

IS THERE AN ASSOCIATION BETWEEN BALANCE CONFIDENCE AND
BALANCE PERFORMANCE IN COMMUNITY-DWELLING
OLDER ADULTS?

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This study is dedicated to my husband, Danny who taught me that success is achieved only through dedication, perseverance, and training. The race is not always to the swift but to those who are persistent! To Mr. and Mrs. Forrest Conrad, my beloved parents who instilled in me the faith and inspiration to accomplish my goals. Also, to my children, Kyle and Kassie, who provided love, support, and encouragement throughout this difficult journey. Belated thanks to my grandmother, Amanda Katherine Cole for fostering an adventurous spirit during my childhood and adolescent years.

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ABSTRACT

Falls are a major concern for older adults. Research suggests older adults do not accurately assess their actual balance and gait abilities placing them at risk of a fall. Although deficits in balance performance in older adults are normally attributed to underlying physiological factors, psychological constructs such as balance confidence may be associated with balance performance.

The objectives of this study were to investigate the associations between balance confidence and balance performance in community-dwelling older adults, and to describe the relationships between sociodemographic, and socioeconomic characteristics of older adults, 65 years of age and older.

A correlational non-experimental research design was used to investigate the associations between balance confidence and balance performance in older adults. The study sample consisted of 140 community-dwelling older adults, 65 to 100 years of age. Data was collected from three residential apartment complexes in Henderson, Kentucky. Study participants completed the Demographic Questionnaire, Folstein Mini-Mental Exam (MMSE), Activities-specific Balance Confidence (ABC) Scale and the Tinetti Performance Oriented Mobility Assessment (POMA) Tool.

Study results indicated a significant correlation between balance confidence and balance performance $F(7, 132) = 40.45, p < .001$. Balance confidence, cognitive health, and number of falls were significant ($p < .001$) predictors of overall gait and balance performance on the POMA Tool. These three predictors explained 68.2% ($R^2 = .682$) of the variance in the multiple regression models.

This study provided evidence of the associations between balance confidence and balance performance in community-dwelling older adults. The ABC scale is a useful screening tool which can be used to identify older adults with deficits in balance confidence, placing them at higher risk for impaired balance, which may progress to a traumatic fall. Further research is warranted to explore the impact of balance confidence on impaired balance and/or gait, which has been associated with falls in older adults.

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CHAPTER 1

INTRODUCTION

Chapter I introduces the present study and the research aims. This chapter also includes the problem statement, a brief description of the significance of the problem, and the purpose of this study. The chapter concludes with the research questions.

The world's population is growing older. The United States' population age 65 and older is expected to double in size within the next 25 years (U.S. Census Brief, 2011). According to 2010 Census Briefs (2011), older adults are the fastest growing age group in the United States. Not only is the population as a whole aging, but the older population itself has also aged. Between 2000 and 2005, the number of adults age 55 and older increased 13% to approximately 67.1 million (He, Sengupta, Velkoff, & DeBarros, 2006). By the year 2030, the largest segment of the U.S. population will be adults over the age of 85 (U.S. Census Brief, 2011). The "graying" of America will have a major impact on the health of the nation due to limited healthcare resources. This growth will require creative use of the available resources and a shift in focus from treatment of chronic illness to a model which focuses on prevention. As the largest segment of the population ages, it is essential to determine how to keep this vulnerable group healthy and functionally independent. The emergent problem of maintaining balance in an aging population will become increasingly important in order to keep older adults safe by preventing falls.

Balance confidence is defined as "an individual's belief or trust in one's abilities or capabilities to remain upright without falling" (Liu-Ambrose, Khan, Eng, Lord & McKay, 2004, p.374). Previous research has suggested absence of balance confidence

may impede mobility and balance performance (Miller, Speechley, & Deathe, 2002). Li, Cardinal, and Vuchinich (2009) studied activity levels and found high levels of worry, such as fear of falling, or absence of balance confidence, has a negative impact on physical activity and a significant indirect effect on balance. Falls can have a significant psychosocial impact, resulting in fear, physical inactivity and subsequent functional decline (Austin, Devine, Dick, Prince, & Bruce, 2007). Austin et al. (2007) conducted a longitudinal study in a group of older women ($n = 1, 182$), 70 to 85 years of age. After three years, they found that 33% of the subjects, who had sustained a fall, were fearful of falling. They also identified that the subjects who were fearful experienced greater changes in balance and mobility. The study results indicated that psychological correlates such as fear of falling may mediate physical activity levels in older adults affecting balance performance.

Research suggests older adults do not accurately assess their actual balance abilities placing them at risk of a fall (Hatch, Gill-Body, & Portney, 2003). The prevalence of balance confidence is estimated at 12% to 65% in older adults who have fallen and between 29% and 80% in those who have not sustained a fall (Büla, Monod, Hoskovec, & Rochat, 2010; Lord, Sherrington, & Menz, 2001). However, even less is known about the incidence of balance confidence in an older adult with functional performance deficits (Fortinsky, Wakefield, Intob, & Panzerb, 2009; Hatch et al. 2003). Older adults who are confident in their balancing ability but have functional deficits may increase their risk of falling by attempting to perform physical activities beyond their capability (Fortinsky et al. 2009). A fall could lead to inactivity resulting in a loss of strength and weakness which may cause problems in balance and gait (Hatch et al. 2003).

Although, a loss of balance confidence has been associated with fear of falling in older adults little is known about its impact on balance performance (Powell & Myers, 1995). Loss of balance confidence, coupled with the high incidence of falls in older adults, may lead to self-imposed restrictions in physical activity and subsequent decline in balance performance. The uncertainty regarding identification of those older adults with low balance confidence and its impact on balance performance supports the need for clarification of the problem.

Problem Statement

Balance confidence in older adults has been recognized as an important psychological construct associated with falls. Many older adults either overestimate or underestimate their risk of falling (Hatch & Lusardi, 2010). A gap exists in current evidence regarding perceived and actual balance performance and its associations with psychological measures such as balance confidence (Delbaere, Close, Brodaty, Sachdev, & Lord, 2010). Also, focusing this study on detection of sociodemographic variables which identify those older adults who lack balance confidence will assist healthcare providers in preventing problems with balance performance. Keeping older adults safe from falls is a goal of Healthy People 2020 (USDHS, 2010).

The single predictor of balance confidence deficits across multiple studies is a previous fall (Miller & Deathe, 2004; Hatch, Gill-Body, & Portney, 2003). Falls are an important cause of morbidity and mortality in older adults (National Vital Statistics Reports, 2006). In 2003, more than 1.8 million older adults 65 years of age and older were treated in emergency departments for fall-related injuries (CDC, 2005). In 2002, incidence rate of fatal falls increased 57%, from 6,248 to 10,097 (CDC, 2005). Fall

related deaths are a major problem and the incidence rate of fatal falls continues to rise, due to the aging baby boomer generation, making this a worldwide problem (National Vital Statistics Reports, 2006).

Balance confidence among community-dwelling older adults, age 65 years and older, has been associated with functional limitations causing problems with balance and mobility (Powell & Myers, 1995). Post-fall psychological problems can potentially be more debilitating than sustaining a fall when a loss of confidence or self-efficacy in balance performance leads to self-imposed restrictions in mobility (Fortinsky et al. 2009; Hatch et al. 2003; Powell & Myers, 1995). Restrictions in mobility and physical activity can lead to decreased strength and muscular atrophy causing progressive functional decline which may lead to disability and loss of independence (Hatch et al. 2003). Post-fall related psychological constructs such as low balance confidence may not only lead to self-imposed restrictions in activity but may precipitate a cascade of events which affects balance performance making this a significant problem for older adults.

Significance of the Problem

There have been studies which examined the relationship between balance confidence and balance performance in older adults, age 65 years of age and older (Hatch et al. 2003; Myers, Fletcher, Myers, & Sherk, 1998; Powell & Myers, 1995). Current research has examined fear of falling and its associations with balance performance (Hadjistavropoulos, 2011; Legters, Verbus, Kitchen, Tomecsko, & Urban, 2006; Miller, Speechley, & Deathe, 2002). This study will expand on what is known about balance confidence and its associations with balance performance by identifying sociodemographic variables which may predict those without balance confidence.

Balance confidence deficits usually occur after sustaining a fall can cause major physical, psychological and functional problems in older adults (Newton & Branch, 2003). Among older adults who fall, there is a high prevalence of fear but the incidence of those without balance confidence and its effect on balance performance is unknown (Hatch et al. 2003). Loss of balance confidence has been associated with negative consequences such as reduced physical activity (Hatch et al. 2003; Liu-Ambrose et al. 2004) and an increased incidence of disability (Büla, Monod, Hoskovec, & Rochat, 2010). The author of this project seeks to contribute to current scientific knowledge by identifying sociodemographic variables which are associated with absence in balance confidence.

The information obtained from this proposed study will facilitate the future development of a tool to be used in clinical practice which will identify older adults at risk of issues with balance confidence. This study was significant due to the current need to investigate the impact of balance confidence and identification of sociodemographic variables which may be useful to clinicians in targeting those at higher risk of deficits in balance confidence. Findings from this study may contribute to a greater understanding of psychological correlates of balance confidence and their associations with balance performance.

Purpose of the Study

The purpose of this study is to investigate the association between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older. The author seeks to contribute to current scientific knowledge by identifying determinants of balance confidence e.g. sociodemographic variables. Health care providers need to be able to identify those older adults at higher risk of lacking balance

confidence. Although deterioration of balance control in older adults has been attributed to the aging process, psychological factors such as an absence of balance confidence may also contribute to changes in balance and gait (Myers, Powell, Maki, Holliday, Brawley, & Sherk, 1996).

An exploration of the sociodemographic variables may assist in identifying those older adults lacking balance confidence, which may negatively influence balance performance. Substantiating which sociodemographic variables are associated with balance confidence levels may assist healthcare providers in targeting older adults experiencing change in their current balance performance before it erodes and a fall occurs. Thus, this study investigates the impact of sociodemographic characteristics and their associations with balance performance in a group of community-dwelling older adults.

Research Questions

The study's research questions and hypotheses are:

Aim 1

Describe the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years and older.

Research hypothesis 1. There will be a positive relationship between balance confidence and balance performance in community-dwelling older adults, age 65 years of age and older.

Null hypothesis 1. There is no relationship between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older.

Aim 2

Research hypothesis 2. To determine if age, gender, income, health status, number of falls, cognitive status, and balance confidence, are associated with balance performance in community-dwelling older adults, age 65 years of age and older.

Null hypothesis 2. To determine if age, gender, income, health status, number of falls, cognitive status, and balance confidence, are not associated with balance performance in community-dwelling older adults, 65 years of age and older.

Aim 3

To determine if age group and/or age (as a continuous variable), will moderate the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years and older.

Research hypothesis 3. To determine if age group and/or age, will moderate the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older.

Null hypothesis 3. To determine if age group and/or age, will not moderate the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of this chapter is to review the current literature regarding the concept of balance confidence and its relationships to balance performance in community-dwelling older adults. This review will discuss the concepts of balance, balance confidence, and balance performance and then expand to a discussion of sociodemographic variables which form the model for this study.

Balance

The concept of balance is important because it is essential in keeping older adults independent and physically active. Historically, the term “balance” was utilized to describe how well a client remained upright, without falling. However, for the purposes of this study, the definition of *balance* is, “remaining upright, without coming to rest on the ground, making small corrections or adjustments in order to gain stability” (Tinetti & Williams, 1997, p.1297). Balance impairment is associated with falls in older adults (Berg, Alessio, Mills, & Tong, 1997; Laughton et al. 2003; Melzer & Alexander, 2009; Muir, Berg, Chesworth, Klar, & Speechley, 2010; Rubenstein, 2006). When the center of gravity extends beyond the individuals base of support, the limits of stability have been violated resulting in imbalance (Tinetti & Williams, 1997). Loss of postural stability occurs more frequently among older adults than younger adults, with approximately 30% of those ages 65 and older experiencing a fall each year (CDC, 2005). With aging, the capability to maintain balance declines and postural sway increases, resulting in an increased incidence of instability and falls (Tinetti, 1986; Tinetti & Williams, 1997).

Balance Confidence

Psychological constructs such as balance confidence is important indicators of balance performance and independence in an older adult population (Fortinsky et al. 2009; Hatch et al. 2003; Pang, Eng & Miller, 2007; Tinetti, Richman & Powell, 1990). The literature indicates that psychological factors can have detrimental effects on physical function in older adults. Among these factors is balance confidence (Arfken, Lach, Birge, & Miller, 1994; Hatch et al. 2003; Pang, Eng, & Miller, 2007), and self-efficacy (Li, Fisher, Harmer, & McAuley, 2005; Mendes de Leon, Seeman, & Baker, 1996; Pang, Eng & Miller, 2007; Tinetti & Powell, 1993; Tinetti, Richman & Powell, 1990). Significant differences across multiple studies were noted between balance confidence and its associations with balance performance measures (Fortinsky et al. 2009; Hatch et al. 2003; Myers et al. 1996). In reviewing the literature balance confidence is equated with several different terms including balance efficacy, self-efficacy, falls efficacy, and fear of falling. Inconsistencies in the use of terms exist.

A near fall can cause psychological consequences which may result in a loss of balance confidence (Powell & Myers, 1995). While being anxious or afraid of falling is a very real concern for over half of the adults 65 years of age and older (Tinetti et al. 1990), loss of confidence may also impact balance performance (Fortinsky et al. 2009; Hatch et al. 2003; Pang & Mak, 2009). A crucial distinction in the construct of balance confidence is one's ability to perform a task is not always associated with their confidence in performing or completing the task (Myers et al. 1996). Interestingly, balance confidence is not an individual's ability to perform a task but, "an older adult's psychological state of confidence or self-efficacy in performing the task" (Powell & Myers, 1995, p.828). This

distinction reflects the importance of the construct as a “mental process” (World Health Organization, 2007).

Miller, Speechley, and Deathe (2002) reported impaired balance confidence in a group ($n = 435$) of community-dwelling male older adults (62 years of age and older), who were unilateral below and above the knee limb amputees. Balance confidence was measured using the Activities-specific Balance Confidence Scale (ABC). The ABC Scale was created by Powell and Myers (1995) to measure balance confidence in moderate to high functioning older adults. The results of the study indicated that 25% of the sample reported confidence scores of less than 50 reflecting impairment in balance confidence. There was no significant difference in confidence levels at 2 years ($p < 0.05$) even though some participants had change in their scores. The group with impaired balance confidence also had lower levels of mobility.

Unfortunately, loss of balance confidence has been associated with activity restriction and sedentary behavior (Rochat, Büla, Martin, Seematter-Bagnoud, & Karmaniola, 2010). In the study by Rochat et al. (2010) balance confidence was examined in a group ($n = 860$) of 65 to 70 year old community-dwelling older adults. The purpose of their study was to examine fear of falling and its impact on gait. They found fear of falling and a loss of balance confidence was associated with deficits in gait performance. The study participants without balance confidence also had the lowest gait scores. Rochat et al. (2010) also identified that a loss of balance confidence was associated with restrictions in activities of daily living.

Determinants of Balance Confidence

Powell and Myers (1995) identified determinants as “an influencing or determining element or factor” (p. 324). Previous studies have examined the following sociodemographic variables as potential determinants of balance confidence: age, gender, falls, health status, income and cognitive status. The discussion which follows is based on a systematic review of key studies which focused on the relationship between balance confidence and the variables in this study.

Age

Past studies which focused on the associations between age and balance confidence will be discussed in this section. There were only a couple of studies which discussed the relationship between age and balance confidence in a community-dwelling older adults (Hatch, Gill-Body, & Portney, 2003; Lajoie & Gallagher, 2004). In both studies, age was one of the variables as a potential determinant of balance confidence.

