risk of falling (RR 0.93, 95% CI 0.86 to 1.02; 34 trials; n=13,617). Positive outcomes were also witnessed in those with a gradual withdrawal of psychotropic medications which reduced the rate of falls (RR 0.34, 95% CI 0.16 to 0.73; one trial; n=93), but not risk of falling.

The “Silver Book” is a handbook for healthcare professionals coming into contact with elderly patients in a primary care setting (Banerjee et al, 2012). Its aim is to provide recommendations that apply in all primary care settings in the first 24 hours. This reference book recommends that older people presenting with a fall could be considered as frail which in turn should trigger a more detailed comprehensive geriatric assessment

(CGA). The guidebook details assessment for high-risk fallers and low-risk fallers suggested an in-depth multifactorial assessment for those at high-risk and an assessment of gait and balance in the acute setting for those at low-risk. The authors recognise that not all fallers will be admitted and so recommend that all urgent care services have robust pathways for the identification and referral of fallers (Banerjee et al, 2012).

1.4 Pathways of care

The Irish National Clinical Programme for Older People (NCPOP) (2010) developed a model of care for Specialist Geriatric Services. This document describes the structures and patient management for the acute inpatient, acute rehabilitation, day hospital, outreach and ambulatory services provided by Specialist Geriatric Services. The report defines Comprehensive Geriatric Assessment (CGA) as a "multidisciplinary diagnostic process focused on determining a frail older person's medical, psychological and functional capability in order to develop a coordinated and integrated plan for treatment and long term follow up"(p.14) which is provided by Specialist Geriatric Teams (SGT). These teams should be "geriatrician led and comprising of medical, nursing, and health and social care professionals and assigned exclusively to a specialist geriatric service"(p.16). The reports recommends that each ED or Acute Medical Assessment Unit (AMAU) in conjunction with the Specialist Geriatric Service should have in place an agreed process for identifying, triaging the frail, "at risk" older patient. The report also recommends that the Specialist Geriatric Service will link with the ED and AMAU when an older person at risk is identified for CGA or admission to a specialist geriatric ward. However the process of identifying the "at risk" older patient is not specified.

The NCPOP recommends defined and agreed referral criteria to the SGT within the ED, AMU and Community and that identified older frail patients should have a timely CGA performed and documented in their permanent health record that is accessible to both the primary and secondary care teams. The report also suggests that each hospital receiving acutely ill older adults must have a dedicated Specialist Geriatric Ward with appropriate staffing levels and a designated MDT (Appendix 3).

Conroy et al (2014) carried out a pre-post cohort study that examined admission avoidance from the ED by embedding CGA within the ED. Previous usual care in the ED was delivered by a multidisciplinary team led by emergency physicians, the intervention for this study saw geriatricians take the lead in a section of the ED of which 8-12 beds were allocated to an Emergency Frailty Unit. The service included the addition of frailty pathways and a standardised pro-forma was developed. In support of the NCPOP recommendations the unit also allowed for greater promotion of community services. While the study lacked any individual patient outcomes the addition of CGA in the ED resulted in improved discharge rates (risk ratio 0.88, 95% CI: 0.81–0.95) and a reduction in re-admission rates in elderly patients (risk ratio 0.77, 95% CI: 0.63–0.93).

1.5 Acute Medical Assessment Unit

It has been noted that poor outcomes and high resource use are common in older people discharged to the community directly from acute assessment units. High rates of re-admission, decline in mental wellbeing or quality of life have been associated with this care process in the UK (Edmans et al, 2013). This has led to the development of clinical pathways and the recommendations of implementing specialist geriatric services. While there is a growing body of evidence that specialist geriatric medical intervention for at risk older people discharged to the community from acute assessment units may reduce the incidence of adverse outcomes and reduce resource use some studies have been lacking in favourable results. Conroy et al (2014) carried out a Randomised Controlled Trial (RCT) to evaluate the effect of specialist geriatric medical management on the outcomes of at risk older people discharged from acute medical assessment units. The individual patient randomised controlled trial compared an intervention of specialist geriatric assessment versus usual care. The authors noted the number of days the participants spent at home in the 90 days following discharge, re-admissions, changes in dependency levels and quality of life was also examined during this time. The study found no significant difference in the number of days spent at home between the two groups (p=0.31, n=420), however the intervention group did have more hospital presentations (mean 0.94 hospital presentations during the 90 day follow-up period in the control group and 1.20 in the intervention group; 95% confidence interval for rate ratio 1.01 to 1.74; P=0.05).

Specialist geriatric medical intervention in an 'at-risk' population of older people discharged from acute assessment units had no effect on patient level outcomes or subsequent use of secondary care or long term care. Conroy et al (2013) suggested a more comprehensive geriatric assessment process that improves the outcomes of frail older people discharged from acute assessment units, along with better ways to identify the patients who will benefit from CGA.

A systematic review and meta-analysis was carried out to profile effective care transition models and also to estimate the effects of these models on patients discharged directly from the ED (Lowthian et al, 2015). Care transition models such as the ED- Community Transition Strategy (ED-CTS) refers to the discharge of patients from the ED to home with referral to community services. This review of the literature was conducted using outcomes of unplanned ED re-attendance up to 1 month, hospital admission post discharge up to 1 month and mortality up to 18 months post discharge. Other outcomes were functional decline and nursing home admission. Nine studies were examined in total, five experimental and four observational. The systematic review examined models of care for patients who were discharged into the community from the ED with community referral after geriatric assessment. Compared with usual care, the evidence indicates no appreciable benefit for ED-CTS for unplanned ED re-attendance up to 30 days (odds ratio (OR) 1.32, 95% confidence interval (CI) 0.99–1.76; n = 1,389), unplanned hospital admission up to 30 days (OR 0.90, 95% CI I 0.70–1.16; n = 1,389) or mortality up to 18 months (OR 1.04, 95% CI 0.83–1.29; n = 1,794). The authors noted that although components of all models of care have been validated previously in other research done, this meta-analyses was unable to show effectiveness in reducing the outcomes measured of unplanned re-attendance, hospital admissions or mortality.

1.6 Readmissions to the ED

Naughton et al (2010) examined the health and non-health factors associated with repeat ED visits in the elderly. This study was carried out in two Dublin hospitals, where 306 patients were interviewed to obtain their demographics and to establish their health service usage. The results showed 37% of those interviewed had a repeat ED visit in the previous 6 months which is in line with the figures of other similar studies done on the

same population. The study saw repeat ED attendees were nearly twice as likely to be admitted than a first-visit attendee. The ED visit group reported high levels of community service use in the previous six months with 93% attending their GP and 51% using community services. Despite the high levels of community service use leading up to the ED admissions repeat visits to the ED were seen. Suggested reasons for readmission rates range from quality of care during admission to the appropriate follow up care and poor use of community services. Benbassat and Taragin (2000) however believe that global readmission rates are not a useful indicator of quality of care based on a systematic review of the literature but that only patients with chronic conditions such as diabetes and asthma with high readmission rates may highlight quality-of-care problems.

The RESPOND study (Barker et al, 2015) was an RCT carried out in two EDs in Australia. Five hundred and twenty-eight community dwelling elderly fallers presenting to the ED and discharged home were recruited for the study. The intervention consisted of a home-based risk factor of falls assessment followed by one to one coaching on education and management of falls risk factors and linkage into community services. The primary outcome measure is falls per person per year, and fall related injuries per person per year. The results of the study are yet to be disseminated however it appears to be a unique patient-centred programme focusing on the first fall of ED attendee in order to prevent a second fall. The authors will evaluate the evidence to support a patient-centred approach to falls prevention.

1.7 Summary of review

Population ageing is a growing concern for healthcare providers. With a growing population comes increased pressure on emergency healthcare. The change in structure of the population will mean healthcare services will also have to grow and adapt to the service user. Elderly falls account for a significant proportion of ED attendances, with high levels of readmissions seen in the literature. Patients presenting to the ED post-fall should be assessed according to the falls guidelines with appropriate interventions and timely follow up in the community. This study will document referrals for this population.

This elderly population should also be assessed for frailty which has been shown to be prevalent in this population and also associated with adverse health outcomes, however the concept of frailty as a condition is relatively new and there is no definite or consistent management for frailty in this vulnerable population.

The aim of this study was to profile elderly fallers attending the ED, to identify the presence of frailty and to document their referral patterns.

Chapter 2: Methodology

2.0 Aims of the study

The aims of this study were to establish the incidence and circumstances of falls among the elderly community-dwelling population attending the ED of a large acute teaching hospital and to describe the patterns of healthcare utilisation among this group. The objectives of the study were:

- To examine prevalence and circumstances of falls among a sample of elderly attending the ED over an 8-month period.
- To describe the socio-demographic and health profile of older patients presenting to the ED following a fall.
- To document the healthcare utilisation among the sample of elderly ED attendees who present with a fall.

2.1 Study design

This was a cross-sectional, observational study.

2.2 Subjects

2.2.1 Subject recruitment

A cross-sectional study was conducted involving patients aged 65 years and over who sustained a fall and presented to the ED at a large acute teaching hospital in Dublin over an 8-month period. The ED attendance records of patients aged 65 years who presented to ED after sustaining a fall were reviewed by the researcher. Fallers were identified by keyword analysis of the ED chart based on pre-determined keywords. If a keyword (slip, trip, stumble, fall, dizziness, weakness, laceration, injury, collapse, blackout, faint, syncope, vasovagal, drop attack, found on floor, found collapsed, seizure, loss of consciousness, unresponsive, transient ischaemic attack) was present these patients were considered possible fall cases and were contacted by telephone by the researcher to determine if a fall took place. These key words have been previously used to identify fallers in the ED of a Dublin teaching hospital (McCarthy et al, 2010). If none of the above

listed key words are present, a fall was considered to be unlikely and no further action was taken.

2.2.2 Inclusion criteria

Participants who presented to the ED in a Dublin Teaching Hospital, and who met the following inclusion criteria were contacted by the researcher, within 48 hours of their discharge from hospital regarding participation in the study.

- Patients who had sustained a fall and presented to the ED.
- Patients living in the community setting and not in residential care.
- Patients aged 65 years and over.
- Patients with the ability to understand and complete the interview were included. If cognitive function was a concern the 10-item Abbreviated Mental Test was carried out by the researcher at the time of contact by telephone. Participants that scored 6 or above were included.
- Ability to provide written informed consent.
- English speaking participants.

2.2.3 Exclusion criteria

- Patients who were long stay residents of a nursing or residential home.
- Patients who scored below 6 on the Abbreviated Mental Test.
- Patients who were unable to provide informed consent.
- Patients who remained an in-patient for longer than one month from the date of the admission in question.

2.2.4 Sample Size

Recent data from St James's hospital showed that in 2010, there were 9,484 ED attendances among those aged 65 years and over. This equated to 26 elderly patients each day, with about 25% of attendees having a history of falls. This meant that approximately 6 patients attended each day with a fall. The researcher focussed on fallers attending on a Monday, 1 day per week for an 8-month period, 6 patients each day X 8 months [34 weeks], giving a planned sample of 204 participants.

2.3 Ethical considerations

An application for ethical approval was submitted to St. James's Hospital/Adelaide and Meath Hospital (SJH/AMNCH) research ethics committee on 30th June 2014 (Appendix 4). Approval was granted on 11th August 2014 (Appendix 5). Recruitment commenced on the 1st October 2014. All participants were provided with a Participant Information Leaflet (Appendix 6) by the researcher. The research aims and objectives were explained at that time of the first telephone contact, 48 hours after discharge and within one week. Participants were informed that their participation was voluntary and that they could withdraw from the study at any time. Any questions and queries were answered. Signed, informed consent (Appendix 7) was obtained from each participant by the researcher. Once the first contact was made by the researcher, information leaflets along with consent forms and stamped addressed envelopes were sent out to the participants for their consideration.

The data collected was coded by the researcher who used a unique identifier for each participant. Only the researcher was able to identify the participant via the code. The identifying codes, the participants' names and medical number were kept on a password protected spreadsheet, to which only the researcher had access to. The data was securely saved to the G-drive of a networked password protected computer at the St. James's hospital site. Portable devices and all files were encrypted. All written documentation was kept in a locked filing cabinet in the physiotherapy department, to which only the researcher had access. The collection, storage and use of participant data, was carried out in accordance with the Data Protection Act (1998).

When contacting patients the researcher cross-referenced patient details with resources such as www.rip.ie and checked for any recent hospital episodes that would inform the researcher if the patient was deceased. If the researcher was unable to verify this status then the researcher would proceed with a phone call using a sensitively prepared script. The researcher introduced themselves and asked to speak to the person in question. If the researcher was informed that the patient was recently deceased a sensitive and respectful message of sympathy was offered and an apology given for disturbing the family/individual.

There was a small risk that participants could feel a little upset discussing their fall. The research physiotherapist was aware of this and conducted the interview with sensitivity and respect.

2.4 Procedure

The ED attendance records of all patients aged 65 years and over were reviewed within 48 hours by the research physiotherapist. Fallers were identified by keyword analysis of the ED chart based on pre-determined keywords. If a keyword (slip, trip, stumble, fall, dizziness, weakness, laceration, injury, collapse, blackout, faint, syncope, vasovagal, drop-attack, found on floor, found collapsed, seizure, loss of consciousness, unresponsive, transient ischaemic attack) was present these patients were considered a possible fall case and were contacted by the researcher to determine if a fall took place. If none of the keywords were present on the ED card, a fall was considered unlikely and no further action was taken.

Once fallers were identified from the ED chart review the researcher contacted the participants by phone within four weeks to clarify if a fall took place. A fall was defined as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other objects" (WHO 2007). Patients who were discharged from the ED were contacted after 48 hours and within one week. Those admitted from the ED and discharged within one month, were contacted after 48 hours and within one week post discharge.

The participant was informed of the study and informed consent explained. The participant was invited to attend the hospital or conduct an interview over the phone at a later date, if willing to participate after a period of reflection. Patient information leaflet and consent forms were sent out in the post and a period of reflection lapsed until the researcher made contact again. This one week period allowed for delivery of post and 48hours for a period of reflection. A hospital visit or over the phone interview was then arranged if the participant wished to take part in the study. Over the course of the study it became apparent that the preference of the participants was to conduct the interview over the phone instead of returning to the hospital. All of the interviews were conducted over the phone. The use of telephone survey has been found to be effective in reassuring

respondents about a survey as well as clarifying points that an individual may not understand (Dillman, 2000). There was no funding available for transport in the study. Before the interview took place the researcher reviewed the patient information leaflet with the participant and the participant was given the opportunity to ask questions and give written consent. Following consent demographic information was obtained from the ED chart. The interview consisted of questions to establish measures of patient function, levels of dependency, falls history and social network. Approximate length of telephone interviews was 40 minutes. The flow chart (Figure 2.1) demonstrates the steps taken in the study.

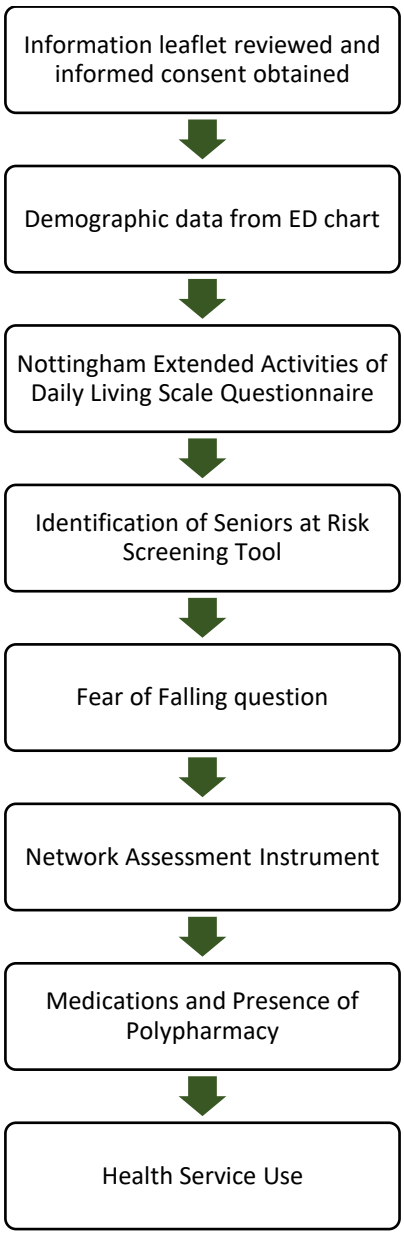

Figure 2.1 Illustrates the sequence of testing to ensure ease of repeatability

2.5 Demographic profile of the participants

2.5.1 Demographics

A demographic profile of the 93 participants was composed from the information provided by the ED chart. This chart provided information on gender, age, and marital status (Appendix 8). During the interview participants' social details were recorded, including housing type, whether they had children and whether they lived alone.

2.5.2 Falls profile

A fall has been defined as an event which results in a person coming to rest inadvertently on the ground or floor or other lower level (WHO, 2012). The National Health Service has defined a fall as a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, or the ground, other than as a consequence of sudden onset of paralysis, epileptic seizure, or overwhelming external force (2011). Falls are common in the community dwelling elderly population with 33% of those aged over 65 and 50% aged over 80 falling in a one year period (Tinetti et al, 2003). The consequences of falls in the elderly can be severe and include hospitalisation, premature nursing home placement, social isolation and increases in morbidity and mortality (Davis et al, 1996).

A falls profile was carried out by the researcher. The circumstances of the fall were noted from the ED chart and confirmed by the patient during the interview. The location of the fall was reported by the participant. Participants were asked about any other falls in the previous twelve months and whether they had a fear of falling. Participants were also asked if they used a mobility aid when walking and if so the type was noted.

The American Geriatric Society(AGS) and British Geriatric Society's (BGS) Clinical Practice Guideline for prevention of falls in older persons recommends a multifactorial risk assessment that should include falls history that details the circumstances, frequency and consequences, medication review and risk factors along with a physical examination, a functional assessment and an environmental assessment (2010). For the purposes of this study a detailed history of falls, medication review and risk factors were identified.

Previous fall history was noted. The participant was asked if they had fallen in the past 12 months and if yes, how many times. It has been well documented that previous falls history is predictive of further falls (Covinsky et al, 2001, Cwikel et al, 1998). The National Institute for Health and Care Excellence (NICE) guidelines outline that identifying single risk factors is informative but that the interaction between multiple risk factors needs to be considered (2013). These risk factors have been well established and the NICE (2013)guidelines recognises them as lower limb muscle weakness, history of falls, balance deficit, sensory impairment, impaired vision, cognitive impairment, fear of falling, use of assistive device, depression and arthritis. Based on these guidelines each participant's level of mobility and use of a walking aid was recorded.

Each respondent was asked if they were afraid of falling. Fear of falling was assessed by asking the individual "are you afraid of falling?" with the options of answering yes/no. This method of ascertaining fear of falling has been used in previous studies. (Murphy et al, 2002, 2003). Fear of falling has been associated with a reduction in physical activity which can lead to a loss of independence, a reduction in social activity and increased frailty (Howland et al, 1998, Arfken et al, 1994).

2.6 Assessments

2.6.1 Nottingham Extended Activities of Daily Living Scale

The Nottingham Extended Activities of Daily Living Scale (NEADL) scale is a self-reported, questionnaire. The questionnaire consists of 22 questions reflecting recent activity (Appendix 9). The 22 questions about everyday activities allowed for four possible answers: "Not at all", "With help", "On your own" or "On your own with difficulty". The researcher asked the participant to choose one answer in response to each question, recording what had actually been done over the previous two weeks. These questions can be divided into four sections of varying types of tasks under the headings; mobility, kitchen, domestic and leisure. Subscales can be created under these headings. Scoring is numerical 0-22, with higher scores representing greater independence. Participants who choose "On your own" or "On your own with difficulty" score 1, while an answer of "Not at all" or "With help" scores 0.

The scale has been demonstrated as a suitable instrument for evaluating activity for community dwelling participants. Hsueh et al (2000) administered the NEADL via telephone interview to 153 community dwelling stroke patients with a mean age of 66.4 years. Hsueh and colleagues examined the validity of the NEADL against the Barthel Index and found that the latter tool has a ceiling effect unlike the NEADL. The study also showed that the subscales of the NEADL had higher coefficient of reproducibility and scalability than the total results suggesting that the subscales better fit the criteria for an acceptable Guttman Scale. These results support the NEADL as a valid tool for this population and also support the examination of the subscale totals along with the complete totals as previously suggested by Lincoln et al (1998).

Sarker et al (2012) later compared the NEADL scale and the Frenchay Activities Index (FAI) to the Barthel Index in a study of 238 patients three months post stroke. Participants had a mean age of 68.6 years and were recruited as inpatients in a hospital or stroke unit and as outpatients in the community. It was found that the NEADL scale was not limited by a floor or ceiling effect unlike the other tools used. This suggests that scores from the NEADL are well distinguished from each other and that change is easily measured therefore increasing responsiveness to change (Terwee et al, 2007). Sarker et al (2012) also reported the NEADL as having high concurrent validity ($r_s > 0.80$) and reliability ($r_i = 0.75$) which is above the recommended minimum standard for reliability criteria in health care questionnaires. They summarised their findings of the NEADL scale as a valid and sensitive tool compared with other extended activities of daily living tools. The NEADL scale has been used with a variety of groups including stroke patients (Wu et al, 2011), patients with Multiple Sclerosis (Nicholl et al, 2002) and patients post hip fracture (Syllias et al, 2011) and has been validated for use over the phone or as a postal survey (Lincoln and Gladman 1992, Hseuh et al, 2000).

The use of the NEADL scale in this study of elderly fallers may provide an insight into levels of dependence in this population It has been identified previously that improved performance of ADL'S in stroke patients was associated with less dependence on social and health resources (Gladman et al, 1993).

2.6.2 Identification of Seniors at Risk (ISAR)

The use of screening tools in the ED allows for identification of patients in need of acute geriatric care. These tools have been developed to quickly identify impairments, demanding less time and resources and identifying if further assessment and treatment is required. This initial assessment can highlight the most important impairments that need to be addressed, detect changes over time and have a prognostic function in conjunction with clinical reasoning (Thiem et al, 2015).

The ISAR tool is a six question self-reported questionnaire. McCusker et al (1999) developed the tool to quickly identify seniors with current disability and screen those at risk of adverse health outcomes and functional decline in the ED setting. The tool is described as a screening tool that takes less than 5 minutes to complete. It is recommended that the tool be used in conjunction with clinical reasoning and is not a diagnostic tool. The six questions enquire about the presence of home help, increased functional dependence, recent hospitalisation, impaired memory, visual problems and poly-medication (Appendix 10). The answers require yes/no responses and patients are considered to be at risk if two or more questions are answered as positive.
McCusker et al (1998) recruited 221 patients from ED's in Canada with the aim of determining the reliability and validity of screening questionnaires. The screening tool composed of a 22 item questionnaire that included the six questions that would later make up the ISAR. Test-retest reliability of 0.78 (95% confidence interval 0.71, 0.83, n=193) was reported and a subset of questions were identified as best for prediction of disability. This subset included questions about the need for regular help, memory and increased assistance, questions that were included in the ISAR.
Dendukuri et al (2004) later evaluated the validity of the ISAR tool using data from two previous studies by McCusker et al 1999 and 2001. Patients in both studies were over the age of 65 and had similar baseline characteristics and the sample size was 1,122 and 550 respectively. Dendukuri et al (2004) reported good to excellent concurrent validity (AUC 0.78-0.86) for detecting severe functional impairment in the ED setting and good predictive validity (0.61-0.71) for high utilization of health services. Hoogerduijinet et al (2010) had similar favourable results for the ISAR tool's ability to predict functional

decline reporting 93.6% negative predictive value in a prospective cohort study of 177 elderly patients in an ED setting.

Sensitivity and specificity of the ISAR tool was summarised in a systematic review by Beaton et al (2013). This paper critically reviewed studies on tools that assess functional decline and included six papers using the ISAR tool. Sensitivity was found to be good ranging between 0.74-0.93 in the six papers reviewed, specificity was less favourable however with a range of 0.29-0.93.

Salvi et al (2012) carried out a prospective cohort study (n=2,057) comparing two screening tools (ISAR and the Triage Risk Screening Tool) and found that the ISAR was highly correlated with frailty. The authors suggested that the tool identifies those at risk of adverse outcomes after an ED visit and can be used to more effectively identify community dwelling elderly in need of geriatric care (Beaton and Grimmer, 2013).

These studies supported the validity of the ISAR tool used in the ED however application in this setting may prevent a true assessment due to the patient's condition at the time. Factors such as distress, delirium and poor balance have been associated with acute illness and may effect a patients recall and recollection (Beaton and Grimmer, 2013). Application of the ISAR tool for this study was carried out with community dwelling patients, within four weeks post discharge from the ED. This is unlike previous studies however it has been suggested that the tool has potential application in the primary care setting (Dendurkuri et al, 2004).

Suijker et al (2014) modified the ISAR tool to an instrument to be used in the primary care setting calling it the Identification of seniors at risk-Primary Care (ISAR-PC). This tool comprises of three variables: dependence in activities of daily living, self-reported memory complaints and age. External validity AUC ranged from 0.63-0.64 and the authors reports higher specificity resulting in less false positives. However, this shortened tool may not address enough limitations of community dwelling elderly e.g questions about increased dependence with ADL'S is asked with referral to the previous 24 hours which is a small time frame and may result in underreporting.

The ISAR tool has been implemented for use in emergency departments in Canada, Australia and Europe. More recently the tools' predictive ability has been noted to be effective in elderly community dwellers experiencing functional decline (Suijker et al, 2014) and also noted for its predictive ability with readmissions (Rosted et al, 2014).

2.6.3 Network Assessment Instrument

The Network Assessment Instrument was administered as part of the interview to identify older peoples' social networks and the level of support they receive within that network. A support network has been defined as "all those closely involved with the elderly respondent providing companionship, advice, help or care." (p149, Wenger, 1991)
Wenger (1991) developed a typology of informal support networks of elderly people based on a survey of 534 community dwelling elderly participants. The initial data collection took place in 1979 and was repeated at four year intervals in 1983 and 1987. The results showed differences of social network size between genders and marital status. The data also showed that most support came from immediate family members. Wenger conducted a follow up study which led to the identification of five different network types and subsequently the Network Assessment Instrument.
The instrument categorises each participant into one of five network types. These support networks are labelled family dependent, locally integrated, wider community focused, local self- contained and private restricted.

- Wider community focused support networks have been described as large networks with weaker ties and reliance that is placed on distant kin and local friends. This network would not sustain high dependency or long-term care needs.
- The family-dependent support network shows a high level of dependency for practical and personal care and is more commonly carried out by one person usually a daughter. Members may be reluctant to seek professional help.
- Private restricted support networks are much smaller than the wider community networks described. People belonging to this network can be expected to rely on formal help and professional services.
- Locally integrated support networks see members with well-established family and community support in neighbours and friends. This network has difficulty supporting high levels of dependency.
- Locally self-contained support networks include members who have loose-knit relationships and a privatised lifestyle. This may be due to a life-long adaptation to low levels of contact. Members are at risk of social isolation and resistant to professional help.

The questionnaire consists of eight questions to identify the closeness and availability of family and children, the level of interaction with neighbours and friends, and the attendance of any community groups (Appendix 11). When analysing a participant's social network type two broad categories are used, 'vulnerable' and 'robust'. Vulnerable social networks are 'local self-contained' and 'private restricted' whilst the remaining networks can be considered 'robust' in nature.

