RELATIVE RISK FOR A FUTURE FALL AMONG
COMMUNITY-DWELLING OLDER ADULTS

A thesis submitted in partial fulfillment of the requirements
For the degree of Master of Arts in Psychology,
General-Experimental

By
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May 2014
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DEDICATION

This thesis is dedicated to my precious daughter, Ella, my loving husband, Eleftherios, and my dear sister, Sona. I cherish and treasure your love and support through the “thick and thin” of my academic life. To my parents, thank you for motivating me to reach greater heights. Through your selfless commitment to higher learning and proactive stand on matters concerning the general welfare of all, you have motivated me to always try hard, aim high, and never give up. To my grandmothers, Veron and Seda, for your gentle love and strong words of encouragement and always believing in me. You both are the embodiment of the Armenian woman - strong, intelligent, persevering, and above all, loving. I only wish to grow to be more like you two, in every sense. To my in-law mother and sister, thank you for your support, morally and otherwise. Marsha, thank you for watching Ella while I worked on this thesis. And Mama Yianna, each time I felt overwhelmed, I thought of your work ethic in regards to your own thesis and your perseverance through it all guided me back on point.

Most importantly, this thesis is dedicated to the countless older adults whom I have encountered, whose lives were drastically impoverished due to falls that could have been prevented. Your pain and suffering inspired me to take this opportunity and try to contribute to prevention efforts, with hopes that this thesis will serve as the stepping stone to a lifetime of productive work dedicated to fall prevention.
ACKNOWLEDGMENT

I would like to thank my committee members who supported my efforts in writing this thesis.

To my chair, Dr. Luciana Lagana’, thank you for all your support, both academic, as well as moral, throughout the years since we have met. You never cease to amaze me, the “Queen of grants and publications”, the professor, the actress, the mother and wife, but above all, the strong, intelligent, hard-working, and beautiful woman that you are! Your challenges are always met with plenty of encouragement and praise. Your expectations of me have always made me feel like I am being held to a higher standard, which motivated me to work that much harder to ensure that I do not let you down, and in this process I have not let my own self down either. Your passion and energy are immense, and I will always continue to learn from you and look up to you. Thank you for all your time and effort. Thank you for rooting for me and focusing on my strengths and accepting my weaknesses. You are second to none, Bella!

To Dr. Scott Plunkett, as I always say, you are the one person who has shown me that being a successful academic and a fun-loving, easy-going person are not mutually exclusive. Thank you for going out of your way to help me with this thesis and taking some of the pressure off by repeatedly reminding me that this is, well, a thesis. I speak for countless students who have utilized the resources you have taken care to develop for us, including the format for this paper and many other selfless endeavors you have undertaken to ensure our success. Thank you, Scott, for always being there for to help. Your kindness and willingness to help with this project is a testament of your commitment to student success. Your high level of dedication and incredible work ethic
will always inspire me. I have learned much from you, Scott, from the “Marriage and Family Relations” class as an undergrad to the several graduate seminars you have taught, and your advisement for this thesis. But most of all and most importantly, I have learned to “enjoy life”. It’s what counts at the end. Thank you, Scott.

To Mai Jara, my dear friend and mentor, thank you for helping put this thesis in a grander perspective. Your thoughtfulness and care to always include others in projects, to expand the scope and magnitude of impact, to help as many students learn and benefit from the work is inspirational, to say the least, if not even contagious. Thank you for taking time from your productive schedule to participate in this project and make it trans-disciplinary. Thank you for sharing the vision of future collaborations to indeed help prevent falls among those who may be at-risk. You are a shining example of Matador success and through your hard work and dedication, you have built a platform to help reach those who may stand to benefit from the results of this study. Thank you for all that you have done to help this thesis thus far, and thank you in advance for all your help in the future. I look forward to working with you on your part of the campus, from now on.

And of course, to my dear husband and fellow older adult falls researcher, Eleftherios Zarpas, thank you. You are my rock, and without all of your input, critiques and most of all, support, this thesis would not materialize. I love that among the many interests we share, our passion to help prevent older adults falls is prevalent. I only hope that I can return the same level of support for when you resume your graduate thesis project and look forward to being on a team together, to help improve fall prevention efforts for years to come. Go team Zarpas!
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ABSTRACT

RELATIVE RISK FOR A FUTURE FALL AMONG COMMUNITY-DWELLING OLDER ADULTS

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The purpose of this study was to examine the level of relative risk for a future fall associated with difficulties with performing various tasks related to normal daily functioning among community-dwelling adults 70 years and older. Functional status is often defined by cumulative scores across indices of independence in performing basic and instrumental activities of daily living (ADL/IADL). However, little is known about the unique relationship of each item with the fall outcome. In this study, risk analysis was performed on 6 ADLs, 7 IADLs and 10 items related to mobility limitations. Furthermore, the items were compared across a subsample of older adults who had a single fall and reported difficulty with walking and/or balance (FRAIL), as well as to a subsample with a history of a single fall and no difficulty with walking or dizziness. The items that had the strongest relationships and highest risk ratios for the FRAIL group, which had the highest probabilities for a future fall, included difficulties with eating (73%); managing money (70%); biting or chewing food (66%); walking a quarter of a mile (65%); using fingers to grasp (65%); and difficulty with dressing without help (65%). For the NDW+ND group, the most noteworthy items included difficulty with bathing or showering (79%); managing money (77%); shopping for personal items (75%); Walking up 10 steps without rest (72%); difficulty with walking a quarter of a mile (72%); and difficulty with stooping/crouching/kneeling (70%). These findings suggest that individuals’ ADLs and IADLs have substantive relationship with the fall outcome among older adults who have difficulty with walking and balance, but these indices do not effectively capture the fall risk associated with older adults who are high-functioning. Moreover, the relationship between items that are related to more challenging activities and the fall outcome revealed, that higher functioning older adults who report difficulties with the 6 items that yielded the highest risk ratios may also be at elevated risk for a fall. This study explored a relatively new perspective of fall-related item analysis and may have future research and clinical implications.
CHAPTER I
INTRODUCTION

Unintentional falls among older adults are a serious public health concern. Nearly half of the people above the age of 85 and a third of those over the age of 65 experience a fall, and nearly half of those who fall will experience another fall within a year (Center for Disease Control and Prevention [CDC], 2006; O’Loughlin, Robitaille, Boivin, & Suissa, 1993; Tinetti, Speechley, & Ginter, 1989; World Health Organization [WHO], 2004). Among older adults, falls are the leading cause of death from injury (Tinetti, 2003). In 2005, fall-related costs had reached $30 billion, and are estimated to more than double by 2020 (Stevens, Corso, Finkelstein, & Miller, 2006). When not fatal, falls can drastically impoverish one’s quality of life, contribute to caregiver burden, and further tax the nation’s health care system (Deiner & Mitchell, 2005).

