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### **Falls Prevention Training at New York Presbyterian Hospital: Does Education Regarding Fall Prevention Reduce Incidence of Falls after Discharge to Home from an Acute Rehabilitation Facility?**

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**by**

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**A capstone project submitted to the Graduate Faculty in Physical Therapy in partial fulfillment of the requirements for the degree of Doctor of Physical Therapy (DPT).**

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This manuscript has been read and accepted for the  
Graduate Faculty in Physical Therapy in satisfaction of the  
capstone project requirement for the degree of D.P.T

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**Abstract****Falls Prevention Training at New York Presbyterian Hospital: Does Education Regarding Fall Prevention Reduce Incidence of Falls after Discharge to Home from an Acute Rehabilitation Facility?****by****Yuning Chiu****Michelle Frager****Hyunseok Lee****Solange Wong****Advisor: Dr. Suzanne Babyar**

The objective of this study was to determine the compared effectiveness of different instruction types for fall prevention training in an inpatient rehabilitation setting based on 6-month falls incidence. This study included 89 English-speaking patients aged 18-90 who participated in a fall prevention training program at New York Presbyterian Hospital's inpatient rehabilitation center. Patients were divided into two class types, a group or an individual class. Both classes were subdivided into with and without a caregiver. A 10-Meter Walk Test, the Montreal Cognitive Assessment (MoCA), and admission and discharge Functional Independence Measure (FIM™) scores were recorded for baseline comparisons among groups. MoCA scores less than 26 designated that a caregiver would be present during the training. Other patients had a caregiver present secondary to vision, speech/language, and hearing issues. Falls were measured over a 6-month follow-up period by phone interview. Results found no significant difference in age, gender, or cognition between fallers and non-fallers as well as no significant difference in fall incidence among different class types. These findings indicate that fall outcome was not affected by different types of training. However, the study did find that falls

prevention training prior to discharge was effective in decreasing overall falls rate (25%) compared to previous studies (33%).

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## Introduction

Unintentional falls are the number one cause of nonfatal injuries treated in hospital emergency departments for all age groups, with the exception of those aged 15-24 years, for which it is still ranked as the number two factor (Centers for Disease Control and Prevention [CDC], 2012). Worldwide, falls are the second leading cause of deaths by accidental injury and the third most prevalent cause of chronic disablement according to the World Health Organization (WHO) (Peeters et al., 2007; World Health Organization, 2012). As people age, they are increasingly at risk of falling and incurring fall-related injuries. One out of three adults aged 65 and older living in the community falls each year (Rubenstein & Josephson, 2006), and those who fall once are two to three times more likely to fall again (Todd & Skelton, 2004). Given the prevalence of falls in the older population and the considerable mortality, morbidity and suffering that accompanies them, the prevention of falls is important.

Because falls are associated with increased morbidity and reduced function, which can lead to premature nursing home placement; it not only has a direct impact on rising healthcare cost but also significant socio-psychological implications (Rowe, 2011). As the percentage of the population age 65 and older increases, the financial toll of falling on the health care system also rises. Data from the 2010 Census showed that 13 percent of the total population was age 65 and above (United States Census Bureau, 2011). One third of this population falls each year and up to 20 percent of falls cause serious injuries: it is estimated that the total cost of all fall-related injuries may reach upward of \$85.4 billion by 2020 (Stevens & Sogolow, 2005; Koh, Manias, Hutchinson, & Johnston, 2007).

While considerable efforts have been devoted to the study of falls for the geriatric population, little research attention has been made to fall incidence in young and middle-aged adults. However, it is important to acknowledge that falls have significant socio-economic consequences regardless of age. Approximately one in four middle-aged adults falls at least once in two years (Talbot, Musiol, Witham, & Metter, 2007). According to the American Occupational Therapy Association, even less serious falls can negatively affect work performance (Chase, Mann, Wasek, & Arbesman, 2012). In addition, Talbolt et al. (2007) predicted that this age group would progressively start showing higher incidences of disease and medication use while engaging in a lower level of physical activity, predisposing middle-aged adults for higher risks of falls. Therefore, prevention of falls should be an important healthcare concern that spans wider age groups.

Fall incidence and severity of fall-related complications rise steadily from middle age and peaks at age 80 and older (Rao, 2005; Rowe, 2011). The risk of a serious injurious fall increases with age as well. The rate of fall injuries for age 85 and older was almost 4 times that of those aged 65 to 75 (WHO, 2008). After a serious fall, older adults may have difficulties performing activities of daily living (ADL) and instrumental activities of daily living (IADL), putting them at an increased risk of early death (Chase, Mann, Wasek, & Arbesman, 2012). This may also result in premature admission to nursing homes. Moreover, even after a fall without physical injury, older adults may develop a fear of falling that leads to decreased overall activity level in social, leisure, and physical aspects. This results in decreased strength and endurance that increases risk of falling in the future (Chase et al., 2012). Fear of falling may prompt further depression, feelings of helplessness and social isolation (Rubenstein & Josephson, 2006).

### **Definition of a Fall**

Although most people understand what a fall is, they have difficulty finding the words to define it. Researchers have tried defining a fall since the 1980s. Kellogg International Working Group on the prevention of falls in the elderly (1987) defined a fall as “unintentionally coming to the ground or some lower level and other than as a consequence of sustaining a violent blow, loss of consciousness, sudden onset of paralysis as in stroke or an epileptic seizure.” (Zecevic, Salmoni, Speechley, & Vandervoort, 2006, p. 369). Due to the different aims and needs of various studies looking at falls, there still is not a universal definition. However, the Kellogg group’s definition and similar variations of it have been more widely acceptable than others (Hauer et al., 2007). For our study, we defined a fall as unintentionally coming to rest on the ground, the floor, or another lower level but excluding coming to rest against furniture, a wall, or another structure (Buckner et al., 1993).

### **Risk Factors and Causes for Falling**

A growing number of falls studies have led to a better understanding of risk factors for falling; more than 400 variables have been identified as potential risk factors (Gillespie et al., 2003). Risk of falling, especially in older adults, is influenced by a combination of both intrinsic and extrinsic factors. Intrinsic risk factors include gait and balance impairments, peripheral neuropathy, vestibular dysfunction, muscle weakness, vision impairment, medical illness, advanced age, impaired ADL, orthostasis, dementia, and drugs. Examples of extrinsic factors are environmental hazards, poor footwear, and restraints (Rubenstein & Josephson, 2006).

Studies show that as the number of risk factors increase, the risk for falling increases dramatically (Fox, Tonner, Stevens, Fineman, & Ross, 2010). Most falls occur due to the presence of multiple factors with the combination of interacting precipitating causes. The top

three causes of falls according to a summary of 12 studies are: accident and environment, gait and balance disorders or weakness, and dizziness and vertigo (Rubenstein & Josephson, 2006).

Accidental falls caused by an environmental hazard account for 25 percent to 45 percent of all falls (Rubenstein & Josephson, 2002). One should note that environmental hazards alone do not lead to falls, but there requires additional risk factors such as advanced age or vision impairment.

Poor vision impairs balance and increases the risk of falls and fractures in older people; Lord (2006) concluded that impaired vision was a significant independent risk factor for falls in the older population.

Not only are there a large number of risk factors identified in the research, there is also a discrepancy in perception of falls. The most frequent reasons for falling suggested by seniors are balance deficits, weather, and inattention; by healthcare providers: medical conditions, balance deficits, and medication; by researchers: muscle weakness, history of falls and gait deficit (Zecevic et. al., 2006). Therefore, use of appropriate wording is important to ensure that both the interviewer and the interviewee are clear as to what defines a fall and what causes a fall.

### **Falls Prevention Effectiveness**

Exercise training, home-modifications, and interventions that address multiple factors are the main types of fall prevention (Stevens, 2010). In addition, the Fall Prevention Center of Excellence suggests that successful fall prevention involves three main strategies: balance training and physical activity; medical management; and environmental/home modifications (2014).

Exercise-based falls prevention studies are effective in reducing the rate of falling. One study using weekly group exercise sessions found that participants were 40 percent less likely to fall and one-third less likely to suffer a fall-related injury (Barnett, Smith, Lord, Williams, &

Baumand, 2003). Individually tailored home exercise programs, like the Otago Exercise Program, also benefit potential fallers. This program consists of muscle strengthening and balance-retraining exercises of increasing difficulty, combined with a walking program. Use of this program reduced falls by 35 percent for community-dwelling women aged 80 years and older (Campbell et al., 1997). In addition, several studies have examined the use of Tai Chi to prevent falls. Community-dwelling adults aged 60 or older who participate in Tai Chi classes experience fewer falls and fall-related injuries, and have a significantly decreased risk of falling compared to those in the control group (Li et al., 2005; Voukelatos, Cumming, Lord, & Rissel, 2007; Wolf, Coogler, & Xu, 1997). Exercise programs designed to prevent falls also prevent injuries caused by falls. This was shown in a systematic review and meta-analysis looking at the effect of fall prevention exercise programs on fall induced injuries (El-Khoury, Cassou, Charles, & Dargent-Molina, 2013). In addition to decreasing falls, exercise also reduces the fear of falling. The Korea Falls Prevention Study looked at community-dwelling adults older than 60 years that had fallen in the previous year. This study showed that a 12-week exercise program reduced participants' fear of falling, while improving their balance, flexibility, muscle strength, and quality of life (Oh et al., 2013).

Home modifications are effective in decreasing falls. Several studies show that elderly participants experience fewer falls and fewer injuries, following a home hazard assessment by an occupational therapist, making home modifications and recommendations for behavioral changes (Campbell et al., 2005; Cumming et al., 1999; Thompson, 1996). Furthermore, simply providing written material about home safety to at-risk individuals can also reduce falls significantly (Plautz, Beck, Selmar, & Radetsky, 1996).

Multifactorial interventions address multiple falls risk factors at the same time and are effective at reducing falls. Small group sessions teaching fall prevention strategies showed a 30 percent reduction in fall rate (Clemson et al., 2004). Day and colleagues (2002) looked at the effectiveness of group-based exercise when used alone or in combination with vision improvement and/or home hazard reduction. They looked at a sample of subjects aged 70 years and older who were living at home. When exercise was used alone, the fall rate decreased by 20 percent, but used in conjunction with vision improvement and home hazard reduction, the rate dropped even more so; with those receiving all three interventions being one third less likely to fall. The Study of Accidental Falls in the Elderly (SAFE) was a program of 4 group classes on how to prevent falls. Subjects in SAFE were all 65 years or older living in the community.

Classes were given weekly over a one-month period. Each hour and a half class included a slide presentation on common household risks, discussions on behavioral risks, self-appraisal of home hazards, and group activities to develop action plans. In addition, each class also included an exercise component. The exercise component had a demonstration of fall prevention exercises, after which participants practiced these exercises. They were also given a manual that described the exercises. The home safety portion included a home inspection with guidance and assistance in reducing fall hazards. During the 23-month follow-up period, 44 percent of those in the control group reported at least one fall compared to 39 percent who received the intervention (Hornbrook et al., 1994). In another study, the intervention strategy was tailored according to an assessment of each participant's fall risk factors. Participants were community-dwellers at least 70 years of age. They were given either a combination of adjustment in their medications, behavioral instructions, and exercise programs aimed at modifying their risk factors. For example, those with postural hypotension received medication adjustment and behavioral



training, versus someone with a gait impairment, who received behavioral training and an exercise program. Furthermore, someone with an unsafe bathtub or toilet transfer received behavioral training, an exercise program, and home modifications. A nurse assessed medication risk factors, while physical therapists assessed impairments in gait, transfer skills or balance, and lower and upper extremity muscle strength or range of motion. During the 12-month follow-up period, researchers found that the multiple-risk factor intervention strategy resulted in a significant reduction in the risk of falling. Thirty-five percent of the intervention group fell, compared with 47 percent of the control group (Tinetti et al., 1994).