A report by the National Council on Ageing and Older People in Ireland (2004) examined loneliness and social isolation among older Irish people using the Social and Emotional Loneliness Scale for Adults Short Form (SELSA-S) and the Network Assessment Instrument. The over the phone interview was completed with 683 participants over the age of 65 identified by public health nurses in both rural and urban areas in Ireland. The study found that 73.2% of older people were locally integrated suggesting close relationships with family and friends and therefore low social isolation. However those reporting poor self-rated health also reported higher levels of loneliness. The recommendations that followed this report suggested that the Network Assessment Instrument should be made available to help identify loneliness and social isolation at individual and community levels.

2.7 Medications

Medical history was ascertained from the ED chart by the researcher and confirmed by the participant. The researcher was unable to gain medical history from thirteen participants. This was due to missing information on the ED charts. One participant had no previous medical history to note. Medical conditions were categorised into areas of medical speciality such as cardiac, neurological, psychological, cancer and orthopaedic conditions. The frequency and type of condition was noted.

The presence of polypharmacy was established from the ED chart and/or the discharge summary on the hospital administration system and confirmed by the participant. Polypharmacy has been defined by the concurrent use of five or more medications and excessive polypharmacy defined as 10 or more medications (Fulton et al, 2005).

The ED chart supplied the patients' medical history and medications on discharge. Medications were reviewed against the Fall Safe Guidance Sheet 'Medicines and Falls in Hospital: Guidance Sheet.' A guidance sheet approved by the British Geriatrics Society for use by prescribers in elderly patients who are at risk of falling. The guidance is used like a traffic light system, highlighting drugs that may pose different levels of risk for falls (Appendix 12). The Fall Safe Project was a local quality service development project led by a Consultant Geriatrican with the aim of delivering a more structured process of care to the patient at risk of falls (http://www.health.org.uk/programmes/closing-gap-through-clinical-communities/projects/fallsafe-project). The categories of medications in this guidance sheet are also included in more commonly used guidance tools such as the Screening Tool of Older Persons' Potentially inappropriate Prescriptions (STOPP) (Gallagher & O'Mahoney 2008) and Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. These criteria have establish medications which are associated with a greater risk of falls (Rochon & Gurwitz 1999).

The STOPP criteria was created in 2008 by a consensus panel of eighteen experts to provide explicit, evidence based rules that would improve medication appropriateness while preventing adverse drug events. The criteria lists five classification of drugs that adversely affect fallers and that may be potentially inappropriate in persons aged over 65. These drugs are: benzodiazepines, neuroleptic drugs, antihistamines, some vasodilator drugs and long-term opiates. The Beers Criteria for Potentially Inappropriate Medication Use in Older Adults suggest the avoidance of certain categories of drug in patients who have a history of falls, as these medications have been shown to cause falls, fainting and difficulty co-ordinating movement. The criteria list the following categories of medication as potentially inappropriate for use in older adults with a history of falls: Anticonvulsants, antipsychotics, benzodiazepines, nonbenzodiazepine hypnotics, tricyclic antidepressants, and selective serotonin uptake inhibitors. Both tools were created specifically for the elderly patient who, due to likely increases in co-morbidities with age may have increased susceptibility to polypharmacy, adverse drug reactions and potentially inappropriate prescribing.

For this study participants' medications were noted from the ED discharge summary, confirmed by the participant and checked against the 'Medicines and Falls in Hospital: Guidance Sheet.'

2.8 Healthcare utilisation

The date and time of presentation at ED, along with the ED waiting time was recorded. The method of referral was documented, whether it was a GP referral or a self-referral along with the reason of referral and triage category as noted by the triage nurse.
The mode of transport and whether the participant was accompanied, outcome of ED visit, and onward referral were also recorded and whether or not the participant was a medical card holder.
Repeat ED visits have been defined as one or more visits to the ED in the previous six months. Repeat ED visits in the over 65's population has been reported to be as high as 37% (Naughton et al, 2010. Drennan et al, 2010). Admissions to the ED in the previous six months were noted from the Patient Administration System (PAS) system.

Utilisation of health care services by the participant was identified from the hospital Patient Administration System (PAS). This system records details on patient activity including admissions, discharges, clinic appointments and community referrals. The Health Service Executive (HSE) reports the target percentage for medical readmissions to the same hospital within 28 days of the index visit should be below 9.6%. The figure for readmissions nationally is 11% for the year 2015 to date. Since 2009 readmission rates nationally have been above the target percentage. Readmissions into Irish hospitals have been suggested to represent new events in elderly patients with chronic conditions and may not be preventable episodes (Moloney et al, 2004). Patients aged 65 years or older, of male gender, who have a primary diagnoses of chronic obstructive pulmonary disease, myocardial infarction, alcohol-related disease and heart failure during the index admission have been significantly associated with readmission internationally (Westert et al, 2001).
Referrals made to the public health nurse, day hospital and out-patient follow up post fall were also noted using this system. Each participant was asked if they had attended their GP in the previous six months and since discharge. Referral to community services such as community Physiotherapy or Occupational Therapy, Medical Social Work, Home-Help services, Home Care Package or Meals-on-Wheels was also established.

2.9 Statistical methods

Data were analysed using IBM SPSS Statistics Version 22. Descriptive statistics, analysis of normality of data and graphical representation was used.

Data that was normally distributed were presented as the mean with standard deviation (SD) and 95% Confidence Intervals (CI). Peasrson's Chi-squared test was used to compare categorical data. The level of statistical difference was set at $p<0.05$. Results will be presented in Chapter 3.

Chapter 3: Results

3.0 Introduction

The aim of the current study was to profile elderly fallers coming into the Emergency Department of a Dublin hospital. It is known that falls account for up to a quarter of admissions from patients over the age of 65. The aim of the study was to examine the prevalence and circumstance surrounding these admissions over an eight month period. Additionally, the study aimed to describe the socio-demographic and health profile of older patients presenting to the ED following a fall while documenting the patterns of healthcare follow up.

A cross sectional study design was conducted. A total of 93 participants completed the study (Figure 3.1). Recruitment commenced on 1st October 2014 and finished on May 20th 2015. The ED attendance records of patients aged 65 years who presented to ED after sustaining a fall were reviewed by the researcher. These patients were then contacted by telephone to take part in the study. An over the phone interview consisted of questionnaires to determine; level of functional dependence, presence of frailty, and type of social network and support provided by that network. Follow up by community services or return hospital appointments was determined from the hospital system and confirmed by the patient.

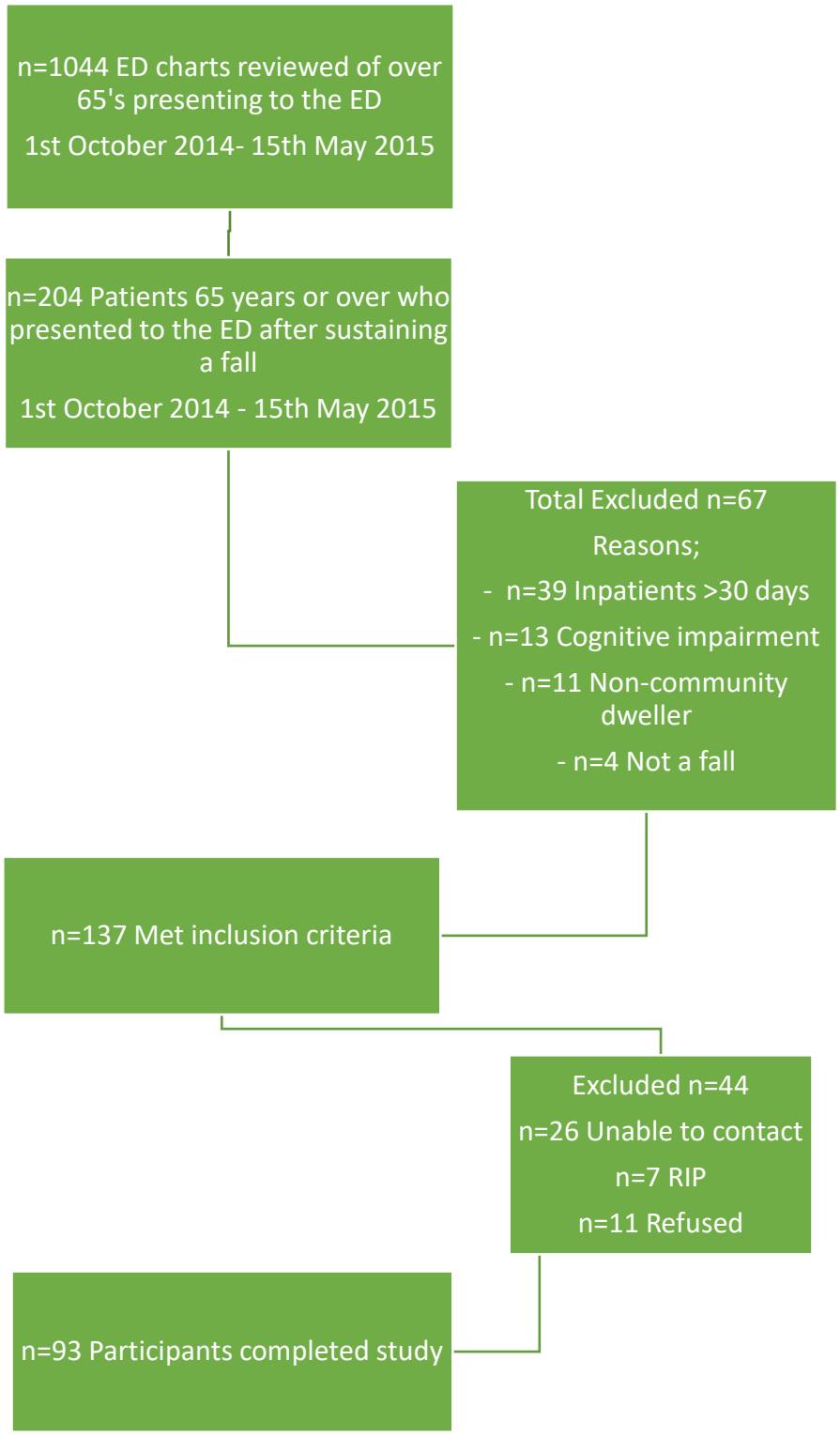

Figure 3.1 Flow of subjects through study

3.1 Demographics of participants

The study sample consisted of 93 participants of which 53 were female (57%) and 40 were male (43%). The mean age was 76.5 years and the oldest participant was 94 years of age. The majority of participants (78%) reported to live in a two-storey house, 10% (9) reported to live in a bungalow and 12% (11) in an apartment or flat. The majority of participants (86%) reported having offspring. Forty-four (47.3%) participants reported to live alone, of which 33 (35.5%) were female and 12 (13%) were male (Table 3.1).

Table 3.1 Demographic profile of participants (n=93)

Variable	**Subjects (n=93) n/%**
Gender	Female 53 (57%)
	Male 40 (43%)
Age (mean ± sd)	Mean 76.5 years of age, Std Dev 7.65
	Range (65-94 years of age)
(65-74)	33 (35.5%) Female 21 Male 12
(75-84)	43 (46.2%) Female 19 Male 24
(85-94)	17 (18.3%) Female 13 Male 4
Married	37 (40%)
Widowed	38 (41%)
Single	11 (12%)
Have children	80 (86%)
Live alone	44 (47%)
Two-storey House	71 (78%)
Bungalow	9 (10%)
Apartment/Flat	13 (12%)

3.1.2 Falls location and circumstances

All participants presented to the ED post-fall. Fifty-seven (61.3%) participants sustained the fall at home, whilst 36 (38.7%) fell in a public place. Participants were asked about the circumstances surrounding the fall. Various circumstances were noted and included falls on the stairs (21.5%), in the bathroom (15.1%), and on the road (20.4%). Falls whilst performing household tasks accounted for 14% of the events. Weather conditions accounted for 3.2% of falls with three participants reporting strong gusts of wind causing their fall (Table 3.2). Table 3.2 outlines the different circumstances leading to the participants fall.

Table 3.2 Falls circumstances (n=93)

Fall Circumstance	Subject n (%)
Climbing stairs	20 (21.5)
Walking on road/footpath	19 (20.4)
Whilst in the bathroom	14 (15.1)
Performing household tasks	13 (14)
Whilst in the garden	8 (8.6)
No details	7 (7.5)
Whilst in the bedroom	5 (5.4)
Getting on/off transport	4 (4.3)
Weather conditions	3 (3.2)

3.1.3 Previous fall history and fear of falling

Previous fall history was also noted with 43 (46%) patients reported having sustained a previous fall in the past year. Fifty-four percent of participants denied having a previous fall in the past year. All participants were asked if they were afraid of falling. Forty-six

percent of participants responded positively to the question, whilst 53.8% reported having no fear of falling (Figure 3.2). Women were more likely to express a fear of falling but no significant statistical difference was found between the genders (x^2= 3.565, p= 0.059). Figure 3.2 shows the presence of fear of falling between the genders.

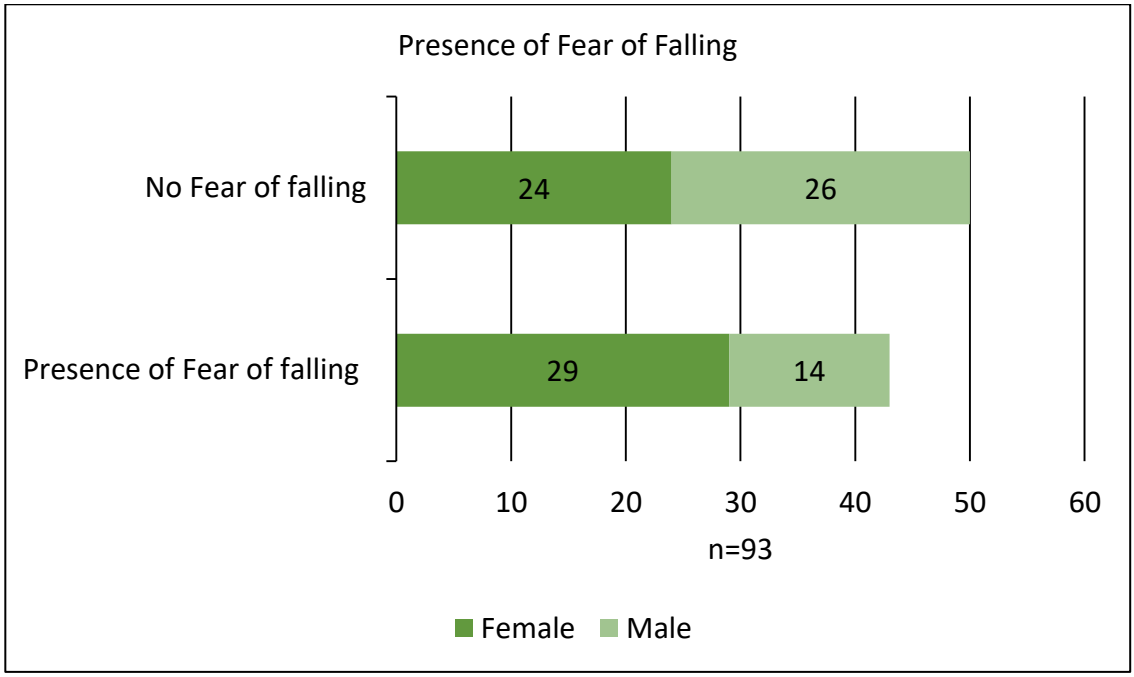

Figure 3.2 Presence of fear of falling (n=93)

3.1.4 Mobility aid

The majority of participants did not report use of a mobility aid when mobilising (57%). Of those who reported to use a mobility aid, the majority used a walking stick (20.4%). Just 9.7% reported to depend on a rollator zimmer frame, 7.5% on elbow crutches and 5.4% on a three or four wheeled rollator (Figure 3.3).

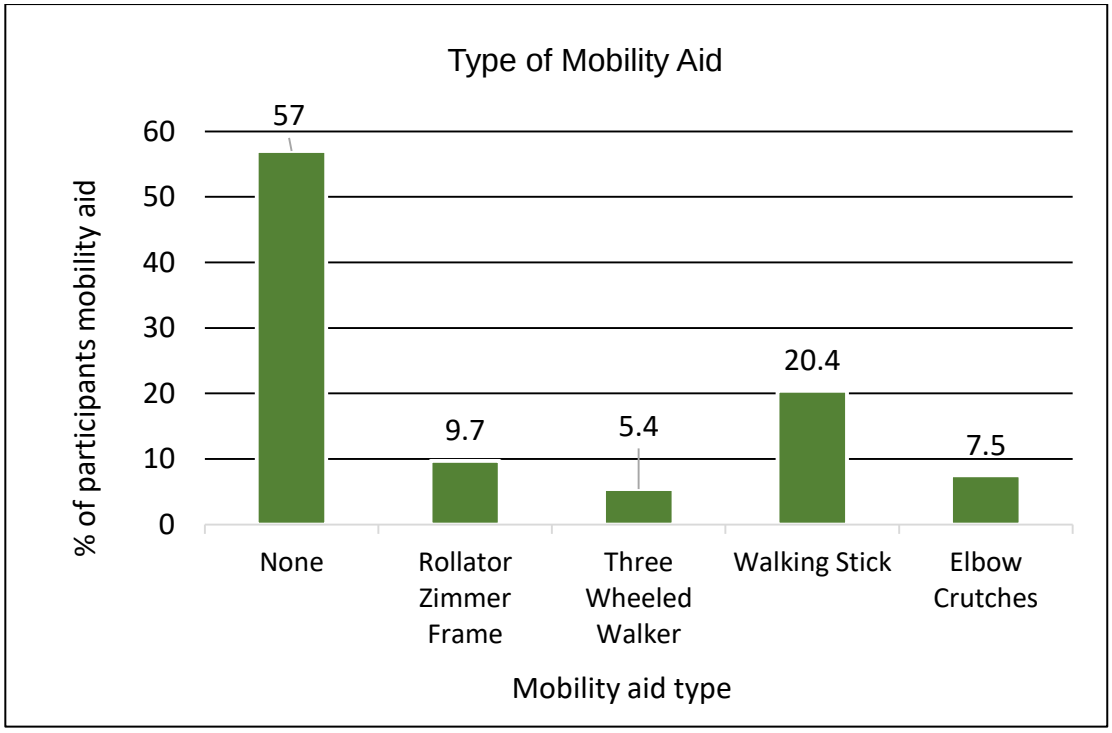

Figure 3.3 Type of mobility aid (n=93)

3.1.5 Medical history

Medical history was ascertained from each participant. The researcher was unable to gain medical history from thirteen participants. One participant had no previous medical history to note. Just over half (51.3%) of participants had three or more medical conditions (Table 3.3). The most common medical conditions noted were cardiac conditions (53.75%) such as hypertension and atrial-fibrillation, followed by endocrine (22.5%) conditions such as diabetes mellitus. Cancer was included in 15% of participants' medical history as was osteoporosis (Figure 3.4). The category labelled 'other' included insomnia, a history of alcohol excess, kidney stones and coeliac disease.

Table 3.3 Number and frequency of medical conditions (n=80)

Number of Medical Conditions	Frequency	Percent
0	1	1.3
1	15	18.8
2	23	28.7
3	17	21.3
4	12	15
5	6	7.5
6	4	5
7	2	2.5

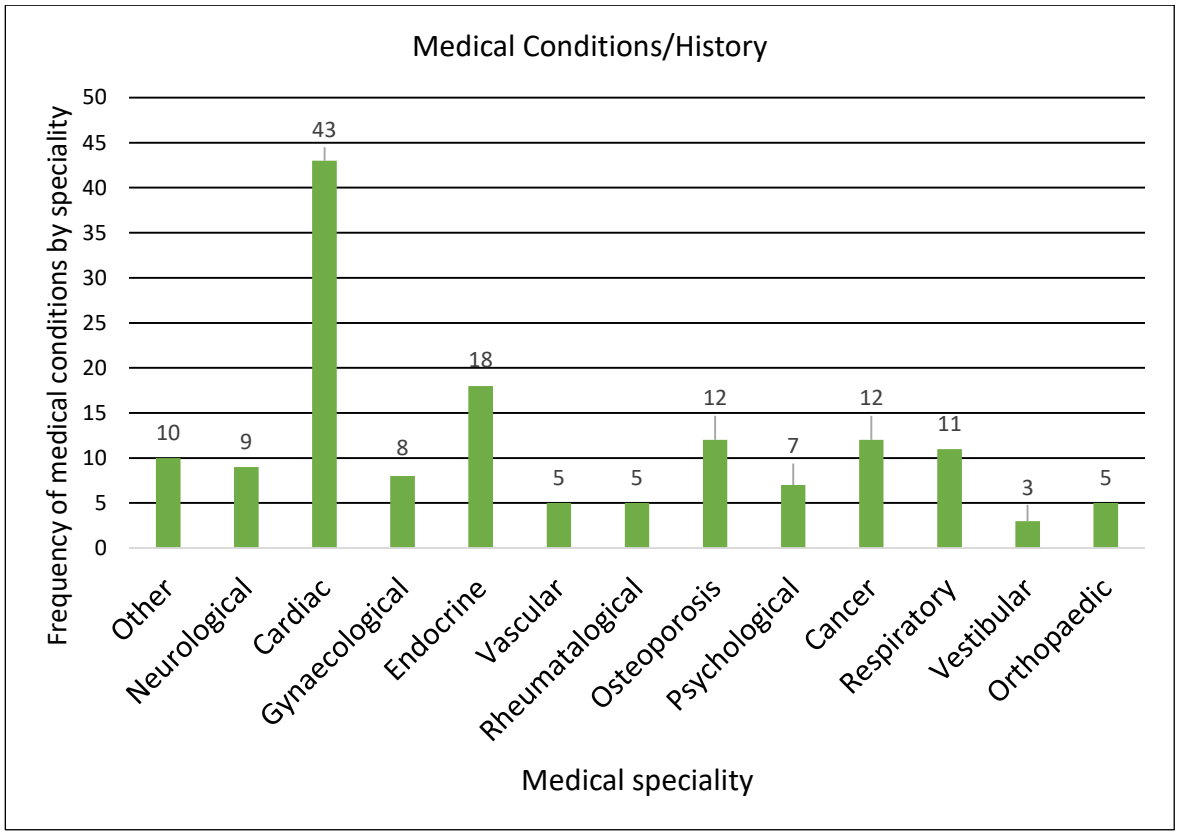

Figure 3.4 Medical conditions (n=80)

3.1.6 Presence of polypharmacy

Polypharmacy was identified in 43 (55.8%) participants, while 34 participants (44.2%) did not have polypharmacy. Data on polypharmacy was not obtained for 16 (17.2%) participants. This was due to either missing information on the ED chart or the participant's uncertainty of the number of medications currently prescribed to them.

3.1.7 Frequency of medications

The number and frequency of medications are shown in Figure 3.5. The most common number of medications per participant was 5 with 18 participants (19.4%) taking five medications regularly. Twelve (12.9%) participants took four medications regularly and 10 (10.8%) participants took two medications regularly. Eight (8.6%) participants took eight or more medications regularly while only one participant took no regular medications.

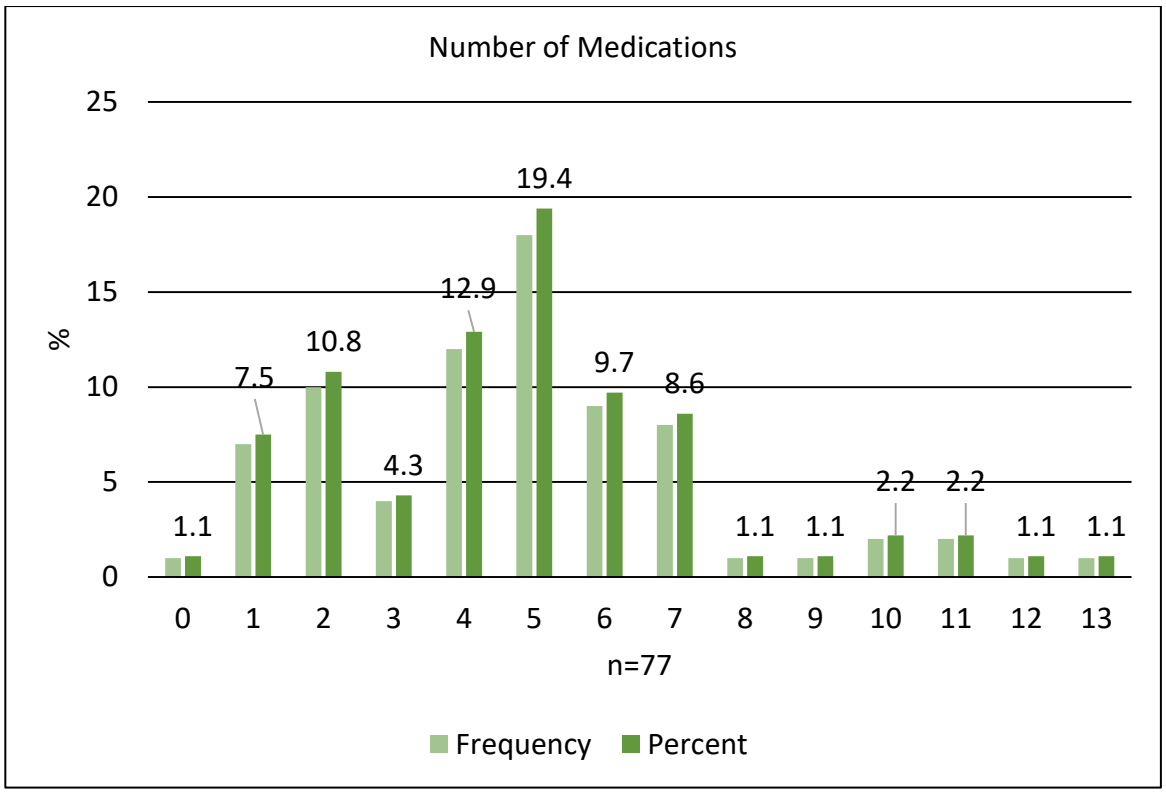

Figure 3.5 Number, frequency and percentage of medications (n=77)

The association between polypharmacy and those with previous falls was examined. Of those who had a history of falls (43 participants), 36 participants had polypharmacy. Pearson's chi-squared test was carried out and a statistically significant difference was

found with p-value of 0.08, significant at a 90% CI (Figure 3.6). Figure 3.6 shows the association between polypharmacy and previous fall history.

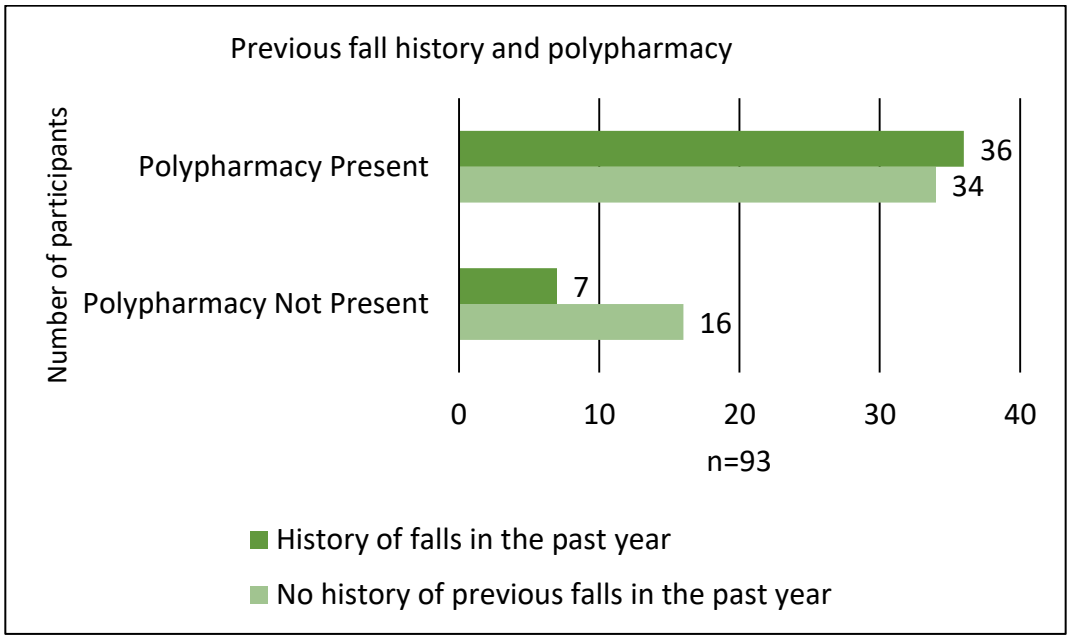

Figure 3.6 Association between polypharmacy and previous fall history (n=93)

3.1.8 Nottingham Extended Activities of Living (NEADL) Scale

The NEADL questionnaire was carried out on all 93 participants. The questionnaire reflects recent activity undertaken by the respondent. Scoring is numerical, from 0-22 and can be divided into subscales under the different sections of the questionnaire; mobility, kitchen, domestic and leisure. Higher scores represent greater independence.