The only mechanism for fall prevention is the facilitation of multifactorial evaluations intended to identify the risk factors that can be modified through targeted preventative interventions (Tromp, Plujim, Smit, Deeg, Bouter, & Lips, 2001). Community-dwelling older adults generally rely on their primary care providers to detect and address increased fall risk levels. Clinical consensus dictates that older adults undergo routine fall risk screenings and suggest that extensive multifactorial evaluations should be reserved for older adults who are considered to be at an elevated risk for falls (American Geriatrics Society [AGS], 2010; Ganz, Bao, Shekelle & Rubenstein, 2007). Such evaluations include assessing the older adults’ perceived functional abilities, as well as their independence in performing basic and instrumental activities of daily living (ADL/IADL). The findings of those evaluations help establish the course of action
intended to prevent future falls (AGS, 2010). However, little is known about the degree of risk associated with reported difficulty with each of those activities and whether there is a difference in risk level among higher-functioning older adults and those who are frail across the various activities in which they engage.

**Statement of the Problem**

The leading bodies that address fall prevention efforts among older adults (i.e., the American and British Geriatrics Societies) have published clinical practice guidelines, which recommend routine screenings to effectively identify older adults who may be at an elevated risk for a future fall. The older adults who are considered to be at high risk are those who present to the health care provider with an acute fall, or whose preliminary screenings reveal that they have experienced two or more falls within the past year. Older adults who indicate having difficulties with walking and/or balance are also considered to be at higher risk, including those with a history of a single fall (AGS, 2010). The guidelines for screening (AGS, 2010) further recommend that individuals who report a single fall undergo a gait and balance evaluation. If no difficulties with walking or balance are reported or demonstrated, then they are not required to undergo further risk assessment (AGS, 2010).

However, there is evidence suggesting that some physicians tend to under-detect falls and gait abnormalities (Rubenstein et al., 2004) and may need to be better aware of the features that predict future falls (Ganz et al., 2007). Even worse, many physicians simply do not follow the existing guidelines for routine evaluations (Wenger et al., 2009). Therefore, if the main criterion for risk assessments for those who have fallen once is to have difficulty with walking or balance when they are being screened for fall risk, then
many older adults may not be adequately identified to be at high risk if their physicians fail to recognize gait abnormalities. Moreover, since the screening process relies substantially on the older adults’ self-reports of perceived difficulty with walking or balance, then some older adults may simply mislead their doctors with their responses, particularly due to the lack of a clear definition for what exactly constitute “difficulties with walking” for the older adults to report themselves.

Given that half of the older adults who have fallen once will fall again (O’Loughlin et al., 1993; World Health Organization [WHO], 2004), it is of great importance to employ effective strategies for timely identification of those individuals who have fallen once and will have a recurring fall, due to the inherent danger associated with older adult falls. Additionally, since the screening process has a high potential for failing to adequately identify the individuals who may be at-risk and who would benefit from further assessment (for reasons stated in the previous paragraph), in this study, it was posited that the criteria for fall risk screening for those who have reported a fall are too stringent to effectively identify the 50% who may fall again. In other words, because of the multifactorial and complex nature of fall risk and because community-dwelling older adults have various levels of functioning, older adults who report a single fall and do not report difficulties with walking or balance could still be at elevated risk. Yet, the screening criteria do not allow for them to be captured.

The existing evidence relating functional ability and ADLs to fall risk suggests, that they are related and that (a) higher-functioning adults may be at lower risk for falls (e.g., Yokoya, Demura, & Sato, 2007), and (b) that individuals with decreased independence in performing their ADL/IADL and mobility limitations may be at higher
risk for falls (e.g. Ganz et al., 2007; Mendes de Leon, Seeman, Baker, Richardson & Tinetti, 1996; Shumway-Cook, Baldwin, Polissar, & Gruber, 1997). However, there is paucity of measures that quantify these relationships in terms of fall risk, as they relate to each item and not the cumulative scores in the scales and indices used to assess functional and mobility limitations. Particularly, to the authors’ knowledge, there are no studies that specifically cover risk of future falls in relation to each of the basic and instrumental ADL/IADL items among community-dwelling older individuals who report experiencing a single fall yet no difficulties with walking or dizziness. While dizziness and difficulty with walking can certainly contribute to fall risk, given the existing fall risk models (CDC, 2006; WHO, 2004), they are not necessarily the only factors that can lead to another fall, and therefore deserve attention given the increased likelihood of a future fall.

**Purpose**

The primary purpose of this retrospective, comparative study is to identify the degree of relative risk (RR) for a future fall that is associated with reported difficulty with performing activities of daily living (ADL/IADL) and other mobility limitations among community dwelling older adults who have reported experiencing a single fall during the past year. Subsequently, in this study the aim is to compare measures of risk associated with difficulty with each activity across two subsets of older adults, one of which is comprised of higher-functioning individuals who report no difficulties with walking and dizziness (NDW+ND), while the other subsample includes older adults who report difficulties with either walking or dizziness, or with both (FRAIL). By better understanding the level of risk associated with each item for each of the two subsamples, the items that are found in the present study to have the strongest association (RR) with
the fall outcome can have clinical implications and serve to better identify those individuals who have fallen once and may be at higher risk for another fall whether they have dizziness and/or difficulty with walking or not.

In this study it is suggested that, instead of being included as part of the multifactorial assessment process, the assessment of activities of daily living (ADL/IADL) and perceived mobility limitations be included in the screening process. This could be done by providing the older adults with packets with the ADL/IADL and select mobility assessment items that the older adults can complete (a) on their own while waiting to be seen by their doctors, or (b) with the help of a “minimally trained office staff” member (Oxman Renfro & Fehrer, 2011). A short screening tool such as this could also improve their communication of perceived functional status without consuming any ‘face-to-face time’ with their physician. Additionally, it is suggested that each of the items on those measures include “weights” based on obtained risk ratios, as they relate to each item, in order to allow for the doctor to better determine the level of risk associated with each response.

Definitions

1. A fall is generally defined as inadvertently coming to rest on the ground, floor, or other lower level, excluding intentional change in position to rest on furniture, wall or other objects. Falls, by definition, must be involuntary and unintentional, and do not include events that result from seizures, being struck, sudden onset of paralysis or loss of consciousness (Kellogg International Working Group, 1987).

2. Relative risk or risk ratio (RR) is defined as a comparison of the risk of a particular event (fall) for different groups of people (NDW+ND vs. FRAIL) and is usually
used to estimate exposure to something that could affect health (Agency for Healthcare Research and Quality [AHRQ], 2014).

3. Activities of daily living (ADL) are the basic tasks of everyday life, such as eating, bathing, dressing, toileting, and transferring (Wiener, Hanley, Clark, & Van Nostrand, 1990). Instrumental activities of daily living (IADL) are tasks that generally allow one to function independently within the community (Bookman, Harrington, Pass, & Reisner, 2007).

**Hypothesis**

The underlying assumption associated with the AGS (2010) fall risk screening process, outlined in their clinical practice guidelines, is that individuals who have experienced a single fall and who do not report difficulties with walking or dizziness are not at an elevated risk for falling. By making this distinction, this somewhat faulty clinical assumption allows for the opportunity for older adults who do function at higher levels to be excluded from further fall risk evaluation. Given that 50% of those who fall will fall again, this is a dangerous assumption to make. In the present study, it is contended that, while some individuals who have fallen once and who have difficulties with walking or balance may indeed be at elevated risk, those who do not report such difficulties may also be at-risk. In order to identify them, their perceived difficulties with more challenging activities that are related to walking (and not simply just walking itself) ought to be considered as the criteria for screening.
Assumptions

This research study was created based upon certain assumptions:

• All participants were community-dwelling adults and did not report having any acute illnesses or disorders, both physically and mentally, as well as any serious cognitive impairments.

