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The Effects of the A Matter of Balance Program on Falls, Physical Risks of Falls, and Psychological Consequences of Falling among Older Adults

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by

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Abstract

The effectiveness of the *A Matter of Balance* (MOB) program, a multifactorial falls prevention intervention, is uncertain. Although targeting multiple risk factors of falling at the same time seems reasonable and desirable, in that falls are often caused by several risk factors, results from previous studies investigating the effects of multifactorial falls prevention interventions are inconsistent. In addition, research shows that single factor interventions (e.g., exercise) can produce the same effects. The cost-effectiveness of multifactorial falls prevention interventions has varied across studies (e.g., Jenkyn, Hoch, & Speechley, 2012; Tinetti, Baker, et al., 1994). Despite the fact that the American Geriatrics Society and British Geriatrics Society (2001) have incorporated multifactorial falls prevention interventions into geriatric practice guidelines, more studies are needed to better understand the effects of the MOB program on falls and risk factors for falling among older adults.

The MOB program aims to reduce fear of falling by increasing self-efficacy and perceived control (Tennstedt et al., 1998). This program provides exercises to enhance older adults' physical capacities, lessons to teach seniors fall-related risk factors, and methods to enhance self-efficacy. Previous studies mainly focused on the effects of the MOB program on fear of falling and falls efficacy. However, falls, fear of falling, and physical frailty (e.g., poor balance) are all

correlated. Little is known about the effects of the MOB program on falls and related physical risk factors. Meanwhile, fear of falling and falls efficacy are two constructs often used to delineate psychological consequences of falling, but there has been confusion about these two constructs. As a result, researchers have been using measures developed for falls efficacy to assess fear of falling in error. Previous study also shows that both fear of falling and falls efficacy need to be examined after intervention with separate appropriate measures(e.g., Valentine, Simpson, Worsfold, & Fisher, 2011). Nevertheless, in the research of the MOB program, studies often examined either fear of falling or falls efficacy, but not both (e.g., Tennstedt et al., 1998; Zijlstra et al., 2009). Therefore, whether the MOB program could improve both fear of falling and falls efficacy is uncertain.

This dissertation includes three studies to examine the effects of the MOB program. The first study explores whether the program could effectively prevent falls and improve physical risk factors (i.e., mobility, walking speed, and postural control) among older adults. The second study examines the psychometric properties of a modified fear of falling measure and the effects of the program on fear of falling and falls-efficacy. The third study investigates whether the effects of the MOB program on falls, mobility, walking speed, and postural control can be maintained across five months. Three studies using a comparison group design were conducted to examine each objective. Data were collected at baseline (Time 1), the conclusion of the program (Time 2), and at a 3-month follow-up (Time 3).

Overall, the studies in this dissertation show that older adults can improve their mobility, walking speed, postural control, fear of falling, and falls efficacy by participating in the MOB program but the program did not affect the total number of falls. The results also showed that older adults who received the MOB program reached their highest performance on mobility and walking speed immediately at the end of the program. However, their performance on postural control continued to improve and was the best at the 3-month follow-up.

Chapter One:

Introduction

Falls are a serious public concern. Findings from previous studies demonstrate that more than 30% of community-dwelling adults aged 65 years and older fall every year (Blake et al., 1988; Campbell, Reinken, Allan, & Martinez, 1981; Prudham & Evans, 1981; Tinetti & Speechley, 1989). Among older people who fall, half become recurrent fallers (Nevitt, Cummings, Kidd, & Black, 1989; Tinetti, Speechley, & Ginter, 1988; Tromp, Smit, Deeg, Bouter, & Lips, 1998). The rates of falls and recurrent falls are even higher among the elderly in institutional care (Kron, Loy, Sturm, Nikolaus, & Becker, 2003; Luukinen, Koski, Laippala, & Kivela, 1995).

Fall-related death is the leading cause of mortality due to unintentional injuries among older adults (Centers for Disease Control and Prevention [CDC], 2005). Although less than 10% of falls lead to fracture or head trauma (Nevitt, Cummings, & Hudes, 1991; Nevitt et al., 1989; Rubenstein & Josephson, 2002; Tinetti et al., 1988), older survivors of falls often experience impaired physical (e.g., poor postural control), psychological (e.g., fear of falling), and mental health (depression; Berg, Alessio, Mills, & Tong, 1997; Fabrício, Rodrigues, & Costa Junior, 2004; Stel, Smit, Pluijm, & Lips, 2004). More importantly, falls place an enormous toll on our society and the health care system (Englander, Hodson, &

Terregrossa, 1996; Stevens, Corso, Finkelstein, & Miller, 2006). Therefore, preventing falls in the older population is crucial.

There are more than 400 fall-related risk factors that have been identified (Oliver, Britton, Seed, Martin, & Hopper, 1997). These risk factors can be broadly categorized into intrinsic risk factors, such as abnormal gait or postural instability, and extrinsic risk factors, such as environmental hazards or footwear (Masud & Morris, 2001; Rubenstein & Josephson, 2006). Although interventions targeting specific risk factors of falling have shown promising results in reducing falls among older adults (e.g., exercise or environmental modification review program; Cumming et al., 1999; Li, Harmer, Fisher, & McAuley, 2004), most of the time falls are a result of the interaction between intrinsic and extrinsic risk factors (Rubenstein, 2006; Rubenstein & Josephson, 2006). Therefore, multifactorial falls prevention interventions typically combine various falls prevention strategies to target several risk factors of falling at the same time, and are thought to be the best method to prevent falls (Rubenstein & Josephson, 2006; Tinetti, 2008).

Even though previous studies have provided evidence on the effects of multifactorial falls prevention interventions in reducing falls, it is worth noting that the effects remain equivocal. One of the reasons for this inconclusiveness is the variation in the results related to the effects of multifactorial interventions on falls. For example, two studies examining the effects of multifactorial interventions on falls among older adults who attended emergency departments because they fell (Davison, Bond, Dawson, Steen, & Kenny, 2005; de Vries et al., 2010) provided similar assessments and interventions but only one study found that multifactorial falls prevention interventions can significantly reduce falls (Davison et al., 2005).

The results from meta-analytic studies examining the effects of multifactorial falls prevention interventions are also inconsistent (Campbell & Robertson, 2007; J. T. Chang et al., 2004; Gates, Fisher, Cooke, Carter, & Lamb, 2008; Gillespie et al., 2009; Petridou, Manti, Ntinapogias, Negri, & Szczerbińska, 2009). While some researchers argue that such programs have a greater impact on falls than single factor interventions (J. T. Chang et al., 2004), others disagree (Campbell & Robertson, 2007; Gates et al., 2008; Petridou et al., 2009). Contributing to this, meta-analytic studies have different inclusion and exclusion criteria, and no single study included in such analyses has used the same intervention. In addition, despite the fact that targeting multiple risk factors of falling at the same time is desirable (given that falls often result from several risk factors), focusing on more risk factors also means investing more resources and money. Although several studies have examined the cost effectiveness of multifactorial falls prevention interventions, the results are not consistent (Jenkyn et al., 2012; Tinetti, Baker, et al., 1994). Thus, whether multifactorial falls prevention interventions are more cost-effective compared to single factor interventions is unclear. All in all, there is not enough evidence to fully support the effects of multifactorial falls prevention interventions on falls among older adults. More studies examining such interventions are needed to help verify their effects on falls.

The *A Matter of Balance* (MOB) program is a multi-component cognitive-behavioral group intervention. This program targets community-dwelling older adults and aims to reduce fear of falling by increasing self-efficacy and perceived control over falling while promoting functional, physical, and social activities. The curriculum of the MOB program consists of eight two-hour sessions. In each session, falls-related topics are discussed (e.g., thoughts and concern about falling and importance of exercise). From the fifth to eighth sessions, participants also practice a series of exercises that target older adults' balance and strength. Throughout the class, various techniques are used such as videos, lecture, group discussions, assertiveness training, exercise training, home assessments, mutual problem solving, and role playing to increase the diversity of activities (Tennstedt et al., 1998).

The effects of the MOB program on falls and physical risk factors of falling are not completely understood. Previous studies have shown that the program can effectively reduce fear of falling by improving falls efficacy and perceived control over falling (Healy et al., 2008; Ory et al., 2010; Smith, Jiang, & Ory, 2012; Smith, Ory, & Larsen, 2010; Tennstedt et al., 1998; Ullmann, Williams, & Plass, 2012; Zijlstra et al., 2009). Fear of falling, falls, and physical frailty (e.g., poor muscle strength and postural unsteadiness) often cause a vicious cycle of decline (Delbaere, Crombez, Vanderstraeten, Willems, & Cambier, 2004). Given the effects of the MOB program on reducing fear of falling, this program should be an effective intervention to break the cycle and reduce falls and improve physical functions. However, currently, relatively few studies have focused on the relationship between the effects of this program on both falls and physical risk factors of falling. Whether this program can effectively reduce falls and improve physical functions among older adults is unclear.

Furthermore, the measurements used in previous studies examining the MOB program are questionable. Fear of falling and falls efficacy are two constructs often used to operationalize psychological consequences of falling (Huang, 2006; Lachman et al., 1998; Tinetti, Richman, & Powell, 1990; Yardley et al., 2005). Although previous research has indicated that these two constructs are unique and should be examined separately (Hadjistavropoulos, Delbaere, & Fitzgerald, 2011; Hadjistavropoulos et al., 2007; Jørstad, Hauer, Becker, & Lamb, 2005; Moore & Ellis, 2008), researchers still confuse fear of falling with falls efficacy and often use them interchangeably (Moore & Ellis, 2008). Moreover, researchers have noted that practitioners should not assume that increased falls efficacy is equivalent to reduced fear of falling, and it is necessary to assess both of them to ascertain that they have improved after a falls intervention (Valentine et al., 2011). However, in research on the MOB program, most studies used only one construct to assess the effects of this program (i.e., mostly falls efficacy). In addition, these studies often concluded that this program can improve fear of falling based on such measures of falls efficacy. Therefore, it is necessary to re-examine the effects of the MOB program on both fear of falling and falls efficacy.

This dissertation consists of three studies that examine the effects of the MOB program on falls, physical risk factors of falling, and psychological aspects of falling among community-dwelling older adults. The first study investigates the effects of the MOB program on falls and physical risk factors of falling among community-dwelling older adults. The second study examines the effects of this program on fear of falling and falls efficacy. An additional goal was to validate a modified fear of falling scale. The third study explores whether the effects of the MOB program on falls and physical risk factors of falling can be maintained over a 3-month period.

The MOB program has been implemented and disseminated in several states in the United States (e.g., Florida, Texas, and South Carolina; Batra, Melchior, Seff, Frederick, & Palmer, 2012; Ory et al., 2010; Tennstedt et al., 1998; Ullmann et al., 2012). The results of this dissertation study further our understating of the effects of the MOB program on falls and physical risks of falling and will help researchers and practitioners ascertain the effects of this program on fear of falling and falls efficacy.

Relevant literature regarding falls, impact of falls on individuals and society, risk factors of falls, fear of falling and falls efficacy measurements, multifactorial falls prevention interventions, and the MOB program is provided in Chapter Two. The three studies are presented in Chapters Three, Four, and Five.

Chapter Two:

Literature Review

Impact of Falls on Individuals and Society

Despite an expanding literature on falls, there is no consensus on what constitutes a fall. The absence of an agreed upon definition allows falls to be interpreted in a variety of ways by researchers, practitioners, and older adults (Zecevic, Salmoni, Speechley, & Vandervoort, 2006). Consequently, not only the validity of studies on falls becomes questionable, but it also makes comparisons between studies more difficult.

A fall can be generally defined as “an unexpected event in which participants come to rest on the ground, floor, or lower level” (Lamb, Jørstad-Stein, Hauer, & Becker, 2005, p. 1619). Research has shown that over 30% of community-dwelling adults aged 65 years and older fall every year, and this rate increases to 40% among those who are 80 years and older (Fabrício et al., 2004; Leveille et al., 2009; Tinetti & Speechley, 1989). In addition, about half of these adults will experience recurrent falls (Nevitt et al., 1989; Tinetti et al., 1988; Tromp et al., 1998).

About 50% of falls occur in public places, and 50% take place at home or in the immediate surrounding areas of adults’ homes (Campbell et al., 1990). However, the propensity of falling inside or outside the house changes with age in the elderly and is different between females and males. Specifically, older adults younger than 75 are more likely to fall outdoors, whereas those older than 75 year old are more likely to fall indoors (Lord, Ward, Williams, & Anstey, 1993). Men have a higher incidence of falling outdoors, and women have higher rates of falling indoors (Campbell et al., 1990). Moreover, when falling inside the house, most falls occur on other level surfaces rather than in the bath or shower, bed site, or on a ladder or stairs (Lord, Ward, Williams, & Anstey, 1994). In terms of the time of day that older adults fall, most of the falls occur in the morning and afternoon, and only a small portion of falls occur between 9 p.m. to 7 a.m. (Campbell et al., 1990).

The total number of fatal falls is increasing as our population ages (Centers for Disease Control and Prevention [CDC], 2005). The age-adjusted death rate per 100,000 in the population due to unintentional falls among older adults 65 years and older was 43 in 2005, and it increased to 51 in 2008. In addition, fall-related deaths increase sharply with age. The age-adjusted death rate per 100,000 population due to unintentional falls from 2000 to 2008 was 12 among adults aged between 65 and 74 years, and it increased exponentially to 72 among adults aged 75 years and older (CDC, 2005). Although this pattern is similar for men and women, previous research shows that men are more likely to experience fatal falls than are women (Stevens et al., 1999; Stevens & Sogolow, 2005).

Despite the fact that falls can cause death among older adults, only 5-10% of falls result in serious physical injuries such as head trauma and fracture (Hall, Williams, Senior, Goldswain, & Criddle, 2000; Leibson, Tosteson, Gabriel, Ransom, & Melton, 2002; Rubenstein & Josephson, 2002; Rutland-Brown, Langlois, Thomas, & Xi, 2006). Most falls among older adults lead to impaired physical, psychological, and mental functions. Common impairments observed among older adults after they fall include a decline in functional performance, social activities, physical activities, and health-related quality of life; pain; isolation or depression; admissions to the hospital or nursing home; increasing difficulties with activities; and developing fear of falling (Fabrício et al., 2004; Hicks, Gaines, Shardell, & Simonsick, 2008; Leveille et al., 2009; Scaf-Klomp, Sanderman, Ormel, & Kempen, 2003; Stel et al., 2004; Suzuki, Ohyama, Yamada, & Kanamori, 2002).

As indicated above, it is therefore not surprising that falls result in significant health services costs for immediate care and subsequent rehabilitation (Stel et al., 2004). In 2009, approximately 2.2 million older adults had nonfatal falls and were treated in the emergency department, and about a half million of these individuals were subsequently hospitalized (CDC, 2005). The average cost for taking care of a fall injury, including the hospital stay, nursing care, emergency room visit, and home health care, but not the physician's service, was estimated around $19,440 dollars (Rizzo et al., 1998). The total cost of a fatal fall injury was about $0.2 billion dollars and $19 billion dollars for non-fatal fall injury in 2000 (Stevens et al., 2006). In addition, the cost of a non-fatal fall injury was expected to reach $32 billion dollars in 2020 for this segment of the population (Englander et al., 1996).

Risk Factors of Falls

Research has shown that older adults often possess multiple risk factors concurrently, and the risk of falling increases as the number of risk factors accumulates (Rubenstein & Josephson, 2006; Tinetti et al., 1988). These risk factors can be broadly categorized into intrinsic risk factors, which are inherent characteristics, and extrinsic risk factors, which are factors outside of an individual (Masud & Morris, 2001). While extrinsic risk factors have a higher association with falls among older adults younger than 75 years old, intrinsic risk factors are more important for those who are 80 years and older (Feder, Cryer, Donovan, & Carter, 2000; Nevitt et al., 1989; Tinetti et al., 1988). Studies have also shown that intrinsic risk factors have a higher association with recurrent falls compared to extrinsic risk factors (Tromp et al., 1998).

The most commonly identified intrinsic risk factors of falling can be categorized into six aspects: demographics, falls experience, use of medication, frailty, physical impairments, and cognitive functions. Regarding demographics, older age (Tinetti et al., 1988; Tromp et al., 1998) and being female and white (Friedman, Munoz, West, Rubin, & Fried, 2002) are significant risk factors of falling. In terms of falls experience, having a history of falls (Nevitt et al., 1989; Tinetti et al., 1988) and the existence of fear of falling (Friedman et al., 2002) are significant predictors of future falls. Use of psychotropic medications (Cumming, 1998; Ensrud et al., 2002; French et al., 2006; Kelly et al., 2003) and polypharmacy (Campbell, Borrie, & Spears, 1989; Feder et al., 2000; Hanlon et al., 2009; Hartikainen, Mäntyselkä, Louhivuori-Laako, Enlund, & Sulkava, 2005)are also associated with falling. Signs of frailty such as having chronic conditions (Campbell et al., 1989; Friedman et al., 2002; Himes & Reynolds, 2012; Lawlor, Patel, & Ebrahim, 2003) and functional limitations (Dunn, Rudberg, Furner, & Cassel, 1992; Formiga, Ferrer, Duaso, Olmedo, & Pujol, 2008; Tromp et al., 1998) often result in falls. Regarding physical impairments, muscle weakness (Moreland, Richardson, Goldsmith, & Clase, 2004), visual impairments (Lord & Dayhew, 2001; Nevitt et al., 1989), abnormal gait (Beauchet et al., 2007; Lin et al., 2004; Shumway-Cook, Brauer, & Woollacott, 2000), and postural instability (Campbell et al., 1989; Maki, Holliday, & Topper, 1994) are all predictors of falling. In terms of cognitive function, studies have found that poor performance on executive functions and speed of processing are associated with falls and recurrent falls (Anstey, Von Sanden, & Luszcz, 2006; Anstey, Wood, Kerr, Caldwell, & Lord, 2009; Buracchio et al., 2011; Holtzer et al., 2007).

For extrinsic risk factors, environmental hazards alone are not sufficient to cause falls. Falls often result from the interaction between environmental hazards and behaviors that involve the use of the environment (Lord, Menz, & Sherrington, 2006; Rubenstein & Josephson, 2006). For example, specific types of footwear, such as athletic and canvas shoes, are associated with the lowest risk of falling (Koepsell et al., 2004; Luukinen, Koski, & Kivelä, 1996). The risk of falls decreases as the contact area between shoes and floor increases (Tencer et al., 2004). Research shows that using a walking aid is associated with an increased risk of falling (Kiely, Kiel, Burrows, & Lipsitz, 1998; Tinetti, Franklin Williams, & Mayewski, 1986). However, older adults who have an intermediate to high activity level can be protected against falls if they use a walking aid during activities (Graafmans, Lips, Wijlhuizen, Pluijm, & Bouter, 2003). Despite the significance of individual intrinsic and extrinsic risk factors, most of the time falls are the result of the interaction between them (Rubenstein, 2006).

Measurements of Psychological Consequences of Falling

Fear of falling is as serious an issue as falls (Cumming, Salkeld, Thomas, & Szonyi, 2000; Friedman et al., 2002). This phenomenon was first delineated as a post-fall syndrome (J. Murphy & Isaacs, 1982) and later described as fear of falling (Gibson, Andres, Isaacs, Radebaugh, & Worm-Petersen, 1987). Such fear is often observed in older adults who frequently try to grab something for support after falling (J. Murphy & Isaacs, 1982), but is also found among older adults without a previous falls history (S. L. Murphy, Williams, & Gill, 2002; Vellas, Wayne, Romero, Baumgartner, & Garry, 1997).

Although a certain level of concern about falls can be protective against falling (Delbaere, Crombez, van Haastregt, & Vlaeyen, 2009), a heightened fear of falling can have a negative impact on adults' health (Brouwer, Musselman, & Culham, 2004; Delbaere et al., 2004; Delbaere, Sturnieks, Crombez, & Lord, 2009; Howland et al., 1998). Research has shown that older adults with a fear of falling may experience activity restriction and curtailment (Howland et al., 1998; Lachman et al., 1998; Tinetti, Mendes De Leon, Doucette, & Baker, 1994), functional limitations (Curcio, Gomez, & Reyes-Ortiz, 2009; Howland et al., 1998), gait and balance problems (Brouwer, Walker, Rydahl, & Culham, 2003; Delbaere et al., 2004; Li, Fisher, Harmer, McAuley, & Wilson, 2003), social isolation (Lachman et al., 1998; Suzuki et al., 2002; Tinetti, Mendes De Leon, et al., 1994), depression (Arfken, Lach, Birge, & Miller, 1994; Burker et al., 1995), decreased quality of life (Arfken et al., 1994), and subsequent falls (Cumming et al., 2000; Delbaere et al., 2004; Friedman et al., 2002; Li et al., 2003). While fear of falling is suggested as a critical endpoint for falls prevention interventions among older adults (Jørstad et al., 2005), these thoughts are usually not discussed or brought up by the elderly (Walker & Howland, 1992), which makes it difficult for practitioners to treat this psychological phenomenon. Therefore, detecting fear of falling is a pressing issue.

Early research usually used a single question (e.g., "are you afraid of falling?" or "are you concerned about falling?") with a yes/no answer to measure fear of falling (Myers et al., 1996; Tinetti & Powell, 1993; Tinetti et al., 1990). This method is easy, quick, and useful in screening for fear of falling among older adults (Scheffer, Schuurmans, van Dijk, van der Hooft, & de Rooij, 2008). Several scales were later developed based on this construct (Huang, 2006; Lachman et al., 1998). However, Tinetti et al.(1990) argued that "fear" has negative connotations and does not predict function well. Therefore, she developed the Falls Efficacy Scale as a measure of fear of falling. This measure was thought to be a better measure to assess fear of falling due to its stronger theoretical basis (i.e., Self Efficacy Theory; Bandura, 1982). Since then, researchers in this area have equated lower falls efficacy with fear of falling. Despite the fact that several studies have demonstrated that fear of falling and falls efficacy are two unique constructs (Hadjistavropoulos et al., 2011;

Hadjistavropoulos et al., 2007; Li et al., 2002; McAuley, Mihalko, & Rosengren, 1997; Moore & Ellis, 2008; Tinetti, Mendes De Leon, et al., 1994; Valentine et al., 2011), researchers have continued to use measures that were developed based on falls efficacy to assess fear of falling. This confusion about the differences between these two constructs has thwarted theory development and practice in the falls field. Not only has the confusion led to an inaccurate estimation in the prevalence of fear of falling (i.e., 3% to 85%; Scheffer et al., 2008), the confusion might have compromised the validity and reliability of current studies and discounted our understanding of fear of falling. Therefore, measuring fear of falling and falls efficacy as separate constructs is very important (Hadjistavropoulos et al., 2011; Moore & Ellis, 2008). In the subsequent sections, several popular measurements of falls efficacy or fear of falling are reviewed.

Measurements of Falls Efficacy

In order to measure fear of falling, Tinetti and colleagues (1990) proposed the term "falls efficacy". They defined this term as the level of confidence a person possesses when performing common daily activities without falling. The researchers indicated that conceptualizing fear of falling as low falls efficacy has four advantages (Tinetti et al., 1990). First, falls efficacy is based on Bandura's theory of self-efficacy (Bandura, 1982). Experience from previous assessments based on this theory (e.g., career development; Hackett & Betz, 1981) suggests that it is possible to develop a valid and reliable measurement (Tinetti et al., 1990). Second, fear has a psychiatric connotation compared to self-efficacy. Third, self-efficacy is strongly connected to function while fear is often a poor predictor of behavior. Last, self-efficacy is more quantifiable than fear. Two examples of measurements developed based on the construct of falls efficacy are the Falls Efficacy Scale (Tinetti et al., 1990) and the Modified Falls Efficacy Scale (Hill, Schwarz, Kalogeropoulos, & Gibson, 1996).

Falls Efficacy Scale (FES). The FES assesses perceived confidence in performing 10 basic daily activities without falling (Tinetti et al., 1990). Each activity is scored on a 10-point scale (1 = very confident to 10 = not confident at all). If a participant currently does not perform an activity on the scale, the participant is asked to rate the item hypothetically. A total score, ranging from 1 to 100, is obtained with higher scores indicating lower confidence. This score system was later revised in the opposite direction, with 1 being not confident at all and 100 being very confident (revised-FES; Tinetti, Mendes De Leon, et al., 1994). The FES can be completed by a patient or administered by a professional. The content validity of the FES was determined by a panel of experts(Tinetti et al., 1990), and the concurrent validity of the FES was demonstrated by comparing it with the Activity-specific Balance Confidence Scale, $r = -.84$ (Powell & Myers, 1995). There is also evidence of the construct validity of the FES. One study found that the FES was significantly correlated to the Physical Self-efficacy Scale, $r = -.33$, $p < .001$ (Powell & Myers, 1995). Other studies found that there were significant differences in the FES between older adults who had high and low mobility, $M = 93.4$ vs. 68.4, $p < .001$ (Powell & Myers, 1995), high fear of falling and low fear of falling, $M = 19.7$ vs. 32.4, $p < .001$ (Myers et al., 1996), and activity avoidance and no activity avoidance, $M = 19.9$ vs. 43.4, $p < .001$ (Myers et al., 1996). Regarding reliability, the FES has been demonstrated to have good internal consistency, Cronbach's $\alpha = .90$ (Powell & Myers, 1995) and 5-day test-retest reliability, $r = .71$ (Tinetti et al., 1990).