The mean score for the NEADL was 14.4 and the median score was 16. Figure 3.7 shows the percentages of participant's responses to each question. Figure 3.8 shows the frequency of NEADL total scores. The lower quartile range for the total NEADL score was 10. The interquartile range was 16 and the upper quartile range was 19. Only 4.4% of participants scored fully.

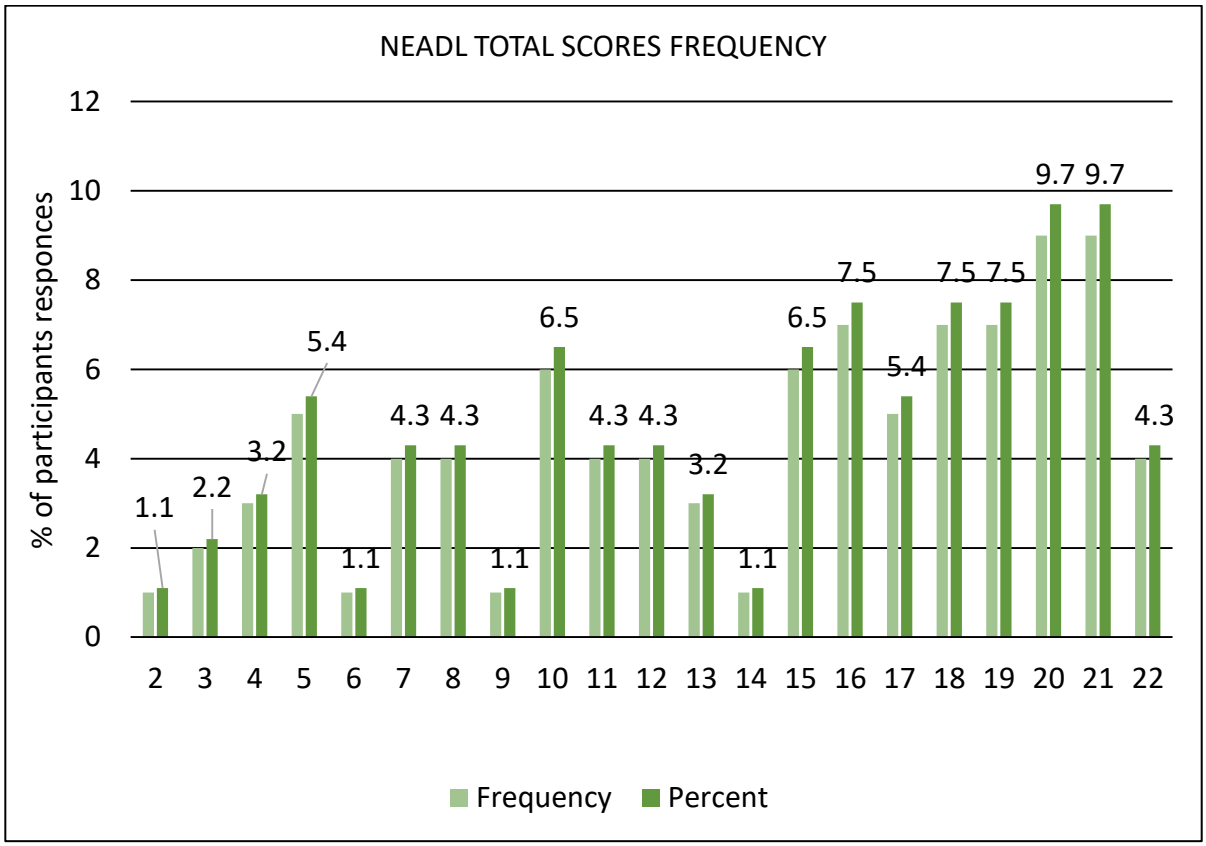

Figure 3.7 NEADL frequency of total scores (n=93)

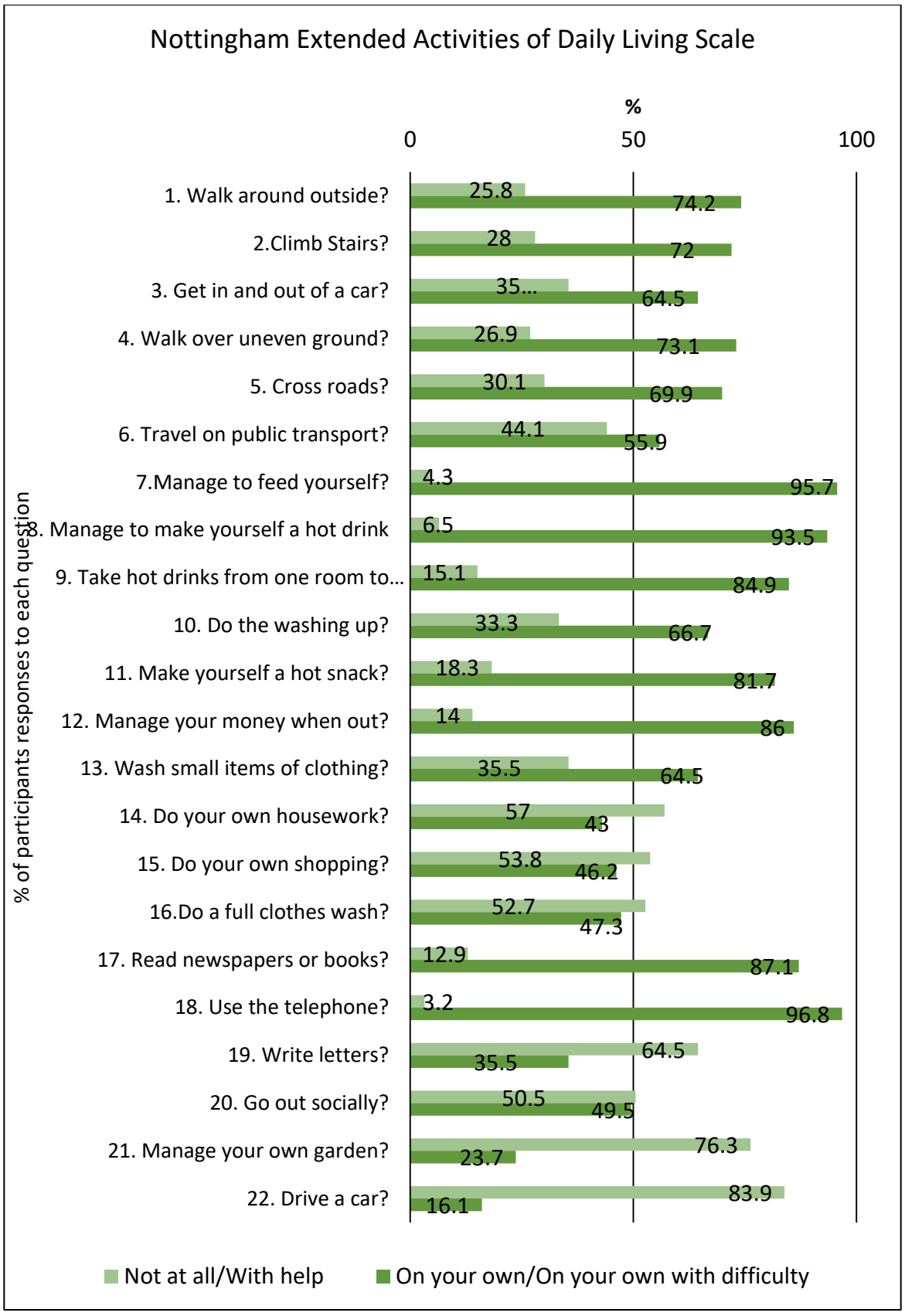

Figure 3.8 NEADL results (n=93)

Independence with mobility was assessed by the first six questions of the NEADL. The majority (38.7%) of participants scored 6/6 in the mobility category, followed by 24.7% scoring 5/6. Nearly 13% scored 0/6 in this category implying that these 12 participants may have needed help with mobility (Figure 3.9).

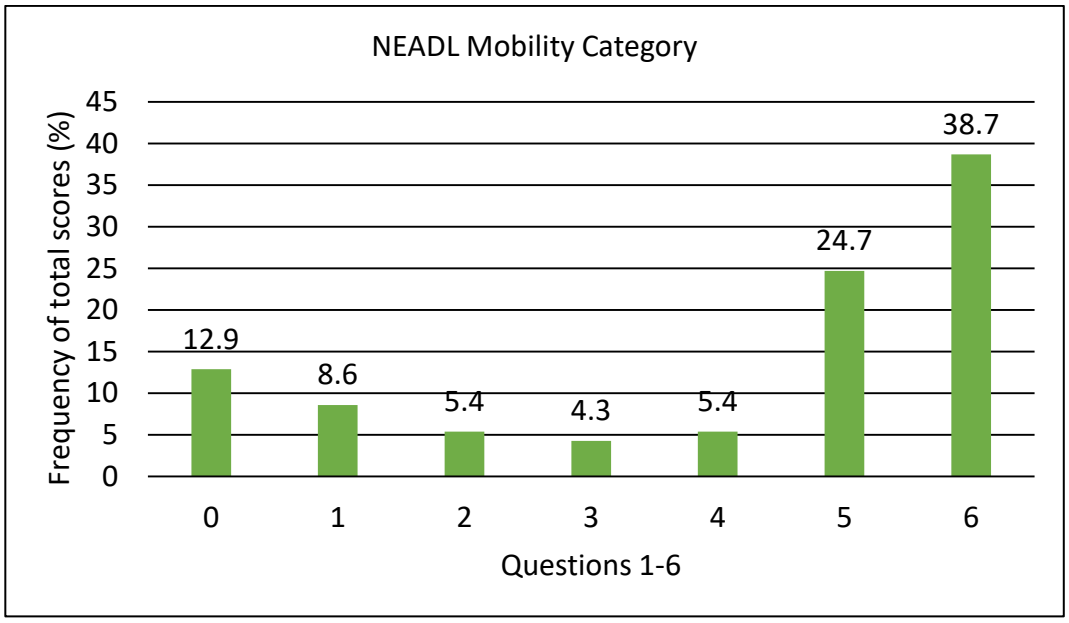

Figure 3.9 NEADL Mobility Category results (n=93)

Recent activity in the kitchen was assessed by questions 7-11. Nearly two-thirds of participants (65.6%) scored 5/5 in this category (Figure 3.10).

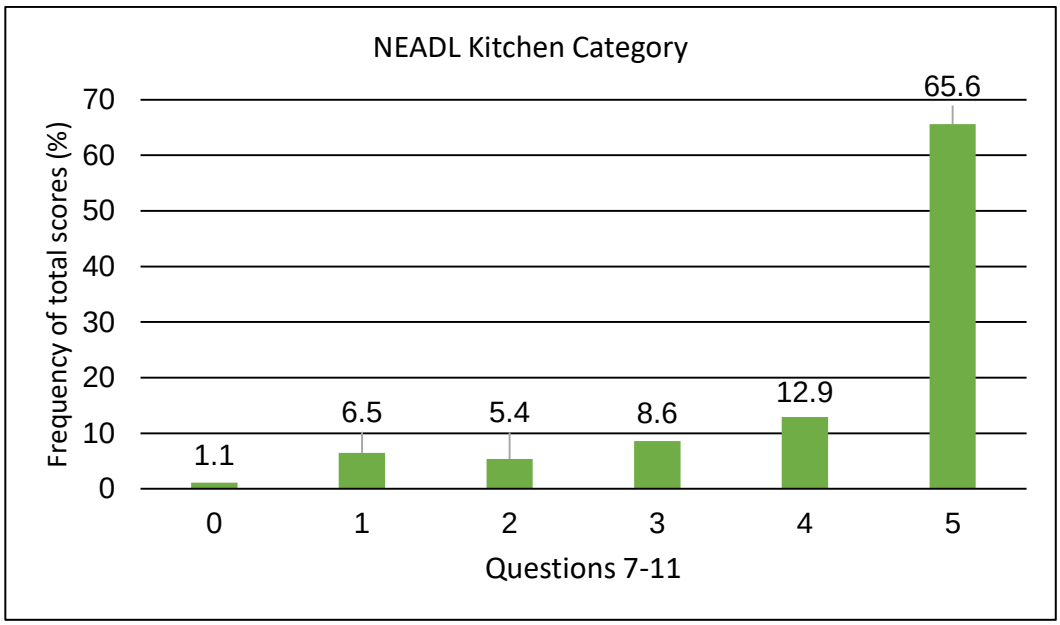

Figure 3.10 NEADL Kitchen Category results (n=93)

Domestic activity was recorded from questions 12 to 17. Twenty-nine percent of participants (27) scored 6/6 in this category. Sixteen participants (15) scored 5/6 for recent domestic activity. The remaining 54.9% (51) scored 4/6 or below (Figure 3.11).

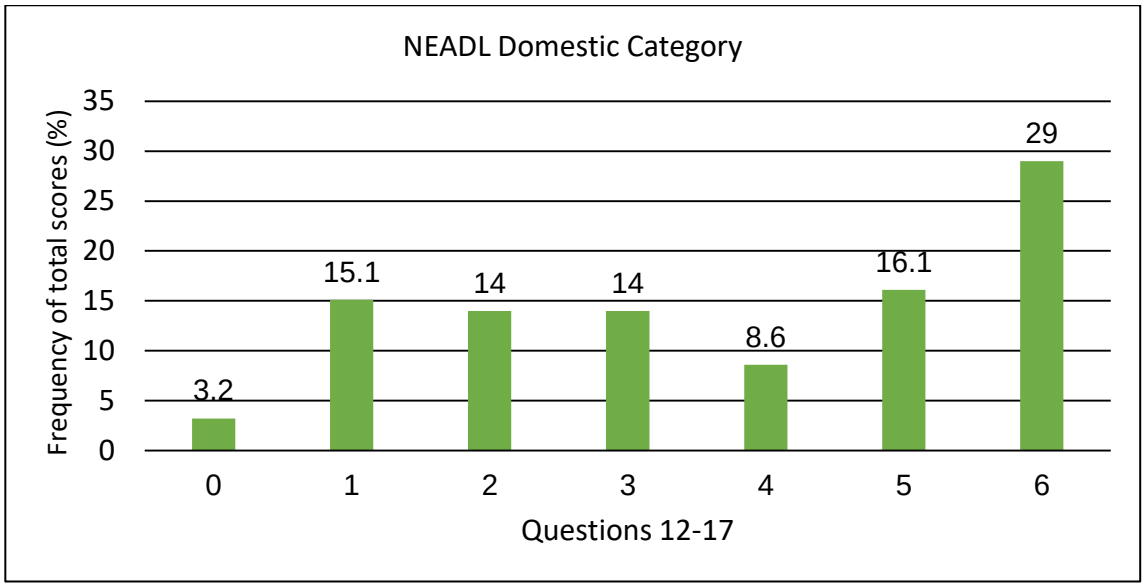

Figure 3.11 NEADL Domestic category results (n=93)

Figure 3.12 shows the frequency of total scores in the leisure category. This category had the lowest scores in comparison to the other categories.

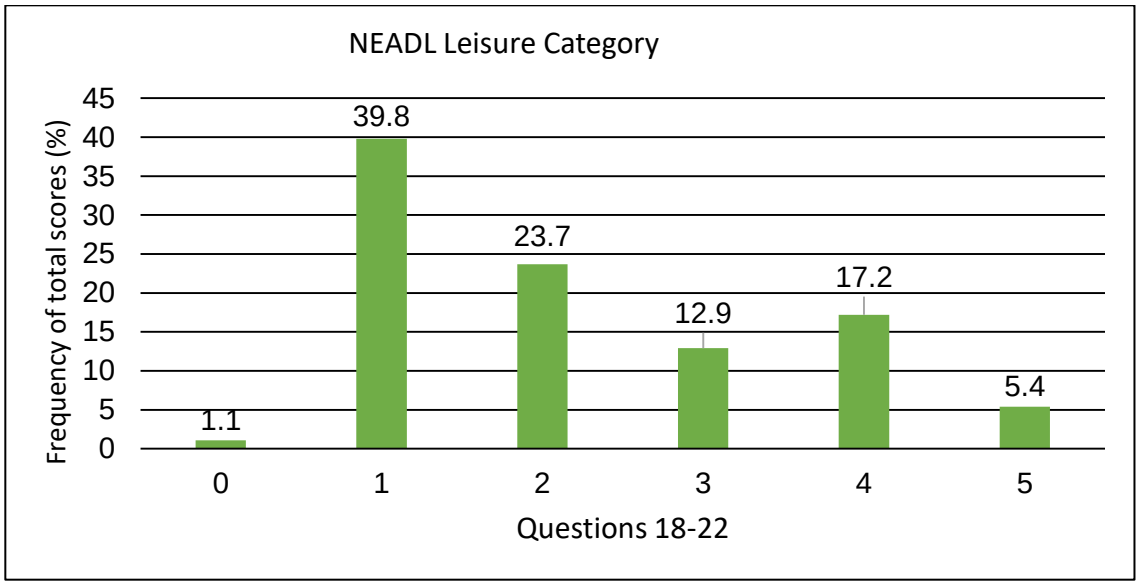

Figure 3.12 NEADL Leisure category results (n=93)

3.1.9 Social network and the Network Assessment Instrument (NAI)

The level of social support for each participant was determined by administering the NAI. This instrument categorises each participant into one of five network types depending on the level of support received from family, friends and neighbours. Nearly half (46, 49.5%) of all participants were categorised into the locally integrated social network suggesting a well-established family and community support in friends and neighbours. The second highest category was the family dependant network where 23 (24.7%) participants reported a high dependency on family for practical and personal care. Eleven (11.8%) participants were placed into the local, self-contained category, 9 (9.7%) in the private restricted network and the remaining 4 (4.3%) participants in the wider community network. Table 3.4 shows the percentage of participants belonging to each of the five groups.

Table 3.4 Network Assessment Instrument results n=93

NAI Category	NAI	NAI Frequency	NAI %	Total %
Vulnerable	Local Self-Contained	11	11.8	
	Private Restricted	9	9.7	21.5
Robust	Locally Integrated	46	49.5	
	Family Dependant	23	24.7	
	Wider Community	4	4.3	78.5

The types of social network can be classified into two categories, namely vulnerable and robust. Vulnerable social network types include the “local self-contained” and the “private restricted” groups, all other networks are considered robust (Wenger 1994).

Twenty (21.5%) participants belonged to a vulnerable social network type while the remaining 73 (78.5%) belonged to a robust social network type.

3.2 Emergency department experience

3.2.1 Referral method

The method of referral to the ED of each participant was ascertained from the ED chart. Self-referral was the most common method with 82.8% of participants presenting to the ED without seeking healthcare professional advice. Just over 16% were referral to the ED by their General Practitioner (GP) (Table 3.5).

Table 3.5 Method of referral to the ED (n=93)

Method of Referral	Subjects (%)
Self-referral	77 (82.8)
General Practitioner	15 (16.1)
Public Health Nurse	1 (1.1)

3.2.2 Mode of transport

Mode of transport to the ED varied between ambulance arrival, car, public transport and surprisingly by foot (Table 3.6). Nearly half (49.5%) of all participants arrived to the ED by ambulance. Fifty-eight participants (62.4%) were accompanied to the ED, 35 (37.6%) were unaccompanied.

Table 3.6 Mode of transport (n=93)

Mode of Transport	**Frequency (%)**
Ambulance	46 (49.5)
Car	26 (28)
By foot	10 (10.8)
Taxi	6 (6.5)
Bus	5 (5.4)

3.2.3 Injuries sustained from fall

The type of injuries sustained from the fall is outlined in Table 3.7. A third of injuries were superficial lacerations. Fractures made up 29% of all injuries. Interestingly nine participants (9.7%) had no obvious injuries.

Table 3.7 Frequency and percent of injuries sustained (n=93)

Injury Sustained	Frequency	Percent
Superficial laceration	31	33.4
Fracture	27	29
Lower Limb Injury	13	14
No Injury	9	9.7
Back Pain	6	6.5
Upper Limb Injury	4	4.3
Rib Pain	2	2.2
Head Injury	1	1.1

3.2.4 Triage category

On presentation to the ED each participant was assigned a triage category based on the nature and severity of the presenting illness/injury. One participant in the study was given a triage category 1 and deemed in need of immediate review. Frequency of triage categories can be seen in Table 3.8.

Table 3.8 Triage categories of participants (n=93)

Triage Category*	Frequency	Percent
1	1	1.1
2	20	21.5
3	50	53.8
4	21	22.6
9	1	1.1

*Manchester Triage System- Triage Category 1: most urgent and needs immediate review. Triage Category 2: review within ten minutes. Triage category 3: review within 1 hour. Triage Category 4: review within 2 hours. Triage Category 5: review within 4 hours. Any category above 5 can be considered less urgent.

3.2.5 Length of time spent in ED

The minimum time spent in the ED was 20.0 minutes. The longest time spent in the ED was 14 hours. The mean was 245.8 (SD 176.11) minutes or 4.09 hours with a range of 20-870 minutes. This time was calculated from the time the patient was triaged by the triage nurse until the time of discharge from the ED as found on the ED chart.

Twenty-six participants out of 93 were admitted from the ED. Sixty-seven participants were discharged from the ED. Of the 26 participants admitted from the ED, the minimum stay was one night. The maximum was 30 nights, patients who were inpatients for longer than 30 nights were excluded from the study as described in the methodology. The average length of stay for a participant was 8.22 nights (Table 3.9).

Table 3.9 Length of hospital admissions (n=26)

Length of Hospital Admissions in Days	Minimum	Maximum	Mean	Std. Deviation
n=26	1	30	8.22	8.03

3.2.6 Medication review

Participants' medications were compared against the traffic light system of classification from the Fall Safe project (n=77). Fifty-one (66%) participants had been prescribed medications that had the potential to increase falls risk (Figure 3.13).

Forty-five (58.4%) participants were prescribed medications that could be considered high risk for falls for example Tramadol (an opiate analgesic that can sedate and cause delirium) Bisoprolol (a beta-blocker that can cause orthostatic hypotension and vasovagal syndrome), and Zolpidem (a sedative that can slow reactions and impair balance). Thirty-two (41.5%) participants were prescribed medium risk medications and 7 (9.1%) participants were prescribed medications that may contribute to the risk of falls (Figure 3.14). Medium risk medications identified included Amlodipine which can cause hypotension, and Digoxin which may cause bradycardia and other arrhythmias. Twenty-eight (36%) participants were prescribed medications that fall into two or more categories of risk.

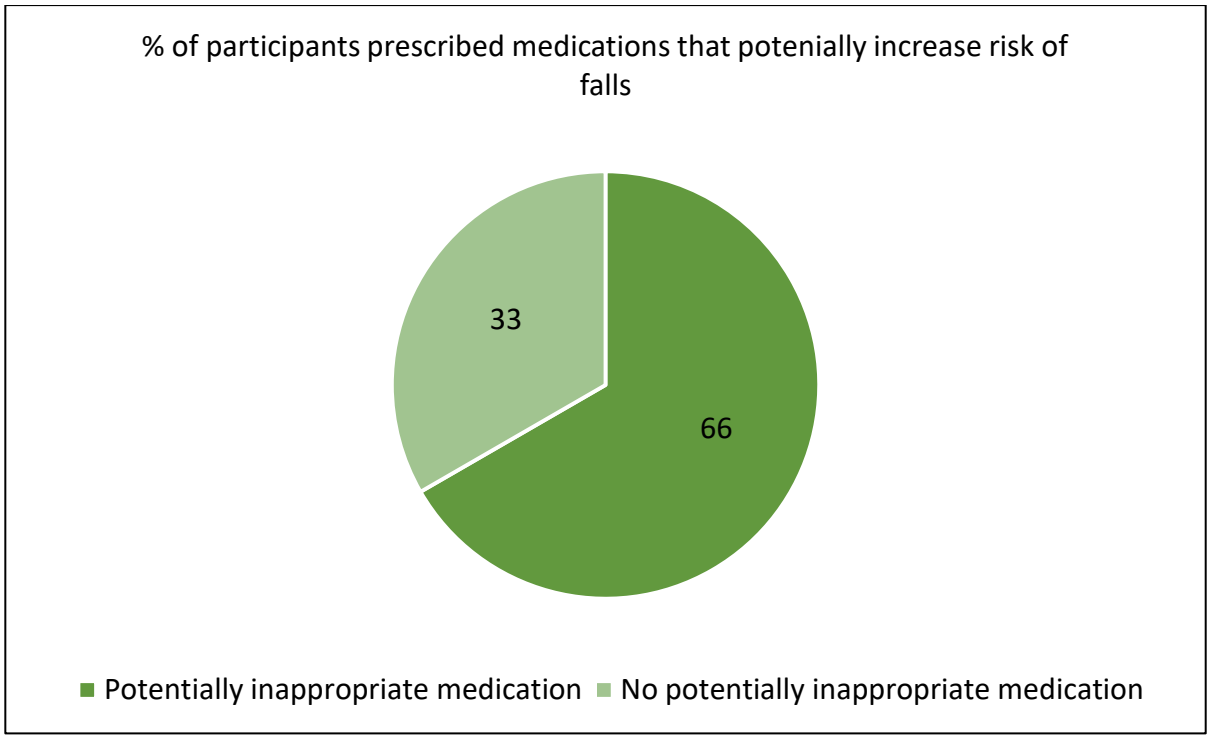

Figure 3.13 Percentage of participants with medication that potentially increase the risk of falling (n=77)

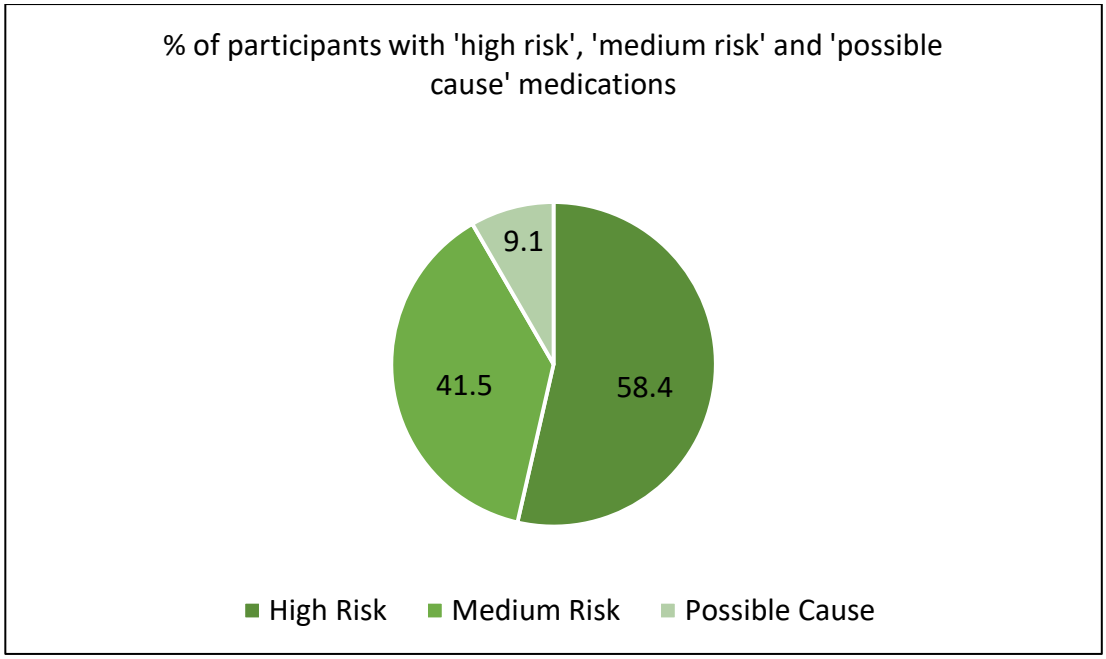

Figure 3.14 Percentage of participants with medications that are associated with high, medium and low risk of falls (n=77)

3.2.7 Identification of Seniors at Risk (ISAR)

As a measure of frailty in this elderly population each participant completed the Identification of Seniors at Risk (ISAR). This tool of six questions determines presence of increased functional dependence, baseline functional dependence, impaired vision, poly-medication, and repeat visits to the ED. A participant is considered to be at risk of frailty if two or more questions are answered positively. Just over half (52.7%) of all 93 participants were rated at risk of decline.