Hatch et al. (2003) conducted a study which focused on the determinants of balance confidence and functional balance in a group of community-dwelling older adults (n = 50). Gait, balance and sociodemographic characteristics including age were measured in the study. The study data were statistically analyzed using step-wise multiple regression analysis. Age was entered into the model as a predictor of balance confidence. They found that adding sociodemographic variable of age to the model increased R² from .57 to .62. Age was also identified as a significant predictor of balance confidence.

Lajoie and Gallagher (2004) conducted a study comparing balance confidence, age, and gait in a group (n=125) of older adults, 65 to 85 years of age. The study participants were all community-dwelling older adults, 45 fallers and 80 non-fallers.

They wanted to determine if postural sway, reaction time, balance scores, and balance confidence were associated with falls. Stepwise multiple regressions ($p < .001$) indicated that as the number of falls and age of the participant increased, the level of balance confidence decreased on the ABC scale. Logistic analysis showed three variables (91% sensitivity and 97% specificity) were associated with the balance scores. They included age, balance confidence, and postural sway. Age was found to be inversely related to balance confidence.

Gender Differences

The influence of gender on balance confidence has been inconsistent across several studies with males having higher balance confidence. Myers et al. (1996) studied a group of community-dwelling older adults ($n = 60$), 65 to 95 years of age, examining balance confidence (ABC Scale), gender bias, and perceptions of daily function. The group identified gender differences on the balance confidence tool. They found male subjects scored higher on the balance confidence scale than the female subjects. However, Lajoie and Gallagher (2004) identified female participants scoring higher on the balance confidence scale than the male subjects.

Fortinsky et al. (2009) examined the alignment between falls risk and balance confidence in a group of community-dwelling older adults ($n = 329$) with a history of falls. They identified a subset of older males whose balance confidence level did not match their balance performance. Their balance confidence scores were high but their balance performance scores were low. They found 42% of the male subjects had misalignment in their level of balance confidence when compared to their level of balance performance and falls risk. Fortinsky et al. (2009) was the first group to identify

a subset of males, with balance confidence scores which did not match their actual balance performance measures. The male subjects in this group were unable to detect deficits in balance and gait. When questioned about their scores on the ABC scale they were unable to recognize the association between their actual balance confidence scores and falls risk.

Number of Falls

The impact of falls and loss of balance confidence in older adults is a major public concern. Falls often have serious consequences for older adults including a loss of balance confidence and independence. Tinetti, Williams, and Mayewski (1996) found that 27% of those who had fallen lacked balance confidence and were fearful of falling again. Falls not only contribute to a loss of balance confidence but also a loss of independence in performing activities of daily living.

Tinetti et al. (1996) surveyed 60 community-dwelling older adults in order to evaluate gait and balance while performing activities of daily living. They wanted to identify standard measures of balance and gait which would identify those at risk of falling. They measured the participants gait and balance while walking, sitting, turning and reaching overhead. The study results indicated that self-reported falls history was correlated with balance confidence measures and also their performance measures. Falls history was associated ($p < .001$) with loss of balance confidence. Those participants who were not confident also tested lower on the Tinetti balance and gait tests.

Maki (2006) studied a group of ($n = 75$) community-dwelling older adults, 65 to 85 years of age. He reviewed the impact of falls on balance confidence and identified a recent fall is a trigger for loss of balance confidence. He used the ABC scale to measure

balance confidence in this group of older adults living in a retirement village. He found 20 to 75% of the participants in his study experienced a loss of confidence after a single fall and the rate increased 40% after a subsequent fall. Falls history was associated ($p < .05$) with a loss of balance confidence.

Health Status

Salbach, Mayo, Hanley, Richards, & Wood-Dauphinee (2006) examined ($n = 89$) community-dwelling older adults, who were post stroke, in order to compare balance confidence and perceived health status with physical performance. Balance confidence was measured using the ABC Scale (Powell & Myers, 1995). After three months of rehabilitative therapy they identified perceived health status was positively correlated ($p < .05$) with balance confidence. The average balance confidence score (ABC scale) was 72 out of 100 points and perceived health status increased 12%. Their conclusion was perceived health status and balance confidence improves after rehabilitative therapy. Perceived health status and balance confidence are modifiable with therapy.

Income

Little is known about the association between income or socioeconomic status and balance confidence. Kim, Se, Kai, and Li (2009) in the Korean Longitudinal Study on Health and Aging, identified discrepancies between socioeconomic status and balance confidence. They randomly selected ($n = 1000$) older adults 65 years of age and older, and found a positive correlation between income and balance confidence ($p < .05$) using the ABC scale. They defined lower socioeconomic status as those older adults with an annual income of less than \$10,000 (US dollars) per year.

Cognitive Status

The influence of cognitive health status on balance confidence is inconsistent across the body of research literature. Myers, Fletcher, Myers, and Shrek (1998) found in a study of 475 community-dwelling older adults that lower cognitive status may affect balance confidence. Those older adults who scored a 25 or less on the MMSE, scored significantly ($< .01$) lower on the ABC scale and had a higher incidence of falls. Higher MMSE scores (27 or $>$) were associated with higher scores on the ABC scale (Myers et al. 1998).

Resnick, Palmer, Jenkins and Spellbring (2000) identified cognitive status was associated ($p < .05$) with an older adult's self-efficacy (balance confidence) in a group of 187 older adults living in a continuing-care retirement community. According to Bandura (1977, 1986, 1995, 1997) confidence is part of self-efficacy. Resnick et al. (2000) found a direct association between scores on the Folstein Mini-Mental Status Exam (MMSE) and self-efficacy. They hypothesized age, gender, mental and physical health has a direct effect on self-efficacy which influences exercise behavior. Those with higher cognitive status also had higher scores on the self-efficacy score including greater confidence.

In stark contrast to the earlier study on cognitive status, Resnick (2004) conducted a four year longitudinal study which examined longitudinal changes in self-efficacy (balance confidence) and exercise behavior. Using path analysis, she identified age, gender, and cognitive status had a limited and inconsistent influence ($F = 2.2, p > .05$) on self-efficacy for exercise in this group ($n = 78$) of older adults living in a retirement community. She concluded cognitive status did not contribute to the model. Resnick (2004) discusses that an older adult's self-efficacy levels are dependent upon more than mental health status. Although, the prevalence of cognitive issues in older

adults has been established in earlier studies, Resnick's (2004) study places doubt on the relationship between self-efficacy (balance confidence) and cognitive status (MMSE). However, Resnick's study sample of 78 was much smaller than Myers et al. (1998) study which had a sample of 475, and Resnick's et al. (2000) sample of 187.

Balance Confidence and Balance Performance

Balance performance is an individual's ability to maintain the body's center of gravity within the limits of stability (Alexander, 1994; Binda, Culham, & Brouwer, 2003; Hatch et al. 2003; Powell & Myers, 1995; Myers et al. 1996; Woollacott & Shumway-Cook, 1997), while sitting, standing, turning around, and walking (Tinetti, 1986 & 2003). Abnormalities in gait and balance not only affect an older adult's ability to remain upright but also their overall functional performance (Woollacott & Shumway-Cook, 1997). Balance performance includes not only static balance (standing), but functional balance, such as gait or movement while carrying a basket of laundry up a flight of stairs (Tinetti, 2003). Tinetti (1986) developed the Tinetti Gait and Balance Scale to measure an older adult's balance performance. From her research, she determined gait and balance was a more accurate test of balance performance than just static balance.

Hatch et al. (2003), studied a small group of (n = 50) community-dwelling older adults, 65 to 95 years of age, with and without a history of falls. The purpose of the study was to examine the relationship between balance, balance confidence and functional mobility, including balance performance. The group assessed balance confidence using the ABC Scale and dynamic balance was assessed with the Berg Balance Scale (BBS). They measured functional mobility with the Timed-Up-And-Go (TUG) Scale. The TUG measures sitting, standing, and gait. These are the same balance performance measures

which are included in the Tinetti Gait and Balance Scale. Their study revealed functional mobility was highly correlated ($p < 0.05$) with balance confidence in a convenience sample of community-dwelling older adults. Hatch et al. (2003) found that the higher the level of balance confidence the higher the level of functional mobility (TUG), including balance performance.

Miller, Magel, and Hayes (2010) studied the effects of a home-based exercise program on balance confidence and balance performance in a small group ($n = 14$) of community-dwelling older adults, 71 to 85 years of age. The group evaluated a home-based standing exercise and balance training program to see if it improved balance performance. The quasi-experimental study utilized twice a day sessions of squats, heel raises, hip abduction and marching including multiple balance exercises. At the end of the four week program, physical therapists evaluated each participants balance confidence and balance performance. After comparing pre and post test differences, the results indicated a significant ($p < .05$) improvement in balance confidence and balance performance measures (gait and balance) on the Tinetti POMA scale.

Yang, Liao, Kwan, Lord, and Lin (2010) studied the relationship between fear of falling, balance confidence, and balance performance in a group of 65 community-dwelling older adults. The participants completed six balance performance tests including, sway range, sitting in a chair, sit-to-stand, timed stance, one-leg stance, and a gait test. Yang et al. (2010) identified those participants which were fearful of falling, without balance confidence, scored lower ($p < .001$) on the balance performance measures.

Review of Literature Summary

Determinants of Balance Confidence

Sociodemographic variables (age, gender) and socioeconomic (income level) have been identified as determinants of balance confidence (Fortinsky et al. 2009; Hatch et al. 2003; Lajoie & Gallagher, 2004; Myers et al. 1996). Several researchers identified cognitive status (Myers et al. 1998; Resnick et al. 2000; Resnick, 2004), history of falls (Maiki, 2006; Tinetti et al. 1996), health status (Salbach et al. 2006), and balance performance (Hatch et al. 2003; Miller et al. 2010; Yang et al. 2010), are determinants of balance confidence. Typically these known determinants have been used to identify those older adults who are at greatest risk of falling but this study will focus on the influence of these variables on balance confidence.

This review identified a direct association between age and decline in balance confidence (Lajoie & Gallagher, 2004; Hatch et al. 2003). Lajoie and Gallagher (2004) found aging is inversely associated with level of balance confidence. They found as age increases (65 years of age and older), balance confidence decreases with males having a 46% higher incidence of injurious falls than females (CDC, 2007).

Myers et al. (1998) also identified cognitive status as a known determinant of balance confidence. The significant relationships between cognitive status and balance confidence may be attributed to the fact that those with significant impairment (MMSE less than 25) were excluded from the study. Powell and Myers (1995) discuss a score of 23 or higher on the MMSE as the recommended cut-off score for accurate completion of the ABC scale. Using a higher exclusion score on the MMSE may eliminate study participants who have cognitive status problems.

Previous findings suggest an older adults falls history is a known determinant of balance confidence (Maki, 2006; Tinetti et al. 1996). They determined confidence not fear may play a role in older adult's remaining independent and functional. Salbach et al. (2006) identified self-perceived health status (greater health perception, better health) as a determinant of balance confidence. Those older adults who perceived themselves as "healthy" were more confident in their abilities to complete activities of daily living including balance performance (Salbach et al. 2006). This finding is consistent with Cummings et al. (2000) research. They found older adults with multiple chronic illnesses perceived their health status as being poor also lead sedentary lifestyles. Overtime, inactivity leads to changes in balance and gait including a higher incidence of falls (CDC, 2007).

Kim et al. (2009) identified socioeconomic status (income) as a known determinant of balance confidence in a group (n = 1000) of older adults age 65 and older. The group found older adults with low income had more problems with their balance and gait and lacked balance confidence. There was a direct association ($p < .001$) between income and level of balance confidence.

Balance Confidence and Balance Performance

A relationship was noted in the review of literature between balance confidence and balance performance (Miller et al. 2010; Tinetti et al. 1990; Yang et al. 2010). Tinetti et al. (1990) emphasized in a study on balance performance the importance of psychological constructs such as balance confidence and self-efficacy. To perform activities of daily living, balance confidence is essential to one's balance performance. Key behaviors measured by Tinetti et al. (1990) were balance and gait. This finding is

consistent with a study by Fortinsky et al. (2009). They discovered balance confidence can also extend above and beyond one's actual level of balance performance. Balance confidence exceeded the limitation of an older adult's balance and gait ability placing them at risk of falling. From the perspective of Miller et al. (2010), balance confidence is a measure of self-efficacy, which directly influences balance performance (balance and gait).

Gaps in the Literature

There were many weaknesses and inconsistencies noted in the studies reviewed on the sociodemographic variables as determinants of balance confidence. Several of the studies reviewed had a small number of participants in the study (Maki, 2006; Miller et al. 2010; Hatch et al. 2003; Resnick, 2004; Tinetti et al. 1996; Young et al. 2010). The samples ranged in size from 14 to 78 participants (Maki, 2006; Miller et al. 2010; Hatch et al. 2003; Resnick, 2004; Tinetti et al. 1996; Young et al. 2010). A small sample size can result in inaccurate results including bias (Tabachnick & Fidell, 2007). According to Tabachnick & Fidell, (2007) samples are obtained in order to make "generalizations" about the population of interest (p. 7). Generalizations about the population of older adults should not be made unless a representative sample has been obtained with an adequate sample size.

The review of the literature indicates that older adults are at risk of developing deficits in balance confidence. There are only a few studies which focused on the relationship between balance confidence and balance performance (Hatch et al. 2003; Miller et al. 2010; Salbach et al. 2006). However, multiple studies focused on balance confidence and falls (Fortinsky et al. 2006; Maki, 2006; Powell & Myers, 1995; Tinetti et

al.1990). Thus, the first aim of this study is to investigate the associations between balance confidence and balance performance (gait plus balance).

Additional gaps in the literature identified a potential alignment between cognitive health status and balance confidence (self-efficacy), but the results are not clear (Myers et al. 1998; Resnick et al. 2000). In a four year study conducted by Resnick (2004), cognitive health status was not associated with self-efficacy or confidence. However, in an earlier study by Resnick et al. (2000) she found an association between MMSE and self-efficacy scores. Thus, the second aim of this study is to examine cognitive status as one of the determinants of balance confidence.

Other gaps in the literature revolved around sociodemographic variables including gender. Fortinsky et al. (2009) identified gender differences with 42% of the male participants being unable to recognize deficits in balance and gait. This study questions whether males have balance confidence which is not related to performance measures. Powell and Myers (1995) found male subjects scored higher on the balance confidence scale than female subjects. However, Lajoie and Gallagher (2004) found balance confidence was higher in female subjects than in male subjects, which contradicts the study by Powell and Myers (1995). More research is needed to clarify the relationship between gender and balance confidence.

There is a gap in the literature regarding the level of balance confidence in older adults (65 to 74 years of age) compared to the oldest of old (75 years and above). Lajoie and Gallagher (2004) and Hatch et al. (2003) found an inverse association with age and balance confidence but did not do an age group comparison. Since the number of falls and disruptions of balance and gait increases around age 75 (CDC, 2007), there may also

be a change in balance confidence. Thus, the third aim of this study will focus on the associations between chronological age and/or age group and its potential effect on balance confidence.

CHAPTER 3

CONCEPTUAL FRAMEWORK

This chapter discusses the theoretical framework, application of Bandura's self-efficacy theory, propositions, hypotheses, variables of the study, definition of variables and the chapter summary. Bandura's (1977; 1982; 1986; 1989; 1997; 1998) theory of self-efficacy was used as the theoretical framework for this study. The theory was developed by Dr. Albert Bandura in 1977, and is frequently used in studies which focus on beliefs and motivation. The self-efficacy theory guided this study including the associations between variables such as balance confidence and balance performance.

Conceptual Framework

According to Bandura (1977) the foundation of the self-efficacy theory is based in social cognitive theory (SCT). The SCT provides a conceptual framework to identify determinants of behavior. Bandura's (1977; 1982; 1986; 1989; 1997; 1998) describes the SCT as a behavioral theory based on "triadic reciprocal causation" or interaction between three determinants (See Figure 1). The three major determinants in the model are the environment, an individual (including personal factors), and behavior. Bandura (1977) conceptualizes the three elements are engaged in an interactive relationship. The three bi-directional arrows in Figure 1 represent a dynamic conceptual model. Within this model, self-efficacy assists in determining behavior based on capability and confidence. The key central component of this theory is self-efficacy.

