

DANCE-BASED THERAPY TO DECREASE FALL RISK
IN OLDER PERSONS

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Doctor of Philosophy

by

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DANCE-BASED THERAPY TO DECREASE FALL RISK IN OLDER PERSONS

presented by Jean Krampe,

a candidate for the degree of Doctor of Philosophy

and hereby certify that, in their opinion, it is worthy of acceptance.

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DEDICATION

I would like to dedicate this doctoral dissertation to my husband, William Krampe, and children, Timothy, and Kristina Krampe.

Bill, my life partner and best friend, your unconditional love and support have been with me every step of the way. Thank you for helping me to fulfill this dream. I look forward to living it with you.

Tim and Tina, you have been witness to and recipient of many sacrifices over the years of my continued education. You were with me every step of the way and were my reprieve during the rough ones. I love you both so much and am so proud of how you've grown up, in spite of my constant academic quest. Thank you for being you.

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DANCE-BASED THERAPY TO DECREASE FALL RISK IN OLDER PERSONS

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ABSTRACT

Loss of balance and diminished gait are major fall risk factors in older persons. Literature suggests that physical activity based on dance may improve balance and gait. The aim of this study is to test the effect of dance-based therapy on selected fall risk factors in older persons defined as: balance, mobility, and fear of falling.

The medical social framework of the Disablement Process, developed by Verbrugge and Jette, was used as the theoretical framework for this study. A single facility pretest/posttest randomized controlled trial (RCT) study design was used. Pre- and post measurements were completed on each person which included the Multi-Directional Reach Test, the GAITRite analysis and completion of the Activities-specific Balance Confidence Scale . The Lebed MethodTM (TLM), recommended as dance-based therapy for populations with physical difficulties, was used as the dance-based therapy.

Following IRB approval, 27 subjects mean age 85, were recruited from an aging in place facility in Columbia, Missouri. Inclusion criteria were: 1) Mini-Mental State Exam of 23 or above, 2) able to stand with or without assistance. Using a Randomization Complete Block Design, the subjects were placed in the treatment group, to participant in 18 dance therapy sessions over 8 weeks, or the control group, to continue with normal activities in the aging in place facility.

Since the sample size was relatively small, parametric and nonparametric tests were used to evaluate both within and between group differences. For parametric test, a paired t-test and a two sample t-test were used to test changes within a group, difference

in changes between groups, respectively. For nonparametric tests, the Wilcoxon signed rank test and the Wilcoxon rank sum test were used. To account for differences in baseline values, the Analysis of Covariance (ANCOVA) was used to test difference in changes between groups. Significance was set at alpha level 05.

Although statistical significance was not found in the measurements chosen for this study, trends were identified in decreasing Backwards Reach, while increasing Step Length Differential following a dance-based therapy program. These results will add to the emerging body of literature for dance-based therapy with older persons. This study was an extension of a pilot study conducted in 2008, which has been translated into practice with dance-based therapy offered weekly in a Program of All-inclusive Care for the Elderly (PACE). As demonstrated in the pilot session, the participants in the dance group enjoyed the activity as evidenced by minimal attrition and consistent attendance. Additional research is needed with a larger sample size and case matched treatment and control group.

CHAPTER 1

INTRODUCTION

This dissertation is presented in a Manuscript Style format, representing the preliminary work lead by this Doctoral Student and the resulting Randomized Control Trial (RCT). Chapters 1, 2, and 3 are the Introduction, Review of the Literature, and Methodology, respectively. A succinct results section follows as Chapter 4. The dissertation concludes with the manuscripts submitted for publication, reporting the preliminary work as Chapter 5 and the RCT dissertation research, as Chapter 6.

Statement of the Problem

Hillary Rodham Clinton admitted that of all the insulting press criticism she received during her husband's 1992 presidential campaign, *the only one that really hurt, and one of the few that was really true, is that I'm middle-aged.... I couldn't believe I saw that in print.* She was 45 (Sheehy, 1995). Even though Clinton may live into her 90's, if she can remain free from heart disease and cancer, the reality of aging and functional decline affects each of us. In addition to functional decline resulting from normal aging, a life changing event such as a fall, often precedes or precipitates functional decline in older persons. Therefore, interventions with efficacy to reduce fall risks are needed.

To address this need, the National Institute on Aging (NIA), one of the National Institutes of Health specifically focused on improving the quality of life for older persons, has identified intervention research studies as one of the ways to impact the challenges the nation will face with the aging population and associated functional decline. The NIA goal specifically calls for research which will add to the body of science *to continue*

to develop and disseminate information about interventions to reduce disease and disability and improve the health and quality of life of older adults (National Institute on Aging, 2007). Research to reduce fall risk and ultimately the number of injurious, life changing falls, meets the NIH goal.

Background and Significance

There is evidence that links aging and functional decline with an increased risk for falling (Daly, 1998). One in three persons 65 and older falls each year (Hausdorff & Rios, Edelber 2001). Of those who fall, 20% to 30% suffer injuries that negate independent living and increase chances of early death (Hornbrook, Stevens, Wingfield, Hollis, Greenlick, & Ory 1994).

The aging population accounts for an ever-increasing percent of the U.S. population. During the past fifty years, the U.S. population has grown older. Over the next 50 years, a small decline in the percent of the population under 18 is anticipated, while a sizeable increase in the percent of elderly expected. As a result, it is projected that one in five Americans will be elderly by the year 2030 (U.S. Department of Health and Human Services, 2004).

The American College of Sports Medicine and the American Heart Association have issued recommendations on the types and amounts of physical activity needed to improve and maintain health in older adults. A panel of scientists with expertise in public health, behavioral science, epidemiology, exercise science, medicine, and gerontology reviewed existing consensus statements and relevant evidence from primary research articles and reviews of the literature (Nelson et al., 2007).

Consequently, the recommendation for older adults includes activities that maintain or increase flexibility. Balance exercises are recommended for older adults at risk of falling. In addition, older adults should have an activity plan for achieving recommended physical activity that integrates preventive and therapeutic recommendations (Nelson et al., 2007). Evidence is beginning to accumulate suggesting that physical exercise based on dance may improve balance, and hence be a useful tool in reducing the risk of falling in older persons (Federici, Bellagamba & Rocchi 2005). Additional research to explore the benefits of dance-based therapy for the growing aging population is needed.

Dance has been an integral aspect of healing and cultural rituals for many centuries. As a result, forms of dancing as exercise have been used to encourage increased physical fitness of older persons. This results in increasing the number of older persons using dance as a health-related activity and promotes older adults in a positive light through increased participation in a healthy, stimulating, and challenging exercise program (Connor, 2000).

Although dance has been an integral aspect of healing and cultural rituals for many centuries, research is emerging about the therapeutic benefit of dance (Connor, 2000). The Lebed Method™ (TLM) 2002, recommended as dance-based therapy for populations with physical difficulties, has recently been the focus of research for its therapeutic benefit with promising results (Sandel et al., 2005; Choi, Yu, Park, & Lee, 2009). TLM, used as the therapeutic intervention in a pilot study led by this nursing doctoral student and this dissertation research, combines low impact dance with upbeat participant specific music.

Traditional exercise has not been readily adopted by older persons due to barriers that include fear of falling, health problems, and motivation to exercise (Cohen-Mansfield, Marx & Guralnik, 2003; Lees, Clark, Niggs & Newman, 2005). An alternative to traditional exercise is dance-based exercise, when targeted at specific outcomes, becomes dance-based therapy. Consequently, research on complementary and integrative interventions in nursing is emerging. When translated into practice, these innovative interventions have the potential to increase the quality of life for older persons (Conn, 2008).

In summary, diversity in exercise programming is important in recognizing the heterogeneity of the aging population (Connor, 2000). Regular physical activity is one of the five essential critical domains for brain health over the life span. Moreover, people are more likely to become and stay physically active if they enjoy what they are doing (Erkman, 2008).

Aim and Hypotheses

The proposed study is based on the findings of a study led by this nursing doctoral student using TLM titled: *A Dance Movement Therapeutic Intervention to Improve Balance and Gait in Community-Based Frail Seniors: A Pilot Study* (Krampe, Rantz, Dowell, Schamp, Skubic & Abbott, 2010). The results of the pilot study confirmed that older persons will initially consent to participate in dance therapy, continue to attend dance sessions, and express enjoyment during the dance sessions. Furthermore, functional trends with increased balance and gait were noted. This dissertation is an extension of the exploratory pilot study findings.

The aim of the proposed study is to test the effect of TLM on selected fall risk factors in older persons defined as: a.) balance, b.) mobility, and c). fear of falling. The hypotheses to be tested are: Participants who are in treatment group compared to the control group will:

1. Demonstrate improved balance, as measured by the Multi-Directional Reach Test (MDRT)
2. Demonstrate increased mobility, as measured by increased velocity, Functional Ambulation Profile (FAP), and decreased step length differential (SLD) on the GAITRite.
3. Experience a decreased fear of falling, as measured by the Activities-specific Balance Confidence (ABC) scale.

Significance to Nursing

The older population is growing, the cost of long-term care is rising, and choices for remaining in the community are increasing. The healthcare arena is looking for practical, sustainable fall reduction programs, which allow facilitation with finite resource. Fall risk in older persons will continue to challenge nurses caring for this rapidly aging population over the next several decades.

The ability to address fall risk in this population will be an increasingly important nursing function as the elderly population continues to increase over the next fifty years and a higher percentage of older persons are living in the community. Simpson, Darwin, and Marsh, 2003, explored what older people are prepared to do to avoid falling and concluded that the healthcare team should negotiate with the older person and seek agreement to the adaptations perceived as necessary. Continued research is needed to

find specific interventions that older persons enjoy, thus engaging the older person to participate.

Definition of Terms

Older Person is defined as an individual aged 65 or older.

Fall is an event which results in the person coming to rest inadvertently on the ground or other lower level, and other than as a consequence of the following: sustaining a violent blow, loss of consciousness, sudden onset of paralysis, or an epileptic seizure (Kellogg International Workgroup Group, 1987).

Fall Risk: is generally categorized into intrinsic and extrinsic factors. Intrinsic, or patient-related, risk factors include advanced age, chronic diseases, muscle weakness, gait disorders, mental status alternations, and medications. Extrinsic factors (e.g., environmental hazards or hazardous activities); are described as primary causes for approximately half of all falls. For purposes of this research, the intrinsic physiological fall risk factors of balance and mobility will be the focus, along with the physiological risk factor of *fear of falling* (Lord et al., 2007).

Balance is defined as the ability of a person to lean or reach and self-correct to the baseline position. The further one can lean or reach without losing balance, the lower the fall risk (Duncan, et al., 1990)

Mobility is defined as a person's habitual gait speed, measured by a velocity score, total Functional Ambulation Profile and step length differential. Low velocity scores have been associated with increased risk of falling, increased incidence of fractures resulting in institutionalization, and subsequently eminent major health issues resulting in death (Guralnik et al., 2000; Van Swearingen et al., 1996).

Fear of falling is defined as activity restriction and avoidance, loss of confidence and the perceived ability to perform various activities without falling (Jorstad, Hauer, Becker, & Lamb, 2005).

Dance is defined as a patterned, rhythmic movement in space and time (Pepper, 1984) and requires the movement and coordination of large and small muscle groups (Murrock, 2007).

Dance-Based Therapy also called Dance Movement Therapy, is the psychotherapeutic use of movement and dance for emotional, cognitive, social, behavioral and physical conditions. Dance-Based Therapy strengthens the body/mind connection through body movements to improve both the mental and physical well-being of individuals (American Dance Therapy Association, 2009).

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter begins with the epidemiology of falls in older persons and the resulting cost of injurious falls. An evidence-based fall literature review follows, identifying a decrease in balance, a decrease in mobility, and the resulting fear of falling as key risk factors for falls in older persons. The literature review continues with interventions to decrease fall risk, and discusses prior studies using dance-based therapy as an intervention. This chapter continues with the theoretical framework driving this study, the Disablement Process, and concludes with the theoretical model for dance-based therapy cyclical effect on decreasing fall risk in older persons.

Epidemiology of Falls

The risk of falling is a major health concern for older adults and extensively researched area. Furthermore, while accidents are the fifth leading cause of death in older adults, after cardiovascular, cancer, stroke, and pulmonary causes, and falls constitute two thirds of these accidental deaths (Rubenstein & Josephson, 2002).

In addition, frail older persons are a subset of the aging population with a rapidly growing trend to continue to live in the community and age in place. Aging in place involves staying in a preferred residence with caregiver and community support (Trader, 2003; Rantz, 2009). The combined aging society and choice for community living seniors will compound the fall problem into the future.