Thirty-two (34%) participants scored positively for one question on the ISAR and 12 (14%) participants scored zero out of six, these combined participants can be considered not at risk of functional decline according to the ISAR. A combined total of 49 (52.7%) participants scored positively for two or more questions as detailed in Figure 3.15.

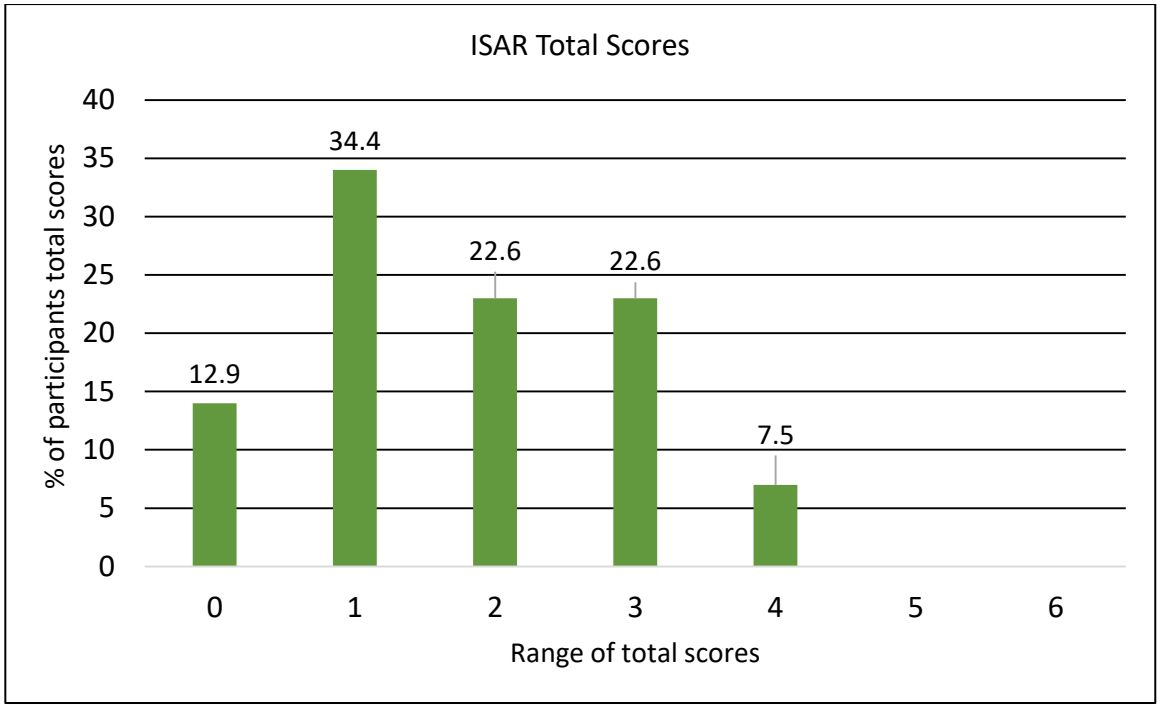

Figure 3.15 ISAR total scores (n=93)

3.3 Healthcare services utilisation

3.3.1 Health service follow up

Information regarding follow up post discharge from the ED or hospital was obtained from each participant. Follow up care in the community included referral to community therapy services such as Physiotherapy (PT) and Occupational Therapy (OT). Referrals included review by the Public Health Nurse (PHN) or by the participants' General Practitioner (GP). Referral to HSE Home Help or for a Home Care Package was also determined from each participant.

Of the 93 participants, 83 (89.2%) participants had health service follow up consisting of either community services or out-patient appointments. Seventeen (18.3%) participants had referrals for two different services. Ten participants (10.8%) did not require further health care services.

The most common type of community service used in this study was GP referral with 23 (24.7%) participants referred to their GP post discharge. Five (5.4%) participants were

referred to the PHN, four (4.3%) participants to community PT and just two (2.2%) participants to community OT (Table 3.10).

Table 3.10 Frequency of referrals to community services (n=93)

Community Service	Frequency	
Community Physiotherapy	Yes	4 (4.3%)
	No	89 (95.7%)
Community Occupational Therapy	Yes	2 (2.2%)
	No	91 (97.8%)
Public Health Nurse	Yes	5 (5.4%)
	No	88 (94.6%)
GP	Yes	23 (24.7%)
	No	70 (75.3%)

Sixty-five participants were referred for Out-Patient Appointment's. Of those 65, 27 (29%) were referred to the fracture clinic, 11 (11.8%) to outpatient physiotherapy, 7 (7.5%) to the Day Hospital, 7 (7.5%) to the Falls and Blackout Clinic and 13 (14%) were referred to other unspecified consultant led clinics (Figure 3.16).

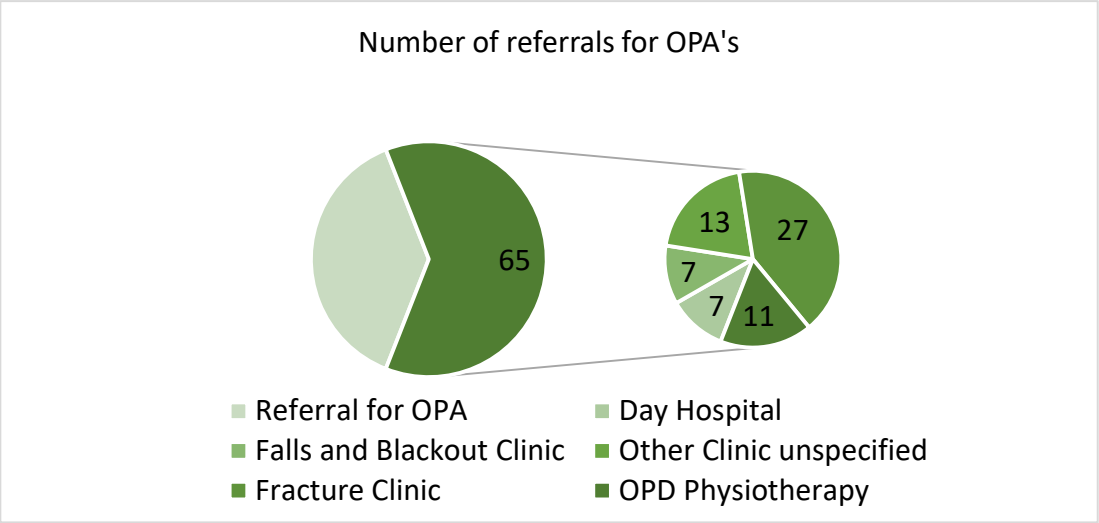

Figure 3.16 Number and type of OPA referrals (n=93)

3.3.2 Previous ED use

Seventeen (18.3%) of the 93 participants had a previous visit to the ED in the previous six months. Sixteen (17%) participants had a previous admission to hospital.

3.3.3 Profile of those admitted versus not-admitted

Twenty-six participants were admitted from the ED, and 67 participants were discharged from the ED. Of those admitted, 14 were female and 12 were male, 57.7% participants had fallen in the previous 12 months, 53.8% had a fear of falling and 57.7% used a mobility aid for mobilising. Of those who did not require admission, 58% had no falls history in the previous 12 months, 56.7% had no fear of falling and 62.7% did not use a mobility aid for mobilising. Pearson's chi-squared test was performed on the total scores of each of the variables seen in Table 3.11 with no statistical difference found.

Table 3.11 Gender and falls history of those admitted versus not-admitted (n=93)

Profile	Admitted (n=26)	Not-Admitted (n=67)	Total (n=93)	p-value
Female	14	39	53	
Male	12	28	40	0.703
Sustained previous fall in past 12 months	15	28	43	
No fall history in past 12 months	11	39	50	0.167
Presence of fear of falling	14	29	43	
No fear of falling	12	38	50	0.359
Mobility aid	15	25	40	
No mobility aid	11	42	53	0.075

Other variables between those admitted and not-admitted were compared as in Table 3.12. Of the 26 participants that were admitted 34.6% belonged to a vulnerable social network type, only 16.4% of those who did not require admission belonged to the same

vulnerable social network types, this was found to be statistically significant using Pearson's chi-squared test at p=0.05. Of those admitted 77% scored positively on the ISAR tool, compared to 41.8% of those who were not admitted which is suggestive that those who were admitted were more at risk of decline. Pearson's chi-squared test found a statistically significant association for this data, p=0.002. Polypharmacy was found in 80% of participants who were admitted and in 47.4% of those not admitted. This was found to be statistically significant using Pearson's chi-squared test (p=0.031). Both admitted and non-admitted groups had high levels of healthcare follow up. Just over 80 percent of those admitted needed further healthcare services while 92.5% of those not-admitted were referred on for follow-up care of either community services or out-patient clinics.

Table 3.12 Profile of those admitted versus not-admitted (N=93)

Profile	Admitted (n=26)	Not-admitted (n=67)	Total (n=93)	p-value
Social Network Type -Robust	17	56	73	
Social Network Type -Vulnerable	9	11	20	0.05
ISAR -Positive	20	28	48	
ISAR- Negative	6	39	45	0.002
Presence of Polypharmacy	16	27	43	
No polypharmacy	4	30	34	0.031
Previous ED attendance in past 6 months	3	14	17	
No ED attendance in previous 6 months	23	53	76	0.295
Follow up	21	62	83	
No follow up	5	5	10	0.1

3.3.4 Profile of those with previous ED use versus those with no previous ED use

Seventeen (18.3%) participants reported to have attended the ED in the previous six months. Ten of those participants were female and 7 were male. Of those who had a recent ED visit 12 (80%) participants were found to have polypharmacy compared to 31 (50%) participants of those who had no previous ED use, no statistically significant difference was found however. Just over 70% of those with previous ED use had positive ISAR scores suggesting possible presence of frailty. There was no significant difference between social network types and previous ED use or not (Table 3.13).

Table 3.13 Profile of those with ED use in the previous six months versus those with no ED use in the previous six months (n=93)

Profile	Previous ED use (n=17)	No Previous ED use (n=76)	Total (n=93)	p-value
Female	10	43	53	
Male	7	33	40	0.8
Presence of Polypharmacy	12	31	43	
No Polypharmacy	3	31	33	0.08
ISAR-Positive	12	36	48	
ISAR- Negative	5	40	45	0.08
Mobility Aid	10	30	40	
No Mobility Aid	7	46	53	0.145
Robust Social Network	14	59	73	
Vulnerable Social Network	3	17	20	0.668

3.4 Summary of results

- Female fallers made up 57% of the study group. The average age was 76.5 years of age.
- The majority of fallers (78%) reported to live in a two-storey house. 61.3% of falls occurred at home where the most common location for a fall was on the stairs (21.5%).
- Forty-six percent of participants had a previous fall in the preceding twelve months with 53.8% of all participants reported to have a fear of falling.
- Just over half (55.8%) had a presence of polypharmacy, a known falls risk.
- Over half (58.4%) of all participants had been prescribed medications that could be considered to carry a high risk for falls.
- Over half of all participants (52.7%) were identified as being frail or at risk of functional decline using the ISAR tool.
- Over a fifth (21%) of participants belonged to a 'vulnerable' social network group.
- Ability levels with activities of daily living was mixed with the mean score for the NEADL questionnaire 14 out of 22.
- Nearly one fifth (18.3%) visited the ED in the previous six months.
- Follow on care post discharge from the ED included community services such as GP, PHN and Community Therapies. Out-patient appointments were arranged for 65 participants.
- Those participants who were admitted from the ED were more likely to belong to a vulnerable social network, have a presence of frailty and polypharmacy with statistically significant differences found.
- Those with previous ED use were more likely to have polypharmacy, a positive ISAR score and use a mobility aid, however no statistically significant association was found.

Chapter 4: Discussion

4.0 Statement of principal findings

This discussion chapter will present an overview of the main findings in the context of the thesis objectives. Of the 93 participants 53 (57%) were female. The mean age of all participants was 76.5 years. Nearly half (47%) reported to live alone. Previous fall history was also noted, nearly half (46%) of participants reported having sustained a previous fall in the past year. Fear of falling was noted in 46% of participants with women more likely to express this than men and 43% used a mobility aid, of which 20% used a walking stick.

Polypharmacy was identified in over half of the (55.8%) participants and nearly 20% reported taking five medications regularly. There was a statistically significant association between polypharmacy and presence of a falls history. Fifty-three (57%) of participants had been prescribed medications that had the potential to increase falls risk with 48.4% prescribed medications that could be considered high risk for falls.

Just over half (52.7%) were rated as 'Frail' using the Identification of Seniors At Risk (ISAR) tool and a fifth (21.5%) of participants belonged to a 'vulnerable' social network group, categorised as 'locally self-contained or private-restricted'. People categorised into these network types have been identified as being at risk of social isolation and resistant to professional help (Wenger, 1994).

The ability levels with activities of daily living were mixed, with the mean NEADL score 14.4 out of 22. Over a third (38.7%) scored fully in the mobility section yet 13% scored zero in this section suggesting that those people were dependent for mobility. Nearly two thirds (65.6%) scored fully in kitchen tasks. Participants were shown to be less independent with domestic tasks with only 29% scoring fully in this section. Independence in leisure activities was the lowest scoring category.

Self-referral to the ED was the most common method of referral with 82.8% of participants presenting to the ED without seeking healthcare professional advice. Just over 16% were referred to the ED by their General Practitioner (GP).

The majority (89.2%) of participants had health service follow up consisting of either community services or out-patient appointments while 18.3% had a previous visit to the

ED in the previous six months and 17% of participants had a previous admission to hospital in the previous six months.

The current study identified the participants as a frail population at risk of functional decline with the presence of some falls risk factors such as polypharmacy, fear of falling, and an existing falls history. Just over a quarter were found to belong to a vulnerable social network. Nearly a quarter of participants were repeat visitors to the ED. Those who had repeat ED use were identified as more likely to be frail and more likely to have a presence of polypharmacy (p=0.08). Follow on care post discharge from the ED included community services such as GP, PHN and Community Therapies. Out-patient appointments were arranged for 64.5% of participants. When compared to the general Irish elderly population this illustrates a vulnerable cohort that are at risk of decline and who depend on healthcare services in particular the ED.

4.1 Findings in the context of current literature

4.1.1 Demographic profile of participants

Of the 93 participants in the study, 53 (57%) were female. Females outnumbered males in the younger old and the oldest old age groups. The mean age of participants was 76.5, ranging from 65 to 94 years of age. The majority of participants were either married (40%) or widowed (41%). Just under half reported to live alone (47%). Similar demographic results were found in The Irish Longitudinal Study on Ageing (TILDA) study (McNamara et al, 2013) where 7,610 participants over the age of 50 were profiled, with a median age of 63.2 years. Women made up the majority of the oldest old age group (85+) and outnumbered men by a factor of 1.5 once over the age of 75 in the TILDA study. Similar marital status distribution was also found in the TILDA study with high marriage rates (78%) and low divorce rates (0.4%) (Mc Namara et al, 2013). In comparison to the present study the majority (73%) of TILDA participants lived with their spouse or children, with 27% reporting to live alone. This figure is significantly lower than the percentage of elderly fallers who live alone in the present study (47%). The TILDA study represents the general elderly population with a wider age range with adults over 50 years of age which may account for the difference however, it also was noted that the proportion of

individuals living alone increases with age (Barrett et al, 2011). Similar figures were found in a report from the National Council of Ageing where 937 people over the age of 65 completed an interview and reported that 28% of the sample lived alone (Garavan et al, 2001). The Irish Census reported a steady increase in the elderly population living alone with 20% living alone in the year 1981, rising to 29% in 2002 and a small drop to 27.7% in 2011, equating to 136,295 elderly (Central Statistics Office, 2012). In a cross-sectional study carried out on elderly patients attending an out-patient geriatric service in Taiwan elderly fallers were found to be significantly more likely to live alone in comparison to elderly non-fallers (28.6% vs. 14%, p=0.031, n=173) (Lee 2011).

4.1.2 Falls profile

In this study fifty-seven (61.3%) participants sustained their fall at home, whilst 36 (38.7%) fell in a public place. Twenty-six percent reported needing assistance with or had no outdoor mobility, and 13% reported to need assistance with all aspects of mobility, including climbing stairs, crossing roads and walking over uneven ground. The Health and Social Services for Older People (HeSSOP) (2001) noted similar figures with 58% of elderly participants reported to have had an accident in the home in the previous 12 months, 77% of which was a fall (n=937). There have been varied estimates of falls in the community-dwelling elderly adult that occur in the home ranging from 25%-75% (Tinetti et al, 1988, Soriano et al, 2007). More recently a US study reported that an estimated 37,991 elderly fallers were treated in the ED for falls associated with carpets (54.2%) and rugs (45.8%), of which 72.8% occurred at home. The study reported that 35.7% of falls at home occurred in the bathroom (Rosen et al, 2013). In this study 20% of those falls at home occurred on the stairs, which is a higher figure than the 10% reported by Tinetti et al (1988) who examined the risk factors for falling in a sample of 336 community dwelling adults over the age of 75. These studies are relatively old with figures taken from the year 1988, this thesis may be more representative of the current elderly faller profile. Other studies have suggested that the location of a fall may be correlated with age noting that the younger-old experience falls outside the home more frequently while the older-old are more likely to fall inside the home (Lord et al, 1993). It has been reasoned that level of mobility also correlates with the location of the fall as those more independent with mobility less likely to be restricted to their homes (Campbell et al, 1990). Lord et al (1993)

later determined that in a study of 704 women aged between 65 and 99 years, the proportion of women who fell outside the home decreased with age and noted a corresponding increase in the proportion who fell at home.

Forty-three (46%) participants reported to have had a previous fall in the past year in this study. This is a significantly higher figure than figures found in the literature. The TILDA study (2013) asked its participants at two time points (2009-2011 and 2012-2013) if they had sustained a fall in the past year and if they had sustained more than one fall in the past year. Wave 1 of the study (years 2009-2011) consisted of 5,272 participants over the age of 50, 19% reported to have sustained a fall in the previous year and 7% reported to have had recurrent falls. In wave 2 of the study carried out between 2012 and 2013 with 7610 respondents, 22% reported to have sustained a fall in the past year and 9% reported recurrent falls. Of those who reported a single fall at wave 1, 24% had another fall by wave 2 and 12% progressed to having recurrent falls. The lower figures could be attributed to the wider age group however the TILDA sample include those aged over 50 years of age. Similar figures of recurrent falls were seen again in a survey of 1000 community dwelling elderly Australians where 19% reported having sustained a fall in the past year and 10% reported having sustained two or more falls in the past year. One-third of these fallers required medical treatment due to the severity of the falls. It could be reasoned that the higher figure of recurrent fallers in this study may be correlated with the severity of the fall, or that recall in this study may have been better due to the proximity of interviews post-fall.

Forty-six percent of participants reported to have a fear of falling (FOF) in this study. Fear of falling (FOF) is common in the elderly population and has been associated with a history of falls, reduced physical functioning and reduced social activity (Murphy et al, 2003, Howland et al, 1993, Tinetti et al, 1994). Other studies report similar figures of FOF in the community dwelling older adult, reports of 30%-45% in those with a previous fall history (Arfken et al, 1994, Tinetti et al, 1994). FOF has been found to increase with age and with women more likely than men to express FOF (35% vs 15% $p < 0.0001$, n=890) (Arfken et al, 1994). Tinetti (1994) examined FOF in relationship to functioning in community dwelling elderly population aged over 72 reporting a statistically significant

association between FOF and activity restriction with 24% of recent fallers versus 15% of non-fallers with a FOF acknowledging activity restriction ($p < 0.001$, n=301).

Although both Tinetti (1994) and Arfken's (1994) studies included community dwelling older adults Tinetti's study included a slightly older age profile with participants over the age of 72, had a smaller sample size (n=301) and included non-fallers also. The higher figures for FOF in this thesis and Arfkens' study could be explained by the methodology where all participants had recently experienced a fall, interestingly Arfken noted that 9% of participants who reported to be very fearful of falling had sustained a serious injury such as a fracture in the previous 12 months compared to 0.5% of those with no FOF and 2% of those with moderate fear. In this study, all participants had sustained an injury requiring medical attention which may explain the higher levels of FOF and correlates with the pattern noted by Arfken et al (1994).

Fear of falling has been demonstrated to restrict activities of daily living in the general elderly population (Zijlstra et al, 2007). Zjilstra et al (2007) conducted a cross-sectional study of 7,431 community-dwelling elderly in the Netherlands, ascertaining presence of FOF and presence of activity avoidance due to FOF. Over half (54.3%) reported FOF and 37.9% reported avoidance of activity, of those with FOF 65.5% reported avoiding activities due to this fear. The study found strong associations with higher age, female gender, fair or poor perceived health and one or multiple falls. Fear of falling has also been associated with reduced gait speed and stride length along with a wider stance in elderly who restrict their activities due to their fear (Donoghue et al, 2012). It has been suggested however that these gait changes could reflect a positive compensatory adaptation by the patient in order to adopt a perceived safer gait (Donoghue et al, 2012).

This profile highlights the presence of falls risks in this population and the need for these risks to be addressed and managed. Current recommendations for falls management include The American Geriatric Society and British Geriatric Society (2010) guidelines that recommend that all older individuals should be asked if they have fallen in the past year including identifying frequency and circumstances surrounding the fall. NICE (2013) guidelines also recommend that older people reporting recurrent falls should be offered a multifactorial falls risk assessment that could lead to a multifactorial intervention.

Physiotherapists have a significant role to play in the assessment and management of falls prevention and education due to their expertise gait and balance re-education (ISCP 2016). However, not all ED's have access to a physiotherapist and due to the busy nature of an ED it would not be a suitable location to carry out treatment such as exercise interventions, which have been found to be the most effective intervention in preventing falls in older people (Gardner et al, 2000). Those patients that are presenting to the ED post-fall and discharged home (10.2% in this study) represent an unmet opportunity for falls education and intervention.

4.1.3 Medications and polypharmacy

Just over half (51.3%) of participants in this study had three or more medical conditions. Cardiac conditions were the most prevalent with over half of participants reporting to have been diagnosed with conditions such as hypertension, atrial-fibrillation, high cholesterol or had procedures such as cardiac stents or had pacemakers in place. An emerging concept known as "complex multi-morbidity" has been defined in research as people with three or more chronic conditions involving three or more body systems (Harrison et al, 2014). These patients represent management difficulties due to their complexity, high healthcare utilisation including frequent ED use (Rowell, 2006). These patients are more likely to be admitted to hospital and have longer hospital stays (Bahler et al, 2015) with a presence of polypharmacy (Guthrie et al, 2011). In primary care settings, 30% of adults over the age of 50 have multi-morbidity, rising to nearly 70% in those aged 70 and older (Smith et al, 2016). In the general elderly Irish population as examined by the TILDA study (2013) one in three reported a diagnosis of hypertension or hypercholesterolemia with 53.7% of those aged 75 and older diagnosed with high blood pressure. The Healthy Ireland Report (2015) noted high blood pressure as the most common health condition in a sample of 7,539 participants aged 15 and over. Twelve percent report having high blood pressure rising to 24% of those aged 45 and over. Other chronic conditions prevalent in this report included chronic back pain (12%), arthritis (10%), asthma (7%), and diabetes (4%). Those over the age of 65 were more likely to have a chronic condition (73%). Just over one fifth (22.5%) of elderly fallers in this study reported to have diabetes mellitus, 14% reported to have a respiratory condition, 15%

reported to have had a cancer diagnosis and 15% reported to have osteoporosis in this study.

Lower figures for diabetes were seen in the general Irish population with the Institute of Public Health in Ireland reporting 8.9% of 65-74 years of age and 11% of over 75's in 2010 having a diagnosis of diabetes (www.hse.ie). Lower figures of respiratory disease was also seen in the general elderly Irish population with TILDA (2013) reporting a prevalence of 5.1% in those aged 65-74 increasing to 5.6% in those aged 75 years and older. Interestingly, the elderly fallers in this study experienced lower rates of osteoporosis (15%) compared to national figures of 22.4% for the general elderly population aged 75 years and older (TILDA 2013). Cancer figures were over twice as prevalent in this study compared to TILDA's figure of 6.1% reporting a cancer diagnosis. It has been reported that the prevalence of chronic conditions will increase yearly with predictions of high blood pressure in adults rising from 24% (2015) to 28.3% in 2020 with the incidence of diabetes expected to rise to 5.9% of the adult population by 2020 (Balanda et al, 2010).

These figures for chronic health conditions in the elderly are associated with increased health care utilisation. The average number of GP consultations per year in the overall Irish population is 4.3, rising to 7.1 in those aged over 65 with the average number of medical or surgical consultations per year at 1.4, rising to 2.3 in the over 65's age group (Healthy Ireland Report, 2015). Services such as the public health nurse are utilised by 6.1% of those aged 65-69 with a medical card rising to 25.5% of those aged 85 and over. Physiotherapy services are used by 6.6% of those aged 65-69 and by 7.3 of those aged 85 and over. Home help utilisation increases to 19.5% of elderly aged over 85 from 2.7% in those aged 65-69 (TILDA 2013). The associated cost of increased healthcare utilisation has been outlined in a report by the Department of Health and Children (2006) estimated that three-quarters of the healthcare expenditure is allocated to the management of chronic diseases. The report suggested that chronic diseases are responsible for 80% of GP consultations and 60% of hospital bed days in Ireland and that the burden of cost will continue to increase by 10-15% over the next decade. In a Cochrane review of 18 randomised controlled studies on interventions to improve outcomes with multi-morbidity in older individuals more favourable results were found when risk factors in common comorbidities were targeted or multidisciplinary team interventions focused on

specific functional difficulties (Smith et al, 2016). Interventions included enhanced multidisciplinary team work, educational interventions and supported self-management type interventions. Mental health and functional outcomes were found to have improved, along with slightly improved medication adherence and patient health behaviours (Smith et al, 2016).