Self-efficacy is defined as "an individual's belief in his/her ability to successfully perform a specific activity" (Bandura, 1977, p.9). The individual is the agent who is able to choose and execute a course of action. Perceived self-efficacy takes into consideration

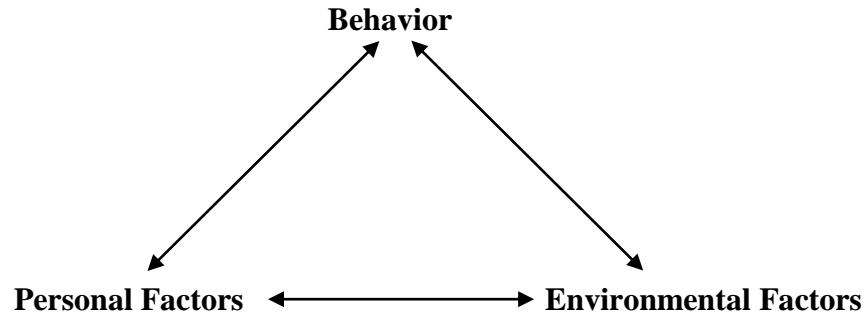


Figure 1. Bandura’s Model of Social Cognitive Theory (SCT). Above is the triadic diagram of the associations between the three major interdependent concepts which form the conceptual cornerstones of the SCT. Bandura’s model includes personal determinants such as biological and cognitive factors consisting of knowledge, perceived self-efficacy and personal goals. Social determinants also influence the model.

an individual’s conceptualization of a situation, including how he or she feels (i.e., affect), thinks (i.e., cognition), and acts (i.e., motivation and behavior), (Bandura, 1986; Webster et al. 2006). Self-efficacy is influenced by “judgments of personal capability” (Bandura, 1977, p. 11). Individual who do not have high levels of self-efficacy, or do not believe they can achieve a specific task or goal, will not have an incentive to act (Bandura, 2004).

Confidence was defined by Bandura (1977) as one’s “strength of belief” (p. 382). Bandura (1977) stated, “self-efficacy differs from the term confidence” (p. 382). Self-efficacy differs from confidence in that it includes both an “affirmation of a capability level and the strength of the belief” (Bandura, 1977, p. 382).

The relationship between self-efficacy and balance confidence has been documented in previous studies (Fortinsky et al. 2009; Hellstrom, Nillson, & Fugl-Meyer, 2001; Hellstrom, Lindmark, Wahlberg, & Fugl-Meyer, 2003; Liu-Ambrose et al. 2004; Mak & Pang, 2009; Myers, Powell, Maki, Holliday, Brawley, & Shrek, 1996; Powell & Myers, 1995; Webster et al. 2006). See Figure 1. Previous studies have

established a positive association between balance self-efficacy and balance confidence (McAuley, 2000; Myers, Fletcher, Myers, & Sherk, 1998; Myers et al. 1996; Pang et al. 2007; Powell & Myers, 1995; Salbach et al. 2006; Tinetti et al. 1990; Webster et al. 2006). Psychological constructs, such as self-efficacy affects an older adult's ability to perform and perhaps their confidence to even attempt tasks.

Sources of Self-Efficacy

In Bandura's (1977) model, self-efficacy is developed through four distinct sources: (a) personal or mastery of behaviors experiences, (b) verbal persuasion, (c) vicarious experience, and (d) emotional arousal. An older adult's perception of self-efficacy is dynamic. Self-efficacy is positively related to effort and performance feedback which is a central concept in this thesis on balance confidence relationship to balance performance (Bandura, 1977).

Cheal and Clemson (2001) identified personal or mastery experience as the most significant factor in increasing balance self-efficacy, which is consistent with Bandura's (1977) theory. They interviewed older adults in a falls prevention program based on Bandura's self-efficacy theory. They found seven out of eight participants in the study experienced increased self-efficacy during performance of their daily activities. The group identified that mastery experiences improved confidence in community-dwelling older adults.

Verbal persuasion is defined as the "process by which an individual's attitudes or behaviors are affected by verbal encouragement or discussion" (Bandura, 1977, p. 14). Through verbal persuasive suggestions, older adults can be convinced they can cope with stressful situations successfully (Bandura, 1977, 1997). Verbal persuasion is a weak

source of self-efficacy mastery, but positive appraisals and encouragement can be very effective (Bandura, 1977). Positive verbal feedback while pursuing an accomplishment causes the participant to work harder toward the goal and supports the individual reaching a higher self-efficacy level.

Vicarious experience is referred to as watching the successful experiences of others (Bandura, 1977). Experiencing a success vicariously provides a significant model which can positively influence behavior (Bandura, 1977). Modeling other's successful behaviors can motivate behavior change and increase self-efficacy levels through vicarious experience (Resnick & Nigg, 2003). When an older adult perceives the effects which follow someone's experiences vicariously, through another's actions, this becomes an additional way to verify what one thinks about self (Bandura, 1977).

Older adults have the ability to alter their thoughts and actions due to "emotional arousal" (Bandura, 1977). Individual characteristics and responses are unique to each person and situation. Bandura (1977) identified stress can hinder or limit an older adults response through anticipatory self-arousal. Unfortunately, by imagining the worst case scenario, individuals can elevate stress levels to create the dysfunction they fear. An example would be an older adult anticipating a fall. Fortunately, Bandura (1997) found coping mechanisms that will reduce stress and increase self-efficacy level can be learned, creating a way for mastery to occur.

According to Bandura (1977), the level of motivation and actions are based on what an individual believes and confidence the goal can be achieved. Self-efficacy strongly affects the choices an individual makes and the course of action an individual pursues (Resnick, 1999). Adults will naturally engage in tasks which are interesting and

avoid those that are not (Pajares, 2002). The higher the sense of self-efficacy an individual possess, the greater the persistence or effort (Bandura, 1977).

Self-efficacy and balance confidence are both based in the field of psychology and refer to an individual's perceived capability to perform specific activities. An efficacious outlook has been associated with higher levels of self-confidence and physical activity (McAuley, Szabo, Gothe, & Olson, 2011). McAuley et al. (2011) found evidence which suggest self-efficacy plays a "pivotal role in a model in which the protective effects conferred by physical activity or functional limitations operate through functional performance" (p.1559). High self-efficacy has been demonstrated in older adults who set goals. Older adults may overestimate their capabilities resulting in costly or injurious consequences including falls.

The self-efficacy theory is an ideal fit for this project due to the underlying component of self-belief or confidence in one's ability to perform a task including balance and/or gait. High self-efficacy or balance confidence has been shown to have a positive impact on improving older adult's participation in activities related to health promotion including functional performance skills such as balance (Resnick, 2004). Also, higher levels of functional performance can improve balance related self-efficacy giving the individual confidence in their abilities (Hatch et al. 2003). The author posits that self-efficacy and balance confidence mirror each other and play a pivotal role in this proposed model based on the protective effects of confidence on functional performance, including balance and gait skills.

Conceptual Model

The following conceptual model (Figure 2) is based on Bandura's (1977, 1982, 1986, 1993, 1996, 1997) self-efficacy theory and empirical studies which describe the hypothesized relationship between the variables in this study. Balance confidence is the main construct which will be studied including its associations with balance performance. The framework for this study was adapted to include only those components of the theory most relevant to the intent of this study, which are the associations between balance confidence and balance performance in community-dwelling older adults.

The working model for this thesis focused on the associations between balance confidence and balance performance. Balance and mobility are fundamental components of balance performance. Balance performance as represented in Figure 2 consists of two separate measures which are balance and gait. Balance and gait have a synergistic relationship which determines an older adult's balance performance (Tinetti, 2003). The tool used for this study was developed by Tinetti (1986) combines the balance and gait scores in order to produce a balance performance score. Confidence or self-efficacy (Bandura, 1977) has been associated with older adult's perceived capabilities or motivation to perform activities including balance performance. Research across multiple studies has demonstrated it is predictive of behavior (Pang & Eng, 2008; Powell & Myers, 1995; Resnick, 1999).

Powell & Myers (1995) conceptualized balance confidence as a psychological construct which can determine whether an individual restricts or actively engages in physical activity. The model hypothesizes a direct relationship between confidence or efficacy and balance performance (gait and balance). Less efficacious older adults, who have had limited exposure to observe socially successful older adults may view

themselves as less efficacious, leading to restrictions in their level of physical activity (Bandura, 1977). Restrictions in activity will lead to a loss of independence.

Associations between balance confidence and efficacy may impact an older adult's activity level resulting in sedentary behavior which can lead to muscular atrophy and imbalance. Loss of balance or imbalance increases the incidence of falls in older adults (Tinetti et al. 2003).

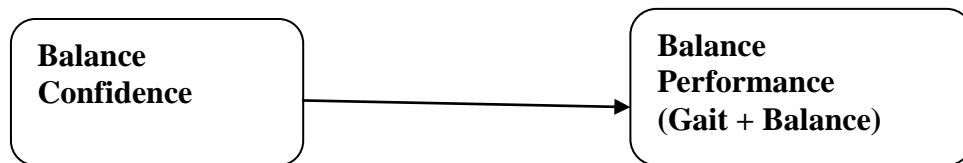


Figure 2. Diagram of the relationships between balance confidence and balance performance in older adults. The review of literature describes the hypothesized relationship between the variables in this study. Balance confidence will be positively correlate with performance measures. The Tinetti Balance Assessment Tool has two distinct sections. The first section is for a balance performance score and the second section is for gait assessment. The separate scores for each section are added together to produce balance performance.

Bandura's (1977) model represents "determinants in a reciprocal causation" and an individual's behavior is viewed as being influenced by these determinants. Psychological constructs such as balance confidence may be improved by manipulating the four principle sources which were discussed earlier in this thesis. They are personal determinants or factors including one's personal goals. Bandura (1977) stated, "Outcome expectations such as balance performance are not only influenced by verbal encouragement, but exposure to role models or even self-modeling" (p. 44). The more one believes in the efficacy of a specific activity including balance confidence, the higher the motivation to perform that specific activity which in this study is gait and balance.

Previous discussion in this thesis reflects the associations between balance confidence and self-efficacy. In the following chapter, the ABC Scale (Powell & Myers, 1995) which is based on Bandura's (1977) self-efficacy theory will be discussed. Psychological issues are important endpoints for investigation due to their impact on balance performance. Testing of this model, represented by Figure 3, is needed in order to clarify consistencies between balance confidence and balance performance in older adults. Figure 2 shows the balance confidence model and its relationship to balance performance.

In the model (Figure 3), the first box is the population of interest an older adult. For this study an older adult is 65 years or older. The sociodemographic variables are shown in the second box of the model. The path between elements in the figure is bidirectional. The proposed process evolves with the aging process. The basic assumptions of this research project are age, income, number of falls in the last year; chronic illnesses, self-perceived health status, and cognitive status are associated with

balance confidence. The third block contains balance confidence or self-efficacy which is the central focus of this study. The last block in Figure 3 is an older adult's balance performance, which is measured by gait, balance and balance plus gait. Bandura (1977) discussed performance is an accomplishment and self-efficacy beliefs account for most of the variance in the expected outcome which in this study model is balance performance (gait, balance & gait plus balance).

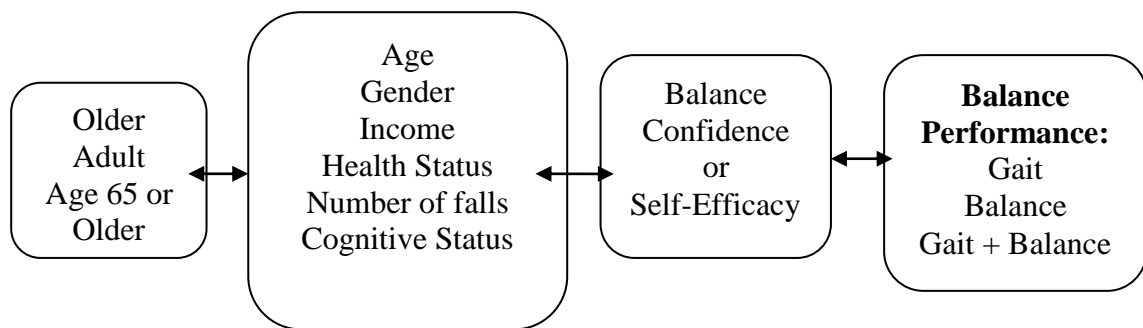


Figure 3. Balance confidence model and its relationship to balance performance.

One of the goals of this project is to form a theoretical framework on which to conceptualize balance confidence. Figure 3, provides a figure of the initial conceptualized model for this project based on the review of literature. The author hypothesizes that sociodemographic variables including age, income, number of falls in the last year, number of chronic illnesses, cognitive health, and self-perceived health status are associated with balance confidence and have a relationship with balance performance. The author postulates that in this study, self-efficacy accounts for most of the variance in the expected study outcome which is an older adult's balance performance. This model

is based on past self-efficacy research completed by Bandura (1977). In this study balance confidence or self-efficacy is conceptualized as having a significant association with balance performance.

CHAPTER 4

METHODOLOGY

This chapter will describe the research methodology and procedures used in this study. The chapter discusses the following sections including the study: setting, population sample, instruments, methods and measurements. Data collection procedure, protection of human subjects and statistical analyses are also discussed.

Setting

This study was conducted in a retirement community in Western Kentucky. Redbanks Towers and Apartments consist of several apartment complexes in a rural setting. The complex has three separate buildings, which provide independent community living for seniors age 65 or older. The occupancy of the complexes is approximately 500 older adults with more than 95% of the residents, age 65 years and older. All interviews and measurements were conducted at the Redbanks Community Center.

Sample

A convenience sample of older adults, age 65 years and older, was recruited from Redbanks retirement community. Both, male and female community-dwelling older adults, of varying socioeconomic level were recruited for this study. According to Sharon Combs, Executive Director, the ethnicity of residents who reside at the center consists of approximately 60% Caucasian, 38% African-American, and 2% Asian (Sharon Combs, personal communication, July 20, 2010). Approval to conduct the study in the apartment complexes was obtained from the facility owner and manager.

Inclusion and Exclusion Criteria

The inclusion criteria for the study were: (a) age 65 years or older, (b) English speaking, (c) ability to read and write English at an 8th grade level, (d) able to ambulate in the room (may use assistance devices such as a cane or walker), and (e) a Mini-Mental Status Exam (MMSE) score of 23 or greater. Those who did not meet these criteria were excluded from the study.

Sample Size Calculation

The sample size was determined by calculating a priori power analysis using the G-Power 3 analysis program (Faul, Erdfelder, Buchner, & Lang, 2009). Power refers to the probability that a test will find a statistically significant difference when such a difference actually exists (Cohen, 1992). According to Cohen (1992), power is the probability of rejecting the null hypothesis when it should be rejected (and thus avoiding a Type II error). It is generally accepted the power should be .80 or greater; which is an 80% or greater chance of finding a statistically significant difference when one exists (Cohen, 1992).

The sample size calculation was performed using multiple regression analysis with eight predictor variables in order to test Hypotheses 1, 2 and 3. The alpha for the test of these models was first set at .05. But because the regression analyses was computed for three separate dependent variables (i.e., the three measures of balance performance), a Bonferroni correction was used by dividing the alpha level of .05 by 3 ($.05/3 = .0167$). Thus, *p*-values of .0167 or less were considered statistically significant. To achieve a power of .80 for a regression using a medium effect ($f^2 = .15$), and an alpha level of .0167, the necessary sample size was $n = 136$.