Approximately 35% to 45% of community-living older adults fall annually and half of this population experience multiple falls. Moreover, 5% to 10% of community-living older adults who fall each year sustain a serious injury; 20% to 30% suffer injuries

that negate independent living and increase chances of early death (Hornbrook et al., 1994).

Cost of Injurious Falls

The magnitude of the fall crisis in older persons is an escalating economic burden. The Centers for Disease Control and Prevention (CDC, 2008) estimates the direct medical costs of falls among persons ages 65 and older in the United States totaled \$200 million for fall related fatalities and \$19 billion for nonfatal fall-related injuries in 2000. Fractures accounted for 35% of nonfatal injuries and 61% of costs. Without effective interventions to impact this crisis, the financial toll is expected to increase as the population ages, and is projected to reach \$54.9 billion by 2020 (Englander, Hodson & Terregrossa, 1996; Stevens, Corso, Finkelstein, & Miller, 2006).

Consequently, the goal to reduce this escalating economic burden has resulted in an interest in physical activity related to health care costs. A better understanding of the impact of changes in physical activity behavior on short-term health care costs can inform resource allocation decisions to increase population levels of physical activity. Increased physical activity among older adults has been associated with lower health care costs within two years, relative to costs for those who were persistently inactive. Therefore these cost savings justify investments in effective interventions to increase physical activity in older adults (Jacobson, 2002; Martinson, Crain, Pronk, O'Connor, & Maciosek, 2003). In summary, it is possible that the human and monetary cost associated with an injurious fall could be reduced if measures were employed to decrease fall risks.

Evidence-Based Fall Literature

A prolific body of literature exists related to falls in the aging population over the last 30 years. A set of significant risk factors for falls in the aging population has been identified and includes physiological, psychological, environmental and psychosocial dimensions. (Chang, 2004; Huang, Gau, Kernohan, & Lin, 2003; Institute of Medicine, 1992; Nikolaus & Bach, 2003). Whereas all four dimensions are important and at times interrelated, the focus of this literature review and research is physiological and psychological fall risk factors

A literature search and review was conducted from CINAHL, MEDLINE, and Cochrane Database of Systematic Reviews (1977-2010) to identify evidence-based nursing fall prevention and risk reduction strategies applicable to the community-living older adult at risk for falling. Search terms included falls, risk factors, evidence-based medicine, and nursing. Additional key terms included elderly, interventions, prevention, and community-based seniors. Only search results with English abstracts were reviewed. Bibliographies from relevant articles and dissertations were hand searched for additional references.

Large prospective and retrospective fall risk studies (Morse, Prowse, Morrow, & Federspiel, 1985; Morse, Black, Oberle & Donahue, 1989) reported three types of falls. These are anticipated physiological falls (falls that occur when the patient has difficulty ambulating and has a cognitive status deficit, (approximately 78% of all falls), unanticipated physiological falls (patient has a “drop attack”, faints or has a seizure), and accidental falls (when a patient trips or slips).

Furthermore, an interdisciplinary review of the literature on falls among the elderly focusing on over 100 publications from 1979-1999 suggests that fall risk can be predetermined and nursing action can be taken to reduce the occurrence and severity of falls. Consequently, other studies are needed to further clarify fall risk factors and define variables, such as mental status and age (Rawsky, 1998).

Moreover, individually tailored interventions to target risk factors and impairments of older people have been found to be more effective than those applied as a standard package (Cameron et al., 2007). An example is a modestly intensive nurse-lead fall prevention program focused on patients who presented to the Emergency Department of a large teaching hospital. Although no significant findings were noted regarding the patients in the intervention group (fewer falls, less admissions and decreased length of stay compared to the control group), the patients in the intervention group were more functionally independent 6 months later (Lightbody, Watkins, Leathley, Sharma, & Lye, 2002).

Interventions to Decrease Fall Risks in Older Persons

Focusing on evidence-based literature, a comprehensive Cochrane review article, that included a review of 62 trials, involving 21, 668 people, reported finding on fall prevention interventions likely to be beneficial and interventions of unknown effectiveness (Gillespie et al., 2007). The classifications systems established by Gillespie and Cochrane aggregated results are provided in Table 2.1: Interventions of Known Effectiveness to Decrease Fall Risk in Older Persons and Table 2.2: Interventions of Unknown Effectiveness to Decrease Fall Risk in Older Persons

Table 2.1: Interventions of Known Effectiveness to Decrease Fall Risk in Older Persons

Interventions of Known Effectiveness Type Of Intervention	# Trials, # of Participants, and Significance
Multidisciplinary, multifactorial, health/environment risk factor screening/intervention programs for and 1) unselected population of community-based seniors 2) seniors with a history of falling or selected because of known risk factors, and 3)- . seniors in residential care facilities	1) (4 trials, 1651 participants, pooled RR 0.73, 95%CI 0.63 to 0.85), 2). (5 trials, 1176 participants, pooled RR 0.86, 95% CI 0.76 to 0.98), and 3). (1 trial, 439 participants, cluster-adjusted incidence rate ratio 0.60, 95% CI 0.50 to 0.73)
A program of muscle strengthening and balance retraining, individually prescribed at home by a trained health professional	3 trials, 566 participants, pooled relative risk (RR) 0.80, 95% confidence interval (95% CI) 0.66 to 0.98)
A home hazard assessment and modification professionally prescribed for seniors with history of falling	3 trials, 374 participants, RR 0.66, 95% CI 0.54 to 0.81
Withdrawal of psychotropic medication	1 trial, 93 participants, relative hazard 0.34, 95% CI 0.16 to 0.74
Cardiac pacing for fallers with cardioinhibitory carotid sinus hypersensitivity	1 trial, 175 participants, WMD -5.20, 95% CI -9.40 to -1.00)
A fifteen-week Tai Chi group exercise intervention	1 trial, 200 participants, risk ratio 0.51, 95% CI 0.36 to 0.73

Table 2.2: Interventions of Unknown Effectiveness to Decrease Fall Risk in Older Persons

Interventions of Unknown Effectiveness Type Of Intervention	# of Trials and # of Participants (Significance not Reported)
Group-delivered exercise interventions	9 trials, 1387 participants
Individual lower limb strength training	1 trial, 222 participants
Nutritional supplementation	1 trial, 46 participants
Vitamin D supplementation with or without calcium	3 trials, 461 participants
Home hazard modification 1) in association with advice on optimizing medication, or 2). in association with an education package on education and reducing fall risk	1 trial, 658 participants, or 2) 1 trial, 3182 participants
Pharmacological therapy (rubasine-dihydroergocristine)	1 trial, 95 participants
Interventions using a cognitive/behavioral approach alone	2 trial, 145 participants
Home hazard modification for older people without a history of falling	1 trial, 530 participants
Hormone replacement therapy	1 trial, 116 participants
Correction of visual deficiency	1 trial, 276 participants

Furthermore, declines in mobility, cognitive impairment, and not using assistive

devices have been identified as major risk factors for a fall (Mahoney Sager, Cross-

Dunham & Johnson, 1994). Lord et al.,(1994) found physiological factors associated with falls in a sample of 414 older community dwelling women included decreased lower limb muscle strength, reaction time, and balance. Physical functions, defined as gait and balance abnormalities, have been identified in the literature numerous times with strong association to fall risk (Huang et al., 2003; Roma et al., 2001; Institute of Medicine, 1992).

In 2007, a physician conducted meta-analysis to identify the prognostic value of risk factors for future falls among older patients reported older adults who have fallen in the past year are more likely to fall again (likelihood ratio range, 2.3-2.8). The most consistent predictor of future falls are clinically detected abnormalities of gait and balance (likelihood ratio range, 1.7-2.4) (Ganz, Bao, Shekelle & Rubenstein, 2007).

Similarity, data collection for one large prospective study extending for 10 years validated fall risks to assist in prediction of falls in the hospitalized patient population using six variables. These variables are a history of falling, in addition to co-morbidities, non-use of assistive devices (cane, wheelchair or walker), administration of IV therapy, type of gait, and mental status (Morse et al., 1985).

In summary, the combination of using assistive devices, poor gait, decreased balance, and decreased mental status are noted in the literature as key indicators of fall risk and are significant for functional decline and loss of independence in older persons (Chang, 2004, Huang et al., 2002, et al. , Lord, Ward, Williams, & Anstey 1994, Mann et al., 1996, Morse et al, 1985, Nikolaus & Bach, 2003; Rubenstein, & Josephson 2002; Roma et al., 2001; Shumway-Cook et al., 1997; Tinetti, Williams, & Mayewski, 1986). The impact of fall prevention programs on reducing falls has been reviewed in a meta-

analysis that reported an overall 4% decrease in the intervention groups receiving fall prevention interventions. Additional intervention studies are needed in the elderly population with goal of preventing falls (Hill-Westmoreland, 2003).

Dependent Variable: Fall Risks

Loss of balance and decreased mobility are major physical risk factors for falls in older persons (Robbins, et al. 1989; Tinetti, et al., 1986). Age related changes in temporal-spatial gait parameters have generally been interpreted as indicating the adoption of a more conservative or less destabilizing gait. A number of investigators have revealed that certain changes in gait patterns may be predictive of falling in older people (Montero-Odasson, 2008; Fritz, 2009). Gait velocity has been consistently reported to differentiate between elderly fallers and non-fallers, with fallers walking significantly slower (Sherrington et al., 2007).

There are a range of possible explanations for the gait changes observed in older fallers. The reduction in the basic temporal-spatial parameters of gait (i.e. velocity and step length) are significantly associated with the same physiological factors found to be risk factors for falls. These parameters can also be modified by cognitive influences. Furthermore, physiological factors, such as anxiety and fear of falling may reflect reluctance rather than inability to walk more quickly in some people (Sherrington et al., 2007).

In addition, a physician-conducted meta-analysis identified the prognostic value of risk factors for future falls among older persons. This report states that older adults who have fallen in the past year are more likely to fall again (Ganz et al., 2007). The literature also reports an older person or may adjust gait, become less mobile, and put

them at a greater risk for a fall, simply because they are afraid to move about (Lach, 2002; Tinetti, Richman & Powell, 1995). Therefore, this phenomenon, known as, fear of falling, has been described with a cyclical connection to balance and mobility (Lach, 2002; Tinetti et al.,1995). When older persons have decreased balance and mobility, they are psychologically concerned about an increased risk for falling and therefore move about less because they are fearful of falling. In reality, decreased mobility can decrease balance, increase the risk for falling, and subsequently result in more falls. Post-fall anxiety and fear of falling have been reported as 73% in recent fallers; 46% of non-fallers report fear of falling (Tinetti, Mendes, Doucette, & Baker, 1994).

In summary, fear of falling can result in functional limitations. Functional limitation of physical functioning is a significant predictor of loss of independence, increased use of medical facilities, and mortality (Jette, & Inglis, 1975; Jette, Haley, Coster, Kooyoomjian, J. Levenson, Heeren et al.,2002). Tinetti et al., 1995 suggested this cyclical phenomenon can be reversed, with improved balance and mobility, thus increasing confidence in moving about, decreasing the physical risk for falling, and reducing the psychological fear of falling.

Dance Therapy Literature Review

The human capacity for rhythm is so natural that most of us take it for granted. When we hear music, we tap our feet to the beat or rock and sway, often unaware that we are even moving. This instinct is an evolutionary novelty among humans (Brown & Parsons, 2008).

While evidence-based literature reports group-delivered exercise interventions as one of the interventions of unknown effectiveness, not enough evidence has been

reported on dance-based literature to undergo a Cochrane review. Therefore, an extensive literature search and review was conducted from CINAHL, Medline, Academic Search Primer, Health Source Nursing Academic, AARP Ageline, and Psych Info (1977-2010) to identify linkages between dance and fall risks in older persons. Search terms included dance, dance-based therapy, movement therapy and therapeutic movement. Additional key terms included fall risk and elderly. Only search results with English abstracts were reviewed. Bibliographies from relevant articles and dissertations were hand searched for additional references.

The literature review revealed a broad collection of clinical and research literature using dance as an intervention. Interest in dance with older persons is growing and has involved multiple disciplines and specialties, including nursing, physical and occupational therapy, kinesiology, medicine, recreation therapy, movement specialties. However, there is limited literature on studies specifically focused on decreasing fall risk in older persons. Furthermore, there is a dearth of dance-based literature on men.