Most studies looking at fall prevention effectiveness are done in a community-setting or hospital-setting. Little hospital-based research exists about the efficacy of fall prevention programs for post-discharge. This is an important area of study given that hospital fall prevention programs are widely implemented across the country. Past research has mostly studied multifactorial interventions for senior residents in the long-term care setting and falls prevention for hospitalized patients while still in the hospital setting. One recent study conducted by Hill, Hoffmann, & Haines (2013) investigated fall incidences and related injuries in the six months after hospital discharge, with the focus on the circumstances of the falls. Our study was designed to investigate the effectiveness of falls prevention education and of different instructional types for a variety of living arrangements after discharge for a wider range of disabilities represented in our sample.

### **Cognitive Impairment**

Increasing attention is being paid to mild cognitive impairment and dementia in number of fall studies with elderly patients. A fall is considered the major cause of morbidity and mortality in patients with dementia (Allan, Ballard, Rowan, & Kenny, 2009). Studies

introducing potential risk factors for falls show some relationship between the incidence rate of fall-related injury and disease diagnosis such as dementia among the elderly population (Muir, Gopaul, & Montero Odasso, 2012). Shaw & Kenny (2003) described, in a randomized multifactorial intervention study, that the older population with dementia have twice the risk of falling than their cognitively intact counterparts - with an annual incidence of approximately 60 percent. Incidence of fracture is three times the “age-adjusted figure for expected fracture incidence” (Shaw & Kenny, 1988, pg. 7). Dementia patients are less likely to recover from falls-related injury, with increased 6-month mortality of up to 71 percent; this rate is three times that of cognitively intact elderly patients (Shaw & Kenny, 1988).

The effects of dementia alone are not directly the most significant intrinsic cause of falls. However, behavioral changes in elderly patients with above disorders as part of the multifaceted causes of fall incidence may contribute to a higher risk for falls (Harlein, Dassen, Halfens, & Heinze, 2009). It is well known that a history of falling is associated with higher risk of future falls (Wood, Bilclough, Bowron, & Walker, 2002). However, reports of fall from the elderly patients with dementia are often unrecognized or incomplete due to decreased recall capability (Shaw & Kenny, 1988). In fact, the majority of studies in long-term care facilities or hospital settings dealing with cognitive impairment and cases of falls in the elderly showed that patients complained about their worsening memory problem. In one study it was indicated that fallers lack a unique cognitive processing - immediate memory (Hausdorff et al., 2006; Chen et al., 2008). Some researchers defined this lack of cognitive processing as impaired performance and stated that cognitive decline was independently associated with impaired performance of daily living and future falls (Kim, Jo, Park & Cheon, 2008; Montero-Odasso, Wells, Borrie, & Speechley, 2009).

The effect of mild cognitive impairment (MCI) in the elderly population is often disregarded. However, MCI affects mortality and morbidity due to its intricate association with other disease states and with other risk factors for falls (Makizako et al., 2013; Montero-Odasso et al., 2009). Smith, Gildeh, & Holmes (2007,) suggested that MCI is an “intermediate clinical state between normal cognitive aging and mild dementia” (p. 330). Progression to Alzheimer’s Disease (AD) or senile dementia of Alzheimer’s Type (SDAT) is common in MCI patients (Solfrizzi et al., 2004). Subtypes of MCI progress into different dementia disorders: amnesic MCI to AD; non-memory MCI to Lewy body dementia, frontotemporal dementia, Huntington’s disease dementia and Parkinson’s disease dementia (PD-D), all of which contribute to the increased mortality and morbidity rate of elderly fallers (Kim et al, 2008; Shaw & Kenny, 1998; Pettersson, Olsson & Wahlund, 2007). MCI-derived dementia such as SDAT and PD-D affect the walking speed and response time, making elderly patients more susceptible to greater risk of falls. This may directly or indirectly cause a substantial number of fall-related injuries, aggravating their ambulatory function dramatically. MCI is also related to the recovery of the patients who sustained fall-related injury. According to one study, impaired cognitive status at admission lowered the rehabilitation outcome of elderly patients with hip fracture – one of the most common causes of admission to the emergency room and the inpatient rehabilitation department. Heruti, Lusky, Barell, Ohry, & Adunsky (1999) suggested that cognitive impairment was strongly associated with functional gains in mobility that may decrease the risk of fall. The geriatric population was reported to have a higher incidence of mild cognitive impairment than the young, and was considered at risk with as much as a 40 percent chance of developing dementia within one year (Smith et al, 2007). This explains why screening cognitive impairment should be taken seriously when assessing fall-related injury among elderly patients.

Some of the established cognitive impairment screening tools, such as the Mini-Mental State Examination (MMSE), have been widely used to screen MCI and dementia. However, The Montreal Cognitive Assessment (MoCA) has a greater advantage over the MMSE in sensitivity and in specificity. The MoCA is administered in 10-minutes, using a 0 to 30 point scale (with higher scores indicating better performance) designed to screen for cognitive impairment and assist first-line healthcare professionals in the detection of MCI and dementia. Sweet, et al. (2011) observed that the MoCA is a better screening tool with a higher sensitivity than MMSE.

Smith et al. (2007) found, in a study done in a memory clinic setting, that MoCA is more sensitive in detecting MCI and dementia than MMSE. With a cut-off score of 26, the MMSE had a sensitivity of 17 percent to detect elderly subjects with MCI, whereas the MoCA detected 83 percent. The MMSE had a sensitivity of 25 percent to detect subjects with dementia, whereas the MoCA detected 94 percent. In patients already diagnosed with MCI, the MoCA helps identify those at risk of developing dementia at a six-month follow-up.

A recent study suggested that the MoCA was more sensitive to cognitive dysfunction followed by aneurysmal subarachnoid hemorrhage (aSAH) or other stroke-associated cognitive impairments than MMSE. Certain MoCA subtests are more sensitive to functional difficulties after aSAH (Schweizer, Al-Khindi, & Macdonald, 2012). Recent articles support the superiority of MoCA over MMSE because MoCA is shown to screen cognitive impairment or dementia associated with so-called elderly disorders such as SDAT, PD-D and vascular disease dementia with more sensitivity than MMSE (Nazem et al, 2009). Screening for MCI utilizing MoCA was considered an important part of our study because the cognitive status of the patient at admission determined whether the standard falls prevention training was given with or without a caregiver.

### **Phone Interview**

Phone interview is an inexpensive and harmless form of research. It has been used in many research settings, from commercial to medical, and continues to be common research method. When used to find high risk fall groups, Korner-Bitensky and Wood-Dauphinee (2008) found phone interviews were effective data collection methods. Interviewees had a trend of reporting more falls as compared to a face-to-face interview, most likely due to a reduction in embarrassment. This study also looked at the ability of a lay person and a trained professional to conduct this phone interview. Both groups had similar results indicating that a well-trained lay person was capable of conducting phone interviews for this type of research (Korner-Bitensky & Wood-Dauphinee, 2008).

### **Purpose**

Falls prevention is a major focus in the preventative care sector of health care. Especially in the hospital setting where patients go home in often a much different state than how they left their homes when they come to the hospital. They are not as mobile and able to negotiate their homes as they were before they went into the hospital. It is important to send patients home with the tools to proactively reduce their risk of falling.

As stated above, many different methods have been implemented within falls prevention education and many have been effective in reducing the number of falls over a wide span of ages. Current literature has mostly focused on multifactorial interventions for senior residents in the long-term care setting and falls prevention for the acute inpatients during their hospital stay. The purpose of our study was to determine the compared effectiveness of different instruction types (individual vs. group vs. caretaker-assisted) for fall prevention in an inpatient rehabilitation setting with regards to 6-month fall incidence post-discharge.

## **Method**

This study was approved by the institutional review boards of Hunter College (City College of New York) and Weill Cornell Medical College.

### **Participants**

Participants were recruited from English-speaking patients aged 18-90 YEARS who were admitted to the Inpatient Rehabilitation Center at New York Presbyterian Hospital/Weill Cornell Medical College where they received fall prevention training from October 2012 to August 2013.

The patient must have also been able to complete a 10-Meter Walk Test (10MWT). All participants or their designated health proxy signed a Health Insurance Portability and Accountability Act (HIPPA) form and an informed consent form; a signed copy of the HIPPA form was given to the subject or the legally authorized representative. Exclusion criteria were inability to complete a 10MWT, non-English speaking, and age under 18 years.

### **Procedure**

The following objective measures were obtained to determine participant eligibility for this study.

#### **Mobility.**

Mobility was assessed by administering the 10-Meter Walk Test (10MWT), which involved measuring the time required to walk 10 meters with additional distance of approximately 3 feet before and after the marker to minimize the effect of acceleration and deceleration. The subject walked at their preferred speed with or without an assistive device.

Three trials were measured and the average of three times was used. The 10MWT can serve as a tool for examining gait capacity and a valid indicator of physical functioning (Cesari et al.,

2005; Peters, Fritz, & Krotish, 2013). Clinical tests have identified it as a predictor for risk of falling (Persson, Hansson, & Sunnerhagen, 2011). It is a simple test that requires only one administrator and no special equipment; it is time-efficient and cost-effective.

### **Cognition.**

Patients with a questionable level of cognition as determined by the occupational therapist received the MoCA version 7.1 test, administered by an occupational therapist as described in Gagnon et al. (2013). A score of less than 26 out of 30 showed cognitive impairment. Patients who scored lower than a 26 on the MoCA test were required to have a caregiver attend fall prevention class with them to either the group or the one-on-one class.

### **Functional measurement.**

The Functional Independence Measure (FIM™) was recorded at admission and at discharge to indicate functional recovery. FIM™ is the most commonly used functional assessment tool in the rehabilitation industry; its reliability and validity have been well recognized. FIM™ was also considered to be least biased when compared with other tools (Cournan, 2011).

### **Statistics.**

All analyses were completed with SPSS™ statistical software, version 19.0. To detect where the group differences occurred, we used the Kruskal-Wallis test because some of the training groups had less than 20 subjects. Post-hoc comparisons were done with the Mann-Whitney test to determine where the differences occurred between respective groups.

### **Falls prevention class.**

Prior to discharge, patients admitted to inpatient rehabilitation received falls prevention training in the form of a group or individual class. Certain topics were discussed in the class to



reduce the risk of falling. Topics included home modifications, such as adding additional lighting; and, behavioral modifications, such as getting up slowly. This class was given in either a one-on-one or a group setting. Whether patients received group or individual training was dependent on their availability during the day and level of cognition.

***Condition 1: Group Falls Prevention Class***

The group falls prevention class was presented by a physical or occupational therapist using a PowerPoint™ presentation with audience participation encouraged. Classes were held twice a week with a class size ranging from three to six participants. Family members and caregivers were encouraged to attend the class with the patient. At the end of the class, patients received a handout (Appendix A) that included all of the information covered in the presentation. Patients with cognitive deficits, as measured by the occupational therapist, received education with a caregiver. Other patients had a caregiver present secondary to vision, speech/language, and hearing issues. The caregiver acted as a proxy and was typically a family member who was caring for the patient upon discharge. Therefore, the Group Falls Prevention class was subdivided into one group that included all patients who received a group class without a caregiver (GrR) and a second group that included all patients who received the education with a caregiver (GrC).

***Condition 2: Individual Falls Prevention Class***

Fall prevention education was given to another group of patients on a one-to-one basis, instead of a group setting. Many of the patients were in the individual class because they were unavailable to attend group class due to a scheduling conflict. The individual falls prevention classes were given by the physical or occupational therapists working directly with the patients. Family members and caregivers were encouraged to attend as well. The physical therapist

utilized the handout (Appendix A) as a guide during the fall prevention education. Patients were encouraged to ask personal questions and the therapist catered the education to the individual patient. This group was also subdivided into two smaller groups, patient alone individual class (InR) and individual class with caregiver (InC), based on need for caregiver due to decreased cognitive status, vision, speech/language, or hearing ability of the patient.

**Phone interview.**

Phone interviews were conducted by the researchers, using a standardized script, six months after the patient was discharged from the hospital. Patients were asked a series of questions about their implementation of the fall prevention methods stated in the falls prevention class and about the number of falls they have had in the six-month period since leaving the hospital (Appendix B). Researchers continued to call until each participant or their family was contacted.