• The respondents’ definitions of a fall did not include events that resulted from loss of consciousness, seizures, or other intrinsic event.

• The participants were be able to read and speak English and comprehend the questions related to the study.

• Participants provided complete and honest answers.

• The entry of data and subsequent analyses were free of errors.
CHAPTER II
REVIEW OF LITERATURE

The importance of evaluating fall risk among community-dwelling older adults has been noted for decades (O'Loughlin et al., 1993; Tinetti, 1987). However, there are still many challenges that serve as barriers to adequately addressing fall risk, particularly among this demographic. First, this is a relatively new field of study, as fall risk models, both in Europe and in the United States, were not identified until about a decade ago. In 2004, the World Health Organization’s Health Evidence Network, which is the researching body for the WHO’s decision makers, published a policy booklet addressing the issue of adult falls at length. Based on international literature reviews, the WHO’s fall risk model includes four main categories: intrinsic, extrinsic, degree of exposure to risk and socioeconomic factors.

In the United States, the Center for Disease Control and Prevention has identified a similar multi-dimensional model, but with only three main categories of risk factors: biological, behavioral, and environmental hazards. It is important to emphasize that while the many risk factors may not cause falls, they are strongly inter-related, and their interactions could significantly increase the probability of falling (Diener & Mitchell, 2005; Hong, Cho, & Tak, 2010). The results of several studies involving community dwelling older adults confirmed that, while the probability of a fall may be 10% to 27% among older adults who have none or one identified risk factor, the synergistic effect of four or more risk factors contribute to a dramatic increase in the probability of falling upwards of 69% to 78% (e.g., Nevitt, Cummings, Kidd, & Black, 1989; Tinetti et al., 1988). Timely detection of elevated fall risk can allow for facilitation of preventative
interventions, and while falls may not be completely eliminated, evidence suggests that multifactorial interventions reduce the frequent falling rate of older adults by 30% to 40% (Ganz et al., 2007).

**Fall Risk Assessments in Clinical Settings**

Traditionally, fall risk evaluations have been (a) heavily focused on clinical identifications of the biological risk factors and (b) generally limited to assessments of older adults residing in institutional settings (Cho, Scarpace, & Alexander, 2004; Myers, 2003; Perell, Nelson, Goldman, Luther, Prieto-Lewis, & Rubenstein, 2001). Most of the measurement tools that were utilized during those evaluations were validated by the developers of the instruments themselves and usually within the setting in which the measures were developed (Kim, Mordiffi, Bee, Devi, & Evans, 2007). These instruments were generally designed to measure a *single dimension* of risk, such as gait, balance, and/or functional mobility (Berg, 1989; Nakamura, Holm, & Wilson, 1998; Podsiadlo & Richardson, 1991; Tinetti, 1986; Whitney, Poole, & Cass, 1998). Clinical evaluations of the biological aspects of fall risk often failed to accurately identify all potential fallers. This is because measures of single dimension of risk present only a limited predictive value of a problem that encompasses multiple dimensions, in addition to the synergistic effect of the interactions between the various risk factors along each of the dimensions (Scott, Votova, Scanlan, & Close, 2007). This is particularly relevant for community-dwelling older adults who function at higher levels and whose behavioral risk factors and exposure to environmental risk factors may vary significantly from those of their institutionalized cohort (King & Tinetti, 1995; Tinetti et al., 1988).
Theoretically, for comprehensive evaluations to take place, community-dwelling older adults would have to visit their primary care providers who would conduct assessments of fall risk factors related to medical conditions that contribute to increased fall risk, such as diabetes or possible side effects of medication use (e.g., Berlie & Garwood, 2010; Huang, Karter, Danielson, Warton, & Ahmed, 2010). Subsequently, they would have to see physical therapists who are trained to conduct performance tests accurately (Matsusaka & McLean, 2003). The latter would address balance, gait, and mobility problems, while optometrists and/or otolaryngologists would address vision (Crews & Campbell, 2004) and hearing loss, dizziness, or improper use of related assistive devices (Grue, Kirkevold, & Ranhoff, 2009; Viljanen et al., 2009). Additionally, to address risk factors related to the behavioral dimension, psychologists would need to be involved to assess anxiety or fears related to falling (Murphy & Isaacs, 1982), while potential environmental hazards, particularly in the older adults’ homes, should be addressed by occupational therapists (Stevens, Holman, Bennet, & de Klerk, 2001). Furthermore, if particular risk factors were to be identified by any of those specialists, then additional diagnostic tests may also need to be rendered prior to actually beginning to deliver preventative interventions.

It is unrealistic to expect that the current health care system could be capable of adequately supporting such resource-intensive practices for routine fall risk assessment among community-dwelling older adults, particularly given the rapid growth of that demographic and the inherent complexity associated with older adult fall risk. The conventional approach to evaluating fall risk along a single dimension is not very effective due to its limited scope, while the theoretical approach to comprehensively
address fall risk among community dwelling older adults is simply not sustainable. As a result, the most practical methodology for fall risk evaluations has evolved to include a greater focus on developing reliable measurement tools that various clinicians can use to address fall risk factors multi-dimensionally. Supplementing this approach with older adults’ self-reports of data when performing diagnostic assessments may not be feasible.

For physicians to facilitate diagnostic assessments to identify the risk factors that can be modified through targeted interventions, they need reliable and practical tools that will allow for better identification of the prognostic values of fall risk (Tromp et al., 2001). Multidimensional fall risk screening measures can serve as the cornerstone for successfully identifying community-dwelling older adults who may be at elevated risk for falls. As a result, several researchers have suggested developing multifactorial fall risk evaluation tools that would be appropriate for use in primary care settings (Chen, Gleeson, Mitchell, O’Donnell & Olson, 2013; Ganz et al. 2007; Hirase, Matsusaka, Nakahara & Okita, 2014; Oxman Renfro & Fehrer, 2011; Tromp et al., 2001).

Multifactorial screenings in primary care setting can include limited clinical evaluations of performance or functional ability by the physicians but also be designed to be administered by “minimally trained office staff” (Oxman Renfro & Fehrer, 2011) and allow for inclusion of self-report data by the older adults themselves, when appropriate, to help the clinicians gain a better, more holistic understanding of the older adults’ fall risk level across all three dimensions simultaneously. However, data regarding the use of screening tools by health care providers does not seem to suggest that most physicians are implementing them in routine care and many of the existing fall risk screening tools used in clinical practice tools continue to lack evidence of successful testing and validation in
community settings (Scott et al, 2007; Vivrette, Rubenstein, Martin, Josephson, & Kramer, 2011). Furthermore, physicians often criticize some of the fall related measures for being “too long and burdensome” in order to be used in clinical settings (Lamb, Jorstad-Stein, Hauer, & Becker, 2005).