Dance has been connected to health promotion since ancient times (Lewis, 1986 & Levy, 1992). Dance is an age-old practice for many people from all countries, and an activity in which most people have participated at some time in their lives (Connor, 2000). Dance in its many forms has recently received increasing attention in the medical literature while suggesting dance as a suitable alternative to traditional forms of exercise for modification of sedentary habits (Pepper, 1984; Morley, 2009). An emerging interest in targeting specific dance therapy to targeted diagnoses has been recently noted (Murrock, Carolyn & Gary 2008; McKinley et al., 2008; Federici et al.; Sandel et. al; 2005; Lebed Davis, 2005; Hackney et al., 2007).

The idea of using dance to benefit older persons in a formalized therapeutic way is gaining attention as the population ages. Dance as means of physical activity has received waves of attention in the clinical environment over the past four decades. The interest in providing dance as an activity for older persons multiplied in the 60's and 70's.

Beal & Berryman-Miller, (1988) reviewed a series of guidebooks and hands on resources for teaching dance to older persons dating back 30 years. This includes guidelines for activities with older adults, program models, research, curriculum models, and intergenerational dance programs. Dancing with older persons requires health and safety considerations, when working with both healthy and frail groups.

Dance Movement Therapy (DMT), used synonymously with the term dance-based therapy, emerged some 60 years ago as a profession (Cohen & In, 1998). It was first developed by Marion Chace, a former dancer, who worked with psychiatric patients during the 1940s in the United States and emerged as a professional organization, the American Dance Therapy Association (ADTA) in 1956 (Cotter, 1999). The modality is officially defined by the ADTA *as the psychotherapeutic use of movement to further the emotional, cognitive, physical, and social integration of the individual* (American Dance Therapy Association, 2009). One of the goals of dance-based therapy is to assist older persons with brain injury regain balance confidence (Cotter, 1999). Sherry Lebed Davis, the founder of The Lebed Method™, further supports using this specific type of dance-based therapy, as an intervention to increase balance and mobility in persons with physical limitations (Lebed Davis, 2002).

Furthermore, the literature reports that dance is enjoyable and engages older people, promoting adherence, and enhancing motivation (Belardinelli et al, 2006). In

addition, evidence suggests that older people are happier dancing than performing aerobic exercise, with measurable increases in quality of life, improved balance, and mobility (Eyigor, Karapolat, Durmaz & Ibisoglu, 2007; Federici et al., 2005; Song, Kim & Jeon, 2004).

Similarly, Gillett et al. (1996) reported on an eight week dance program. The findings indicate dancing to appropriate music, the social support inherent in the dance classes, and being with other women who were similar in age, weight, and fitness level increased the participant's enjoyment. This contributed to the high attendance rate of 86%.

While dance by its very nature, is a physical activity and exercise, it is unique form of exercise, because it simultaneously involves the individual socially, creatively, expressively, and physically. Dance provides a much-needed outlet for adults whose opportunities for physical recreation and expression are limited. Thus, therapeutic dance can emphasize an older person's strengths, rather than focusing on limitations. In adapting dance for therapeutic purposes, specific goals should be considered: 1) to increase the individuals pride in what his or her body can do, 2) to provide an enjoyable physical outlet for the person with few such opportunities, 3) to improve physical ability, and 4) to improve functional ability in daily life (Konnyu, 2005).

Conversely, it is important to recognize that different strategies may be needed to reach different groups of people, and that targets may need to be set for different subgroups (Hecox et al. 1975). This is also true of the different type of dance. Ballroom dance may appeal to one group of older persons, whereas, tango may be preferred by others. The number of studies to evaluate dance in diverse populations published over

the past 5 years demonstrates the increasing interest in various styles of dance as effective and enjoyable alternatives to traditional exercise (Konnyu, 2005).

At the same time, emerging research is reporting dance can be used as a therapeutic intervention to effectively target balance and mobility in older persons (Jacobson et al., 2005). The number of dance sessions in a therapeutic intervention study varies, but generally is between 18 and 24 sessions over a several months. For example, one study reported significant improvement in balance for the study group in middle aged and older participants, compared to the control group. Caribbean based-dance steps were used as the dance intervention twice weekly for three months (Federici et al., 2005). Another study reported improvements in mobility following 20 Tango sessions for Parkinson's patients, compared to traditional exercise (Hackney, Kantorovich, Levin, & Earhart, 2007).

Similarly, The Lebed Method™ dance intervention was used in a pilot study with a group of breast cancer survivors to increase range of motion; investigators reported positive results after 18 sessions conducted in 12 weeks (Sandel et al, 2005). TLM was developed by a professional dancer and her physician brothers as dance-based therapy for women with lymphedema. Movements have been found to be beneficial for other persons with conditions that limit upper and lower body movement, range of motion, and balance. Moreover, TLM can be done seated or standing, making it an ideal form of dance-based therapy for persons with aging functional or physical limitations.

In another pre-post study by Song and colleagues (n=73), the same group of investigators evaluated the effectiveness of dance as part of a motivation enhancement exercise program, also among elderly women (age range 54-90), in a nursing home (Song

et al., 2004). Dance classes were 50 minutes and performed 4 times a week for 6 months. To assess individuals' motivation, classes were supervised only in the first portion of the program (10 weeks) with the remaining portion unsupervised (14 weeks). Using a cut-off attendance rate of 80%, the study compared participants (n=46) to drop-outs (n=27) with respect to changes in health behaviors, motivation and functional status after 6 months. Participants, compared with drop outs reported increased motivation to engage in health behaviors, particularly with respect to their perceived benefits. Participants also reported improved functional status, and increased performance of health behaviors, including exercise related behaviors.

A recent study which compared Tango-dancing and walking programs in older persons at risk for falls reported promising results. Fallers (N = 30) age 62-91 were randomly assigned to a 10-wk (40 hr, 2 hr 2x/wk) tango class or walk group. The Activities-specific Balance Confidence (ABC) scale, sit-to-stand scores, and normal and fast walk were measured pre-, post-, and 1 month post-intervention. Two-way repeated-measures ANOVAs indicated a significant main effect ($p < .01$) for time on all measures. (McKinley, 2008).

Similarly, Verghese, 2006, conducted a study to define the cognitive and physical attributes of regular social dancing so as to help establish its health benefits and help plan future dance interventions to prevent adverse outcomes in older adults such as falls, slow gait, and dementia. Twenty-four cognitively normal older social dancers were compared with 84 age, sex, and education-matched older non-dancers participating in a community-based study. Motor and cognitive performance was assessed using validated clinical and

quantitative methods. The results of this study suggest that long-term social dancing may be associated with better balance and gait in older adults.

Furthermore, Kudlacek, Pietschmann, Bernecker, Resch, and Willvonseder, (1997) investigated whether senior dancing has any effect on peripheral or lumbar bone density. They performed a prospective study over a 12-month period on bone density at a spinal and peripheral measuring site in 28 female senior members (mean age: 67 +/- 2 yr) of a dancing group in Vienna. Lumbar Bone Mineral Density (BMD) was assessed by quantitative computed tomography. The group classified as dancers with osteoporosis showed a significant increase in lumbar bone density, whereas in the group of dancers without signs of osteoporosis, the BMD remained unchanged.

Using TLM as the dance-based intervention to increase balance and gait in older persons, a pilot study was conducted in St. Louis, Missouri, 2008. (Krampe et al, 2010). Partnering with research professors at the University of Missouri-Columbia, this study combined the expertise of the practicing Interdisciplinary Team in a Program of All-inclusive Care for the Elderly (PACE) with the experience of gerontology researchers to guide the study. Study participants were community-based frail seniors, eligible to be nursing home residents per the Missouri guidelines for Medicaid frailty eligibility, but supported in the community (National PACE Association, 2008). The results of the pilot study confirmed that older persons will initially consent to participate in dance therapy, continue to attend dance sessions, and express enjoyment during the dance sessions. Furthermore, functional trends with increased balance and gait were noted. This was the first time TLM has been used as an intervention in a study with older persons to impact balance and gait. The complete study is reported in Chapter 5.

In summary, while emerging research is reporting dance can be used as a therapeutic intervention to effectively target balance, mobility, and ultimately fear of falling in older persons, more research is needed (Krampe, et al. 2010 Jacobson et al., 2005). The quality of an individual's life can be enhanced through exposure to dance regardless of age or functional limitations. This concept has grown, elevating the value of dance as an alternate means of exercise and therapy (Hackey et al., 2007).

Independent Variable: Dance-Based Therapy

Older persons believe that wellness and health includes psychological and social factors, as much as medical ones. Thus, wellness and health are much more than just the absence of disease (Connor, 2000). Dance provides exercise, group interaction, creative release, and improved functional capacities. Dancing offers an opportunity to reduce stress and promote relaxation. Rhythmic activity, such as dancing, provides tension release. The music also provides a sensory stimulus that encourages a pleasure response (Connor, 2000). The mind and body are in constant reciprocal interactions, reflecting pattern of thinking and feeling (Williams, 2007). The study of the relationship between physical and psychological connections is relative when exploring dance-based exercise to impact fall risk for older persons.

Dance-based exercise has become increasingly popular with older persons because of the physiological benefits. Dance may promote wellness by strengthening the immune system through muscular action and physiological processes. Dance promotes movement of the head and trunk; the center of gravity is shifted in every direction from the axis of support. This promotes the development of factors that contribute to the maintenance of balance, such as coordination and joint mobility (Federici et al., 2005).

Dance requires the rhythmic coordination of many parts of the body simultaneously. Sequencing skills enhance concentration; visual, tactile and auditory stimuli are involved (Connor, 2000).

Dance involves the culturally mediated body, emotion, and mind. So do illness and pain. Dance conditions an individual to moderate, eliminate, or avoid tension, chronic fatigue, and other disabling conditions that result from the effects of stress. Dance may help the healing process as a person gains a sense of control through (1) possession by the spiritual in dance, (2) mastery of movement, (3) escape or diversion from stress and pain through a change in emotion, states of consciousness, and/or physical capability, and (4) confronting stressors to work through ways of handling their effects (Hanna, 1995). Participation in leisure activities is associated with a reduced risk of dementia, even after adjustment for base-line cognitive status and after the exclusion of subjects with possible preclinical dementia (Verghese, 2003).

Dance engages older people, promoting adherence and enhancing motivation (Belardinelli et al, 2006). In addition, evidence suggests that older people are happier dancing than performing aerobic exercise, with measurable increases in quality of life, improved balance, and mobility (Federici, et al. 2005; Song, et al., 2004; Eyigor, et al., 2007). Dance is an enjoyable social activity for many older persons (Sandel et al, 2005; Lebed Davis, 2002).

Theoretical Framework-Disablement Process

The focus on decreasing fall risk in older persons is applicable to numerous theoretical frameworks (Nagi, 1965; Lawton & Nemohow, 1973; Roy, 1991;, and Verbrugge & Jette, 1994). For the pilot study, conducted prior to completing doctoral

coursework, the Roy Adaptation Model (RAM), and Environmental Press Theory (EPT) were used as joint frameworks. The RAM states that a person is an adaptive system with four adaptive modes: physiological, self-concept, role function and interdependence. Conceptually, adaptation means to adjust to the environment and affect the environment. Persons adapt by using coping mechanisms. Lawton and Nemohow's EPT compliments the RAM by saying that the person strives to achieve a "zone of maximum comfort" and physical competence helps adapt to the environment (Lawton & Nemohow, 1973; Roy, 1991) .

After continued scholarly study the most appropriate framework to operationally drive the study was determined to be the medical social framework of the Disablement Process (Verbrugge & Jette, 1994). The Disablement Process is an elaboration of the Disablement Model, developed by Saad Nagi (1965). Based on the preceding literature review on fall risk and dance-based therapy, a cyclical model was developed, adapted from the Disablement Process, using dance based therapy as an intervention to decrease fall risk in older persons.

The Disablement Model has four central concepts presented along a continuum: Active Pathology, Impairments, Functional Limitations, and Disability (Nagi, 1965) as visually displayed in Figure 2.1.