Modified Falls Efficacy Scale (mFES). The mFES includes 10 indoor activities from the FES and four additional outdoor activities to assess falls efficacy (Hill et al., 1996). This scale was designed to be completed by the patient or administered by a professional. Each activity is scored on a 10-point visual analogue scale (0 = not confident/ not sure at all, 5 = fairly confident/fairly sure, and 10 = completely confident/completely sure). If an individual currently does not engage in an activity on the scale, the individual is asked to rate the item hypothetically. An average score ranging from 0 to 10 is obtained, with higher scores indicating more confidence in performing activities without falling. The construct validity of the mFES was supported. Hill and colleagues (1996) administered the mFES in two independent samples: healthy older adults and patients who attended a falls and balance clinic. They found that there was a significant difference in the mFES between these two groups, $F(14, 159) = 5.25$, $p < .001$. Regarding reliability, the mFES was found to be internally consistent, Cronbach's $\alpha = .95$,with good 1-week test-retest reliability, ICC = .95 (Hill et al., 1996).

Measurements of Fear of Falling

Fear of falling has been defined as a lasting concern about falling that can cause individuals to avoid activities they remain capable of performing (Tinetti & Powell, 1993). Delbaere and colleagues (2009) indicated that older adults benefit from some level of fear of falling because it can raise their awareness of falls; however, high levels of such fear may limit mobility and lead to further deconditioning. Fear of falling can be observed in older adults with or without the experience of falling (Tinetti, Mendes De Leon, et al., 1994; Tinetti et al., 1990). In addition, individuals who undergo one of these outcomes (i.e., falls or fear of falling) will often be subjected to the other, and subsequently a vicious cycle develops (Cumming et al., 2000; Friedman et al., 2002). Examples of measurements developed based on the fear of falling construct are the Survey of Activity and Fear of Falling in the Elderly (Scheffer et al., 2008), the Geriatric Fear of Falling Measure (Huang, 2006), and the Falls Efficacy Scale-International (Yardley et al., 2005).

Survey of Activity and Fear of Falling in the Elderly (SAFE). The SAFE assumes that there are undesirable consequences of fear of falling that will lead to activity restriction and poor quality of life, and is therefore designed to assess the role of fear of falling in activity restriction (Lachman et al., 1998). The scale focuses on three domains (i.e., activity level, fear of falling, and activity restriction) based on 11 activities related to activities of daily living, instrumental activities of daily living, mobility, and social activities. The SAFE can be administered by a clinician or a professional.

There are six questions for each activity: First, “Do you currently do it?” The answer for this question is scored as yes/no. Second, “When you do this activity, how worried are you that you might fall?” The response for this question ranges from 0 to 3 (0 = not at all worried, 1 = a little worried, 2 = somewhat worried, and 3 = very worried). Third, "Do you not do this activity because you are worried that you might fall?" The response categories for this question are the same as the responses in the second question. Fourth, "In addition to worrying about falling, are there other reasons that you do not do this activity?" Fifth, "If you are not worried, what are the reasons that you do not do the activity?" The response categories for the fourth and fifth questions require elaboration for those adults who answer "yes". Sixth, "Compared to five years ago, how often do you do this activity?" The response ranges from 1 to 3 (1 = more than you used to, 2 = about the same, and 3 = less than you used to). Depending on respondents' answers, some of these questions might be skipped. For example, if a respondent answers "no" for the first question, the respondent will jump to the third question.

Next, to obtain the scores for the activity level domain, an administrator adds up the "yes" answers to the first question for the 11 different activities. This score ranges from 0 to 11, with higher scores indicating more active participants. The fear of falling domain is calculated by averaging the total score of the responses to the second questions. It ranges from 0 to 3 with higher scores denoting a greater fear of falling. The activity restriction domain is calculated by summing the participants' responses of "3 = less than you used to do" in the sixth question from all activities. This score ranges from 0 to 11, with higher a score indicating greater activity restriction. The third, fourth, and fifth questions assess the reasons that adults do not carry out activities in addition to their fear of falling.

The content validity of the SAFE was determined by an expert panel (Lachman et al., 1998). The concurrent validity was demonstrated when comparing the fear of falling domain with a single fear of falling question, *r* = -.59 (Lachman et al., 1998). The construct validity of the SAFE was also established. One study compared each domain of the SAFE with the revised-FES and found that the revised-FES was significantly associated with the activity level domain, *r* = .69, the fear of falling domain, *r* = -.76, and the activity restriction domain, *r* = -.59 (Lachman et al., 1998). Another study by Hotchkiss et al. (2004) also found that the fear of falling domain of the SAFE was correlated with the Activity-specific Balance Confidence Scale, *r* = -.66, and the revised-FES, *r* = -.67.Regarding reliability, studies by Lachman et al.(1998)and Li et al. (2002) both found that the SAFE has good internal consistency, Cronbach's α = .91 and .71, respectively.

Geriatric Fear of Falling Measure (GFFM). Huang (2006) developed the GFFM, a cultural-specific assessment of fear of falling, based on the perspectives of community-dwelling older adults in Taiwan. This assessment includes 15 items and is designed to be administered by health care providers. Each item describes a situation (e.g., I will ask others for help when I need something that is too high to reach), and participants are asked to score the degree to which they agree with each item on a 1 to 5 scale (1 = never to 5 = always). The total possible score ranges from 15 to 75; higher scores indicate greater fear of falling. A panel of experts examined the measure, and it was found to have a content validity index of 86%. The construct validity of the GFFM was evident by using confirmatory factor analysis, GFI =.92, AGFI = .89, CFI = .90, RMSEA = .07 (Huang, 2006). In addition, evidence for concurrent validity was demonstrated by comparing the GFFM and the revised-FES, $r = .29$, $p = .002$. Regarding reliability, the GFFM was found to have good internal consistency, Cronbach's $\alpha = .86$, and 2-week test-retest reliability, $r = .88$, $p < .001$.

Falls Efficacy Scale-International (FES-I). The FES-I was developed by the Prevention of Falls Network Europe (ProFaNE; Yardley et al., 2005). The FES-I includes 10 reworded FES items and six new activities to assess the level of concern about falling during basic, physical, and social activities. The level of concern about falling is scored on a scale of 1 (not at all concerned) to 4 (very concerned). If a participant currently does not perform an activity on the scale, the participant is asked to rate the item hypothetically. After scoring all 16 items, a total score ranging from 16 to 64 is obtained, with higher scores indicating greater concerns about falling. The scale is designed to be administered by structured interview or self-report. The content validity was determined by a panel of experts (Yardley et al., 2005). Evidence for construct validity of the FES-I was demonstrated in the study by Yardley et al. (2005). The researchers found that the there were significant differences in the FES-I among older adults when comparing age,< 75 years ($M = 29.37$) vs. ≥ 75 years ($M = 33.86$), $p < .001$, sex, male ($M = 28.69$) vs. female ($M = 32.50$), $p < .001$, socioeconomic status, high ($M = 30.57$) vs. low ($M = 35.42$), $p < .001$, falls status in the past year, no fall ($M = 26.94$) vs. ≥ 1 fall ($M = 35.54$), $p < .001$, chronic disease, absent ($M = 24.77$)vs.

present (M = 33.77), $p < .001$, dizziness, absent (M = 24.36) vs. present (M = 35.20), $p < .001$, number of medications,< 4 medications (M = 29.01) vs. ≥ 4 medications (M = 36.40), $p < .001$, and psychoactive medication, absent (M = 30.74) vs. present (M = 35.79), $p < .001$. Regarding reliability, FES-I demonstrates good internal consistency, Cronbach's α = .96, and 1-week test-retest reliability, ICC = .96 (Yardley et al., 2005).

Multifactorial Falls Prevention Interventions

Multifactorial falls prevention interventions combine several evidence-based prevention strategies to improve or modify intrinsic and/or extrinsic risk factors of falling (Campbell & Robertson, 2007; J. T. Chang et al., 2004; Gates et al., 2008; Gillespie et al., 2009; Petridou et al., 2009; Rubenstein & Josephson, 2006; Tinetti, Baker, et al., 1994). In a typical multifactorial falls prevention intervention, multidimensional assessment is undertaken to identify falls-related risk factors, followed by interventions aimed to address these risk factors. Given that most falls among older adults involve several risk factors, multifactorial falls prevention interventions have been thought to be the optimal way to manage falls among older adults (Cumming, 2002; Rubenstein & Josephson, 2006; Tinetti, 2008). In addition, several geriatric practice guidelines have recommended that practitioners incorporate this type of intervention into their practices (American Geriatrics Society et al., 2001; National Institutes for Clinical Excellence, 2004).

Several meta-analyses have examined the effectiveness of multifactorial falls prevention interventions compared to single factor interventions (Campbell & Robertson, 2007; J. T. Chang et al., 2004; Gates et al., 2008; Gillespie et al., 2009; Petridou et al., 2009). There are three major findings from these studies. First, these meta-analytic studies found that multifactorial falls prevention interventions can significantly reduce the rate of falling but not the total number of fallers and fall-related injuries. For example, Chang et al. (2004) found that multifactorial falls prevention interventions significantly reduced the risk factors of falling by 12% and rate of falling by 20%. Comparable results were found in the studies by Campbell and Robertson(2007), Gillespie et al. (2009), and Petridou et al. (2009), which showed a 22%, 25%, and 10% significant reduction in the rate of falling, respectively. Regarding the total number of fallers and fall-related injuries, in the meta-analytic study by Gates et al. (2008), the researchers found that the pooled effect favored multifactorial falls prevention interventions, but was not significant. Therefore, Gates and colleagues concluded that multifactorial falls prevention interventions may reduce the rate of falling without affecting the total number of fallers and fall-related injuries.

Second, the results from the meta-analytic studies showed that the best component in multifactorial falls prevention interventions is uncertain. Multifactorial falls prevention interventions target many modifiable risk factors simultaneously. One might assume that if multifactorial falls prevention interventions incorporate the most effective component (e.g., exercise or education) with higher frequency and/or intensity, the interventions will provide the greatest effects on falls. However, Chang et al. (2004) examined the frequency of the components in all studies they included but were unable to identify the most effective component. Another example is the study by Gates et al. (2008). The researchers conducted subgroup analyses to examine: 1) whether interventions that were more physically active (e.g., exercise) were more effective than those that were less physically active (e.g., education or referral), and 2) whether including a doctor as part of the intervention would change the effects of multifactorial falls prevention interventions. Their results showed that there were no significant differences in the effects between interventions providing knowledge or referrals and those that were more physically active. In addition, they found that whether a doctor was involved in the multifactorial falls prevention interventions did not change the treatment effects. The study by Gillespie et al. (2009) also had similar findings. The researchers conducted subgroup analyses to examine the components of multifactorial falls prevention interventions. They found that whether the included components and intensity of multifactorial falls prevention interventions are large or small, the interventions would reduce the rate of falling but not the risk of falling.

Lastly, the results from the meta-analyses suggested that the effects of multifactorial falls prevention interventions would not vary by older adults' falls tendency. In the study by Chang et al. (2004), the researchers found that effects of multifactorial falls prevention interventions on the rate of falling did not differ by studied population (i.e., high risk vs. low risk and nursing home vs. community), suggesting that the effects of multifactorial falls prevention interventions were not due to enrollment of people at high risk. Similarly, Gillespie et al. (2009) found that there were no differences in the treatment effect of multifactorial falls prevention interventions between participants who were at high and low risk of falling at baseline. In other words, whether an individual's risk for falling is high or low, the multifactorial falls prevention interventions would reduce the rate of falling but not the risk of falling.

Caution, however, should be exercised when interpreting the results from these meta-analyses. Although there have been many studies examining multifactorial falls prevention interventions, it is still inconclusive whether or not multifactorial falls prevention interventions are effective in reducing falls among older adults. First, the results from several meta-analyses showed that compared to multifactorial falls prevention interventions, single factor interventions were also effective in preventing falls. For example, in the meta-analytic study by Chang et al. (2004), although less effective than multifactorial falls prevention interventions, exercise alone was also noted to significantly reduce the risk of falling by 14% among older adults. Similarly, Campbell and Robertson (2007) found that single factor interventions (reduce falls by 23%) were as effective as multifactorial falls prevention interventions (reduce falls by 22%). In contrast, the study by Petridou et al. (2009) found that exercise alone (reduce falls by 55%) was approximately five times more effective in preventing falls compared to multifactorial falls prevention interventions (reduce falls by 10%).

Furthermore, the high cost of multifactorial falls prevention interventions might be a barrier to implementing such interventions in communities, especially since research has not consistently demonstrated their effects (Cumming, 2002; Petridou et al., 2009). For example, one study found that multifactorial falls prevention interventions are more cost-efficient than the cost of medical care and hospitalization (Tinetti, Baker, et al., 1994). In this study, the researchers reported that the cost per fall prevented was $1,947 for their multifactorial falls prevention intervention compared to $12,392 for the cost of medical care to prevent one fall, and to an average charge of $11,800 per hospitalization due to injurious falls. In contrast, a study by Jenkyn, Hoch, and Speechley (2012) found that their multifactorial falls prevention intervention not only cannot reduce falls, but the average total cost of the intervention ($18,916) was twice as high as the cost of usual care ($9,780).

Taking all of these factors into consideration, the effectiveness of multifactorial falls prevention interventions remain inconclusive. The inconsistent findings across meta-analyses may be related to the fact that the inclusion and exclusion criteria across these studies are not comparable. Also, none of the included studies in these meta-analyses used the same multifactorial falls prevention intervention, which makes it more difficult to draw conclusions due to the increased variation in the primary studies. Furthermore, few studies have conducted cost-effective analyses. It is, therefore, difficult to judge whether multifactorial falls prevention interventions are a better intervention in terms of the cost per fall prevented compared to single factor interventions. More studies are required to better understand the effectiveness of multifactorial falls prevention interventions.

The *A Matter of Balance* Program

The *A Matter of Balance* (MOB) program is a multi-component cognitive-behavioral group intervention. It targets community-dwelling older adults and aims to reduce fear of falling by increasing self-efficacy and control over falling. This goal is achieved with four strategies: 1) reconstructing misconceptions and promoting a view that falls and fear of falling are controllable, 2) setting realistic goals to increase activity level, 3) changing the environment to reduce fall-related risks, and 4) promoting physical exercise to optimize strength and balance. In order to increase the diversity of activities, various techniques are used in the MOB program including videos, lectures, group discussions, assertiveness training, exercise training, home assessments, mutual problem solving, and role playing (Tennstedt et al., 1998).

The MOB curriculum consists of eight two-hour sessions. The goal of the first session (Introduction to the Program) is to welcome all the members, share the goals of the MOB program with the class, and clarify individuals' beliefs or biases related to falls and concerns about falls. The aim of the second session (Exploring Thoughts and Concerns about Falling) is to recognize that there are different ways of looking at falls and fear of falling. The goal of the third session (Exercise and Fall Prevention) is to understand the importance of exercise in preventing falls. Participants are taught to identify not only the barriers to exercising, but also the best suited exercises for fall prevention. In addition, a series of exercises is introduced to participants and practiced at the beginning of the subsequent sessions. The aim of the fourth session (Assertiveness and Fall Prevention) is to recognize and understand that low blood pressure, leg weakness, and poor flexibility and balance can contribute to falls. In addition, participants learn the importance of being assertive when discussing fall-related issues with others (e.g., talk with doctors about concerning about falls). The goal of the fifth session (Managing Concerns about Falling) is to recognize the impact of misconceptions about falls on individuals' feelings and actions and learn how to shift self-defeating thoughts into self-motivating thoughts. In this session, participants are also taught how to individualize exercise plans to prevent falls and set up a personal action plan to begin an exercise program. The aim of the sixth session (Recognizing Fall-ty Habits) is to determine which activities are and are not risk-taking behaviors by discussing habits that increase risk of falling and introducing a home safety checklist to evaluate the individuals' home environment. The goal of the seventh session (Recognizing Fall Hazards in the Home and Community) is to identify strategies to reduce physical hazards in the home and community. In addition, procedures of how to get up from the floor easily are taught to participants. The aim of the eighth session (Practicing No Fall-ty Habits/ Fall Prevention: Putting it All Together) is to review all of the materials discussed during the previous sessions and recognize the physical and psychological changes that individuals have experienced from participating in the MOB program (Tennstedt et al., 1998; Zijlstra et al., 2009).

Two randomized-controlled trials have examined the effects of the MOB program on reducing fear of falling (Tennstedt et al., 1998; Zijlstra et al., 2009). The American MOB (AMOB) program recruited English-speaking adults aged 60 years and older who reported a fear of falling, but no major physical or health conditions (n = 434). The adapted Dutch version (DMOB) of the program included people aged 70 years and older who reported a fear of falling, did not use a wheelchair, were not confined to bed, and were not waiting for placement in a nursing home (n = 540). The AMOB took place twice a week for 4 weeks and the DMOB took place once a week for 8 weeks. In addition, a booster session was held 6 months after the final session in the DMOB. After the conclusion of the program, the AMOB conducted a sixth month follow-up and another at a year after the baseline interview; the DMOB had an eighth month and fourteenth month follow-up. With the exception of the differences in the frequency that the programs were offered, the two versions used the same instruction materials and techniques.

The AMOB used a self-modified FES, incorporating two additional activities to the original modified FES, to measure fear of falling (Cronbach's α: .90-.93), the Perceived Control Over Falling scale to measure the beliefs of control over falling, and the Perceived Ability to Manage Falls and Falling scale to measure the perceived ability in managing falls. In addition to these three outcomes, the AMOB included the abbreviated Sickness Impact Profile to examine participants' health status (including somatic autonomy, mobility range, mobility control, social behavior, psychological autonomy, and emotional stability) and the Intended Activity Scale to measure participants' willingness to perform various activities. Falls data were collected at baseline and each follow-up. The participants' falls history in the three months prior to beginning the program was also obtained.

In the study of the AMOB, the researchers considered that attendance at a minimum of five sessions was necessary for achieving the treatment effects and therefore conducted two separate analyses: 1) first examining the effects of the AMOB by comparing participants who attended at least five sessions with those who attended less than five sessions, and 2) comparing participants who attended at least five sessions with the control group. In the first analysis, the results showed that participants who attended at least five sessions had a significantly higher level of intended activity and better health status compared to those who attended fewer than five sessions at the end of the 4-week program. However, there were no significant differences in the scores of the self-modified FES and total number of falls between these two groups. In the second analysis, the results showed that participants who attended at least five sessions had a significant improvement in falls efficacy, perceived ability to manage falls, and mobility control right after intervention compared to the control group. The effects of the AMOB on falls efficacy and perceived abilities to manage falls remained significant at the 12-month follow-up. In addition, participants reported significantly better health, mobility, and social behavior. Regarding falls status, no significant effects of the AMOB were observed throughout the study.

The DMOB used a single question (i.e., “Are you concerned about falling?”) and a modified mFES (i.e., changing wording of the question from “How confident” to “How concerned”) to assess fear of falling. Another single-item question was used to measure the participants’ fear-induced activity avoidance (i.e., “Do you avoid certain activities due to concerns about falling?”). The DMOB also included the Perceived Control Over Falling scale and the Frenchay Activities Index to assess frequency of daily activities and the Consequence of

Falling Scale to measure perceived loss of functional independence and damage to identity. Participants recorded their incidence of falling on falls calendars and their falls history six months before baseline was obtained.

The results of the DMOB study showed that significantly fewer participants in the intervention group experienced fear of falling and avoided activities compared to the control group right after the intervention. These significant differences persisted until the 14-month follow-up for fear of falling and 8-month follow-up for avoidance of activities. Participants in the intervention group did not perceive significantly greater control over falling right after the intervention but it became significant at the 8-month and 14-month follow-ups compared to the control group. Participants in the intervention group also had a significantly higher level of activity and reported less perceived loss of functional independence and damage to their identity compared to the control group right after the intervention and at the 8-month follow-up. Less damage to their identity was still significantly perceived at the 14-month follow-up. In terms of falls, there were significantly fewer recurrent fallers in the intervention group compared to the control group from baseline to the 14-month follow-up. However, the number of fallers was not significantly different between the two groups.

Five other studies have used a single-group design to examine the effects of the MOB program among community-dwelling older adults (Healy et al., 2008; Ory et al., 2010; Smith et al., 2012; Smith et al., 2010; Ullmann et al., 2012). The study by Healy et al. followed the format used in the AMOB (i.e., twice a week for 4 weeks). The researchers used the falls efficacy scale modified by Tennstedt et al., the Perceived Control Over Falling scale, the Perceived Ability to Manage Falls and Falling scale, and one single item to assess whether the degree of concern about falling interfered with social activity as outcome variables. Healy and colleagues found that participants reported significant improvement in falls efficacy, perceived control over falling and perceived abilities to manage falls at the 6-week, 6-month, and 12-month follow-ups. Self-reported exercise levels significantly increased at the 6-week follow-up and continued to be significant at the 6-month follow-up but were lower than they were at 6 weeks. They were not significant at 12 months. Social activity improved significantly at six weeks only. The number of falls reported monthly improved significantly at the 6-month and 12-month follow-ups.

In the studies by Ory et al., (2010), Smith et al., (2010), Smith et al., (2012), and Ullmann et al. (2012), the researchers did not include any measures of fear of falling or falls efficacy. Instead, they used the Perceived Ability to Manage Falls and Falling scale and all found that participants reported significant improvement in perceived abilities in managing falls at the end of the intervention compared to their initial levels at baseline. The scores on the Perceived Ability to Manage Falls and Falling scale were found to decrease across the follow-up measurements but were still significant at the 6-month follow-up in Smith et al.'s (2012) study. Ory and colleagues (2010) also found that participants reported an increase in the number of days they were physically active and a reduction in the number of days they were physically unhealthy after the completion of the MOB program. Smith et al., (2010) found that participants had a significant reduction in the total number of falls at the end of the intervention. In addition, participants in this study reported that they had significantly fewer days when they felt unhealthy physically and mentally. Ullmann et al. (2012) included the Timed Up and Go test and found that participants significantly improved their walking speed.

In sum, the research of the MOB program to date has shown that this program has significantly positive effects on falls efficacy and fear of falling among older adults. The MOB program has the potential to increase older adults' perceived control over falling and perceived abilities to manage falls, as well as motivate older adults to participate more in activities. In addition, the MOB program can improve adults' overall sense of health. However, the effects of the MOB program on falls status are still unclear. Although the DMOB study found that the MOB program significantly reduced the total number of recurrent fallers, the AMOB study found that the total number of falls between the intervention and control groups were not significantly different. Moreover, although a reduction in the total number of falls was found in the studies by Smith et al., (2010) and Healy et al. (2008), no control or comparison group was used in these studies. Therefore, no firm conclusions can be drawn regarding the effects of the MOB program on falls due to the inconsistent findings and poor study designs in abovementioned studies. In addition, although Ullmann et al. (2012) found that participants had an increased walking speed after participating in the MOB program, this study also had no control or comparison group. So, whether the improvement on walking speed was due to this program is uncertain and further investigation is needed.

Chapter Three:

The Effects of the A Matter of Balance Program on Falls and Physical Risk of falls

Abstract

This study investigated the effects of the *A Matter of Balance*(MOB) program on falls and physical risk factors of falling among community-dwelling older adults using a comparison group design. A total of 103 adults (52 received the program, 58 comparison) aged 60 and older were enrolled in this study. Data on falls, mobility (the Performance-Oriented Mobility Assessment), walking speed (the Timed Up and Go test), postural control (the Functional Reach test), and other known risk factors of falling were collected at baseline and at the end of the program. Multivariate analysis of variance and Chi-square statistics were used to examine baseline characteristics. Multivariate analysis of covariance with repeated measures was used to investigate the effects of this program. The results showed that older adults who participated in the MOB program had significant improvements in their mobility, walking speed, and postural control, compared to those in the comparison group. No significant effects were found regarding the total number of falls. Although older adults who participated in the MOB program may be more likely to fall because this program promotes an active life style, this current study found that the total number of falls did not

increase or reduce significantly. Therefore, more longitudinal studies are warranted to examine whether the MOB program actually prevents older adults from falls or puts them at an increased risk of falling.

Introduction

Falls are a major health concern among older adults. Over 30% of the community-dwelling seniors fall every year (Masud & Morris, 2001; Rubenstein & Josephson, 2002). Falling in the aging population often results in injuries and bruises (Stevens & Sogolow, 2005), reduced physical and social activities (Fabrício et al., 2004), impaired functional performance (Sekaran, Choi, Hayward, & Langa, 2013), and a decline in health-related quality of life (Scaf-Klomp et al., 2003; Suzuki et al., 2002). More importantly, the expenses for fall-related care are expected to surge as the population ages (Englander et al., 1996; Stevens et al., 2006); therefore, preventing falls has been an important topic of research.

Multifactorial falls prevention interventions have received much attention in the past decade. This approach targets multiple risk factors of falling (e.g., balance and medication) by employing several evidence-based interventions simultaneously (Rubenstein & Josephson, 2006). Because of the comprehensiveness of multifactorial falls prevention interventions, they are thought to be the best method to reduce falls among older adults (Cumming, 2002; Rubenstein & Josephson, 2006; Tinetti, 2008). Also, several geriatric practice guidelines have recommended incorporating this type of intervention into standard practice (American Geriatrics Society et al., 2001; National Institutes for Clinical Excellence, 2004).