For these reasons it is contended that in order to successfully incorporate the fall risk screening process into routine geriatric care for physicians, the mechanism for the screening should overlap some of the existing practices that physicians engage in with their older patients. Given that assessments of the older adults’ activities of daily living (ADL/IADL) are often a part of the older adults’ physical annual evaluation process, and because the data regarding the ADLs/IADLs and mobility measures can be collected either by “minimally strained office staff” or reported by the older adults themselves on a questionnaire while they wait to be seen by the doctor, the benefits of the process are twofold. First, the minimally burdensome process would serve the purpose of providing the doctor with pertinent information regarding their patients’ overall functional status as a routine part of their physical evaluation. Also, it would provide greater insight regarding level of fall risk than just the simply inquiry regarding history of falls and balance problems alone, as suggested by the AGS (2010), particularly for those older adults who report a single fall. However, the latter would only be possible if the physicians have some kind of relative risk (RR) measures that accompany each response to the reported difficulties with the activities of daily living or other functional limitations, which is the primary purpose of the proposed study.
Self-Assessment as a Practical Alternative

Older adult *self-assessment*, as the basis for the initial screening for fall risk, can be an effective strategy for identifying those among them who may be at an elevated risk for falls, with the added benefit of also increasing awareness of an older adults’ own risk level (Vivrette *et al.*, 2011). Interestingly, despite the high prevalence of falls, many older adults are not aware of their own fall risk (Braun, 1998). To date, the only nationally available multifactorial fall-risk self-assessment screener that has been validated for community dwelling older adults was commissioned by the U.S. Centers for Disease Control and Prevention (2011). It is a 12-item dichotomized checklist that advises persons who scored into the “at-risk” category for a fall to follow up with a physician for further assessment (Rubenstein *et al.*, 2011).

The items selected as independent predictors of fall risk were adapted from the clinical practice guidelines from the American Geriatrics Society (2010). Some of the items used in this study are similar in their nature for the domain of physical functioning that they intend to assess, except that they are worded differently. For example, while one of the items in the present study includes questions asking whether the older adults have “*difficulty getting in and out of bed or chair without any help*?”, the FRQ poses the statement, “*I need to push down with my hands to stand up from a chair*” for the older adults to endorse as “yes” or “no”. FRQ includes self-report measures of gait and mobility, balance, lower extremity muscle weakness, peripheral sensory problems, medication, and assistive device use, as well as two psychological measures-depressed mood and fear of falling, which was operationalized as a dichotomized self-report of “*I am worried about falling*” (Rubenstein, Vivrette, Harker, Stevens, & Kramer, 2011).
Construct validity was assessed by comparing responses on the Fall Risk Questionnaire (FRQ) to an independent clinical fall risk examination using standard geriatric assessment approaches and metrics \((kappa = .875, p < .001)\). Per the authors, item-by-item agreement was established \((Chronbach’s alpha = .746, sensitivity = 100\%, \text{ and specificity} = 83.3\%)\). However, the authors acknowledged that the sample used for this validation study was small \((n = 40)\) and relatively homogenous and no information was available to determine the tool’s success in predicting future falls (Rubenstein et al., 2011).

Although there is insufficient information to determine the predictive power of this measure, the findings indicated that the instrument has the potential to identify those who are at an elevated risk. More importantly, the study demonstrated that self-report values of perceived functional abilities, including balance, strength, mobility, etc., are in agreement with clinical evaluations along the same domains, which is consistent with findings from other studies confirming the congruence of self and physician rated health measures for the older adult demographic (Ferrer, Lamarca, Orfila, & Alonso, 1999; Maddox & Douglass, 1973).

**Self-Report Measures Related to Fall Risk**

While self-report information may not always be as precise as data collected through clinical diagnostic techniques, subjective evaluations of perceived fall risk among older adults have been shown to have relevant implications. Specifically, fall-related *efficacy* refers to one’s perception of his or her capabilities within a particular domain of activities and represents the degree of confidence a person has in performing common daily activities without falling (Tinetti, Mendes de Leon, Doucette & Baker,
Fall-related efficacy has been emphasized in fall-related research for several decades since it provides insight into older adults’ behaviors that may contribute to the increased likelihood of them experiencing a fall. Similarly, fall-related fear, has also been researched for over three decades (Bhala, O’Donnell, & Thoppil, 1982; Murphy & Isaaca, 1982). Fall-related fear has been found to lead to distress, reduced quality of life, increased medication use, and decline in overall physical functioning due to self-imposed reduction in activities, which, in turn, have been found to lead to decreased muscle strength, flexibility, coordination, and decline in overall functioning, thus increasing the risk for future falls (Bruce, Devine, & Prince, 2002; Delbaere, Crombez, Vanderstraeten, Willems & Cambier, 2004; Franzoni, Rozzini, Boffelli, Frisoni & Trabucchi, 1994; Lach, 2005; Lachman, Howland, Tennstedt, Jette, Assmanmn & Peterson, 1998; Mendes de Leon et al, 1996; Yardley & Smith, 2002). Fear of falling was originally operationalized as low perceived self-efficacy and measured using the Falls Efficacy Scale (Tinetti, Richman, & Powell, 1990) through self-report data. However, it was later demonstrated that fear and efficacy were two related yet separate constructs (Li, Fisher, Harmer, Chautmeton, & Wilson, 2002; Tinetti et al., 1994).

Nevertheless, the Fall Efficacy Scale (FES) is considered to be the ‘gold standard’ (Skelton, 2004) and is the most widely used fall related psychological measurement tool (Moore & Ellis, 2009). The FES is comprised of 10 items, each representing a functional ability similar to ADL/IADLs and confidence in performing each task without falling is rated between 1 “very confident” and 10 “not confident at all”. It has been reviewed extensively (e.g., Powel & Myers, 1995; Yardley, Beyer, Hauer, Kempen, Piot-Ziegler, & Todd, 2005) across wide a variety of clinical geriatric samples and has consistently
yielded excellent psychometric properties—high reliability ($\alpha = 0.91$, Tinetti et al., 1990). According to Huang and Wang (2009), the scores on the FES among older adults have also been demonstrated to have excellent correlations with balance ($r = .07$), gait ($r = .67$) and mobility ($r = .71$), which indicates that self-reported information about functional abilities that were conventionally assessed clinically have been found to be relatively reliable. This suggests that there may be some value in the inclusion of items relating to these functional domains on questionnaires intended to help community dwelling older adults screen themselves for fall risk. Therefore, there is sufficient justification for the use of the self-report health information in order to evaluate the potential fall risk factors among community-dwelling older adults, i.e., the target population of this thesis.

**Measure of Association vs. Risk Factor**

It is important to point out that the variables assessed in this study are not to be interpreted as *causes* of falls, but rather as factors that are *associated* with falls. In this study, the relative risk (RR) for a future fall is assessed in relation to the items that relate to ADL/IADLs and mobility limitations which were adopted by the authors of the 1984 National Health Interview Survey (NHIS). This study is based on its Supplement on Ageing (SOA, 1984). It is widely noted in fall-related literature that a fall can result in decreased functioning and mobility (e.g., Bruce et al., 2002; Delbaere et al., 2004; Franzoni et al., 1994; Kiel, O’Sullivan, Teno & Mor, 1991; Lach, 2005; Mendes de Leon et al., 1996; Shumway-Cook et al., 1997; Yardley & Smith, 2002), which are associated with increased risk for a future fall. Therefore, conducting an in-depth item analysis on measures related to daily activities, functioning, and mobility can be material in
identifying potentially at-risk individuals based on their responses, since the not being able to perform such activities could indicate a greater, latent underlying cause, but may not be the root cause of a fall themselves.