Study Instruments

The instruments used in this study were the: (a) Socioeconomic/Demographics Questionnaire; (b) Folstein Mini-Mental Status Exam; (c) Activities-specific Balance Confidence (ABC) Scale; and the (d) Tinetti Performance Oriented Mobility Assessment (POMA) Tool. A brief description of the proposed variables and instruments which were used in this study are discussed in Table 1.

Socioeconomic–Demographics Questionnaire

This 13-item instrument was developed by the investigator in collaboration with the PI's mentor, Clementina Ceria-Ulep, Associate Professor and Department Chair of Nursing, University of Hawaii. The following variables were measured by the Socioeconomic–Demographics Questionnaire (DQ): (a) date of birth, (b) place of birth, (c) language spoken at home, (d) gender, (e) ethnicity, (f) marital status, (g) employment status, (h) educational level, (i) yearly income, (j) live alone or with others, (k) number of chronic illness, (l) number of falls in the last year, and (m) a self-rating of health (Appendix C).

Folstein Mini-Mental Status Exam

The Folstein Mini-Mental Status Exam (MMSE) is a simple test to qualify cognitive function and screen for memory loss. The domains tested are judgment, recent memory, spatial orientation, remote memory, capacity to perform calculations and capacity to follow commands (Folstein, Folstein & McHugh, 1975). The test is divided into five sections which involve a related series of questions or commands.

Table 1. Instruments Used in This Study

Instrument	Construct	Measurement
Demographics		(1) date of birth, (2) place of birth, (3) gender, (4) ethnicity, (5) marital status, (6) employment status, (7) educational level, (8) yearly income, (9) live alone or with others, (10) number of chronic illnesses, (11) Number of falls in the last 12 months, & (12) perceived health
Activities-specific Balance Confidence Scale (ABC)	Balance Confidence	The ABC consists of 16 self-rated questions regarding confidence in performing specific activities. “How confident are you that you will not lose your balance or become unsteady when you perform listed activities” on a horizontal line the individual circles one percent score which reflects confidence in balance while performing specific tasks: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%. An 11-point scale is used to indicate level of confidence in performing the activity without losing balance. To score the form, total the ratings (possible range = 0 – 1600) and divide by 16 to get each subjects ABC score. A score of 80% is high level functioning; 50-80% is moderate level, & < 49% low level.
Mini-Mental Status Exam	(MMSE)	The MMSE: 30 questions and is used to screen for cognitive impairment. A score of less than 23 on MMSE were excluded from the study.
Tinetti Balance Test	Balance	Patient is seated in an armless chair. The PI rates the subjects balance upon arising 0 or 1, arising from chair rated as 0, 1 or 2, attempt to rise is rated as 0, 1 or 2, balance is rated as 0, 1 or 2, nudging is rated as 0, 1 or 2, eyes shut rate balance as 0, 1 or 2, turning 360 degrees rated as 0, 1 or 2, sitting down is rated as 0, 1 or 2. Balance score is the total number divided by 16
Tinetti Gait Test	Gait	Initiation of gait is rated as the older adult walks down a hallway or across a room slow then fast. The examiner then rated as a 0 or 1, step length and heights is 0, 1 or 2, step symmetry 0 or 1, step continuity rated as a 0 or 1, path 0, 1 or 2, trunk rated as 0, 1 or 2, walking stance is rated as 0 or 1. The gait score is the total number divided by 12

The individual receives a single point for each answer with a range of scores from 0-30. According to Crum, Bassett, and Folstein (1993) a score of 27 to 30 is considered normal cognitive function. A score of 21 to 26 on the MMSE is considered mild cognitive impairment, and moderate impairment is a score of 11 to 20. Crum et al. (1993) established population-based norms by age and educational level. The norms allowed for variations between the younger age group (65-84) and the older age group (85 years of age and older). Reliability and validity was established in 15 studies which examined the effectiveness of a MMSE for cognitive function, the sensitivity ranged from 63% to 100% and specificity ranged from 52% to 99%. The MMSE is an independent clinical tool which assists in the diagnosis of cognitive problems (Tombaugh & McIntyre, 1992). The optimal level to detect problems with cognitive change in older adults is a score of 23 or less, with a sensitivity of 86%, and a specificity of 83% (Crum et al. 1993; Appendix G).

Activities-Specific Balance Confidence Scale

Balance confidence was measured using the Activities-Specific Balance Confidence (ABC) Scale. The 16-item questionnaire was developed by Powell and Myers (1995) to measure balance confidence in older adults using a visual analogue scale (0-100). The questionnaire requires subjects to rate their confidence in maintaining balance while completing activities of daily living. The ABC Scale is based on Bandura's (1977) Self-Efficacy Model, and is designed to evaluate the client's confidence or self-efficacy in performing the activities on a visual analogue scale. The scale ranges from 0 (no confidence) to 100% (complete confidence) that the task can be performed without losing balance. The average percentage across the 16 items is calculated as the overall balance

confidence score. Well older adults will score in the 90-100% range (Myers et al. 1998). Lajoie and Gallegher (2004) established cutoff score of 67% results in 84% sensitivity and 87% specificity in correctly classifying fallers and non-fallers. A key element in the instrument design is it examines balance confidence in progressively more challenging situations. The test starts with simple reaching for an object overhead and progresses to activities such as those performed outside of the home, including shopping in a mall.

The ABC has been tested for reliability and validity in community-dwelling older adults. Cronbach (1951) suggests that reliability means that a scale consistently reflects the construct it is measuring and a value of .70 to .80 is an acceptable goal. Powell and Myers (1995) reported a test-retest reliability of .82 to .92 and a Cronbach's alpha of .96. Powell and Myers (1995) established construct validity by evaluating the tool with the Falls Efficacy Scale ($r = .85$).

This tool was appropriate for the study because of its validity and the population of interest. The ABC has been examined for readability in older adults using the Flesch-Kincaid reading level. Based on this assessment, Wagner et al. (2005) recommend participants have a US 8th grade reading level or higher due to the readability of the tool. The ABC is a useful clinical tool for a range of different individuals including older adults (Appendix D).

Tinetti Performance Oriented Mobility Assessment Tool

The Tinetti Performance Oriented Mobility Assessment (POMA) Tool measures both gait and balance (Tinetti, 1986). The tool consists of separate balance and gait tests which after being combined, form a single balance performance score. The tool is based on task performance. The balance section requires subjects to perform a variety of routine

functional tasks (standing, sitting, nudged balance, 360 degree turn, and standing balance), and the gait section consists of a timed 10 foot walk. Lin et al. (2004) found inter-rater reliability agreement (test-retest scores range 0.93 - 0.99), with less than 10% variability in a group ($n = 15$) of community-dwelling older adults. The Tinetti POMA Tool was chosen for this project because it is considered to be a gold-standard instrument which can be used to test mobility and balance in older adults (Langley & Mackintosh, 2007).

Participants perform specific tasks or activities of daily living listed (sitting, standing, walking, turning in a circle, and gait evaluation) and described on the assessment tool. Scoring of the tool is on a three point ordinal score (0-2 scale). A score of a zero represents the most impairment, and a two represents independence on the task. An individual's scores are combined to form three measures, which reflect: 1) an overall gait assessment score, 2) balance assessment score and 3) gait and balance scores. The total possible score for the balance component is 16 points and the total score for the gait segment is 12 points. Older adults who score a total of 19 points or below are at high risk of falls due to impaired balance performance, moderate risk is 19-24 points, and scores above 24 points are at limited risk of falls.

The reliability of the tool was established by Tinetti (1990). He studied older adults with impaired balance that was at risk of falling. He identified a score of 36 or less was found to have 70% sensitivity and 52% specificity in community-dwelling older adults. The tool has shown good reliability ($r \geq .80$, $p < .001$) in a group of 126 older adults (Appendix E & F).

Variables

Independent and Dependent Variables

Aim 1: Describe the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older. The independent variable was balance confidence and the dependent variable was balance performance.

Aim 2: Describe the associations among sociodemographic variables, cognitive health status, balance confidence and balance performance in community-dwelling older adults, 65 years of age and older. The independent variables were age, gender, income, health status; number of falls, cognitive health status, and balance confidence and the dependent variable was balance performance.

Aim 3: To determine if age group and/or age (as a continuous variable) will moderate the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older. The independent variable was balance confidence and the dependent variable was balance confidence.

Moderator Variable

Age, was dichotomized into two groups (65 – 84 and > 85) and as a continuous variable was used as a moderator variable for Hypothesis 3.

Dependent Variables

The dependent variable was balance performance as measured by: (a) Tinetti POMA tool, gait score (ratio), (b) Tinetti POMA tool balance score (ratio), and (c) Tinetti's POMA gait and balance scores combined (ratio).

Data Collection

After obtaining approval to conduct the study from the University of Hawai'i Committee on Human Subjects, a private interview was scheduled and conducted with all eligible participants who agreed to participate in the study. The interviews were conducted in a small private office. Each interview took approximately 50 minutes for the principal investigator (PI) to complete.

Table 2.

Study Data Collection Sequence

Data collection tool	Sequence	Number of minutes
Demographic questionnaire	1	5
Activities-Specific Balance Confidence Tool (ABC)	2	10
Mini Mental Status Exam of less than 23 are excluded	3	15
Tinetti Balance Assessment Tests (Gait & Balance)	4	20

Note. This table reflects the sequence used in collecting the data for the study.

The PI had a check-in table to register for the study. A volunteer nursing student checked participants in and distributed information on the study. The PI was responsible for obtaining the demographic data, and performing the MMSE, ABC Scale and the Tinetti balance and gait tests. A trained research assistant, who was also a physical therapist, assisted with the Tinetti Balance and Gait tests. Appendix B, which is also the consent form, contains the testing instructions for each instrument. The consent form and the testing directions were read to all participants in this study by the PI. Confidentiality was also discussed with each study participant. All of the signed consents and forms were placed in separate envelopes that were coded to ensure participant confidentiality.

Safety

Prior to conducting the balance tests, each subject was informed that an assistive device (gait belt) could be used during the tests in order to minimize the risk of falls. A gait belt was available for those participants who were unsteady or had experienced a fall in the last year. The PI and a research assistant (RA) walked beside the participants during the balance and gait tests. Participants who did not feel safe performing the gait or balance test were reassured they could attempt to perform as much of the task as possible but could stop at any time during the test if they felt unsteady. The examiner was responsible for entering the lowest possible score for the task that were not completed.

Privacy

All interviews were conducted in a private office in the community recreation room. Faculty members at the University of Evansville assisted by making appointments, and assisting potential participants in filling out the questionnaires while the PI completed the Tinetti Balance Performance Tool.

Subject Incentive

As an incentive for participation in the study, a \$10.00 Walmart card was provided to each participant as an incentive payment upon completion of the sociodemographic form.

Protection of Human Subjects

All participants were asked to sign a consent form which explained the purpose of the study. Participants could withdraw from the study at any time without repercussions. Approval to conduct the study was obtained from the University of Hawaii's Institutional

Review Board (IRB) Committee on Human Subjects (Appendix I). In order to maintain privacy data management consisted of locking the informed consent and confidentiality agreements in a locked file which is accessible only to the PI. The questionnaires and balance forms were assigned a code number and locked in a separate file with no identifying information on the documents. The surveys and demographic questionnaires were kept in a separate locked file. Electronic statistical information was recorded in a password protected file. In order to ensure confidentiality and anonymity of the participants, results from the project will be published in an aggregate manner without identifying individual participants.

Statistical Analysis

IBM's Advanced Statistical Professional Software Package (SPSS 18.0) was used to enter, organize, sort, filter, view, store, and monitor the data. The SPSS software was also used to perform statistical analyses and flag missing data. Accuracy of the data was ensured by proofreading or using visual inspection of the original data against the computerized data file. The author also screened the data for accuracy by examination of descriptive statistics and the use of graphs. Scatter plots were used to examine and test linearity amongst pairs of observed variables. Univariate outliers were examined using SPSS "Explore Outlier" function. Missing data may bias parameter estimates and increase Type 1 and Type II error rates, so listwise deletion was performed (Tabachnick & Fidell, 2007, p. 63). The data was checked to verify that the variables meet the assumptions of normal distribution, homogeneity of variance, and independence. This will be discussed further in the results section of this dissertation.

Sociodemographic Variables

Univariate descriptive statistics (frequencies, percents, means, standard deviations, and ranges) were used to describe sample characteristics.

Aim 1. Describe the relationship between balance confidence and balance performance.

Pearson product-moment correlations and scatter plots were used to assess the bivariate relationships between balance confidence and balance performance (gait, balance, total POMA score). Pearson's r was used to determine the degree of the relationship between pairs of variables. Tabachnick and Fidell (2007) remarked, "An r value of +1.00 or -1.00 indicates perfect predictability of one score when the other is known" (p.56). If the correlation between the two variables was positive, then as one variable increased the other variable also increased. Negative correlation means as one variable increased, the other variable decreased. Values close to .00 represent no linear relationship or predictability between the variables. The following guidelines which were recommended by Cohen (1988) were used in reviewing the effect size: (a) $r = .10$, a small effect; (b) $r = .30$, a medium effect; and (c) $r = .50$, a large effect (p.231). Two-tailed tests were used for all correlation analyses and p values of .0167 or less will be considered statistically significant.

Aim 2. Describe the associations among sociodemographic variables, cognitive health status, and number of falls in the last year, balance confidence and balance performance.

Univariate Analysis

As a preliminary screen, Pearson product-moment correlations and scatter plots were used to assess the bivariate relationships between predictors (sociodemographic variables, health status, number of falls, cognitive health status, and balance confidence) and balance performance (gait, balance, total POMA score). The subset of potential predictors that were not significantly related were reported and eliminated from consideration in the multivariate analysis.

Multivariate Analysis

Multiple linear regression methods were performed to model the relationship among the univariate predictors of balance performance. All other assumptions suggested by Field (2009), for multiple regression analyses were met. In addition, because the regression analysis was computed for three separate dependent variables (gait, balance, and gait + balance), a Bonferroni correction was used whereby the alpha level of .05 was divided by 3 ($.05/3 = .0167$). Thus, p values of .0167 or less were considered statistically significant.

Aim 3. To determine if age group and/or age (as a continuous variable), will moderate the relationship between balance confidence and balance performance in older adults. For this analysis, age was dichotomized into 65 to 84, and ≥ 85 years of age. Two age groups were created for this study, in order to compare young older adults, and old older adults. This comparison was performed due to the statistical data which indicates falls increase to 50% in the 85 year and older age group. The author wanted to measure the associations between the two groups. Age was also measured as a continuous

variable. Multiple linear regressions were used to examine whether age group was a moderator between balance confidence and balance performance. Two-tailed tests were used for all regression analyses. In addition, because regression analysis was computed for three separate dependent variables,(i.e. gait, balance, and gait + balance), a Bonferroni correction was used whereby the alpha level of .05 was divided by 3($.05/3 = .0167$). Thus, p values of .0167 or less were considered statistically significant.

CHAPTER 5

RESULTS

The purpose of this study was to examine the associations between balance confidence and balance performance in community-dwelling older adults and to describe the sociodemographic variables which influenced balance confidence. This chapter includes the statistical analysis of the data and research findings. The descriptive tables are also included.

Sample

A convenience sample ($n = 140$) was collected over a three-month period from April 2011 to June 2011. One hundred and forty older adults signed the consent forms and agreed to participate in this study. There were 100 (71.4%) female and 40 (28.6%) male participants. The mean age was 78 years with a standard deviation of 8.72. The age ranged from 65 to 100 years of age.

Instrument Reliability Analysis

Table 3 presents the Cronbach alpha internal consistency reliability coefficients for the MMSE, ABC, and Tinetti scales. The reliability scores should be greater than .70 (Cronbach, 1951). A Cronbach alpha of .70 is normally considered to indicate a reliable set of items (Cronbach, 1951). All of the scores were greater than the recommended .70 with the exception of the MMSE score which was .69. The author notes that the MMSE score is slightly below the recommended score of .70 but the MMSE has known reliability and validity across nursing and psychological research studies (Folstein et al. 1975; Tombaugh & McIntyre, 1992).