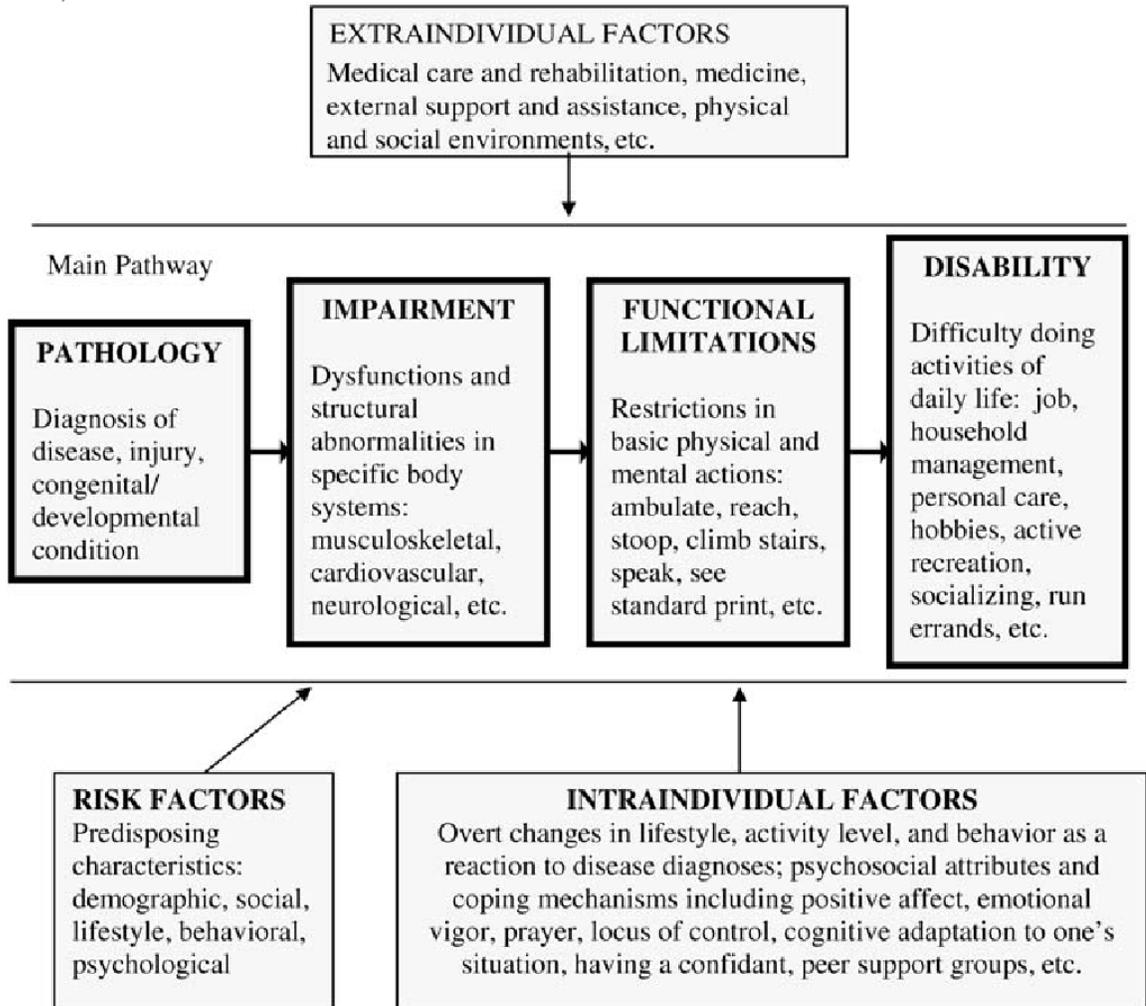
Functional Limitations, specifically physiological and psychological, were the focus of this research. Verbrugge and Jette define Functional Limitations as *restrictions in performing fundamental physical and mental actions used in daily life by one's age-sex group: ambulating, reaching, stooping, climbing stairs, producing intelligible speech, see standard print, etc.* This includes balance and mobility (Verbrugge & Jette, 1994).

Active Pathology is defined as the *diagnoses of disease, injury, congenital/developmental conditions*, Impairments is defined as *dysfunctions and structural abnormalities in specific body systems: musculoskeletal, cardiovascular, neurological, etc.* Disability is defined as *difficulty doing activities of daily life; job, household management, personal care, hobbies, active recreation, clubs, socializing with friends and kin, childcare, errands, sleep, trips, etc.*

The Disablement Model states there are predisposing Risk Factors, defined as demographic, biological, social, physical, and environmental factors, that impact Functional Limitations. The proposed study will account for the social and environmental Risk Factors of the study subjects by using a controlled environment at an Aging in Place (AIP) facility, TigerPlace (Rantz, Skubic, Miller & Krampe, 2008).

The Disablement Model states that Functional Limitations can be modified with therapeutic regimens to increase capacity. This slows the progression towards Disability, defined as *experienced difficulty* performing activities (Verbrugge & Jette, 1994). The proposed dance-based therapy is a therapeutic regimen to increase capacity, measured by increased balance, mobility, and decrease fear of falling, thus slowing down the pathway from Functional Limitations to further Disability as noted in Figure 2.1.

Figure 2.1: Schematic Representation of the Disablement Process Model (Verbrugge & Jette, 1994)



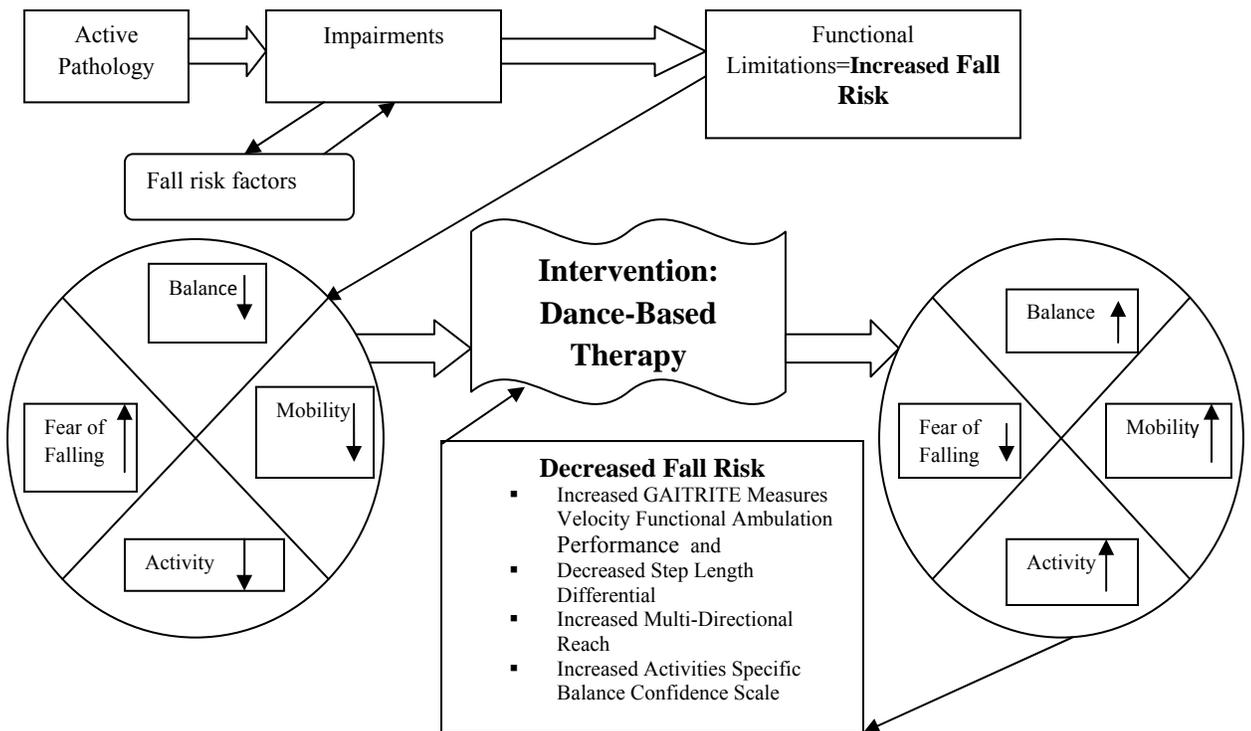
For this study, key fall risk factors are defined as decreased balance, mobility and subsequent fear of falling. Balance is defined as the ability of a person to lean or reach and self-correct to the baseline position. The further one can lean or reach without losing balance, the lower the fall risk (Duncan, Weiner, Chandler & Studenski, 1990).

Mobility, defined as a person's habitual gait speed, measured by a velocity score, total FAP and SLD. Low velocity scores have been associated with increased risk of falling, increased incidence of fractures resulting in institutionalization, and subsequently

eminent major health issues resulting in death (Guralnik et al., 2000; Van Swearingen et al., 1996).

As a result, fear of falling is defined as activity restriction and avoidance, loss of confidence and the perceived ability to perform various activities without falling (Jorstad, Hauer, Becker, & Lamb, 2005). Based on the preceding literature review on fall risk and dance-based therapy, a cyclical model, adapted from the Disablement Process, using dance based therapy to decrease fall risk in older persons is visually displayed in Figure 2.2.

Figure 2.2. Krampe Cyclical Model of Dance-Based Therapy for Older Persons to Decrease Fall Risk (Adapted from the Disablement Process Model, Verbrugge & Jette, 1994)



CHAPTER 3

METHODOLOGY

This chapter includes a description of the research design, setting, sample and analysis for this intervention study. The sampling procedure and the experimental and control group protocols are described. The procedures for data collection, strategies to prevent attrition, the study variables, and measurements are explained in detail.

Aim and Hypotheses

The aim of the proposed study is to test the effect of TLM on selected fall risk factors in older persons defined as: a.) balance, b.) mobility, and c). fear of falling. The hypotheses to be tested are: Participants who are in treatment group compared to the control group will:

1. Demonstrate improved balance, as measured by the Multi-Directional Reach Test (MDRT)
2. Demonstrate increased mobility, as measured by increased velocity, Functional Ambulation Performance (FAP), and decreased step length differential (SLD) on the GAITRite.
3. Experience a decreased fear of falling, as measured by the Activities-specific Balance Confidence (ABCS) scale.

Setting

Participants for the proposed research were be recruited from TigerPlace retirement community, affiliated with the MU Sinclair School of Nursing (SSON). Using the concept of *aging in place* (AIP), rather than forcing residents to move as their needs change, TigerPlace offers varied services as needed. TigerPlace not only promotes the

independence of its residents (Rantz, 2003) but helps residents remain healthier and active longer by providing nursing care coordination, direct personal care as needed, ongoing nursing assessment, health promotion activities, and social activities – all within well-designed housing. This special built environment is designed to help residents avoid expensive and debilitating hospitalizations, and for most residents, avoid relocation to a nursing home.

Sample

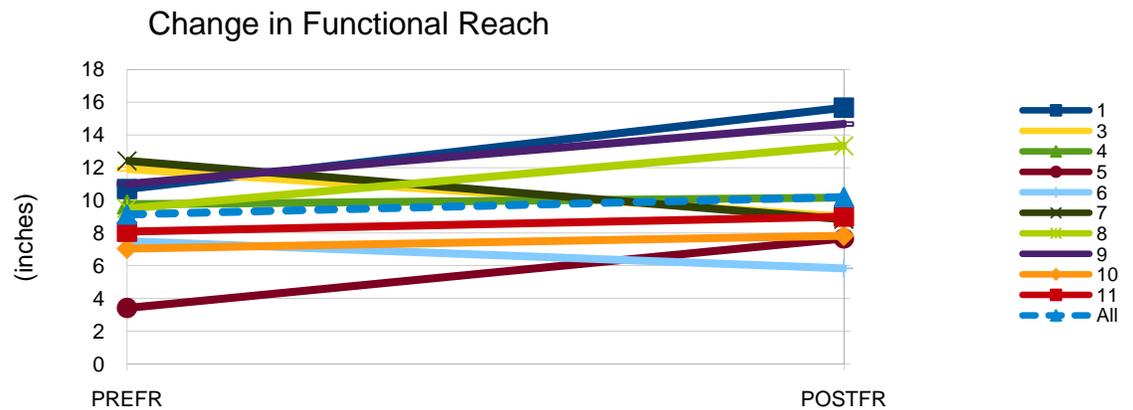
TigerPlace has 60 residents 20 men and 40 women, ranging in age from 63 to 99 years. The median age is 89 and the mean is 86. There are 8 married couples, and the remaining residents are widowed or single. About 90% of the residents have at least one chronic illness; 60% have multiple chronic illnesses. Common illnesses include arthritis, heart disease, and diabetes, a few have early stage Alzheimer's. Similar to the frail population of the pilot study, 23 residents use a walker; 11 use a wheelchair, one wears leg braces, and four use canes as needed. In general, the residents are socially engaged and are active in the community. A letter of support for this study from the Managing Director at TigerPlace is included as Appendix A.

Sample Size and Study Power

In the pilot study, a functional difference was noted in several of the participants before and after TLM intervention in the ability to move their shoulders measured by the Functional Reach. The change in FR, as noted in Figure 3, tended to group into 3 types of responders: Improved (average of 4 inches), no change (average of 1 inch) and worsen (average of -2 inches).