Polypharmacy was present in 43 (55.8%) participants in this study. Polypharmacy has been defined by different sources internationally as the concurrent use of upwards of four or five medications. For this study the definition of polypharmacy being the concurrent use of five or more medications by Fulton and Riley Allen (2005) was used. In comparison to the general Irish elderly population this figure is much higher. TILDA (2013) reported that 31% of this population were taking five or more medications regularly (n=8093). It was reported that the prevalence of polypharmacy increases with age with a 6% rise to 37% seen in the over 75's age group. It was also noted that polypharmacy was more prevalent in those who had sustained a fall in the last year (37% versus 23% in the 65-74 years age group) and was associated with worse self-rated health.Risks associated with polypharmacy in the elderly have been identified to include adverse drug events (Hanlon et al, 2006), poor medication adherence (Vik et al, 2004) and functional impairment (Agostini et al, 2004). Polypharmacy has been identified as a risk factor for falls with best practice suggesting that all elderly fallers should receive a multifactorial falls risk assessment that includes a medication review to reduce falls risks (NICE 2013). Polypharmacy is associated with risks for the elderly patient and there is the additional cost to the exchequer, directly by the cost of medications and indirectly by the cost of healthcare utilisation. For example the TILDA report (2012) noted 11% of the total healthcare budget was spent on medications in 2010 equating to €1.5 billion, with €600 million spent on the over 50's age group.

In this study 53 (57%) participants were prescribed medications that had the potential to increase falls risk. Nearly half (48.4%) were taking medications that could be considered a high risk for falls. There is strong evidence of an association between potentially inappropriate prescribing (PIP) and falls in the elderly. PIP can lead to adverse drug events such as falls, orthostatic hypertension, heart failure and delirium. The older adult may be more susceptible to medications due to their physiology for example liver and kidney

function may be reduced in the older adult which changes the way medications are metabolised (Pretorius et al, 2013). The prevalence of adverse drug events leading to hospitalisation in the older adult has been reported to be as high as one in six (Beijer, de Blaey, 2002). The prevalence of PIP was examined in an Irish hospital in elderly fallers presenting to the Emergency Department (ED), this study applied the STOPP and Beers criteria to the prescription of 1016 elderly patients presenting to the ED. They found a significant prevalence of PIP in elderly fallers at baseline and again 12 months post-fall. 53.1% had at least one STOPP criteria pre-fall with no change post-fall (53.7%, $p = 0.64$). Beers criteria were identified in 44% pre-fall, with no change post-fall (41.5%, $p = 0.125$). Polypharmacy was present in 63.1% pre-fall and in 64% of participants 12 months post-fall. A high prevalence of psychotropic prescribing was noted with 15% of participants taking antipsychotic medications, 30% hypno-sedatives and 26% antidepressants (McMahon et al, 2014). A lack of improvement between pre and post-fall prescribing was identified despite medication reviews being part of a comprehensive assessment (McMahon et al, 2014).

In a retrospective cross-sectional study on PIP in two differing socio-economic profiles in middle aged adults (45-64 years), PIP was found to be common (42.9% in the Republic of Ireland group and 21.1% in the Northern Ireland group) (Cooper et al, 2016). The study included data from 751,673 patients and found age group, female gender and polypharmacy were significantly associated with PIP ($p < 0.05$). The more deprived group had higher rate of multi-morbidity and associated polypharmacy (Cooper et al, 2016).

Medications have been identified as a modifiable risk factor for falls in the elderly and the gold standard of practice includes a medication review during assessment of the elderly faller (NICE, 2004).

4.1.4 Frailty, social and functional profile

The results of the NEADL questionnaire in this study were mixed, around 75% of participants reporting to have mobilised outdoors independently, 56% travelled on public transport, 70% crossed roads independently yet 28% had difficulty or had not managed to climb stairs in the previous two weeks. This figure may be indicative of the 29% who had sustained a fracture in their fall. Independence with kitchen tasks was high and more

dependence with domestic tasks was reported however, 57% reported to need help or not able to manage doing the housework with similar figures of dependence to do the grocery shopping. Some leisure activities had high self-rated independence for example 87.1% reported to read newspapers or books however only half (49.5%) reported to have gone out socially on their own.

Tools such as NEADL scale are used by healthcare professionals to measure disability and functional impairment and have been used in many different populations such as stroke patients and post orthopaedic surgery (Harwood and Ebrahim 2002). Independence with extended activities of daily living in the elderly population can mean the difference between remaining in their own home and having to seek accommodation with assisted living. The NEADL scale has been validated and deemed to be reliable in patients post stroke and in patients post-total hip replacement (Nouri and Lincoln, 1987. Chong, 1995. Harwood and Ebrahim, 2002). More recently an RCT assessing the effect of a 12-week strength training programme on elderly fallers post hip fracture found that the intervention improved strength and endurance and resulted in better NEADL scores. This study reported on the NEADL sum scores at baseline and again at the end of the intervention of 12 weeks noting improvements at follow up with an effect size of 0.1 (n=93). However differences in reporting on the NEADL scale including no results of each sub-category makes it difficult to compare the results of this study to the RCT (Sylliaas et al, 2012).

The ISAR (Identification of Seniors at Risk) tool was completed by 93 participants in this study, with 53 (57%) scoring positively for two or more questions suggesting that these patients could be considered frail. Salvi (2012) conducted a prospective study in two urban ED's in Italy with a cohort of 200 elderly patients in which they administered the ISAR to screen for frailty. This study had similar findings to the present study with 58.5% of subjects identified as frail. Compared to the general elderly Irish population these figures are much higher. TILDA reported 7% of over 60's are frail, with this figure rising to 15% in those over the age of 80. Slightly higher figures have been reported in Northern Ireland with 21% of over 60's and 36% of over 80's reported as frail (Scarlett et al, 2014). The strength of the ISAR tool has been identified in its rapid and simple administration and could be used in conjunction with a Comprehensive Geriatric Assessment (CGA).

There has been a call for frailty to be given more consideration by healthcare professions when assessing and treating the elderly patient (Clegg et al, 2013). Frailty is routinely assessed by physiotherapists in both acute and post-acute rehabilitation settings. Measures such as the Clinical Frailty Scale (CFS), the Elderly Mobility Scale (EMS), the Timed Up and Go test (TUG), along with measurements for grip strength and gait speed are all measures used to assess frailty. Physiotherapists are uniquely qualified to provide gait re-education, balance re-education, and falls education (www.iscp.ie) in order to manage frailty and its associated deficits in the elderly adult. The management of frailty however should include all members of a multi-disciplinary team as suggested by the British Geriatrics Society and as part of a Comprehensive Geriatric Assessment (Conroy et al, 2015).

In this study 47% of participants lived alone and 21.5% participants belonged to a vulnerable social network type. This is higher than that reported from the TILDA study in which around 25% of those aged 65-74 live alone and around 43% of over 75's live alone. Irish data from the TILDA study noted that 71% of those aged 75 and over either live with their children or have at least one child living in the same county, however this age group also is more likely to have all their children living abroad (Kamiya and Timonen, 2011). It has been noted that living alone increases the risk of using certain health services such as the GP (Inouye et al, 2008). Loneliness, social isolation and social exclusion have been recognised as risk factors for adverse health events in the elderly (WHO 2002). A vulnerable social network type as categorised by the Network Assessment Instrument (NAI) where people tend to have no relatives or family in close proximity, rely on professional help and are at risk of social isolation (Wenger, 1991). In the English Longitudinal Study on Ageing (ELSA), 11% of participants over the age of 75 reported to feel isolated and 21% reported to feel lonely (Banks et al, 2008). In a meta-analytic review to determine if social relationships influence risk for mortality the authors examined 148 studies and found a 50% increased likelihood of survival for participants with stronger social relationships (95% CI 1.42 to 1.59) (Holt-Lunstad et al, 2010).

Loneliness in older adults has been also be associated with increased healthcare use, and in particular with emergency department utilisation (Molloy et al, 2010). In a cross-sectional study of 2,033 community-dwelling over-65's a higher frequency of loneliness

was associated with emergency hospitalisation (odds ratio=1.29, 95% confidence interval=1.08–1.55). It is suggested that those who are lonely may not have social support in their community to help in a situation that may not warrant an ED visit, and so will utilise the ED (Molloy et al, 2010).

4.1.5 Use of the emergency department and other health care services

In this study, 18.3% had a previous visit to the ED in the previous six months and 17% participants had an admission to hospital in that time. Those with repeat ED use were more likely to be female, had polypharmacy, more positive frailty scores and required a mobility aid in this study.

Data from the UK (England only) reported 19.4% (3,556,284) of all attendances to the ED in the year 2012 were for patients aged 65 and over (Winter 2014). In the year 2010-11, 6.5% of attendees to the ED were aged over 80 and 1.8% were over the age of 90, and 62% of those aged over 85 were admitted from the ED (Imison et al, 2012).

Use of the ED in Ireland has been shown to be consistent across the elderly age groups with only a small increase in use seen with increasing age: 15% of 60-69 years old age group, 16.7% of 70-79 years age group and 14.9% of over 80's when asked if they had attended the ED in the past twelve months (Barrett et al, 2011). Figures for re-attendance to the ED were noted by Naughton et al (2009) in a study of 307 elderly patients attending two Irish ED's. Over a third (37%) of these participants reported a repeat ED visit in the previous 6 months, a single previous visit was reported by 21%, two visits reported by 9% and 7% reported 3 or more visits. The authors noted that reasons for re-attendance vary in the literature from physical need to patient's perception of lack of alternative options. Interestingly, 90% of participants had contact with their GP in the previous 6 months and 44% had been referred to the ED by a healthcare professional, with the authors suggesting that community services are unable to deal with this populations need. Other reasons for ED attendances were addressed in a descriptive study based in an ED in Australia where 100 patients over the age of 70 were interviewed. Over half (57%) lived alone, 73% presented during business hours, 58% arrived by ambulance, 80% presented for illness and 65% were discharged home within 48hours. Over half (56%) reported

feeling socially disconnected. Patients reported difficulty accessing primary care, preference for timely care and for 'fast-tracking' to specialist care as the reasons for attending the ED. This sample reported that accessing care after hours was difficult and 20% had attended the ED 3-6 times in the previous 12 months (Lowthian et al, 2013).

In a systematic review of eleven studies on the patterns of use and adverse outcomes in the older adult attending the ED similar factors were identified between the studies. Age, functional impairment, recent hospitalisation or ED use, living alone and lack of social support were all identified from the research as risk factors for adverse outcomes (Aminzadeh and Dalziel 2002). The authors called for more appropriate screening in the ED such as the use of the ISAR tool to identify high risk elderly patients leading to a more thorough assessment by a geriatrician and then onto specialist geriatric services for holistic management (Aminzadeh and Dalziel, 2002).

Comprehensive Geriatric Assessment (CGA) has been defined as 'a multidimensional, interdisciplinary diagnostic process to determine the medical, psychological, and functional capabilities of a frail older person in order to develop a coordinated and integrated plan for treatment and long-term follow-up' (Rubenstein et al, 1991). CGA has been found to improve outcomes for elderly patients with reduced readmission rates, reduced mortality and improved quality of life seen in the research (Ellis et al, 2011). Assessment of elderly patients attending the ED has been reported as complex and time-consuming in a high pressure, busy environment, with ED clinicians feeling 'uncomfortable' with elderly patients due to a perceived lack of training in the specialty of geriatric medicine (McNamara et al, 1992). The introduction of geriatricians into the ED was examined by Conroy et al (2013) who reported on the impact of an Emergency Frailty Unit (EFU) based in an ED. The EFU differed to usual care found in the ED as the clinical leads included geriatricians instead of only emergency physicians, integrating geriatric medicine in the acute setting for frail patients who needed it. Improved outcomes were reported with admission rates decreasing in those aged 85 and over (61.2% in intervention period versus 69.6% in the control period, $p<0.001$) along with a reduction in readmissions post-discharge from the ED (risk ratio 0.77 (95% CI: 0.63–0.93) for 90 day readmissions) (Conroy et al, 2013).

In the present study, 16.1% of participants were referred to the ED from their GP and 24.7% were advised to follow up with their GP post-discharge. The HSE's National Clinical Programme for Older People (NCPOP) (www.hse.ie) aims to address the needs of the frail older person presenting to hospital. The programme recommends that a Specialist Geriatric Service (a multidisciplinary team led by a geriatrician that is assigned specifically to a specialist geriatric service) should work closely with community based services such as GP's and primary care teams with liason between the two easily accessible and timely in nature and including tracking of frail patients discharged home. The strategy acknowledges that currently there is no patient case management in the transition of patients from the acute setting to home and that this should be addressed with an integrated single assessment, referral and tracking system (2012). In the Department of Health's statement of strategy 2015-2017 emphasis is put on primary care services as the best approach to deliver improved patient outcomes. The strategy aims to deliver 28 new primary care centres by 2017 and also provide new community nursing units to address the ageing population. The strategy reports a priority to further extend GP services and to include new management models for chronic disease and older persons, along with implementing free GP care to the over 70's (Department of Health, 2014).

In this study, 27 (29%) participants were referred to the fracture clinic, 11 (11.8%) had physiotherapy out-patient appointments (OPA) in the referring hospital, 13 (13.9%) had other OPA's, 7 (7%) were referred to the falls and black out clinic and 7% had follow up in the day hospital. Seventeen (18.3%) participants had referrals for two different services. Of those with follow-up 36.6% had a community service follow up of either GP, community physiotherapy, community occupational therapy or the public health nurse. In a study based in two Irish ED's examining factors associated with repeat ED attendance in those aged over 65 low community follow up was reported (Naughton et al, 2010). The study of 306 participants reported 37% had repeat ED visits, defined as a repeat ED visit over a period of 6 months. High (93%) GP use was noted in the repeat ED visit group but only 51% had contact with community services. Nearly half (48%) of patients discharged directly from the ED (n=148) had no community follow up, and 18% of this group were repeat ED attendees. Only 3% were referred to community nursing and another 3% to other services suggesting a lack of transitional care for those discharged directly from ED.

The authors found this population used the ED out of necessity due to a perceived lack of community supports and suggested that the ED be more proactive in identifying and monitoring risk factors for re-attendance along with more appropriate community support referral (Naughton et al, 2010). The results of this thesis along with other Irish data seem to highlight the unmet need of this population in relation to prompt follow up care in the community. A lack of specialist community services available has been noted in Ireland, in addition to long waiting lists for community therapists (O'Neill et al, 2003). The development of an outreach pathway for prompt treatment in this population being discharged home from the ED post-fall could address this issue.

4.2 Clinical, research and policy implications of the thesis findings

4.2.1 Falls management

Falls management has been recommended by the NICE guidelines (2013) to include a multifactorial assessment to identify risk factors for falling. This should include a healthcare professional asking if the patient has fallen in the past year identifying frequency, context and the characteristics of the fall. The evidence based guidelines suggest assessment should also include assessment of gait, balance, mobility, visual impairment, urinary incontinence, home hazards and a cardiovascular examination and medication review encompassing the roles of physiotherapy, occupational therapy, nursing and the medical team. In this study 67 participants (72%) were discharged directly from the ED, although it was out of the scope of this study to assess if a falls assessment or intervention took place, it can be presumed that only those who had a follow up in the day hospital or a Physiotherapy Out-Patient Appointment (OPA) may have received a full multidisciplinary falls prevention intervention. Over 10% of this study's sample had no follow up, 7.5% of these were discharged straight from the ED. This represents a missed opportunity for secondary falls prevention in a population that relies heavily on the ED post-fall.

Interventions to prevent falls in the elderly have been found to be effective if they include a multifactorial falls risk assessment and management programme, with exercise programmes being the most effective intervention (Chang et al, 2004). The entire MDT

would have a role in these assessments but the role of Physiotherapists are essential to provide exercise programmes. Some exercise programmes delivered in the community have been found to be able to reduce the rate of falls by 35% (Robertson et al, 2002). As part of a multifactorial intervention, home safety interventions delivered by an OT were found to be more effective for those at a higher falls risk based on 6 trials (pooled ratio of 0.81, n=4208)(Gillespie et al, 2012). In a meta –analysis, Sherrington and Tiedemann (2015) found smaller relative benefits of exercise as a single intervention in high risk people in comparison to the findings of a Cochrane review (Gillespie et al, 2012) of the same topic

Evidence that an interdisciplinary approach to falls prevention has been shown to significantly decrease the risk of further falls (Close et al, 1999). Close et al (1999) conducted an RCT with elderly fallers attending the ED comparing usual care to an intervention of a detailed medical and OT assessment with referral to community services. The detailed medical assessment examined balance, cognition, vision and medication and if appropriate a follow up in the day hospital for multidisciplinary input was sent. The OT intervention comprised of a single home visit to identify and modify environmental hazards and for falls education and to supply aids or appliances. At a 12 month follow-up, 183 falls were reported in the intervention compared to 510 reported falls in the control group ($p=0.0002$). The intervention group reduced their risk of falls (odds ratio 0.39 [95% CI 0.23-0.66]) and reduced the odds of admission (0.61 [0.35-1.05]), while the control group declined in their functional ability as shown in their Barthel score ($p<0.00001$). The findings support a more structured multidisciplinary falls strategy with improved interdepartmental communication seen while using the ED as the prime location for a thorough multidisciplinary team assessment (Close et al, 1999).

Certain medications put the elderly at a higher risk of falls and should be avoided if an alternative is possible. Withdrawal of long-term medications such as benzodiazepines has been noted to be difficult due to dependency and more appropriate prescribing may be needed (Salonoja et al, 2012). An absence of medication modification in elderly fallers in the ED has been highlighted in practice and a closer integration between hospital, primary care and pharmacy has been highlighted (McMahon et al, 2013). McMahon et al (2013) identified an increase in psychotropic prescribing in a study of 1016 elderly attending the

ED post-fall, along with a significant prevalence of potentially inappropriate prescribing that did not improve in the following year.

The NCPOP model of care for Specialist Geriatric Services sets out to describe an ideal pathway of care at each stage of a frail elderly person through the hospital system. It recommends identifying frail elderly or 'at risk' patients in the ED and Acute Medical Assessment Unit with a Comprehensive Geriatric Assessment (CGA) provided by a Specialist Geriatric Team.

4.2.2 Reducing ED admissions

Despite falls prevention pathways, falls prevalence in the elderly remains high and emergency services are the first to respond to the complex needs of this type of patient (British Geriatrics Society, 2012b). From the results of this study it was evident that the majority of elderly fallers self-referred to the ED, with only 16% going to their GP first, this may be due to the working hours of the GP or to the severity of the fall however with an increasing ageing population unplanned attendances will continue to put pressure on the ED services. Older people attend the ED more readily than younger populations and are more likely to use the ED for management of chronic conditions (Aminzadeh and Dalziel, 2002). It has been noted that the elderly present to the ED with more complex comorbidities with atypical clinical presentations and more cognitive disorders which complicate assessment and management (Samaras et al, 2010). Non-clinical factors have also been associated with ED use in the elderly.

The majority of urgent care in the UK is delivered in primary care with community services such as rapid access clinics and Hospital at Home delivering continuity of care with some success (Oliver et al, 2014), adopting similar services in ROI may reduce ED admissions. Services such as a community MDT providing at home care for elderly patients with chronic conditions have reduced mortality and re-admission rates in certain trusts in the U.K (Sheppard et al, 2008). The Nottinghamshire Ambulance Trust also developed a pathway for elderly fallers to be brought to a community falls assessment and treatment team by paramedics instead of to the ED. Benefits to the patient were reported to be significant in an RCT of 204 adults over the age of 60 living at home or in residential care.

The intervention consisted of referral to a community fall prevention service led by OT's physiotherapists and nurses which included strength and balance training and home hazard modifications along with a medication review. A 55% reduction in falls in the following year along with a 60% reduction in 999 calls for falls over that time was reported (Logan et al, 2010). Adopting more community based falls-prevention programmes similar to the U.K may address the needs of the frail elderly faller and reduce ED attendances in Irish hospitals.

4.2.3 Frailty management

In the current study 57% of all participants were identified by the ISAR tool as being frail. Those who had higher ED utilisation in the previous six months were more likely to score positively in the ISAR (70%). Those who were admitted from the ED were more likely to be frail (p=0.002). The National Positive Ageing Strategy in Ireland aims to improve the management of acutely ill frail older adults in the acute setting, while improving education of public, healthcare professionals and concurrently reduce the number of falls in the older person (DOHC 2013). The lack of effective strategies for screening frail elderly in the community along with the risks of functional decline has been recently identified in an Irish study, where the measurement of frailty was described as an obstacle to care due to the lack of standardised tools (Scarlett et al, 2014). In a systematic review of outcome measures for frailty twenty outcome measure were identified all focusing on different aspects of a dynamic process (de Vries et al, 2011). Some outcome measure were found to be more suitable for research than in clinical practice the authors noting that more research into their clinimetric properties needed (de Vries et al, 2011).

4.2.4 Comprehensive Geriatric Assessment

The NCPOP (2012) recommend each ED or Acute Medical Assessment Unit (AMAU) in conjunction with Specialist Geriatric Service should have an agreed process to identify the frail older patient with a timely CGA performed after triage. The AMAU provides a structured environment for assessment and treatment following admission to the ED (Byrne et al, 2014). The AMAU differs to the ED in that patients are generally seen by

senior clinician as opposed to a non-consultant hospital doctor (NCHD) who are considered junior doctors with less experience (Watts et al, 2016). A patient is expected to stay less than 5 days in the AMAU, with specific diagnosis driven out-patient pathways and direct communication with GP's along with urgent OPA follow ups preventing admissions (Watts et al, 2016). Older patients have been found to be overrepresented in the AMAU with over one-third (35%) attending the service and 60.5% of this group admitted compared to 32% of under 65's (n=3071) (Fallon et al, 2015). The challenge remains however in the ED to identify older people with frailty who may present in an atypical fashion that requires detailed multidisciplinary care to provide the correct diagnosis and management as well as appropriate placement for ongoing care or admission avoidance (Ellis et al, 2014). This may be further complicated by specific challenges such as delirium and functional decline. Identifying patients with specific frailty syndromes can be critical to identifying those at highest risk of poor outcomes and most likely to benefit from further specialist interventions (Ellis et al, 2014). The British Geriatrics Society recognises the importance of the development and management of service for people with frailty and published a report entitled 'Fit for Frailty'. The report outlines the characteristics of a good frailty service noting the expertise of staff as an essential characteristic. The BGS call for training and education of the MDT in the area of frailty in order to provide the interventions needed as part of comprehensive geriatric assessment, however the plan to deliver the training is not detailed (*BGS* 2015).

Comprehensive Geriatric Assessment (CGA) has been defined as an in depth assessment across all domains that can be adapted to the specific purpose and requiring a trained multidisciplinary team. (British Geriatric Society, 2010). CGA has been examined as multidisciplinary approach to the elderly population (Welsh et al, 2010). The NCPOP (2012) recommend each ED or AMAU in conjunction with Specialist Geriatric Service should have an agreed process to identify the frail older patient with a timely CGA performed after triage. A Specialist Geriatric Ward should also be available with a link to Day Hospital and to on/off-site rehabilitation according to the NCPOP. A Specialist Geriatric Ward differs to general wards in that the multidisciplinary staff have training in in the area of care of the elderly. However not all agree that CGA has to occur in a specialist geriatric ward, Welsh et al (2013) suggest CGA can start at admission in the ED

or AMAU, continue on other wards and also be performed in the community. Conroy et al (2014) reported from a pre-post cohort study that it is possible to embed CGA within ED's. Positive results from the study included readmission rates falling from 26% at 90 days follow up to 19.9%, however in-patient bed day use increased.

Edmans et al (2013) conducted an RCT on 433 patients aged over 70 who were discharged from the AMAU within 72 hours and who were at risk of functional decline according to their ISAR score. The control group received usual care in the AMAU by the consultant physician and the medical team but no additional intervention. The intervention group received assessment by a geriatrician in the AMAU who also co-ordinated follow up care in the community post-discharge for the patient such as further assessment at home or in a clinic, liaison with primary care team or specialist geriatric services. There was no effect on the primary outcome of days spent at home over 90 days follow up, (intervention group 79.7 days v's control group 80.2 days). Over half (54%) of participants had at least one hospital presentation during the study with a higher number of presentations seen in the intervention group (0.94 hospital presentations v's 1.20, p=0.05). The authors explained the lack of favourable outcomes seen in the results due to the intervention acting more like a liaison service to the community rather than true CGA.

Conroy et al (2011) conducted a systematic review of five studies. No significant evidence was found to support CGA that was either nurse led or geriatrician-led however the studies did not report on all the same outcomes. No significant significance was found in the studies on the outcomes of mortality [RR 0.92 (95% CI 0.55–1.52)] or readmissions [RR 0.95 (95% CI 0.83–1.08)] or for subsequent institutionalisation, functional ability, quality-of-life or cognition. In contrast, a meta-analysis of RCT's examining CGA where the primary outcome was "living at home" patients who received CGA were more likely to be alive and in their own homes (95% confidence interval 1.05 to 1.28; P = 0.003) (Ellis et al, 2011). A systematic review of 13 randomised and quasi-experimental trials showed the benefits for an acute geriatric unit including fewer falls, (risk ratio (RR) = 0.51, 95% confidence interval (CI) = 0.29-0.88), less delirium (RR = 0.73, 95% CI = 0.61-0.88), less functional decline at discharge from baseline 2-week prehospital admission status (RR = 0.87, 95% CI = 0.78-0.97), and a shorter length of hospital stay (weighted mean difference (WMD) = -0.61, 95% CI = -1.16 to -0.05) (Fox et al, 2012). In addition, White et al (2010)

found that the presence of a senior physician resulted in a reduction in medical inpatient admissions of 12 per cent, and a reduction in admissions to the acute medical assessment unit of 21 per cent. Cooke et al (2003) also reported the impact of senior decision-making in reducing admissions can be further enhanced by the use of dedicated assessment and observation wards.

Follow up in the community for frail elderly patients discharged home or hospital at home teams could support ED based CGA. The U.K have adopted the role of "interface" geriatricians who complete CGA in the acute setting and follow up in the community. The principle of 'Interface Geriatrics' is the implementation of rapid CGA to acute elderly admissions in hospital combined with community geriatric care (Conroy et al, 2010). Such services can include rapid access clinics and home visits which have so far been aimed at elderly with chronic conditions in order to reduce ED attendance (Fox et al, 2013).

4.3 Summary of discussion

This study provides important demographic data from a population of elderly fallers and those at risk of falling. It provides an insight into the characteristics of this sub-group in which to compare to the general elderly population. Frailty, social isolation, polypharmacy and high-risk medications are part of the profile of this population and should be addressed as part of a CGA as is best practice. This study highlights the dependence on the ED for elderly fallers, demonstrating the high ED use along with other healthcare services needs for continued care. This should be considered for policy implications and service planning.

4.4 Limitations of the study

This study is the first detailed Irish study, providing a detailed description of important demographic data from a population of elderly fallers and those at risk of falling, however there are a number of limitations;

- This study was conducted in a single-centre and may not reflect the general population of elderly fallers- therefore it may have limited generalisability.
- The study did not reach the planned sample size. The small sample size limits the generalisation of the study findings.

- Due to the retrospective nature of the study there may have been under-reporting of falls rates by the participants. Although all participants were cognitively sound, recall bias cannot be ruled out.
- Over 200 fallers attended the ED in the study period, 67 were excluded due to the exclusion criteria but 44 participants were lost to follow-up. These patients either refused, had passed away or the researcher was unable to contact them.
- Assessor bias by the researcher cannot be ruled out as the single researcher completed all assessment and was aware of falls status of each participant.
- There was a relatively small range of assessments. These assessments were mostly self-reported measures by the participant and so may be subjected to response bias.
- The level of detail surrounding the participants' healthcare use was lacking. The researcher noted what follow up was recommended by the healthcare professionals involved but whether the participant availed of that service was not determined
- As the researcher was also working full-time contact with participants was primarily in the evenings which may have led to missing out on potential participants.
- The researcher determined what follow up services each patient was referred to however, it was not determined if these appointments were attended.