Nevertheless, while preventing falls by addressing several risk factors at the same time seems promising, the effects of multifactorial falls prevention interventions are still inconclusive. First, although some studies show that multifactorial falls prevention interventions can significantly reduce falls among older adults (e.g., Clemson et al., 2004; Davison et al., 2005; Rubenstein et al., 2007), others find the opposite (e.g., de Vries et al., 2010; Lord et al., 2005; Shumway-Cook et al., 2007). Furthermore, even in studies with comparable multifactorial falls prevention interventions and populations the findings are mixed. For example, the studies by the Davison et al. (2005) and de Vries et al. (2010) included older adults aged 65 years and older who attended emergency department because of falling. Both studies assessed older adults' medical conditions, physical functions, medication, vision, and environmental hazards and provided exerice and educational programs, medication and environmental modification, devices, and referals as interventions. Nevertheless, only the study by Davison et al. (2005) reported a significant effects on falls.

Second, results from meta-analytic studies investigating the effects of multifactorial falls prevention interventions are also inconclusive (Campbell & Robertson, 2007; J. T. Chang et al., 2004; Gates et al., 2008; Gillespie et al., 2009; Petridou et al., 2009). For example, while the result of the meta-analysis study by Campbell and Roberson (2007) showed that a multifactorial falls prevention intervention is effective for preventing falls for individual patients, Gates and colleagues (2008) found that the evidence to support the effectiveness of such interventions is limited. Moreover, several meta-analytic studies comparing multifactorial falls prevention interventions and single factor interventions (e.g., exercise) show that single factor interventions are also an effective approach to reduce falls (Campbell & Robertson, 2007; J. T. Chang et al., 2004; Petridou et al., 2009). Given that targeting multiple factors at the same time might require more resources compared to single factor interventions, determining whether multifactorial falls prevention interventions are the best method to prevent falls is important. Thus, more studies in this area are needed to better understand the effects of multifactorial falls prevention interventions.

The MOB program is a multifaceted cognitive-behavioral intervention (Tennstedt et al., 1998) and its effects on falls and physical risk factors of falling(e.g., postural control) are less studied. This program targets community-dwelling older adults and aims to reduce fear of falling by enhancing falls self-efficacy and perceived control over falling. This goal is achieved through four strategies: 1) reconstructing misconceptions and promoting a view that falls and fear of falling are controllable, 2) setting realistic goals to increase activity level, 3) changing the environment to reduce fall-related risks, and 4) promoting physical exercise to optimize strength and balance. The curriculum of the MOB program is highly structured and consists of a variety of activities and techniques (e.g., videos, lectures, and group discussions). Fall-related topics such as exploring thoughts and concerns about falling and recognizing fall hazards at home and in the community are discussed throughout the eight sessions.

Starting in the third session, exercise is introduced to participants and practiced at the beginning of the subsequent sessions.

Four studies so far have reported the effects of the MOB program on falls (Healy et al., 2008; Smith et al., 2010; Tennstedt et al., 1998; Zijlstra et al., 2009), but only one study examined the impact of this program on physical risk factors of falling (Ullmann et al., 2012). In a randomized-controlled trial by Tennstedt et al. (1998), the researchers found that there were no significant differences in the total number of falls between participants who received the MOB program and those in the control group. However, using a similar design, Zijlstra et al.(2009) reported significantly fewer recurrent fallers in the intervention group compared to the control group at the 14-month follow-up, although the total number of fallers was not reduced after the program. In one study by Smith et al. (2010) that used a single group design, the researchers found that older adults who participated in the MOB program had a significant reduction in their total number of falls at the completion of the program. Similarly, Healy et al. (2008) used the same design and found that the total number of falls decreased significantly at the 6-month and the 12-month follow-ups. Regarding the physical risk factors of falling, Ullmann et al. (2012) investigated the effects of the MOB program on walking speed. They used a single group design and the Timed Up and Go test as their outcome measure. The researchers found that participants had significantly faster walking speeds right after the completion of the MOB program.

Taken all together, the effects of the MOB program on falls are still unclear. Although the studies by Smith et al. (2010) and Healy et al. (2008) provided additional evidence regarding the effects of the MOB program on falls, no comparison groups were used in these studies; therefore, whether the reduction in the total number of falls was due to the MOB program is uncertain. In addition, based on results from the two randomized-controlled trials (Tennstedt et al., 1998; Zijlstra et al., 2009), it is difficult to determine whether the MOB program can significantly prevent falls among older adults due to their inconsistent results. Moreover, Tennstedt et al. (1998) indicated that because the MOB program encourages older adults to engage in more activities, they may actually fall more due to the increased exposure to their surrounding environments. Therefore, whether the MOB program actually reduces or increases falls requires further investigation. Furthermore, whether the MOB program can improve physical risk factors of falling, such as gait and postural control, is uncertain. Although Ullmann et al. (2012) found that older adults had a faster walking speed after completing the MOB program, this study also used a single group design and therefore whether the improvement on walking speed was due to the program could not be determined.

Previous research has shown that fear of falling, falls, and physical frailty (e.g., poor balance and loss of strength) often form a vicious cycle that can lead to further declines (Delbaere et al., 2004). While the MOB program aims to reduce fear of falling and emphasizes several fall-related risk factors (e.g., education on medication use and environment hazards), in theory it should be an effective program to break the cycle and subsequently prevent falls and stop further physical deconditioning. In addition, the MOB program incorporates exercises that stress strength and balance components. Previous studies using exercises emphasizing balance and strength (e.g., Tai chi) have successfully improved older adults physical performance (e.g., mobility and balance; Faber, Bosscher, Chin, & van Wieringen, 2006; Li et al., 2004). Therefore, the MOB program should also be a good modality to improve older adults' physical performance.

This current study investigates the effects of the MOB program on falls and physical risk factors of falling among older adults. Specifically, falls status, mobility, walking speed, and postural control were compared between the MOB group and the comparison group from baseline (Time 1) to the completion of the program (Time 2). The hypothesis tested was that from Time 1 to Time 2, the total number of falls would reduce and performance on mobility, walking speed, and postural control would improve in the MOB group. In contrast, these outcomes would remain stable or worsen in the comparison group. The Institutional Review Board at the University of South Florida approved all protocols for this study.

Method

Intervention

In this study, the MOB program was provided by the West Central Florida Area Agency on Aging Inc. (WCFAAA). A total of six programs, led by five experienced volunteer lay leaders, were held in either community centers or senior independent living apartments in Hillsborough County, Florida. The program followed the format standardized by Zijlstra et al. (2009) which included eight 2-hour weekly sessions.

In the comparison group, individuals had a brief discussion with the primary investigator about their performance on mobility, walking speed, and postural control after the Time 1 assessment. The primary investigator provided suggestions for exercise that those participants could easily do every day (e.g., walking or group exercise in community centers). At the end of the study, participants in the comparison group received a result sheet of their performance on the mobility, walking speed, and postural control measures at Time 1 and Time 2 including the established norms. In addition, if they wished to participate in the MOB program, they were referred to centers where this program is provided.

Participants

The recruitment for the participants in the MOB group included two steps. First, adults signed up for the MOB program either on the Internet or at the front desks of two community centers or two independent living apartments. Second, the service coordinators or site managers informed these seniors about this study. If they wished to join the study, the adults then made an appointment with the primary investigator for the Time 1 assessment.

The participants in the comparison group were recruited from a community center, an independent living apartment, and a calling list. In the community center, the site manager discussed this study with the older adults. Those who were interested in the study then met with the primary investigator for the Time 1 assessment. In the independent living apartment, flyers were distributed to the residents. Individuals who wished to join this study contacted the primary investigator directly to set up an appointment at this apartment complex. For the calling list, the primary investigator contacted older adults on the list directly and discussed the study with them. If the individual was interested in participating, an appointment was made for the Time 1 assessment to be conducted in the Cognitive Aging Lab in the School of Aging Studies at the University of South Florida. To be eligible to participate, community-dwelling adults had to be 60 years and older, speak and read English, and not use a wheelchair. There were 52 older adults in the MOB group and 58 in the comparison group enrolled in this study. Seven individuals in the MOB group were excluded because they were younger than 60 years old or never started the study (Figure 1).

Measures

The outcome variables in this study were older adults' falls status and performance on mobility, walking speed, and postural control. Fall-related risk factors including demographics, pain, chronic conditions, functional limitations, global cognitive function, and fear of falling were also obtained during the interviews (Chen, Peronto, & Edwards, 2012; Muir, Gopaul, & Montero Odasso, 2012; Rubenstein & Josephson, 2006; Shumway-Cook et al., 2000). In addition, the number of different types of physical exercise those participants did regularly per week was recorded to ensure that the differences between the MOB group and the comparison group were not because one group was more active than the

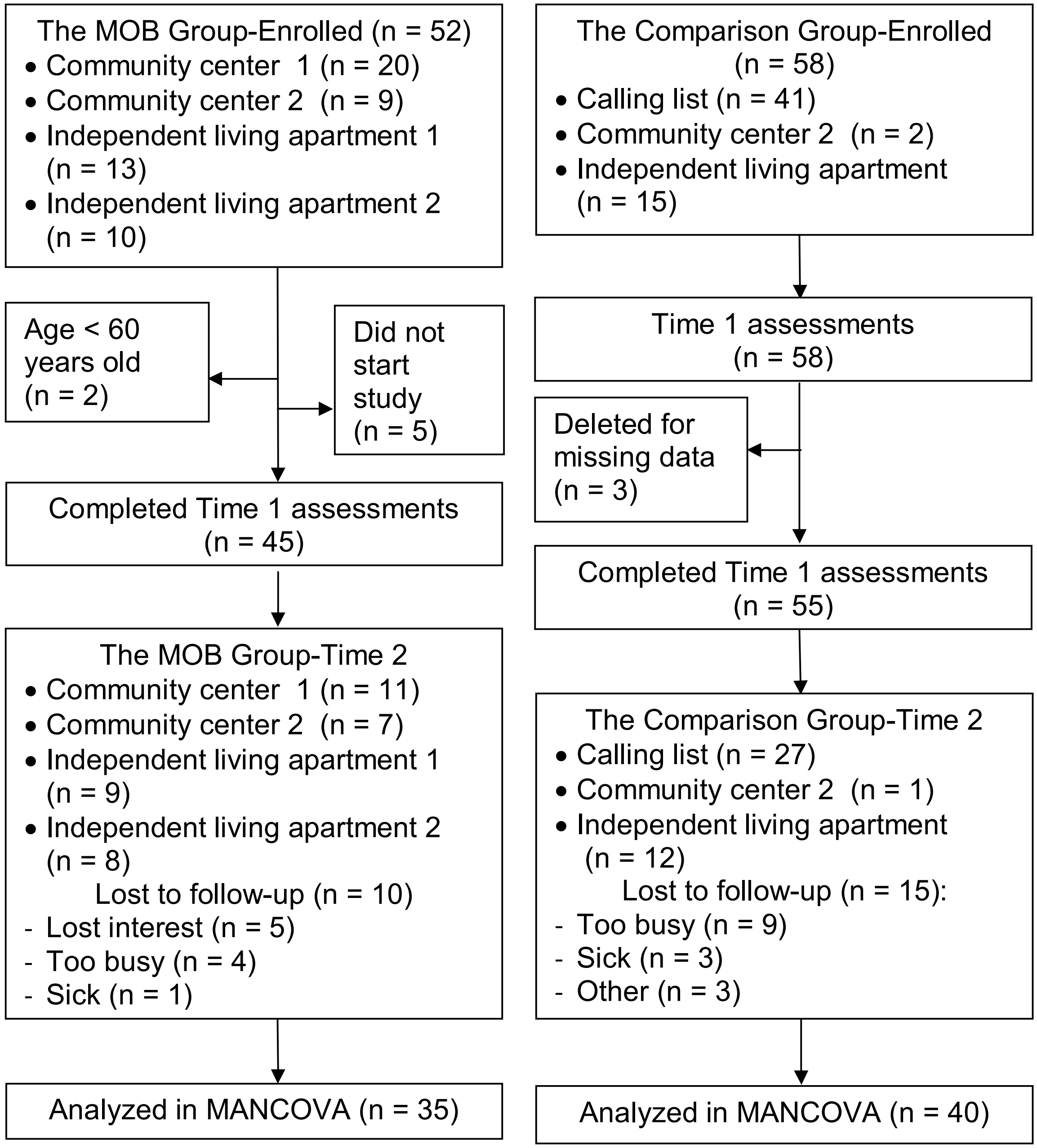

Figure 1. Study Profile

other.

Falls. A fall was defined as “an unexpected event in which participants come to rest on the ground, floor, or lower level” (Lamb et al., 2005). During the interview, participants were asked whether they had fallen in the past two months. Participants who reported they fell were coded as 1 otherwise they were coded as 0. The total number of falls was also recorded for those who reported a fall.

Mobility, Walking speed, and Postural Control. Three measures that have been used to predict falls in previous research were included in this current study (Duncan, Studenski, Chandler, & Prescott, 1992; Shumway-Cook et al., 2000; Tinetti, 1986; Tinetti et al., 1986). The Performance-Oriented Mobility Assessment (POMA) was used to assess overall mobility (Tinetti, 1986), the Timed Up and Go (TUG) test was used to examine walking speed (Shumway-Cook et al., 2000), and the Functional Reach Test (FR) was used to examine postural control (Duncan, Weiner, Chandler, & Studenski, 1990).

The POMA consists of a series of observations on the performance of balance and gait. The observations on balance include sitting balance, balance when arising from a chair, the number of attempts when arising from a chair, immediate standing balance (the first five seconds), standing balance, standing balance when nudging, standing balance with eyes closed, steadiness and continuity when turning 360 degrees, and sitting down. The observations on gait include initiation of gait, step length and height of feet, step symmetry and continuity, deviation of walking path, trunk stability, and walking stance. Each observation has its own scoring criterion (e.g., discontinuous steps when turning 360 degrees or left foot does not clear floor completely when walking). The possible scores are 16 in balance performance and 12 in gait performance. A total score, ranging from 0 to 28, was obtained by summing up the scores of the balance and gait performances with higher scores indicating better mobility. The predictive validity of the POMA was demonstrated in previous studies that showed that it was able to predict future falls (Robbins et al., 1989; Tinetti et al., 1986). Evidence also supported the convergent validity of the POMA. One study found that the POMA was significantly related to maximum step length, $r = .75$, $p < .01$, tandem stance time, $r = .69$, $p < .01$, one leg stance time, $r = .74$, $p < .01$, tandem walk time, $r = -.62$, $p < .01$, the TUG test, $r = -.65$, $p < .01$, and the 6-minute Walk Test, $r = .62$, $p < .01$ (Cho, Scarpace, & Alexander, 2004).Regarding reliability, the POMA was found to have good two-week intra-rater, ICC = .93, and inter-rater reliability, ICC = .99 (Lin et al., 2004).

The TUG test was conducted by asking participants to rise up from a chair, walk a 3-meter (10 ft) course at their regular pace, turn around, walk back, and sit back down in the chair. The total time (in seconds) used to complete the test was recorded. The longer it took individuals to complete the course,the slower their walking speed. The predictive validity of the TUG test is demonstrated by its ability to predict falls (Beauchet et al., 2007; Lin et al., 2004; Shumway-Cook et al., 2000), fear of falling (Austin, Devine, Dick, Prince, & Bruce, 2007), and a decline in activities of daily living among older adults(Lin et al., 2004).The construct validity of the TUG test is evident. Previous studies showed that there were significant differences between fallers and non-fallers (Beauchet et al., 2007; Lin et al., 2004; Shumway-Cook et al., 2000). Research has also supported the convergent validity of the TUG test. This test was found to be significantly associated with the Older Adults Resources and Services ADL scale, r = -.45(Lin et al., 2004), the Barthel Index of ADL, r = -.78, and the Berg Balance Scale, r = -.81(Podsiadlo & Richardson, 1991). Regarding reliability, the TUG test demonstrated good 1-day intra-rater, ICC = .92, and inter-rater reliability, ICC = .91 (Nordin, Rosendahl, & Lundin-Olsson, 2006).

The FR test was performed by asking participants to stand with their feet shoulder width apart and flex one shoulder to 90 degrees with a closed fist. A yardstick was held next to the flexed shoulder, and the initial reading on the yardstick was then taken. Next, participants were asked to slide their fist as far as they could without moving their feet, and the final reading on the yardstick was then taken. The score (in inches) of the FR test was obtained by subtracting the initial reading from the final reading for each individual. The predictive validity of the FR test is demonstrated by its ability to predict recurrent falls (Duncan et al., 1992). Evidence also supports the construct validity and convergent validity of the FR test. The FR test was found to be able to differentiate older adults who fell, M = 7.8 in., and did not fall, M = 10.2 in., p< .001, and older adults who had recurrent falls, M = 6.44 in., and those who did not, M = 9.97 in., p <. 001 (Duncan et al., 1992). In addition, the FR testis significantly correlated with the TUG test, r = .71, and tandem walking, r = .67 (Weiner, Duncan, Chandler, &

Studenski, 1992).The FR test has also demonstrated good inter-rater reliability, ICC = .98, and one-week test-retest reliability, r = .89 (Duncan et al., 1990).

Demographics Information. Information about age, gender, race, and education of participants was obtained at the Time 1 assessment. Age and education were recorded as continuous variables in years. Sex was treated asa dichotomous variable with female coded as 1. Race was coded as follows: White = 1, Hispanic = 2, Black = 3, and Asian = 4.

Pain. Participants were asked whether they were often troubled with pain during interview. This variable was coded dichotomously with 1 as "trouble with pain most of the time" and 0 as "no trouble with pain". Participants who indicated they had some pain but that it did not affect them were also coded as 0.

Chronic Conditions. At the Time 1 interview, participants were asked whether a doctor had ever informed them that they had any of the following conditions: high blood pressure, diabetes, cancer, lung disease, stroke, arthritis, depression, heart disease, osteoporosis, and asthma. A composite score ranging from 0 to 10 was calculated by summing up all reported conditions for each participant, with higher scores indicating more chronic conditions.

Functional Limitations. The Katz Activities of Daily Living scale (Katz, Downs, Cash, & Grotz, 1970) and the Lawton Instrumental Activities of Daily Living scale (Lawton & Brody, 1969)were used to assess the adults' functional limitations. The Katz Activities of Daily Living scale includes six activities: bathing, dressing, toileting, transferring, continence, and feeding. Each activity was scored as either dependent (a score of 1) or independent (a score of 0). The

Lawton Instrumental Activities of Daily Living scale includes eight activities: using a telephone, shopping, preparing food, housekeeping, doing laundry, traveling away from home, taking medication properly, and handling personal finances. Each activity was scored as either less able to perform independently (a score of 1) or more able to do independently (a score of 0; Vittengl, White, McGovern, & Morton, 2006). A composite score ranging from 0 to 14 was calculated by adding up the scores from the two scales for all participants(Spector & Fleishman, 1998), with higher scores indicating more functional limitations.

Global Cognitive Function. The Montreal Cognitive Assessment (MoCA) was used to examine participants' overall cognitive function(Nasreddine et al., 2005). It assesses several cognitive domains including: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. The total score can range from 0 to 30 with a score lower than 26 indicating mild cognitive impairment (Nasreddine et al., 2005).This assessment has good internal consistency, Cronbach's $\alpha = .83$, and 35-day test-retest reliability, $r = .92$, $p < .001$ (Nasreddine et al., 2005).

Fear of Falling. Research has shown that fear of falling and falls efficacy should be measured separately (Hadjistavropoulos et al., 2011; Jørstad et al., 2005; Moore & Ellis, 2008; Valentine et al., 2011). Therefore, the Geriatric Fear of Falling Measure (GFFM; Huang, 2006) was used to measure fear of falling and the Modified Falls Efficacy Scale (mFES; Hill et al., 1996) was used to measure falls efficacy.

The GFFM includes 15 statements in three domains (i.e., psychosomatic symptoms, adopting an attitude of risk prevention, and modifying behavior). One example statement is “When there is an obstacle on the ground or floor, I prefer to detour than go over it.” Participants rated their level of agreement based on a 1-5 scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always) for each statement. Higher scores indicated a greater fear of falling. A total score is calculated ranging from 15 to 75, with higher scores indicating greater fear of falling. This scale was previous validated with older adults in Taiwan. In the current study, the GFFM was found to have good internal consistency, Cronbach’s α = .85 to .91, and 8-week test-retest reliability, $r = .78$, $p < .001$. It also had good concurrent validity with the mFES, $r = -.73$, $p < .001$.

The mFES includes 14 activities. During the interview, participants were asked “How confident are you that you can do each of the activities without falling?” Each activity was scored on a 10-point visual analogue scale (0 = not confident/ not sure at all, 5 = fairly confident/fairly sure, and 10 = completely confident/completely sure). If a participant currently did not do an activity on the scale, the participant was asked to rate the item hypothetically. An average score ranging from 0 to 10 was obtained, with higher scores indicating more confidence in performing activities without falling. The mFES has good internal consistency, Cronbach’s α = .95, and one-week test-retest reliability, ICC = .95, (Hill et al., 1996).

Other Physical Exercise. At the Time 1 interview, the participants were asked whether they had been participating in any exercise group or doing any exercise on their own. Those who answered “yes” were further asked how many different physical exercises they had been doing every week. The total number of physical exercises per week was recorded and used in the analyses.

Procedure

The primary investigator or one of the two trained research assistants interviewed all of the participants in this study. Informed consents were obtained at the first meeting. For the MOB group, the Time 1 assessment took place one week before the program started, and the Time 2 assessment was completed within two weeks of the end of the program. For the comparison group, the length of time between the two interviews was approximately the same duration as occurred in the MOB group. Each interview lasted about 40 minutes. The same measures were collected at Time 1 and Time 2.

Analyses

Attrition was first examined by multivariate analysis of variance (MANOVA) to investigate if there were significant differences between the participants who had complete data and those who were lost to follow-up within the MOB group and the comparison group.

Next, MANOVA and Chi-square statistics were performed to examine if there were significant differences in characteristics at Time 1 between the two groups including age, years of education, chronic conditions, functional limitations, MoCA sores, the GFFM, the mFES, and the total number of other physical exercise at Time 1. Categorical variables of sex, race, pain, and falls status at Time 1 were compared with Chi-square statistics. Variables that differed significantly were used as covariates in the following analyses.

Repeated measures multivariate analysis of covariance (MANCOVA) was then used to examine the effects of the MOB program on the total number of falls, mobility, walking speed, and postural control. The Fisher's LSD test was performed to further examine the effects of the MOB program if significant group x time interactions were found. A p level less than .05 was considered as statistically significant for all analyses.

Results

Attrition

Figure 1 displays the study profile. A total of 45 participants in the MOB group and 58 in the comparison group completed the Time 1 assessment. There were three participants in the comparison group who did not complete the MoCA at Time 1. Two of them refused to complete the assessment and one did not have time to do it. Therefore, they were excluded from the analyses due to missing data.

At Time 2, 10 participants in the MOB group and 15 in the comparison group were lost to follow-up. Results of the MANOVA showed that there were no significant differences at Time 1 between participants who did and did not complete the study within the MOB group, Wilks' $\Lambda = .70$, $F(12, 32) = 1.17$, $p = .344$, $\eta^2 = .30$, or within the comparison group, Wilks' $\Lambda = .83$, $F(12, 42) = .71$, $p = .735$, $\eta^2 = .17$.

Baseline Analyses (Time 1)

Table 1 displays these characteristics for the two groups at Time 1.Age, years of education, total number of chronic conditions, functional limitations, the MoCA, the GFFM, the mFES, and total number of other physical exercises performed between the MOB group and the comparison group at Time 1 were compared with MANOVA. The analysis showed that there were significant differences in some of the characteristics between the two groups, Wilks' $\Lambda = .76$, $F(8, 91) = 3.61$, $p = .001$, $\eta^2 = .24$. Significant differences were evident in age, $F(1, 98) = 8.53$, $p = .004$, $\eta^2 = .08$, chronic conditions, $F(1, 98) = 7.29$, $p = .008$, $\eta^2 = .07$, functional limitations, $F(1, 98) = 5.06$, $p = .027$, $\eta^2 = .05$, MoCA scores, $F(1, 98) = 17.98$, $p < .001$, $\eta^2 = .16$, fear of falling, $F(1, 98) = 13.33$, $p < .001$, $\eta^2 = .12$, and falls efficacy, $F(1, 98) = 11.55$, $p = .001$, $\eta^2 = .11$. Specifically, relative to the participants in the comparison group, those in the MOB group were significantly older and reported more chronic conditions, more functional limitations, worse MoCA scores, greater fear of falling, and lower falls efficacy. Years of education, $F(1, 98) = 2.95$, $p = .089$, $\eta^2 = .03$, and total number of other physical exercises, $F(1, 98) = .432$, $p = .512$, $\eta^2 < .01$, were similar between the two groups.

Chi-square statistics were performed to compare the differences in sex, race, pain, and falls status between the two groups. There was a significant difference in race between the MOB group and the comparison group, $\chi^2(3, N = 100) = 17.20$, $p = .001$. In the MOB group, there were fewer individuals who were white and more individuals who were Hispanic, black, and Asian. No significant

Table 1

Characteristics Between the MOB Group and Comparison Group at Time 1

Variables	MOB (n = 45)	Comparison (n = 55)
	M (SD) or %	M (SD) or %
Age (years)**	78.89 (9.31)	74.76 (8.23)
Sex: Female (%)	76%	71%
Race**		
White (%)	64%	96%
Hispanic (%)	31%	4%
Black (%)	2%	0%
Asian (%)	2%	0%
Education (years)	14 (3.32)	15 (2.19)
Pain (%)	73%	64%
Chronic conditions (0-10)**	3.27 (1.57)	2.40 (1.62)
Functional limitations (0-14)*	1.87 (2.82)	.78 (2.21)
Montreal Cognitive Assessment (0-30)***	22.13 (5.44)	26.04 (3.73)
Geriatric Fear of Falling Measure(15-75)***	39.49 (11.97)	31.18 (10.76)
Modified Falls Efficacy Scale (0-10)**	7.18 (2.30)	8.53 (1.67)
Other physical exercises	1.04 (1.26)	1.22 (1.36)
Fallers (%)	33%	29%
Total Number of falls	.42 (.66)	.42 (.76)

Note.