The items selected to be tested in this thesis inquire about very similar tasks as the Falls Efficacy Scale (Tinetti et al., 1990), as well as the Activities-Specific Balance Efficacy Scale (ABC) developed by Powel and Myers (1995), which quantify level of perceived fall risk during everyday activities that require strength, balance, and coordination. For example, the FES inquires about older adults’ confidence in performing the following activities without falling: “cleaning the house (e.g., sweep, vacuum, dust)”, “getting dressed or undressed”, “preparing simple meals”, “taking a bath or shower”, “going to the shop”, “getting in or out of a chair”, “going up or down stairs”, “walking around in the neighborhood”, “reaching for something above your head or on the ground”, or “going to answer the telephone before it stops ringing”.

Similarly, nearly all of the measures used in the original study (SOA, 1984) from which data for this study were used, include inquiring about the same tasks, such as doing light or heavy housework, dressing, bathing, walking up ten steps without rest, walking a quarter of a mile, using the telephone, getting in and out of a chair or bed, reaching up overhead, stooping/ crouching/kneeling, and other activities. However, instead of asking information about older adults’ degree of confidence regarding performing them, in this study, respondents were asked whether they had difficulties with doing so without any help. Generally speaking, the instruments used in this study are widely accepted as measures of daily living skills, often referred to as “activities of daily living” (ADLs) and
“instrumental activities of daily living” (IADLs), as well as general measures of limited mobility, that are commonly used in geriatric care.
CHAPTER III

METHODOLOGY

Procedures

The Longitudinal Study of Aging (LSOA) is based on a sample drawn from the Supplement on Aging (SOA) to the 1984 National Health Interview Survey (NHIS). Three different procedures were used to collect the interview data in the Longitudinal Study of Aging (LSOA), including personal interviewing in the household, telephone/computer-assisted telephone interviewing (CATI), as well as mail-in, paper questionnaires. The interviewers who conducted the personal interviews were Bureau of the Census staff who had undergone special training for this project. The NHIS basic questionnaire was used to collect basic health information about all household members. SOA interviews were conducted with the sample person whenever possible. There was no protocol required for this study, as the data are available publically and do not include any individual identifiers.

Sample

Of the 7,478 individuals in the sample, 1,675 (22.9%) indicated that they had experienced at least one fall within the past year, which is below the general rate of one in three commonly reported in fall-related literature (CDC, 2006; O’Loughlin et al., 1993; Tinetti et al., 1989; WHO, 2004). The individuals who reported falling were significantly older ($\bar{x} = 78.15, SD = 6.21$) than the individuals who reported no falls ($\bar{x} = 76.43, SD = 5.32$), $F(1, 7477) = 128.04, p < .001$. Of those who fell, 837 (50%) indicated that they only fell once and were on average, one year younger ($\bar{x} = 77.6, SD = 5.99$) than the 838 (50%) adults who reported experiencing more than one fall ($\bar{x}$
bar = 78.7, SD = 6.37), a difference that was statistically significant, $F(1,1674) = 4.16, p. < .001$. Post-hoc Sheffe test revealed that individuals over 80 years of age had significantly higher rates of fallings ($p < .001$).

Figure 1. The mean age of the non-fallers, single-fallers and recurrent fallers.

The sample included 3466 (60%) women, who accounted for 62% of all the fallers. The rate of falls among women was higher (20%) than among men (13.6%), both for single falls (11.6% vs. 8.2%) as well as recurrent falls (5.4% vs. 8.5%). Although the difference in fall rates among the sexes is statistically significant, as revealed through a Chi-square test of independent samples, the magnitude of the difference is marginal, $\chi^2(1, 7478) = 51.52, p. < .001, \varphi = .08$. Additionally, there was no significant interaction between age and sex for falls $F(26, 5786) = 1.176, p = .245$. For the purposes of this
thesis, the subsequent analyses and descriptions will only include the individuals who indicated experiencing at least one fall during the past 12 months. Of those who indicated having a single fall \((N = 833)\), 50.4\% \((n = 415)\) indicated having no difficulties with walking or dizziness \((\text{NDW+ND})\), while 49.6\% \((n = 413)\) reported difficulties with walking, balance, or both \((\text{FRAIL})\).

**Measurement**

The demographic variables included age and sex. The item analysis for obtaining risk ratio included measures modeled after the activities of daily living (ADLs) index \((\text{Katz, Ford, Moskowitz, Jackson, & Jeffe, 1963})\); the instrumental activities of daily living (IADLs) were modeled after the Duke University Center for the Study of Aging and Human Development (1978) index; and the 10-item mobility limitation measures were adopted from the Nagi (1976) scale relating to disability.

The more general construct that is adopted in this study as the main determining factor for identifying higher functioning older adults is their perceived difficulty with “walking.” Although walking is generally considered as one of the ADLs, for the purpose of this thesis, it was isolated, because of the AGS (2010) criterion that was specified as part of the recommended screening process. Similarly, an item regarding “sometimes having dizziness” was also isolated, and those individuals who reported no difficulties with walking and no dizziness were selected as the “NDW+ND” subsample. This was done because according to the AGS (2010) screening guidelines, these individuals would not be considered at-risk and would not have further evaluations. The remaining respondents who provided a positive response to the item “Sometimes I have trouble with dizziness”, as well as those who indicated that they fell due to dizziness were included in
the FRAIL group, because according to the AGS (2010) guidelines for screening, they would be considered as being at high risk and would be recommended to undergo further evaluations.
CHAPTER IV
RESULTS

We used SPSS 22.0 (IBM SPSS Inc., Armonk, NY) for all data analyses. Risk ratios were calculated for 23 items via the SPSS construction of 2x2 contingency tables. Each table included the dichotomous responses to (a) the functional status measures (0 = “no difficulty”, 1 = “difficulty”) and (b) the fall outcome (0 = “single fall” and 1 = “two or more falls”). This was done due to the fact that the goal of this study was to determine risk for a future fall among participants who reported a history of a single fall. The same analysis was carried out for each of the 2 groups - the FRAIL group and the NDW+ND group. The strength of the association between the functional status items and fall outcome was quantified through Cramer’s $V$ contingency coefficient ($V$). Choosing this coefficient was optimal, as it is robust to chi-square significance obtained merely because of large sample size alone, and has greater generalizability across numerous contingency tables of varied sizes (Crewson, 2014). We set as the minimum threshold for the measure of association a $V$ value of 0.10 (10%), with values above this level being indicative of a substantive relationship between the items. Additionally, for each item, we chose to covert the relative risk ratios (RR) to probabilities using the formula. Reporting results in percentage form enhances the interpretability of the change in fall risk associated with reported difficulties engaging in each of the activities (vs. no reported difficulty).

The results of the risk analyses revealed that there were variations in risk ratios across each of the items, and that there were differences among the two groups of respondents across the relative risks ratios for each of the survey items. The measures of
associations ($V$) were also obtained for each relationship between items and fall outcome, and were found to be statistically low. For the FRAIL group, all of the chi-square tests and measures of association were significant at $p < .05$ level, whereas, in the higher functioning group, only 17 items revealed significant relationships, with only 14 meeting the minimum threshold criterion.