## Results

One hundred and twenty-three patients from the inpatient rehabilitation at New York Presbyterian Hospital were recruited between October 2012 and August 2013. The demographic characteristics of these 123 patients can be seen in Table 1. Of the 123 recruits, 89 fully completed the 6-month follow-up phone interview and 1 person partially completed the interview. Nine people declined to complete the 6-month follow-up phone interview; 5 were deceased in the 6-month period; 3 were unable to consent; 1 was re-hospitalized; and, 14 were lost to follow-up. Of the 89, 60 were in the GrR class, 10 were in the GrC class, 12 were in the InR class and 7 were in the InC class. Table 2 depicts the characteristics of the participants.

Table 1. Demographic Characteristics of the Recruited Subjects

|                      | N                          | Mean | Std. Deviation | Std. Error | 95% Confidence Interval |             | Minimum | Maximum |       |
|----------------------|----------------------------|------|----------------|------------|-------------------------|-------------|---------|---------|-------|
|                      |                            |      |                |            | Lower Bound             | Upper Bound |         |         |       |
| Age as a Number      | Group Class                | 77   | 66.8           | 17.0       | 1.9                     | 62.9        | 70.7    | 24.     | 93.00 |
|                      | Group Class with Caregiver | 13   | 65.8           | 12.8       | 3.5                     | 58.0        | 73.5    | 35.0    | 80.00 |
|                      | Individual Class           | 17   | 63.2           | 19.3       | 4.6                     | 53.2        | 73.1    | 21.0    | 89.00 |
|                      | Individual with Caregiver  | 9    | 59.4           | 23.1       | 7.7                     | 41.6        | 77.2    | 22.0    | 88.00 |
|                      | Total                      | 116  | 65.6           | 17.4       | 1.6                     | 62.4        | 68.8    | 21.0    | 93.00 |
| MoCA Numerical Score | Group Class                | 73   | 29.5           | 1.4        | .16                     | 29.1        | 29.8    | 22.0    | 30.00 |
|                      | Group Class with Caregiver | 12   | 18.1           | 5.0        | 1.4                     | 14.9        | 21.4    | 11.0    | 30.00 |
|                      | Individual Class           | 15   | 29.1           | 1.9        | .50                     | 28.0        | 30.2    | 24.0    | 30.00 |
|                      | Individual with Caregiver  | 7    | 22.2           | 8.1        | 3.0                     | 14.7        | 29.8    | 11.0    | 30.00 |
|                      | Total                      | 107  | 27.7           | 4.8        | .46                     | 26.7        | 28.6    | 11.0    | 30.00 |
| Admission FIM™       | Group Class                | 75   | 75.9           | 12.4       | 1.4                     | 73.0        | 78.7    | 36      | 98    |
|                      | Group Class with Caregiver | 13   | 71.1           | 17.7       | 4.9                     | 60.4        | 81.8    | 47      | 100   |
|                      | Individual Class           | 17   | 80.1           | 11.2       | 2.7                     | 74.3        | 85.9    | 63      | 105   |
|                      | Individual with Caregiver  | 9    | 59.3           | 21.8       | 7.2                     | 42.5        | 76.1    | 22      | 86    |
|                      | Total                      | 114  | 74.7           | 14.5       | 1.3                     | 72.0        | 77.4    | 22      | 105   |
| Discharge FIM™       | Group Class                | 75   | 96.9           | 10.7       | 1.2                     | 94.4        | 99.4    | 70      | 118   |
|                      | Group Class with Caregiver | 13   | 87.4           | 11.2       | 3.1                     | 80.6        | 94.2    | 56      | 99    |
|                      | Individual Class           | 17   | 98.6           | 9.6        | 2.3                     | 93.6        | 103.6   | 78      | 115   |
|                      | Individual with Caregiver  | 9    | 78.2           | 19.9       | 6.6                     | 62.9        | 93.5    | 48      | 105   |
|                      | Total                      | 114  | 94.6           | 12.7       | 1.1                     | 92.2        | 97.0    | 48      | 118   |

Table 2. Demographic Characteristics of the Participants Who Completed the Survey

|                      |                            | N  | Mean | Std. Deviation | Std. Error | 95% Confidence Interval |             | Minimum | Maximum |
|----------------------|----------------------------|----|------|----------------|------------|-------------------------|-------------|---------|---------|
|                      |                            |    |      |                |            | Lower Bound             | Upper Bound |         |         |
| Age as a Number      | Group Class                | 60 | 66.7 | 17.6           | 2.2        | 62.1                    | 71.2        | 24.0    | 93.0    |
|                      | Group Class with Caregiver | 9  | 64.6 | 15.3           | 5.1        | 52.8                    | 76.4        | 35.0    | 80.0    |
|                      | Individual Class           | 12 | 62.5 | 22.4           | 6.4        | 48.3                    | 76.8        | 21.0    | 89.0    |
|                      | Individual with Caregiver  | 7  | 54.2 | 23.2           | 8.7        | 32.8                    | 75.7        | 22.0    | 76.0    |
|                      | Total                      | 88 | 64.9 | 18.5           | 1.9        | 61.0                    | 68.9        | 21.0    | 93.0    |
| MoCA Numerical Score | Group Class                | 57 | 29.6 | 1.1            | .14        | 29.3                    | 29.9        | 25.0    | 30.0    |
|                      | Group Class with Caregiver | 8  | 18.3 | 3.2            | 1.1        | 15.6                    | 21.0        | 14.0    | 23.0    |
|                      | Individual Class           | 11 | 28.8 | 2.2            | .67        | 27.3                    | 30.3        | 24.0    | 30.0    |
|                      | Individual with Caregiver  | 5  | 24.0 | 8.6            | 3.8        | 13.2                    | 34.7        | 11.0    | 30.0    |
|                      | Total                      | 81 | 28.0 | 4.3            | .47        | 27.1                    | 29.0        | 11.0    | 30.0    |
| Admission FIM™       | Group Class                | 59 | 76.3 | 12.0           | 1.5        | 73.2                    | 79.5        | 40      | 98      |
|                      | Group Class with Caregiver | 9  | 72.0 | 15.5           | 5.1        | 60.0                    | 83.9        | 54      | 94      |
|                      | Individual Class           | 12 | 79.3 | 10.2           | 2.9        | 72.8                    | 85.8        | 63      | 99      |
|                      | Individual with Caregiver  | 7  | 61.0 | 17.1           | 6.4        | 45.1                    | 76.8        | 35      | 86      |
|                      | Total                      | 87 | 75.0 | 13.2           | 1.4        | 72.2                    | 77.9        | 35      | 99      |
| Discharge FIM™       | Group Class                | 59 | 97.4 | 11.1           | 1.4        | 94.5                    | 100.3       | 70      | 118     |
|                      | Group Class with Caregiver | 9  | 89.5 | 6.8            | 2.2        | 84.3                    | 94.7        | 78      | 99      |
|                      | Individual Class           | 12 | 96.9 | 9.6            | 2.7        | 90.7                    | 103.0       | 78      | 107     |
|                      | Individual with Caregiver  | 7  | 75.2 | 21.1           | 7.9        | 55.7                    | 94.8        | 48      | 105     |
|                      | Total                      | 87 | 94.7 | 13.0           | 1.4        | 91.                     | 97.5        | 48      | 118     |

## Demographics

We analyzed the statistical differences of the demographic variables such as age, gender, MoCA, 10MWT, and discharge FIM™ scores among groups with different training types using Chi-square analysis.

### Age.

A Chi-square analysis was used to compare difference in age among class types. There was no statistically significant difference in age among different class types ( $\chi^2 = 2.043, p = .564$ ). Chi-square analysis also showed that there were no statistically significant differences among age groups, with distribution by 5-year age increments, between non-fallers and fallers post-discharge ( $\chi^2 = 14.108, p = .442$ ).

### Gender.

A Chi-square analysis was used to examine any gender differences between class types and it found that there was no statistically significant difference in gender between class types ( $\chi^2 = 3.406, p = .333$ ). Among 89 participants, 33 female participants did not fall and 14 female participants fell post discharge; 34 male participants did not fall and 8 participants fell post discharge. Chi-square analysis found no significant difference in gender and the fall incidence after discharge ( $\chi^2 = 14.956, p = .328$ ).

### Mobility.

No significant difference was present between fallers and non-fallers in their scores on the 10MWT was discovered through *t*-Test analysis ( $p=.701$ ). Using the Kruskal-Wallis Test, a significant difference ( $p = .027$ ) in the 10MWT times was found between the class training types. The Mann-Whitney test was used for post hoc analysis. Significant differences between the

GrR and the GrC classes ( $p = .007$ ) and between the GrC and InC classes ( $p = .034$ ) were found in 10MWT times.

### **Cognition.**

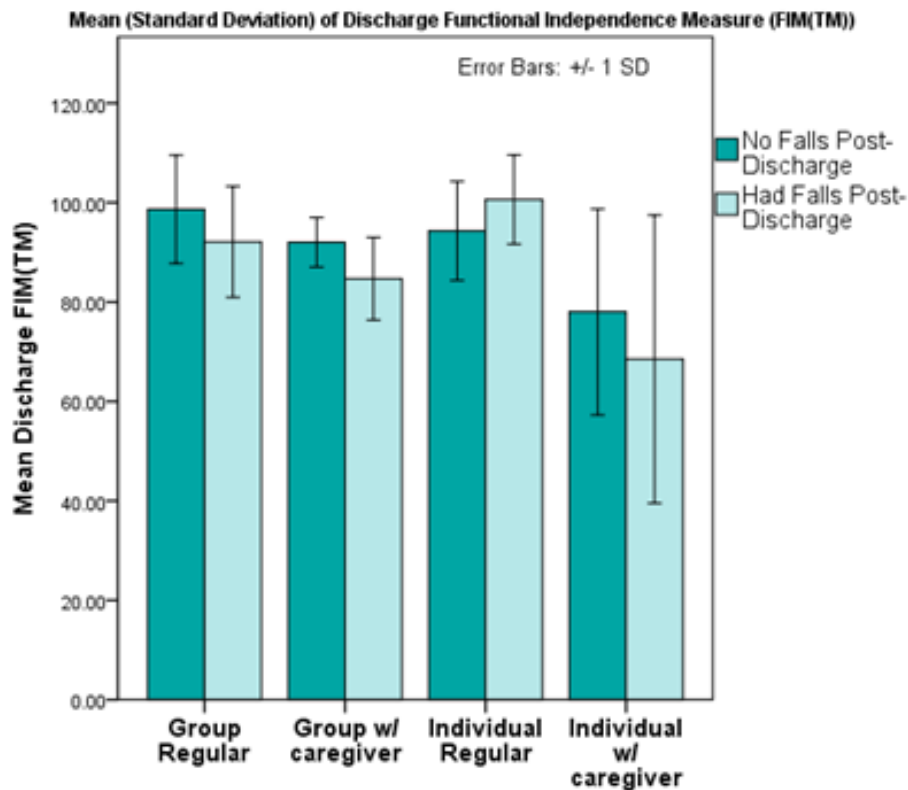
Kruskal-Wallis test was used to analyze differences in MoCA scores between class types of all patients recruited; a significant difference was found ( $p < .001$ ). Mann-Whitney tests were used for post hoc analysis to compare different class types. There were no significant differences between GrR and InR ( $p=.402$ ) and between GrC and InC ( $p=.307$ ). There were significant differences between MoCA scores of: GrR and InC ( $p<.001$ ); GrC and InR ( $p<.001$ ); and, InR and InC ( $p=.030$ ). Again, the Mann-Whitey test was used to detect a difference in MoCA scores between fallers and non-fallers. The analysis found no significant difference ( $p= .157$ ) in MoCA scores between fallers and non-fallers.

### **Discharge FIM™ score.**

Kruskal-Wallis tests ( $p < .005$ ) showed the groups in different class types did not differ for length of stay ( $\chi^2 = 3.974, p = .264$ ) or admission FIM™ ( $\chi^2 = 6.205, p = .102$ ) but their discharge FIM™ scores were statistically significantly different ( $\chi^2 = 13.11, p = .004$ ). Using the Bonferonni correction ( $p < .008$ ), Mann-Whitney tests showed that the regular group training class ( $n=59$ ) had a significant difference from the individual training with caregiver ( $n=7$ ) present ( $p = .004$ ). There were no significant differences between GrR and InR ( $p = .830$ ), GrC and InR ( $p = .059$ ), and GrC and InC ( $p = .133$ ). Two comparisons of discharge FIM™ scores failed to meet the criterion of the Bonferonni correction for their mean rank differences: GrR differed from GrC ( $p = .017$ ); and, InR and InC ( $p = .028$ ). When grouped by fall status, discharge FIM™ score did not appear to have an impact on falls after discharge because there was no significant difference between fallers and non-fallers ( $p = .111$ ). Mean (Standard

Deviation) of discharge FIM™ scores for different training types between faller vs. non-faller are shown in Figure 1.