Table 3. Cronbach's Alpha Reliabilities for Scales ($N = 140$)

	Number items	Reliability (α)
Tinetti Balance	9	.94
Tinetti Gait	8	.88
Tinetti Gait + Balance	17	.96
ABC scale	16	.98
MMSE	30	.69

ABC Scale

The ABC scale rates older adult's level of balance confidence while performing daily activities. In this study, the tool demonstrated an inter-rater reliability of .95. Inter-rater reliability was established by working with a trained physical therapist (PT), who teaches in the doctoral program at the University of Evansville. A random sample of 10 participants, 56 to 67 years of age, was used to test interrater reliability of the ABC scale and the Tinetti POMA. All of the participants were employees of the University of Evansville. The PT and the PI simultaneously rated and scored the volunteers as they completed the written tool and the balance tests. An agreement score of .98 was obtained for the POMA testing and .95 ($p < .05$) for the ABC scale. In an earlier study by Duncan and Studenski (1994) using the Tinetti POMA tool in a group of ($n = 134$) older adults they found an inter-rater reliability of .85 ($p < .05$). After reviewing the inter-rater reliability results in previous studies the author found the results to be consistent with previous research.

Interobserver reliability was strengthened by following the operations manual created by the PI prior to this experience. Clear and concise instructions were given to the participants. A training DVD, created by Mary Tinetti, creator of the balance and gait tool, was observed by the PI and the PT prior to the study. This probably assisted in

improving inter-rater reliability scores on the POMA tool. Both the PI and the PT watched the training DVD multiple times before the research study began. The PT tutored the PI on scoring various balance and gait tests until the PI's comfort level improved and scoring was consistent between both the PI and PT.

Cronbach's Alpha for the ABC scale was established as a means of reliability. As shown in Table 3, the alpha on the ABC scale was .98. Criterion related validity was used to estimate the validity of the ABC Scale and outcome expectancy measures. The 16 item ABC scale alpha scores demonstrated a high rate of reliability ($\alpha = .98$) which was consistent with previous studies (Lajoie & Gallagher, 2004).

Tinetti POMA Tool

Reliability of the Tinetti POMA tool was also examined. The POMA consists of three different scores. The first test in the POMA is the Tinetti balance test which consists of 9 balance tests with a maximum score of 16 points (Tinetti, 1986). The reliability coefficient alpha of the Tinetti balance test items was $\alpha = .94$ (see Table 3). The second part of the POMA tool is the Tinetti gait test which consists of 8 gait items with a maximum score of 16 points. The reliability coefficient of the gait section was $\alpha = .88$. The Cronbach's Alpha on the POMA (balance + gait) was $\alpha = .96$. The total score on the Tinetti POMA tool is 28 points (Appendix E & F). An alpha of .96 is consistent with previous studies in scientific literature (Lin et al. 2004; Tinetti, Speechley, & Ginter, 1988).

MMSE

The reliability coefficient alpha for the 30 items in the MMSE was .69 (Table 3). In this study, the internal consistency of the MMSE was adequate ($\alpha = .69$). The results are consistent with those of Holzer, Tischler, Leaf, and Meyers (1984), who examined a large sample ($n = 4,321$) of community dwelling older adults for dementia. They found an internal consistency on the MMSE to be adequate ($\alpha = 0.77$). While an alpha of 70% is considered “acceptable” in most statistical research textbooks (Field, 2005; Tabachnick & Fidell, 2007), a 69% demonstrates adequate internal consistency of the MMSE, with a score slightly below the acceptable 70%. The reliability demonstrates the MMSE’s ability to “produce consistent results when the same entity is measured under the same circumstances” (Field, 2005, p.743).

Descriptive Results

The frequencies and percentages of the categorical data are presented in Table 4. A large majority of the study participants (96.4%), were born in the United States (US), widowed (64.7 %), had a high school diploma (55.50%), an annual income of \$10,000 - \$19,999 (59.10%), and lived alone (81.80%). The participants self-reported having heart disease (9%) and arthritis (10%). The average number of falls in the last year was 1.12 (SD 1.75) and a range of 0 to 12 (Table 5). The average score on the MMSE was 28.82 (SD 1.64), with a range from 23 to 30.

Chronic Illnesses

In this study most of the participants identified a history of multiple chronic illnesses. Chronic illnesses noted in this sample of older adults are listed in Table 4.

The participants in this study self-reported 0 to 12 chronic illnesses. There were four participants who denied having a chronic illness. Chronic illness was described as any illness which lasts longer than six months in duration.

Chronic illnesses self-reported by study participants (Table 4) included diabetes (4%), memory (9%), depression (5%), anxiety (3%), Parkinson's disease (1%), epilepsy or seizures (2%), cancer (2%), stroke (1%), heart disease (9%), hypertension (22%), balance problems (5%), kidney disease (3%), osteoporosis (5%), emphysema (1%), hip fracture (2%), arthritis (10%), hearing problems (2%), vision problems (14%), cataracts (1%), and macular degeneration (1%). The number one chronic illness identified in the participants of this study was hypertension (22%).

Table 4. Demographic Characteristics ($N = 140$)

	Frequency	%
Gender		
Female	100	71.40
Male	40	28.60
Age groups		
65 – 84	95	68
85+	45	42
Birth place		
US	135	96.40
Mexico	1	0.70
Germany	1	0.70
Scotland	1	0.70
England	2	1.50
Marital status		
Single/never been married	4	2.90
Married	26	18.70
Widowed	90	64.70
Divorced or separated	19	13.70
Educational status		
Some high school	24	17.50
High school diploma	76	55.50
Some college	28	20.40
Associate's degree	4	2.90
Bachelor's degree	2	1.50
Master's degree	3	2.20
Annual income		
	Frequency	%
Less than \$10,000	20	14.60
\$10,000 - \$19,999	81	59.10
\$20,000 - \$29,999	17	12.40
\$30,000 - \$39,999	11	8.00
\$40,000 - \$49,999	5	3.60
\$50,000 - \$59,999	2	1.50
\$60,000 - \$69,999	1	0.70
Residents living with		
Live with spouse only	14	10.20
Live with spouse and other relatives	3	2.20
Live with other relatives or friends	2	1.50
Live with other unrelated individuals	6	4.40
Live alone	112	81.80

Table 4. Demographics (Continued)

Comorbidities or chronic illnesses		
Diabetes	16	04
Memory	48	09
Depression	23	05
Anxiety	13	03
Parkinson's Disease	2	01
Epilepsy or seizures	12	02
Cancer	12	02
Stroke	8	01
Heart Disease	49	09
Hypertension	106	22
Balance problems	27	05
Kidney Disease	13	03
Osteoporosis	25	05
Emphysema	9	01
Hip fracture	11	02
Arthritis	63	10
Hearing problems	15	02
Vision problems	84	14
Cataracts	38	01
Macular degeneration	14	01

Table 5. Means and Related Statistics for Demographic Characteristics

	<i>M</i>	<i>SD</i>	Range	Skewness	Kurtosis
MMSE	28.82	1.64	23.00 – 30.00	-1.39	1.38
Number of falls last year	1.12	1.75	0.00 – 12.00	3.00	12.98
Self-described health	3.07	1.11	1.00 – 5.00	0.41	-0.71
Age	79.13	8.68	65.00 – 100.00	0.08	-1.12
Annual income	1.34	1.11	0.00 – 6.00	1.62	3.21

Balance Confidence

The average score on the ABC scale was 74.46 (SD 19.19), with a range of 28 to 98.75 (Refer to Table 6). Scores of 80 or above on the ABC are associated with high levels of balance confidence. There were 23 participants (16.78%), who scored below the

80% cut-off score for balance confidence recommended by Powell and Myers (1995) placing them at risk for lacking balance confidence and spiraling balance performance.

Tinetti Gait Test

In Table 6, the average gait score was 9.53 ($SD = 2.82$) with a range of scores on the test from 1.0 to 12.00. The maximum score on the Tinetti Gait test is 12.00 (Tinetti, 1986). There were 63 participants out of the total ($n = 140$) who scored the maximum score of 12.00 (Data not shown). A score of 12 indicates there were no deficiencies in step length and height, floor clearance, step symmetry was equal, no trunk sway, walked a straight line, and heels were almost touching during the walk test (Tinetti, 1986).

Tinetti Balance Test

The average score for the sample was 12.22 ($SD 4.28$) with a range of 1.0 to 16.00 (refer to Table 6). The maximum score on the Tinetti Balance test was 16.00 (Data not shown). There were 57 participants who scored a 16 on the balance tests. A score of 16 indicates an absence of deficits in balance while sitting in a chair, rising from a chair, or standing balance with eyes open, or closed, turning 360 degrees, or sitting down in a chair.

Table 6. Summary of Balance Confidence and Balance Performance

	<i>M</i>	<i>SD</i>	Range	Skewness	Kurtosis
ABC score	74.46	19.19	28.00 – 98.75	-0.64	-0.82
Tinetti Gait total	9.53	2.82	1.00 – 12.00	-0.87	-0.21
Tinetti balance total	12.22	4.28	1.00 – 16.00	-0.79	-0.69
Tinetti balance + gait	21.75	7.01	3.00 – 28.00	-0.80	-0.55

Combined Balance and Gait Scores on the Tinetti Test

The average score on the combined Tinetti balance plus the Tinetti gait test was 21.75 ($SD = 7.01$) with a range of participant scores from 3 to 28. There were 55 high participants, who scored the maximum score of 28 (Data not shown) on the combined test. There were also 63 participants who scored in the 24-28 range, a low risk group for falls, with good balance and gait (Tinetti, 1986). The combined Tinetti POMA (balance plus gait) scores indicate that 45% of this group ($n = 140$) of community-dwelling older adults are at low risk for balance performance problems or falls.

Skewness and Kurtosis

According to Pearson (1895), skewness and kurtosis values should be between -1 to +1 in a normal distribution. In Table 5, there were three variables with values outside of this skewness range: MMSE (-1.39), the number of falls in the last year (3.0), and annual income (1.62). These three variables exhibited slight skewness and kurtosis outside of Pearson's (1895) recommended range of normality. However, according to Pearson (1995) not all data fall inside the normal range of distribution. In reality, all data points may not be symmetrical with an equal number of negative and positive points on each side of the mean. After consulting the study statistician, Dr. Francisco Conde, and dissertation committee members, the decision was made to not transform the variables due to the minimal degree of skewness and distance from the study mean.

Univariate, Bivariate, and Multivariate Results

Aim 1

The first aim of this study was to describe the relationship between balance confidence and balance performance. As shown in Table 7, Pearson correlations revealed

a positive, significant association between balance confidence and the Tinetti POMA (gait plus balance) score ($p < .01$, $r = .74$; Table 7). Balance confidence was also positively associated with gait ($p < .01$, $r = .73$), and balance ($p < .01$, $r = .74$). The size and the direction of the relationships suggest as balance confidence increases, balance performance improves. Results supported Hypothesis one, describing the relationship between balance confidence and balance performance (Table 7). Note correlations are only a preliminary test and the multiple regression analysis will be discussed later in this document.

Table 7. Pearson Correlation Analysis of Balance Confidence and the Tinetti POMA Scores

Tinetti POMA scores		Balance subscale (POMA)	Gait subscale (POMA)	Balance + gait (total POMA)
Balance confidence	Pearson correlation	.736**	.728**	.743**
	Sig. (2-tailed)	.000	.000	.000
	<i>N</i>	140	140	140

** Correlation is significant at the 0.01 level (2-tailed).

Aim 2

The second aim of the study was to describe the associations among sociodemographic variables, cognitive health, self-perceived health status, number of falls in the last year, balance confidence and balance performance.

Univariate Analysis

The correlation coefficients in Table 8 provide a visual display of the relationships amongst the study variables including the sociodemographic data, cognitive

health, self-perceived health status, number of falls in the last year, balance confidence, and balance performance.

Table 8. Correlations for All Variables Involved in Bivariate Analyses ($N = 140$)

	1	2	3	4	5	6	7	8	9
1. Gait	--								
2. Balance	.94**	--							
3. Bal + gait	.98**	.99**	--						
4. ABC	.73**	.74**	.74**	--					
5. MMSE	.52**	.50**	.52**	.35**	--				
6. Falls	-.60**	-.59**	-.60**	-.50**	-.32**	--			
7. Health	.38**	.37**	.38**	.42**	.21*	-.35**	--		
8. Age	-.15	-.20*	-.18*	-.25**	-.02	.20*	-.20*	--	
9. Income	.10	.08	.09	.23**	-.001	-.14	.33**	-.28**	--
10. Gender	.12	.11	.10	.12	.11	.10	.12	.21*	.12

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

Balance confidence. Balance confidence (ABC) was significantly correlated with the Tinetti gait ($r = .73, p < .01$), Tinetti balance ($r = .74, p < .01$) and the combined Tinetti balance plus gait, POMA score ($r = .74, p < .01$). Please refer to Table 8 which is the correlation matrix.

Cognitive status. The MMSE was significantly correlated with the Tinetti gait test ($r = .52, p < .01$), balance tests ($r = .50, p < .01$), and the combined balance plus gait test ($r = .52, p < .01$). The correlation between the MMSE and the ABC scale was significant ($r = .35, p < .01$).

Number of falls. The number of falls in the last year was negatively or inversely correlated with gait ($r = -.60, p < .01$), balance ($r = -.59, p < .01$), gait plus balance ($r = -.60, p < .01$), ABC scale ($r = -.50, p < .01$), and the MMSE ($r = -.32, p < .01$). The correlations indicate that as the number of falls in the last year increase, the scores on the Tinetti tests, balance confidence, and cognitive health scores decline (see Table 8).

Health status. Study participants ($N = 140$) were asked to rate their self-perceived health status as excellent, very good, good, fair or poor. The correlations between health status and gait ($r = .38, p < .01$), balance ($r = .37, p < .01$), gait plus balance ($r = .38, p < .01$), ABC scale ($r = .42, p < .01$), MMSE ($r = .21, p < .05$) and falls ($r = -.35, p < .01$); are all significantly correlated (See Table 8). Health status was positively correlated with all of the measures except falls. A negative correlation ($r = -.35, p < .01$), was noted between health status and the number of falls in the last year. The inverse score reflects health status and number of falls. As the participants health status declines the number of falls increase.

Chronological Age. Chronological age was significantly correlated with balance confidence (ABC; $r = -.25, p < .01$), the number of falls ($r = .20, p < .05$), balance ($r = -.20, p < .05$), and gait plus balance ($r = -.18, p < .05$). The relationship between age and balance indicated a negative association between the two variables. Age was negatively associated with balance and balance confidence ($p < .05$). As chronological age

increased, balance confidence decreased. Age was not significantly correlated with gait, cognitive health or self-perceived health status. The age of study participants was 65 to 100 with a mean of 72 years of age.

Income. Income was significantly correlated with balance confidence (ABC scale, $r = .23, p < .01$), self-perceived health status ($r = .33, p < .01$), and age ($r = -.28, p < .01$). Income and age were negatively correlated ($p < .01$). This inverse relationship indicates as the participant grows older or age increases, income decreases.

Gender. Gender was significantly correlated with age ($r = .21, p < .05$) in this study. The correlation between gender and the Tinetti POMA scores was not significant. Also, there was not a correlation between balance confidence and gender in this group of 140 community-dwelling older adults.

Multivariate Analyses

The variables which were identified as significant ($p < .05$) in the Univariate analysis were tested in multiple regression models. The model included the following independent variables: age, gender, income, health status, number of falls, cognitive health status and balance confidence. The dependent variable was balance performance which was measured by the: (a) Tinetti POMA tool, gait score (ratio), (b) Tinetti POMA balance score (ratio), and (c) Tinetti POMA gait plus balance score (ratio). The combined balance plus gait score is total balance performance (Tinetti, 1986).