Although notably a slow improvement, the study participants were all frail seniors with multiple co-morbidities impacting overall function. Based on these promising results and considering the frailty of the pilot study participants, an effect size for the proposed research for FR was set at 3 inches and a power analysis was conducted.

Figure 3.1: Functional Reach Measurements Pre and Post Lebed Method™ Intervention Program of All Inclusive Care for the Elderly, Pilot 2008



For the Functional Reach measure, the proposed study will have about 80% power to detect a difference of 3 inches between the two Functional Reach group means with a level of significance of 0.05 and a total sample size of 28 (n1 = 14 and n2 = 14). This will provide both functional and statistical significance.

The aim of the proposed study is to test the effect of TLM on selected fall risk factors in older persons defined as balance, mobility, and fear of falling. A single facility pretest/posttest randomized controlled trial (RCT) study design was used (Portney & Watkins, 2000; Polit & Beck, 2006). Two groups formed by random assignment were compared as depicted in Figure 3.2. (R=Randomization, O=Group, X=Intervention, 1=Baseline measurement and 2=Post measurement).

Figure 3.2: Pretest/Posttest Randomized Controlled Trial (RCT) Study Design

R	C	X	O
1		2	
	C		O
1		2	

This nursing doctoral student trained under the TLM founder, Sherry Lebed Davis and became Lebed Method™ Certified in 2009, led dance therapy sessions with older persons for six months, and led the dance therapy sessions that were the study intervention. A Lebed Method™ therapeutic dance routine, specifically choreographed for older persons, was used (Lebed Davis, 2002). Baseline and post-intervention measurements were obtained on study subjects to test the research hypotheses.

Inclusion and Exclusion

The cognitive level is important for inclusion criteria because a routine is taught over the first several weeks; the same routine is used throughout the course of the study (Krampe et al., 2009). A Mini-Mental State Exam (MMSE) of 23 or above is necessary to follow the dancing instructions (Foreman, Fletcher, Mion, & Simon, 1996).

TLM can be done sitting or standing. Although this study is focused on persons able to stand for short periods, both seated and standing options were available for each dance. This is important because an older person's energy level varies from day to day. Participants in the intervention group were encouraged to participate in the entire session either, seated, standing, or a combination of both.

The entire populations of residents at TigerPlace were reviewed for inclusion criteria with the assistance of the nurse at TigerPlace. The inclusion criteria included residents with 1) MMSE score of 23 or above within the past six months and 2) the ability to stand up with or without assistance for short periods of time, based on the

nature of the intervention intended to be done standing, or seated, or a combination of both. The MMSE is conducted every six months during routine assessments by the TigerPlace nurse. The MMSE score and ability to stand for all residents from their most recent assessment will be reviewed with the TigerPlace nurse. A list of all TigerPlace residents who met the inclusion criteria was compiled.

Because the dance-based therapy requires the ability of the participant to understand instructions from the leader and repeat movements that are demonstrated, persons with severe dementia, extreme spinal deformities, severely restricted upper extremity function, and frail individuals who are unable to stand unsupported were excluded. The ability to perform the pre-and post- intervention measurements outlined for the study would also be compromised in these individuals.

However, TLM may be useful for studies with other populations using alternate measurements, e.g. totally seated participants. This will be considered for future study (Duncan et al., 1990).

Recruitment

The administrator at TigerPlace invited this doctoral nursing student to give a presentation about the dance-based therapy study at the December TigerPlace Resident Meeting. A recruitment sign was posted in the hallway near the front desk explaining the project and included in Appendix B.

TLM used props during the dance sessions to add to the fun nature of the therapy, such as feather boas for the women and hats for the men. A sample of these was also displayed with the recruitment sign. This nursing doctoral student met individually with each TigerPlace resident meeting inclusion criteria and invited them to participate in the

study. Thirty participants meeting inclusion criteria verbally consented or were strongly considering participating in the dance-based study at the end of the recruitment phase. Each participant was randomly assigned to either the intervention group, who participated in the TLM sessions, or the control group, who followed their usual routine during the course of the study (Portney & Watkins, 2000).

Allocation to Group

A Randomization Complete Block Design (RCBD) method was used to assign the participants to the treatment or control group. The participants were placed in order of consenting and a table of random assignment, provided by the biostatisticians at the University of Missouri Medical Research Office was used by the nursing doctoral student to assign the groups. The block method was used to remove a potential bias related to the date of consent. Many of the residents at TigerPlace have been participants in previous studies affiliated with the University of Missouri. The process used by the nursing doctoral student during recruitment was to approach these residents first. Therefore, the first group of residents may have been more interested in being in the treatment group, thus introducing bias. To minimize this factor, the stratification by three subgroups was used, making a statistically equal chance of each group of three, the initial consenters, mid recruitment consenters, and final consenters being assigned to the treatment or control group. Table 3.1: Stratification of Groups by Randomization Complete Block Design depicts the process used.

The groups were not otherwise matched. Age or functional limitations were not used as factor in assigning the groups. Subsequently, the participant ages ranged from a broad 63 to 96.

Table 3.1: Stratification of Groups by Randomization Complete Block Design

Recruitment # by date of consent	Block 1=initial consenters 2=mid-recruitment consenters 3=final consenters	Group Assignment T= Dance C= No-dance
1	1	C
2	1	T
3	1	C
4	1	C
5	1	T
6	1	C
7	1	C
8	1	T
9	1	T
10	1	T
11	2	T
12	2	T
13	2	T
14	2	C
15	2	C
16	2	T
17	2	C
18	2	C
19	2	T
20	2	C
21	3	T
22	3	T
23	3	T
24	3	C
25	3	C
26	3	C
27	3	C
28	3	T
29	3	C
30	3	T

The last two participants (#29 and #30) were a married couple, so rather than split these participants into different groups; they were both placed in the treatment group, making the dispersion 16 in the treatment group and 14 in the control group. Appendix C Subject Flow Diagram Dance describes the flow of participants through each phase.

A letter of notification to group allocation as per Appendix D and E was put in each participant’s mailbox at the end of December. The treatment group’s notice included a schedule of the dance session for the six week intervention period, plus two weeks of makeup sessions. In addition, the days and times for the dance session were included on the monthly activities calendar for TigerPlace, and the daily event calendar

posted on the dining tables and the bulletin boards and the front desk. A total of forty dance-based therapy sessions were conducted in January and February.

The sample size is limited by the number of participants recommended for TLM dance sessions; the Lebed Method™ recommends small group classes (Sandel et al, 2005). The goal to recruit 30 persons was based on projections from current participation in research and activities at TigerPlace, along with the recruitment experience during the pilot study at PACE (Krampe et al., 2009).

Protocol for Intervention

The timeline for recruitment and therapeutic dance sessions are outlined in Table 3.2 Dance-Based Therapy to Decrease Fall Risk in Older Persons Study Timeline

Table 3.2 Dance-Based Therapy to Decrease Fall Risk in Older Persons Study Timeline

Timing	Activity	Description of Activity
Weeks 1-3	Pre-intervention Measurements	Conduct balance, mobility, fear of falling all study participants. Randomly assign subjects to intervention group and control group using the sealed envelope method. Distribute TLM session schedule to intervention group participants and confirm attendance for 1 st week of dance sessions.
Weeks 4-10	Intervention : The Lebed Method™ (TLM)	Sessions offered various times and days each week. Attendance confirmed on a weekly basis. Intervention group participants encouraged to attend 3 sessions each week, 45 minutes for 6 weeks. Control group does not attend TLM sessions.
Weeks 11-12	Make Up Sessions	Sessions offered at various times and days each week. Intervention group participants encouraged to attend sessions if necessary to make up times missed in previous weeks, for a total of 18 sessions.
Weeks 10-13	Post-intervention Measurements	Repeat balance, mobility and fear of falling assessments on all participants in intervention group and control groups. Incentive distributed to each participant who completes post measurements.
	Post Study	Complete data entry, data analysis, write results and disseminate.

The subjects in the study group were asked to attend 18 dance sessions, three sessions weekly for six weeks. The study timeline is outlined in Table 3. 2. Multiple sessions were offered, along with make-up sessions as indicated on the schedule in Appendix D. Eighteen sessions is based on the pilot conducted in 2008, related literature to impact balance and mobility, and similiar studies (Federici, Bellagamba, & Rocchi, 2005; Hackney, Kantorovich, Levin, & Earhart, 2007; Sandel et al, 2005; Krampe et al., 2009, Choi et al., 2009).

TLM combines gentle low impact jazz and ballet movements repeated several times as a dance routine using a range of tempos. The movements were choreographed to music older persons enjoy.. Each session began with deep breathing and a lymphatic warm up. Dance steps were targeted to specific outcomes outlined in Table 3.3 to improve balance by shifting the body and relocating the center of gravity. The same set of movements that were used in the pilot study was used at TigerPlace, with the music revised to include Big Band Music (Krampe et al., 2010).

Table 3.3 The Lebed Method™ Dance Routine for the Elderly Persons and Intended Outcome

Dance Based Therapy	Specific Movements	Intended Outcome	Intended Effect on Fall Risk
Lymphatic Warm Up	Deep Breathing, head, chin, chest, rolls, ear to shoulder, arm circles, easy marches	Open up chest and lungs; give muscles oxygen to perform well	Increase balance and mobility*
Dance #1	Spine Roll Up, sway, step touch, jazz shoulders	Develop balance and strengthen lower extremities	Increase balance*and mobility
Dance #2	Seated: march, touch toe, hand to shoulder, heel lift	Shift weight from side to side; develop balance	Increase mobility and balance*
Dance #3	Step forward, step back, one arm swim, shimmy, easy swing	Balance and strengthen lower legs	Increase mobility
Break	Everyone drinks water, relaxes, rests, visits	Group sharing; benefit of social aspect of dancing	Attendance rate indirectly related to physical outcome measures**
Dance #4	Hips swing side to side, hips push forward, climb the ladder, arms open high/cross, put out the fire, strut your stuff	Accommodate shifting movements; develop balance and flexibility	Increase balance*
Dance #5	Shoe Shine, shut the door, side reach, bow and arrow, circle the world, arm swings	Accommodate shifting movements; develop balance and flexibility	Increase balance*
Cool Down	Closing comments	Group sharing, benefit of social aspect of dancing	Attendance rate indirectly related to physical outcome measures**

*Ultimately decrease Fear of Falling

**The group component of dance is intended to increase the social benefits of exercise. Although the social impact was not measured directly in this study, limited attrition and high attendance rates are indirect measures of this component.

Slow and easy jazz side arm swings repeated to music were be interjected to help the treatment group learn to accommodate shifting movements. A combination of dance marches, including step touch forward and side-to-side were included to impact the fall risk factors of decreased balance and impaired mobility. Participants were encouraged to do as much as they could, while striving to increase movement each session, and most importantly, have fun. The same dance sequences were used throughout the 18 session intervention, so the participants develop confidence in performing the routine and experienced a cumulative effect (Lebed Davis, 2002).

Human Subjects Concerns

This proposal received a Research Enrichment & Dissemination (READ) Award from the University of Missouri Interdisciplinary Center on Aging. An IRB application was submitted and approved at that time (HS IRB Behavioral Sciences: Project # 1123897). See Appendix F and Appendix G for the informed consent and HIPAA consent. An addendum was submitted to the IRB to include the current proposed measures, following the dissertation committee review and approval of this proposal. The nursing doctoral student obtained a written informed consent from each subject who agreed to participate in the study. An incentive of a \$25.00 Wal-Mart gift certificate was given to each participant who completed the study and post-measurements.

Measurements and Instruments

The dependent variables were improved balance, increased mobility and decreased fear of falling. The instruments to measure each of these variables, the process for data collection, scoring, norms, and psychometric properties of each instrument is described in detail below.

1. Demonstrate improved balance, as measured by the Multi-Directional Reach Test (MDRT)
2. Demonstrate increased mobility, as measured by increased Velocity, Functional Ambulation Performance (FAP), and decreased step length differential (SLD) on the GAITRite.
3. Experience a decreased fear of falling, as measured by the Activities-Specific Balance Confidence (ABCS) scale.