Figure 1. Mean (Standard Deviation) of Discharge Functional Independence Measure (FIM™) Scores, Comparing Individuals Who Fell (Fallers) to Those Who Did Not Sustain a Fall (Non-Faller) After Discharge from Inpatient Rehabilitation



## Falls

From the GrR class (n=60), 12 reported falling. From the GrC class (n=10), 3 reported falling. From the InR class (n=12), 5 reported having falls. From the InC class (n=7), 2 reported falling. Using Chi-square analysis, no significant differences ( $\chi^2 = 2.276$ ,  $p = .427$ ) were found among class types in the occurrence of falls.



**Phone Interview Results**

The results from the phone interview are listed below in the following tables and figures. They are separated by two different comparisons, between subjects who fell after discharge and those who did not (Tables 3-5); and, between the four different class types (Tables 6-8). The tables are further divided between home modifications (Tables 3 and 6), behavioral modifications (Tables 4 and 7), and medical changes (Tables 5 and 8). There were three modifications and changes that were statistically significant between fallers and non-fallers as seen in Figures 2-4.

**Fallers vs. Non Fallers.**

Table 3. Fallers and Non-Fallers: Frequency Analysis of Home Modifications and Chi-Square

## Analysis Results

| Home Modification                               | Non –Fallers |      |                  | Fallers |      |                  | <i>p</i> |
|---|--------------|------|------------------|---------|------|------------------|----------|
|   | % Yes        | % No | % Not Applicable | % Yes   | % No | % Not Applicable |          |
| Used Night Lights                               | 62.7         | 32.8 | 4.5              | 72.7    | 27.3 | 0                | .496     |
| Decluttered the house                           | 41.8         | 41.8 | 16.4             | 68.2    | 31.8 | 0                | .040     |
| Repaired railings or put railings in            | 20.9         | 56.7 | 22.4             | 31.8    | 54.5 | 13.6             | .477     |
| Removed throw rugs                              | 41.8         | 34.4 | 23.9             | 50.0    | 31.8 | 18.2             | .769     |
| Removed or clearly marked raised thresholds     | 12.1         | 50.0 | 37.9             | 27.3    | 50   | 22.7             | .174     |
| Installed nonskid surface on bathtub floor      | 55.2         | 37.3 | 7.5              | 59.1    | 40.9 | 0                | .419     |
| Installed grab bars near toilet and bathtub     | 50.7         | 41.8 | 7.5              | 59.1    | 36.4 | 4.5              | .760     |
| Used a shower chair or tub transfer bench       | 69.7         | 30.3 | 0                | 90.9    | 9.1  | 0                | .047     |
| Installed handheld showerhead                   | 59.7         | 35.8 | 4.5              | 54.5    | 45.0 | 0                | .481     |
| Used a longhandled reacher, shoehorn, or sponge | 62.7         | 34.3 | 3.0              | 54.5    | 45.5 | 0                | .499     |
| Used a walking aid                              | 77.6         | 22.4 | 0                | 77.3    | 22.7 | 0                | .974     |
| Repaired walking aid                            | 13.6         | 32.2 | 54.2             | 27.3    | 22.7 | 50.0             | .319     |

Figure 2. Home Modification: Decluttered Space: Fallers vs. Non Fallers

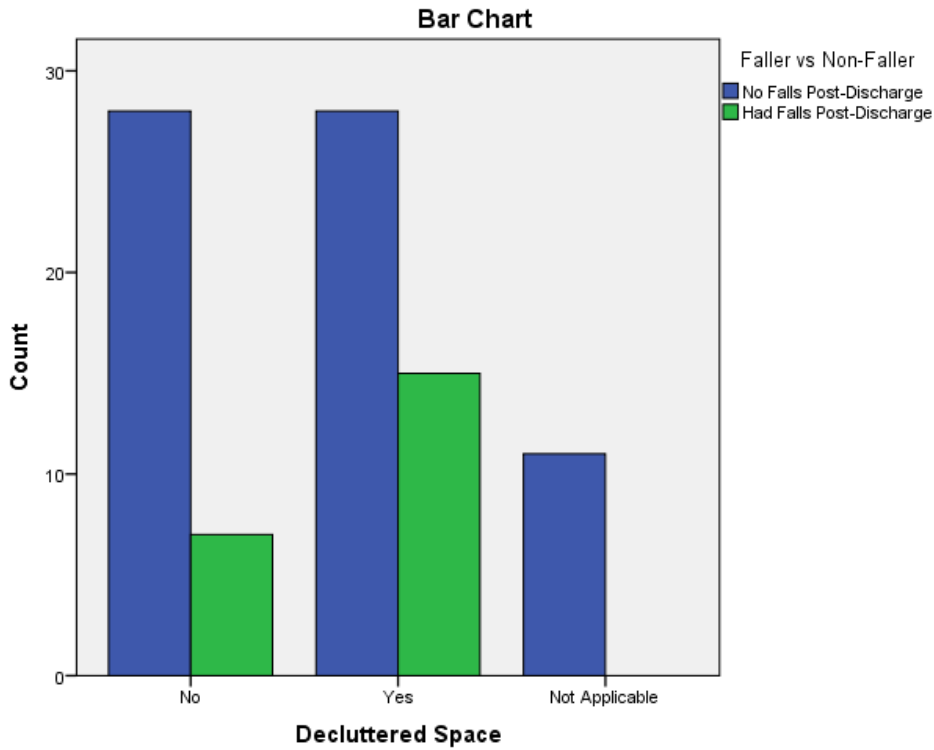


Figure 3. Home Modification: Used Shower Chair or Tub Transfer Bench: Fallers vs Non Fallers

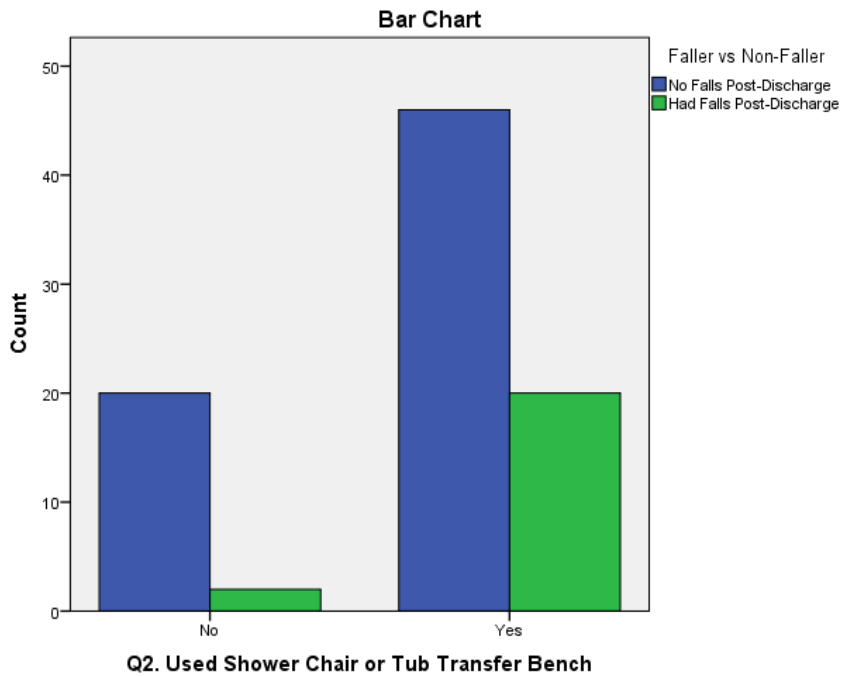


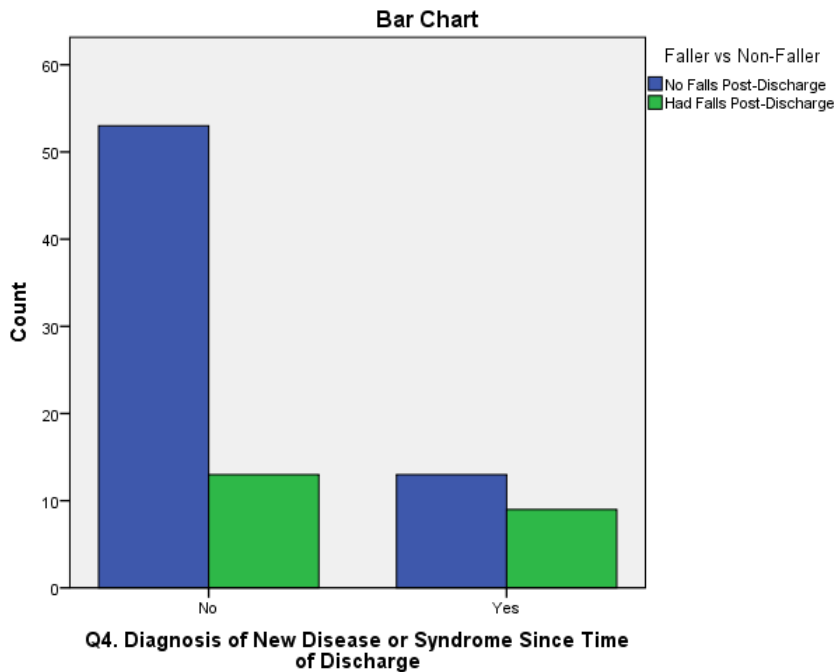
Table 4. Fallers and Non-Fallers: Frequency Analysis of Behavioral Modifications and Chi-Square Analysis Results

| Behavioral Modification                     | Non –Fallers |      |                  | Fallers |      |                  | <i>p</i> |
|---|--------------|------|------------------|---------|------|------------------|----------|
|   | % Yes        | % No | % Not Applicable | % Yes   | % No | % Not Applicable |          |
| Got up slowly to avoid dizziness            | 79.1         | 17.9 | 3.0              | 90.9    | 4.5  | 4.5              | .297     |
| Avoided rushing to answer the phone or door | 87.9         | 10.6 | 1.5              | 90.9    | 0    | 9.1              | .077     |
| Wore supportive non-slip footwear           | 73.1         | 25.4 | 1.5              | 59.1    | 31.8 | 9.1              | .169     |
| Avoided walking on wet surfaces             | 86.6         | 10.4 | 3.0              | 86.4    | 4.5  | 9.1              | .928     |
| Took breaks when performing ADLs            | 77.3         | 22.7 | 0                | 81.8    | 13.6 | 4.5              | .156     |
| Asked for help when needed                  | 86.6         | 11.9 | 1.5              | 95.5    | 0    | 4.5              | .177     |
| Kept commonly used items within reach       | 95.5         | 4.5  | 0                | 95.5    | 0    | 4.5              | .133     |

Table 5. Fallers and Non-Fallers: Frequency Analysis of Medical Changes and Chi-Square Analysis Results

| Medical Changes                             | Non –Fallers |      |                  | Fallers |      |                  | <i>p</i> |
|---|--------------|------|------------------|---------|------|------------------|----------|
|   | % Yes        | % No | % Not Applicable | % Yes   | % No | % Not Applicable |          |
| Diagnosis of a new disease or syndrome      | 19.7         | 80.3 | 0                | 40.9    | 59.1 | 0                | .047     |
| Change in medications since discharge       | 42.4         | 57.6 | 0                | 57.1    | 42.9 | 0                | .238     |
| Hospitalization since time of discharge     | 15.2         | 84.8 | 0                | 28.6    | 71.4 | 0                | .167     |
| A past medical problem not being controlled | 9.2          | 90.8 | 0                | 14.3    | 85.7 | 0                | .511     |
| Decrease in mental status since discharge   | 9.1          | 90.9 | 0                | 28.6    | 66.7 | 4.8              | .013     |

Figure 4. Medical Changes: Diagnosis of a New Disease or Syndrome: Fallers vs. Non-Fallers