Assumptions for Multiple Regression Analysis

This section will discuss assessments of multicollinearity, normality, linearity, homoscedasticity, and independence of residuals.

Multicollinearity. The absence of multicollinearity (correlated predictor variables) is not a formal assumption of Multiple Linear Regression (MLR); however, the presence of multicollinearity can pose a problem for the stability of the regression coefficients and should thus be considered and addressed when computing MLR. Each regression model was formally tested for the presence of multicollinearity by computing measures of multicollinearity consisting of the Tolerance and the Variance Inflation Factor (VIF). Typically, tolerance measures should be $> .20$ and the VIF should be < 10.0 (Neter, Kutner, Nachtsheim, & Wasserman, 1996). The independent variables in the tested models met these assumptions for the models that had no interaction term. The highest VIF value for a model without an interaction term was 1.79, and the lowest tolerance was .56 for the number of falls. Introducing an interaction term increases the incidence of multicollinearity because an interaction term is computed by multiplying two predictors together. Thus, for the models with the interaction of balance confidence and age group, the highest VIF value was 4.36, and the lowest tolerance was .22 for balance confidence, but even with those more extreme values, the cutoffs were not exceeded.

Normality plots of the regression model. For each regression model, normal probability plots of the residuals were created. Probability plots are a graphical representation for comparing a data set with the normal distribution. As shown in Figure 4, the probability plot can be used, along with the standardized residual of the linear regression model, to examine a visual representation of the data. This assists in visualizing whether the data is normally distributed. Figure 4 presents the normal probability plot of the standardized residuals for the third regression. The dots do not

show any marked deviations from the diagonal line. The plots for the other regressions looked almost identical to this plot; thus, only the plot for the third regression is shown.

Also, Mahalanobis' distance was computed to assess multivariate normality for each regression (Field, 2009). The critical chi-square value for a regression model with seven predictors is 24.32 ($p < .001$). The independent variables or predictors included in the model were age, gender, income, cognitive health, falls, health status, and balance confidence. The dependent variables were the Tinetti POMA scores (gait, balance, and gait plus balance). When the regressions were first computed using the original sample

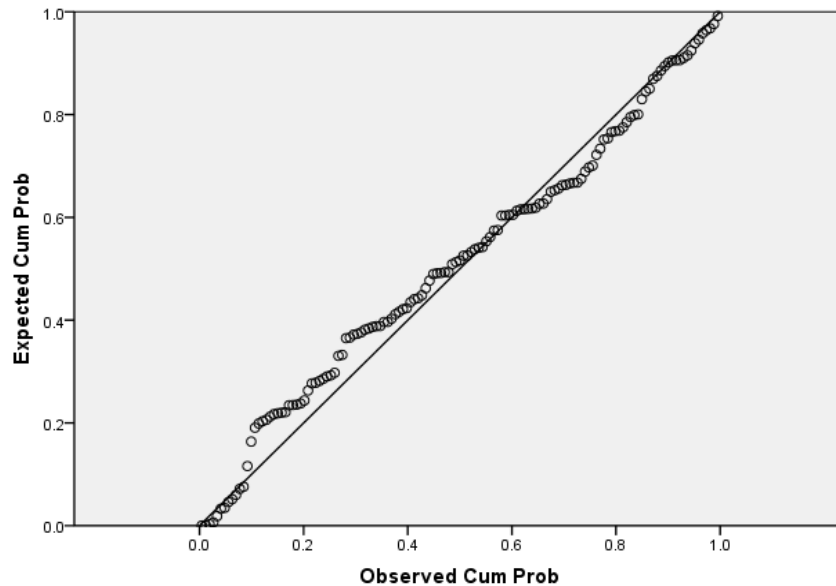


Figure 4. Normal probability plot for the Tinetti balance plus gait regression model.

size of $N = 140$, three participants had Mahalanobis' distance values that exceeded the critical value; thus, those three participants were determined to be multivariate outliers but were not excluded from the analyses. All results were then recomputed for the participants. For these 140 participants, the maximum value for Mahalanobis' distance for the regressions was 21.13. The predictors used in the regression model were age, gender, income, cognitive health, falls, health status, and balance confidence. This did not

exceed the critical chi-square value of 24.32 for $df = 7, p < .001$. The maximum value for Mahalanobis' distance for the regression model was 20.30. The variables used in the regression model were age, gender, income, cognitive health, falls, health status, and balance confidence. The dependent variables were the Tinetti POMA tests (gait, balance, and gait plus balance). This did not exceed the critical chi-square value of 26.13 for $df = 8, p < .001$. Thus, the assumption of multivariate normality was met for each of the regression models using the final sample of $n = 140$ participants.

Linearity. A linear relationship was determined between the independent and dependent variables by plotting the studentized residuals against the standardized predicted values of the dependent variable for each regression. Figure 5 displays a scatterplot showing this relationship for the first regression. As can be seen in the scatterplot, there were no obvious curvilinear patterns in the data; thus, a linear relationship could be assumed. The plots for the other regressions looked almost identical; thus, only the plot for the first regression is shown.

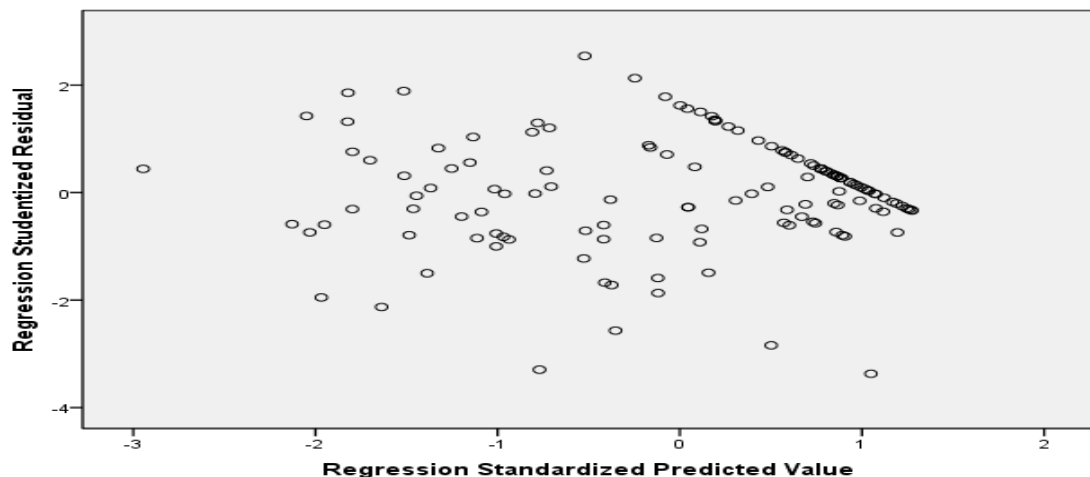


Figure 5. Scatterplot of studentized residuals and standardized predicted values for the Tinetti balance + gait regression model.

Homoscedasticity. Figure 5 can also be used to assess the data for homoscedasticity, which is a measure of whether the error variances are equal across all levels of the independent variables. When error variances are not equal, obvious patterns (e.g., bowtie pattern, fan pattern) will appear in the scatterplot, indicating heteroscedasticity, or if the number of points above and below zero is very different, heteroscedasticity may be a problem. Figure 5 shows that the dots are a little more spread out on the left side than on the right, which may indicate slight heteroscedasticity, but slight heteroscedasticity should not impact the significance tests of the regression results (Tabachnick & Fidell, 2001). The plot is free of any strong patterns, thus indicating that the assumption of homoscedasticity has been met sufficiently.

Independence of residuals. Figure 5 can also be used to check for independence of residuals. As before, patterns in the plot can signify that the error terms are not independent. Figure 5 is sufficiently free of patterns.

Multivariate Analyses

Tinetti gait score. The overall model was significant, $F(7, 132) = 38.33, p < .001$. Balance confidence, cognitive health, and number of falls were significant predictors of gait performance in the multiple regression models. These three predictors explained 67% ($R^2 = .67$) of the variance in the multiple regression model (see Table 9).

Tinetti balance score. The overall model was significant, $F(7, 132) = 36.96, p < .001$. Balance confidence, cognitive health, and number of falls were significant predictors of balance score. These three predictors explained 66.2% ($R^2 = .662$) of the variance in the multiple regression model.

Tinetti gait plus balance score. The overall model was significant, $F(7, 132) = 40.45, p < .001$. Balance confidence, cognitive health, and number of falls were significant predictors of overall gait and balance performance. These three predictors explained 68.2% ($R^2 = .682$) of the variance (Table 9) in the multiple regression model. The combined scores represent the critical Tinetti POMA score reflecting balance performance.

Aim 3

To determine if age group and/or age (as a continuous variable), will moderate the relationship between balance confidence and balance performance. In the final regression model balance confidence and the Tinetti gait score was significant, $F(8, 128) = 36.52, p < .001$ (Table 10). The overall model for the balance score was significant, $F(8, 128) = 35.96, p < .001$. Also, the overall model for the Tinetti balance plus gait score was significant, $F(8, 128) = 39.24, p < .001$ (Table 10).

Thus, age group did not moderate the relation between balance confidence and balance performance in community-dwelling older adults; age 65 years and older (Table 10). Age (computed as a continuous variable) was not significant (Results not shown). Failure to reject the null hypothesis three implies there is insufficient evidence to support the idea of real difference. Age or age group did not moderate the relationship between balance confidence and balance performance in this group of community-dwelling older adults.

Table 9. Multiple Regression Models

Predictors	<i>B</i>	<i>SE B</i>	β	<i>R</i> ²
DV = Tinetti Gait Score df (7,132)				.67
Balance confidence (ABC)	0.07	0.01	0.51***	
Cognitive health	0.43	0.09	0.25***	
Gender	-0.05	0.33	0.01	
Number of falls	-0.44	0.10	-0.27***	
Health	0.12	0.15	0.05	
Age	0.02	0.02	0.05	
Income	0.13	0.35	0.02	
DV = Tinetti Balance Score df (7,132)				.662
Balance confidence (ABC)	0.12	0.01	0.53***	
Cognitive health	0.60	0.15	0.23***	
Gender	-0.16	0.50	-0.02	
Number of falls	-0.59	0.15	-0.24***	
Health	0.15	0.23	0.04	
Age	-0.02	0.03	-0.04	
Income	-0.29	0.17	-0.09	
DV = Tinetti Balance + Gait Score df (7,132)				.682
Balance confidence	0.19	0.02	0.53***	
Cognitive health	1.03	0.23	0.24***	
Gender	-0.21	0.79	-0.01	
Number of falls	-1.03	0.24	-0.26***	
Health	0.27	0.36	0.04	
Age	-0.01	0.04	-0.01	
Income	-0.39	0.27	-0.08	

$p < .05^*$ $p < .01^{**}$ $p < .001^{***}$

Table 10. Regression Model for Age Group

Predictors	<i>B</i>	<i>SE B</i>	β	<i>R</i> ²
DV = Tinetti Gait Score df (7, 132)				.695
Balance confidence	0.06	0.02	0.38***	
Cognitive health	1.33	0.32	0.24***	
Gender	0.04	0.32	0.01	
Number of falls	-1.44	0.31	-0.32***	
Health	0.07	0.14	0.03	
Age group	-.14	0.33	-0.02	
Income	0.12	0.35	0.02	
Age Group × Balance Confidence	0.02	0.02	0.12	
DV = Tinetti Balance Score df (7,132)				.692
Balance confidence	0.10	0.02	0.47***	
Cognitive health	1.68	0.48	0.20***	
Gender	0.01	0.49	0.00	
Number of falls	-2.15	0.47	-0.31***	
Health	0.07	0.22	0.02	
Age group	0.11	0.51	0.01	
Income	-0.51	0.53	-0.05	
Age Group × Balance Confidence	0.01	0.02	0.04	
DV = Tinetti Balance + Gait Score df (7,132)				.710
Balance confidence	0.16	0.04	0.44***	
Cognitive health	3.01	0.77	0.21***	
Gender	0.05	0.78	0.00	
Number of falls	-3.59	0.75	-0.32***	
Health	0.13	0.35	0.02	
Age Group	-0.03	0.81	-0.00	
Income	-0.39	0.84	-0.02	
Age Group × Balance Confidence	0.03	0.04	0.07	

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

CHAPTER 6

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

This chapter discusses the study findings based on the statistical analysis. Also, the study limitations, implications, and recommendations for further research are discussed. The chapter concludes with a discussion about potential threats to the validity and research implications. This research project was based on Bandura's (1977, 1982, 1986, 1993, 1997) self-efficacy theory, hence the results will be discussed from a social cognitive perspective.

Discussion

The study results indicate balance confidence is significantly associated ($p < .001$) with balance performance in this sample of 140 community-dwelling older adults, 65 to 100 years of age. Loss of balance confidence can have detrimental effects on balance and gait in older adults leading to a loss of independence. Individuals who lack balance confidence may restrict their level of physical activity causing greater decline in gait and balance. This study adds to our understanding of what is known about the associations between balance confidence and balance performance. In addition, study findings support the influence of Bandura's self-efficacy theory as forming the theoretical foundation for this project. Study findings provide additional knowledge on the relationships between age, gender, income, cognitive health, self-perceived health status, falls history, and balance performance.

Hypothesis 1

Research Hypothesis 1. There will be a positive relationship between balance performance and balance confidence in community-dwelling older adults, 65 years of age and older. The regression model results supported the association ($p < .001$) between balance confidence and balance performance, in a group of community-dwelling older adults, which ranged in age, from 65 to 100 years. Study findings are in concordance with previous studies including the participants were predominately female, Caucasian, widowed, community-dwelling, lived alone with a history of at least one fall (Hatch et al. 2003, Myers et al. 1996 & 1998; Powell & Myers, 1995). The results of the first regression model suggest balance confidence positively associated with balance performance in community-dwelling older adults, 65 years of age and older. This outcome agrees with previous studies on balance confidence (Myers et al. 1996 & 1998; Powell & Myers, 1995; Hatch et al. 2003).

Loss of balance confidence is a common problem in older adults affecting up to 70% of those who have deficits with gait and balance (Powell & Myers, 1995). Overall, this study demonstrates that an association exists between balance confidence and balance performance but causation cannot be implied from a correlational study. In the regression models for predicting Tinetti POMA (gait and balance), balance confidence was significant ($p < .001$). Specifically, balance confidence is a psychological construct which is associated with balance and gait measures (balance performance) in community-dwelling older adults. However, only an association between the two major variables (balance confidence and balance performance) can be established by the study results.

Balance Performance

Hypothesis 2

Research Hypothesis 2. To determine if age, gender, income, health status, number of falls, cognitive status, and balance confidence, are associated with balance performance in community-dwelling older adults, age 65 years of age and older.

Multivariate Analysis. In the multiple regression models, there were only three variables which were significant. The three significant ($p < .001$) predictor variables in the multiple regression models were cognitive status, falls, and balance confidence. The variables which were not significant in the multiple regression models included age, age group, gender, socioeconomic level (income), and health status. These nonsignificant variables did not contribute to the multiple regression models. The discussion which follows will focus on the three predictors of balance performance.

Cognitive Status

In the multiple regressions models cognitive status (MMSE score) was one of the variables which was significantly ($p < .001$) associated with balance performance in the multiple regression models. In this cohort of older adults, balance confidence was associated with the participant's current cognitive status on the MMSE (Univariate analysis Table 8). This is similar to earlier studies by Myers et al. (1998) in which the group investigated cognitive impairment and its association with balance confidence. They identified higher MMSE scores of 27 to 30 are associated with higher scores on the ABC scale. Both studies identified positive associations between cognitive status and balance confidence ($p < .001$).