Table 3.4: Measurements and Instruments

Measure	Instrument	Reported As
Balance	Muti-Directional Reach Test (MDRT)	Forward, Right, Left and Backwards Reach in inches
Mobility	GAITRite	Velocity cm/sec Functional Ambulation Performance (FAP) score 1-100 Step Length Differential (SLD) difference between right and left step length in cm
Fear of Falling	Activities Balance Confidence Scale	Confidence level 1-100%

The Multi-Directional Reach Test (MDRT)

The Multi-Directional Reach Test (MDRT), an extension of the Functional Reach (FR) test, is a measure to assess balance that may contribute to risk of falling among older persons. It is a functional test that measures the difference, in inches, between the participant's arm's length and maximal forward, right, left and backwards reach; the further one can reach without losing balance, the lower the fall risk (Duncan, Weiner, Chandler & Studenski, 1990; Newton, 2000). The interclass correlation for the MDRT were FR=0.92, BR=0.929, RR=0.0926 and LR =0.0947. Cronbach's Alpha was 0.842. The MDRT is valid tool for measuring the limits of stability as derived by reach in four directions. A copy of the FR instrument is included in Appendix H.

MDRT is useful for detecting balance impairment and change in balance performance over time (Duncan et al., 1990). Although standing FR is useful in the clinical assessment of instability, it may be difficult to perform in patients with severe dementia, extreme spinal deformities, severely restricted upper extremity function, and frail individuals who were unable to stand unsupported (Duncan et al., 1990).

The MDRT takes approximately 10 minutes to complete. This includes the time providing the instructions to the participant (Krampe et al., 2009). Functional reach was measured using a leveled yardstick secured to a tripod at shoulder height. The subjects were asked to perform maximal reaches with the outstretched arm forward, to the right, to the left and leaning backward, with feet flat on the floor. Reach was measured by the participants total hand excursion along a yardstick affixed a telescoping tripod (Newton, 2000).

Two trials are recorded and the highest score is used. Scores with less than six or seven inches indicate limited functional balance, along with an increased fall risk. Most healthy individuals with adequate functional balance can reach ten or more inches (Duncan et al., 1990).

Interrater and test retest reliabilities are high, $r=0.92$, as is intrarater reliability, $r=.98$ (Duncan et al., 1990). Further testing completed by Eagle et al. (1999) on a sample of elderly inpatients reported additional psychometric testing. The results included: sensitivity (ability to detect falls when they are present) = 76%; specificity (ability to identify correctly the absence of falls) = 34%; Positive Predictive Value (how well test predicted compared to actual number of falls) = 33%; and Negative Predictive Value (how well negative test correctly predicts absence of falls) = 77%. These were acceptable

for the proposed study, which was not intended to predict falls, but rather measure a difference of FR before and after a therapeutic dance-based intervention.

GAITRite

The GAITRite provides an objective measurement of key parameters of timing and distance via an electric walkway connected to the serial port of a Windows personal computer. The 20-foot portable carpet captures gait elements without use of additional sensors or placement of any devices on the participant (GAITRite Manual, 2007).

Encapsulated within the electronic walkway are sensor pads. Each sensor pad has an active area of 24 inches square (61cm square) and contains 2,304 sensors arranged in (48x48) grid pattern. The sensors are placed on .5 inch (1.27cm) centers. Multiple sensor pads are connected to form the desired length of the walkway. As the subject ambulates across the walkway, the pressure exerted by the feet onto the walkway activates the sensors (GAITRite Manual, 2007).

The walkway does not only sense the geometry of the activating objects but also the relative arrangement between them in a two dimensional space and reports multiple measures of mobility on a FAP, along with displaying a visual footprint pattern of mobility as noted in Figure 3.3 (GAITRite Manual, 2007). An example of the complete FAP is included in the Appendix I (GAITRite Manual, 2007).

Figure 3.3:GAITRite Functional Ambulation Profile Visual Footprint Pattern



The GAITRite portable gait analysis system provides measurements in real time of temporal and spatial parameters of gait including step length (cm) and velocity

(cm/sec). Gait-related predictors of fall-risk such as analysis of how the foot strikes the surface are also quantified. The pressure exerted by the feet onto the walkway activates the sensors (GAITRite Manual, 2007).

A GAITRite assessment takes less than five minutes. The participants were provided instructions prior to the assessment. A measurement of the participant's leg length, from the hip to the floor, was taken prior to the assessment and recorded. Using a normal stride with shoes on, the participant was to walk the length of the walkway and step off (GAITRite Manual, 2007).

Velocity, defined as habitual gait speed and measured by the GAITRite velocity score, was used as one of the measures of mobility for the study. Velocity is automatically calculated by the GAITRite, by dividing the distance traveled by the Ambulation Time. It is expressed in centimeters per second (cm/sec). Ambulation Time is the time elapsed between the first contact of the first and last footfalls. It is measured in seconds.

The normal velocity is 127.2-138 cm/sec for ages 20-79. A person needs to ambulate with 98 cm/s velocity to need to cross an intersection. Velocity scores <54 cm/s indicate an increased risk of falling, score <69 cm/s indicate and increased incidence of fractures, institutionalization, or death and scores <90 cm/s eminent major health issues (Guralnik et al., 2000; VanSwearingen, Paschal, Bonino & Yang, 1996).

The GAITRite system has strong concurrent validity and test retest reliability. The GAITRite has been reported to have high reliability (ICCs ≥ 0.85) and high concurrent validity when compared with video-based motion analysis systems (ICCs \geq

0.93) for spatial and temporal parameters of gait such as velocity and stride length (Bliney, Morris & Webster, 2003; McDonough, Batavia, Chen & Kwon, 2001).

SLD was a second measure used for mobility. The GAITRite measures step length along the line of progression, from the heel center of the current footprint to the heel center of the previous footprint on the opposite foot. The step length can be a negative value if the subject fails to bring the landing foot heel point forward of the stationary foot heel point. The unit of measure is centimeters and the step length difference from the right to left foot upon ambulating is measured on the horizontal axis of the walkway from the heel point of the current footfall to the heel point of the previous footfall on the opposite foot. Asymmetries in ambulation that impact fall risk can be accessed through the SLD (Montero-Odasso, 2005; Callisaya, 2009).

A third measure of mobility used is the GAITRite FAP score. The FAP is a quantitative means of assessing gait based on specific spatial and temporal gait parameters. The FAP score is generated automatically by the GAITRite and integrates specific components of locomotion to provide a single, numerical representation of gait. Scores range from zero to 100 (GAITRite Manual, 2007). The FAP is a reliable measure of gait normality's and abnormalities when walking at a preferred gait (Nelson et al., 2002; Titanvona, Pitkanen, Paakkonen & Tarkka, 2003). Thus, subjects are instructed to walk at a normal pace during a GAITRite analysis.

Activities-specific Balance Confidence Scale (ABCS)

One way to decrease fear of falling is to measure it, with the ultimate goal of offering interventions to decrease this problem. The first widely used instrument to measure fear of falling, the Fall Efficacy Scale (FES) consists of 10 activities of daily

living (ADL) commonly performed by older persons (Tinetti et al.,1990). Powell and Myers (1995) identified two areas of weakness with the FES: a tendency to be too generic rather than situation specific, and not sensitive enough to loss of balance in higher functioning seniors. To address these weaknesses, the Activities-specific Balance Confidence (ABC) scale was created to include more situation-specific measures of balance confidence and assess seniors at various levels of functioning, particularly more active seniors. The ABC scale assesses a wider continuum of activity difficulty and more detailed activity descriptors (Powell & Myers, 1995).

The ABC scale is globally intended to quantify fear of falling, with the goal to offer interventions to decrease fear of falling by identifying the specific situations that cause an older person to have a low confidence level in performing everyday activities. Specific interventions can be tailored for individuals (Powell & Myers, 1995).

The ABC scale is globally intended to quantify fear of falling, with the goal to offer interventions to decrease fear of falling by identifying the specific situations that cause an older person to have a low confidence level in performing everyday activities. Specific interventions can be tailored for individuals (Powell & Myers, 1995). The ABC scale is also intended to be used in research studies that include interventions to impact fall risks. Aggregate levels of fear of falling can be measured, using the ABC scale before and after the intervention, to test the effectiveness of the intervention.

The ABC scale takes approximately 15 minutes to complete. The scale, a self report instrument comprised of 16 questions, asks an older person how confident they are that they will not lose their balance or become unsteady performing normal activities e.g., walk inside the house, up and down stairs, or bend over. The ABC scale can be self-

administered via personal, or telephone interview. Regardless of the method of administration, each respondent should be queried concerning his or her understanding of instructions, and probed regarding difficulty answering specific items (Powell & Myers, 1995). A copy of the ABC scale is included in the Appendix J.

For this study, the questions were read to each participant with a request to respond using the defined scale for 0-100%. The score is tabulated to reflect the continuum from no confidence to completely confident (0-100%) Elderly respondents are asked to choose one of the percentage points on the scale from 0% to 100%. The ratings (possible range = 0 to 1600) are totaled and divided by 16 (or the number of items completed) to get each person's ABC score. If a person qualifies his/her response to items #2, #9, #11, #14, or #15 (different ratings for "up" vs. "down" or "onto" vs. "off"), separate ratings are solicited and the lowest confidence rating of the two is used (as this will limit the entire activity, e.g., likelihood of using stairs). If they do not currently do the activity in question, they are asked to try and imagine how confident they would be doing the activity. Total scores can be computed if at least 12 of the items are answered (Myers et al., 1998).

Scores of less than 80 are indicative of a moderate level of functioning characteristic of persons with chronic conditions. ABC scores above 50 and less than 80 are indicative of a moderate level of functioning characteristic of persons with chronic conditions. Scores above 80 indicate higher functioning, usually active older adults and are achievable through exercise and rehabilitative therapy. Well older people have been reported to score 90-100% (Myers, Fletcher, Meyers, & Sherk, 1998).

The ABC scale was developed inductively with older adults and therapists, with

evidence for test-retest reliability, hierarchical ordering, ability to discriminate between fallers and non-fallers, and high vs. low mobility groups (Powell & Myers 1995), and association with balance performance measures (Myers, Powell & Maki, 1996). Cronbach's Alpha was high for the ABCS 0.95 and the instrument demonstrated strong internal consistency, reliability and validity when self administered (Talley, Wyman, & Gross, 2008). Initial test-retest reliability was computed by administering the ABC scale to a group of 30 high mobility and 30 low mobility older persons. The total score on the ABC scale was stable over a two-week period with $r=.92$ (Powell & Myers, 1995).

Protection of Safety

There was minimal risk involved with participation in this study. All movements in the dance therapy program were been developed for people with potential physical difficulties (Lebed Davis, 2002). TLM can be done sitting or standing. Each dancer had a chair at their side so they can stop and rest at any time. Although this study was focused on persons able to stand for short periods, both seated and standing options were available for each dance. Breaks were included in each session with water served. The participants were reminded each session to drink extra water throughout the day. Participants were encouraged to participate in the entire session, either seated, standing, or a combination of both (Lebed Davis, 2002).

The MDRT and GAITRite pre-and post dance assessments require the older persons participating in this study to reach in four directions and walk on a 20 foot mat. In addition to the nursing doctoral student, participants were guarded by a research assistant or physical therapist, in case of loss of balance (Duncan et al. 1990).

CHAPTER 4

RESEARCH REPORT

This chapter begins with the results section providing a description of the sample and attendance at dance sessions. The data analysis is next, examining the research aim and hypotheses and an interpretation of these findings. Since the sample size was relatively small, parametric and nonparametric tests were used to evaluate both within and between group differences. For parametric test, a paired t-test and a two sample t-test were used to test changes within a group, difference in changes between groups, respectively. For nonparametric tests, the Wilcoxon signed rank test and the Wilcoxon rank sum test were used. In order to account for differences in baseline values, the Analysis of Covariance (ANCOVA) was used to test difference in changes between groups. The limitations of the study are provided and a discussion concludes the chapter.

Results

There were 17 female and 10 male participants in the study group. Twenty-seven participants were Caucasian and one of Asian ethnicity. Of the 27 participants, 4 were couples. Table 4:2 displays the Age Range of the Study Sample, from 63 to 96.

Table 4.2 Age Range of the Study Sample

	N	Minimum	Maximum	Mean	Std. Deviation
Age	27	63	96	84.50	7.396

Dance-Based Therapy sessions were offered six times each week for four weeks, five times each week for two weeks and then eight additional make ups sessions for a total of 40 sessions in January and February. Participants were asked to attend a total of 18 sessions. A notice was posted weekly by the Activity Director at TigerPlace to remind the study group of the days and times for dancing. In addition, the Dance-Based Therapy

was posted on the monthly calendar, with the other activities. Tiger Place has posted daily activities which are diverse and allow the residents to choose. The participants in the treatment group and the control group were encouraged to continue with their normal routine at Tiger Place. Appendix K includes the activities for February 2010, as an example of the activities offered during the period that the dance-based therapy study was in progress.