### Differences Among Class Types.

Table 6. Class Type: Frequency Analysis of Home Modification and Chi-Square Analysis

#### Results

| Home Modification                           | Group |      |      | Group with Caretaker |      |      | Individual |      |      | Individual with Caretaker |      |      | <i>p</i> |
|---|-------|------|------|----------------------|------|------|------------|------|------|---------------------------|------|------|----------|
|   | % Yes | % No | % NA | % Yes                | % No | % NA | % Yes      | %No  | % NA | % Yes                     | % No | % NA |          |
| Used Night Lights                           | 63.9  | 31.1 | 4.9  | 70.0                 | 30.0 | 0    | 58.3       | 41.7 | 0    | 85.7                      | 14.3 | 0    | .79      |
| Repaired railings or put railings in        | 21.3  | 50.8 | 27.9 | 40.0                 | 60.0 | 0    | 25.0       | 66.7 | 8.3  | 14.3                      | 71.4 | 14.3 | .32      |
| Decluttered the house                       | 52.5  | 34.4 | 13.1 | 40.0                 | 40.0 | 20.0 | 41.7       | 58.3 | 0    | 28.6                      | 57.1 | 14.3 | .53      |
| Removed throw rugs                          | 40.0  | 36.7 | 23.3 | 80.0                 | 10.0 | 10.0 | 33.3       | 41.7 | 25.0 | 42.9                      | 28.6 | 28.6 | .37      |
| Removed or clearly marked raised thresholds | 16.7  | 46.7 | 36.7 | 20.0                 | 20.0 | 60.0 | 18.2       | 72.7 | 9.1  | 0                         | 85.7 | 14.3 | .08      |
| Installed nonskid surface on bathtub floor  | 56.7  | 35.5 | 8.3  | 70.0                 | 30.0 | 0    | 50.0       | 50.0 | 0    | 42.9                      | 57.1 | 0    | .61      |
| Installed grab bars near toilet and bathtub | 53.3  | 40.6 | 6.7  | 60.0                 | 30.0 | 10.0 | 50.0       | 41.7 | 8.3  | 42.9                      | 57.1 | 0    | .94      |
| Used a shower chair/transfer bench          | 78.0  | 22.0 | 0    | 70.0                 | 30.0 | 0    | 66.7       | 33.3 | 0    | 71.4                      | 28.6 | 0    | .82      |
| Installed handheld showerhead               | 61.7  | 33.3 | 5.0  | 50.0                 | 50.0 | 0    | 58.3       | 41.7 | 0    | 42.9                      | 57.1 | 0    | .75      |

|  |      |      |      |      |      |      |      |      |      |      |      |      |     |
|--|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| Used a longhanded reacher, shoehorn, or sponge | 70.0 | 26.7 | 3.3  | 30.0 | 70.0 | 0    | 50.0 | 50.0 | 0    | 42.9 | 57.1 | 0    | .12 |
| Used a walking aid                             | 78.3 | 21.7 | 0    | 60.0 | 40.0 | 0    | 83.3 | 16.7 | 0    | 85.7 | 14.3 | 0    | .51 |
| Repaired walking aid                           | 18.5 | 27.8 | 53.7 | 25.0 | 12.5 | 62.5 | 0    | 41.7 | 58.3 | 28.6 | 42.9 | 28.6 | .45 |

Table 7. Class Type: Frequency Analysis of Behavioral Modifications and Chi-Square Analysis

| Behavioral Modification                     | Group |      |      | Group with Caretaker |      |      | Individual |      |      | Individual with Caretaker |      |      | <i>p</i> |
|---|-------|------|------|----------------------|------|------|------------|------|------|---------------------------|------|------|----------|
|   | % Yes | % No | % NA | % Yes                | % No | % NA | % Yes      | %No  | % NA | % Yes                     | % No | % NA |          |
| Got up slowly to avoid dizziness            | 80.0  | 16.7 | 3.3  | 90.0                 | 10.0 | 0    | 0          | 100  | 0    | 57.1                      | 28.6 | 14.3 | .29      |
| Avoided rushing to answer the phone or door | 89.8  | 6.8  | 3.4  | 90.0                 | 0    | 10.0 | 91.7       | 8.3  | 0    | 71.4                      | 28.6 | 0    | .38      |
| Wore supportive non-slip footwear           | 70.0  | 26.7 | 3.3  | 70.0                 | 20.0 | 10.0 | 66.7       | 33.0 | 0    | 71.4                      | 28.6 | 0    | .88      |
| Avoided walking on wet surfaces             | 85.0  | 11.7 | 3.3  | 90.0                 | 0    | 10.0 | 91.7       | 8.3  | 0    | 85.7                      | 14.3 | 0    | .76      |
| Took breaks when performing ADLs            | 76.3  | 22.0 | 1.7  | 100.0                | 0    | 0    | 83.3       | 16.7 | 0    | 57.1                      | 42.9 | 0    | .48      |
| Asked for help when needed                  | 88.3  | 10.0 | 1.7  | 90.0                 | 10.0 | 0    | 91.7       | 8.3  | 0    | 85.7                      | 0    | 14.3 | .44      |
| Kept commonly used items within reach       | 96.7  | 1.7  | 1.7  | 100.0                | 0    | 0    | 91.7       | 8.3  | 0    | 85.7                      | 14.3 | 0    | .56      |



Table 8. Class Type: Frequency Analysis of Medical Changes and Chi-Square Analysis Results

| Medical Changes                                   | Group |      |      | Group with Caretaker |      |      | Individual |      |      | Individual with Caretaker |      |      | <i>p</i> |
|---|-------|------|------|----------------------|------|------|------------|------|------|---------------------------|------|------|----------|
|   | % Yes | % No | % NA | % Yes                | % No | % NA | % Yes      | %No  | % NA | % Yes                     | % No | % NA |          |
| Diagnosis of a new disease or syndrome            | 25.4  | 74.6 | 0    | 10.0                 | 90.0 | 0    | 33.3       | 66.7 | 0    | 28.6                      | 71.4 | 0    | .63      |
| Change in medications since discharge             | 41.4  | 58.6 | 0    | 50.0                 | 50.0 | 0    | 66.7       | 33.3 | 0    | 42.9                      | 57.1 | 0    | .43      |
| Hospitalization since time of discharge           | 15.5  | 84.5 | 0    | 20.0                 | 80.0 | 0    | 33.3       | 66.7 | 0    | 14.3                      | 85.7 | 0    | .53      |
| A past medical problem not being controlled       | 3.5   | 96.5 | 0    | 30.0                 | 70.0 | 0    | 25.5       | 75.5 | 0    | 14.3                      | 85.7 | 0    | .02      |
| Decrease in mental status since time of discharge | 8.6   | 89.7 | 1.7  | 20.0                 | 80.0 | 0    | 25.0       | 75.0 | 0    | 28.6                      | 71.4 | 0    | .59      |

## Discussion

The results indicate that fall outcome at six months after discharge was not affected by type of training received. Training groups had similar baseline characteristics in major categories related to falls: age, gender, ethnicity, 10MWT scores, MoCA scores, and admission and discharge FIM scores. There was no significant difference in the occurrence of falls among class types. In addition, the proportion of falls and no falls was similar across the four training groups. This suggests that no training type was more effective than another in decreasing fall incidences. Consequently, we failed to reject the null hypothesis, which is that fall outcome is not affected by group instruction versus individual instruction. However, this study found that overall there were more non-fallers. Our study found that, at six months, only 25 percent of the participants fell. This figure is lower than the yearly rate of 33 percent of falls in adults aged 65 and older reported by the CDC. Therefore, the falls prevention class was effective in decreasing falls rate. Each training group had similar characteristics in major categories related to falls.

## Demographics

Most research shows that fall incidence increases with age, but there is no consensus yet on gender and falls. Fall incidence and severity of fall-related complications rise steadily from middle age and peaks at age 80 and older (Rao, 2005; Rowe, 2011). Alamgir, Muazzam, & Nasrullah (2012) showed that falls mortality among all unintentional injury mortality increased with age (23.19% for 65-69 years and 53.53% for 85+ years), and the proportion of falls mortality was significantly higher among females than males. A study conducted by Rossat et al. (2010) concluded that the female gender is associated with the recurrence of falls. Stevens & Sogolow (2005) found that the rate for non-fatal, unintentional fall-related injuries for elderly

women is 40-60% higher than for men of comparable age. However, in a recent study done by Pereira, Baptista, & Infante (2013), when factoring in the values for comorbidities, lean and fat body mass, and balance equally, men had a higher probability of falling than women. Our study found no significant difference in gender or age and the rate of fall post discharge. This could be due to our limited sample size, with the most number of subjects in the 65-69 age group and less than 6 subjects in each of the 65 and younger age groups. As mentioned earlier, prior research studies were conducted in the inpatient setting, skilled-nursing facilities, or the general population. Little research has been performed on our particular patient population, community-dwelling subjects discharged from acute inpatient rehabilitation.

### **Mobility**

Slower gait speed has been shown to be directly associated with an increased fall risk; in a study done in 19-45 year-old subjects, a decrease in gait speed increases the odds of fall (Espy, D., Yang, F., Bhatt, T., & Pai, Y, 2010). Verghese, Holtzer, Lipton, & Wang (2009) showed that a gait speed less and 0.7m/s had a 1.5-fold increased risk for falls compared with normal speed in the 70 and older population. In our study, the gait speed was measured by 10 MWT, which is a reliable tool for collecting gait speed and has a high reliability and concurrent validity (Fritz & Lusardi, 2009; Peters et al., 2013). Our results did not present any significant difference between fallers and non-fallers in their scores on the 10MWT.

### **Cognition**

Less research has examined the relationship between mild cognitive impairment and falls, but a recent study conducted by Delbaere et al. (2012) suggested that the incidence of injurious or multiple falls in people with mild cognitive impairment was nearly doubled when compared with people who are cognitively intact. Tinetti, Speechley, & Ginter (1988) had also reported

that older adults with cognitive impairment were five times more likely to fall than those with impairment. Our results showed that MoCA scores for fallers and non-fallers among different training groups were similar except for the InC group, but there are too few cases in the InC group to establish a valid connection. Our analysis found no significant difference in MoCA scores between fallers and non-fallers. This could be due to the our small sample size and skewed distribution towards the cognitive-intact category, making it difficult to make a meaningful comparison.

### **Functional Status**

Discharge FIM™ outcomes, particularly in the Transfer domain, have been linked to higher fall occurrence in a study conducted by Chin, Wang, Ong, Lee, & Kong (2013); FIM™ scores, in the Motor and Cognitive domains have also been tied to fallers in the inpatient setting according to Lee & Stokic (2008). Forrest et al. (2012) concluded that FIM™ score was inversely related to the rate of falls. But our study found no significant difference between discharge FIM™ score and the occurrence of falls among different training types. This is in concordance with a retrospective study conducted by Petitpierre, Trombetti, Carroll, Michel, & Herrmann, (2010); their study showed a non-linear relationship between FIM™ score and falls.

### **Home Modifications**

A greater percentage of subjects fell despite making the following changes: decluttering the house (68.2% within Faller vs Non-Faller), and using a shower chair or tub transfer bench (90.9% within Faller vs Non-Faller). For both of these questions on the survey, the interviewer had difficulty in getting a definitive yes or no answer from the respondent. When asked about making these changes in their home, subjects were supposed to respond by saying yes, no, or not applicable. Even though 68 percent of participants reported decluttering their home, this figure

may have included those who decluttered their house prior to discharge, or never had clutter in the first place. Furthermore, everyone's definition of clutter varies. Answers to this question were too subjective and varied to measure with a simple yes, no, or not applicable. Ninety percent of the fallers reported using a shower chair or tub transfer bench. Some participants reported using this equipment, but only in the beginning after being discharged. Like the question about clutter, it was hard to measure their response only using yes, no, or not applicable. It is possible that they stopped using the adaptive equipment prematurely. In addition, the equipment might have been used incorrectly because there was no home assessment.

There were no differences between fallers and non-fallers whether or not they made the following home modifications: used a night light; added or repaired railings; removed throw rugs; removed or clearly marked raised thresholds; installed non-skid surface in bathroom; installed grab bars near the tub and/or toilet; installed hand-held shower; used long-handled reacher, shoehorn, or sponge; used walking aid; and, repaired walking equipment.