* p< .05 ** p< .01 *** p< .001

differences were found in sex, p = .603, pain, p = .301, and falls status, p = .648. These significant variables were included in subsequent analyses as covariates.

Effects of the MOB Program

MANCOVA was conducted to examine the effects of the MOB program on the total number of falls, the POMA, the TUG test, and the FR test accounting for age, race, chronic conditions, functional limitations, MoCA scores, the GFFM, and the mFES at Time 1. Four hypotheses were tested in this current study. From Time 1 to Time 2: 1) the total number of falls would be significantly reduced among participants in the MOB group relative to those in the comparison group, 2) the participants in the MOB group would demonstrate a significant improvement on their mobility (i.e., higher scores in the POMA) relative to those in the comparison group across time, 3) the participants in the MOB group would have a significantly faster walking speed (i.e., use less time in the TUG test) than those in the comparison group after the completion of the MOB, and 4) the participants in the MOB group would have significantly better postural control (i.e., reach farther in the FR test) than those in the comparison group.

The MANCOVA showed that there was an overall significant main effect of group, Wilks' Λ = .79, $F(4, 63) = 4.134$, $p = .005$, $\eta^2 = .21$, and a significant group x time interaction, Wilks' Λ = .53, $F(4, 63) = 13.79$, $p < .001$, $\eta^2 = .47$, after adjusting for the covariates. The effect of time was not significant, Wilks' Λ = .94, $F(4, 63) = 1.06$, $p = .383$, $\eta^2 = .06$. Table 2 displays the univariate F tests for the group main effect (i.e., the MOB group vs. the comparison group), time main

Table 2

Univariate F Tests for the Total Number of Falls, the Performance-Oriented Mobility Assessment, the Timed Up and Go test, and the Functional Reach Test Adjusted for Significant Covariates at Time 1

Effect	MOB	Comparison			
	Mean (SE)	Mean (SE)	F (df = 1, 66)	η^2	Post-Hoc Test (Fisher's LSD adjustment)
Total Number of Falls					
Group**	.11 (.11)	.60 (.10)	9.45	.12	
Time			1.97	.02	
GroupxTime			1.80	.02	
Performance-Oriented Mobility Assessment†					MOB: *p*(Time 2 > Time 1) < .001 Comparison: *p*(Time 1 > Time 2) = .01 Time 1: *p*(Comparison > MOB) = .629 Time 2: *p*(MOB > Comparison) = .002
Group	24.29 (.51)	23.08 (.47)	2.53	.02	
Time			1.34	.01	
GroupxTime***			21.38	.22	
Timed Up and Go test‡					MOB: *p*(Time 1 > Time 2) < .001 Comparison: *p*(Time 2 > Time 1) = .007 Time 1: *p*(Comparison > MOB) = .484 Time 2: *p*(Comparison > MOB) < .001
Group**	12.45 (.55)	14.66 (.51)	7.31	.08	
Time			.60	.01	
GroupxTime***			21.14	.23	
Functional Reach Test†					MOB: *p*(Time 2 > Time 1) < .001 Comparison: *p*(Time 1 > Time 2) = .013 Time 1: *p*(Comparison > MOB) = .012 Time 2: *p*(MOB > Comparison) = .042
Group	10.35 (.29)	10.44 (.27)	.05	< .01	
Time			1.01	.01	
GroupxTime***			24.07	.25	

Note. All analyses adjusted for age, race, chronic conditions, functional limitations, MoCA scores, the GFFM, and the mFES at Time 1.

†. Higher scores indicate better performance.

‡. Lower scores indicate better performance.

** $p < .01$ *** $p < .001$

effect (i.e., changes from Time 1 to Time 2), and group x time interaction for the total number of falls, the POMA, the TUG test, and the FR test.

To examine the first hypothesis, the effect of the MOB program on the total number of falls was tested. The univariate results showed a significant main effect for group, $F(1, 66) = 9.45$, $p = .003$, $\eta^2 = .12$, but no effect for time, $F(1, 66) = 1.97$, $p = .165$, $\eta^2 = .02$, and no group x time interaction, $F(1, 66) = 1.80$, $p = .185$, $\eta^2 = .02$, after accounting for age, $F(1, 66) = .63$, $p = .432$, race, $F(1, 66) = .35$, $p = .555$, chronic conditions, $F(1, 66) = .71$, $p = .404$, functional limitations, $F(1, 66) = .15$, $p = .696$, MoCA scores, $F(1, 66) = .35$, $p = .558$, the GFFM, $F(1, 66) = .20$, $p = .658$, and the mFES, $F(166) = 3.21$, $p = .078$, at Time 1. The nonsignificant group x time interaction indicated that the total number of falls reported did not differ between the two groups from baseline to post test.

The second hypothesis was tested by examining the effects of the MOB program on the POMA. The univariate results showed that there were no main effects for group, $F(1, 66) = 2.53$, $p = .117$, $\eta^2 = .02$, no effect for time, $F(1, 66) = 1.34$, $p = .252$, $\eta^2 = .01$, but a significant group x time interaction, $F(1, 66) = 21.38$, $p < .001$, $\eta^2 = .22$, after accounting for age, $F(1, 66) = 16.74$, $p < .001$, race, $F(1, 66) = 1.69$, $p = .198$, chronic conditions, $F(1, 66) = 4.34$, $p = .041$, functional limitations, $F(1, 66) = 3.46$, $p = .067$, MoCA scores, $F(1, 66) = 5.68$, $p = .02$, the GFFM, $F(1, 66) = 2.28$, $p = .136$, and the mFES, $F(1, 66) = 8.67$, $p = .004$, at Time 1. Results from Fisher’s LSD test revealed that participants’ mobility was not significantly different between the two groups at Time 1, $p = .629$. However, participants in the MOB group reported significantly better mobility than those in the comparison group at Time 2, $p = .002$. In addition, participants in the MOB group demonstrated a significant improvement on their mobility from Time 1 to Time 2, $p < .001$. In contrast, mobility among those in the comparison group became significantly worse over time, $p = .01$ (See Figure 2). These results suggest that older adults can significantly improve their mobility after completing the MOB program.

To test the third hypothesis, the effects of the MOB program on the TUG test were examined. The univariate results showed that there was a significant main effect for group, $F(1, 66) = 7.31$, $p = .009$, $\eta^2 = .08$, no effect for time, $F(1, 66) = .60$, $p = .442$, $\eta^2 = .01$, and a significant group x time interaction, $F(1, 66) = 21.14$, $p < .001$, $\eta^2 = .23$, after accounting for age, $F(1, 66) = 8.22$, $p = .006$, race, $F(1, 66) = .36$, $p = .55$, chronic conditions, $F(1, 66) = 2.90$, $p = .094$, functional limitations, $F(1, 66) = 5.80$, $p = .019$, the MoCA, $F(1, 66) = .92$, $p = .34$, the GFFM, $F(1, 66) = 5.53$, $p = .022$, and the mFES, $F(1, 66) = 2.29$, $p = .135$, at Time 1. The Fisher's LSD test showed that there was no significant difference in walking speed between the MOB group and the comparison group at Time 1, $p = .484$. At Time 2, participants in the MOB group walked significantly faster than those in the comparison group, $p < .001$.Moreover, in the MOB group, participants demonstrated a significant improvement on their walking speed from Time 1 to Time 2, $p < .001$. In the comparison group, participants walked significantly slower across time, $p = .007$ (See Figure 2). These results indicate that by participating in the MOB program older adults can significantly improve their walking speed.

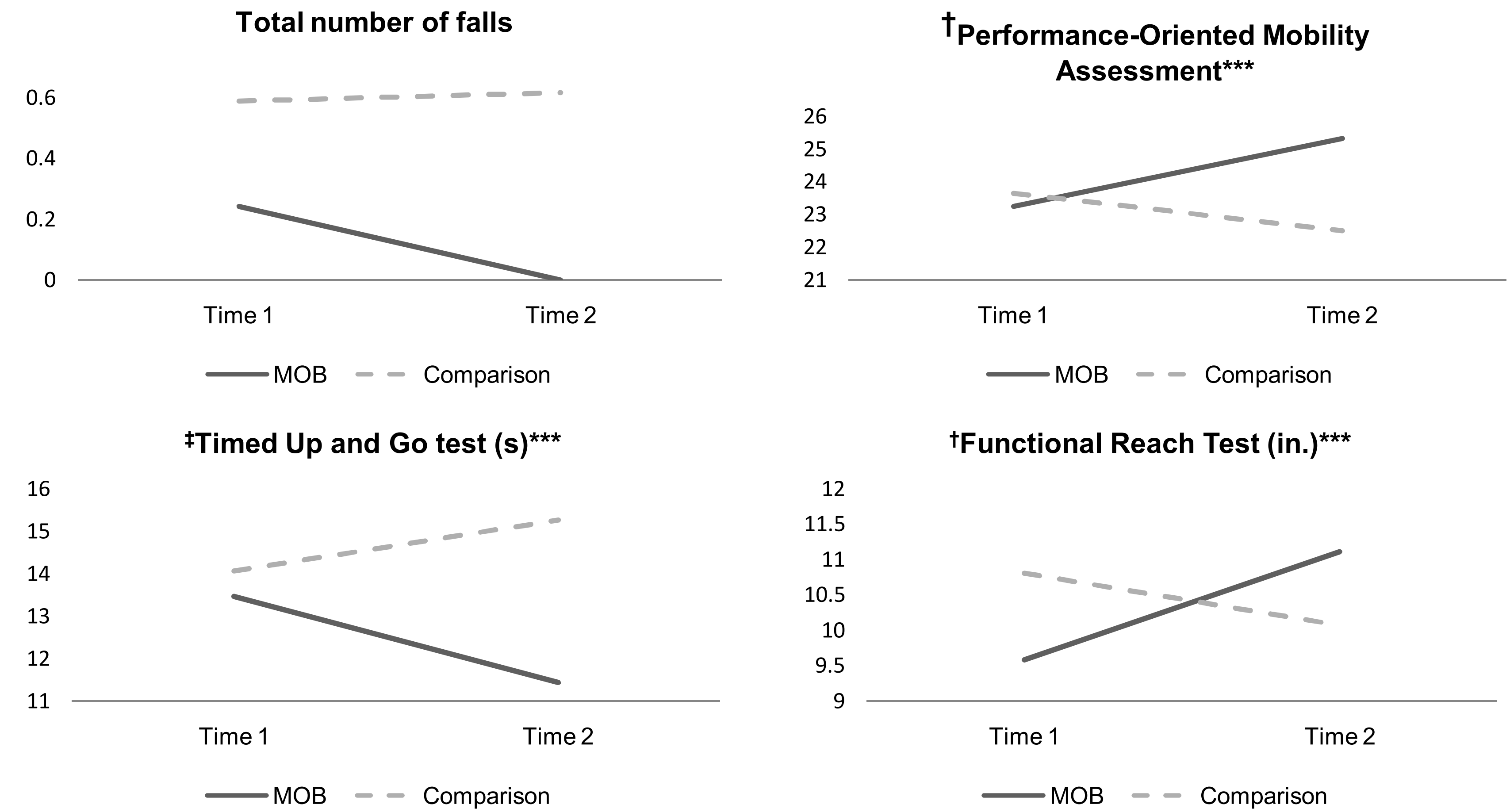

Figure 2. Group by time interaction on total number of falls, the Performance-Oriented Mobility Assessment, the Timed Up and Go test, and the Functional Reach Test.

†. Higher scores indicate better performance.

‡. Lower scores indicate better performance.

*** $p < .001$

The last hypothesis was tested by examining the effects of the MOB program on the FR test. The univariate results showed that there was no main effect for group, $F(1, 66) = .05$, $p = .284$, $\eta^2 < .01$, no effect for time, $F(1, 66) = 1.01$, $p = .318$, $\eta^2 = .01$, but a significant group x time interaction, $F(1, 66) = 24.07$, $p < .001$, $\eta^2 = .25$, after accounting for age, $F(1, 66) = 11.20$, $p = .001$, race, $F(1, 66) = .59$, $p = .45$, chronic conditions, $F(1, 66) = .56$, $p = .458$, functional limitations, $F(1, 66) = 1.05$, $p = .309$, MoCA scores, $F(1, 66) = 1.30$, $p = .259$, the GFFM, $F(1, 66) = 2.27$, $p = .137$, and the mFES, $F(1, 66) = 2.22$, $p = .141$, at Time 1. Results of Fisher's LSD test revealed that at Time 1, participants in the comparison group had significantly better postural control than those in the MOB group, $p = .012$. In contrast, at Time 2, participants in the MOB group performed better in the FR test than those in the comparison group, $p = .042$. In addition, from Time 1 to Time 2, participants in the MOB group demonstrated significant improvement in their postural control, $p < .001$. However, postural control was significantly worse among those in the comparison group from Time 1 to Time 2, $p = .013$ (See Figure 2). The results indicated that older adults can significantly improve their postural control by participating in the MOB program.

Discussion

This current study examined the effects of the MOB program on the total number of falls, the POMA, the TUG test, and the FR test. Analyses revealed that the total number of falls between the MOB group and comparison group was not significantly different from Time 1 to Time 2. Therefore, the first hypothesis was not supported. However, the results showed that older adults in the MOB group had significantly better performance on the POMA, the TUG test, and the FR test relative to those in the comparison group from baseline to the post test. Thus, the second, third, and fourth hypotheses were supported.

The first hypothesis tested whether the total number of falls among older adults who received the MOB program would decrease significantly after they completed the program. Similar to the findings in study by Tennstedt et al. (1998), this study found that the total number of falls among participants in the MOB group did not change significantly from Time 1 to Time 2 when compared with the comparison group. Tennstedt et al. noted that while older adults may have an increased likelihood of falling because the MOB program encourages older adults to engage in more activities, the nonsignificant changes in the total number of falls over time might be deemed as the indirect effects of this program. These indirect effects could possibly be the result of the combination of the education and exercise components of the MOB program. The MOB program employs a cognitive restructuring approach (Lachman, Weaver, Bandura, Elliot, & Lewkowicz, 1992) to change older adults' attitude about falling and to teach them that falls are manageable and preventable. This step can lower older adults' anxiety about falling and increase their falls efficacy so that they are able to return to their activity or engage in more activity. In addition, older adults learn about the modifiable risk factors of falling around them throughout the program (e.g., environmental hazards in the community or behaviors those might cause falls). At the same time, older adults practice exercises to improve their balance and strength. Consequently, while increasing activity levels, older adults not only are better able to negotiate the potential risks they encounter, they also have better balance and strength which may help them to regain steadiness if a fall does occur.

Nevertheless, one other possible explanation for the lack of significant reduction in the incidence of falling was that too few falls occurred in the study participants during the 8-week study. Although over 30% of older adults fall each year (Fabrício et al., 2004; Leveille et al., 2009; Tinetti & Speechley, 1989), within such a short study period, enough falls events might not have been recorded to significantly capture this phenomenon. Therefore, to further examine the MOB program on the total number of falls, a study with long-term follow-up is recommended.

Similar to the previous study by Ullmann et al. (2012), this study found that older adults performed significantly faster in walking speed after participation in the MOB program. Furthermore, the current study supports evidence that the MOB program can effectively improve older adults' mobility and postural control. Based on a previous study (Freiberger, Häberle, Spirduso, & Zijlstra, 2012), it is possible that the exercise component of the MOB program has a greater impact on adults' physical performance than the education component. A study by Freiberger and colleagues (2012), combined the education component of the MOB program with a strength and balance program to form a multifaceted program. The effect of this program on physical performance was then compared with a strength and balance program and a fitness program. The researchers found that the improvement on postural control, walking speed, and lower body strength was only observed in the strength and balance program and fitness program. Therefore, the exercise component of the MOB program may have a greater impact on mobility, walking speed, and postural control than the education component.

It is possible that cognitive function could influence the effects of the MOB program. According to the published norms of the MoCA (Nasreddine et al., 2005), most participants in the MOB condition (82%) had mild cognitive impairment. MoCA scores at Time 1 were significantly different between the MOB group and the comparison group, and were thus entered as a covariate in the analyses. The results showed that MoCA scores at Time 1 were a significant covariate only for the POMA outcome. Those with higher MoCA scores tended to perform better on POMA at Time 1. This may be due to the POMA requiring an individual to follow several instructions (e.g., please turn 360 degrees) in order to complete the assessment. However, MoCA was not a significant covariate for any other outcomes. Thus, cognitive status did not affect the ability to benefit from the MOB as indicated by walking speed and postural control.

Falls are often caused by the interaction of multiple risk factors (Rubenstein & Josephson, 2006). Older adults who possess a higher total number of risk factors are more likely to fall (Rubenstein & Josephson, 2006; Tinetti et al., 1988). In a previous review (The National Council on the Aging, 2005), the researchers noted that older adults who are at high risk of falling (e.g., had two or more falls in the past year, had injury due to fall, or had gait and/or balance problem) may benefit more from individualized multifactorial falls prevention interventions. In contrast, among those who are at low to moderate risk, an exercise program targeting risk factors known to increase the possibility of falling (e.g., gait and balance) with a raised level toward moderate intensity may be as effective as a multifactorial falls prevention intervention. The eligible criteria in this current study did not exclude older adults who were at high or low risk of falling. Therefore, whether the MOB program can be applied to older adults with all levels of fall risk is uncertain. More studies are warranted to investigate if older adults across all levels of risk can derive similar benefits from the MOB program.

Previous studies have indicated a need to have a booster session 6 months after the final session of the MOB program to maintain its effects on the psychological aspects of falling (Tennstedt et al., 1998; Zijlstra et al., 2009). Although there were immediate improvements in mobility, walking speed, and postural control among older adults in the MOB group in the current study, the duration of these effects is unknown. It is recommended that future studies investigate whether a booster session is necessary to maintain these physical functions as well. Also, if a booster session is required, the components that need to be incorporated in this booster session also need to be identified.

There are limitations to this study. First, the participants in the study were all self-selected. They might have had experience with falling, problems with mobility or postural control, or high level of fear of falling. Therefore, these participants might have had more potential for improvement. Second, a Hawthorne Effect could have occurred. All participants were aware that they were being studied, and this might have caused them to exercise harder or pay more attention to fall hazards. We did not collect data on whether participants in the MOB group followed the class instructions or practiced the learned exercises at home. Therefore, it is unknown if the participants were following the guidelines of this program or just attended the class. Third, in current study, only the total number of physical exercises that participants had been doing regularly was recorded; however, the type of physical exercise that participants engaged in was not collected. Some adults might have been participating in moderate to high intensity activities (e.g., water aerobic or jogging), and this could have more of an effect on their physical functions and potentially bias their performance on the physical measures. Given that the outcomes in the current study were related to physical performance, whether participants had been active or not might play a role in their mobility, walking speed, and postural control. Future studies should record the exercises those participants have been doing regularly to account for potential bias on the physical measures. Fourth, although participants in the comparison group did not receive any intervention in this study, the discussion they had with the primary investigator about their physical functions and exercises that could easily be done at home could potentially bias the results. These participants could have invested more time and effort to improve their physical performance. Therefore, future study should include a group which receives no attention from the primary investigator. Nevertheless, this study has several strengths. First, this was the first study investigating the effects of the MOB program on mobility and postural control, adding new information to the knowledge of the effectiveness of the MOB program. Second, compared to previous studies using a single group design to examine the effects of the MOB program on falls and physical risk factors of falling (Healy et al., 2008; Smith et al., 2010; Ullmann et al., 2012), this study included a comparison group. Therefore, the findings regarding the effects of MOB on falls and physical performance are more robust. Third, although fear of falling and falls efficacy are correlated, they are two unique psychological phenomena of falling (Hadjistavropoulos et al., 2011; Hadjistavropoulos et al., 2007; Jørstad et al., 2005; Moore & Ellis, 2008). Previous research has indicated the necessity to measure fear of falling and falls efficacy separately after interventions in order to ascertain that both psychological phenomena of falling have improved (Valentine et al., 2011). This current study has incorporated measures of fear of falling and falls efficacy and therefore was able to account for the variances of these two psychological phenomena of falling.

In sum, while previous research has established that participation in MOB program affects the psychological aspects of falling (Healy et al., 2008; Smith et al., 2012; Smith et al., 2010; Tennstedt et al., 1998; Zijlstra et al., 2009), this study found that older adults can improve their mobility, walking speed, and postural control significantly by participating the MOB program. Furthermore, even though the MOB program has the potential to increase the incidence of falling, the results of this study showed that the total number of falls were not significantly different between the MOB and comparison groups. However, based on the results of this study and previous studies (Healy et al., 2008; Smith et al., 2010; Tennstedt et al., 1998; Zijlstra et al., 2009), the effects of the MOB program remain uncertain. Future studies are recommended to examine the MOB program longitudinally. In addition, while targeting risk factors of falls can reduce the incidence of falling (Chen & Janke, 2012; Rubenstein, 2006; Tinetti, Mendes De Leon, et al., 1994), it may be helpful to incorporate measures of other risk factors (e.g., changes in medications, exercise adherence, or strength) not assessed in this study to further examine the effects of the MOB program among community-dwelling older adults.

Chapter Four:

The Effects of the A Matter of Balance Program on the Measures of Psychological Consequences of Falling

Abstract

This study aimed to examine the construct and predictive validities and reliability of the Modified Falls Efficacy Scale-International Florida (mFES-IF) and to re-examine the effects of the *A Matter of Balance* (MOB) program on fear of falling and falls efficacy. One hundred and three community-dwelling older adults (≥ 60 years) completed the study (55 received the program, 58 comparison). Pearson's correlation, logistic regression, and Cronbach's α were used to examine he psychometric properties of the mFES-IF. The effects of the MOB program were examined by multivariate analysis of covariance. The results showed that the mFES-IF had acceptable construct validity, internal consistency, and, 8-week test-retest reliability. However, the predictive validity of the mFES-IF was not supported. Regarding the effects of the MOB program, this study found that older adults who participated in this program reported a significant improvement on falls efficacy, as indicated by the Modified Falls Efficacy Scale: $F(1, 65) = 43.60$, $p < .001$, $\eta^2 = .35$, and a significant reduction in fear of falling, as indicated by the mFES-IF: $F(1, 65) = 19.86$, $p < .001$, $\eta^2 = .19$, and by the Geriatric Fear of Falling Measure: $F(1, 65) = 15.57$, $p < .001$, $\eta^2 = .17$. The

current study found that the mFES-IF has acceptable validity and reliability and that the MOB program has potential to affect falls efficacy and fear of falling among community-dwelling older adults.

Introduction

Fear of falling is a serious psychological consequence of falls. The estimated prevalence of fear of falling ranges from 21% to 85% among seniors living in communities (Scheffer et al., 2008). Such fear has been ranked as the greatest concern among community-dwelling older adults, more than a fear of being robbed in the street or having financial problems (Howland et al., 1993). In addition, it can have serious consequences. Previous studies have shown that fear of falling can result in falls and functional limitations (Cumming et al., 2000; Friedman et al., 2002; Li et al., 2003), slower walking speed and increased gait variability (Delbaere, Sturnieks, et al., 2009; Reelick, van Iersel, Kessels, & Rikkert, 2009; Rochat et al., 2010), altered postural control (Adkin, Frank, Carpenter, & Peysar, 2002; Davis, Campbell, Adkin, & Carpenter, 2009; Yiou, Deroche, Do, & Woodman, 2011), and activity restriction (Delbaere et al., 2004). More importantly, fear of falling has been linked to reduced health-related quality of life (N. Chang, Chi, Yang, & Chou, 2010; Li et al., 2003; Suzuki et al., 2002). Therefore, effective interventions to reduce fear of falling are needed to prevent older adults from experiencing these deleterious consequences.

The MOB program is a multifaceted intervention. It targets community-dwelling older adults and aims to reduce fear of falling by increasing falls efficacy and perceived control over falling (Tennstedt et al., 1998; Zijlstra et al., 2009).

This program includes eight 2-hour sessions. In the MOB program, participants learn to recognize the misconception of falls and fear of falling and counteract and control these false beliefs. In addition, this program teaches participants about modifiable behaviors and environmental hazards related to falls and strategies to change them. Moreover, the MOB program promotes continued or increased engagement in activity in a safe manner and physical exercise to build up older adults' strength and improve their balance.

To date, several studies have examined the effects of the MOB program on falls efficacy, fear of falling, and other psychological consequences of falling. For example, Tennstedt et al. (1998) used a self-modified Falls Efficacy Scale in a randomized controlled trial and found that the MOB program can significantly enhance falls efficacy. Healy et al. (2008) conducted a study with a single group design and also noted that older adults who participated in the MOB program had a significant improvement on the same Falls Efficacy Scale used by Tennstedt et al. In a study by Zijlstra et al.(2009), the researchers altered the scoring system of the Modified Falls Efficacy Scale and used it in a randomized-controlled trial. They reported that there were significant differences in this scale across time and concluded that the MOB program can reduce fear of falling. Several other studies have used the Perceived Control Over Falling scale and/or the Perceived Ability to Manage Falls and Falling scale, which were developed by Lawrence et al. (1998) and are based on the Bandura's self-efficacy theory to examine the MOB program. Results from these studies showed that the MOB program effectively improved older adults' sense of control over falling and perceived abilities to manage falls (Healy et al., 2008; Ory et al., 2010; Smith et al., 2012; Smith et al., 2010; Tennstedt et al., 1998; Ullmann et al., 2012; Zijlstra et al., 2009).