The attendance was tracked for each session by the doctoral student and recorded. Reasons for not attending were not recorded daily, however, the doctoral student checked weekly with the TigerPlace Nurse and Activities staff to identify if continued anticipation was feasible from a functional status point for participants who did not attend. This proved to be beneficial and guide the approach to encourage continued participation or take a break from the treatment.

The participants who were recruited for this study have greater opportunities to be involved in other daily activities, compared to the participants in the pilot project. There was an attempt to compensate for this by offering multiple opportunities to attend dance sessions, so the total of 18 sessions could be achieved.

A goal of 18 sessions was communicated to each person in the treatment group at the beginning of the study. The participants were aware of this goal and agreed to attend as many sessions as possible. Seven out of the thirteen participants in the treatment group that completed the study attended eighteen sessions, compared to one out of eleven participants in the pilot study. Figures 4.1 and 4.2 identify the number of session attended per participant. This data reinforces the results of the pilot study that older persons will join dance -based therapy sessions and they will continue to attend.

Appendix M provides a personal communication from the TigerPlace Administration stating the activity was a very positive experience.

The reasons for limited attendance by some of the participants in the treatment group were related to medical frailty issues, including hospitalizations, depression, falls, and pain issues. One person required a break of two different weeks during the eight week study, due to medical issues, but returned to complete a total of 13 sessions. Two participants who completed three sessions the first couple of weeks were not able to continue do to medical reasons, but were included in the post-measurements. One person in the treatment group who completed eighteen sessions was not able to complete the GAITRite data collection due to frailty issues that were increased from the pre-measurement period. The impact of the frailty issues on the study results is discussed further in the Interpretation section.

Figure 4.1 Pilot Study # of Sessions Attended Per Participant

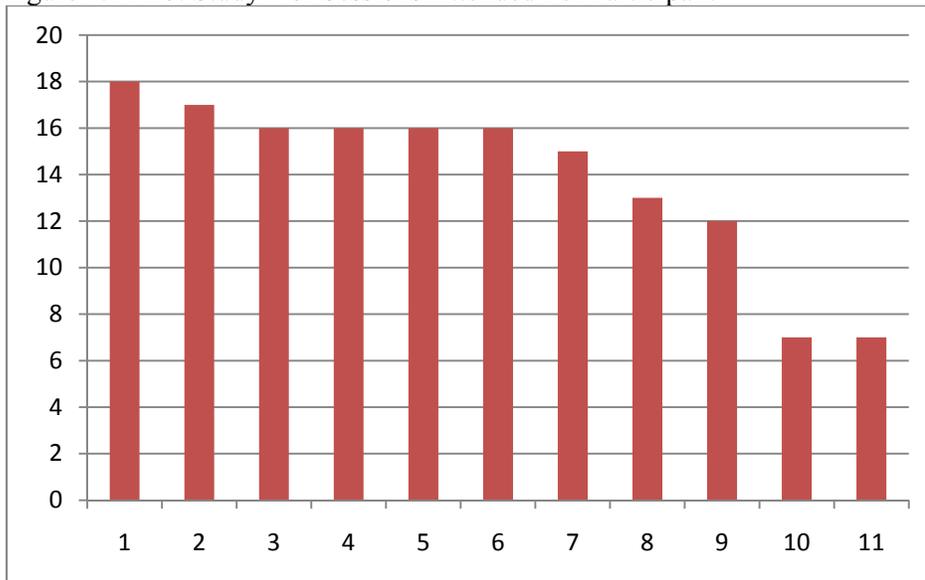
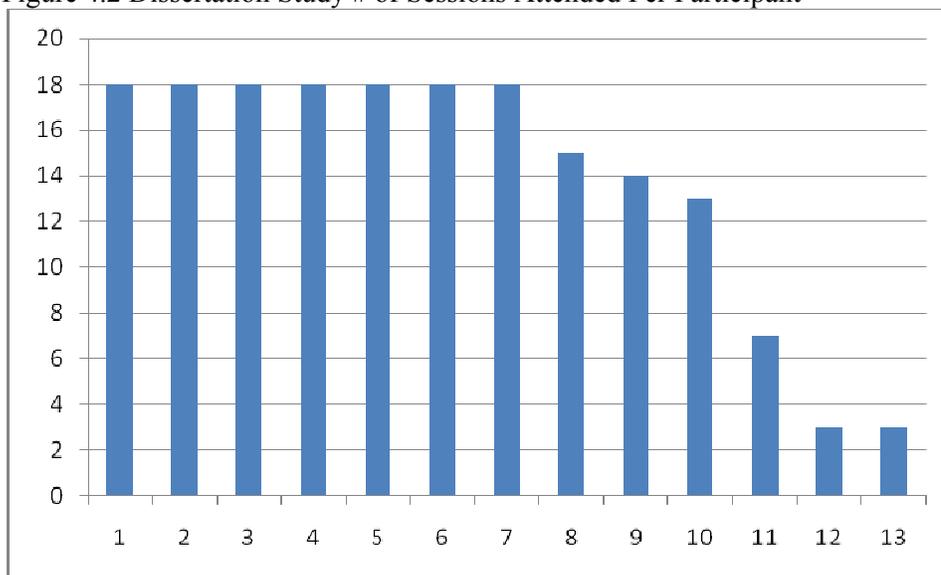


Figure 4.2 Dissertation Study # of Sessions Attended Per Participant



Data Analysis

The aim of the proposed study was to test the effect of TLM on selected fall risk factors in older persons defined as: a.) balance, b.) mobility, and c). fear of falling. The hypotheses to be tested were: Participants who are in TLM program will:

1. Demonstrate improved balance, compared to the control group as measured by the MDRT.
2. Demonstrate increased mobility, compared to the control group as measured by increased gait velocity, FAP and, decreased SLD on the GAITRite.
3. Experience a decreased fear of falling compared to the control group as measured by the ABC scale..

Utilizing SAS and SPSS software, analysis of covariance (ANCOVA) methods were used to compare treatment and control groups with respect to the baseline and post intervention MDRT measurements, GAITRite measurement of mobility (habitual gait defined as velocity), FAP, SLD and total score on the ABC scale.

To assure data quality, all data were double-entered in the spreadsheet and the dataset was used only after a cleaning process of files. Comparison of the baseline value of each outcome was used as the covariate. Since the sample size is relatively small, it is hard to evaluate whether or not each outcome measures follows normal distribution. Therefore both parametric and nonparametric tests were used to evaluate both within and between group differences. For parametric test, a paired t-test and a two sample t-test were used to test changes within a group, difference in changes between groups, respectively.

For nonparametric tests, the Wilcoxon signed rank test and the Wilcoxon rank sum test were used. In order to account for differences in baseline values, the Analysis of Covariance (ANCOVA) was used to test difference in changes between groups. The assumption on homogeneous random errors in ANCOVA was visually checked in the residual plot for each outcome measures and no serious violation was found (Jackson & Hewett, 2001). The General Linear Model procedure in SAS was used for ANCOVA. Statistical significance was set at alpha level = 0.05. Statistical support was provided by biostatisticians at the University of Missouri Medical Research Office. The following Table 4.3 and 4.4 display the Paired T-Test by Group and a Two Sample T-Test to test changes within a group, difference in changes between groups, respectively. Table 4.5 shows the results from the ANCOVA. Even though there was a distributional difference

in pre-measures between two groups, the data did not show post-measures in the treatment group improved significantly compared to the control, even after controlling for the pre-measures. There is no significant p-value in the comparison post ABC scores between groups. The mean, after controlling for pre-measures in the control group is slightly higher than the one for the treatment group, but inconclusive. This insignificance might be due to the small sample size. The study does not have enough power to detect the small group difference. The study was projected to have about 80% power to detect a difference of 3 inches between the two Functional Reach group means with a level of significance of .05 and a total sample size of 28. The post-measurement sample size of 24, not factoring in missing data for the ABCS, did not result in enough power for significance.

Table 4.3: Data Analysis Paired T-Test by Group

Measure	Group 1=Treatment 2=Control	n	Mean of Premeasures (SD)	Mean of Postmeasures (SD)	Mean Difference	p1	p2
Forward Reach (FR)	1	13	9.88 (4.28)	9.02 (2.62)	-0.87	0.39	0.62
	2	11	13.20 (3.06)	11.45 (1.57)	-1.75	0.089	0.15
Right Reach (RR)	1	13	6.90 (2.33)	7.71 (2.73)	.81	0.24	0.28
	2	11	8.73 (2.56)	9.34 (1.76)	0.61	0.24	0.32
Left Reach (LR)	1	13	7.96 (2.94)	8.58 (2.91)	0.62	0.34	0.33
	2	11	9.59 (2.31)	9.57 (1.93)	-0.02	0.98	0.98
Backwards Reach (BR)	1	13	4.75 (2.31)	2.50 (1.06)	-2.25	0.00	0.00
	2	11	5.48 (2.23)	2.27 (1.23)	-3.20	0.00	0.00
Functional Ambulation Profile (FAP)	1	12	71.85 (19.93)	72.92 (14.47)	-1.42	0.44	0.65
	2	11	75.82 (15.87)	78.00 (14.50)	2.18	0.45	0.66
Velocity	1	12	61.84 (32.10)	65.00 (28.13)	-1.60	0.76	0.91
	2	11	67.80 (22.42)	71.77 (21.51)	3.97	0.22	0.39
Step Length Differential (SLD)	1	12	2.88 (2.45)	2.67 (2.28)	-0.21	0.71	0.73
	2	11	3.91 (2.35)	3.72 (2.47)	-0.19	0.77	0.70

p-value¹ are based on a paired T-test by group while p-value² are based on a Wilcoxon rank sum test

FR Mean of pre-measure = clinical difference

FR and BR=both groups decreased; T decreased less than C

SLD= negative is better

The mean pre-measurement Forward Reach for the treatment group was 9.88 (SD 4.29), versus the control group 13.20 (SD 3.06). The treatment group had more baseline functional difficulties related to balance: less than 6 or 7 inches indicating limited functional balance, along with an increased fall risk (Duncan et al., 1990). The other measurements, although inconclusive, did not support dance-based therapy.

Table: 4.4 Data Analysis Two- Sample T-Test

Measure	Group	N	Mean of Difference (\pm SD)	95% Confidence Interval For Mean of Differences	P-value ¹	P-value ²
FR	1	13	-0.87 (\pm 3.49)	(-2.97, 1.24)	0.52	0.39
	2	11	-1.75 (\pm 3.09)	(-3.82, 9.32)		
RR	1	13	0.81 (\pm 2.36)	(-0.62; 2.23)	0.82	0.95
	2	11	0.61 (\pm 1.64)	(-0.49;1.72)		
LR	1	13	0.62 (\pm 2.25)	(-0.74;1.97)	0.52	0.51
	2	11	-0.02 (\pm 2.59)	(-1.76;1.72)		
BR	1	13	-2.25 (\pm 1.68)	(-3.26; -1.23)	0.23	0.48
	2	11	-3.20 (\pm 2.29)	(-4.75; -1.66)		
FAP	1	12	-1.42 (\pm 6.19)	(-5.35; 2.51)	0.27	0.72
	2	11	2.18 (\pm 9.11)	(-3.94; 8.30)		
Velocity	1	12	-1.60 (\pm 17.84)	(-12.94-9.74)	0.37	0.45
	2	11	3.97 (\pm 10.09)	(-2.81; 10.75)		
SLD	1	12	-0.21 (\pm 1.89)	(-1.41;0.99)	0.98	0.95
	2	11	-0.19 (\pm 2.04)	(-1.56-1.18)		
ABCS	1	6	3.93(\pm 7.93)	(-4.40; 12.25)	0.80	1.00
	2	9	5.35(\pm 13.26)	(-4.84; 15.54)		

P-value¹ are based on a two sample t-test while P-value² are based on a Wilcoxon rank sum test.

FR =less decline in T versus C

BR showed both groups decreased; T decreased less than C

SLD show both groups declined; neg is better, so T showed more improvement than C

Small trends were noted in FR, BR, and STL, despite functional difference in groups. A decline in both groups may be due to seasonal declines in older persons related to winter months (CDC, 2010).