4.5 Recommendations for future research

- Recruiting participants from more centres could give a greater sample size and therefore a larger and more representative sample of the population.
- Conducting this study in the participants home setting may have resulted in higher participant numbers as the researcher was unable to contact a number of potential participants via telephone at different stages in the process.
- The range of assessments mostly consisted of self-reported assessment, the addition of validated outcome measures performed by a physiotherapist or another allied healthcare professional to assess falls could provide further insight

into this population. In addition a quality of life measure could be used in future research within this population

- A prospective falls diary could be included in this population to reduce recall bias.
- This study was a cross sectional study and so is associated with a level of bias by nature. An RCT or cohort study would further reduce bias.
- This study has identified there is a lack of screening and assessment for frailty which could be addressed with an interventional study based in the ED or AMAU in this population of elderly fallers.
- Comparing and validating the use of a screening tool to identify frailty in elderly fallers in a community setting also may result in more proactive treatment from healthcare professionals. The effect on the emergency department could also be examined.
- A follow up assessment at a later date that would determine healthcare utilisation in the following 6 months post ED admission would provide a better insight into this populations' healthcare utilisation.
- Mental and physical health have been shown in the literature to be associated with each other and so a quality of life measure could be used in future research within this population, particularly after the potential trauma of seeking emergency medicine.

Conclusion

The aim of this study was to profile a sample of the elderly population who had attended the ED following a fall. The findings highlighted a population in which many were recurrent fallers and who frequently used the ED. The sample had many risk factors associated with falls such as the presence of a falls history, the presence of polypharmacy, fear of falling and use of a mobility aid. The results highlighted a vulnerable population in which frailty and risk of functional decline were evident, along with many belonging to a social network categorised as vulnerable or were living alone. The findings of this study provided a demographic profile of these elderly fallers that could be used for national and international comparison. The characteristics of this population could further warrant the development of a standardised screening tool for frailty used in the ED for elderly fallers.

The study highlighted the use of the ED in this population, noting the level of attendances in the previous six months. Patterns of referral to community services post discharge, were described. High healthcare utilisation was required in this population with the majority being referred to out-patient services and clinics. Low community referral was noted which could represent a missed opportunity for frailty management in the community, that may be ideally addressed by the full MDT as part of a continued CGA. Addressing the needs of this population and using all available opportunities to do so whether in the ED, AMAU or community setting may have great benefits to the healthcare system as well as to the patient.

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Appendices

Appendix 1: American Geriatrics Society, Beers Criteria 2015.

Table 2. 2015 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Organ System, Therapeutic Category, Drugs	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Anticholinergics				
First-generation antihistamines Brompheniramine Carbinoxamine Chlorpheniramine Clemastine Cyproheptadine Dexbrompheniramine Dexchlorpheniramine Dimenhydrinate Diphenhydramine (oral) Doxylamine Hydroxyzine Meclizine Promethazine Triprolidine	Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; risk of confusion, dry mouth, constipation, and other anticholinergic effects or toxicity Use of diphenhydramine in situations such as acute treatment of severe allergic reaction may be appropriate	Avoid	Moderate	Strong
Antiparkinsonian agents Benztropine (oral) Trihexyphenidyl	Not recommended for prevention of extrapyramidal symptoms with antipsychotics; more-effective agents available for treatment of Parkinson disease	Avoid	Moderate	Strong
Antispasmodics Atropine (excludes ophthalmic) Belladonna alkaloids Clidinium-Chlordiazepoxide Dicyclomine Hyoscyamine Propantheline Scopolamine	Highly anticholinergic; uncertain effectiveness	Avoid	Moderate	Strong
Antithrombotics				
Dipyridamole, oral short-acting (does not apply to the extended-release combination with aspirin)	May cause orthostatic hypotension; more effective alternatives available; intravenous form acceptable for use in cardiac stress testing	Avoid	Moderate	Strong
Ticlopidine	Safer, effective alternatives available	Avoid	Moderate	Strong
Anti-infective				
Nitrofurantoin	Potential for pulmonary toxicity, hepatoxicity, and peripheral neuropathy, especially with long-term use; safer alternatives available	Avoid in individuals with creatinine clearance <30 mL/min or for long-term suppression of bacteria	Low	Strong
Cardiovascular				
Peripheral alpha-1 blockers Doxazosin Prazosin Terazosin	High risk of orthostatic hypotension; not recommended as routine treatment for hypertension; alternative agents have superior risk–benefit profile	Avoid use as an antihypertensive	Moderate	Strong

Table 2 (Contd.)

Organ System, Therapeutic Category, Drugs	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Central alpha blockers Clonidine Guanabenz Guanfacine Methyldopa Reserpine (>0.1 mg/d)	High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension	Avoid clonidine as first-line antihypertensive Avoid others as listed	Low	Strong
Disopyramide	Disopyramide is a potent negative inotrope and therefore may induce heart failure in older adults; strongly anticholinergic; other antiarrhythmic drugs preferred	Avoid	Low	Strong
Dronedarone	Worse outcomes have been reported in patients taking dronedarone who have permanent atrial fibrillation or severe or recently decompensated heart failure	Avoid in individuals with permanent atrial fibrillation or severe or recently decompensated heart failure	High	Strong
Digoxin	Use in atrial fibrillation: should not be used as a first-line agent in atrial fibrillation, because more-effective alternatives exist and it may be associated with increased mortality	Avoid as first-line therapy for atrial fibrillation	Atrial fibrillation: moderate	Atrial fibrillation: strong
	Use in heart failure: questionable effects on risk of hospitalization and may be associated with increased mortality in older adults with heart failure; in heart failure, higher dosages not associated with additional benefit and may increase risk of toxicity	Avoid as first-line therapy for heart failure	Heart failure: low	Heart failure: strong
	Decreased renal clearance of digoxin may lead to increased risk of toxic effects; further dose reduction may be necessary in patients with Stage 4 or 5 chronic kidney disease	If used for atrial fibrillation or heart failure, avoid dosages >0.125 mg/d	Dosage >0.125 mg/d: moderate	Dosage >0.125 mg/d: strong
Nifedipine, immediate release	Potential for hypotension; risk of precipitating myocardial ischemia	Avoid	High	Strong
Amiodarone	Amiodarone is effective for maintaining sinus rhythm but has greater toxicities than other antiarrhythmics used in atrial fibrillation; it may be reasonable first-line therapy in patients with concomitant heart failure or substantial left ventricular hypertrophy if rhythm control is preferred over rate control	Avoid amiodarone as first-line therapy for atrial fibrillation unless patient has heart failure or substantial left ventricular hypertrophy	High	Strong
Central nervous system				

Table 2 (Contd.)

Organ System, Therapeutic Category, Drugs	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Antidepressants, alone or in combination Amitriptyline Amoxapine Clomipramine Desipramine Doxepin >6 mg/d Imipramine Nortriptyline Paroxetine Protriptyline Trimipramine	Highly anticholinergic, sedating, and cause orthostatic hypotension; safety profile of low-dose doxepin (≤6 mg/d) comparable with that of placebo	Avoid	High	Strong
Antipsychotics, first- (conventional) and second- (atypical) generation	Increased risk of cerebrovascular accident (stroke) and greater rate of cognitive decline and mortality in persons with dementia Avoid antipsychotics for behavioral problems of dementia or delirium unless nonpharmacological options (e.g., behavioral interventions) have failed or are not possible ***and*** the older adult is threatening substantial harm to self or others	Avoid, except for schizophrenia, bipolar disorder, or short-term use as antiemetic during chemotherapy	Moderate	Strong
Barbiturates Amobarbital Butabarbital Butalbital Mephobarbital Pentobarbital Phenobarbital Secobarbital	High rate of physical dependence, tolerance to sleep benefits, greater risk of overdose at low dosages	Avoid	High	Strong
Benzodiazepines *Short- and intermediate- acting* Alprazolam Estazolam Lorazepam Oxazepam Temazepam Triazolam	Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; in general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes in older adults	Avoid	Moderate	Strong

Table 2 (Contd.)

Organ System, Therapeutic Category, Drugs	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Long-acting Clorazepate Chlordiazepoxide (alone or in combination with amitriptyline or clidinium) Clonazepam Diazepam Flurazepam Quazepam	May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, and periprocedural anesthesia			
Meprobamate	High rate of physical dependence; very sedating	Avoid	Moderate	Strong
Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics Eszopiclone Zolpidem Zaleplon	Benzodiazepine-receptor agonists have adverse events similar to those of benzodiazepines in older adults (e.g., delirium, falls, fractures); increased emergency department visits and hospitalizations; motor vehicle crashes; minimal improvement in sleep latency and duration	Avoid	Moderate	Strong
Ergoloid mesylates (dehydrogenated ergot alkaloids) Isoxsuprine	Lack of efficacy	Avoid	High	Strong
Endocrine				
Androgens Methyltestosterone Testosterone	Potential for cardiac problems; contraindicated in men with prostate cancer	Avoid unless indicated for confirmed hypogonadism with clinical symptoms	Moderate	Weak
Desiccated thyroid	Concerns about cardiac effects; safer alternatives available	Avoid	Low	Strong
Estrogens with or without progestins	Evidence of carcinogenic potential (breast and endometrium); lack of cardioprotective effect and cognitive protection in older women Evidence indicates that vaginal estrogens for the treatment of vaginal dryness are safe and effective; women with a history of breast cancer who do not respond to nonhormonal therapies are advised to discuss the risk and benefits of low-dose vaginal estrogen (dosages of estradiol <25 μg twice weekly) with their healthcare provider	Avoid oral and topical patch Vaginal cream or tablets: acceptable to use low-dose intravaginal estrogen for management of dyspareunia, lower urinary tract infections, and other vaginal symptoms	Oral and patch: high Vaginal cream or tablets: moderate	Oral and patch: strong Topical vaginal cream or tablets: weak
Growth hormone	Impact on body composition is small and associated with edema, arthralgia, carpal tunnel syndrome, gynecomastia, impaired fasting glucose	Avoid, except as hormone replacement after pituitary gland removal	High	Strong

Table 2 (Contd.)

Organ System, Therapeutic Category, Drugs	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Insulin, sliding scale	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting; refers to sole use of short- or rapid-acting insulins to manage or avoid hyperglycemia in absence of basal or long-acting insulin; does not apply to titration of basal insulin or use of additional short- or rapid-acting insulin in conjunction with scheduled insulin (i.e., correction insulin)	Avoid	Moderate	Strong
Megestrol	Minimal effect on weight; increases risk of thrombotic events and possibly death in older adults	Avoid	Moderate	Strong
Sulfonylureas, long-duration Chlorpropamide	Chlorpropamide: prolonged half-life in older adults; can cause prolonged hypoglycemia; causes syndrome of inappropriate antidiuretic hormone secretion	Avoid	High	Strong
Glyburide	Glyburide: higher risk of severe prolonged hypoglycemia in older adults			
Gastrointestinal				
Metoclopramide	Can cause extrapyramidal effects, including tardive dyskinesia; risk may be greater in frail older adults	Avoid, unless for gastroparesis	Moderate	Strong
Mineral oil, given orally	Potential for aspiration and adverse effects; safer alternatives available	Avoid	Moderate	Strong
Proton-pump inhibitors	Risk of *Clostridium difficile* infection and bone loss and fractures	Avoid scheduled use for >8 weeks unless for high-risk patients (e.g., oral corticosteroids or chronic NSAID use), erosive esophagitis, Barrett's esophagitis, pathological hypersecretory condition, or demonstrated need for maintenance treatment (e.g., due to failure of drug discontinuation trial or H_2 blockers)	High	Strong
Pain medications				
Meperidine	Not effective oral analgesic in dosages commonly used; may have higher risk of neurotoxicity, including delirium, than other opioids; safer alternatives available	Avoid, especially in individuals with chronic kidney disease	Moderate	Strong

(Continued)

Table 2 (Contd.)

Organ System, Therapeutic Category, Drugs	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Non-cyclooxygenase-selective NSAIDs, oral: Aspirin >325 mg/d Diclofenac Diflunisal Etodolac Fenoprofen Ibuprofen Ketoprofen Meclofenamate Mefenamic acid Meloxicam Nabumetone Naproxen Oxaprozin Piroxicam Sulindac Tolmetin	Increased risk of gastrointestinal bleeding or peptic ulcer disease in high-risk groups, including those aged >75 or taking oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents; use of proton-pump inhibitor or misoprostol reduces but does not eliminate risk. Upper gastrointestinal ulcers, gross bleeding, or perforation caused by NSAIDs occur in approximately 1% of patients treated for 3–6 months and in ~2–4% of patients treated for 1 year; these trends continue with longer duration of use	Avoid chronic use, unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol)	Moderate	Strong
Indomethacin	Indomethacin is more likely than other NSAIDs to have adverse CNS effects. Of all the NSAIDs, indomethacin has the most adverse effects.	Avoid	Moderate	Strong
Ketorolac, includes parenteral	Increased risk of gastrointestinal bleeding, peptic ulcer disease, and acute kidney injury in older adults			
Pentazocine	Opioid analgesic that causes CNS adverse effects, including confusion and hallucinations, more commonly than other opioid analgesic drugs; is also a mixed agonist and antagonist; safer alternatives available	Avoid	Low	Strong
Skeletal muscle relaxants Carisoprodol Chlorzoxazone Cyclobenzaprine Metaxalone Methocarbamol Orphenadrine	Most muscle relaxants poorly tolerated by older adults because some have anticholinergic adverse effects, sedation, increased risk of fractures; effectiveness at dosages tolerated by older adults questionable	Avoid	Moderate	Strong
Genitourinary				
Desmopressin	High risk of hyponatremia; safer alternative treatments	Avoid for treatment of nocturia or nocturnal polyuria	Moderate	Strong

The primary target audience is practicing clinicians. The intentions of the criteria are to improve the selection of prescription drugs by clinicians and patients; evaluate patterns of drug use within populations;

Table 3. 2015 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug–Disease or Drug–Syndrome Interactions That May Exacerbate the Disease or Syndrome

Disease or Syndrome	Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Cardiovascular					
Heart failure	NSAIDs and COX-2 inhibitors Nondihydropyridine CCBs (diltiazem, verapamil)—avoid only for heart failure with reduced ejection fraction Thiazolidinediones (pioglitazone, rosiglitazone) Cilostazol Dronedarone (severe or recently decompensated heart failure)	Potential to promote fluid retention and exacerbate heart failure	Avoid	NSAIDs: moderate CCBs: moderate Thiazolidinediones: high Cilostazol: low Dronedarone: high	Strong
Syncope	AChEIs Peripheral alpha-1 blockers Doxazosin Prazosin Terazosin Tertiary TCAs Chlorpromazine Thioridazine Olanzapine	Increases risk of orthostatic hypotension or bradycardia	Avoid	Peripheral alpha-1 blockers: high TCAs, AChEIs, antipsychotics: moderate	AChEIs, TCAs: strong Peripheral alpha-1 blockers, antipsychotics: weak
Central nervous system					
Chronic seizures or epilepsy	Bupropion Chlorpromazine Clozapine Maprotiline Olanzapine Thioridazine Thiothixene Tramadol	Lowers seizure threshold; may be acceptable in individuals with well-controlled seizures in whom alternative agents have not been effective	Avoid	Low	Strong
Delirium	Anticholinergics (see Table 7 for full list) Antipsychotics Benzodiazepines Chlorpromazine Corticosteroids[4] H_2-receptor antagonists Cimetidine Famotidine Nizatidine Ranitidine Meperidine Sedative hypnotics	Avoid in older adults with or at high risk of delirium because of the potential of inducing or worsening delirium Avoid antipsychotics for behavioral problems of dementia or delirium unless nonpharmacological options (e.g., behavioral interventions) have failed or are not possible ***and*** the older adult is threatening substantial harm to self or others Antipsychotics are associated with greater risk of cerebrovascular accident (stroke) and mortality in persons with dementia	Avoid	Moderate	Strong

Table 3 (Contd.)

Disease or Syndrome	Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Dementia or cognitive impairment	Anticholinergics (see Table 7 for full list) Benzodiazepines H_2-receptor antagonists Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics Eszopiclone Zolpidem Zaleplon Antipsychotics, chronic and as-needed use	Avoid because of adverse CNS effects Avoid antipsychotics for behavioral problems of dementia or delirium unless nonpharmacological options (e.g., behavioral interventions) have failed or are not possible ***and*** the older adult is threatening substantial harm to self or others. Antipsychotics are associated with greater risk of cerebrovascular accident (stroke) and mortality in persons with dementia	Avoid	Moderate	Strong
History of falls or fractures	Anticonvulsants Antipsychotics Benzodiazepines Nonbenzodiazepine, benzodiazepine receptor agonist hypnotics Eszopiclone Zaleplon Zolpidem TCAs SSRIs Opioids	May cause ataxia, impaired psychomotor function, syncope, additional falls; shorter-acting benzodiazepines are not safer than long-acting ones If one of the drugs must be used, consider reducing use of other CNS-active medications that increase risk of falls and fractures (i.e., anticonvulsants, opioid-receptor agonists, antipsychotics, antidepressants, benzodiazepine-receptor agonists, other sedatives and hypnotics) and implement other strategies to reduce fall risk	Avoid unless safer alternatives are not available; avoid anticonvulsants except for seizure and mood disorders Opioids: avoid, excludes pain management due to recent fractures or joint replacement	High Opioids: moderate	Strong Opioids: strong
Insomnia	Oral decongestants Pseudoephedrine Phenylephrine Stimulants Amphetamine Armodafinil Methylphenidate Modafinil Theobromines Theophylline Caffeine	CNS stimulant effects	Avoid	Moderate	Strong

Disease or Syndrome	Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Parkinson disease	All antipsychotics (except aripiprazole, quetiapine, clozapine) Antiemetics Metoclopramide Prochlorperazine Promethazine	Dopamine-receptor antagonists with potential to worsen parkinsonian symptoms Quetiapine, aripiprazole, clozapine appear to be less likely to precipitate worsening of Parkinson disease	Avoid	Moderate	Strong
Gastrointestinal					
History of gastric or duodenal ulcers	Aspirin (>325 mg/d) Non-COX-2 selective NSAIDs	May exacerbate existing ulcers or cause new or additional ulcers	Avoid unless other alternatives are not effective and patient can take gastroprotective agent (i.e., proton-pump inhibitor or misoprostol)	Moderate	Strong
Kidney and urinary tract					
Chronic kidney disease Stages IV or less (creatinine clearance <30 mL/min)	NSAIDs (non-COX and COX-selective, oral and parenteral)	May increase risk of acute kidney injury and further decline of renal function	Avoid	Moderate	Strong
Urinary incontinence (all types) in women	Estrogen oral and transdermal (excludes intravaginal estrogen) Peripheral alpha-1 blockers Doxazosin Prazosin Terazosin	Aggravation of incontinence	Avoid in women	Estrogen: high Peripheral alpha-1 blockers: moderate	Estrogen: strong Peripheral alpha-1 blockers: strong
Lower urinary tract symptoms, benign prostatic hyperplasia	Strongly anticholinergic drugs, except antimuscarinics for urinary incontinence (see Table 7 for complete list)	May decrease urinary flow and cause urinary retention	Avoid in men	Moderate	Strong

The primary target audience is the practicing clinician. The intentions of the criteria are to improve selection of prescription drugs by clinicians and patients; evaluate patterns of drug use within populations; educate clinicians and patients on proper drug usage; and evaluate health outcome, quality of care, cost, and utilization data.

[a] Excludes inhaled and topical forms. Oral and parenteral corticosteroids may be required for conditions such as exacerbations of chronic obstructive pulmonary disease but should be prescribed in the lowest effective dose and for the shortest possible duration.

CCB = calcium channel blocker; AChEI = acetylcholinesterase inhibitor; CNS = central nervous system; COX = cyclooxygenase; NSAID = nonsteroidal anti-inflammatory drug; SSRIs = selective serotonin reuptake inhibitors; TCA = tricyclic antidepressant.

Table 4. 2015 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medications to Be Used with Caution in Older Adults

Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Aspirin for primary prevention of cardiac events	Lack of evidence of benefit versus risk in adults aged ≥80	Use with caution in adults aged ≥80	Low	Strong
Dabigatran	Increased risk of gastrointestinal bleeding compared with warfarin and reported rates with other target-specific oral anticoagulants in adults aged ≥75; lack of evidence of efficacy and safety in individuals with CrCl <30 mL/min	Use with caution in in adults aged ≥75 and in patients with CrCl <30 mL/min	Moderate	Strong
Prasugrel	Increased risk of bleeding in older adults; benefit in highest-risk older adults (e.g., those with prior myocardial infarction or diabetes mellitus) may offset risk	Use with caution in adults aged ≥75	Moderate	Weak
Antipsychotics Diuretics Carbamazepine Carboplatin Cyclophosphamide Cisplatin Mirtazapine Oxcarbazepine SNRIs SSRIs TCAs Vincristine	May exacerbate or cause syndrome of inappropriate antidiuretic hormone secretion or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults	Use with caution	Moderate	Strong
Vasodilators	May exacerbate episodes of syncope in individuals with history of syncope	Use with caution	Moderate	Weak

The primary target audience is the practicing clinician. The intentions of the criteria are to improve selection of prescription drugs by clinicians and patients; evaluate patterns of drug use within populations; educate clinicians and patients on proper drug usage; and evaluate health outcome, quality of care, cost, and utilization data.

CrCl = creatinine clearance; SNRIs = serotonin-norepinephrine reuptake inhibitors; SSRIs = selective serotonin reuptake inhibitors; TCAs = tricyclic antidepressants.

Appendix 2: STOPP (Screening Tool of Older Person's Prescriptions)/START (Screening Tool to Alert doctors to Right Treatment) criteria.

STOPP: Screening Tool of Older People's Potentially Inappropriate Prescriptions

The following drug prescriptions are potentially inappropriate in persons aged ≥ 65 years of age

Cardiovascular System

1. Digoxin at a long-term dose > 125µg/day with impaired renal function
2. Loop diuretic for dependent ankle oedema only i.e. no clinical signs of heart failure
3. Loop diuretic as first-line monotherapy for hypertension
4. Thiazide diuretic with a history of gout
5. Non cardioselective Beta-blocker with Chronic Obstructive Pulmonary Disease
6. Beta-blocker in combination with verapamil
7. Use of diltiazem or verapamil with NYHA Class III or IV heart failure
8. Calcium channel blockers with chronic constipation
9. Use of aspirin and warfarin in combination without histamine H_2 receptor antagonist
10. Dipyridamole as monotherapy for cardiovascular secondary prevention
11. Aspirin with a past history of peptic ulcer disease without histamine H_2 receptor antagonist or Proton Pump Inhibitor
12. Aspirin at dose > 150mg day
13. Aspirin with no history of coronary, cerebral or peripheral vascular symptoms or occlusive event
14. Aspirin to treat dizziness not clearly attributable to cerebrovascular disease
15. Warfarin for first, uncomplicated deep venous thrombosis for longer than 6 months duration
16. Warfarin for first uncomplicated pulmonary embolus for longer than 12 months duration
17. Aspirin, clopidogrel, dipyridamole or warfarin with concurrent bleeding disorder

STOPP: Screening Tool of Older People's Potentially Inappropriate Prescriptions

Gastrointestinal System

1. Diphenoxylate, loperamide or codeine phosphate for treatment of diarrhoea of unknown cause
2. Diphenoxylate, loperamide or codeine phosphate for treatment of severe infective gastroenteritis
3. Prochlorperazine (Stemetil) or metoclopramide with Parkinsonism
4. PPI for peptic ulcer disease at full therapeutic dosage for > 8 weeks
5. Anticholinergic antispasmodic drugs with chronic constipation

Respiratory System

1. Theophylline as monotherapy for COPD
2. Systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD
3. Nebulised ipratropium with glaucoma

Musculoskeletal System

1. NSAID with history of peptic ulcer disease or gastrointestinal bleeding, unless with concurrent histamine H_2 receptor antagonist, PPI or misoprostol
2. NSAID with moderate-severe hypertension
3. NSAID with heart failure
4. Long-term use of NSAID (>3 months) for symptom relief of mild osteoarthtitis
5. Warfarin and NSAID together
6. NSAID with chronic renal failure
7. Long-term corticosteroids (>3 months) as monotherapy for rheumatoid arthrtitis or osterarthritis
8. Long-term NSAID or colchicine for chronic treatment of gout where there is no contraindication to allopurinol

STOPP: Screening Tool of Older People's Potentially Inappropriate Prescriptions

The following drug prescriptions are potentially inappropriate in persons aged ≥ 65 years of age

Urogenital System

1. Bladder antimuscarinic drugs with dementia
2. Antimuscarinic drugs with chronic glaucoma
3. Antimuscarinic drugs with chronic constipation
4. Antimuscarinic drugs with chronic prostatism
5. Alpha-blockers in males with frequent incontinence i.e. one or more episodes of incontinence daily
6. Alpha-blockers with long-term urinary catheter *in situ* i.e. more than 2 months

Endocrine System

1. Glibenclamide or chlorpropamide with type 2 diabetes mellitus
2. Oestrogens with a history of breast cancer or venous thromboembolism
3. Beta-blockers in those with diabetes mellitus and frequent hypoglycaemic episodes i.e. ≥ 1 episode per month
4. Oestrogens without progestogen in patients with intact uterus

STOPP: Screening Tool of Older People's Potentially Inappropriate Prescriptions

The following drug prescriptions are potentially inappropriate in persons aged ≥ 65 years of age

Drugs that adversely affect fallers.

1. Benzodiazepines
2. Neuroleptic drugs
3. First generation antihistamines
4. Vasodilator drugs with persistent postural hypotension i.e. recurrent > 20mmHg drop in systolic blood pressure
5. Long-term opiates in those with recurrent falls

Analgesic Drugs

1. Use of long-term powerful opiates e.g. morphine or fentanyl as first line therapy for mild-moderate pain
2. Regular opiates for more than 2 weeks in those with chronic constipation without concurrent use of laxatives
3. Long-term opiates in those with dementia unless indicted for palliative care or management of moderate/severe chronic pain syndrome

Duplicate Drug Classes

Any duplicate drug class prescription e.g. two concurrent opiates, NSAID's, SSRI's, loop diuretics, ACE inhibitors

START: Screening Tool to Alert doctors to Right Treatments

These medications should be considered for people ≥ 65 years of age with the following conditions, where no contraindication to prescription exists.

Cardiovascular System

1. Warfarin in the presence of chronic atrial fibrillation.
2. Aspirin in the presence of chronic atrial fibrillation, where warfarin is contraindicated, but not aspirin
3. Aspirin or clopidogrel with a documented history of atherosclerotic coronary, cerebral or peripheral vascular disease in patients with sinus rhythm.
4. Antihypertensive therapy where systolic blood pressure consistently >160 mmHg
5. Statin therapy with a documented history of coronary, cerebral or peripheral vascular disease, where the patient's functional status remains independent for activities of daily living and life expectancy is greater than 5 years
6. Angiotensin Converting Enzyme (ACE) inhibitor with chronic heart failure
7. ACE inhibitor following acute myocardial infarction
8. Beta-blocker with chronic stable angina

Respiratory System

1. Regular inhaled β_2 agonist or anticholinergic agent for mild to moderate asthma or COPD
2. Regular inhaled corticosteroid for moderate-severe asthma or COPD, where predicted FEV1 <50%.
3. Home continuous oxygen with documented chronic type 1 respiratory failure or type 2 respiratory failure.