Despite the fact that the abovementioned studies have provided evidence of the effects of the MOB program on falls efficacy, fear of falling, and perceived ability to control and manage falls, it is important to mention that there are limitations due to the measurements that were used in these studies. First of all, the studies examining the MOB program have confused fear of falling with falls efficacy. Fear of falling and falls efficacy are two constructs often used to operationalize psychological consequences of falling (Huang, 2006; Lachman et al., 1998; Tinetti et al., 1990; Yardley et al., 2005). Fear of falling is defined as a "lasting concern about falling that leads an individual to avoid activities that the individual remains capable of performing"(Tinetti & Powell, 1993). On the other hand, falls efficacy is described as the confidence that an individual possesses when performing daily activities without falling (Tinetti et al., 1990). Although a greater fear of falling is significantly related to lower levels of falls efficacy (Li et al., 2002; McAuley et al., 1997), these two psychological phenomena have been identified as unique constructs (Hadjistavropoulos et al., 2011; Hotchkiss et al., 2004; Lachman et al., 1998; Li et al., 2002; Moore & Ellis, 2008; Valentine et al., 2011). Nevertheless, even though the relationship between fear of falling and falls efficacy has been established over one decade, Moore and Ellis(2008) noted that researchers still often equate fear of falling with falls efficacy. Many studies have utilized measures of falls efficacy to assess fear of falling and referred the outcomes of falls efficacy measures as fear of falling (e.g., Hill, Womer, Russell, Blackberry, & McGann, 2010). Given that fear of falling and falls efficacy are two different entities, they should be assessed with the appropriate measure (Hadjistavropoulos et al., 2011; Moore & Ellis, 2008).

Yet, as noted above in the research on the MOB program, several studies have used measures of falls efficacy as measures of fear of falling (Healy et al., 2008; Tennstedt et al., 1998). For example, Healy et al. (2008) and (Tennstedt et al. (1998) used the measures developed based on falls efficacy (e.g., the self-modified Falls Efficacy Scale) as their outcome variables. However, they concluded that the MOB program can reduce fear of falling. Moreover, some studies actually used the Perceived Ability to Manage Falls and Falling scale, which is a measure of self-certainty of avoiding falls and handling falls if they occur (e.g., "I can find a way to get up if I fall."; Lawrence et al., 1998), but concluded that the MOB program can improve falls efficacy (Ory et al., 2010; Smith et al., 2012; Smith et al., 2010). Although these studies still provide important information regarding the MOB program, concluding that this program can improve fear of falling or falls efficacy with a measure developed based on the other constructs is misleading.

Second, another limitation in the current studies examining the MOB program was that they did not measure both fear of falling and falls efficacy simultaneously. Results from one recent study have shown that falls efficacy and fear of falling may need to be measured separately to ascertain that both have improved (Valentine et al., 2011). In this study, Valentine and colleagues (2011) used structural equation models to examine the path from improved postural instability to increased activity participation while accounting for fear of falling, self-efficacy in balance, falls, perceived consequences of falling, depression, anxiety, and self-perceived steadiness on their feet among older adults discharged to home from geriatric medical wards. The results indicated that reduced fear of falling and increased self-efficacy in balance formed their own independent end points and were not directly correlated. In addition, Valentine and colleagues found that although improved postural instability was related to fear of falling and falls efficacy, fear of falling is largely influenced by the perceived consequence of falling but self-efficacy in balance is affected by the individuals' sense of steadiness on their feet. In other words, it is possible that self-efficacy in balance is improved with little to no changes in fear of falling if the rehabilitation programs do not address perceived consequence of falling. For these reasons, these researchers suggested that in addition to monitoring postural instability, fear of falling and falls efficacy should be assessed individually in clinical practice to ensure that both psychological phenomena have indeed improved after the intervention.

Nevertheless, all of the studies examining the effects of the MOB program thus far have used only one of these psychological constructs – either measures of fear of falling or falls efficacy. For example, in the studies by Healy et al. (2008) and Tennstedt et al.(1998), the researchers only examined the effects of the MOB program on falls efficacy. Similarly, Zijlstra et al. (2009)used a single question with multiple responses (i.e., never to very often) to assess fear of falling. In addition, although the Zijlstra and colleagues used the Modified Falls

Efficacy Scale (Yardley et al., 2005) in their study, they modified the original question from “How confident” to “How concerned” and changed the scoring system from a 0to10 scale (i.e., not confident at all to very confident) to a 1to4 scale (i.e., not at all concerned to very concerned). As a result, this measurement became a measure of fear of falling instead of falls efficacy. Consequently, whether the participants in these studies demonstrated improvements in both fear of falling and falls efficacy is uncertain.

Taken all together, the confusion about fear of falling and falls efficacy has often made researchers equate falls efficacy with fear of falling and misuse these measures. In addition, the study by Valentine et al. (2011) supports that one should not conclude that fear of falling is reduced based on increased falls efficacy without actually measuring fear of falling. While previous studies have used only one of these measures to examine the MOB program, it is difficult to determine the effects of this program on both constructs simultaneously. Given that the relationship between fear of falling and falls efficacy is becoming clearer (Hadjistavropoulos et al., 2011; Hadjistavropoulos et al., 2007; Jørstad et al., 2005; Moore & Ellis, 2008; Valentine et al., 2011), there is a need to clarify the effects of the MOB program on these two constructs. Hence, the aim of this current study was to re-examine the effects of the MOB program on fear of falling and falls efficacy using a comparison group design.

An additional goal of this current study was to modify the Falls Efficacy Scale-International (Yardley et al., 2005) to assess fear of falling based on activities that older adults living in Florida usually engage in. Individuals’ participation in some activities is affected by their geographic region. For example, water activities are more common in Florida than some other states. While fear of falling is often induced by a certain situation or stimulus (Coelho et al., 2010), activities that individuals have no prior experiences with may be less likely to provoke such fear. For instance, older adults living in Florida may have difficulty answering the item “walking on icy sidewalk” in the Activities-specific Balance Confidence Scale (Powell & Myers, 1995) because they have minimal experience with this event. Given that Florida is one of the States with the highest older adult population (Administration on Aging, 2013), having a scale that is tailored to the activities older adults usually perform in this state may be warranted. Therefore, the items in the Falls Efficacy Scale-International were modified to fit the activities that older adults who live in Florida might encounter more frequently.

Furthermore, most existing scales ask older adults to imagine doing an activity if they are not currently doing it (e.g., the Activities-specific Balance Confidence Scale). There are several drawbacks to this approach. Lachman et al. (1998) indicated that answering questions hypothetically is not the best way to assess fear of falling among older adults. In their experience, older adults often have difficulty answering questions in an abstract situation. In addition, when older adults report that they do not engage in an activity, it is possible that they either do not do the activity at all or they have a really strong fear of falling so they have stopped doing it. On the one hand, given that fear of falling is induced by a certain stimulus, it might be less meaningful to ask older adults to rate an activity hypothetically when they do not perform the activity at all. On the other hand, an avoided activity often results from heightened fear of falling (Delbaere, Crombez, et al., 2009; Lachman et al., 1998). Asking older adults to imagine their fear of falling when engaging in an avoided activity may consequently cause intense fear (Chung et al., 2009; Lapp, Agbokou, & Ferreri, 2011) and may result in an overestimated report of fear of falling. Researchers have indicated that older adults do not necessarily stop engaging in activities because of a fear of falling (Hadjistavropoulos et al., 2011; Lachman et al., 1998). In addition, fear of falling and activity avoidance are two independent predictors of future falls (Delbaere et al., 2004). Therefore, when measuring fear of falling, it is necessary to separate fear of falling in activities actually engaged in from fear of falling in those activities already avoided. To this end, “does not apply” and “avoid doing it” were included in the scoring system of the modified scale in an attempt to capture these distinctions in the data.

Method

Intervention

In this current study, six MOB programs were provided by the West Central Florida Area Agency on Aging Inc. (WCFAAA) and led by five trained volunteer lay leaders. Each group included between 8 and 14 people. The program took place 2-hour a week for eight weeks (Zijlstra et al., 2009). All leaders followed the standardized manual to guide the program.

No intervention was given to the comparison group. Individuals in the comparison group had a brief discussion with the primary investigator about their performances on mobility, walking speed, and postural control at the first interview. They received a sheet listing their physical performance results with the established norms at the end of the study. They were also offered an opportunity to participate the MOB program at the end of the study period.

Participants

Participants in the MOB group were recruited from local community centers and independent living apartments. Individuals who signed up for the program were informed about the study. If individuals wished to participate, they then made an appointment with the primary investigator. Participants in the comparison group were recruited from a community center, an independent living apartment, and a calling list. The seniors in the community center learned about the study from the site manager and residents in the independent living apartment were informed through flyers. These older adults contacted the primary investigator to schedule an appointment if they were interested in participating in the study. The primary investigator contacted the seniors on the calling list and discussed the study with them. Those who wished to participate in the study scheduled an appointment with the primary investigator.

To be eligible in current study, community-dwelling adults had to be at least 60 years old, speak and read English, and not use a wheelchair. A total of 110 participants enrolled in this study, with 52 in the MOB group and 58 in the comparison group. Seven people in the MOB group were excluded from the study because they either did not start the study (n = 5) or they were younger than 60 years old (n = 2).

Measures

The outcome variables were measures of falls efficacy and fear of falling. The Modified Falls Efficacy Scale was used to measure falls efficacy and the Geriatric Fear of Falling Measure and the Modified Falls Efficacy Scale-International Florida were used to measure fear of falling.

The Modified Falls Efficacy Scale (mFES) was modified by including four additional outdoor activities to the original Falls Efficacy Scale (10 activities) to measure falls efficacy (Hill et al., 1996). Participants were asked to rate their confidence level when doing each activity without falling on a 10-point visual analogue scale (0 = not confident/ not sure at all and 10 = completely confident/completely sure). If older adults currently did not perform an activity, they were asked to estimate their confidence level when they did the activity hypothetically. An average score, from 0 to 10, was calculated; higher scores indicated a higher level of confidence doing activities without falling. The construct validity of the mFES was demonstrated by its ability to distinguish between healthy older adults and patients in falls clinic, $F(14, 159) = 5.25$, $p< .001$ (Hill et al., 1996).In addition, this scale was found to have good internal consistency, Cronbach's $\alpha = .95$, and one-week test-retest reliability, ICC= .95(Hill et al., 1996).

The Geriatric Fear of Falling Measure (GFFM) was developed by Huang (2006). During the interview, individuals were asked to rate their level of agreement with 15 statements (e.g., I will ask others for help when I need something that is too high to reach) on a 5-point scale (1 = never, 2 = rarely, 3 =

sometimes, 4 = often, and 5 = always). This measure was found to have good construct validity, internal consistency, and 2-week test-retest reliability in a sample of community-dwelling older adults in Taiwan. A total score, ranging from 15 to 75, was calculated for each individual, with higher scores indicating greater fear of falling. In the current sample, the Cronbach's α ranged from .85 to .91. In addition, the relationship of the GFFM with the mFES was -.73, $p < .001$, providing evidence of the construct validity of the GFFM.

The Modified Falls Efficacy Scale-International Florida (mFES-IF) removed four items (i.e., walking up or down a slope, walking on an uneven surface, walking on a slippery surface, and reaching for something above your head or on the ground) from the original Falls Efficacy Scale-International and included six additional items (i.e., walking around a swimming pool, getting in or out of the car, walking outside after it rains, walking on a beach, walking on a trail, and walking on a golf course) to measure fear of falling among older adults who reside in Florida. The final mFES-IF included 18 items. The content validity of the mFES-IF was determined by five experts in the field of gerontology or geriatrics who also live in Florida (content validity index = 83%). When administering the mFES-IF, older adults were asked if they had concerns about falling when doing each activity. In addition, they were asked to think about how they usually perform the activities when replying to the items. The mFES-IF is measured on a 0 to 5 scale: 0 (does not apply), 1 (not at all concerned), 2 (somewhat concerned), 3 (fairly concerned), 4 (very concerned), and 5 (avoid doing it). To measure fear of falling in activities older adults are actually doing, an average fear of falling score was calculated for activities rated from1 to 4, with higher scores indicating a greater fear of falling.

In addition to these three psychological measures, information on falls history, demographics, pain, chronic conditions, functional limitations, global cognitive function, mobility, postural control, and walking speed was also collected. Falls were measured by asking participants whether they had fallen in the past two months. Individuals who reported they fell in the past two months were further asked how many times they fell. The total number of falls reported was included in the analyses. Demographic information collected in this study included age, gender, race, and education. Age and education were measured in years. Sex was dichotomized with female coded as 1 and male as 0. Race was categorized into four groups with White coded as 1, Hispanics as 2, Black as 3, and Asian as 4. Regarding pain, participants were asked if they were troubled with pain most of time. The responses were dichotomized with yes as 1 and no as 0.

Chronic conditions were measured by asking participants if their doctors have ever informed them that they have the following conditions: high blood pressure, diabetes, cancer, lung disease, stroke, arthritis, depression, heart disease, osteoporosis, and asthma. A composite score ranging from 0 to 10 was calculated by summing up all conditions that were reported. Functional limitations were measured by asking whether the adults needed help when performing the activities in the Katz Activities of Daily Living scale (including bathing, dressing, toileting, transferring, continence, and feeding; Katz et al., 1970). In addition, they were asked if they less able to perform tasks in the Lawton Instrumental Activities of Daily Living scale due to difficulties (including using a telephone, shopping, preparing food, housekeeping, doing laundry, traveling away from home, taking medication properly, and handling personal finances; Lawton & Brody, 1969). Activities reported as “need assistance” or “less able to do” were coded as 1. A total score from 0 to 14 was calculated by adding up activities coded as 1 for each participant, and this score was used in the analyses (Spector & Fleishman, 1998). Global cognitive function was measured by the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005). This measure assesses multiple cognitive domains, such as executive functions and memory. The possible scores range from 0 to 30. A final score below 26 indicates mild cognitive impairment (Nasreddine et al., 2005). Previous research has found that this assessment has good internal consistency, Cronbach’s $\alpha = .83$, and test-retest reliability, $r = .92$, $p < .001$ (Nasreddine et al., 2005).

Mobility was measured by the Performance-Oriented Mobility Assessment (POMA; Tinetti, 1986). The measure includes observations of balance and gait with a total possible score ranging from 0 to 28; higher scores indicate better mobility. The POMA has good predictive validity (e.g., predicting falls at the 10-month follow-up; Faber, Bosscher, & van Wieringen, 2006), convergent validity (e.g., moderate correlaition with the Timed Up and Go test, $r = -.65$, $p < .01$; Cho, Scarpace, & Alexander, 2004), and intra-rater, ICC= .93, and inter-rater reliability, ICC = .99 (Lin et al., 2004). Postural control was measured by the Functional Reach Test (FR; Duncan et al., 1990). This test measures how far (in inches) individuals can reach forward without moving their feet. The FR has good construct validity (e.g., fallers [M = 7.8 in.] vs. non-fallers [M = 10.2 in.], $p < .001$; Duncan et al., 1992), and 1-week test-retest reliability, $r = .89$ (Duncan et al., 1990). Walking speed was measured by the Timed Up and Go test (TUG; Shumway-Cook et al., 2000). During the test, a person is asked to get up from a chair, walk a 3-meter course, turn around, walk back to the chair, and sit down. In the current study, each participant completed two trials. An average score of the two trials (in seconds) was computed and used in the analyses. Previous studies have shown that the TUG test has good predictive validity (e.g., predicting falls at the 1-year follow-up; Lin et al., 2004), construct validity (e.g., fallers [M = 16.8 s] vs. non-fallers [M = 12.9 s], $p < .001$; Lin et al., 2004), and one-day intra-raterreliability, ICC = .92, and inter-rater reliability, ICC = .91(Nordin et al., 2006).

Procedure

In the MOB group, the first meeting (Time 1) with the participants was scheduled one week before the initial class of the MOB program. The second meeting (Time 2) was scheduled within two weeks after the last session of the program. The participants in the comparison group were also interviewed twice within the same interval period. All participants were interviewed by either the primary investigator or one of the two trained research assistants. Each interview included the same measures and lasted approximately 40 minutes. All informed consents were obtained at the first meeting. This study was reviewed and received approval from the Institutional Review Board at the University of South Florida.

Analyses

First, the attrition in the current study was analyzed with multivariate analysis of variance (MANOVA) to investigate if there were significant differences in Time 1 characteristics between the participants who were lost to follow-up and those who remained in the study within the MOB group and the comparison group.

Next, the psychometric properties of the mFES-IF were tested. Specifically, the construct validity, predictive validity, internal consistency and test-retest reliability of the mFES-IF were examined. All validations of the mFES-IF used data collected at Time 1; the tests for predictive validity and test-retest reliability used data from Time 1 and Time 2. The construct validity of the mFES-IF was tested by examining: 1) its relationship to the mFES and the GFFM with Pearson's correlations, and 2) whether there was a significant difference in the mFES-IF between participants who fell and who did not with independent *t*-test. The predictive validity of the mFES-IF was tested by its ability to predict falls status at Time 2 by using logistic regression. Regarding reliability, the internal consistency of the mFES-IF was explored using Cronbach's α(between .70 and .90; Portney & Watkins, 2008). The test-retest reliability of the mFES-IF was tested by the correlation between the scores at Time 1 and Time 2 among older adults in the comparison group (n = 40) with Pearson's correlation.

To compare characteristics at Time 1 between the MOB group and comparison group, MANOVA was employed to examine whether there were significant differences in age, education, chronic conditions, functional limitations, MoCA scores, the POMA, the TUG test, the FR, the total number of falls, and other physical exercises. Chi-square statistics were used to indentify if there were significant differences in sex, race, and pain between the two groups. Significant variables at Time 1 were used as covariates in the subsequent analyses.

To address the impact of the MOB program on fear of falling and falls efficacy across time, repeated measures multivariate analysis of covariance (MANCOVA)was performed accounting for the significant differences at Time 1. Fisher's LSD tests were then used to examine significant group x time interactions. *P* values less than .05 indicated statistical significance.

Results

Attrition

Forty-five older adults in the MOB group and 58 in the comparison group were interviewed at Time 1. In the comparison group, two people refused to complete the MoCA and one person did not have time to complete it. These participants were therefore deleted from the dataset.

Regarding attrition, 10 participants in the MOB group were lost to follow-up at Time 2 due to lost interest (n = 5), being too busy (n = 4), or illness (n = 1) and 15 in the comparison group because they were too busy (n = 9), sick (n = 3), or other reasons (e.g., cannot reach or moved back to the north; n = 3). MANOVA was performed to compare the Time 1 characteristics between the participants who were lost to follow-up and those who remained in the study within each group. There were no significant differences within the MOB group, Wilks' Λ = .70, $F(12, 32) = 1.17$, $p = .344$, $\eta^2 = .30$, or within the comparison group, Wilks' Λ = .83, $F(12, 42) = .71$, $p = .735$, $\eta^2 = .17$, between those who did and did not complete the study.

Validation of the mFES-IF

The scores of the mFES-IF at Time 1 ranged from 1 to 3.63, *M* = 1.59, *SD* = .60, and ranged from 1 to 3.75, *M* =1.53, *SD* = .66, at Time 2. Among the activities at Time 1, participants had the highest fear of falling when walking on a trail, *M* = 2.09, *SD* = 1.00, and the lowest fear of falling when preparing a simple meal, *M* = 1.23, *SD* = .49. Most participants did not walk on a golf course normally (73%). Among the avoided activities, walking in a place with crowds had highest frequency (7%). At Time 2, walking on a trail, *M* = 1.96, *SD* = 1.01, continued to be the activity that produced the highest fear of falling among participants. Preparing a simple meal still induced the lowest fear of falling at Time 2, *M* = 1.27, *SD* = .58. Walking on a golf course still had the highest frequency response of "does not apply" (81%). The most commonly avoided activity was going up and down stairs (7%). These results are presented in Table 3.

The construct validity of the mFES-IF was examined by testing the following hypotheses: 1) that the mFES-IF would have a moderate and negative correlation with the mFES and a moderate and positive correlation with the GFFM, and 2) participants who reported that they fell in the past two months at Time 1 would have significantly higher scores on the mFES-IF than those who

Table 3
Mean Scores of the Modified Falls Efficacy Scale-International Florida

	Time 1			Time 2		
	Mean (SD)	Does not apply (%)†	Avoid doing it (%)†	Mean (SD)	Does not apply (%)‡	Avoid doing it (%)‡
1. Walking on a trail	2.09 (1.00)	28%	2%	1.96 (1.01)	39%	0%
2. Going up or down stairs	2.05 (1.37)	3%	6%	1.91 (.90)	7%	7%
3. Taking a bath or shower	1.85 (.97)	0%	0%	1.65 (.83)	0%	0%
4. Walking in a place with crowds	1.82 (.97)	3%	7%	1.69 (.92)	4%	5%
5. Walking outside after rain	1.71 (.92)	5%	2%	1.70 (.87)	4%	3%
6. Walking around swimming pool	1.65 (.85)	31%	6%	1.60 (.96)	40%	0%
7. Walking around in the neighborhood	1.58 (.78)	6%	3%	1.55 (.82)	5%	0%
8. Getting dressed or undressed	1.55 (.77)	0%	0%	1.51 (.79)	0%	0%
9. Getting in or out of a chair	1.52 (.76)	1%	2%	1.45 (.76)	0%	0%
10. Walking on a beach	1.46 (.81)	26%	5%	1.52 (.99)	29%	4%
11. Going to the shop	1.46 (.75)	4%	0%	1.40 (.70)	1%	1%
12. Walking on a golf course	1.41 (.80)	73%	5%	1.43 (.85)	81%	0%
13. Cleaning the house	1.41 (.72)	16%	2%	1.39 (.81)	13%	1%
14. Going to answer the telephone before it stops ringing	1.40 (.78)	0%	0%	1.35 (.71)	0%	0%
15. Getting in or out of a car	1.39 (.76)	0%	0%	1.37 (.77)	0%	0%
16. Going out to a social event	1.35 (.72)	2%	0%	1.33 (.73)	1%	1%
17. Visiting a friend or relative	1.33 (.69)	3%	1%	1.38 (.74)	4%	1%
18. Preparing simple meals	1.23 (.49)	3%	0%	1.27 (.58)	1%	0%

Note.
†. The percentage was calculated based on 100 participants.
‡. The percentage was calculated based on 75 participants.

reported that they did not fall. Pearson's correlations were used to examine the first hypothesis. The results showed that the mFES-IF was significantly correlated to the mFES, $r = -.78$, $p < .001$, and the GFFM, $r = .70$, $p < .001$. Next, an independent *t*-test was performed to test the second hypothesis. The result showed that participants who fell in the past two months had significantly higher fear of falling than those who did not fall, $M = 1.81$ vs. $M = 1.49$, $t(48.32) = 2.29$, $p = .026$, d = .51. These findings support the construct validity of the mFES-IF.

The predictive validity of the mFES-IF was examined with logistic regression to investigate whether the scores of the mFES-IF at Time 1 could predict falls status at Time 2. The results showed that the mFES-IF at Time 1 did not predict older adults who reported they fell at Time 2, OR = 2.35, $p = .057$. Thus, the predictive validity of this scale was not supported.

To test the reliability of the mFES-IF, Cronbach's α was calculated to examine internal consistency. The results showed that the Cronbach's α ranged from .89 (Time 1) to .92 (Time 2), indicating the scale is internally consistent. In terms of the test-retest reliability, Pearson's correlation was conducted to examine the correlation between the scores of the mFES-IF at Time 1 and Time 2 among participants in the comparison group ($n = 40$). The results showed that these two scores were significantly correlated, $r = .66$, $p < .001$, providing the evidence of 8-week test-retest reliability of the mFES-IF. These results indicated that the mFES-IF is a reliable measure.

Time 1 Comparison Between the MOB group and the Comparison Group

Table 4 displays the characteristics at Time 1 of the two groups. MANOVA was conducted to examine whether there were significant differences in age, education, chronic conditions, functional limitations, MoCA scores, the POMA, the TUG test, the FR, the total number of falls, and other physical exercises between the MOB group and the comparison group at Time 1. The results showed that there were significant differences between the two groups, Wilks' $\Lambda = .76$, $F(10, 89) = 2.80$, $p = .005$, $\eta^2 = .24$. Participants in the MOB group were significantly older, $F(1, 98) = 8.53$, $p = .004$, $\eta^2 = .08$, and had more chronic conditions, $F(1, 98) = 7.29$, $p = .008$, $\eta^2 = .03$, more functional limitations, $F(1, 98) = 5.06$, $p = .027$, $\eta^2 = .05$, poorer MoCA scores, $F(1, 98) = 17.98$, $p < .001$, $\eta^2 = .16$, worse mobility, $F(1, 98) = 6.24$, $p = .014$, $\eta^2 = .06$, slower walking speed, $F(1, 98) = 4.82$, $p = .031$, $\eta^2 = .05$, and poorer postural control, $F(1, 98) = 21.24$, $p < .001$, $\eta^2 = .19$, than the participants in the comparison group. Education, $F(1, 98) = 2.95$, $p = .089$, $\eta^2 = .03$, the total number of falls, $F(1, 98) = .001$, $p = .978$, $\eta^2 < .01$, and total number of other physical exercises, $F(1, 98) = .432$, $p = .512$, $\eta^2 < .01$, were not significantly different between the two groups. Next, Chi-square statistics were performed to investigate if there were significant differences in sex, race, and pain between the MOB group and comparison group. The results indicated that there was a significant difference in race between these two groups, $\chi^2(3, N = 100) = 17.20$, $p = .001$. Specifically, fewer participants were white and more participants were Hispanic, black, and Asian in the MOB group relative to the comparison group.