**The FRAIL Group**

For the FRAIL group, there were 15 items that met this criterion. However, the relationships between the items were relatively low and only ranged from .100 to .155 (16%). For this group, the probability of a future fall associated with the 15 items meeting the selected minimum threshold ranged from almost 60% to 73%. The highest risk ratio related to the fall outcome was obtained for the item representing reported difficulties with eating independently, $RR = 2.72 \ (95\% \ CI = 1.54-4.79, V = .112, p. < .001)$. This result indicates that the probability of a future fall for those who reported difficulties with eating was 73% higher than for those individuals who reported no difficulty with eating. Interestingly, difficulty with managing money without help had the second highest relative risk ratio for the fall outcome and yielded the strongest relationship, $RR = 2.34 \ (95\% \ CI = 1.65-3.31, V = .155, p < .001)$. The probability of a fall among individuals who reported difficulties with managing money was nearly 70% higher than for those who reported no difficulty with this task.

*Trouble with biting or chewing food* without assistance had the second strongest relationship with the fall outcome and the third highest risk ratio, $RR = 1.92 \ (95\% \ CI = 1.47-2.51, V = .150, p. < .001)$. This suggests that the probability of falling for the second time for respondents who reported difficulties with biting or chewing food was 66% (vs.
no difficulty with the tasks, respectively). The next three items that had the highest risk for a future fall were related to difficulties with walking a quarter of a mile, RR = 1.85 (95% CI = 1.39-2.47, \( V = .134, \ p < .001 \)), using fingers to grasp, RR = 1.85 (95% CI = 1.38-2.49, \( V = .129, \ p < .001 \)), and dressing, RR = 1.82 (95% CI = 1.33-2.49, \( V = .118, \ p < .001 \)). The probabilities for a future fall related to difficulties with the above-mentioned activity items were 65% for each. The remaining 10 items all yielded a probability for a future fall between 60% and 65%. These results are illustrated in greater detail in Table 1.

### Table 1

*The Relative Risk Ratios and Measures of Association for the Frail Group*

<table>
<thead>
<tr>
<th>Difficulty with:</th>
<th>R.R.</th>
<th>Lower</th>
<th>Upper</th>
<th>Cramer's (( V ))</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing money</td>
<td>2.335</td>
<td>1.648</td>
<td>3.308</td>
<td>.155</td>
<td>.000</td>
</tr>
<tr>
<td>Trouble biting or chewing food</td>
<td>1.916</td>
<td>1.465</td>
<td>2.506</td>
<td>.150</td>
<td>.000</td>
</tr>
<tr>
<td>Walking a quarter of mile</td>
<td>1.853</td>
<td>1.391</td>
<td>2.468</td>
<td>.134</td>
<td>.000</td>
</tr>
<tr>
<td>Using fingers to grasp</td>
<td>1.849</td>
<td>1.377</td>
<td>2.484</td>
<td>.129</td>
<td>.000</td>
</tr>
<tr>
<td>Shopping for personal items</td>
<td>1.666</td>
<td>1.279</td>
<td>2.170</td>
<td>.122</td>
<td>.000</td>
</tr>
<tr>
<td>Dressing</td>
<td>1.819</td>
<td>1.328</td>
<td>2.492</td>
<td>.118</td>
<td>.000</td>
</tr>
<tr>
<td>Doing light housework</td>
<td>1.762</td>
<td>1.292</td>
<td>2.403</td>
<td>.118</td>
<td>.000</td>
</tr>
<tr>
<td>Doing heavy housework</td>
<td>1.649</td>
<td>1.231</td>
<td>2.210</td>
<td>.113</td>
<td>.001</td>
</tr>
<tr>
<td>Eating</td>
<td>2.717</td>
<td>1.542</td>
<td>4.787</td>
<td>.112</td>
<td>.000</td>
</tr>
<tr>
<td>Being on feet for 2 hours</td>
<td>1.713</td>
<td>1.267</td>
<td>2.316</td>
<td>.111</td>
<td>.000</td>
</tr>
<tr>
<td>Walking up 10 steps w/o rest</td>
<td>1.599</td>
<td>1.222</td>
<td>2.093</td>
<td>.109</td>
<td>.001</td>
</tr>
<tr>
<td>Getting outside</td>
<td>1.540</td>
<td>1.184</td>
<td>2.002</td>
<td>.101</td>
<td>.001</td>
</tr>
<tr>
<td>Preparing own meals</td>
<td>1.601</td>
<td>1.183</td>
<td>2.166</td>
<td>.100</td>
<td>.002</td>
</tr>
<tr>
<td>Getting in or out of bed or chair</td>
<td>1.585</td>
<td>1.194</td>
<td>2.105</td>
<td>.100</td>
<td>.001</td>
</tr>
<tr>
<td>Reaching up over head</td>
<td>1.519</td>
<td>1.173</td>
<td>1.968</td>
<td>.100</td>
<td>.001</td>
</tr>
<tr>
<td>Stooping/crouching/kneeling</td>
<td>1.631</td>
<td>1.197</td>
<td>2.221</td>
<td>.098</td>
<td>.002</td>
</tr>
<tr>
<td>Bathing or showering</td>
<td>1.507</td>
<td>1.154</td>
<td>1.968</td>
<td>.094</td>
<td>.003</td>
</tr>
<tr>
<td>Using the telephone</td>
<td>1.727</td>
<td>1.199</td>
<td>2.486</td>
<td>.094</td>
<td>.003</td>
</tr>
<tr>
<td>Lifting/carrying 25 lbs</td>
<td>1.566</td>
<td>1.157</td>
<td>2.118</td>
<td>.092</td>
<td>.004</td>
</tr>
<tr>
<td>Using toilet</td>
<td>1.683</td>
<td>1.185</td>
<td>2.389</td>
<td>.092</td>
<td>.003</td>
</tr>
<tr>
<td>Reach out as if to shake hands</td>
<td>1.928</td>
<td>1.122</td>
<td>3.312</td>
<td>.076</td>
<td>.016</td>
</tr>
<tr>
<td>Lifting/carrying 10 lbs</td>
<td>1.345</td>
<td>1.037</td>
<td>1.743</td>
<td>.072</td>
<td>.025</td>
</tr>
<tr>
<td>Sitting for 2 hours</td>
<td>1.362</td>
<td>1.003</td>
<td>1.850</td>
<td>.062</td>
<td>.048</td>
</tr>
</tbody>
</table>

**The NDW+ND Group**

For the NDW+ND group, the strength of significant associations between activity item and fall risk outcome was low, yet still higher than the associations relative to the
FRAIL group, ranging from .107 to .190. Although all 14 items were significantly associated with the fall outcome, two of the items had 95% Confidence Intervals that were too large to convey meaningful risk ratios. Those items were related to experiencing difficulties with *getting in and out of bed or chair* and with *getting outside*. The cross-tabulations showed that less than 1% of the respondents in this group indicated having difficulties with each of those activities (a reasonable outcome, as individuals who do not have difficulties with walking or balance would not typically report having difficulties with items of this nature).