Central Nervous System

1. L-DOPA in idiopathic Parkinson's disease with definite functional impairment and resultant disability
2. Antidepressant drug in the presence of moderate-severe depressive symptoms lasting at least three months.

START: Screening Tool to Alert doctors to Right Treatments

These medications should be considered for people ≥ 65 years of age with the following conditions, where no contraindication to prescription exists.

Gastrointestinal System

1. Proton Pump Inhibitor with severe gastro-oesophageal acid reflux disease or peptic stricture requiring dilatation
2. Fibre supplement for chronic, symptomatic diverticular disease with constipation

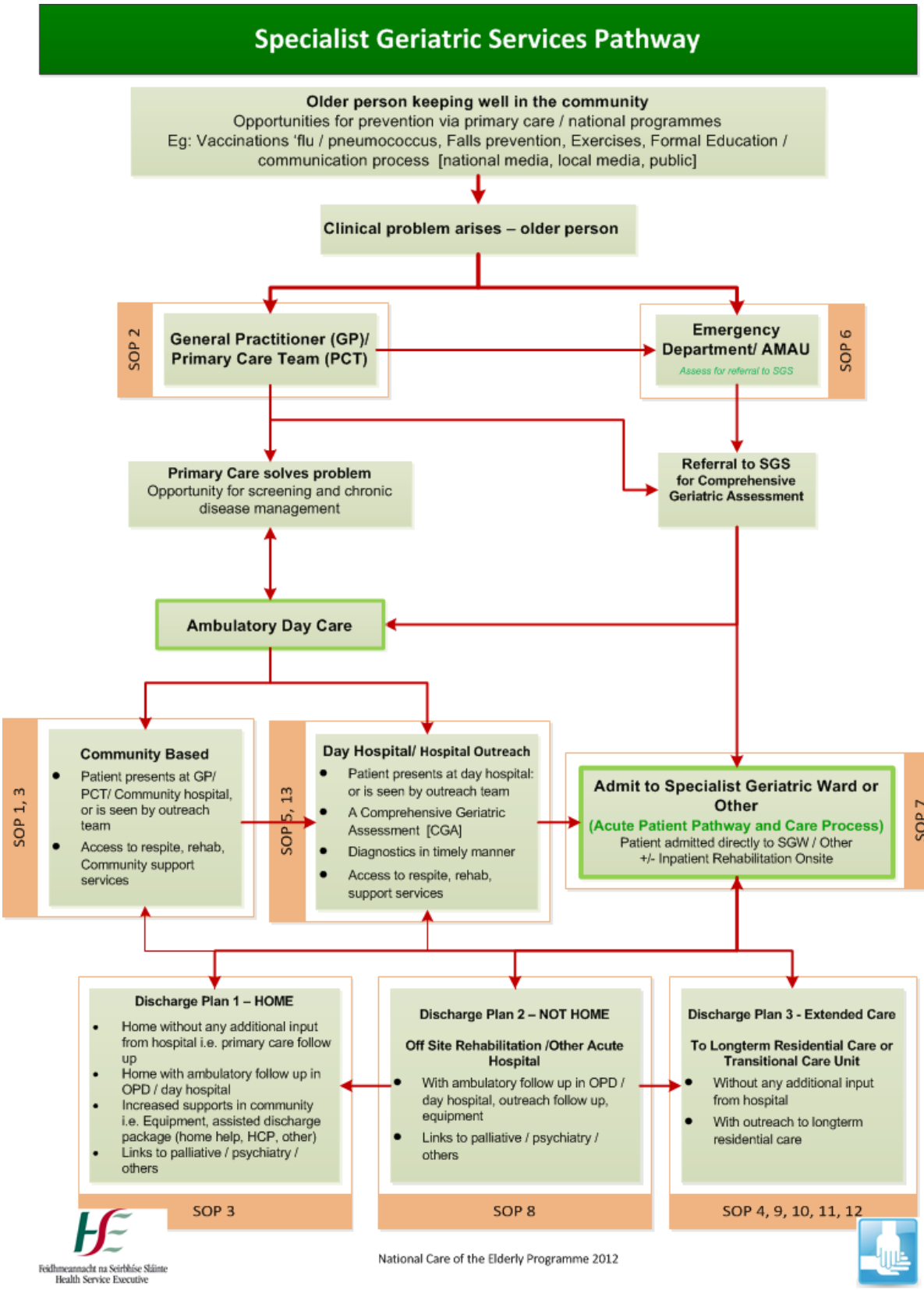
Musculoskeletal System

1. Disease-modifying anti-rheumatic drug (DMARD) with active moderate-severe rheumatoid disease lasting > 12 weeks
2. Bisphosphonates in patients taking maintenance corticosteroid therapy
3. Calcium and Vitamin D supplement in patients with known osteoporosis

Endocrine System

1. Metformin with type 2 diabetes +/- metabolic syndrome
2. ACE inhibitor or Angiotensin Receptor Blocker in diabetes with nephropathy
3. Antiplatelet therapy in diabetes mellitus with co-existing major cardiovascular risk factors
4. Statin therapy in diabetes mellitus if co-existing major cardiovascular risk factors present

Appendix 3: National Care of the Elderly Programme, Specialist Geriatric Services Pathway



Appendix 4: Ethics application

STANDARD APPLICATION FORM

For the Ethical Review of Health-Related Research Studies, which are not Clinical Trials of Medicinal Products For Human Use as defined in S.I. 190/2004

DO NOT COMPLETE THIS APPLICATION FORM
IF YOUR STUDY IS A CLINICAL TRIAL OF A MEDICINAL PRODUCT

Version 2: June 30th 2014

Title of Study: A profile of older emergency department attendees following a fall and their patterns of healthcare utilisation

Principal Investigators: Dr. Frances Horgan and Dr. Geraldine McMahon

Applicant's Signature:

For Official Use Only – Date Stamp of Receipt by REC:

TABLE OF CONTENTS MANDATORY /OPTIONAL

This Application Form is divided into Sections.

Sections A, B, C, D, E, J, K, L are **Mandatory.**

Sections F, G, H, and I are optional. Please delete Sections F, G, H, and I if these sections do not apply to the application being submitted for review.

IMPORTANT NOTE: Please refer to **Section I** within the form before any attempt to complete the Standard Application Form. **Section I** is designed to assist applicants in ascertaining if their research study is in fact a clinical trial of a medicinal product.

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

SECTION A GENERAL INFORMATION

SECTION A IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

A1 TITLE OF THE RESEARCH STUDY:

A profile of older emergency department attendees following a fall and their patterns of healthcare utilisation

A2 Principal Investigator(s):

Title: Dr. **Name:** Frances Horgan
Qualifications: PhD
Position: Senior Lecturer in Physiotherapy
Dept: Physiotherapy
Organisation: Royal College of Surgeons in Ireland
Address: 123 St Stephen's Green, Dublin 2
TEL: 01 402 2472 **E-MAIL:** fhorgan@rcsi.ie

Title: Dr **Name:** Geraldine McMahon
Qualifications: PhD BSCAnat FRCSEd FCEM FRCPI

Position: Consultant and Senior Lecturer in Emergency Medicine, St James's Hospital
Dept: Emergency Department
Organisation: St James's Hospital
Address: James's St, Dublin 8
TEL: 01 4162745 / 410 3332 **E-MAIL:** gmcmahon@stjames.ie

A3 (a) Is this a multi-site study? No

A3 (b) Please name each site where this study is proposed to take place and state the lead investigator for each site:

Site:	Lead Investigator:
ST JAMES'S HOSPITAL	DR GERALDINE MCMAHON

A3 (C) FOR ANY OF THE SITES LISTED ABOVE, HAVE YOU GOT AN OUTCOME FROM THE RESEARCH ETHICS COMMITTEE (WHERE APPLICABLE)?

Not applicable

A4. CO-INVESTIGATORS:

NAME OF SITE

St James's Hospital

Title: Ms. **Name:** Niamh Murphy
QUALIFICATIONS: BSc Physiotherapy, MSc
POSITION: Physiotherapy Manager
ORGANISATION: St James's hospital
Address: James's Street, Dublin 8
ROLE IN RESEARCH: Physiotherapy manager at St James's Hospital

NAME OF SITE

St James's Hospital

Title: Ms **Name:** Sophie Lang
QUALIFICATIONS: BSc Physiotherapy
POSITION: Physiotherapist
ORGANISATION: St James's Hospital
Address: James's St, Dublin 8
ROLE IN RESEARCH: Research Physiotherapist

A5. Lead contact person who is to receive correspondence in relation to this application or be contacted with queries about this application.

Title: Dr. **Name:** Frances Horgan
Address: School of Physiotherapy, Royal College of Surgeons in Ireland,
123 St Stephen's Green, Dublin 2
TEL (WORK): 01 402 2472 **TEL (MOB.):** 087 2368755
E-MAIL: fhorgan@rcsi.ie

A6. Please provide a lay description of the study.

Falls are common in the elderly, with 1 in 3 of those aged over 65 years experiencing a fall, 1 in 2 of those aged 80 years and over experience a fall annually. The elderly are over-represented in emergency departments, and a quarter of these presentations are related to falls. This study will explore the profile of the elderly attending the emergency department in St James's hospital with a fall. We will look in detail at their healthcare needs, and use of healthcare services. This study is important in planning services for this vulnerable group for the future.

A7 (A) IS THIS STUDY BEING UNDERTAKEN AS PART OF AN ACADEMIC QUALIFICATION? Yes

A7 (b) IF YES, please complete the following:
Student Name: Sophie Lang **Course:** MSc Research
Institution: RCSI **Academic Supervisor:** Dr Frances Horgan

SECTION B STUDY DESCRIPTORS

SECTION B IS MANDATORY

B1. Provide information on the study background.

Recent data from St James's hospital shows that in 2010, there were 9,484 ED attendances among those aged 65 years and over. This equates to 26 elderly patients each day, with about 25% of attendances having a history of a fall, which means approximately 6 patients each day with a fall. The rate of hospital admission was higher in the elderly groups in contrast with those aged less than 65. The higher utilisation of emergency services among the elderly, in particular those who sustain a fall, warrants further investigation, if specialist geriatric services are to be responsive to the needs of the elderly.

B2. List the study aims and objectives.

The aims of this study are to establish the incidence and circumstances of falls among the elderly community-dwelling population attending the ED of a large acute teaching hospital and describe the patterns of healthcare utilisation by this group.
The study objectives are;

1. To examine the incidence and circumstances of falls among a sample of elderly attending the ED department over an 8-month period;
2. To describe the socio-demographic and health profile of older patients presenting to the ED following a fall;
3. To document the healthcare needs and healthcare utilisation among the sample of elderly ED attendees who present with a fall;
4. To make recommendations for appropriate care pathways for falls prevention and falls management.

B3. List the study endpoints (if applicable).

To establish the incidence and circumstances of falls among the elderly community dwelling attending the ED and their healthcare utilisation.

B4. Provide information on the study design.

Cross-sectional design

B5. Provide information on the study methodology.

The ED records of all patients aged 65 years and over will be reviewed within 48 hours of their attendance at the ED by the researchers.
The research team will be Dr Horgan, Dr McMahon and a research physiotherapist, Sophie Lang who is a St James's hospital employee.

What we would propose to do is to identify fallers from the chart review (key word analysis of ED chart), the researcher would contact the participant by phone if it is likely that they experienced a fall recently and attended the emergency department at St. James's hospital. The researcher would clarify the presence of a fall or not, inform the participant of the study and invite them to attend the hospital to discuss the study further. The hospital visit would then allow the researcher to go through the study PIL, the participant would have an opportunity to ask questions and would be asked to sign a consent form, giving written consent, if they wish to take part in the study. Our previous experience of this methodology is that patients did not object to a follow up phone call to establish how they were and many felt the offer of extra research assessments after their attendance at ED enhanced their experience.

If the patient consents to the study, we will review their ED chart and note demographic information Patients who are discharged from the ED will be followed up by a phone call at one week and invited to attend for assessment with the researcher at the hospital or as a home visit. Patients who are admitted from the ED will be phoned within 1-month by the researcher.

The research team will be Dr Horgan, Dr McMahon and the research physiotherapist Sophie Lang who is a St James's hospital employee.

B6. What is the anticipated start date of this study?

September 2014

B7. What is the anticipated duration of this study?

12-15 months

B8 (a) <u>How many</u> research participants are to be recruited <u>in total</u>?

204

B8 (b) Provide information on the statistical approach to be used (if appropriate) / source of any statistical advice.

Recent data from St James's hospital shows that in 2010, there were 9,484 ED attendances among those aged 65 years and over. This equates to 26 elderly patients each day, with about 25% of attendees having a history of falls. This means that approximately 6 patients attend each day with a fall. We will focus on fallers attending on a Monday, 1 day per week for an 8-month period, 6 patients each day X 8 months [34 weeks], giving a sample of 204 participants.

B8 (c) Please justify the proposed sample size and provide details of its calculation (including minimum clinically important difference).

The sample size detail as set out in Q8 (b) is based on activity figures at the ED and the period of time allocated for data collection 8-months.

B8 (d) Where sample size calculation is impossible (e.g. It is a pilot study and previous studies cannot be used to provide the required estimates) then please explain why the sample size to be used has been chosen.

We will focus on fallers attending on a Monday, 1 day per week for an 8-month period, 6 patients each day X 8 months [34 weeks], giving a sample of 204 participants.

SECTION C study PARTICIPANTS

SECTION C IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

SECTION C1 PARTICIPANTS – SELECTION AND RECRUITMENT

C1. 1 How many research participants are to be recruited? At each site (if applicable)? And in each treatment group of the study (if applicable)?

NAME OF SITE:	NAMES OF TREATMENT GROUP (IF APPLICABLE)		
	INSERT NAME OF GROUP:	INSERT NAME OF GROUP:	INSERT NAME OF GROUP:
ST JAMES'S HOSPITAL	ED ATTENDEES > 65 YEARS WITH A FALL	NOT APPLICABLE	

C1.2 How will the participants in the study be selected?

ED charts will be reviewed using keyword analysis by Dr McMahon and the research physiotherapist (SL) (Both St James' hospital employees) to identify attendees over aged 65 years who have sustained a fall. Fallers will be identified by keyword analysis of the ED chart based on pre-determined keywords. If a keyword (slip, trip, stumble, fall, dizziness, weakness, laceration, injury, collapse, blackout, faint, syncope, vasovagal, drop attack, found on floor, found collapsed, seizure, loss of consciousness, unresponsive, transient ischaemic attack) is present, these patients will be considered possible fall cases and will be contacted by the research physiotherapist to determine if a fall took place. They will then be invited to participate in the study by the research physiotherapist.

C1.3 How will the participants in the study be recruited?

Elderly patients aged > 65, who are community dwelling and who attended the ED because of a fall will be contacted and invited to participate in the study.

C1.4 What are the main inclusion criteria for research participants? (please justify)

Patients aged 65 years and over, living in the community will be included, able to understand the questions and complete the interview. If the research physiotherapist is concerned about cognitive function they may conduct a simple test, the 10-item Abbreviated Mental Test Score, subjects scoring >6 will be included.

C1.5 What are the main exclusion criteria for research participants? (please justify)

Patients admitted to hospital after a fall, who are still inpatients at 1-month will be excluded. Patients who are long-stay residents in a nursing home will be excluded, subjects scoring <6 on the AMTS may be excluded.

C1.6 Will any participants recruited to this research study be simultaneously involved in any other research project?

Not to my knowledge

SECTION C2 PARTICIPANTS – INFORMED CONSENT

C2.1 (a) Will informed consent be obtained? Yes

C2.1 (b) If no, please justify.

Not applicable

C2.1 (c) If yes, how will informed consent be obtained and by whom?

The ED charts will be reviewed to identify patients who meet the inclusion criteria, they will then be contacted by the research physiotherapist to confirm that they attended the ED and had a fall. They will be then informed about the study, they will be invited to attend the hospital to discuss the study. Each participant will be invited to attend the hospital to meet the research physiotherapist to go

through the study information, consent process and study interview (if they consent for the study).

C2.1 (d) Will participants be informed of their right to refuse to participate and their right to withdraw from this research study?

Yes

C2.1 (e) If no, please justify.

Answer

C2.1 (f) Will there be a time interval between giving information and seeking consent? Yes

C2.1 (g) If yes, please elaborate.

Eligible patients will be identified through 'keyword' analysis of 'falls' from the ED charts and will be contacted in the same week of presentation at the ED by the research physiotherapist. The research physiotherapist will contact the 'eligible patient' by phone, she will confirm that they attended the ED and had a fall. She will inform them of the study, she will invite them to attend the hospital if they wish to discuss being in the study, this will be scheduled within a week of the phone call where possible by the research physiotherapist.

C2.1 (h) If no, please justify.

Not applicable

SECTION C3 adult participants - CAPACITY

C3.1 (a) Will all adult research participants have the capacity to give informed consent? YES

SECTION c4 participants under the age of 18

C4.1 (a) Will any research participants be under the age of 18 i.e. Children?

No

SECTION C5 PARTICIPANTS - CHECKLIST

Please confirm if any of the following groups will participate in this study. This is a quick checklist for research ethics committee members and it is recognised that not all groups in this listing will automatically be vulnerable or lacking in capacity.

C5.1 Patients Yes
C5.2 Unconscious patients No
C5.3 Current psychiatric in-patients No
C5.4 Patients in an emergency medical setting No
C5.5 Relatives / Carers of patients No
C5.6 Healthy Volunteers No
C5.7 Students No
C5.8 Employees / staff members No
C5.9 Prisoners No
C5.10 Residents of nursing homes No
C5.11 Pregnant women No
C5.12 Women of child bearing potential No
C5.13 Breastfeeding mothers No
C5.14 Persons with an acquired brain injury No
C5.15 Intellectually impaired persons No
C5.16 Persons aged > 65 years Yes

C5.17 If yes to any of the above, what special arrangements have been made to deal with issues of consent and assent (if any)?

The study will be explained in full to each participant by the research physiotherapist. If the research physiotherapist has concerns about their understanding they may undertake a simple assessment of cognition, the Abbreviated Mental Test Score (AMTS). The AMTS is a 10 item test, patients scoring <6 may need to be excluded. This will be explained to the patients. They will be given an opportunity to ask questions and these will be answered by the research physiotherapist, they will be advised that they can decline to take part in the study at any stage.

SECTION D research PROCEDURES

SECTION D IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

D1. WHAT RESEARCH PROCEDURES OR INTERVENTIONS (OVER AND ABOVE THOSE CLINICALLY INDICATED AND/OR OVER AND ABOVE THOSE WHICH ARE PART OF ROUTINE CARE) WILL RESEARCH PARTICIPANTS UNDERGO WHILST PARTICIPATING IN THIS STUDY?

Patients will be invited to complete some additional questionnaires that would not be included in routine care. They will include, an activity questionnaire (Nottingham Extended ADL scale) and a Network Assessment Questionnaire. They will also be asked some questions about their fall and their use of healthcare services in the past month.

D2. If there are any potential harms resulting from any of the above listed procedures, provide details below:

The patients may feel a little upset discussing their recent fall.

D3. What is the potential benefit that may occur as a result of this study?

By gathering additional information on activity levels, social support and the circumstances of the fall and healthcare use, this information will be very valuable in determining the healthcare needs of this vulnerable group and planning appropriate services in the future).

D4 (A) WILL THE STUDY INVOLVE THE WITHHOLDING OF TREATMENT?

NO

D5. HOW WILL THE HEALTH OF PARTICIPANTS BE MONITORED DURING AND AFTER THE STUDY?

The health of the participants will be monitored by the research physiotherapist during but **not** after the study. If during the study the researcher is concerned or the participant raises some health concerns to the researcher, this will be notified to their GP. As this is not a clinical trial, there will be no Independent Safety Monitoring Board. No

interventions are being provided in this study, the study will comprise a detailed assessment only.

D6 (A) WILL THE INTERVENTIONS PROVIDED DURING THE STUDY BE AVAILABLE IF NEEDED AFTER THE TERMINATION OF THE STUDY? NO

D7. PLEASE COMMENT ON HOW INDIVIDUAL RESULTS WILL BE MANAGED.

No interventions are being provided in this study, the study will comprise a detailed assessment only.

D8. PLEASE COMMENT ON HOW AGGREGATED STUDY RESULTS WILL BE MADE AVAILABLE.

This is an observational cross-sectional study, we do not plan on making individual results available to the research participants. However, if we do receive a request we will facilitate this request. We will relay 'incidental findings' to the research participant if this arises, e.g. poor gait or balance, need for gait aid or other assistive device. If we find negative findings, we will inform their GP.

D9. WILL THE RESEARCH PARTICIPANT'S GENERAL PRACTITIONER BE INFORMED THE RESEARCH PARTICIPANT IS TAKING PART IN THE STUDY (IF APPROPRIATE)? NO

D10. WILL THE RESEARCH PARTICIPANT'S HOSPITAL CONSULTANT BE INFORMED THE RESEARCH PARTICIPANT IS TAKING PART IN THE STUDY (IF APPROPRIATE)?
YES

SECTION Edata protection

SECTION E IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

SECTION E1 data processing - consent

E1.1 (A) WILL CONSENT BE SOUGHT FOR THE PROCESSING OF DATA? YES

SECTION E2 data processing - GENERAL

E2.1 WHO WILL HAVE ACCESS TO THE DATA WHICH IS COLLECTED?

The study Principal Investigators Dr Frances Horgan, Dr Geraldine McMahon and research physiotherapist (SL) will have access to the data that is collected. Dr Mahon and Sophie Lang are St James' hospital employees and will access the confidential patients records. Dr Horgan will not access the patient records.

E2.2 WHAT MEDIA OF DATA WILL BE COLLECTED?

Data will be in hard copy initially, during the participant interview the researcher will complete the research data collection form and some questionnaires on activity and social networks. This data will then be entered onto an Excel spread sheet. There will be no photographic or audio/video data.

E2.3 (A) WOULD YOU CLASS THE DATA COLLECTED IN THIS STUDY AS anonymous, irrevocably anonymised, pseudonymised, coded or identifiable data?

Data will be coded, the researcher will use a unique identifier for each participant. The researcher will be able to identify the participant via the code if necessary.

E2.3 (B) IF 'CODED', PLEASE CONFIRM WHO WILL RETAIN THE 'KEY' TO RE-IDENTIFY THE DATA?

The lead investigator at each site (Dr Geraldine McMahon at St James's Hospital) will retain the 'key' to re-identify the data.

E2.4 WHERE WILL DATA WHICH IS COLLECTED BE STORED?

The data will be securely saved to the V drive of a networked password protected computer at the site (St James's Hospital). The use of any portable devices and files will be encrypted.

E2.5 PLEASE COMMENT ON SECURITY MEASURES WHICH HAVE BEEN PUT IN PLACE TO ENSURE THE SECURITY OF COLLECTED DATA.

The data forms will be stored in a locked filing cabinet in the RCSI School of Physiotherapy. The Excel data file will be securely saved to the V Drive of a networked password protected computer at each site (St James's Hospital). Encryption software will be utilised. Portable devices and all files will be encrypted. Personal data will not be stored on portable devices or laptops. All data will be kept safe and secure for 5 years.

E2.6 (A) WILL DATA COLLECTED BE AT ANY STAGE LEAVING THE SITE OF ORIGIN?

YES

E2.6 (B) IF YES, PLEASE ELABORATE.

The Principal Investigator Dr Horgan is based at the RCSI School of Physiotherapy and may conduct data analysis at that site. The data file will be encrypted and will be non-identifiable data.

E2.7 WHERE WILL DATA ANALYSIS TAKE PLACE AND WHO WILL PERFORM DATA ANALYSIS (IF KNOWN)?

The research physiotherapist (SL) may perform the data analysis at the RCSI School of Physiotherapy. The research physiotherapist (SL) will be able to seek the advice of statisticians at the RCSI in relation to statistical analysis. This will take place towards the end of the study.

E2.8 (A) AFTER DATA ANALYSIS HAS TAKEN PLACE, WILL DATA BE DESTROYED OR RETAINED?

Data will be retained until the findings are published and for 5 years.

E2.8 (B) PLEASE ELABORATE.

Coded data will be retained for 5 years.

E2.8 (C) IF DESTROYED, HOW, WHEN AND BY WHOM WILL IT BE DESTROYED?

Not applicable

E2.8 (D) IF RETAINED, FOR HOW LONG, FOR WHAT PURPOSE, AND WHERE WILL IT BE RETAINED?

Data will be retained until the findings have been published, the data will be retained for 5 years.

E2.9 PLEASE COMMENT ON THE CONFIDENTIALITY OF COLLECTED DATA.

The data collected will be coded and stored on a password-protected file. It will not be disclosed to third parties.

E2.10 (A) WILL ANY OF THE INTERVIEW DATA COLLECTED CONSIST OF AUDIO RECORDINGS / VIDEO RECORDINGS? NO

E2.11 (A) WILL ANY OF THE STUDY DATA COLLECTED CONSIST OF PHOTOGRAPHS/ VIDEO RECORDINGS? NO

SECTION e3 ACCESS TO HEALTHCARE RECORDS

E3.1 (A) DOES THE STUDY INVOLVE ACCESS TO HEALTHCARE RECORDS (HARD COPY / ELECTRONIC)? YES

E3.1 (B) IF YES, PLEASE ELABORATE.

The researchers (Dr McMahon, Dr Horgan and research physiotherapist) will conduct a keyword analysis of the ED chart. This is to determine if an individual aged over 65 years sustained a fall event. It may be necessary to access the health record to confirm medications and the presence of polypharmacy only.

E3.1 (C) WHO WILL ACCESS THESE HEALTHCARE RECORDS?

The researchers Dr McMahon, Dr Horgan and research physiotherapist Sophie Lang.

E3.1 (D) WILL CONSENT BE SOUGHT FROM PATIENTS FOR RESEARCH TEAM MEMBERS TO ACCESS THEIR HEALTHCARE RECORDS? YES

SECTION f HUMAN BIOLOGICAL MATERIAL

f1 Bodily Tissue / Bodily Fluid Samples - general

F1 1 (a) Does this study involve human biological material? NO

f5 Genetic testing

F5.1 (a) Does this research study involve 'genetic testing'? No

f6 commercial value

F6.1 (a) Will the human biological material in this research study or the data derived from the analysis of the human biological material be commercially valuable or is there the possibility that it will become commercially valuable? No

section G radioactive material / diagnostic or therapeutic ionising radiation

G1 radioactive material / diagnostic or therapeutic ionising radiation - general

G1.1 (a) Does this study/trial involve exposure to <u>radioactive materials</u> or does this study/trial involve other <u>diagnostic or therapeutic ionising radiation</u>? NO

SECTION H MEDICAL DEVICES

H1 (A) IS THE FOCUS OF THIS STUDY/TRIAL TO INVESTIGATE/EVALUATE A <u>MEDICAL DEVICE</u>? NO

If the answer to question H1 (a) is No, please delete the following questions in this

SECTION I.3 FOOD AND FOOD SUPPLEMENTS

I3.1 (a) Does this study involve <u>food or food supplements?</u> No

SECTION j INDEMNITY

SECTION J IS MANDATORY

<u>IMPORTANT NOTE:</u> This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

J1 (A) IS EACH SITE IN WHICH THIS STUDY IS TO TAKE PLACE COVERED BY THE CLINICAL INDEMNITY SCHEME (CIS)? NO

J1 (B) IF THE ANSWER IS 'NO' FOR ANY SITE, WHAT OTHER ARRANGEMENTS ARE IN PLACE IN TERMS OF INDEMNITY / INSURANCE?

Dr Horgan is covered by the RCSI Indemnity Policy.