Table 4

Time 1 Characteristics Between the MOB Group and Comparison Group

Variables	MOB (*n* = 45)	Comparison (*n* = 55)
	M (*SD*) or %	*M* (*SD*) or %
Age (years)**	78.89 (9.31)	74.76 (8.23)
Sex: Female (%)	76%	71%
Race**		
White (%)	64%	96%
Hispanic (%)	31%	4%
Black (%)	2%	0%
Asian (%)	2%	0%
Education (years)	14 (3.32)	15 (2.19)
Pain (%)	73%	64%
Chronic conditions (0-10)**	3.27 (1.57)	2.40 (1.62)
Functional limitations (0-14)*	1.87 (2.82)	.78 (2.21)
Montreal Cognitive Assessment (0-30)***	22.13 (5.44)	26.04 (3.73)
Performance-Oriented Mobility Assessment (0-28)*	22.76 (4.06)	24.75 (3.88)
Timed Up and Go test (s)*	14.27 (3.56)	12.59 (4.00)
Functional Reach Test (in.)***	9.28 (2.40)	11.46 (2.30)
Number of falls	.42 (.66)	.42 (.76)
Other exercises	1.04 (1.26)	1.22 (1.37)

Note.

* $p < .05$ ** $p < .01$ *** $p < .001$

Effects of the MOB on Fear of Falling and Falls Efficacy

MANCOVA was then performed to investigate the effects of the MOB program on falls efficacy (i.e., indicated by the mFES) and fear of falling (i.e., indicated by the mFES-IF and the GFFM) accounting for age, race, chronic conditions, functional limitations, MoCA scores, the POMA, the TUG test, and the FR at Time 1. Two hypotheses were tested: 1) whether the participants in the MOB group would have a significant improvement in their falls efficacy compared to those in the comparison group across time, and 2) whether participants in the MOB group would have a significant reduction in fear of falling relative to the participants in the comparison group from Time 1 to Time 2. Table 5 shows the univariate F tests for the mFES, the mFES-IF, and the GFFM. Generally, the MANCOVA showed that there was no main effect of group, Wilks' $\Lambda = .92$, $F(3, 63) = 1.87$, $p = .145$, $\eta^2 = .08$, no effect of time, Wilks' $\Lambda = .98$, $F(3, 63) = .41$, $p = .743$, $\eta^2 = .02$, but a significant group x time interaction, Wilks' $\Lambda = .52$, $F(3, 63) = 19.35$, $p < .001$, $\eta^2 = .48$.

The first hypothesis was tested by examining the effects of the MOB program on the mFES. The univariate results showed that there was a significant main effect of group, $F(1, 65) = 4.26$, $p = .043$, $\eta^2 = .05$, no effect of time, $F(1, 65) = .04$, $p = .85$, $\eta^2 < .01$, and a significant group by time interaction, $F(1, 65) = 43.60$, $p < .001$, $\eta^2 = .35$, after accounting for age, $F(1, 65) = .42$, $p = .52$, race, $F(1, 65) = .64$, $p = .427$, chronic conditions, $F(1, 65) = .01$, $p = .937$, functional limitations, $F(1, 65) = 2.17$, $p = .145$, MoCA scores, $F(1, 65) = 1.43$, $p = .237$,

Table 5

Univariate F Tests for the Modified Falls Efficacy Scale, the Modified Falls Efficacy Scale-International Florida, and the Geriatric Fear of Falling Measure Adjusted for Significant Differences at Time 1

Effect	MOB	Comparison			
	Mean (SE)	Mean (SE)	F (df = 1, 65)	η^2	Post-Hoc Test (Fisher's LSD adjustment)
Modified Falls Efficacy Scale†					
Group*	8.58 (.28)	7.69 (.26)	4.26	.05	MOB: *p*(Time 2 > Time 1) < .001
Time			.04	<.01	Comparison: *p*(Time 1 > Time 2) = .008
GroupxTime***			43.60	.35	Time 1: *p*(Comparison > MOB) = .513
					Time 2: *p*(MOB > Comparison) < .001
Modified Falls Efficacy Scale-International Florida‡					
Group	1.62 (.11)	1.61 (.10)	.35	<.01	MOB: *p*(Time 1 > Time 2) < .001
Time			1.14	.01	Comparison: *p*(Time 2 > Time 1) = .004
GroupxTime***			19.86	.19	Time 1: *p*(MOB > Comparison) = .169
					Time 2: *p*(Comparison > MOB) = .026
Geriatric Fear of Falling Measure‡					
Group	32.90 (1.94)	36.10 (1.50)	1.66	.02	MOB: *p*(Time 1 > Time 2) < .001
Time			.35	<.01	Comparison: *p*(Time 2 > Time 1) = .02
GroupxTime***			15.57	.17	Time 1: *p*(MOB > Comparison) = .525
					Time 2: *p*(Comparison > MOB) = .008

Note. All analyses adjusted for age, race, chronic conditions, functional limitations, MoCA scores, the POMA, the TUG test, and the FR at Time 1.

†. Higher scores indicate higher level of falls efficacy.

‡. Higher scores indicate higher level of fear of falling.

* *p*< .05 *** *p*< .001

mobility, $F(1, 65) = 12.27$, $p = .001$, walking speed, $F(1, 65) = 1.49$, $p = .70$, and postural control, $F(1, 65) = 2.39$, $p = .127$. The Fisher's LSD test showed that there was no difference between the MOB group and the comparison group at Time 1, $p = .513$. However, participants in the MOB group reported significantly higher falls efficacy than those in the comparison group at Time 2, $p < .001$. In addition, from Time 1 to Time 2, falls efficacy increased significantly among the participants in the MOB group, $p < .001$, but decreased significantly among those in the comparison group, $p = .008$. These results suggest that older adults can enhance their falls efficacy by participating in the MOB program.

The second hypothesis was tested by examining the effects of the MOB program on fear of falling. There were two measurements used to assess fear of falling: the mFES-IF and the GFFM. For the mFES-IF, there was no main effect of group, $F(1, 65) = .35$, $p = .557$, $\eta^2 < .01$, no effect of time, $F(1, 65) = 1.14$, $p = .29$, $\eta^2 = .01$, but a significant group by time interaction, $F(1, 65) = 19.86$, $p < .001$, $\eta^2 = .19$, after accounting for age, $F(1, 65) = 1.76$, $p = .189$, race, $F(1, 65) = .44$, $p = .51$, chronic conditions, $F(1, 65) = .20$, $p = .653$, functional limitations, $F(1, 65) = .01$, $p = .912$, MoCA scores, $F(1, 65) = .20$, $p = .657$, mobility, $F(1, 65) = 8.02$, $p = .006$, walking speed, $F(1, 65) = .01$, $p = .916$, and postural control, $F(1, 65) = 1.83$, $p = .181$. The Fisher's LSD test revealed that participants in these two groups had similar levels of fear of falling indicated by the mFES-IF at Time 1, $p = .169$. At Time 2, participants in the MOB group had significantly lower fear of falling than those in the comparison group, $p = .026$. Moreover, across time, fear of falling reduced significantly among participants in the MOB group, p

< .001, and increased significantly among those in the comparison group, p = .004.

For the GFFM, there was no main effect of group, $F(1, 65) = 1.66$, p = .202, $\eta^2 = .02$, no effect of time, $F(1, 65) = .35$, $p = .558$, $\eta^2 < .01$, but a significant group by time interaction, $F(1, 65) = 15.57$, $p < .001$, $\eta^2 = .17$, after accounting for age, $F(1, 65) = .44$, $p = .51$, race, $F(1, 65) = 4.06$, $p = .048$, chronic conditions, $F(1, 65) = .97$, $p = .329$, functional limitations, $F(1, 65) = 2.78$, $p = .10$, cognitive function, $F(1, 65) = .01$, $p = .911$, mobility, $F(1, 65) = 10.79$, $p = .002$, walking speed, $F(1, 65) = 2.90$, $p = .094$, and postural control, $F(1, 65) = 1.94$, $p = .168$. The Fisher's LSD test showed that there was no significant difference in fear of falling indicated by the GFFM between the two groups at Time 1, $p = .525$, however participants in the MOB group noted significantly less fear than those in the comparison group at Time 2, $p = .008$. In addition, participants in the MOB group had a significant reduction in fear of falling across time, $p < .001$. In contrast, the level of fear of falling increased significantly among participants in the comparison group from Time 1 to Time 2, $p = .02$. The results from the analyses on the mFES-IF and the GFFM showed that the MOB program has the potential to significantly reduce older adults' fear of falling. Figure 3 shows the plots of the changes in the mFES, mFES-IF, and GFFM from Time 1 to Time 2 by groups.

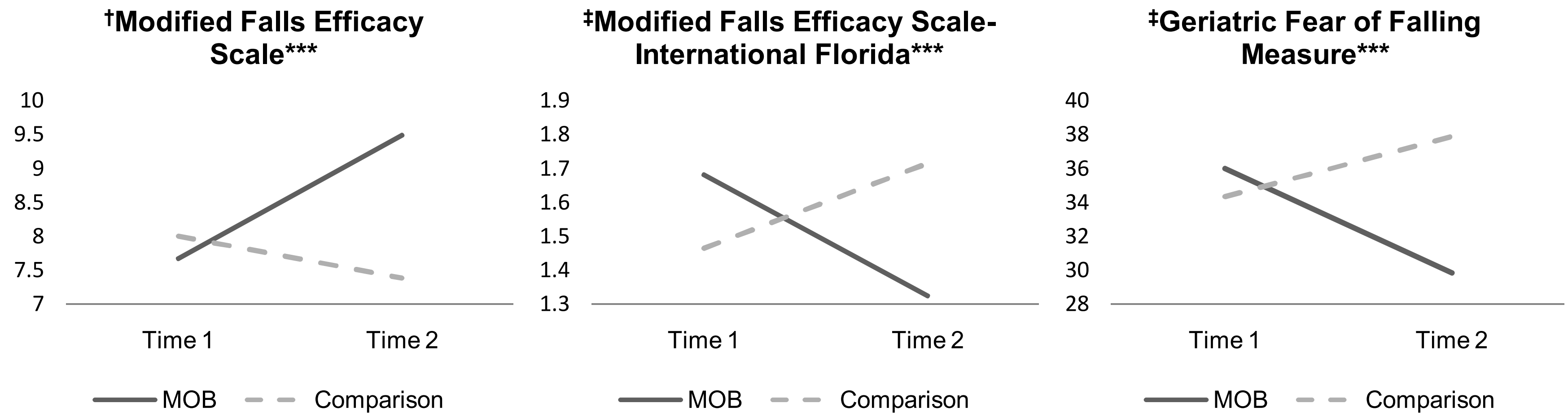

Figure 3. Group by time effect on the Modified Falls Efficacy Scale, Modified Falls Efficacy Scale-International Florida, and Geriatric Fear of Falling Measure.

†. Higher scores indicate higher level of falls efficacy.

‡. Higher scores indicate higher level of fear of falling.

*** *p*< .001

Discussion

The purpose of this study was to test the psychometric properties of the mFES-IF and to re-examine the effects of the MOB on fear of falling and falls efficacy. The mFES-IF was modified to include activities that older adults who live in Florida may engage in frequently. The scoring system was altered to have the final scores be related to fear of falling on activities older adults were actually performing. The results showed that the mFES-IF has good content and construct validities. Regarding predictive validity, the mFES-IF was found to be unable to predict older adults who reported any falls at Time 2. Hence, the predicative validity of this instrument was not supported. For the reliability, the mFES-IF demonstrates acceptable internal consistency and 8-week test-retest reliability.

In terms of the effects of the MOB on fear of falling and falls efficacy, older adults in the MOB group had significantly a higher level of fear of falling and lower level of falls efficacy at Time 1 than participants in the comparison group. However, the results showed that participants in MOB had a significant decline in their fear of falling and an increase in their falls efficacy across time at Time 2 after adjusting the significant covariates at Time 1. In contrast, fear of falling increased and falls efficacy decreased significantly from Time 1 to Time 2 among those in the comparison group.

The mFES-IF

Overall, the mFES-IF has demonstrated acceptable psychometric properties. One advantage of this scale is that the activities were of regional relevance to older adults who live in Florida. Among the six added activities, four items are leisure activities (i.e., walking around swimming pool, walking outside after rain, walking on a beach, walking on a trail, and walking on a golf course) and two items are activities those older adults encounter often because of the geographic region (i.e., walking outside after rain and getting in or out of car). Using the six activities coupled with the global activities (e.g., taking a bath or shower or going out to a social event) in the original Falls Efficacy Scale-International scale, the mFES-IF provides a broader range of activities that challenge the older adults in this study daily, and therefore can be applied to a wider range of older adults who live in Florida. A further advantage of the mFES-IF is that the scale incorporates “does not apply” and “avoid doing it” in the scoring system and therefore older adults do not have to answer questions hypothetically. Not only does this make it easier for older adults to answer the scale, the final scores can then also reflect their actual fear of falling while performing daily activities.

The construct validity of the mFES-IF was examined by its relationship with the mFES and the GFFM. The negative correlation between the mFES-IF and the mFES and positive correlation between the mFES-IF and the GFFM correspond with previous research (Huang, 2006; Tinetti et al., 1990). In addition, the moderate correlations of the mFES-IF with the mFES and the GFFM indicate that these scales reflect similar underlying constructs but they are not the same scales. We also found that older adults who fell had significantly higher scores than those who did not. This result provides another piece of evidence that the mFES-IF is a measure of fear of falling.

In this study, the mFES-IF was not a significant predictor of falls status. It is possible that the study period was too short (8 weeks) and therefore not enough falls events occurred to capture this relationship. Most studies examining the relationship between fear of falling and falls efficacy with falls have at least a one-year follow-up (Delbaere et al., 2010; Delbaere et al., 2004; Hotchkiss et al., 2004). Hence, a long-term follow-up may be required in order to accurately examine the predictive validity of the mFES-IF.

Although this study provided evidence to support the test-retest reliability of the mFES-IF, the reliability coefficient of this scale (r = .66) was lower than the recommended level for a measure used for diagnosis (r = .90; Portney & Watkins, 2008). It could be that the test-retest interval (8 weeks) was too long, thus giving time for participants in the comparison group to change their behaviors. In addition, the discussion between the primary investigator and participants on mobility, walking speed, and postural control performance at Time 1 may have affected their performances at Time 2. Future studies are recommended to examine the test-retest reliability of the mFES-IF with a shorter test-retest interval. The mFES-IF is the first scale that allows older adults to skip items if they do not engage in the activities. No problems occurred when administering this scale during the study period. Nevertheless, it is worth noting that older adults may confuse “does not apply” with “avoid doing it” when they have to select one option between them. For example, during the interview, some older adults indicated that it was difficult for them to clean the house due to their unsteadiness, and they hired maids to do this task since several years ago. Therefore, they wondered whether they should answer “cleaning the house” as “does not apply” or “avoid doing it.” Although this confusion would not affect their scores related to fear of falling, it may have led to an underestimated total number of avoided activities. Previous research has linked activity avoidance to future falls and physical frailty (N. Chang et al., 2010; Deshpande et al., 2008). Therefore, it is important to identify the activities older adults avoid accurately. One option to reduce this confusion is to add a statement on the scale to inform older adults that they should score “avoid doing it” if they used to do the activity, but they have stopped doing it due to concern about falling. Another option is to add a time element to the two options. For example, “does not apply” could be changed to “I have never done it before” and “avoid doing it” rephrased as “I do not do it now because I worry about falling”. More studies are needed to examine if these two options would help identify avoided activities more accurately.

Measuring fear of falling on activities those older adults are actually performing has clinical implications. Previous research has indicated that fear of falling is an important endpoint for falls prevention (Jørstad et al., 2005). In addition, this fear is not usually discussed by older adults (Walker & Howland, 1992). The mFES-IF is able to separate activities that older adults perform from those they do not perform. Thus, the results of this scale can provide a list of individualized activities that older adults engage in with their corresponding rating of fear of falling. Practitioners can use the mFES-IF to help older adults reduce fear of falling on specific activities (e.g., reduce fear of falling when walking on a trail or taking a bath or shower), instead of providing global falls prevention (e.g., training balance or strength). Not only can the scale help practitioners address the meaningful activities of older adults and help to keep them more active, it consequently, could also help to delay the cessation of these meaningful activities by older adults.

One limitation of the mFES-IF is that with activities tailored for older adults who live in Florida, this scale may not be appropriate for populations outside of this, or similar, states. Although modifications to the scoring system might be used to minimize this limitation, the mFES-IF is unable to assess fear of falling in activities older adults might perform regularly in other geographic regions. Most current measures of fear of falling and falls efficacy have used global activities, such as taking a bath or shower, to allow cross-cultural comparisons (Kempen et al., 2007; Parry, Steen, Galloway, Kenny, & Bond, 2001; Ruggiero et al., 2009; Tinetti et al., 1990; Yardley et al., 2005). Nevertheless, these scales ignore the importance that geographic specific activities might have on the development of fear of falling. Given that fear of falling is situation and stimulus specific, a scale with geographic activities and global activities may be a more accurate measure to reflect such fear.

The MOB Program

Based on the recommendations from previous studies (Hadjistavropoulos et al., 2011; Moore & Ellis, 2008; Valentine et al., 2011), measures of fear of falling and falls efficacy were included to examine the effects of the MOB program on these two psychological phenomena of falling. Similar to the findings in the studies by Healy et al. (2008) and Tennstedt et al. (1998), the MOB program was found to effectively increase older adults' falls efficacy right after the program. In addition, consistent with the study by Zijlstra et al. (2009), it was also found that older adults can significantly reduce their fear of falling by participating the MOB program. Therefore, it is concluded that the MOB program not only is effective at increasing falls efficacy but also reducing fear of falling.

The MOB program was more effective in improving falls efficacy (η^2 = .35) than fear of falling (η^2 = .17-.19). Currently, there is no gold standard as to what level of fear of falling or falls efficacy is beneficial. Having either too high or too low of levels in both psychological phenomena of falling (i.e., become too active or sedentary) could put older adults in a dangerous situation (Delbaere, Crombez, et al., 2009). Thus, although this current study shows that there are immediate benefits of the MOB program on fear of falling and falls efficacy, whether the improvement on these two psychological phenomena of falling is sufficient will need more investigation.

A long-term follow-up is needed in future studies. Previous research shows that the effects of the MOB program on falls efficacy reduced after 6 months (Tennstedt et al., 1998). Later, Zijlstra et al. (2009) included one booster session 6-months after the last session of the MOB program. At the completion of the booster session, the researchers found that the participants in the intervention group were able to maintain their fear of falling at a similar level as it was at the last session, while those in the control group reported a heightened fear. The results also showed that although there was a significant difference in fear of falling between the intervention group and the control group right after the booster session, the effects of the MOB program started to decline and no significant differences between the two groups were found at the 1-year follow-up. Therefore, to maintain the effects of the MOB program among community-dwelling older adults, a continued booster session might be required. Given that the MOB program uses a volunteer lay leader model, one way to increase the frequency of booster sessions is to train past participants of the program. This would allow older adults living in the same community to meet frequently to share their experiences and thoughts about fear of falling and practice the exercises.

Previous studies have shown that cognitive impairment is associated with poor adherence to a treatment program and medication use (Ekman, Fagerberg, & Skoog, 2001). Based on the published norms for the MoCA (Nasreddine et al., 2005), 82% of the participants in the MOB group had mild cognitive impairment. Given that the MOB program requires older adults to process a lot of information (i.e., eight sessions of education and group discussion), cognitive function might play an important role in the information uptake and program adherence. MoCA was included as a covariate in the analyses, but was not a significant factor for fear of falling or falls efficacy. Future studies should further investigate whether cognitive function can influence the effectiveness of the MOB program.

It is still not clear whether the exercise or education component of the MOB program is more effective at improving fear of falling or falls efficacy. While some studies show that education programs alone can significantly improve falls efficacy (e.g., Brouwer et al., 2003), others show that exercise interventions alone can achieve the same effects (e.g., Sattin, Easley, Wolf, Chen, & Kutner, 2005; Taggart, 2002). One study by Li, Fisher, Harmer, and McAuley (2005) investigated the effects of Tai Chi exercise on fear of falling and falls efficacy. The researchers found that Tai Chi exercise was an effective intervention to reduce fear of falling and enhance falls efficacy. Nevertheless, they also found that the reduction of fear of falling was only observed among older adults who had an improvement in their falls efficacy. Among those who did not note much improvement in their falls efficacy, their fear of falling stayed at similar level throughout the study. Therefore, to disentangle the effects of the exercise and education components of the MOB program on falls efficacy and fear of falling might be complicated. It is likely that either the exercise or education component can improve falls efficacy among older adults. However, to reduce fear of falling, both components are required.

There are limitations in the current study. First, although a comparison group was used in the study, this study was not a randomized-controlled trial. Therefore, a causal relationship between the MOB program and fear of falling and falls efficacy cannot be made. However, all variables that were significantly different between the MOB group and comparison group at Time 1 were incorporated into the models to account for the variance. Therefore, the findings are more robust than previous studies that have used a single group design. Second, all participants were self-selected. Not only might this have affected their performance and effort put forth in the study, they might also originally have had problems with their balance or high levels of fear of falling and therefore had greater potential to improve. Third, although no intervention was given to the participants in the comparison group, they did receive brief education about physical function and exercise from the primary investigator. Future studies are recommended to incorporate a group which receives no attention.

In conclusion, this current study modified an existing scale to create the mFES-IF to measure fear of falling in activities among older adults living in Florida. It was found that the mFES-IF has acceptable validity and reliability. Regarding the effects of the MOB program, this study followed previous studies' suggestions and incorporated measures of fear of falling and falls efficacy simultaneously to examine this program. The results showed that older adults could immediately reduce their fear of falling and enhance their falls efficacy by participating in the MOB program. Therefore, the MOB program appears to be an effective intervention to reduce fear of falling and enhance falls efficacy among community-dwelling older adults.

Chapter Five:

The Long-term Effects of the A Matter of Balance Program on Falls and Physical Risk of Falling

Abstract

Using growth curve modeling, this study examined whether older adults who participated in the *A Matter of Balance* (MOB) program had significantly fewer falls over a 5-month period than older adults who did not receive this program. In addition, this study investigated the trajectories of mobility (the Performance-Oriented Mobility Assessment), walking speed (the Timed Up and Go test), and postural control (the Functional Reach test) among older adults who participated in the program. The results showed that the total number of falls did not change over time in the current sample. However, participants who received the MOB program had significant improvements on mobility, walking speed, and postural control, over time after accounting for individual characteristics, fear of falling, and falls efficacy. The improvements on mobility and walking speed reached the highest level at the end of the MOB program. Although these effects were diminished, participants' mobility and walking speed were better at the end of the study than their initial level at baseline. Participants' postural control continued to improve and reached the highest level at the end of the study.

Introduction

Falls have a devastating impact on older individuals in our society. In addition to injuries (e.g., fracture or bruises; Rubenstein & Josephson, 2002; van Balen et al., 2001), falls can result in impaired physical (e.g., poor postural control) and psychological (e.g., fear of falling) functioning and poorer health-related quality of life (Fabrício et al., 2004; Scaf-Klomp et al., 2003; Suzuki et al., 2002). The costs for treating falls and fall-related injuries among older adults have also increased dramatically (Stevens et al., 2006). For these reasons, falls prevention among older adults has become an important topic in public health and policy (Centers for Disease Control and Prevention, 2010; U.S. Department of Health and Human Services, 2010).

The MOB program is a multifaceted intervention that is used to reduce fear of falling among community-dwelling older adults (Tennstedt et al., 1998). This evidence-based program includes 8-weekly sessions incorporating standardized education and exercise. The education component covers topics such as misconceptions about falls, risk behaviors of falling, and environmental hazards. The exercise component targets older adults' balance and muscle strength. In the previous study (Chapter 3), the effect of the MOB program on falls and physical risk factors of falling was examined. No significant effects of the MOB program on reducing the total number of falls immediately after the completion of the program were found. However, older adults who participated in the MOB program demonstrated significant improvements in their mobility, walking speed, and postural control at the end of the program.

Nevertheless, one of the limitations in the previous study was the lack of power. It is possible that the non-significant difference in the total number of falls between older adults who received the MOB program and those who did not may be due to the small number of falls recorded during this eight week period. Given that the MOB program encourages older adults to participate in more activities, researchers are concerned that older adults who participate in this program may actually fall more due to increased exposure to risk factors of falling (Healy et al., 2008; Tennstedt et al., 1998; Zijlstra et al., 2009). For these reasons, it is necessary to have a long-term follow-up to monitor the changes in the occurrence of falls.

To date, no study has examined the long-term effects of the MOB program on the physical risk factors of falling. The previous study (Chapter 3) found that older adults experienced immediate improvements on mobility, walking speed, and postural control by participating in the MOB program. However, whether these effects can be maintained for at least three months after the completion of the program is unknown.

Therefore, this follow-up study had two goals. The first goal was to monitor the changes in the total number of falls over time between older adults who received the MOB program and those who did not participate in the program. The second goal was to investigate whether the effects of the MOB program on physical risk factors of falling started to decline after the completion of the program.