### **Personal Safety Modifications**

Our findings indicate that the frequency of implementing behavioral changes to avoid falls had no impact on falls rate. There was no significant difference between fallers and non-fallers whether or not they did the following: getting up slowly to avoid dizziness; not rushing to answer the phone or door; wearing supportive/non-slip shoe wear; avoiding walking on wet surfaces; taking breaks when performing daily self-care routine; asking for help when needed; and, keeping commonly-used items within reach.

### **Changes in Medical Condition or Medication**

Our study found that changes in medical condition affected falls rate. Forty percent of fallers had the diagnosis of a new disease or syndrome, and close to 30 percent experienced a

decline in mental status. This suggests that physical and mental health are factors to consider when assessing falls risk. Though not formally documented, a number of patients reported during the phone interview that they developed depression after leaving the hospital which was considered both a disease and a decrease in mental status. Perhaps these physical and mental health changes created an additional burden on the patient, thereby putting them at a higher risk for falls. Thus, it is possible that despite making the suggested home and behavioral modifications, subjects fell because of a change in their medical condition. Interestingly, the results from our study showed that a change in medications had no effect on falls rate. There was no significant difference between fallers and non-fallers whether or not they had a change in medications since time of discharge. Other research, however, has correlated the addition of medications with a significant increase in risk of falls in elderly patients, regardless of drug class (Freeland et al, 2012).

### **Limitations and Future Directions**

Results from this study should be considered in light of several limitations. This study lacked a control group of subjects that did not receive falls prevention training. The number of completed phone interviews was less than anticipated, due to fewer subjects agreeing to participate and those lost to follow-up. Group size was uneven, with three of the four training groups consisting of less than 20 subjects.

Additionally, we were not able to recruit our original target sample size. Therefore, some of our analyses related to interaction effects were underpowered. With regards to the survey, we omitted questions regarding exercise and general physical health. This is an important aspect to consider given that previous fall prevention studies show exercise as an effective intervention (Barnett et al., 2003; Campbell et al., 1997; El-Khoury et al., 2013; Gardener et al., 2000). Other

changes to the survey include adding questions about fear of falling, falls history, where the falls occurred, and vision changes. In the cohort study Hill et al. (2013) conducted, 68.5 percent of falls occurred inside the home for their community-dwelling participants, with the bedroom being the most frequent location. While the phone interviewers did not formally investigate and document how and where the fall incidences occurred, a number of the participants volunteered this information. An estimate showed that indoor falls were more frequent than those external to the home environment.

Re-phrasing current questions for clarity and removing ones that are too subjective would also improve the survey as a tool. In addition, we must consider the practicality and financial feasibility of implementing certain home modifications. Along with making the home modifications, a home assessment by a license professional would have ensured that the equipment was not only installed correctly, but also being used properly. Other limitations include reporting bias and the absence of visual cues in telephone interviews. The absence of visual cues may prevent people from disclosing information deemed sensitive (Groves, 1990; Novick, 2008). Some studies regarding the use of phone interviewing in research have shown that they induce social desirability bias, which occurs when respondents want to show themselves in the best light. As a result, desirable behaviors are over-reported, and undesirable behaviors are under-reported (Moum, 1998; Bowling, 2005; Novick, 2008).

Instead of following up at six months from discharge, future studies can follow up with patients at one year after discharge. Twelve months allows for all four seasons, giving a more representative picture of falls incidence throughout the year. Another option is to follow up at one month, so the time frame between receiving falls prevention training and follow-up measurements is closer. It might be easier for subjects to recall the number of falls over one

month instead of six, especially if there are any memory issues. Furthermore, the falls prevention class might be more recent in their minds when following up at one month after discharge as opposed to six months. There is also the option to conduct monthly follow up over the course of one year, because climate and season may influence fall rates for older adults (Stevens, Thomas, & Sogolow, 2007). Future research should also include an economic evaluation of falls prevention programs in an inpatient rehabilitation setting.

### **Implications**

Patient education prior to discharge from inpatient rehabilitation appears to be effective in fall prevention after discharge for patients with a wide variety of admitting diagnoses. Most participants made some of the environmental, behavioral, and medical changes that were appropriate to their situations. Physical and mental status deterioration were the issues that were most frequently reported among people who fell after discharge. Thus, programs that only look at specific interventions, like balance training or home-modifications, should include a patient education component to increase effectiveness. Based on our findings, an interaction among fall incidence and physical or mental deterioration might indicate that physician follow-up after discharge from inpatient rehabilitation needs to play a role in fall prevention. A larger sample size is needed in order to determine if training type (group versus individual training, with or without a caretaker present) has an influence on fall prevention.



**Appendix A - Falls Prevention Class Handout**



# Fall Prevention at Home

## Fall Prevention at Home

One-third of adults aged 65 and older fall each year. Falls are the most common cause of nonfatal injuries among older adults. Most fractures in older adults are caused by falls. Though very common, falls can often be prevented.

Most falls occur in the home setting. Common ways people fall at home include:

- Tripping over obstacles.
  - Hurrying to answer the phone.
  - Rushing to the bathroom.
  - Getting out of bed too quickly.
  - Standing up too quickly.
  - Walking at night without a light.
  - Getting in and out of a bathtub.
  - Tripping over throw rugs or raised thresholds.
  - Slipping on a wet or slippery surface.
-

## What can increase your risk of falling?

- History of falling
- History of stroke
- Uncontrolled diabetes
- Parkinson's Disease
- Multiple Sclerosis
- Heart disease
- Osteoarthritis
- Medication side-effects
- Urinary urge
- Numbness in your feet
- Balance problems
- Vertigo or dizziness
- Difficulty with memory or concentration
- Muscle weakness
- Vision problems
- Fear of falling
- Fatigue/insomnia
- Recent illness

Many of these conditions can be managed by your doctor or your rehabilitation therapist to help prevent falls before they happen.

## What can you do to prevent falls?

### **Medical Management:**

Get regular vision check-ups. Vision changes can increase your risk of falls. Always keep an up-to-date list of all of your medications:

- Bring the list to all of your doctors' appointments.
  - Review the dosages and time of day that you are taking your medicines with your doctor.
  - Discuss any side-effects and drug interactions with your doctor, especially if a new medicine has been added.
  - Regularly check the expiration dates on your medicines.
-

## Medical Management

*(continued):*

Ask your doctor which medicines can put you at risk for falling. Some medicines have side-effects which can include:

- Dizziness or lightheadedness
- Feeling extra sleepy
- Heart racing or skipping a beat
- Extra swelling in your legs
- Confusion, difficulty paying attention, or difficulty remembering things

Important: Call your doctor if you see any of these changes or notice anything unusual.

### Daily Routine:

Make small changes to your habits and routines to help prevent falls. Some suggestions are:

- When getting out of bed, sit at the edge of the bed before standing to avoid dizziness.
- When getting up from a chair, make sure you have your balance before walking.
- Don't rush to answer the door bell or telephone.
- Wear supportive shoes with non-slip soles.
- Do not walk on wet or slippery surfaces.
- Pace yourself to conserve energy. Break up your tasks and take rest breaks.
- Know your abilities and your limitations. Ask for help when needed.

### Home Safety:

Consider these home safety tips to reduce your risk of falls:

- Good lighting is necessary to keep your balance and move safely.
  - Make sure all stairwells and walkways are well lit.
  - Use nightlights in hallways, bedrooms and bathroom.
-

**Home Safety** *(continued)*:

- Make sure staircases and railings are sturdy and in good repair.
- Remove clutter in order to have a clear walking path.
- Remove throw rugs. If you cannot remove them, tape down the edges with double-sided tape.
- Remove raised thresholds. If you cannot remove them, use brightly colored tape to make the threshold more visible.
- Make sure walking surfaces are smooth. Repair all cracks, raised tiles or loose boards.
- Store frequently used items within reach.
- Place a non-skid surface on the floor of the bathtub.
- Install grab bars near your toilet and bath tub. (Towel bars should not be used as grab bars.)

**Adaptive Equipment:**

Use different types of adaptive equipment to make your daily tasks easier.

- Sit on a shower chair when bathing if you feel weak or imbalanced.
- Install a handheld shower head.
- Use a raised toilet seat if you have a hard time getting up from a low seat.
- If you have difficulty bending or reaching, use long-handled adaptive equipment. These can include long-handled reachers, shoehorns, and sponges.
- Use your walking equipment as recommended by your therapist.
- Replace worn-down walker, crutch or cane tips.

**Exercise**

Make exercise part of your routine. Improving your fitness has been proven to reduce your risk of falling.

- Do basic strengthening and stretching exercises to keep your body strong and flexible.
- Perform balance exercises to improve your stability.
- Build up your endurance through aerobic exercise such as walking. This will help you have the energy to do your activities safely with less fatigue.

Important: Check with your doctor and therapist before starting any new exercise.

## **Are You Afraid of Falling?**

You are not alone. The fear of falling is very common after leaving the hospital.

- 73% of people who have fallen in the past year develop a fear of falling.
- Fear of falling can lead to balance problems and difficulty walking. It can also lead to less involvement in enjoyable activities.

Overcome your fear of falling:

- Be as active as possible in your home and community.
- Build up your confidence by moving around safely.
- Follow the advice of your rehabilitation therapist.
- Practice, practice, practice!

## **What else can I do?**

- Keep a list of important phone numbers at key locations throughout your home, including near every telephone.
- Hip protectors can help to prevent hip fractures caused by falls, especially if you have osteoporosis. Talk to your rehabilitation therapist for more information.
- Personal emergency response systems allow you to call for help in an emergency at home. Life Alert is one example. Speak with your social worker for more details.

## Appendix B - Phone Interview Questions

### Falls Prevention Follow-Up Phone Interview

Hello my name is \_\_\_\_\_ and I'm calling from New York Presbyterian Hospital. I'm looking for \_\_\_\_\_ is this her? (If they say no then ask to speak with them and if they are not home then say "ok we'll call her back") When you were a patient back in \_\_\_\_\_ we started a study with you about falls prevention and received an informational brochure. Do you remember this? At the time we discussed a follow-up phone interview as part of the study and, now, this is it. It takes about 10 – 15 minutes to complete. You can skip over any question you do not wish to answer and all of your answers will be kept confidential. Is now a good time to do the survey? [If they say no, then ask what is a better time]  
Ok, if at any point you do not wish to continue doing this survey you may stop.

#### Demographics

Are you living alone? Yes or No

If "No"

With whom do you live?

Does anyone help you with your day-to-day activities? Yes or No

In what type of home do you live?

- Apartment vs. Private house
- If Apartment:
  - Are there steps to enter the building? Rail?
  - Elevator?
  - Are there steps inside the apt? Rail?
- If Private house:
  - Are there steps to enter? Rail?
  - Are there steps inside? Rail?

**Question 1: During falls prevention education, we discussed ways to make your home safe. Since leaving the hospital, what changes have you made in your home based on what you learned? Please Respond Yes, No, or Not Applicable to the following changes:**

- Increased lighting in areas like stairways, hallways, and other areas around the home
- Used night-lights
- Repaired railings or put railing in.
- De-cluttered the house
- Removed throw rugs
- Removed raised thresholds or clearly marked them.
- Put a nonskid surface on the bathtub floor.
- Installed grab bars near your toilet and bath tub.



**Question 2: During falls prevention education, we discussed the use of adaptive equipment such as long-handled shoe horn. Since leaving the hospital, have you used any of the following devices? Please Respond Yes, No, or Not Applicable to the following changes:**

- Use of a shower chair or tub transfer bench.
- Installed a handheld shower head.
- Using a long handled reacher, shoehorn, or sponge.
- Using walking aid, such as a walker or cane
- Repairing walking equipment like your walker or cane if it becomes worn.

**Question 3: During falls prevention educations, we discussed certain changes to your daily routine to help prevent falls. Since leaving the hospital, have you made any changes to your daily habits or routines? Please Respond Yes, No, or Not Applicable to the following changes:**

- When waking up or standing up, getting up slowly to avoid dizziness.
- Not rushing to answer the phone or door.
- Wearing supportive, nonslip shoe wear.
- Not walking on wet surfaces.
- Taking breaks when performing your daily self-care routine
- Asking for help when needed
- Keeping commonly-used items within reach.