J2 (A) IS EACH MEMBER OF THE INVESTIGATIVE TEAM COVERED BY THE CLINICAL INDEMNITY SCHEME (CIS)? NO

J2 (b) If no, do members of the investigative team not covered by the Clinical Indemnity Scheme (CIS) have either current individual medical malpractice insurance (applies to medical practitioners) or current professional liability insurance either individually or as provided by their hosting/employing institution (generally applies to allied healthcare professionals, university employees, scientists engineers etc.)?

Dr Horgan will be covered by the RCSI insurance policy.

J3 (A) WHO OR WHAT LEGAL ENTITY IS THE <u>SPONSOR</u> OF THIS RESEARCH STUDY?

Dr Frances Horgan the study PI.

J3 (B) WHAT ADDITIONAL INDEMNITY ARRANGEMENTS HAS THE <u>SPONSOR</u> PUT IN PLACE FOR THIS RESEARCH STUDY IN CASE OF HARM BEING CAUSED TO A RESEARCH PARTICIPANT (IF ANY)?

Dr Horgan is covered by the RCSI Insurance Policy.

SECTION kCOST AND RESOURCE IMPLICATIONS and funding

SECTION K IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

K1 (A) ARE THERE ANY COST / RESOURCE IMPLICATIONS RELATED TO THIS STUDY? NO

K2 (a) Is funding in place to conduct this study? NO
K2 (b) If no, has funding been sought to conduct this study? YES

K2 (c) Please state the source of funding (industry, grant or other) and the amount of funding.

Irish Research Council – application submitted for MSC scholarship (26K January 28th 2014, outcome awaited May 2014) – unsuccessful outcome June 16th 2014, we will still proceed with study

K2 (d) Is the study being funded by an external agency? NO
K2 (f) Do any conflicts of interest exist in relation to funding? Please elaborate.

There are no conflicts of interest.

K2 (g) Please provide additional details in relation to management of funds.

Not applicable – no current funds

K3. Please provide details of any payments (monetary or otherwise) to investigators.

Not applicable – no current funds

K4. Please provide details of any payments (monetary or otherwise) to participants.

Out of pocket expenses incurred by the research participants, for attending the hospital for the research interview will be covered, this would include the cost of car parking or a taxi if required.

SECTION l ETHICAL ISSUES

SECTION L IS MANDATORY

L1. Please identify any particular additional ethical issues that this project raises and discuss how you have addressed them.

The participants will be initially contacted by phone by the research physiotherapist, to confirm that they had a recent fall and attended the ED. If this fall event and ED visit is confirmed by the patient, they are eligible to be included. We will explain that we are doing a study and will invite them to the hospital if they wish to discuss being in the study. We will schedule an appointment at the hospital within a week of the phone call. When the patient attends we will go through the PIL and the informed consent process. We will advise the participant that we may need to check some details about medications in their health record, this is included on the consent form. We will then proceed with the research interview. All data will be managed in accordance with the Data Protection Act. Participants will be advised that they may withdraw from the study at any stage and that their participation will not in any way affect the treatments that they are receiving.

Some of the patients identified in the study group may be at risk of dying. When we are contacting patients, we will cross-reference patient details with resources such as www.rip.ie and any recent hospital episodes to ensure that we are aware if the patient identified is recently deceased. If we are unable to verify

If we are unable to verify if a patient is recently deceased we will proceed with a phone call using a sensitively prepared script. The researcher will introduce themselves sensitively, they will confirm who has answered the phone and their relationship with the patient in question. The researcher will ask if it would be possible to speak to the patient in question. If they are informed that the patient is recently deceased, they will very sensitively and respectfully offer a message of sympathy and apologise for disturbing the family/individual. They will close the conversation and conclude the phone call sensitively

PLEASE ENSURE THIS APPLICATION FORM IS FULLY COMPLETED AS INCOMPLETE SUBMISSIONS WILL NOT BE REVIEWED.

Appendix 5: Ethics approval letter

THIS NOTEPAPER MUST NOT BE USED FOR PRESCRIPTIONS OR INVOICING PURPOSES

~~SJH/AMNCH Research Ethics Committee~~ Secretariat
Ph: 4142341 email: Ursula.Ryan@amnch.ie

THE ADELAIDE & MEATH HOSPITAL, DUBLIN
INCORPORATING
THE NATIONAL CHILDREN'S HOSPITAL

TALLAGHT, DUBLIN 24, IRELAND
TELEPHONE +353 1 4142000

Dr. Frances Horgan
School of Physiotherapy
Royal College of Surgeons in Ireland
123 St. Stephen's Green
Dublin 2

11th August 2014

RE : A Profile of older emergency department attendees following a fall and their patterns of healthcare utilisation (Version 2 30 June 2014)

REC Reference : 2014/4/Chairman (1) 2014/08 List 31 (1) (please quote reference on all correspondence)

Dear Dr. Horgan,

Thank you for your correspondence dated 30th June in which you sent in response to the Committee's request for clarifications in relation to the above referenced study.

The Chairman of the Committee has reviewed your response and has given ethical approval on behalf of the Committee.

Full ethical approval is now in place for this study.

Yours sincerely

Ms. Ursula Ryan
Secretary, SJH/AMNCH Research Ethics Committee

135703001

Appendix 6: Patient Information Leaflet

School of Physiotherapy

Royal College of Surgeons in Ireland

123, St Stephen's Green, Dublin 2

Patient Information Leaflet

Study title: **A profile of older emergency department attendees following a fall and their patterns of healthcare utilisation**

Principal investigator's name: Dr Geraldine McMahon

Principal investigator's title: Consultant Physician Emergency Medicine, St James's Hospital

Telephone number of Principal investigator: 01 416 2745 / 410 3332

Academic Sponsor/co-Principal investigator's name: Dr Frances Horgan

Academic Sponsor/co-Principal investigator's title : Senior Lecturer in Physiotherapy

Telephone number of Academic Sponsor/co-Principal investigator's name: 014022472

Co-investigator's name: Sophie Lang

Co-investigator's title: Research Physiotherapist St James's /Postgraduate MSc Student, RCSI

Telephone number of co-investigator: 01 416 2503

You are being invited to take part in a clinical research study to be carried out at St James's Hospital.

Before you decide whether or not you wish to take part, you should read the information provided below carefully and, if you wish, discuss it with your family, friends or doctor. Take time to ask questions – don't feel rushed and don't feel under pressure to make a quick decision.

You should clearly understand the risks and benefits of taking part in this study so that you can make a decision that is right for you. This process is known as 'Informed Consent'.

You don't have to take part in this study. If you decide not to take part it won't affect your future medical care.

You can change your mind about taking part in the study any time you like. Even if the study has started, you can still opt out. You don't have to give us a reason. If you do opt out, rest assured it won't affect the quality of treatment you get in the future.

Why is this study being done?

Many people aged over 65 years experience a fall and often attend the hospital emergency department (ED). We would like to find out more about the needs of those affected by a fall who attend the ED and who are discharged home; how the fall affects you, what help/needs you have, what contact you have with your GP or other health services after the fall. By having this information it would help us to better understand the

needs of those who are over 65 and have a fall, it would help us to improve services to meet the needs of this patient group.

Who is organising and funding this study?

This research study is being undertaken by researchers in the School of Physiotherapy at the Royal College of Surgeons in Ireland (RCSI) and the emergency department at St James's hospital.

Why am I being asked to take part?

You are being asked to take part because you recently attended the Accident and Emergency Department after a fall. To take part in this study you must; (1) be able to give informed consent, (2) have had a fall and attended the Accident and Emergency department at St James's hospital, (3) be able to complete and understand the interview.

How will the study be carried out?

This study will start in autumn 2014. We will identify fallers from a chart review, the research physiotherapist will contact you by phone if you experienced a fall recently and attended the emergency department at St. James's hospital. The research physiotherapist will clarify the presence of a fall or not, inform you of the study and invite you to attend the hospital or conduct an over the phone interview to discuss the study further. The hospital visit or over the phone interview will allow the research physiotherapist to go through the study information with you. You will be able to ask questions and you will be asked to sign a consent form, giving written consent, if you wish to take part in the study. This will be followed by an assessment which will involve asking you some details about your health, your recent fall, your activities and support in the community and if you attended your GP or used other health services. The interview should last about 45 minutes.

What will happen to me if I agree to take part?

You are being contacted because you had a fall and recently attended the Accident and Emergency department at St James's hospital. We will tell you about the study and answer questions that you may have. You will be asked to sign a consent form. We will then do an assessment and ask you some questions about your health, your recent fall, your activities and support in the community and if you attended your GP or used other health services. We may need to check your chart for some details e.g. your medications. The interview should last about 45 minutes.

What are the benefits?

This study will help us to understand better the needs of those who have had a fall and who attend the emergency department, it will allow us to plan and improve services to meet their needs.

What are the risks?

There is a very slight risk that you may feel a little upset describing your fall, or answering questions about your attendance at the hospital, if we find that you need further support we will inform you and your GP.

What if something goes wrong when I'm taking part in this study?

If we find that you need further support we will inform you and your GP.

Will it cost me anything to take part?

You will not incur any expenses, there is no financial cost to you by taking part in the study. We will be able to cover some out of pocket expenses should you attend the hospital for assessment, this would include the cost of car parking or a taxi.

Is the study confidential?

To maintain anonymity and confidentiality, a unique identification number (UIN) will be used for each participant in this study. A master sheet recording your name and related UIN will be stored on a password protected computer, only accessible to the researchers (Dr Frances Horgan and Dr Geraldine McMahon and the research physiotherapist [Sophie Lang] (who is a St James's hospital employee). We will need to check your chart for some details for the study e.g. medications. The informed consent sheet will be held separate to all other data in a key locked cabinet in the School of Physiotherapy of RCSI, accessible only to the researchers. Following data collection, your results will be entered into a computer file, which is password protected and it will be destroyed after 5 years. The results may be published in a scientific journal. However, the collected data will be confidential and participants will not be identifiable.

Where can I get further information?

If you have any further questions about the study or if you want to opt out of the study, you can rest assured it won't affect the quality of treatment you get in the future.

If you need any further information now or at any time in the future, please contact:

Name: Dr Frances Horgan

Address: School of Physiotherapy, Royal College of Surgeons in Ireland, 123 St Stephen's Green, Dublin 2.

Phone No: 01 402 2472 (office hours)

Name: Sophie Lang, Physiotherapist, St James's hospital employee

Address: Physiotherapy Department, St James's Hospital, James's Street, Dublin 8.

Phone No: 01 416 2503 (office hours)

Appendix 7: Consent Form

School of Physiotherapy
Royal College of Surgeons
123, St.Stephens Green, Dublin 2

Patient Consent Form

Study title: A profile of older emergency department attendees following a fall and their patterns of healthcare utilisation

I have read and understood the **Information Leaflet** about this research project. The information has been fully explained to me and I have been able to ask questions, all of which have been answered to my satisfaction.	YES ☐	NO ☐
I understand that I don't have to take part in this study and that I can opt out at any time. I understand that I don't have to give a reason for opting out and I understand that opting out won't affect my future medical care	YES ☐	NO ☐
I am aware of the potential risks of this research study	YES ☐	NO ☐
I give permission for researchers to look at my medical records to get information. I have been assured that information about me will be kept private and confidential.	YES☐	NO☐
I have been given a copy of the Information Leaflet and this completed consent form for my records.	YES☐	NO☐
Storage and future use of information: I give permission for information collected about me to be stored or electronically processed for the purpose of scientific research and to be used in <u>related studies or other studies in the future</u> but only if research is approved by a Research Ethics Committee.	YES☐	NO☐

Patient Name (Block Capitals) | Patient Signature | Date

To be completed by the Principal Investigator or nominee.

I, undersigned, have taken the time to fully explain to the above patient the nature and purpose of this study in a way that they could understand. I have explained the risks involved as well as the possible benefits. I have invited them to ask questions on any aspect of the study that concerned them.

Name (Block Capitals) | Qualifications | Signature | Date

Appendix 8: Demographic profile

Unique ID			Date of consent:		
Year of birth:			Age:		
Gender: M F			Health insurance/Medical card		
Date of Admission to ED:			Time of admission:		
Triage Category:			Length of stay:		
Length of waiting time:			Mode of Transport:		
If accompanied: Y N					
Method of Referral:			Reason for referral:		
Admitted: Y N Reason:					
Discharged; Y N			Date of discharge:		
Length of Hospital admission:					
Follow up: Y N GP Clinic OPD Day Hospital			Community Referral: Community Physiotherapy Community Occupational Therapy Public Health Nurse Home help Meals on wheels Private carers:		
Living alone	Single	Married	Children	Carers	Widowed

Bungalow	2-Story House	Terraced	Detached	Privately owned	Social housing
Medications:					
Medical History/Co-morbidities					
Presence of polypharmacy:					

Circumstances around fall:
Location:
Outcome/Injuries sustained:
Previous Fall History:

Level of mobility:	Independent	Assistance	Supervision	Other
Mobility aid:	Rollator Zimmer Frame	Walking stick	3-wheel rollator	Other

Are you afraid of falling?	YES	NO

Before Fall: Previous falls:	Hospital admissions:	Length of stay:
ED attendance in last 6 months:	GP visits:	PHN:
Community Physio:	Community OT:	Other community:
Home help	Meals on wheels	Home care attendant

Day Centre	Day hospital	
After Fall (1 month)	Hospital admissions:	Length of stay:
	GP visits:	PHN:
Community Physio:	Community OT:	Other community:
Home help	Meals on wheels	Home care attendant
Day Centre	Day hospital	

Appendix 9: Nottingham Extended Activities of Daily Living Scale (NEADL)

	Not at all	With help	On your own	On your with difficulty
1.Walk around outside?				
2.Climb stairs?				
3.Get in and out of a car?				
4. Walk over uneven ground?				
5.Cross roads?				
6. Travel on public transport?				
7. Manage to feed yourself?				
8. Manage to make yourself a hot drink?				
9. Take hot drinks from one room to another?				
10. Do the washing up?				
11. Make yourself a hot snack?				
12. Manage your own money when out?				
13. Wash small items of clothing?				
14. Do your own housework?				

15. Do your own shopping?				
16. Do a full clothes wash?				
17. Read newspapers or books?				
18. Use the telephone?				
19. Write letters?				
20. Go out socially?				
21. Manage your own garden?				
22. Drive a car?				

Appendix 10: Identification of Seniors at Risk (ISAR) Tool

1. Before the illness or injury that brought you to the Emergency, did you need someone to help you on a regular basis?	YES ☐ NO ☐	1 0
2. Since the illness or injury that brought you to the Emergency, have you needed more help than usual to take care of yourself?	YES ☐ NO ☐	1 0
3. Have you been hospitalized for one or more nights during the past 6 months (excluding a stay in the Emergency Department)?	YES ☐ NO ☐	1 0
4. In general, do you see well?	YES ☐ NO ☐	1 0
5. In general, do you have serious problems with your memory?	YES ☐ NO ☐	1 0
6. Do you take more than three different medications every day?	YES ☐ NO ☐	1 0
	TOTAL:	

Appendix 11: Network Assessment Instrument (NAI)

Question	Codes	Family Dependent	Locally Integrated	Local Self-Contained	Wider Community	Private Restricted
1. How far away does your nearest (IN TERMS OF DISTANCE) child or other relative live? (INCLUDES RELATED MEMBERS OF HOUSEHOLD; EXCLULDES SPOUSE)	No relatives (0) Within 1 mile (1) 1-5 miles (2) 6-15 miles (3) 16-50 miles (4) 50+ miles (5)	1	2,3	3,4	4,5	4,5
2. Do you have any children? IF YES: Where does your nearest child live?	No children (0) Within 1 mile (1) 1-5 miles (2) 6-15 miles (3) 16-50 miles (4) 50+ miles (5)	1,2	1,2,3	0,3,4	5	5,5
3. Do you have any living sisters or brothers? IF YES:	No sisters or brothers (0) Within 1	1,2	1,2,3	2,3,4	0,5	0,5

Where does your nearest sister brother live?	mile (1) 1-5 miles (2) 6-15 miles (3) 16-50 miles (4) 50+ miles (6)					
4. How often do you see any of your children or other relatives to speak to?	Never no relative (0) Daily (1) 2-3 times/week (2) At least weekly (3) At least monthly (4) Less often (5)	1,2	1,2	3,4	4,5	0,5
5. Do you have friends in this community? IF YES: How often do you have a chat or do something with one of your own	Never/no friends (0) Daily (1) 2-3 times/week (2) At least weekly (3) At least monthly	4,5	1,2,3	4,5	2,3	0,5

friends?	(4) Less often (5)					
6. How often do you see any of your neighbours to have a chat with or do something with?	No contact with neighbours (0) Daily (1) 2-3 times/week (2) At least weekly (3) At least monthly (4) Less often (5)	0,4,5	1,2,3	3,4	3,4	0,5
7. Do you attend religious meetings'?	Yes, regularly (1) Yes. occasionally (2) No (0)	2	1	0,2	1,2	0
8.Do you attend meetings of any community or social groups, such as old people's	Yes regularly (1) Yes occasiona	0,2	1	0,2	1	0

clubs, lectures or anything like that?	lly (2) No (0)					
Network Type:						

Appendix 12: Fall Safe Guidance Sheet 'Medicines and Falls in Hospital: Guidance Sheet.

Medicines and Falls in Hospital: Guidance Sheet

All patients should have their drug burden reviewed with respect to its propensity to cause falls.

The history should establish the reason the drug was given, when it started, whether it is effective and what its side effects have been.

An attempt should be made to reduce the number and dosage of medications, and ensure they are appropriate and not causing undue side effects.

Falls can be caused by almost any drug that acts on the brain or on the circulation. Usually the mechanism leading to a fall is one or more of:

- **sedation**, with slowing of reaction times and impaired balance
- **hypotension**, including the 3 syndromes of paroxysmal hypotension – orthostatic hypotension, vasovagal syndrome and vasodepressor carotid sinus hypersensitivity
- **bradycardia, tachycardia or periods of asystole**

Falls may be the consequence of recent medication changes, but are usually caused by medicines that have been given for some time.

This guidance was prepared by:

Dr Adam Darowski, Consultant Physician, Clinical Lead, The FallSafe Project

Dr Jeremy Dwight, Consultant Cardiologist

Dr John Reynolds, Consultant in Clinical Pharmacology

John Radcliffe Hospital, Oxford, March 2011

This guidance has been approved by the British Geriatrics Society.

Key to tables overleaf:

Red	High risk: can commonly cause falls alone or in combination
Amber	Moderate risk: can cause falls, especially in combination
Yellow	Possibly causes falls, particularly in combination
Green	National Institute for Health and Clinical Excellence (NICE) guidelines

DRUGS ACTING ON THE BRAIN (PSYCHOTROPIC DRUGS)

There is good evidence that stopping these drugs can reduce falls (1).

Taking such a medicine roughly doubles the risk of falling. There is no data on the effect of taking two or more such tablets at the same time (2).

Sedatives, antipsychotics and sedating antidepressants cause drowsiness and slow reaction times. Some antidepressants and antipsychotics also cause orthostatic hypotension.

MEDICATION GROUP		COMMONLY USED MEDICATIONS WITHIN THE GROUP	EFFECTS ON FALLS RISK
Sedatives: Benzodiazepines		Temazepam, Nitrazepam Diazepam, Lortemazepam Chlordiazepoxide, Flurazepam, Lorazepam, Oxazepam, Clonazepam	Drowsiness, slow reactions, impaired balance. Caution in patients who have been taking them long term.
Sedatives: "Zs"		Zopiclone, Zolpidem	Drowsiness, slow reactions, impaired balance.
Sedating antidepressants (tricyclics and related drugs)		Amitriptyline, Dosulepin Imipramine, Doxepin Clomipramine, Lofepramine, Nortriptyline, Trimipramine Mirtazapine, Mianserin Trazodone	All have some alpha blocking activity and can cause orthostatic hypotension. All are antihistamines and cause drowsiness, impaired balance and slow reaction times. Double the rate of falling.
Monoamine oxidase inhibitors (MAOIs)		Phenelzine, Isocarboxazid, Tranylcypromine	MAOIs are little now used; all (except moclobemide) cause severe orthostatic hypotension.
Drugs for psychosis and agitation		Chlorpromazine, Haloperidol, Fluphenazine, Risperidone Quetiapine, Olanzapine	All have some alpha receptor blocking activity and can cause orthostatic hypotension. Sedation, slow reflexes, loss of balance.
Selective serotonin reuptake inhibitor (SSRI) antidepressants		Sertraline, Citalopram, Paroxetine, Fluoxetine	Cause falls as much as other antidepressants in population studies. Several population studies have shown that SSRIs are consistently associated with an increased rate of falls and fractures, but there are no prospective trials. The mechanism of such an effect is unknown. They cause orthostatic hypotension and bradycardia only rarely as an idiosyncratic side effect. They do not normally sedate. They impair sleep quality.

Drugs acting on the brain (psychotropic drugs) - continued

MEDICATION GROUP		COMMONLY USED MEDICATIONS WITHIN THE GROUP	EFFECTS ON FALLS RISK
Serotonin and norepinephrine reuptake inhibitor (SNRI) antidepressants A combination of an SSRI and a noradrenaline re-uptake inhibitor		Venlafaxine, Duloxetine	As for SSRIs but also commonly cause orthostatic hypotension (through noradrenaline re-uptake blockade).
Opiate analgesics		All opiate and related analgesics – Codeine, Morphine, Tramadol	Sedate, slow reactions, impair balance, cause delirium.
Anti-epileptics		Phenytoin	Phenytoin may cause permanent cerebellar damage and unsteadiness in long term use at therapeutic dose. Excess blood levels cause unsteadiness and ataxia.
		Carbamazepine, Phenobarbitone	Sedation, slow reactions. Excess blood levels cause unsteadiness and ataxia.
		Sodium valproate, Gabapentin	Some data on falls association.
		Lamotrigine, Pregabalin Levatiracetam, Topiramate	Insufficient data to know if these newer agents cause falls.
Parkinson's disease (PD): Dopamine agonists		Ropinirole, Pramipexole	May cause delirium and orthostatic hypotension.
Parkinson's disease (PD): MAOI-B inhibitors		Selegiline	Causes orthostatic hypotension. The subject of drugs and falls in PD is difficult, as falls are so common, and orthostatic hypotension is part of the disease. In general only definite drug related orthostatic hypotension would lead to a change in medication.
Muscle relaxants		Baclofen, Dantrolene	Sedative. Reduced muscle tone. No falls data on muscle relaxants. Tend to be used in conditions associated with falls.

Drugs acting on the brain (psychotropic drugs) - *continued*

MEDICATION GROUP		COMMONLY USED MEDICATIONS WITHIN THE GROUP	EFFECTS ON FALLS RISK
Vestibular sedatives Phenothiazines		Prochlorperazine	Dopamine antagonist – may cause movement disorder in long term use. Alpha receptor blocker and antihistamine.
Vestibular sedatives Antihistamines		Cinnarazine, Betahistine	Sedating. No evidence of benefit in long term use.
Sedating antihistamines for allergy		Chlorphenamine, Hydroxizine, Promethazine, Trimeprazine	No data, but sedation likely to contribute to falls. Long half lives.
Anticholinergics acting on the bladder		Oxybutinin, Tolterodine, Solifenacin	No data, but have known Central Nervous System (CNS) effects.

DRUGS ACTING ON THE HEART AND CIRCULATION

Maintaining consciousness and an upright posture requires adequate blood flow to the brain. This requires an adequate pulse and blood pressure. In older people a systolic blood pressure of 110mmHg or below is associated with an increased risk of falls.

Any drug that reduces the blood pressure or slows the heart can cause falls (or feeling faint or loss of consciousness or "legs giving way") (3). In some patients the cause is clear – they may be hypotensive, or have a systolic drop on standing. Others may have a normal blood pressure lying and standing, but have syncope or pre-syncope from carotid sinus hypersensitivity or vasovagal syndrome. Stopping cardiovascular medication reduces syncope and falls by 50%, and reduces the prevalence of these four syndromes (4, 5).

MEDICATION GROUP		COMMONLY USED MEDICATIONS WITHIN THE GROUP	EFFECTS ON FALLS RISK
Alpha receptor blockers		Doxazosin, Indoramin, Prazosin, Tamsulosin, Terazocin, Alfluzosin	Used for hypertension or for prostatism in men. They commonly cause severe orthostatic hypotension. Stopping them may precipitate urinary retention in men.
		Sedating antidepressants	See 'sedating antidepressants' in the 'drugs acting on the brain' table. Orthostatic hypotension.
		Drugs for psychosis and agitation	See 'drugs for psychosis and agitation' in the 'drugs acting on the brain' table. Orthostatic hypotension.
Centrally acting alpha 2 receptor agonists		Clonidine, Moxonidine	May cause severe orthostatic hypotension. Sedating.
Thiazide diuretics		Bendroflumethiazide, Chlorthalidone, Metolazone	Cause orthostatic hypotension, weakness due to low potassium. Hyponatraemia.
Loop diuretics		Furosemide, Bumetanide	Dehydration causes hypotension. Low potassium and sodium
Angiotensin converting enzyme inhibitors (ACEIs)		Lisinopril, Ramipril, Enalapril, Captopril, Perindopril	These drugs rely almost entirely on the kidney for their elimination and can accumulate in dehydration or renal failure.
		Fosinopril, Trandolapril, Quinapril	Excreted by liver and kidney.

Drugs acting on the heart and circulation - *continued*

MEDICATION GROUP		COMMONLY USED MEDICATIONS WITHIN THE GROUP	EFFECTS ON FALLS RISK
		**Symptomatic hypotension in systolic cardiac failure** • ACEIs and beta blocker have a survival benefit in systolic cardiac failure and should be maintained whenever possible. • NICE recommends: stop nitrates, calcium channel blockers and other vasodilators. If no evidence of congestion, reduce diuretics. If problem persists, seek specialist advice. • The mortality risk from a fall at age 85 is about 1% per fall. The frequency of falls determines the balance between risk and benefit. Most cardiac failure in older people is diastolic (preserved left ventricular function). ACEIs and beta blockers have little survival benefit in diastolic failure.	
Angiotensin receptor blockers (ARBs)		Losartan, Candesartan, Valsartan, Irbesartan, Olmesartan, Telmesartan, Eprosartan	May cause less orthostatic hypotension than ACEIs. Excreted by liver and kidney.
Beta blockers		Atenolol, Sotalol - Renally excreted. May accumulate.	Can cause bradycardia, hypotension, carotid sinus hypersensitivity, orthostatic hypotension and vasovagal syndrome.
		Bisoprolol, Metoprolol, Propranolol, Carvedilol, Timolol eye drops	Can cause bradycardia, hypotension, carotid sinus hypersensitivity, orthostatic hypotension and vasovagal syndrome.
Antianginals		Glyceryl trinitrate (GTN)	A common cause of syncope due to sudden drop in blood pressure.
		Isosorbide mononitrate, Nicorandil	Cause hypotension and paroxysmal hypotension.
Calcium channel blockers that only reduce blood pressure		Amlodipine, Felodipine, Nifedipine, Lercanidipine	Cause hypotension and paroxysmal hypotension.
Calcium channel blockers which slow the pulse and reduce blood pressure		Diltiazem, Verapamil	May cause hypotension or bradycardia.
Other antidysrhythmics		Digoxin, Amiodarone, Flecainide	May cause bradycardia and other arrhythmias. Data on digoxin and falls probably spurious due to confounding by indication.

Drugs acting on the heart and circulation - *continued*

MEDICATION GROUP		COMMONLY USED MEDICATIONS WITHIN THE GROUP	EFFECTS ON FALLS RISK
Acetylcholinesterase inhibitors (for dementia)		Donepezil, Rivastigmine, Galantamine	Cause symptomatic bradycardia and syncope.