Method

Participants

This study attempted to contact 45 participants in the MOB group and 55 in the comparison group with complete baseline information from the previous study (Chapter 3) 3-months after the last session of the MOB program. The inclusion criteria were community-dwelling older adults who were at least 60 years old, spoke and read English, and did not use a wheelchair. Older adults who participated in the MOB program were from two community centers and two independent living apartments. For the comparison group, participants were from a community center, an independent living apartment, and a calling list. The details of participants' characteristics can be found in Chapter 3.

Intervention

The West Central Florida Area Agency on Aging Inc. provided six MOB programs in two community centers and two independent living apartments. One or two volunteer lay leaders led each program, and a total of five individuals led the six programs. Each volunteer lay leader followed the procedure standardized by Zijlstra et al.(2009). The MOB program included 2-hour weekly sessions for eight weeks.

No intervention was provided to the participants in the comparison group. After the baseline interview, the primary investigator discussed the adult's performance on mobility, walking speed, and postural control tests with each participant. All participants received the results of their mobility, walking speed, and postural control tests, including the established criteria and norms for each test, after the post assessments. At the end of the study, they were also referred to the sites where the MOB program was provided if they wished to participate in the program.

Measures

The total number of falls and the scores on the Performance-Oriented Mobility Assessment (POMA; Tinetti, 1986), the Timed Up and Go (TUG) test(Shumway-Cook et al., 2000), and the Functional Reach Test (FR; Duncan et al., 1990) were the outcome variables in the current study.

A fall in the current study was defined as “an unexpected event in which participants come to rest on the ground, floor, or lower level” (Lamb et al., 2005). During the interview, older adults were asked whether they had fallen in the past two months. The response was either “yes” or “no”. Participants who reported they fell were further asked how many times they had fallen. The total number of falls was recorded and used as a continuous variable in the analyses.

The POMA is a measure of overall mobility (Tinetti, 1986). During the interview, an administrator observed the older adult’s performance on balance and gait. There were 10 observations for each performance on balance and gait. Each observation had its own scoring criteria. The possible scores for the performance on balance were 0 to 16 and 0 to 12 for the performance on gait. A total score of mobility ranging from 0 to 28 was obtained by summing up the scores for the performance on balance and gait for each individual. Higher scores on the POMA indicate better overall mobility. The POMA was previously found to have good convergent validity (e.g., the relationship with one leg stance time, r = .74, $p < .01$; Cho et al., 2004). In addition, the POMA was found to have good 2-weekinter-raterreliability, ICC =.99 (Lin et al., 2004).

The TUG test is a measure of walking speed (Shumway-Cook et al., 2000). In this test, older adults were asked to get up from a chair, walk a 3-meter course, and sit back down in their chair. During the process, older adults were asked to walk at their regular pace. The amount of time used to complete the test was recorded in seconds, with longer times indicating slower walking speed. This test was found to have good predictive validity (e.g., predicting future falls; Shumway-Cook et al., 2000), construct validity (e.g., the relationship with the Barthel Index of ADL, $r = -.78$; Lin et al., 2004), and 1-day inter-rater reliability, ICC = .91 (Nordin et al., 2006).

The FR is a measure of postural control (Duncan et al., 1990). To complete this test, an older adult was asked to flex one shoulder to 90 degrees. Then, a yardstick was held next to the shoulder with the arm placed horizontally to get the first measurement. The older adults were then asked to lean forward as far as possible while keeping their feet stationary to obtain the second measurement. The postural control score was calculated by subtracting the first measurement from the second measurement (in inches), with higher scores on the FR indicating better postural control. The FR was found to have good predictive validity (e.g., predicting recurrent fallers, odds ratio = 8.07;Duncan et al., 1992), construct validity (e.g., relationship with tandem walking, $r = .67$; Duncan et al., 1992), and 1-week test-retest reliability, $r = .89$ (Duncan et al., 1990).

Variables known to affect falls including age, sex, race, education, functional limitations, chronic conditions, fear of falling, falls efficacy, and global cognitive function were also collected during the interview (Rubenstein & Josephson, 2002). Age and education were measured continuously in years. Sex and race were dichotomous with female and white coded as 1. Functional limitations were measured by the Katz Activities of Daily Living scale (scores ranged from 0 to 6; Katz et al., 1970) and the Lawton Instrumental Activities of Daily Living scale (scores ranged from 0 to 8; Lawton & Brody, 1969). A composite score ranging from 0 to 14 was calculated by adding up the scores from these two scales (Spector & Fleishman, 1998), with higher scores indicating more functional limitations. Chronic conditions were measured based on older adults' self report of the following conditions: high blood pressure, diabetes, cancer, lung disease, stroke, arthritis, depression, heart disease, osteoporosis, and asthma. The total number of chronic conditions was obtained by summing up all of the conditions the participants reported (ranging from 0 to 10).

Fear of falling was measured by the Modified Falls Efficacy Scale-International Florida (mFES-IF). When administering this scale, participants were asked to rate their concern about falling based on how they usually engaged in the 18 activities listed in the scale. Each activity was measured on a 0 to 5 scale (0: does not apply, 1: not at all concerned, 2: somewhat concerned, 3: fairly concerned, 4: very concerned, and 5: avoid doing it). An average score, ranging from 0 to 4, was calculated by summing up the scores of activities rated between 1 and 4 and divided by the total number of activities rated between 1 and 4;

higher scores indicated a greater fear of falling. This scale has been found to have good construct validity (e.g., significant difference between older adults who fell and who did not: $M = 1.81$ vs. $M =1.49$, $t(48.32) = 2.29$, $p = .026$, d = .51, internal consistency, Cronbach's $\alpha = .89$ to .92, and 8-week test-retest reliability, $r = .66$, $p < .001$.

Falls efficacy was measured using the Modified Falls Efficacy Scale (mFES; Hill et al., 1996). This scale included 14 different activities. Older adults were asked how confident they were that they could do these activities without falling. Each activity was scored on a 10-point visual analogue scale (0 = not confident/ not sure at all and 10 = completely confident/completely sure). The average score, ranging from 0 to 10, was calculated, with higher scores indicating greater confidence levels. If older adults reported that they were currently not engaging in certain activities on the list, they were asked to imagine how they would perform in the activities and rate the activities hypothetically. The construct validity of the mFES has been demonstrated by significant differences in the mFES scores between healthy older adults and patients in a falls clinic, $F(14, 159) = 5.25$, $p < .001$(Hill et al., 1996). The scale was found to have good internal consistency, Cronbach's $\alpha = .95$, and 1-week test-retest reliability, ICC = .95 (Hill et al., 1996).

Older adults' global cognitive function was measured by the Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005). This scale assesses attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. The total possible scores range from 0 to 30. A score lowers than 26 is indicative of mild cognitive impairment (Nasreddine et al., 2005). Previous studies found that this scale is internally consistent, Cronbach's $\alpha = .83$, and has a 35-day test-retest reliability, $r = .92$, $p < .001$ (Nasreddine et al., 2005).

Procedure

All participants in the MOB group had three face-to-face interviews: the first occurred one week before the first class (Time 1), the second within two weeks after the last session (Time 2), and the third at a 3-month follow-up after the last session (Time 3). For older adults in the comparison group, the duration between each interview was arranged to be approximately the same as in the MOB group for each individual. The primary investigator met with the participants in person for the first two interviews (i.e., Time 1 and Time 2). At Time 3, participants were contacted by phone or mail to collect information regarding their falls status during the previous two months. A signed informed consent was obtained from each participant at the Time 1 interview. The same measures were used throughout the study.

Analyses

Characteristics at Time 1 were first examined between participants in the MOB group. These characteristics included age, sex, race, education, functional limitations, chronic conditions, and mFES-IF, mFES, and MoCA scores. Multivariate analysis of variance (MANOVA) was used to compare the continuous variables, and Chi-square statistics were used when the variables were categorical. These analyses were conducted using SPSS 21 software.

Next, four two-level growth curve models were built for the purposes of this study. The advantage of using growth curve modeling is that it allows researchers to examine trajectories of change while taking into account individual and group factors. In addition, growth curve modeling uses all available data as long as there is no missing data among variables in Level 2 models (Raudenbush & Bryk, 2002). In general, in the Level 1 model, regression analyses were performed to investigate if the outcome variables (e.g., total number of falls and the POMA) changed over time. In the Level 2 model, individual characteristics (e.g., age and sex) and group variables (e.g., the MOB group vs. the comparison group) were added to estimate the Level 1 parameters. These analyses were performed using the HLM 6.02 software.

The first model was built to examine potential changes in the total number of falls over time between the participants in the MOB group and comparison group. The second, third, and fourth models were built to identify whether the effects of the MOB program on the POMA, the TUG test, and the FR started to decline after the final session of the program. In the first model, the group variable (MOB) was coded as 1 if participants received the MOB program and coded as 0 for those in the comparison group.

The unconditional model (e.g., equation 1) and unconditional growth model (e.g., equation 2) were first examined. Time was coded as months from the first interview. Time-squared ($Time^2$) was entered to test if the changes in the outcome variables across time were curvilinear rather than linear in nature.

$$\text{Level 1: Falls} = \pi_{0j} + r_{ij} \tag{1}$$

Level 2: $\pi_{0j} = \beta_{00} + u_{0j}$

Level 1: Falls = $\pi_{0j} + \pi_{1j}\,(\text{Time})_{ij} + \pi_{2j}\,(\text{Time}^2)_{ij} + r_{ij}$ (2)

Level 2: $\pi_{0j} = \beta_{00} + u_{0j}$

$\pi_{1j} = \beta_{10} + u_{1j}$

$\pi_{2j} = \beta_{20} + u_{2j}$

If significant changes in the outcome variables were found over time, time invariant individual characteristics (i.e., age, sex, race, education, functional limitations, chronic conditions, and MoCA scores) were then entered to estimate the baseline levels of the outcome variables (i.e., Level 1 intercept: π_{0j}). For example:

Level 1: Falls = $\pi_{0j} + \pi_{1j}\,(\text{Time})_{ij} + \pi_{2j}\,(\text{Time}^2)_{ij} + r_{ij}$ (3)

Level 2: $\pi_{0j} = \beta_{00} + \beta_{01}\,(\text{age})_j + \beta_{02}\,(\text{sex})_j + \beta_{03}\,(\text{race})_j + \beta_{04}$

$(\text{education})_j + \beta_{05}\,(\text{functional limitations})_j + \beta_{06}$

$(\text{chronic conditions})_j + \beta_{07}\,(\text{MoCA scores})_j + u_{0j}$

$\pi_{1j} = \beta_{10} + u_{1j}$

$\pi_{2j} = \beta_{20} + u_{2j}$

Next, the mFES-IF and mFES were included as time variant characteristics in the models to account for the effects of the MOB program on fear of falling and falls efficacy over time (e.g., equation 4). After the mFES-IF and mFES were entered, the effects of the MOB program on the POMA, the TUG test, and the FR were then checked to determine if they started to decline after the last session of the MOB program. Significant quadratic terms (Time^2) indicate a decelerated growth rate.

$$\text{Level 1: Falls} = \pi_{0j} + \pi_{1j}\,(\text{Time})_{ij} + \pi_{2j}\,(\text{Time}^2)_{ij} + \pi_{3j}\,(\text{mFES-IF})_{ij} + \pi_{4j}\,(\text{mFES})_{ij} + r_{ij} \quad (4)$$

$$\text{Level 2: } \pi_{0j} = \beta_{00} + \beta_{01}\,(\text{age})_j + \beta_{02}\,(\text{sex})_j + \beta_{03}\,(\text{race})_j + \beta_{04}\,(\text{education})_j + \beta_{05}\,(\text{functional limitations})_j + \beta_{06}\,(\text{chronic conditions})_j + \beta_{07}\,(\text{MoCA scores})_j + u_{0j}$$

$$\pi_{1j} = \beta_{10} + \beta_{11} + u_{1j}$$

$$\pi_{2j} = \beta_{20} + u_{2j}$$

$$\pi_{3j} = \beta_{30} + u_{3j}$$

$$\pi_{4j} = \beta_{40} + u_{4j}$$

Last, group x time interaction was created by entering group variable (i.e., MOB) to the equations to estimate the slopes of Time (i.e., π_{1j} in a Level 2 model) and examine if the changes in the outcome variables over time differed significantly between the groups (e.g., equation 5). This analysis examined if there was a significant effect of the MOB program on total number of falls over time.

$$\text{Level 1: Falls} = \pi_{0j} + \pi_{1j}\,(\text{Time})_{ij} + \pi_{2j}\,(\text{Time}^2)_{ij} + \pi_{3j}\,(\text{mFES-IF})_{ij} + \pi_{4j}\,(\text{mFES})_{ij} + r_{ij} \quad (5)$$

$$\text{Level 2: } \pi_{0j} = \beta_{00} + \beta_{01}\,(\text{age})_j + \beta_{02}\,(\text{sex})_j + \beta_{03}\,(\text{race})_j + \beta_{04}\,(\text{education})_j + \beta_{05}\,(\text{functional limitations})_j + \beta_{06}\,(\text{chronic conditions})_j + \beta_{07}\,(\text{MoCA scores})_j + u_{0j}$$

$$\pi_{1j} = \beta_{10} + \beta_{11}\,(\text{MOB})_j + u_{1j}$$

$$\pi_{2j} = \beta_{20} + u_{2j}$$

$$\pi_{3j} = \beta_{30} + u_{3j}$$

$\pi_{4j} = \beta_{40} + u_{4j}$

For all models, random intercepts and slopes were tested first. If a random intercept or slope was not significant, the intercept or slope was then set to be fixed. All models were estimated using restricted maximum likelihood. An alpha value less than .05 was considered to be statistically significant.

Results

Time 1 Characteristics

Among all participants in the MOB group (n = 45), 35 completed the interview at Time 2 and 18 completed the interview at Time 3. In the comparison group (n = 55), 40 participants completed the interview at Time 2 and 15 provided information regarding their falls status at Time 3.

MANOVA was used to examine characteristics (i.e., age, education, chronic conditions, functional limitations, the MoCA, the mFES-IF, and the mFES) between participants who received the MOB program and those in the comparison group (Table 6). The results from the MANOVA showed that there were significant differences between these two groups, Wilks' Λ = .77, $F(7, 92)$ = 4.02, p = .001, η^2 = .23. Specifically, participants in the MOB group were significantly older, $F(1, 98)$= 8.53, , p = .004, η^2 = .08, and had more chronic conditions, $F(1, 98)$ = 7.29, p = .008, η^2 = .07, more functional limitations, $F(1, 98)$ = 5.06, p = .027, η^2 = .05, lower MoCA scores, $F(1, 98)$ = 17.98, p < .001, η^2= .16, a greater fear of falling, $F(1, 98)$ = 8.06, p = .006, η^2 = .07, and lower falls efficacy, $F(1, 98)$ = 11.55, p = .001, η^2 = .11, than the participants in the comparison group . In addition, there were significantly fewer individuals who

Table 6
Characteristics Between the MOB Group and Comparison Group at Time 1

Variables	MOB (n = 45)	Comparison (n = 55)
	M (*SD*) or %	*M* (*SD*) or %
Age (years)**	79 (1.30)	74 (1.18)
Sex: Female (%)	76%	71%
Race: White (%)***	64%***	96%
Education (years)	14 (.41)	15 (.37)
Chronic conditions (0-10)**	3.27 (.24)	2.40 (.22)
Functional limitations (0-14)*	1.87 (.36)	.78 (.32)
Montreal Cognitive Assessment (0-30)***	22.13 (.68)	26.03 (.62)
Modified Falls Efficacy Scale-International Florida (0-4)**	1.78 (.09)	1.44 (.08)
Modified Falls Efficacy Scale (0-10)**	7.18 (.30)	8.53 (.27)
Total number of falls		
Time 1	.42 (.66)	.42 (.76)
Time 2[a]	.14 (.43)	.48 (.91)
Time 3[a]	< .01 (< .01)	.60 (.91)

Note.
[a] The average total number of falls was calculated based on 35 participants in the MOB group and 45 in the comparison group at Time 2. At Time 3, the average was based on 18 participants in the MOB group and 15 in the comparison group.
* *p*< .05 ** *p*< .01 *** *p*< .001

were white in the MOB group than the comparison group, $\chi^2(1, N = 100) = 17.08$, $p < .001$. The education level and sex of the participants, $p = .089$ and $p = .603$ respectively, were similar between these two groups.

Growth Curve Models

The results of all unconditional models showed significant intercepts, *ps* < .001. However, the results of the unconditional growth models showed that only the POMA, the TUG test, and the FR changed significantly over time, *ps* < .001, but not the total number of falls, $p = .251$. Therefore, we continued to build the models for the POMA, the TUG test, and the FR. In the following models, only the intercepts (u_{0j}) and slopes of Time (u_{1j}) were kept random due to difficulties with model convergence.

Effects of the MOB program on the POMA, the TUG test, and the FR over time. Table 7 shows the effects of all variables for the POMA, the TUG test, and the FR. At Time 1, sex was significantly associated with the POMA, $b = 2.86$, $p = .011$. This result suggested that participants who were female performed better than males at Time 1. A significant relationship was found between age and the TUG test, $b = .12$, $p = .035$, indicating that older age at Time 1 was related to slower initial walking speeds. The FR was significantly correlated with age, $b = -.07$, $p = .029$, and MoCA scores, $b = .16$, $p = .023$. These significant relationships show that participants who were older at Time 1 tended to have shorter initial reaching distances. In addition, participants who scored higher on the MoCA at Time 1 performed better in their initial reaching distance. The significant variance

Table 7.
Summary of Growth Curve Models Examining the Effects of the A Matter of Balance Program on Mobility, Walking Speed, and Postural Control

	Performance-Oriented Mobility Assessment †		Timed Up and Go test ‡		Functional Reach test †	
	Estimate	SE	Estimate	SE	Estimate	SE
Intercept, β_0	30.19**	6.92	3.59	7.09	12.96**	4.03
Age	-.08	.05	.12*	.05	-.07*	.03
Sex: Female	2.86*	1.07	.75	.88	.72	.68
Race: White	-1.43	.90	1.64	1.15	-.44	.51
Education	.01	.15	- .01	.14	-.12	.11
Chronic conditions	-.29	.24	-.16	.23	.03	.18
Functional limitations	-.42	.25	.36	.18	-.06	.15
Montreal Cognitive Assessment	-.13	.12	.06	.09	.16*	.07
Slope: Time, β_1						
Intercept	.85*	.33	-.98**	.26	.86**	.28
Slope: Time^2, β_2						
Intercept	-.15*	.05	.14**	.04	-.07	.05
Slope: Modified Falls Efficacy Scale, β_3						
Intercept	.35	.24	-.20	.26	.07	.16
Slope: Falls Efficacy Scale-International Florida, β_4						
Intercept	-.17	.51	-.05	.41	-.35	.40
Variance (Intercept)	9.85***	3.14	8.95***	2.99	2.54***	1.59
Variance (Time)	.01	.12	.03	.16	.01	.11
Residual	2.22	1.49	2.03	1.42	1.49	1.22

Note.
†. Higher scores indicate better performance.
‡. Lower scores indicate better performance.
* $p< .05$ ** $p< .01$ *** $p< .001$

of the intercepts indicated that all participants in the MOB group had significantly different initial scores on the POMA, the TUG test, and the FR, $p < .001$.

Significant effects of time were found in the models of the POMA, the TUG test, and the FR, but significant quadratic terms were only found in the POMA and the TUG test. Specifically, regarding the POMA, participants' scores increased every month, $p = .015$. Their performance reached the highest level at Time 2 and started to decline, $b = -.15$, $p = .007$ (Figure 4). In terms of the TUG test, participants' speed increased every month, $p = .001$. However, this growth rate slowed down over time, $b = .13$, $p = .002$ (Figure 5). For the FR, participants reached farther every month, $p = .004$, and reached their highest level at Time 3 (Figure 6). The non-significant variance of the time slope indicated that all participants' growth rates on the POMA, the TUG test, and the FR were similar.

Discussion

This current study examined the effects of the MOB program on the total number of falls over time. In addition, the study investigated whether the effects of the MOB program on physical risk factors of falling started to decline after the last session among participants who received the program. This study found that the total number of falls did not change significantly from Time 1 to Time 3 in current sample. Regarding the effects of the MOB program on mobility (i.e., the POMA), participants' mobility improved significantly from Time 1 to Time 2. This improvement reached the highest level at the last session of the program. Although these effects were diminished at Time 3, participants' mobility was better at the end of the study compared to their initial level at Time 1. For the

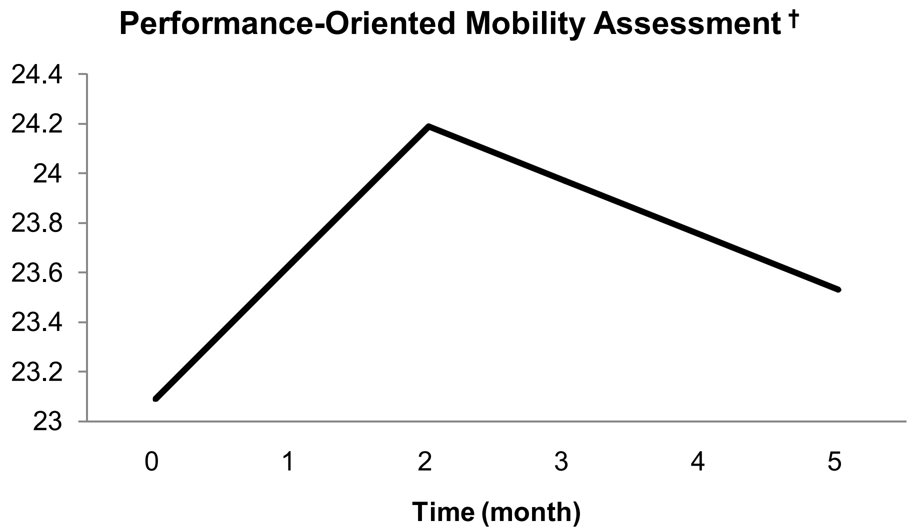

Figure 4. Effects of the A Matter of Balance program on the Performance-Oriented Mobility Assessment over time
†. Higher scores indicate better mobility.

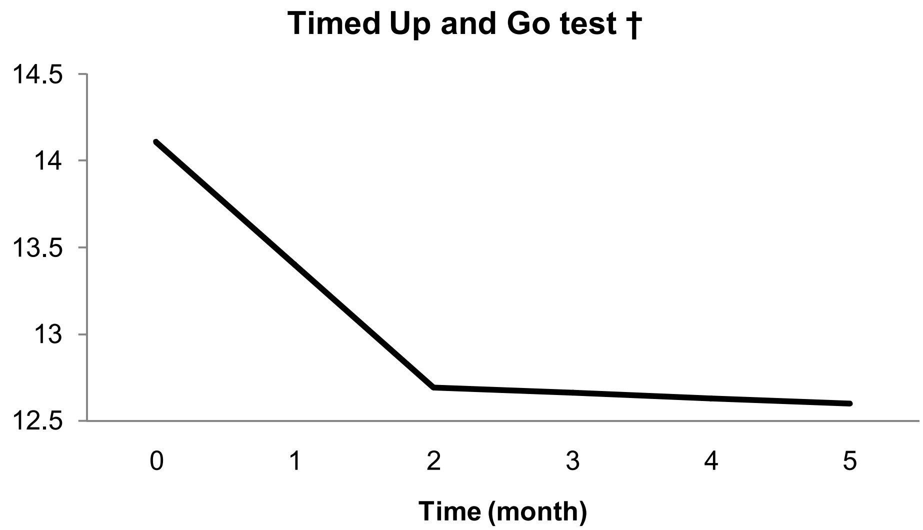

Figure 5. Effects of the A Matter of Balance program on the Timed Up and Go test over time
[†]. Higher scores indicate slower walking speed.

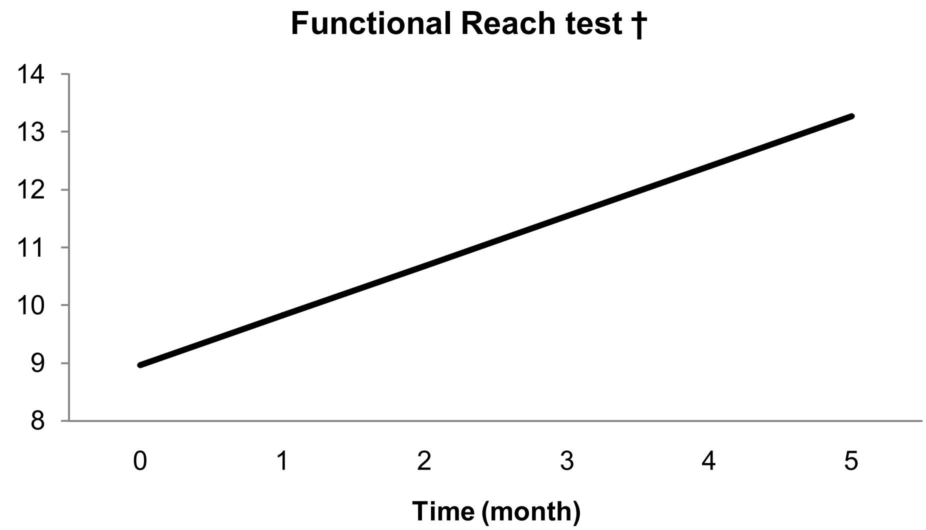

Figure 6. Effects of the A Matter of Balance program on the Functional Reach Test over time
†. Higher scores indicate better postural control.

effects of the MOB program on walking speed (i.e., the TUG test), participants demonstrated a significant improvement in their walking speed over time. Their walking speed increased rapidly during the program; however, the growth rate slowed down after the program ended. In terms of the effects of the MOB program on postural control (i.e., the FR), this study found that participants' postural control continued to improve from Time 1 to Time 3.