Overall, the individuals in the NDW+ND group displayed moderate levels of risk, and the probabilities for falling among those who reported difficulties with engaging in some of these activities ranged from about 65% to 79%. The item with the highest relative risk ratio was having difficulties with *bathing or showering* independently, RR = 3.71 (95% CI = 1.74-7.89, \(V = .144, p < .001\)), suggesting a 79% probability of a future fall among those who reported difficulties with performing this activity independently. Difficulties with *managing money* independently had the second highest relative risk ratio, RR = 3.41 (95% CI = 1.53-7.58, \(V = .127, p = .002\)), indicating a 77% probability of a future fall for those who have difficulties engaging in this activity.

Older adults who reported difficulties with *shopping for personal items* independently were 3 times more likely to fall than those who reported no difficulty with this task, RR = 3.03 (95% CI = 1.54-5.97, \(V = .134, p = .001\)). Difficulties with *preparing own meals* independently was also associated with nearly 3 times the likelihood for a second fall, RR = 2.99 (95% CI = 1.32-6.78, \(V = .112, p = .006\)). The probability of falling for those with difficulties engaging in this activity was about 75%. Experiencing
difficulties with walking up 10 steps without rest had a relatively strong relationship with the fall outcome, as well as an elevated risk ratio, RR = 2.58 (95% CI = 1.67-3.97, \( V = .175 \), \( p < .001 \)), with the probability of a fall being over 72%. Similarly, reported difficulties with walking a quarter of a mile yielded a strong association and risk, RR = 2.54 (95% CI = 1.71-3.78, \( V = .188 \), \( p < .001 \)). For the NDW+ND group, the strongest relationship was between fall risk and experiencing difficulties with stooping/crouching/kneeling, RR = 2.28 (95% CI = 1.62-3.22, \( V = .190 \), \( p < .001 \)). The probability of falling for individuals who reported difficulties with stooping/crouching/kneeling was about 70%. The remaining 5 items had relative risk ratios ranging from 1.89-2.24, as illustrated in greater detail in Table 2.

### Table 2

*The Relative Risk Ratios and Measures of Association for the NDW+ND Group*

<table>
<thead>
<tr>
<th>Difficulty with:</th>
<th>R.R.</th>
<th>Lower</th>
<th>Upper</th>
<th>Cramer's (V)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stooping/crouching/kneeling</td>
<td>2.281</td>
<td>1.617</td>
<td>3.216</td>
<td>.190</td>
<td>.000</td>
</tr>
<tr>
<td>Walking a quarter of mile</td>
<td>2.542</td>
<td>1.710</td>
<td>3.779</td>
<td>.188</td>
<td>.000</td>
</tr>
<tr>
<td>Being on feet for 2 hours</td>
<td>2.229</td>
<td>1.564</td>
<td>3.175</td>
<td>.180</td>
<td>.000</td>
</tr>
<tr>
<td>Walking up 10 steps w/o rest</td>
<td>2.576</td>
<td>1.671</td>
<td>3.637</td>
<td>.175</td>
<td>.000</td>
</tr>
<tr>
<td>Doing heavy housework</td>
<td>2.240</td>
<td>1.468</td>
<td>3.417</td>
<td>.161</td>
<td>.000</td>
</tr>
<tr>
<td>Bathing or showering</td>
<td>3.710</td>
<td>1.743</td>
<td>7.894</td>
<td>.144</td>
<td>.000</td>
</tr>
<tr>
<td>Getting in or out of bed or chair</td>
<td>7.298</td>
<td>2.014</td>
<td>26.445</td>
<td>.140</td>
<td>.000</td>
</tr>
<tr>
<td>Shopping for personal items</td>
<td>3.026</td>
<td>1.535</td>
<td>5.967</td>
<td>.134</td>
<td>.001</td>
</tr>
<tr>
<td>Managing money</td>
<td>3.409</td>
<td>1.532</td>
<td>7.583</td>
<td>.127</td>
<td>.002</td>
</tr>
<tr>
<td>Picking up/lifting 10 lbs</td>
<td>2.321</td>
<td>1.357</td>
<td>3.972</td>
<td>.127</td>
<td>.002</td>
</tr>
<tr>
<td>Trouble biting or chewing food</td>
<td>1.886</td>
<td>1.253</td>
<td>2.840</td>
<td>.122</td>
<td>.002</td>
</tr>
<tr>
<td>Reaching up over head</td>
<td>1.993</td>
<td>1.242</td>
<td>2.300</td>
<td>.115</td>
<td>.004</td>
</tr>
<tr>
<td>Preparing own meals</td>
<td>2.992</td>
<td>1.320</td>
<td>6.784</td>
<td>.112</td>
<td>.006</td>
</tr>
<tr>
<td>Getting outside</td>
<td>4.467</td>
<td>1.360</td>
<td>14.678</td>
<td>.107</td>
<td>.007</td>
</tr>
<tr>
<td>Dressing</td>
<td>3.531</td>
<td>1.169</td>
<td>10.670</td>
<td>.094</td>
<td>.017</td>
</tr>
<tr>
<td>Lifting/carrying 25 lbs</td>
<td>1.506</td>
<td>1.065</td>
<td>2.131</td>
<td>.094</td>
<td>.020</td>
</tr>
<tr>
<td>Doing light housework</td>
<td>2.340</td>
<td>1.029</td>
<td>3.518</td>
<td>.084</td>
<td>.037</td>
</tr>
<tr>
<td>Sitting for 2 hours</td>
<td>1.579</td>
<td>.899</td>
<td>2.776</td>
<td>.064</td>
<td>.110</td>
</tr>
<tr>
<td>Reaching out as if to shake hands</td>
<td>2.573</td>
<td>.571</td>
<td>11.601</td>
<td>.051</td>
<td>.203</td>
</tr>
<tr>
<td>Using toilet</td>
<td>2.874</td>
<td>.477</td>
<td>17.333</td>
<td>.048</td>
<td>.228</td>
</tr>
<tr>
<td>Using the telephone</td>
<td>1.647</td>
<td>.725</td>
<td>3.741</td>
<td>.048</td>
<td>.229</td>
</tr>
<tr>
<td>Using fingers to grasp</td>
<td>1.322</td>
<td>.758</td>
<td>2.306</td>
<td>.039</td>
<td>.325</td>
</tr>
<tr>
<td>Eating</td>
<td>.633</td>
<td>.065</td>
<td>6.121</td>
<td>-.016</td>
<td>.690</td>
</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION

The purpose of this study was to quantify the relative risk associated with each activity item from the ADL and IADL indices, as well as with 10 items related to more challenging tasks. Additionally, this study aimed to determine whether there were differences in relative fall risk across those items among older adults with a history of a single fall - who reported having difficulties with walking or dizziness - and those who reported not having difficulties related to these items. Our results supported the hypotheses that (a) items across the 2 indices of daily living skills (ADL/IADL) and the 10-item functional limitations scales yielded unique and meaningful relative risk ratios, (b) the responses of the two groups were related to fall outcome for generally different items, with the NDW+ND group’s responses having stronger relationships between fall outcome and more challenging activities, and (c) older adults who reported no dizziness and no difficulty with walking may be at elevated risk and need further evaluation, despite the AGS’s (2010) recommendations.