Health care providers recognize the importance of cognitive status in daily activities including speech, and the ability to solve problems. But, many may not

associate the connection between cognitive function and balance confidence. Balance confidence and cognitive status are directly correlated and play a major role in gait and balance (Myers et al. 1998). The role of cognitive status in movement and gait is still being explored by researchers across multiple disciplines including nursing. Although cognition is usually thought of as a “way of thinking or mental processing,” it is also involved in control of movement (Lyman, 1999). The memory structures in the central nervous system are essential to balance and gait (Lyman, 1999). Multi-tasking skills such as carrying a basket of laundry while climbing up steps would involve not only balance confidence but also cognitive processing and balance performance skills (Silsipadol, 2006).

The cognitive status scores of the participants in this study ranged from 23 to 30 on the MMSE. It is interesting to know that 56% of the participants in this study scored a perfect score of 30 on the MMSE indicating a high cognitive status. Perhaps those living independently in a retirement community have higher cognitive status than those living independently in single family dwellings. Most of the participants in this study participate in multiple activities at the retirement community requiring higher level of cognition.

The MMSE is recommended to be given at intervals in time to monitor for change from the baseline measurement. This study did not allow for subsequent or periodic measurements which may have detected subtle changes in the group’s cognitive status.

Falls

Balance confidence was inversely associated to falls in this study ($-.60, p < .001$, Table 8). Falls was also a predictor ($p < .001$) of balance performance in the multiple

regression models. Causation and other conflicting variables must be taken into consideration when examining the association between balance confidence and falls.

After an older adult sustains a fall, balance confidence has been found to decrease. These results are in concordance with Tinetti's et al. (1996) research. They identified 27% of older adults who had fallen lacked balance confidence and were fearful of falling again.

In past literature, the association between falls and loss of confidence usually begins after the second fall (Tinetti et al. 1990; Tinetti, Mendes de Leon, & Doucette, 1994). The implications of these findings are significant in a society which is struggling to meet the health care needs of its older population. Balance confidence and self-efficacy are constructs which can be studied in order to develop interventions which affect an older adult's balance thus decreasing the incidence of falls. Identification of those older adults who are experiencing deficits in balance confidence before a fall occurs would have a major impact on a society trying to prevent falls in an aging society.

There are clearly differences between older adults with balance confidence and those who have lost confidence placing them at risk of falling. Identifying those individuals who do not have balance confidence before they sustain a fall could decrease older adult's risk of ending up in an emergency room. This not only would improve the injury rate of older adults but could improve mortality and morbidity rates. Falls continue to be a serious threat to the safety and health of older adults and often lead to a loss of independence. Maintaining balance and gait in older adults will continue to promote independent living and perhaps delay or decrease dependence on long-term care in future generations.

Balance Performance

Balance performance is associated ($p < .001$) with balance confidence in the correlational analysis (.74) and the multiple regression models. Balance performance measures included not only the Tinetti POMA score but individual gait and balance test scores. Across all performance measures balance performance was significantly ($p < .001$) related to balance confidence. Hatch et al. (2003) identified “balance performance was a strong determinant of balance confidence in community-dwelling older adults” (p.1072). Hence, an older adult’s ability to balance and move about in the environment is associated with their level of balance confidence. Strengthening performance measures such as gait and balance may have a direct impact on an older adult’s ability to complete daily tasks.

Balance performance not only improves balance confidence. Bandura (1997) postulated self-efficacy (balance confidence) can influence performance. High self-efficacy expectations can increase an older adult’s participation in activities involving balance and gait (Bandura, 1997). Low self-efficacy can result in avoidance of the tasks including gait and balance (Bandura, 1997). Therefore, boosting balance confidence can result in higher balance performance scores. Hence, an association exists not only between balance performance and balance confidence but also between balance confidence and balance performance. Self-efficacy (balance confidence) encourages (high self-efficacy) older adults to select daily tasks which challenge their abilities or discourages (low self-efficacy) and hinders their ability to lead an active lifestyle.

Hypothesis 3

Research Hypothesis 3. To determine if age group and/or age (as a continuous variable), will moderate the relationship between balance confidence and balance performance in community-dwelling older adults, 65 years of age and older. In this study, age group divisions did not moderate the relationship between balance confidence and balance performance. Chronological age was also not significantly associated with balance confidence or balance performance in the multiple regression analysis. One of the possible reasons for these results is the age divisions were skewed due to the small number of participants, age 85 and older. The 65 to 84 age group had 93 (67.9%) participants and the 85 and older group had only 44 (32.1%) of the total (n = 140) sample. Another possible reason may have been the older adults in this study were very active and only the most active volunteered for the study. Age has been correlated with impaired balance (Kulmala et al. 2003; Powel & Myers, 1995, Hatch et al. 2003) and impaired functional status (Lusardi, Pellecchia, & Schulman, 2003; Binder, Storandt, & Birge, 1999) across multiple studies. In this project chronological age was not significantly associated with balance confidence and balance performance ($p < .001$). There were times during the study when older adults who were residents of Redbanks would push their walker past the study area and comment they were not “well-enough” to participate in a balance study.

Additional Findings

Additional findings of interest were identification of a subgroup of older adults who have balance confidence scores inconsistent with their balance performance, placing them at risk for sustaining of a fall. In this study, there were 11 (0.80 %) participants

who scored a 155 or above on balance confidence out of a potential 160 points. Out of the 11 participants who scored 155 or above in balance confidence, 2 (0.15 %) participants, scored low on balance performance placing them at risk of sustaining a fall. While the percentage of older adults in this subgroup of participants is low, the risk of falling is great. Poor balance has repeatedly been shown to be associated with falls (Lajoie & Gallagher, 2004; Lin et al. 2004; Shumway-Cook & Woollacott, 2001; Tinetti, 1986, 2003; Tinetti & Williams, 1997).

Another finding which provides additional evidence for this study is the negative relationship between the number of falls in the last year and the balance performance in the regression models. The number of falls ($\beta = -.30, p < .001$) has a significant negative correlation with balance performance scores (balance, gait, & balance + gait). The results of the statistical analyses indicate that as the balance performance score decreases, the number of falls increase.

Relationship of Findings to Bandura's Self-Efficacy Model

The findings of this study are supported by Bandura's self-efficacy model (1982, 1986, 1989, & 1997). The ABC Scale was created to measure an older adult's confidence or self-efficacy (Figure 1). Bandura (1997) discussed in previous studies that growing older and chronic illness has a debilitating influence on physical function but an older adult's perceptions of their capabilities plays a major role in behavior. Balance confidence was significantly associated with balance performance measures ($p = .001$). In older adults balance confidence was associated with the level of performance on the balance and gait test which is consistent with the study proposal (Figure 2).

Hatch et al. (2003) identified, “poor functional performance scores were associated with impaired balance confidence” (p.1079). They hypothesized that those with poor balance had difficulty with balance and falls lead to impaired balance confidence. The three variables in the multiple regression models which supported an association were balance confidence (self-efficacy), number of falls in the last year, and cognitive health status. The author of this study acknowledges there were other variables which may have influenced the results of this study. Thus, the present study was supported by Bandura’s self-efficacy model (Figure 6).

One of the major questions of this study is whether deficits in balance confidence influenced balance performance or perhaps older adults who had deficits in gait and balance lost their confidence after multiple falls. Another weakness of this project was the correlational design. Unfortunately, correlation does not always prove causation and unknown determinants of balance confidence may have influenced the study results.

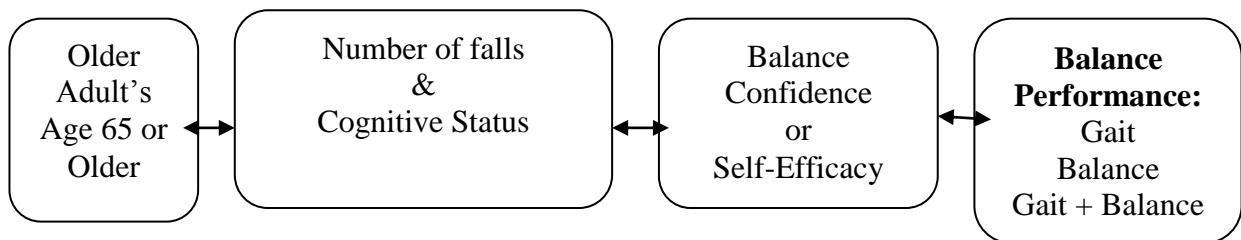


Figure 6. This model forms the conceptual framework for this study. Balance confidence and its relationship to balance performance.

Questions related to this study included the influence of balance performance on confidence levels. Poor functional performance due to stroke or other balance issues may precede changes in balance confidence. Less efficacious individuals may simply sit on the couch and not move in early adulthood, then lose muscle mass causing balance issues.

In this individual, confidence may be absent due to low self-efficacy before the change in balance performance occurs. More needs to be learned about the role of self-efficacy and its association with balance performance, since 67% of the variance in the multiple regression models was explained by balance confidence, 33% is still remaining as an unknown. A cause and effect relationship cannot be inferred due to the structure of this descriptive correlational designed study. According to Field (2009) a correlational study examines the relationship or associations between two or more variables.

Limitations of the Study

The results of this study are limited by the homogeneity of the sample. The sample was drawn from a single apartment complex for older adults in a single geographic area. There were also threats to internal and external validity in this study. There were several interruptions during completion of the cognitive tests. There was noise from the library and hallway throughout the study. The lighting on day one was somewhat dim so a table lamp was added to the conference table so residents could see the forms. Another issue was a large puzzle set-up on the conference table which caused issues in completion of the paperwork. These events occurred during the initial phase of the study and were distracting for the participants.

Another study limitation was the omission of a tool to measure self-efficacy. The ABC tool was developed to measure self-efficacy, but the author concedes that balance confidence is only one small element in an individual's total self-efficacy. The author questions whether the ABC tool measures all of the different components of self-efficacy or simply confidence which is only one aspect of self-efficacy (Bandura, 1986).

Methodological Limitations

The limitations of this study included the following: (a) the reliance on self-report tools such as the ABC scale; (b) the sample was drawn from only one apartment complex in a single geographic area which limited its generalizability (c) cross-sectional study cannot verify cause and effect. Many of the participants requested clarification of the questions in the tool. Hatch et al. (2003) identified patients who are more frail or have uncorrected visual problems may need assistance completing the questionnaire. In order to address these concerns individual appointments were scheduled with the PI in order to answer questions and concerns pertaining to the study.

The Hawthorne effect or study bias may have affected participant's self-reported results. Many of the study participants remarked they had perfect balance but when measured problems were detected. This same group reported the absence of falls while completing the paperwork and later during the performance measures discussed a recent fall they had experienced. This may have lead to under-reporting of the number of falls in the last year.

The participants in this study were all community-dwelling and live in a facility which offers weekly exercise programs. They were high functioning, which may have limited the study results. All but two of the participants, were able to complete the Tinetti balance and gait tests. The two participants who had difficult completing the tests had difficulty completing the initial walk test and were dependent upon a walker to complete activities of daily living. Both of these participants were referred to a balance program at a local hospital due to their gait problems. Even after completing a training program, the participants may not have improved confidence due to their instability and dependence

upon an assistive device. There are currently no studies which examined assistive dependent subjects and balance confidence.

Study Strengths

The strengths of this study included the high positive associations amongst the study variables. Balance confidence not only was highly associated with balance performance but also cognitive health status and the number of falls in the last year. The regression model results were very similar to those obtained by Myers et al. (1996). Results were also similar to a study conducted by Hatch et al. (2003), which examined the determinants of balance confidence, and found participants sociodemographic characteristics were not significantly associated with balance confidence.

Several study strengths were identified from this study. The tools Tinetti POMA has been considered the gold standard in measurement of older adults balance and gait. Mary Tinetti who developed the tool is one of the leading researchers in falls and mobility in older adults. Possibly one of the strengths of the study is the measurement of not only balance and gait but the tests reflects movements older adults perform during daily activities such as sitting, standing, balance and gait.

Since 45% of the subjects tested at the low risk level for balance or gait problems this reflects a high functioning group of older adults. These findings suggest that almost half of the participants were having problems with balance and gait. In this study an additional strength was high balance confidence scores were reflected in high Tinetti POMA scores. Those older adults who tested in the average or greater balance confidence range also demonstrated “high functioning” with scores of 24 to 28 on the Tinetti POMA, gait and balance tests.

Implications for Nursing

The implications for nursing focus on the importance of balance control and balance performance in an aging society. Balance is not static, but rather dynamic. Older adults with balance problems fall during movement not standing (Tinetti et al. 1984). This concept was the impetus for this study. Much research has been done on balance in older adults but few studies focused on the associations between balance confidence and balance performance.

As health care resources become limited due to increasing budget constraints and the number of older adult's increases, prevention will become increasingly more important. The CDC's Division of Unintentional Injury Prevention (2010), projected annual direct and indirect costs from falls amongst older adults are expected to approach \$54.9 billion by 2020. Focus should be on identification of those older adults who are just starting to experience changes in balance before falls occur. According to Mary Tinetti, "falling doesn't have to be an inevitable part of aging because it is preventable," (Tinetti, 2011, p. 42). Focus should be on routine screening especially in those who have little support at home. Screening should focus on comprehensive examinations which evaluate not only physical but psychological status.

Nurses are in a pivotal position to advocate for older adults. Programs which focus on falls and injury prevention are necessary in order to keep older adults safe. Healthy People 2020, specifically targets fall-prevention in older adults, with a goal of reducing the number of fall related deaths from 38 per 100,000 to less than 34 per 100,000 over the next ten years (U.S. Department of Health & Human Services, 2010). This national health goal will be very difficult to reach due to the expanding numbers of older adults. Nurses can increase public awareness and understanding of the role of

balance in the prevention of falls to facilitate Healthy People 2020 of decreasing the number of falls in older adults.

Recommendations

Recommendations would include conducting additional research to further investigate the variables in this study using a larger sample of community-dwelling older adults. The majority of the subjects in this project were Caucasian, so an ethnically diverse sample may yield different results. The study group living at Redbank's had access to physical activity classes including weight training and Tai Chi which may have improved their balance. Perhaps replication of the study using a convenience sample from various single family dwellings or government housing may have different results.

Qualitative studies may provide useful information on an older adult's perceptions of balance confidence. Balance confidence is a psychological construct which has underlying physical factors which may underlie this concept. The information obtained from a qualitative study may provide a link in the associations between psychological and physical constructs.

Critical research is needed to develop a tool which examines psycho/physical constructs and evaluates early changes in balance confidence. Early detection of balance impairment in older adults, whether psychological or physical, including development of new and innovative instruments will assist in improving our current system. The new instruments must be concise and provide rapid detection of minor changes in confidence and balancing abilities in older adults. Other recommendations include focusing on both functional and cognitive status which impacts quality of life across all age groups. The focus should be on evaluation of psychological constructs which impact function and

prevent falls. As the numbers of older adults increase, nurses will play a critical role in the health care of our aging population.

Conclusions

This study adopted a social cognitive perspective in order to investigate the associations between self-reported balance confidence, and performance based balance and gait assessment scores in older adults. A discussion of the results is organized around the study questions and hypotheses. Specifically, the study investigated whether older adult's scores on a balance confidence questionnaire (ABC), were associated with balance and gait scores on the Tinetti Tool.

Psychological issues are important endpoints for investigation due to their impact on functional performance measures such as balance and gait. As expected, there is an association between balance confidence and balance performance in older adults, age 65 years and older. Psychological constructs such as balance confidence is a modifiable variable which impacts functional performance measures including balance and gait. This study demonstrated the importance of balance confidence on physical performance measures such as balance performance (balance, gait, balance plus gait). Future research should examine other factors which may influence balance confidence and balance performance with a larger sample in multiple housing settings. Focus should also be on obtaining baseline data and measurement of variables at different points in time such as 3 months, 6 months and again at 9 months. Building on this study to expand the body of knowledge regarding balance confidence and balance performance in community dwelling older adults may assist in establishing future work on this important issue.