This current study found that the total number of falls during the past 2-months did not change significantly over time. This nonsignificant trajectory for the total number of falls could be due the lack of power. In addition, although one randomized-control trial examining the effects of the MOB program found a significant difference in the total number of recurrent fallers between the intervention group and the control group, this difference was not evident until the 14-month follow-up (Zijlstra et al., 2009). Therefore, a larger sample size and a longer study period may be needed to more accurately examine the effects of this program on falls.

It is possible that the effects of the MOB program may be moderated by older adults' cognitive function. The results of this study showed that MoCA scores at Time 1 were a significant covariate for the FR test. Those with better MoCA scores tended to have better postural control at Time 1 and Time 2, but there was no relationship at Time 3. More studies are warranted to investigate the impact of cognitive function on the effects of the MOB program.

After accounting for the effects of the MOB program on falls efficacy, fear of falling, and individual characteristics, the results indicated that older adults who enrolled in the MOB program demonstrated significant improvements on the POMA, the TUG test, and the FR over time. The results also showed that the effects of the MOB program decreased after the last session of the program. The length of this study was five months, and whether the trajectories of these trajectories continued beyond the study period is unknown. Nevertheless, the fact that the effects of the MOB program on the POMA and the TUG test decreased across time warrants the addition of a booster session approximately 3 months after the last session. Previous research has explored the use of a booster session to maintain the effects of the MOB program on fear of falling and falls efficacy (Zijlstra et al., 2009). Future studies need to investigate whether this same booster session could be used to affect older adults' mobility, walking speed, and postural control.

There are limitations to this study. Despite the use of growth curve modeling that utilizes all available data, there might have not been enough falls events recorded. In addition, the study period was only 5 months, and the results cannot be generalized beyond this study period. Future research would benefit from a larger sample size with a longer follow-up period. Another limitation was that participants in the comparison group learned exercises that they could practice at home from the primary investigator. Although no other formal intervention was given to the comparison group, these participants might have changed their behaviors after the meeting with the primary investigator. Hence, future studies should also include a group that receives no attention or education to reduce the potential bias.

Overall, the study found that the MOB program did not have a significant effect on the total number of falls over the 5 month period. However, older adults did improve their mobility, walking speed, and postural control by participating in the MOB program. The performance on mobility was likely to reach the highest level at the end of the MOB program and decline after the program. Older adults' walking speed continued to improve across the study, but the growth rate slowed down after the last session of the program. The performance on postural control kept improving and reached its highest at the end of the study.

Chapter Six:

Concluding Remarks

Falls can happen to people of any age. However, falls among older adults are particularly dangerous due to high incidence of falling combined with high susceptibility to injuries because of comorbidities and functional declines (Rubenstein, 2006). The MOB program targets several known risk factors of falling and promotes an active life style. In addition, exercises that strengthen muscles and improve postural control are taught during the class (Tennstedt et al., 1998). Although the MOB program has been implemented and disseminated in most parts of the United States, the effects of this program are not completely understood.

The three studies in this dissertation study provide valuable information regarding the effects of the MOB program on falls, mobility, walking speed, postural control, and psychological consequences of falling. Study 1was one of the first studies to investigate whether the MOB program can impact older adults' total number of falls, mobility, walking speed, and postural control. The results showed that older adults could improve their mobility, walking speed, and postural control by participating in the MOB program but the program does not affect the total number of falls. Study 2 was the first to examine the effects of the MOB program on fear of falling and falls efficacy simultaneously with separate appropriate measures (Hadjistavropoulos et al., 2011; Moore & Ellis, 2008; Valentine et al., 2011). This study found that older adults can both significantly reduce their fear of falling and improve falls efficacy immediately after completing the MOB program. Moreover, the results suggested that the MOB program had a greater impact on older adults' falls efficacy than fear of falling. Also, in the second study, the psychometric properties of the Modified Falls Efficacy Scale-International Florida measure were examined. The results showed that this scale had acceptable construct validity, internal consistency, and 8-week reliability.

Study 3 was one of the first longitudinal studies to examine the effects of the MOB program on falls, mobility, walking speed, and postural control. The results showed that participants who received the MOB program did not have a significant reduction in the total number of falls between baseline and the 3-month follow-up relative to the participants in the comparison group. On the other hand, participants who received the MOB program had significant improvements in their mobility, walking speed, and postural control over time. Although participants reached their highest performance level on mobility and walking speed at the completion of the MOB program, their performance on these two measures was still significantly better at the 3-month follow-up as compared to baseline. Regarding postural control, the study found that participants continued to improve over the entire 5-month study period. Each study in this dissertation study contributes our further understanding of the MOB program.

Limitations and Future Study

There are common limitations in these three studies. The three studies used a comparison group design to address the limitation in previous research (Healy et al., 2008; Ory et al., 2010; Smith et al., 2012; Smith et al., 2010; Ullmann et al., 2012; Zijlstra et al., 2009), but cause and effect cannon be determined without randomized-controlled trials. Therefore, the generalizability of the results from these studies may be limited. Nevertheless, by adjusting for the significantly different characteristics at baseline between the group which received the MOB program and the comparison group, the results can be deemed as robust.

Participants were all self-selected. The participants who received the MOB program especial they may have had problems with their balance or previous falling experiences. Thus, they had more room to improve their physical functions. Moreover, participants were not blinded. Therefore, they might have put forth more effort to exercise or paid more attention to fall hazards during the study period.

There was a lack of statistical power when investigating the effects of the MOB program on falls. In prior research, only one study with a single group design found significant changes in falls status immediately at the completion of the program (Smith et al., 2010). Other studies showed that the MOB program either had no effects on falls, or the effects were observed until 6 to 12 months later after the end of the program (Healy et al., 2008; Tennstedt et al., 1998; Zijlstra et al., 2009). Although the prevalence of falls at baseline among the participants in this dissertation study was comparable with previous research (i.e., over 30% of older adults; Fabrício et al., 2004; Leveille et al., 2009; Tinetti & Speechley, 1989), the incidence of falling was low throughout the study period. There was not enough total number of falls recorded at the end of the MOB program and the 3-month follow-up to have adequate statistical power. Future studies are recommended to use a larger sample size or conduct a longer follow-up study to examine the effects of the MOB program on falls.

Although participants in the comparison group received no intervention, they learned about their physical performance and exercises that could improve or maintain their physical function from the primary investigator. This learning experience could have modified these participants' behaviors and attitudes towards falls. Therefore, future studies should either reduce the discussion of physical function and exercise or include another group that receives no attention to minimize the potential bias.

Previous research shows that older adults' level of risk of falling needs to be taken in to account when providing falls interventions (The National Council on the Aging, 2005). This dissertation study did not exclude participants based on their risk level. Therefore, whether participants at all levels of risk can receive similar benefits from the MOB program needs more investigation.

The findings of the current study provide several interesting avenues for future research. First, the necessity for a booster session to maintain the effects of the MOB program on mobility, walking speed, and postural control should be examined. Future research should also identify core components that should be incorporated in interventions. Second, cognitive status may potentially influence the effects of the MOB program. Therefore, future studies should also investigate whether older adults with cognitive impairments derive the same benefits from the MOB program compared to those who have normal cognitive status. Finally, follow-up with a longer time lag is required to sufficiently investigate the effects of the MOB program on mobility, waking speed, and postural control. Because several participants in the study suggested that attendance rate might increase if they start exercises in the first class, future research should explore if introducing exercises at the first session of the MOB program will lead to a better program attendance rate and higher impact on falls and physical functions.

In conclusion, older adults can improve their mobility, walking speed, and postural control by participating in the MOB program. There were immediate improvements on mobility and walking speed, but booster sessions to maintain performance may be needed. Postural control improved across the entire study period. No significant effect of the program on falls was found over time. The MOB program can significantly reduce older adults’ fear of falling and improve their falls efficacy simultaneously. A larger effect size of the MOB program was found on falls efficacy than fear of falling.

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Appendices

Appendix A: Health Conditions Scale

In this survey, I am interested in health conditions. Please answer the three questions below.

HEALTH CONDITIONS

1. Are you often troubled with pain?

(1) Yes

(2) No (If NO, please jump to the third question)

2. How bad is the pain most of the time?

(1) Mild

(2) Moderate

(3) Severe

3. Have a doctor ever told you that you have the following conditions?

	Yes	No
a) High blood pressure	( )	( )
b) Diabetes	( )	( )
c) Cancer	( )	( )
d) Lung disease	( )	( )
e) Stroke	( )	( )
f) Arthritis	( )	( )
g) Depression	( )	( )
h) Heart disease	( )	( )
i) Osteoporosis	( )	( )
j) Asthma	( )	( )

4. Are you taking more than 4 medications right now?

(1) Yes

(2) No

5. How many medications are you taking right now?

RECORD: ______ ______ NUMBER OF MEDICATIONS

6. Do you currently participate in any other exercise group or program?

(1) Yes

(2) No

7. How many other exercise group or program you are participating now?

RECORD: ______ ______ NUMBER OF EXEICISE GROUP OR PROGRAM

Appendix B: Falls and Fear of Falling Screening Scale

In this survey, I am interested in any fall you experienced in the past two months and your experience in fear of falling. A fall is an unexpected event in which you come to rest on the ground, floor, or lower level. Please answer the three questions below.

Falls

1. Have you experienced any falls in the past two months?

    (1) Yes

    (2) No (If no, please jump to fear of falling section)

2. How many times did you fall in the past two months?

    RECORD: ______ ______ NUMBER OF TIMES

3. Did any of these falls result in injuries?

    (1) Yes

    (2) No

4. Did you receive any medical attention due to any of these falls?

    (1) Yes

    (2) No

Fear of Falling

1. Are you concerned about falling?

    (1) Slightly concerned

    (2) Moderately concerned

    (3) Very concerned

Appendix C: Modified Falls Efficacy Scale

In this survey, I am interested in your confidence in doing activities without falling. For each of the following activities, please circle a number from 0 to 10 to show your confidence in doing each activity without falling. A score of **0** means **Not at all Confident** and a score of **10** means **Very Confident**. Please reply thinking about how you usually do the activity. If you currently don't do the activity (example: if someone prepares meal for you), please answer to show whether you think you would be concerned about falling **IF** you did the activity.

Question: **How confident are you that you do each of the activities without falling?**

1. Get dressed and undressed	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
2. Prepare a simple meal	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
3. Take a bath or shower	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
4. Get in/out of chair	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)

5. Get in/out of bed	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
6. Answer the door or telephone	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
7. Walk around the inside of your home	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
8. Reach into cabinets or closets	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
9. Light house keeping	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
10. Simple shopping	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)

11. Using public transportation	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
12. Crossing roads	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
13. Light gardening or hanging out the wash	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)
14. Using front or rear steps at home	Not Confident at all (0)	(1)	(2)	(3)	(4)	Fairly Confident (5)	(6)	(7)	(8)	(9)	Very confident (10)

Total Scores: _____

*Hill et al. (1996)

Appendix D: Geriatric Fear of Falling Measure

In this survey, I am interested in how concerned you are about falling. Please read each statement and leave a check mark on the 1 to 5 scale to show your level of agreement. A score of **1** means that **you would Never do anything like the statement.** A score of **5** means that **you Always do something like the statement.**

	1. Never	2. Rarely	3. Sometimes	4. Often	5. Always
1. To avoid climbing to reach up high, I will take advantage of new tools or techniques, such as using a long-handled mop to wipe tiles					
2. When walking on steep terrain or going outdoors, I will use an umbrella or cane for support to prevent myself from falling					
3. I will sit on a chair when taking a bath or hold some support					
4. I need assistance when going out (e.g., I used to take buses, but now I either take a taxi or ask others for a ride)					
5. Nowadays, I do less housework that requires more walking, such as sweeping and mopping					
6. When there is an obstacle on the ground or floor, I prefer to detour than go over it					

	1. Never	2. Rarely	3. Sometimes	4. Often	5. Always
7. I go out less during rainy days					
8. I will ask others for help when I need something that's too high to reach					
9. I will take care to avoid passing close to places where objects are piled up					
10. Nowadays, I do less outdoor activities (e.g., trips, community activities, or visiting friends)					
11. I have changed my exercise style (e.g., from active to passive, from outdoor to indoor, or less frequent)					
12. I don't sleep well because I worry about falling					
13. My heart races when I think about falling after climbing to reach something high					
14. I frequently recall terrible experiences I've had falling					
15. I have become more sensitive, agitated, irritable, and critical of others					

Total Scores: _____

*Huang (2005)

Appendix E: Modified Falls Efficacy Scale-International Florida

In this survey, I am interested in how concerned you are about falling when doing activities. For each activity, please circle the opinion closest to your own to show how concerned you are that you might fall if you did this activity. Please reply thinking about how you usually do the activity.

		Does not apply	Not at all concerned	Somewhat concerned	Fairly concerned	Very concerned	avoid doing it
1.	Cleaning the house (e.g. sweep, vacuum or dust)	0	1	2	3	4	5
2.	Getting dressed or undressed	0	1	2	3	4	5
3.	Preparing simple meals	0	1	2	3	4	5
4.	Taking a bath or shower	0	1	2	3	4	5
5.	Going to the shop	0	1	2	3	4	5
6.	Getting in or out of a chair	0	1	2	3	4	5

		Does not apply	Not at all concerned	Somewhat concerned	Fairly concerned	Very concerned	avoid doing it
7.	Going up or down stairs	0	1	2	3	4	5
8.	Walking around swimming pool	0	1	2	3	4	5
9.	Walking around in the neighborhood	0	1	2	3	4	5
10.	Getting in or out of a car	0	1	2	3	4	5
11.	Going to answer the telephone before it stops ringing	0	1	2	3	4	5
12.	Walking outside after rain	0	1	2	3	4	5
13.	Walking on a beach	0	1	2	3	4	5
14.	Visiting a friend or relative	0	1	2	3	4	5
15.	Walking in a place with crowds	0	1	2	3	4	5

		Does not apply	Not at all concerned	Somewhat concerned	Fairly concerned	Very concerned	avoid doing it
16.	Walking on a trail	0	1	2	3	4	5
17.	Walking on a golf course	0	1	2	3	4	5
18.	Going out to a social event (e.g. religious service, family gathering or club meeting)	0	1	2	3	4	5

Total activities (A):_____ Total Scores (B):_____ Scores (B/A):_____

Appendix F: Functional Reach Test

Equipment and Set up:

A yard stick is attached to a wall at about participant's shoulder height.

Instructions:

A participant is asked to stand next to the yard stick with feet at shoulder width and flex the near-wall shoulder to 90 degrees with closed fist. The initial reading on the yard stick is then taken. Next, the participant is asked to slide the fist as far as they can without moving their feet. The final reading on the yard stick is then taken. The initial reading is subtracted from the final to obtain the functional reach score.

*Duncan et al. (1990).

Initial reading: (__________) inches

Final reading: (__________) inches

Scores: (__________) inches

Appendix G: Tinetti Performance Oriented Mobility Assessment

Balance Tests		
Initial instructions: Subject is seated in hard, armless chair. The following maneuvers are tested		
1. Sitting Balance	Leans or slides in chair (0)	
	Steady, safe (1)	
2. Arises	Unable without help (0)	
	Able, uses arms to help (1)	
	Able without using arms (2)	
3. Attempts to arise	Unable without help (0)	
	Able, requires > 1 attempt (1)	
	Able to rise, 1 attempt (2)	
4. Immediate standing Balance (first 5 seconds)	Unsteady (swaggers, moves feet, trunk sway) (0)	
	Steady but uses walker or other support (1)	
	Steady without walker or other support (2)	
5. Eyes closed	Unsteady (0)	
	Steady (1)	
6. Turning 360 degrees (1)	Discontinuous steps (0)	
	Continuous steps (1)	
7. Turning 360 degrees (2)	Unsteady (grabs, staggers) (0)	
	Steady (1)	
8. Sitting down	Unsafe (misjudged distance, falls into chair) (0)	
	Uses arms or not a smooth motion (1)	
	Safe, smooth motion (2)	
	BALANCE SCORE:	**_____/16**

Gait Tests		
Initial Instructions: Subject stands with examiner, walks down hallway or across room, first at “usual” pace, then back at “rapid, but safe” pace (using usual walking aids)		
1. Initiation of Gait (immediately after told to “go”)	Any hesitancy or multiple attempts to start (0)	
	No hesitancy (1)	
2. Step length (Right foot)	Does not pass left stance foot with step (0)	
	Passes left stance foot (1)	
3. Step length (Left foot)	Does not pass right stance foot with step (0)	
	Passes right stance foot(1)	
4. Step height (Right foot)	Right foot does not clear floor completely (0)	
	Right foot completely clears floor (1)	
5. Step height (Left foot)	Left foot does not clear floor completely (0)	
	Left foot completely clears floor (1)	
6. Step Symmetry	Right and left step length not equal (estimate) (0)	
	Right and left step length appear equal (1)	
7. Step continuity	Stopping or discontinuity between steps (0)	
	Steps appear continuous (1)	
8. Path	Marked deviation (0)	
	Mild/moderate deviation or uses walking aid (1)	
	Straight without walking aid (2)	
9. Trunk	Marked sway or uses walking aid (0)	
	No sway but flexion of knees or back or spreads arms out while walking (1)	
	No sway, no flexion, no use of arms, and no use of walking aid (2)	
10. Walking stance	Heels apart (0)	
	Heels almost touching while walking (1)	
	GAIT SCORE:	**______/12**

*Tinetti (1986).

Appendix H: Timed Up and Go test

Equipment and Set up:

A stopwatch is required. Mark off a 3-meter (10 ft.) distance using tape or other clear marking on a path free from obstruction. Place a chair at one end of the path.

Instructions:

- Instruct participant to sit on the chair and back against the chair.
- Instruction to participant: “When I say go, you will stand up from the chair, walk to the mark on the floor, turn around, walk back to the chair and sit down.” “I will be timing you using the stopwatch.”
- Ask participants to repeat the instructions to make sure they understand
- Demonstrate if needed
- Use a cue like “ready, set, go” might be helpful
- The stopwatch should start when you say “Go”

*Shumway-Cook et al. (2000)

Time 1: (________) minutes, (________) seconds

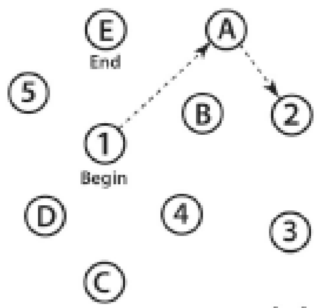
Time 2: (________) minutes, (________) seconds

Appendix I: The Montreal Cognitive Assessment

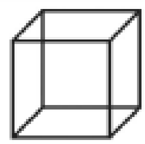
MONTREAL COGNITIVE ASSESSMENT (MOCA)
Version 7.1 Original Version

NAME :
Education : Date of birth :
Sex : DATE :

VISUOSPATIAL / EXECUTIVE — POINTS



[ ]

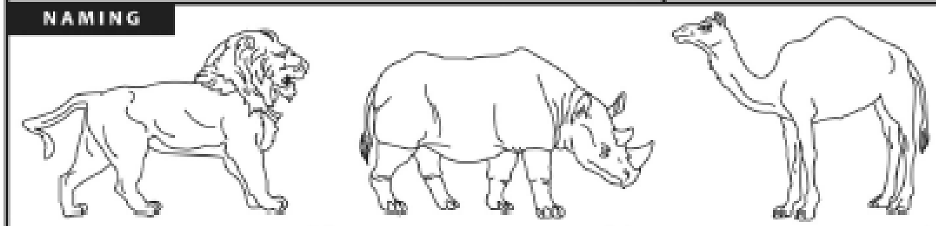


Copy cube [ ]

Draw CLOCK (Ten past eleven) (3 points)

[ ] Contour [ ] Numbers [ ] Hands — __/5

NAMING



[ ] [ ] [ ] — __/3

MEMORY

Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED	
1st trial						No points
2nd trial						

ATTENTION

Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order [ ] 2 1 8 5 4
Subject has to repeat them in the backward order [ ] 7 4 2 — __/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors
[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B — __/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65
4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt** — __/3

LANGUAGE

Repeat : I only know that John is the one to help today. [ ]
The cat always hid under the couch when dogs were in the room. [ ] — __/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words) — __/1

ABSTRACTION

Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler — __/2

DELAYED RECALL	Has to recall words WITH NO CUE	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only	__/5
Optional	Category cue							
	Multiple choice cue							

ORIENTATION

[ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City — __/6

 www.mocatest.org Normal ≥26 / 30 TOTAL __/30

Administered by: ____________

Add 1 point if ≤ 12 yr edu

*Nasreddine et al. (2005)

Appendix J: Permission to use the Montreal Cognitive Assessment

Gmail by Google

Tim Chen <otfish@gmail.com>

PERMISSION TO USE THE MoCA
5 messages

Tim <otfish@gmail.com> Wed, Oct 24, 2012 at 11:00 AM
To: info@mocatest.org

Hi,

My name is Tuo Yu Chen. I am a doctoral student in the School of Aging Studies at University of South Florida. I am working on my dissertation study and would like to include MOCA to measure older adults' cognitive function. I notice that I will need a written permission to use MOCA. Please let me know what material I will need to provide in order to get the permission.

Thank you!

Chen
--
Tuo-Yu (Tim) Chen, M.S.
Doctoral Candidate
University of South Florida
School of Aging Studies
13301 Bruce B. Downs Blvd.
Tampa, FL 33612
(813)-468-6806
Fax (813)-974-9754
tchen@mail.usf.edu

Tina Brosseau <tina.brosseau@cedra.ca> Wed, Oct 24, 2012 at 11:41 AM
Reply-To: tina.brosseau@cedra.ca
To: Tim <otfish@gmail.com>

Good morning,

Thank you for your interest in the MoCA.

In order to grant permission to use the MoCA test, we need more information.

- What is the title of your study?

- How many subjects will participate in the study and how many times will the MoCA be administered?

- Is the study industry funded? If so, a licensing agreement must be completed.

Thank you,

Tina Brosseau

Projects & Development Manager

Center for Diagnosis & Research on Alzheimer's disease (CEDRA)

Phone: (450) 672-9637 / Fax: (450) 672-1443

www.cedra.ca / www.mocatest.org

From: Tim [mailto:otfish@gmail.com]
Sent: 24 octobre 2012 11:00
To: info@mocatest.org
Subject: PERMISSION TO USE THE MoCA
[Quoted text hidden]

Tim <otfish@gmail.com> Wed, Oct 24, 2012 at 11:49 AM
To: tina.brosseau@cedra.ca

Hi Tina,

Thank you for the quick reply. Below is my answer for each question.

- What is the title of your study?

The Effects of A Matter of Balance on Falls, Physical Risks of Falls, and Psychological Consequences of Falling among Older Adults

- How many subjects will participate in the study and how many times will the MoCA be administered?

There will be 180 participants in this study. This is a study with pre- and post- design.

- Is the study industry funded? If so, a licensing agreement must be completed.

This is not a funded study.

Thank you!
Chen
[Quoted text hidden]

Info-MoCA <info@mocatest.org> Wed, Oct 24, 2012 at 12:34 PM
Reply-To: info@mocatest.org
To: Tim <otfish@gmail.com>
Cc: info@mocatest.org

You are welcome to use the MoCA in your study as described below with no further permission requirements if it is not industry funded.

Any modification to the MoCA ©/ Instructions, requires prior written approval by copyright owner.

We would be happy if you could share your findings once your study is completed.

All the best,

Tina

From: Tim [mailto:otfish@gmail.com]
Sent: 24 octobre 2012 11:49
To: tina.brosseau@cedra.ca
Subject: Re: PERMISSION TO USE THE MoCA
[Quoted text hidden]

Tim <otfish@gmail.com> Fri, Oct 26, 2012 at 9:38 AM
To: info@mocatest.org

Thank you!
[Quoted text hidden]

Appendix K: Functional Status

In the following survey, I am interested in your abilities to perform daily activities. The first scale is the Katz Activities of Daily Living Scale which you will be asked if you need assistance in performing the six activities. The second scale is the Lawton Instrumental Activities of Daily Living Scale which you will be asked if you are able to perform eight activities.

1. Katz Activities of Daily Living Scale

	Do not need assistance **NO** supervision, direction or personal assistance	**Need assistance** **WITH** supervision, direction, personal assistance or total care
1. Bathing		
2. Dressing		
3. Toileting		
4. Transferring		
5. Continence		
6. Feeding		

2. Lawton Instrumental *Activities of Daily Living Scale*

	More able	**Less able**
1. Use a telephone		
2. Shopping		
3. Preparing food		
4. Housekeeping		
5. Doing laundry		
6. Traveling away from home		
7. Taking medications properly		
8. Handling personal finance		

* Katz et al. (1970), Lawton & Brody (1969)

About the Author

Tuo-Yu Chen received a Bachelor's Degree in Occupational Therapy from Chung Shan Medical University, Taiwan, in 2004 and a Master's Degree in Occupational Therapy from University of Pittsburgh in 2008. His research interests are in Examining falls, fear of falling, and related issues among older adults. He has disseminated his research findings through publications in top-tier journals and presentations at national and international conferences.