The items that had the strongest $V$ relationships and highest risk ratios in the FRAIL group included having difficulties with eating (73%); managing money (70%); biting or chewing food (66%); walking a quarter of a mile (65%); using fingers to grasp (65%); and having difficulties with dressing without help (65%). For the NDW+ND group, the most noteworthy items related to fall outcome included experiencing difficulties with showering (79%); managing money (77%); shopping for personal items (75%); walking 10 steps without rest (72%); difficulties with walking a quarter of a mile (72%); and difficulties with stooping/crouching/kneeling (70%).
Discussion of the Findings

Two of the top 3 items associated with the highest probability of a future fall for the FRAL group included eating (73%) and biting or chewing food (66%), which are the more basic of the ADLs. Neither of those items was relevant in the NDW+ND, which supports the classification of the two groups based on their perceived functional abilities. Additionally, the older adults in the FRAIL group reported difficulties with using fingers to grasp (65%), which can be considered as another basic skill. As previously mentioned, it important to understand these relationships in terms of associations and not in terms of causality. These findings support the notion that other latent risk factors, for instance, older adults’ overall frailness, may be contributing to the increased risk associated with difficulties performing these basic tasks. Individuals in the NDW+ND group were regarded as higher functioning precisely because it was presumed that they would not report difficulties with such basic activities of functioning. The above finding also suggests that using some of the activity items of the ADL index with populations of higher functioning older adults may not be fruitful, as the activities on that index do not effectively capture the relatively small limitations of this group.

The two items that overlapped in the two groups included managing money and walking a quarter of a mile. However, the relative risk ratio associated with each of these items in the groups varied somewhat significantly, with the FRAIL group exhibiting lower risk ratios than the NDW+ND group (70% vs 77%; and 65% vs. 72%, respectively). This finding is rather surprising, and further research is needed to better understand the 7% difference between the two groups concerning these items.

The findings on older adults in the NDW+ND group concerning fall outcome
were somewhat unexpected, especially concerning the following activities: difficulties
with showering (79%); shopping for personal items (75%); walking 10 steps without rest
(72%); and difficulties with stooping / crouching / kneeling (70%). Yet, these findings
are reasonable, as these activity items describe tasks that are more challenging, and thus
they are more characteristic of the higher functioning group. The findings on this group
should be investigated further in future studies. Generally speaking, they seem to imply
that fall risk for those older individuals may be related more closely to the behavioral
dimension, as opposed to the biological dimension that seems to be associated with the
responses from those in the FRAIL group.

Overall, the results of the risk analysis revealed that the magnitude of association
between activities and fall outcome was statistically low. Fall risk is multifactorial and
complex, while each of the items that were found to be significantly associated with fall
outcomes represent common, often basic activities of daily functioning. Therefore,
relationships between fall and such activities, even if of relatively low magnitude, could
be meaningful when attempting to identify seniors who may be at risk of experiencing a
future fall (given that each respondent reported a history of a single fall). Above all,
because falls can be a matter of life and death, any strategy that could help predict a
future fall is better than relying on chance alone.

Limitations and Research Implications

In this study, we identified several daily activities that related to fall outcome. Our
findings will add to the understanding of the relationship between functional status and
fall risk, particularly as it relates to each of the items most commonly used in geriatric
research and clinical practice. However, this study had several limitations, the most
prominent being that since this was a secondary analysis of an existing dataset, the definition of a fall used for the study could not be verified. Extensive research of documentation related to the original study (LSOA, 1984), as well as other fall-related publications that were based on data from the Supplement on Aging (1984), yielded no indication of the definition that may have been used. This indicates that some, albeit few, respondents may have included falls that occurred as a result of some intrinsic event in their responses. However, given the large sample of individuals who reported falls \( n = 1675 \), it is doubtful that this confusion could have affected the finding in any relevant way. Secondly, the collection of data for this study took place in 1984, and there may have been some aspects of fall risk that may have changed since then, but it is difficult to reliably identify any such factor.

Suggestions for further research include replication of findings in other community dwelling samples and a deeper evaluation of the increased risk ratios related to the NDW+ND group’s results across the 6 items. Furthermore, in addition to the dichotomized responses that were used in this study, the original dataset (which is available to the public) also includes responses to each of the items that are measured along 3 additional levels of difficulty, rated from “some” to “unable”. For example, if a respondent indicated that they have difficulties with eating, there is data regarding a follow up question intended to determine the level of difficulty that is associated with the response. Through logistic regression, the data can be further analyzed to determine which levels of the difficulty are the responses associated most strongly to the fall outcome in order to better identify the older adults who may be at the highest risk for a future fall.
Implications

Given that measures of independence along the indices of activities of daily living are commonly used in clinical practice, the availability of relative risk associated with each item of those measures for older adults who report a single fall, particularly if difficulties with walking and/or dizziness are also present, allows for practical and feasible evaluation of fall risk. The results of this study suggest that health care providers can effectively screen their patients for risk of a future fall by using information that is already available to them. Also, they may not have to collect additional information that is not routine for their practice, solely for the purposes of fall risk assessment. Primary care physicians often have limited time that they can devote to each patient, and given that geriatric patients often have chronic conditions that may occupy the significant portion of their evaluations during their visit with the physician, facilitating greater feasibility for addressing fall risk without consuming additional time and resources from their visit can serve to improve the probability of fall risk screening taking place, as well as the effectiveness of the screening itself.

Conclusion

The purpose of this study was to examine the degree of fall risk associated with each response to various measures of functional ability, as set forth in the National Health Survey Interview’s Supplement on Aging (1984). Particularly, the aim was to determine whether there were differences in the relative risk associated with responses among single fallers who report difficulties with walking and/or dizziness, and those who reported having neither of those conditions. The results supported the hypothesis that there were differences among the two subsamples, and moreover, the item risk analyses revealed
that each subsample had unique set of items had the strongest associations and carried the highest risk according the pre-determined distinction based on the level of functioning of the subsamples.
REFERENCES


scale. *The Journals of Gerontology: Series A, Biological Sciences and Medical Sciences* 50, 28–34.


APPENDIX A

MEASURES USED IN THE THESIS

Demographic Measures
Age
Sex

Functional Status
Difficulty walking
Sometimes have trouble with dizziness/fell because of dizziness

Ability Measures
Difficulty performing the following activity without help - walk quarter of mile
Difficulty performing the following activity without help - walk up 10 steps w/o rest
Difficulty performing the following activity without help - stand/being on feet for 2 hours
Difficulty performing the following activity without help - sitting for 2 hours
Difficulty performing the following activity without help - stoop/crouch/kneel
Difficulty performing the following activity without help - reaching up over head
Difficulty performing the following activity without help - reach out as if to shake hands
Difficulty performing the following activity without help - using fingers to grasp
Difficulty performing the following activity without help - lifting/carrying 25 lbs
Difficulty performing the following activity without help - lifting/carrying 10 lbs

Activities of Daily Living
Trouble biting or chewing food
Have difficulty bathing or showering
Have difficulty dressing
Have difficulty eating
Have difficulty getting in or out of bed or chair
Have difficulty getting outside
Have difficulty using toilet
Have difficulty preparing own meals
Have difficulty shopping for personal items
Have difficulty managing money
Have difficulty using the telephone
Have difficulty doing heavy housework
Have difficulty doing light housework