APPENDIX A
STUDY ADVERTISEMENT



BALANCE RESEARCH STUDY

Adults 65 years of Age and Older Needed for Study

Receive a \$10.00 Wal-Mart Gift Card for participation in the study.

Qualifications: Must be 65 years of age or older and able to walk 20 feet.

When: April & May 2011

Where: Redbanks Community Center

Reason for the Study: To investigate balance!

Contact Information:

Jane Woods, Secretary at the University of Evansville

Telephone: (812) 488-1046

Angie Wooton, RN, Family Nurse Practitioner is the investigator for this study. She is a Doctoral Student at the University of Hawaii and a Professor of Nursing at the University of Evansville.

Telephone: (270) 827-8338 Email: aw43@evansville.edu

APPENDIX B

RESEARCH CONSENT LETTER

Project Information: Associations between Balance Confidence and Balance Performance in Community-Dwelling Older Adults

Principal Investigator: Angie Wooton, RN, MSN, FNP-C, PhD ©,

Assistant Professor of Nursing at the University of Evansville, Evansville, Indiana

This research project is being conducted to meet part of the requirements for a doctoral degree. Adults who are 65 years of age or older are invited to participate in this study. The purpose of this study is to assess balance confidence and balance performance in older adults, 65 years of age and older. The study will be conducted by Angie Wooton, a doctoral student at the University of Hawai'i at Manoa School of Nursing. She is also the principal investigator (PI) or researcher for this study.

You are being asked to participate in a research study on balance confidence and your ability to balance while standing and walking. This is a consent form. It is to provide you with information about this study. The researcher will talk with you about this information. Please take your time to review this consent form and discuss any questions you may have with the researcher. You may take your time to make your decision about participating in this study and you may discuss it with your regular doctor, friends and family before you make your decision. If there are any words or sections in this consent form that you do not understand, please ask the research staff to explain them. If you agree to take part in this study, you will be asked to sign this consent form.

It is important that you understand that taking part in this study is of your own free will. You may decide not to participate, or you may decide to stop being in the study at any time, and it will not affect your regular medical care now, or in the future. Your participation in this research will involve completing several pages of questionnaires that require reading, filling blanks, circling answers and some writing. The researcher will also observe your balance while you: (1) stand from a chair, (2) sit in a chair, (3) stand (eyes open and then eyes closed), and (3) perform a 10 foot timed walk.

A brief questionnaire will ask about background data such as date of birth, marital status, and yearly income. Please ask questions if you are unsure about any of the information. If you would like help filling out the form the researcher can help you. It is estimated that your participation in this study will last approximately 30 minutes. No identifying information will be collected, allowing for completely

anonymous responses. You will be given a \$10.00 Wal-Mart gift card for your time upon submitting your completed questionnaire and balance testing.

There are minimal risks associated with the study. If you agree to participate in this research, it is possible that some of the questions asked may cause discomfort while answering the questions or while your balance is measured. You have the right to refuse to participate, or withdraw, at any time without penalty. If you do withdraw, it will not affect you in any way. If you have questions about your rights as a research subject, contact the University of Hawai'i Committee on Human Subjects at (808) 956-5007. If you were to become upset after the studies completion, you can discuss this with the principal investigator who can provide a phone number for resources in the community.

Your participation in this study will be held in complete confidence. **All personal information will be kept confidential to the extent allowed by law. Agencies with research oversight, such as the University of Hawaii Committee on Human Studies, have the authority to review research records.** All answered questionnaires will be held in a locked drawer for the duration of the study. Electronic results will be recorded into software with protected password. The information shared by you will become a part of a grouped database and may be used by the researcher for future research activities and publications. **All personal information will be destroyed upon completion of the research project.** When results are published, it will be as a group, not traceable to an individual, maintaining your anonymity.

It is hoped that the information you provide in this study will help us better understand the associations between balance confidence and balance performance.

Participation in this research is voluntary. If you have any questions about the study at any time you can contact the principal investigator, Angie Wooton, Assistant Professor of Nursing at 1800 Lincoln Avenue, Evansville, Indiana. My current phone number is (812) 488-2591 and my email address is aw43@evansville.edu.

By signing this consent form you are agreeing that you read and fully understand the contents of this document and are openly willing consent to take part in this study. All your questions concerning this study have been answered. You will receive a copy of this consent form to keep with you.

Name: _____ (Printed)

Signature: _____

Date: _____

APPENDIX C

SOCIODEMOGRAPHIC QUESTIONNAIRE

Please answer *all* the questions below:

1. Date of Birth: ____/____/____
2. Were you born in the United States?
 Yes No if no, what other country were you born? _____
3. What language(s) do you speak at home? _____
4. What is your gender? Male Female
5. What is your marital status?
 Single/ never been married
 Married
 Widowed
 Divorced or Separated
6. What is your employment status?
 Unemployed
 Employed
7. Please check the highest level of education you have completed?
 Grade School
 Some High School
 High School Diploma
 Some College
 Associate Degree
 Bachelor's Graduate
 Post Graduate work
 Master's Degree
 PhD

8. Please check your total **yearly** income:

- | | |
|--|---|
| <input type="checkbox"/> Less than \$10,000 | <input type="checkbox"/> \$50,000 - \$59,999 |
| <input type="checkbox"/> \$10,000 - \$19,999 | <input type="checkbox"/> \$60,000 - \$69,999 |
| <input type="checkbox"/> \$20,000 - \$29,999 | <input type="checkbox"/> \$70,000 - \$79,999 |
| <input type="checkbox"/> \$30,000 - \$39,999 | <input type="checkbox"/> \$80,000 - \$89,999 |
| <input type="checkbox"/> \$40,000 - \$49,999 | <input type="checkbox"/> \$90,000 - \$100,000 or more |

9. Please select the statement below that *best describes* your current living arrangement.

- Live with spouse only
- Live with spouse and other relatives
- Live with other relatives or friends
- Live with other unrelated individuals
- Live alone
- Other

10.	Please select the condition(s) your doctor has diagnosed that you have:
<input type="checkbox"/>	Anxiety
<input type="checkbox"/>	Memory problems
<input type="checkbox"/>	Depression
<input type="checkbox"/>	Diabetes
<input type="checkbox"/>	Parkinson's disease
<input type="checkbox"/>	Epilepsy or seizure disorder
<input type="checkbox"/>	Cancer, Please identify type_____
<input type="checkbox"/>	Stroke
<input type="checkbox"/>	Heart Condition
<input type="checkbox"/>	High Blood Pressure
<input type="checkbox"/>	Balance Problem, Please identify type _____
<input type="checkbox"/>	Kidney Disease
<input type="checkbox"/>	Osteoporosis
<input type="checkbox"/>	Emphysema
<input type="checkbox"/>	Hip Fracture
<input type="checkbox"/>	Arthritis
<input type="checkbox"/>	Hearing Problems
<input type="checkbox"/>	Vision Problems
<input type="checkbox"/>	Cataracts
<input type="checkbox"/>	Macular Degeneration

10. How many times have you fallen in the last year? Number: _____
(A **fall** is when a person unintentionally comes to rest on the ground or low level)

11. **How would you describe your health?** (Please check one)
 Excellent Very Good Good Fair Poor

APPENDIX D

THE ACTIVITIES-SPECIFIC BALANCE CONFIDENCE SCALE

Instructions to Participants: For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:
 “0” = Not confident and “10” = Completely Confident

How confident are you that you will not lose your balance or become unsteady when you....	Please <u>circle</u> the number that best identifies your confidence in carrying out the activity item from the boxes below ranging from: ‘0’ = not confident to ‘10’ = completely confident										
1. Walk around the house.	0	1	2	3	4	5	6	7	8	9	10
2. Walk up or down stairs.	0	1	2	3	4	5	6	7	8	9	10
3. Bend over and pick up a slipper from the front of a closet floor.	0	1	2	3	4	5	6	7	8	9	10
4. Reach for a small can off a shelf at eye level.	0	1	2	3	4	5	6	7	8	9	10
5. Stand on your tiptoes and reach for something above your head.	0	1	2	3	4	5	6	7	8	9	10
6. Stand on a chair and reach for something.	0	1	2	3	4	5	6	7	8	9	10
7. Sweep the floor.	0	1	2	3	4	5	6	7	8	9	10
8. Walk outside the house to a car parked in the driveway.	0	1	2	3	4	5	6	7	8	9	10
9. Get into or out of a car.	0	1	2	3	4	5	6	7	8	9	10
10. Walk across a parking lot to the mall.	0	1	2	3	4	5	6	7	8	9	10
11. Walk up or down a ramp.	0	1	2	3	4	5	6	7	8	9	10
12. Walk in a crowded mall where people rapidly walk past you.	0	1	2	3	4	5	6	7	8	9	10
13. Are bumped into by people as you walk through the mall.	0	1	2	3	4	5	6	7	8	9	10
14. Step onto or off an escalator while you are holding onto a railing.	0	1	2	3	4	5	6	7	8	9	10
15. Step on or off an escalator while holding onto parcels such that you cannot hold onto the railing.	0	1	2	3	4	5	6	7	8	9	10
16. Walk outside on icy sidewalks. (Winter)	0	1	2	3	4	5	6	7	8	9	10
Total Score											

You have completed the questionnaire please tell Mrs. Wooton

APPENDIX E

TINETTI BALANCE ASSESSMENT TOOL: BALANCE SECTION

Balance Section

(Start with client seated in hard, armless chair)

	Balance Assessment	Score
1. Sitting Balance	Leans or slides in chair = 0 Steady, safe = 1	
2. Rises from chair	Unable to without help = 0 Able, uses arms to help = 1 Able without use of arms = 2	
3. Attempts to rise	Unable to without help = 0 Able, requires > 1 attempt = 1 Able to rise, 1 attempt = 2	
4. Immediate standing Balance (first 5 seconds)	Unsteady (staggers, moves feet, trunk sway) = 0 Steady but uses walker or other support = 1 Steady without walker or other support = 2	
5. Standing balance	Unsteady = 0 Steady but wide stance and uses support = 1 Narrow stance without support = 2	
6. Nudged	Begins to fall = 0 Staggers, grabs, catches self = 1 Steady = 2	
7. Eyes Closed	Unsteady = 0 Steady = 1	
8. Turning 360 degrees	Discontinuous steps = 0 Continuous = 1	
	Unsteady (grabs, staggers) = 0 Steady = 1	
9. Sitting down	Unsafe (misjudged distance, falls into chair) = 0 Uses arms or not a smooth motion = 1 Safe, smooth motion = 2	
	Balance Total Score	/16

APPENDIX F

TINETTI BALANCE ASSESSMENT TOOL: GAIT SECTION

Gait Section:

Patient stands with PI, walks across room (+/- aids) first at usual pace then at rapid pace

	Gait Assessment	Score
1. Indication of gait (Immediately after being told to go)	Any hesitancy or multiple attempts = 0 No hesitancy = 1	
2. Step length and height	Step to = 0 Step through R = 1 Step through L = 1	
3. Floor clearance	Foot drop = 0 L foot clears floor = 1 R foot clears floor = 1	
4. Step symmetry	Right and left step length not equal = 0 Right and left step length appear equal = 1	
5. Step continuity	Stopping or discontinuity between steps = 0 Steps appear continuous = 1	
6. Path	Marked deviation = 0 Mild/moderate deviation or uses W. aid = 1 Straight without W. aid = 2	
7. Trunk	Marked sway or uses W. aid = 0 No sway but flex. Knees or back or uses arms for stability = 1 No sway, flex., use of arms or w. aid = 2	
8. Walking	Heels apart = 0 Heels almost touching while walking = 1	
	Gait score	/12
	Balance score	/16
	Gait + Balance = Balance Performance Score	/28

APPENDIX G

MINI-MENTAL STATE EXAM (MMSE)

Participant: _____

Date _____

Orientation

5 () What is the (year) (season) (date) (day) (month)?

5 () Where are we (state) (country) (town) (facility) (floor)?

Registration

3 () Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer.

Then repeat them until he/she learns all 3. Count trials and record.

Trials _____

Attention and Calculation

5 () Serial 7's. 1 point for each correct answer. Stop after 5 answers.

Alternatively spell "world" backward.

Recall

3 () Ask for the 3 objects repeated above. Give 1 point for each correct answer.

Language

2 () Name a pencil and watch.

1 () Repeat the following "No ifs, ands, or buts"

3 () Follow a 3-stage command: "Take a paper in your hand, fold it in half, and put it on the floor."

1 () Read and obey the following: CLOSE YOUR EYES

1 () Write a sentence.

1 () Copy the design shown.

_____ **Total Score**

ASSESS level of consciousness along a continuum _____ Alert, Drowsy, Stupor, and Coma

"MINI-MENTAL STATE." A PRACTICAL METHOD FOR GRADING THE COGNITIVE STATE OF PATIENTS FOR THE CLINICIAN. *Journal of Psychiatric Research*, 12(3): 189-198, 1975. Used by permission.

APPENDIX H

UNIVERSITY OF HAWAII

Committee on Human Studies

February 2, 2011

TO: Angela Wooton
Principal Investigator
School of Nursing

FROM: Nancy R. King
Director



Re: CHS #18853- "Is There an Association Between Balance Confidence and Balance Performance in Community-Dwelling Older Adults?"

This letter is your record of CHS approval of this study as exempt.

On February 2, 2011, the University of Hawai'i (UH) Committee on Human Studies (CHS) approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46 (2).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at <http://www.hawaii.edu/irb/html/manual/appendices/A/belmont.html>

Exempt studies do not require regular continuing review by the Committee on Human Studies. However, if you propose to modify your study, you must receive approval from CHS prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) CHS may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify CHS when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact CHS at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.

APPENDIX I

PERMISSION TO USE INSTRUMENT LETTERS

Mary Tinetti
Yale School of Medicine

Dear Professor Wooton,

Dr. Tinetti gives you permission to use the Tinetti POMA tool in your dissertation study on balance.

Please be sure to indicate the following: “reprinted with permission, Mary E. Tinetti, M.D. © Copyright; 2006” when referencing this document.

Regards,

Jane

Jane Mallory
Sr. Administrative Assistant
Yale School of Medicine
Dept. Internal Medicine/Section of Geriatrics
Mail: 333 Cedar St., P.O. Box 208025,
New Haven, CT 06520
Campus Location: Harkness Mem Bldg. A,
367 Cedar St., Rm. 311, New Haven, CT 06510
Telephone: 203-688-5238, Fax: 203-688-4209
E-mail: jane.mallory@yale.edu

Jane:

Please give Angie permission.

Angie: This is not a falls risk measure. It is a mobility measure that includes both gait and balance performance components. I would suggest that you use both the gait and balance tools in order to get an accurate score of the subjects **balance performance**. You can use the data for additional research articles not just your dissertation. The combination of the two tools is a very good fit. Good luck with your study and let me know if I can provide further assistance.
Regards and it was great to talk to you,

Mary Tinetti MD

From: Wooton, Angie [aw43@evansville.edu]
Sent: Monday, November 08, 2010 4:26 PM
To: Tinetti, Mary
Subject: Tinetti Performance Oriented Mobility Assessment

Hello Dr. Tinetti,

I am requesting permission to use the Tinetti POMA Tool in my proposed dissertation study on balance confidence and its associations with balance performance in community-dwelling older adults.

I have one question regarding the instrument scoring interpretation:

Do the combined scores on the balance and gait section only give a falls risk score?

Do you think this will fit with my proposed research study?

Thanks for your assistance,

Angie Wooton

Angela Wooton, RN, MSN, FNP-C, PhD Student UH
Assistant Professor of Nursing
University of Evansville
Evansville, IN 47722

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(270) 827-8338 home

"A teacher affects eternity; he can never tell where his influence stops." Henry Brooks Adams

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