**Question 4: Have there been any changes in your health status since you left the hospital? Please Respond Yes, No, or Not Applicable to the following changes:**

- A diagnosis of a new disease or syndrome
- An increase or decrease in the number of medications you are taking.
- A trip to the hospital.
- A past medical problem not being properly controlled.
- Decrease in mental status.

**Question 5: A fall is defined as unintentionally coming to rest on the ground, the floor, or another lower level. We do not count coming to rest against furniture, a wall, or another structure or person as a fall. In the past 6 months, how many falls have you had?**

- 0
- 1
- 2
- 3
- 4
- more than 4

**Question 6: If the patient answers more than 4 times- What was the frequency of these falls?**

- once a month
- twice a month

- once a week
- multiple times a week

**Question 7: What do you think caused your falls?**

- Change in medical status
- slipped
- tripped over something
- lost balance
- knees buckled
- got dizzy
- fainting
- other, specify briefly: \_\_\_\_\_

**Question 8: When your fall(s) occurred, were you using an assistive device (such as cane or walker)**

Yes/No

**Question 9: Can you please list for me your current medications?**

Thank you so much for helping with this research. If you have questions about this study, you may call Dr. Suzanne Babyar at the Hunter College Doctor of Physical Therapy program 212-481-4469 or the other contacts listed on the consent document we gave you.

## Reference List

- Alamgir, H., Muazzam, S., & Nasrullah, M. (2012). Unintentional falls mortality among elderly in the United States: time for action. *Injury*, *43*(12), 2065-2071
- Allan, L. M., Ballard, C. G., Rowan, E. N., & Kenny, R. A. (2009). Incidence and prediction of falls in dementia: a prospective study in older people. *PLoS One*, *4*(5), e5521.
- American Geriatrics Society (2001). Guideline for the prevention of falls in older persons. *Journal of the American Geriatrics Society*, *49*, 664-672.
- Barnett, A., Smith, B., Lord, S., Williams, M., & Baumand, A. (2003). Community-based group exercise improves balance and reduces falls in at-risk older people: A randomized controlled trial. *Age and Ageing*, *32*(4), 407-414.
- Bowling, A. (2005). Mode of questionnaire administration can have serious effects on data quality. *Journal of Public Health*, *27*(3), 281-291.
- Buchner, D. M., Hornbrook, M. C., Kutner, N. G., Tinetti, M. E., Ory, M. G., Mulrow, C. D., ... & Wolf, S. L. (1993). Development of the common data base for the FICSIT trials. *Journal of the American Geriatrics Society*, *41*(3), 297-308.
- Campbell A. J., Borrie M. J., Spears G. F., Jackson S. L., Brown J. S., & Fitzgerald J. L. (1990). Circumstances and consequences of falls experienced by a community population 70 years and over during a prospective study. *Age and Ageing*, *19*(2): 136-141.
- Campbell, A. J., Robertson, M. C., Gardner, M. M., Norton, R. N., & Buchner, D. M. (1999). Falls prevention over 2 years: A randomized controlled trial in women 80 years and older. *Age and Ageing*, *28*(6), 513-518.
- Campbell, A. J., Robertson, M. C., Gardner, M. M., Norton, R. N., Tilyard, M. W., & Buchner, D. M. (1997). Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *British Medical Journal*, *315*(7115), 1065-1069.
- Campbell, A. J., Robertson, M. C., La Grow, S. J., Kerse, N. M., Sanderson, G. F., Jacobs, R. J., & Hale, L. A. (2005). Randomised controlled trial of prevention of falls in people aged > or =75 with severe visual impairment: the VIP trial. *British Medical Journal*, *331*(7520), 817.
- Centers for Disease Control and Prevention. (2010). *Causes of injury death: Highlighting unintentional injury*. Retrieved from [http://www.cdc.gov/Injury/wisqars/pdf/Leading\\_Causes\\_injury\\_Deaths\\_Age\\_Group\\_Highlighting\\_Unintentional\\_Injury%20Deaths\\_US\\_2009-a.pdf](http://www.cdc.gov/Injury/wisqars/pdf/Leading_Causes_injury_Deaths_Age_Group_Highlighting_Unintentional_Injury%20Deaths_US_2009-a.pdf).
- Centers for Disease Control and Prevention. (2011). *Causes of nonfatal injuries treated in hospital emergency departments*. Retrieved from [http://www.cdc.gov/Injury/wisqars/pdf/National\\_Estim\\_10\\_Leading\\_Causes\\_Nonfatal\\_Injuries\\_Tx\\_Hospital-ED\\_US2010-a.pdf](http://www.cdc.gov/Injury/wisqars/pdf/National_Estim_10_Leading_Causes_Nonfatal_Injuries_Tx_Hospital-ED_US2010-a.pdf).
- Centers for Disease Control and Prevention. (2012). *WISQARS: Your source for U.S. injury statistics*. Retrieved from <http://www.cdc.gov/injury/wisqars/pdf/WISQARS-FactSheet20120425-a.pdf>.
- Cesari, M., Kritchevsky, S. B., Penninx, B. W., Nicklas, B. J., Simonsick, E. M., Newman, A. B., ... & Pahor, M. (2005). Prognostic value of usual gait speed in well-functioning older people—Results from the health, aging and body composition study. *Journal of the American Geriatrics Society*, *53*(10), 1675-1680.

- Chase, C. A., Mann, K., Wasek, S., & Arbesman, M. (2012). Systematic review of the effect of home modification and fall prevention programs on falls and the performance of community-dwelling older adults. *American Journal of Occupational Therapy*, 66(3), 284-291.
- Chen, Y.M., Hwang, S.J., Chen, L.K., Chen, D.Y., & Lan, C.F. (2008). Risk factors for falls among elderly men in a veterans home. *Journal of the Chinese Medical Association*, 71(4), 180-185.
- Clemson, L., Cumming, R. G., Kendig, H., Swann, M., Heard, R., & Taylor, K. (2004). The effectiveness of a community-based program for reducing the incidence of falls in the elderly: a randomized trial. *Journal of the American Geriatrics Society*, 52(9), 1487-1494.
- Cournan, M. (2011). "Use of the functional independence measure for outcomes measurement in acute inpatient rehabilitation. *Rehabilitation Nursing*, 36(3), 111-117.
- Cumming, R. G., Thomas, M., Szonyi, G., Salkeld, G., O'Neill, E., Westbury, C., & Frampton, G. (1999). Home visits by an occupational therapist for assessment and modification of environmental hazards: a randomized trial of falls prevention. *Journal of the American Geriatrics Society*, 47(12), 1397-1402.
- Day, L., Fildes, B., Gordon, I., Fitzharris, M., Flamer, H., & Lord, S. (2002). Randomised factorial trial of falls prevention among older people living in their own homes. *British Medical Journal*, 325(7356), 128.
- El-Khoury, F., Cassou, B., Charles, M-A., & Dargent-Molina, P. (2013). The effect of fall prevention exercise programmes on fall induced injuries in community dwelling older adults: systematic review and meta-analysis of randomised controlled trials. *British Medical Journal*, 347, f6234.
- Espy, D., Yang, F., Bhatt, T., & Pai, Y. (2010). Independent influence of gait speed and step length on stability and fall risk. *Gait & Posture*, 32(3), 378-382.
- Fall Prevention Center of Excellence. (2014). *Information for researchers and educators*. Retrieved from <http://www.stopfalls.org/researchers-educators>.
- Forrest, G., Huss, S., Patel, V., Jeffries, J., Myers, D., Barber, C., & Kosier, M. (2012). Falls on an inpatient rehabilitation unit: risk assessment and prevention. *Rehabilitation Nursing*, 37(2), 56-61.
- Fox, P., Vazquez, L., Tonner, C., Stevens, J., Fineman, N., & Ross, L. (2010). A randomized trial of a multifaceted intervention to reduce falls among community-dwelling adults. *Health Education & Behavior*, 37(6), 831-848.
- Freeland, K., Thompson, A., Zhao, Y., Leal, J., Mauldin, P., & Moran, W. (2012). Medication use and associated risk of falling in a geriatric outpatient population. *The Annals Of Pharmacotherapy*, 46(9), 1188-1192.
- Fritz, S., & Lusardi, M. (2009). White paper: "walking speed: the sixth vital sign". *Journal Of Geriatric Physical Therapy (2001)*, 32(2), 46-49.
- Gagnon, G., Hansen, K., Woolmore-Goodwin, S., Gutmanis, I., Wells, J., Borrie, M., & Fogarty, J. (2013). Correcting the MoCA for education: effect on sensitivity. *The Canadian Journal Of Neurological Sciences. Le Journal Canadien Des Sciences Neurologiques*, 40(5), 678-683.

- Gardner, M. M., Robertson, M. C., & Campbell, A. J. (2000). Exercise in preventing falls and fall related injuries in older people: a review of randomised controlled trials. *British Journal of Sports Medicine*, 34(1), 7-17.
- Gillespie, L., Gillespie, W., Robertson, M., Lamb, S., Cumming, R., & Rowe, B. (2003). Interventions for preventing falls in elderly people. *The Cochrane Database of Systematic Reviews*, (4).
- Groves, R. (1990). Theories and methods of telephone surveys. *Annual Review of Sociology*, 16, 221-240.
- Harlein, J., Dassen, T., Halfens R.J.G., & Heinze, C. (2009). Fall risk factors in older people with dementia or cognitive impairment: a systemic review. *Journal of Advanced Nursing*. 65(5), 922-933.
- Harmer, P. A., & Li, F. (2008). Tai Chi and falls prevention in older people. [Review]. *Medicine and Sport Science*, 52, 124-134.
- Hauer, K., Lamb, S. E., Jorstad, E. C., Todd, C., & Becker, C. (2006). Systematic review of definitions and methods of measuring falls in randomised controlled fall prevention trials. *Age and Ageing*, 35(1), 5-10.
- Hausdorff, J., Doniger, G.M., Springer, S., Yogev, G., Simon, Ely.S., & Giladi, Nir. (2006). A common cognitive profile in elderly fallers and in patients with Parkinson's disease: The prominence of impaired executive function and attention. *Experimental Aging Research*, 32(4), 411-429.
- Heruti, R., Lusky, A., Barell, V., Ohry, A., & Adunsky, A. (1998) Cognitive status at admission: does it affect the rehabilitation outcome of elderly patients with hip fracture? *Archive of Physical Medicine and Rehabilitation*, 80(4), 432-6.
- Hill, A., Hoffmann, T., & Haines, T. (2013). Circumstances of falls and falls-related injuries in a cohort of older patients following hospital discharge. *Clinical Interventions in Aging*, 87, 65-774.
- Hill, A., Hoffmann, T., McPhail, S., Beer, C., Hill, K., Oliver, D., & ... Haines, T. (2011). Evaluation of the sustained effect of inpatient falls prevention education and predictors of falls after hospital discharge--follow-up to a randomized controlled trial. *The Journals Of Gerontology. Series A, Biological Sciences And Medical Sciences*, 66(9), 1001-1012.
- Hornbrook, M. C., Stevens, V. J., Wingfield, D. J., Hollis, J. F., Greenlick, M. R., & Ory, M. G. (1994). Preventing falls among community-dwelling older persons: results from a randomized trial. *Gerontologist*, 34(1), 16-23.
- Kellogg International Work Group on the Prevention of Falls by the Elderly. (1987). The prevention of falls in later life. *Danish Medical Bulletin*, 34 (Suppl. 4), 1-24.
- Kim, J.W. Jo, H.Y., Park, M.J., & Cheon, S.M. (2008). Mild cognitive impairment in Parkinson's disease. *Journal of Movement Disorders*, 1(1), 19-25.
- Koh, S. S. L., Manias, E., Hutchinson, A. M., & Johnston, L. (2007). Fall incidence and fall prevention practices at acute care hospitals in Singapore: A retrospective audit. *Journal of Evaluation in Clinical Practice*, 13(5), 722-727.
- Korner-Bitensky, N., & Wood-Dauphinee, S. (2008). Finding fallers using telephone versus home interviews and laypersons versus health professionals: Is the information valid? [corrected] [published erratum appears in *PHYS OCCUP THER GERIATR* 2009;27(3):273]. *Physical & Occupational Therapy in Geriatrics*, 26(4), 1-12.

- Lee, J., & Stokic, D. (2008). Risk factors for falls during inpatient rehabilitation. *American Journal Of Physical Medicine & Rehabilitation / Association Of Academic Physiatrists*, 87(5), 341.
- Li, F., Harmer, P., Fisher, K. J., McAuley, E., Chaumeton, N., Eckstrom, E., & Wilson, N. L. (2005). Tai Chi and fall reductions in older adults: a randomized controlled trial. *Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 60(2), 187-194.
- Mahoney J. E., Palta M., Johnson J., Jalaluddin M., Gray S., Park, S., & Sager, M. (2000). Temporal association between hospitalization and rate of falls after discharge. *Archive of Internal Medicine*, 160(18), 2788-2795.
- Makizako, H., Shimada, H., Doi, T., Park, H., Yoshida, D., Uemura, K., & ... Suzuki, T. (2013). Poor balance and lower gray matter volume predict falls in older adults with mild cognitive impairment. *BMC Neurology*, 13(1), 102.
- Montero-Odasso, M., Wells, J., Borrie, M., & Speechley, M. (2009). Can cognitive enhancers reduce the risk of falls in older people with mild cognitive impairment? A protocol for a randomised controlled double blind trial. *BMC Neurology*, 942.
- Moum, T. (1998). Mode of administration and interviewer effects in self-reported symptoms of anxiety and depression. *Social Indicators Research*, 45, 279-318.
- Muir, S.W., Gopaul, K., & Montero Odasso, M.M. (2012). The role of cognitive impairment in fall risk among older adults: a systematic review and meta-analysis. *Age and Ageing*, 41(3): 299-308.
- Lord, S. (2006). Visual risk factors for falls in older people. *Age And Ageing*, 35 Suppl 2ii42-ii45.
- Nazem, S., Siderowf, A.D., Duda, J.E., Ten Have, T., Colcher, A., Horn, S.S., & ... Weintaub, D. (2009). Montreal Cognitive Assessment performance in patients with Parkinson's disease with "normal" global cognition according to Mini-Mental State Examination score. *Journal of the American Geriatric Society*, 57, 304-308.
- Novick, G. (2008). Is there a bias against telephone interviews in qualitative research? *Research in Nursing & Health*, 31(4), 391-398.
- Oh, D. H., Park, J. E., Lee, E. S., Oh, S. W., Cho, S. I., Jang, S. N., & Baik, H. W. (2013). Intensive exercise reduces the fear of additional falls in elderly people: findings from the Korea Falls Prevention study. *Korean Journal of Internal Medicine*, 27, 417-425.
- Peeters, G. M., De Vries, O. J., Elders, P. J., Pluijm, S. M., Bouter, L. M., & Lips, P. (2007). Prevention of fall incidents in patients with a high risk of falling: design of a randomised controlled trial with an economic evaluation of the effect of multidisciplinary transmurial care. *BMC Geriatrics*, 7(1), 15.
- Pereira, C., Baptista, F., & Infante, P. (2013). Men older than 50 yrs are more likely to fall than women under similar conditions of health, body composition, and balance. *American Journal Of Physical Medicine & Rehabilitation / Association Of Academic Physiatrists*, 92(12), 1095-1103.
- Petitpierre, N., Trombetti, A., Carroll, I., Michel, J., & Herrmann, F. (2010). The FIM instrument to identify patients at risk of falling in geriatric wards: a 10-year retrospective study. *Age And Ageing*, 39(3), 326-331.
- Peters, D., Fritz, S., & Krotish, D. (2013). Assessing the reliability and validity of a shorter walk test compared with the 10-Meter Walk Test for measurements of gait speed in healthy, older adults. *Journal Of Geriatric Physical Therapy (2001)*, 36(1), 24-30

- Persson, C. U., Hansson, P. O., & Sunnerhagen, K. S. (2011). Clinical tests performed in acute stroke identify the risk of falling during the first year: postural stroke study in Gothenburg (POSTGOT). *Journal of Rehabilitation Medicine*, 43(4), 348-353.
- Pettersson, S.F., Olsson, E., Wahlund, L.O. (2007). Effect of divided attention on gain in subjects with and without cognitive impairment. *Journal of Geriatric Psychiatry and Neurology*. 20, 58-62.
- Plautz, B., Beck, D. E., Selmar, C., & Radetsky, M. (1996). Modifying the environment: a community-based injury-reduction program for elderly residents. *American Journal of Preventive Medicine*, 12(4 Suppl), 33-38.
- Quach, L., Galica, A. M., Jones, R. N., Procter-Gray, E., Manor, B., Hannan, M. T., & Lipsitz, L. A. (2011). The nonlinear relationship between gait speed and falls: the maintenance of balance, independent living, intellect, and zest in the elderly of Boston study. *Journal of the American Geriatrics Society*, 59(6), 1069-1073.
- Rao, S.S. (2005) Prevention of falls in older patients. *American Family Physician*, 72(1), 81-88.
- Rizzo, J. A., Baker, D. I., McAvay, G., & Tinetti, M. E. (1996). The cost-effectiveness of a multifactorial targeted prevention program for falls among community elderly persons. *Medical Care*, 34(9), 954-969.
- Robertson, M. C., & Campbell, A. J. (2001). Falls prevention and the role of home exercise programmes. *Journal of the Royal Society for the Promotion of Health*, 121(3), 143.
- Rossat, A., Fantino, B., Nitenberg, C., Annweiler, C., Poujol, L., Herrmann, F., & Beauchet, O. (2010). Risk factors for falling in community-dwelling older adults: which of them are associated with the recurrence of falls?. *The Journal Of Nutrition, Health & Aging*, 14(9), 787-791.
- Rowe, J. (2011) Fall prevention: Core characteristics and practical interventions. *Home Health Care Management & Practice*, 23(1), 20-26.
- Rubenstein, L. Z. (2006). Falls in older people: epidemiology, risk factors and strategies for prevention. *Age and Ageing*, 35 Suppl 2, ii37-ii41.
- Rubenstein, L. Z., & Josephson, K. R. (2002). The epidemiology of falls and syncope. *Clinics in Geriatric Medicine*, 18(2), 141-58.
- Rubenstein, L. Z., & Josephson, K. R. (2006). Falls and their prevention in elderly people: What does the evidence show? *Medical Clinics of North America*, 90(5), 807-824.
- Schweizer, T.A., Al-Khindi, T., & Macdonald, R.L. (2012).Mini-Mental State Examination versus Montreal Cognitive Assessment: Rapid assessment tools for cognitive and functional outcome after aneurysmal subarachnoid hemorrhage. *Journal of the Neurological Sciences*. 316(1), 137-140.
- Shaw, F., Bond, J., Richardson, D., Dawson, P., Steen, I., McKeith, I., & Kenny, R. (2003). Multifactorial intervention after a fall in older people with cognitive impairment and dementia presenting to the accident and emergency department: randomised controlled trial. *BMJ (Clinical Research Ed.)*, 326(7380), 73.
- Shaw, F.E., & Kenny, R.A. (1998). Commentary: can falls in patients with dementia be prevented? *Age and Ageing*, 27, 7-9.
- Sherrington, C., Whitney, J. C., Lord, S. R., Herbert, R. D., Cumming, R. G., & Close, J. C. (2008). Effective exercise for the prevention of falls: a systematic review and meta-analysis. *Journal of the American Geriatric Society*, 56(12), 2234-2243.

- Smith, T., Gildeh, N., & Holmes, C. (2007). The Montreal Cognitive Assessment: validity and utility in a memory clinic setting. *The Canadian Journal of Psychiatry*, 52(5), 329-332.
- Solfrizzi, V., Panza, F., Colacicco, A.M., D'Introno, A., Capurso, C., Torres, F., . . . & Capurso, A. (2004). Vascular risk factors, incidence of MCI, and rates of progression to dementia. *Neurology*, 63(10), 1882-1891.
- Stevens, J. (2010). A CDC compendium of effective fall interventions: What works for community-dwelling older adults (2nd ed.). Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.
- Stevens, J., & Sogolow, E. (2005). Gender differences for non-fatal unintentional fall related injuries among older adults. *Injury Prevention*, 11(2), 115-119.
- Stevens, J., Thomas, K., & Sogolow, E. (2007). Seasonal patterns of fatal and nonfatal falls among older adults in the U.S. *Accident; Analysis And Prevention*, 39(6), 1239-1244.
- Sweet, L., Adel, M.V., Metcalf, V., Wright, L., Harley, A., Leiva, R., & Taler, V. (2011). Montreal Cognitive Assessment (MoCA) in geriatric rehabilitation: Psychometric properties and association with rehabilitation outcomes. *International Psychogeriatric Association*, 23, 1582-1591.
- Talbot, L. A., Musiol, R. J., Witham, E. K., & Metter, E. J. (2005). Falls in young, middle-aged and older community dwelling adults: Perceived cause, environmental factors and injury. *BMC Public Health*, 5, 86.
- Thompson, P. G. (1996). Preventing falls in the elderly at home: a community-based program. *Medical Journal of Australia*, 164(9), 530-532.
- Tinetti, M., Speechley, M., & Ginter, S. (1988). Risk factors for falls among elderly persons living in the community. *The New England Journal Of Medicine*, 319(26), 1701-1707.
- Tinetti, M. E. (2003). Clinical practice. Preventing falls in elderly persons. *New England Journal of Medicine*, 348(1), 42-49.
- Tinetti, M., Baker, D., McAvay, G., Claus, E., Garrett, P., Gottschalk, M., & ... Horwitz, R. (1994). A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *The New England Journal Of Medicine*, 331(13), 821-827
- Tinetti, M., & Kumar, C. (2010). The patient who falls: "It's always a trade-off". *JAMA: The Journal Of The American Medical Association*, 303(3), 258-266.
- Todd, C., & Skelton, D. (2004). What are the main risk factors for falls amongst older people and what are the most effective interventions to prevent these falls? Copenhagen: World Health Organization Regional Office for Europe, Health Evidence Network Report. Retrieved from [http:// www.euro.who.int/document/e82552.pdf](http://www.euro.who.int/document/e82552.pdf)
- United States Census Bureau. (2011). *The Older Population: 2010*. Retrieved from <http://www.census.gov/prod/cen2010/briefs/c2010br-09.pdf>.
- Vellas B.J., Wayne S.J., Garry P.J., & Baumgartner R.N. (1998). A two-year longitudinal study of falls in 482 community-dwelling elderly adults. *The Journals Of Gerontology. Series A, Biological Sciences And Medical Sciences*, 53(4), M264-274.
- Verghese, J., Holtzer, R., Lipton, R., & Wang, C. (2009). Quantitative gait markers and incident fall risk in older adults. *The Journals Of Gerontology. Series A, Biological Sciences And Medical Sciences*, 64(8), 896-901
- Voukelatos, A., Cumming, R. G., Lord, S. R., & Rissel, C. (2007). A randomized, controlled trial of Tai Chi for the prevention of falls: the Central Sydney Tai Chi trial. *Journal of the American Geriatric Society*, 55(8), 1185-1191.



- Wolf, S. L., Coogler, C., & Xu, T. (1997). Exploring the basis for Tai Chi Chuan as a therapeutic exercise approach. *Archive of Physical Medicine and Rehabilitation*, 78(8), 886-892.
- Wood, B.H., Bilclough, J.A., Bowron, A., & Walker, R.W. (2002) Incidence and prediction of falls in Parkinson's disease: A prospective multidisciplinary study. *Journal of Neurology, Neurosurgery, and Psychiatry*, 72, 721-725.
- World Health Organization. Ageing, & Life Course Unit. (2008). *WHO global report on falls prevention in older age*. World Health Organization.
- World Health Organization (2012). *Falls*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs344/en/>
- Zecevic, A. A., Salmoni, A. W., Speechley, M., & Vandervoort, A. A. (2006). Defining a fall and reasons for falling: comparisons among the views of seniors, health care providers, and the research literature. *The Gerontologist*, 46(3), 367-376.