Table 4.5 Data Analysis ANCOVA by Group

Measure	N	parameters	Estimates	Standard Error	p-value
FR	24	PREFR	0.29	0.11	0.02
		Group (1-2)	-1.48	0.89	0.11
RR	24	PRERR	0.60	0.16	0.00
		Group (1-2)	-0.53	0.82	0.52
LR	24	PRELR	0.54	0.17	0.00
		Group (1-2)	-0.17	0.81	0.90
BR	24	PREBR	0.25	0.10	0.02
		Group (1-2)	0.41	0.42	0.35
FAP	23	PREFAP	0.86	0.09	0.00
		Group (1-2)	-3.80	3.15	0.24
Velocity	23	PREVelocity	0.82	0.12	0.00
		Group (1-2)	-5.79	2.00	0.34
Step Length Differential	23	PRESLD	0.65	0.17	0.00
		Group (1-2)	-0.38	0.78	0.63

The data analysis using both t-test and ANCOVA supported improvement in BR and SLD following dance-based therapy. Although non-significant, trends were noted. These two areas were not measured in the pilot study

Table 4.6 Data Analysis ABCS Independent Paired T Test by Group

Measure	Group: 1=Treatment 2-Control	Pre-Mean	Post-Mean	Mean Difference	P value
ABCS	1=6	8.40	8.74	3.37	.72
	2=9	7.36	7.71	5.54	

Table 4.7: ABCS Data Analysis using Wilcoxon Rank Sum Test.

Group	N	Mean Difference	SD	p
1	6	3.93	7.93	0.99
2	9	5.35	13.25	

The ABCS requires that at least 12 out of 16 questions are answered in order to maintain the established reliability of 0.95 (Talley, Wyman, & Gross, 2008). Nine participants did not answer at least 12 questions, excluding these participant's ABCS results excluded from the final analysis. Additional study confirmed there is no way to deal with the missing data if the situations were not relevant for some of the subjects (Personal correspondence with Myers, 2010)

The questions most frequently not answered, were #s 6, 7, 12, 13, 14, 15, and 16. These questions represent activities that higher functioning older persons may feel confident doing e.g. shopping in a busy mall. A person with a lower functioning level may no longer be performing these activities and never anticipates performing them again, thus would answer zero. Two of the questions, # 14 and #15 are related to getting on or off an escalator. The nursing doctoral student discovered, during the course of the study, that there are only two escalators in Columbia, Missouri. Thus, the participants would most likely not be exposed to this activity, making the question difficult to answer.

ABCS scores above 50 and less than 80 are indicative of a moderate level of functioning characteristic of persons with chronic conditions. Scores above 80 indicate higher functioning, usually active older adults (Myers, 1998). The self report component of the ABCS makes it subjective. The ABCS scores for the 15 participants that answered at least 12 questions are displayed in Table 4.6 below. Comparing the individual reported

differences in the pre-post measure of the participant with the lowest pre-measurement and also highest increase in ABCS, reported as a 28% increase in six weeks (Participant #6), an inconsistency is noted with an increase of no points on the FAP score, a total measure of total ambulation parameters measured objectively with the GAITRite. In addition, Participant #7, also in the control group, self-reported reported an 18% on the ABCS post-measurement score while the FAP result was minus five from baseline.

Table 4.8: ABCS in Comparison to FAP Pre-Post Difference

ID	Group 1=T 2=C	Age	ABCS_Pre	ABC_Post	ABCS Difference	FAP difference
10	1	85	66.67	66.92	0.26	-3
12	1	81	94.29	93.57	-0.71	-3
13	1	81	94.69	95.31	0.63	-1
19	1	83	77.86	84.33	6.48	-1
22	1	82	62.69	81.67	18.97	11
29	1	88	95.63	93.56	-2.06	-9
30	1	91	96.25	96.25	0.00	4
1	2	86	83.00	84.00	1.00	1
3	2	93	72.50	63.75	-8.75	-1
4	2	87	74.33	63.57	-10.76	-15
*6	2	79	35.67	64.06	28.40	0
*7	2	91	77.86	95.77	17.91	-5
15	2	74	88.75	88.75	0.00	0
17	2	94	62.67	80.71	18.05	3
24	2	83	93.85	92.31	-1.54	0

*0 increase in FAP ; 5 points decrease in FAP, measured by the GAITRite

Interpretation

Although no significance was found, trends were identified that will add to the body of literature about dance-based therapy. The change in the mean BR increased by 2.25 inches in the treatment group, while the SLD mean, decreased by .21 cm. Both of

these were new trends in the treatment group not measured in the pilot study. The other measures did not support the efficacy of the study, but were inconclusive.

Extreme examples of mean changes were further analyzed. Although the age difference is not significant between the treatment and control group, the treatment group appears to be at a lower level of function, prior to the dance intervention.

There is a consistent difference in the mean pre-measurements for the treatment group, compared to the control group, representative of a lesser level of function and higher level of frailty. The mean pre-measurement Functional Forward Reach for the treatment group was 9.88 inches, versus the control group 13.20 inches. This measurement is very important to function in older persons and supports the assumption that the treatment group had more functional difficulties prior to the intervention. Scores with less than six or seven inches in Functional Reach indicate limited functional balance, along with an increased fall risk. Most healthy individuals with adequate functional balance can reach ten or more inches (Duncan et al., 1990). Conversely, the PreFR in the treatment group is significantly different at 0.43 at baseline. Furthermore, the PreRR is very close to being significant at .082. Although an alternate form of therapy was not provided to the control group, the normal activities of many of this group include a regular exercise routine of walking on the treadmill and attending community exercise sessions outside of TigerPlace.

The study design was chosen to compare a treatment and control group. The facility which is the aging in place model, representing the continuum of aging from an active older person to frail, demonstrates a disparity between the levels of function in the two groups at baseline. The only physical inclusion criteria, being able to stand with or

without assistance, did not identify the extreme continuum of aging representative of the study subjects.

A randomized method was used to assign the groups, but a match on functional level was not included. Three persons in the treatment group reported falls during the study, which is another representation of decreased function at baseline, compared to none in the control group. The reasons for attrition and limited attendance by some of the participants in the treatment group were related to medical frailty issues, including hospitalizations, depression, falls, and pain issues. Furthermore, one person in the treatment group discontinued dancing after the first session due to a perception that he was much healthier than the rest of the group and the dance sessions would not increase his balance or mobility. One person required breaks of two different weeks during the eight week study, due to medical issues, but returned and completed the study.

Limitations

Since all of the participants were recruited from the same facility, the results may not be generalizable. Although the TigerPlace population is representative of the older population as a whole, it is anticipated further study will be needed based on the results of this research to include other populations of older persons socioeconomically different.

Members in the intervention group were at risk for the Hawthorne effect when completing the ABC scale post intervention. Since fear of falling is a subjective measurement and this group may be considered special due to being in the dance group, a tendency to report the desired outcome may have occurred. All participants were asked to complete the ABCS as honestly as possible, regardless of group assignment (Portney &

Watkins, 2000). Members in the control group were also at risk for the reverse Hawthorne effect when completing the ABC scale post intervention. The dance-based therapy sessions were created decrease fear of falling, thus the group not dancing may have thought that they were at a higher risk of falling by not receiving the intervention, compared to the treatment group. There was disappointment expressed by members of the control group not being placed in the treatment group, therefore the self-reported scores on the ABCS may have been biased. When collecting the post-measurement ABCS data, participants asked what they had scored on the pre-measurement. This information was not provided.

Finally, the random assignment of the intervention and control groups, intended to remove bias, result in disappointment expressed by several study subjects who wanted to be in the dance intervention group. This did not cause attrition, but was a point of discussion during the study. The residents at TigerPlace communicate freely with each other about activities occur at the facility. The discussion may have introduced bias into the study (Polit & Beck, 2008).

Discussion

Twenty seven subjects mean age 85, participated in a study testing the effect of dance-based therapy in January and February, 2010. The subjects were randomly assigned to a treatment and control group. The treatment groups were asked to attend 18 dance sessions over a two-month period. The high attendance rate, with over 50% of the treatment group attending 18 sessions, demonstrates an interest in this type of dance-based therapy. The intervention received positive feedback from the manager of the facility. Although Wicoxon, T-tests and ANCOVA analysis did not reveal significant

effect of the dance-based therapy, trends increased of backwards reach and decreased step length differential were noted. Although inconclusive, these trends add to the trends noted in the pilot study (Krampe, 2010).

The research on the physical benefits of dance-based therapy in older persons continues to accumulate (Jacobson et al., 2005). Although the concept of dance-based therapy for older persons has been around for 30 years, previous research has been focused primarily on increasing quality of life with older persons (Beal & Berryman-Miller, 1988). Dance Movement Therapy tends to focus on improving psychological outcomes over traditional physiological outcomes (Cotter 1999). The idea of using dance to benefit seniors in a formalized, physical therapeutic way is growing attention as the population ages. This study facilitated a regular exercise routine for persons who may have otherwise chosen not to exercise during the study period.

Individuals with a sedentary life history are the most difficult to motivate with respect to exercise adherence. This can be aided by selecting activities that are enjoyable and by allowing individuals to select some of their own activities. Equally, it is important not to discourage participation by overzealous prescription that may cause adverse events. Dance as therapeutic therapy comes in many forms and levels of intensity. The intervention used for the eight weeks of dance based therapy was based on the routine choreographed for the pilot study. The nursing doctoral student was sensitive to the fall risk and functional limitations of some of the participants in the treatment group. A future study with stratified groups based on function is necessary.

The participants who were recruited for this study have greater opportunities to be involved in other daily activities, compared to the participants in the pilot project. There

was an attempt to compensate for this by offering multiple opportunities to attend dance sessions, so the three sessions per week can be achieved. The availability of dance needs to be customized in further study to support similar results with good attendance.

TLM allows the leader to customize the group sharing component of the sessions as appropriate to the group. The TigerPlace residents enjoyed reminiscing about the music chosen from the Big Band era, and discussed some of the dancing activities they enjoyed during those years. They were interested in the stories behind some of the music, so a discussion on the breaks was facilitated by this doctoral student. In addition, the residents were interested in TLM, and expressed enjoyment receiving information about this method.

During the course of the study, visitors were allowed to participate as room allowed. This included TigerPlace residents who did not meet the study criteria or who were available to participate after the recruitment period had ended. Two residents in this category regularly joined the group. One of these resident's daughter was pleased that she was participating and said her mother used to dance on the Lawrence Welk Show.

During the month of February, Sinclair School of Nursing students joined the group on Wednesdays and Thursdays, as part of their clinical experience at TigerPlace. The students were similarly involved with other activities involving the control group, thus a bias was not introduced to the study. In addition, several family members attended the dance sessions with the residents over the course of the study, including, daughters and sisters.

Although this study was focused on fall risk, a broader issue related to maintaining physical function is relevant to the aging population. Future study

researching the impact of dance-based therapy on function in older persons would be valuable.

The lack of significance discussed in the previous section may be due to the sample size. Although attrition was low, each participant lost to follow up is important in a small sample. Thus, future study should include a larger sample and factor in attrition due to medical issues inherent to this population.

Furthermore, the gender mix was initially balanced with 20 females and 10 males. Only one male attended 18 sessions. Future qualitative studies focused on men's interest in dance-based therapy would be helpful in providing insight into a successful program to engage men in this activity.

This study is the first randomized clinical trial using The Lebed Method with older persons. This success of recruiting participants for this study reinforces the results reported in the pilot study, that older persons will consent to participate and will continue to attend dance sessions. This dance method has merit in serving as dance-based therapy with an aging population, both the well older persons and persons with functional limitations. Future study is needed to build evidence of the benefits of dance-based therapy in this growing population.

CHAPTER 5

Dance-Based Therapy in a Program of All-inclusive Care for the Elderly: An Integrative Approach to Decrease Fall Risk

Krampe, J, Rantz, M., Dowell, L., Schamp, R., Skubic, M. & Abbott, C. (2010) *Nurs Admin Q* 34 (2), 156–161 Lippincott Williams & Wilkins

ABSTRACT

Loss of balance and diminished gait are major fall risk factors in older persons. Literature suggests that physical activity based on dance may improve balance and gait. The aim of this pilot study was to determine if dance based therapy affects the balance/gait of community-based frail seniors. The Roy Adaptation Model (RAM), and Environmental Press Theory (EPT) were used as joint frameworks. Seniors have multiple options, e.g. increasing function, when faced with increased levels of physical press as a result of aging. Eleven subjects were recruited from a Program of All-inclusive Care (PACE). Inclusion criteria was 1) Mini-Mental State Exam of 23 or above, 2) attending the PACE program Monday, Wednesday, Friday, and 3) able to stand with or without assistance. Using a longitudinal design, a Lebed Method dance intervention choreographed to impact balance and gait, was conducted three times a week for six weeks. Functional Reach (FR) and Timed Get Up and Go (TGUG) were measured at baseline, post-intervention, and repeated to estimate the persistence of the effect. Excel graphs were compared looking for functional trends. The PI conducted an interview with the subjects post-intervention. Dance therapy results in positive functional trends, suggesting further study will be useful using dance-based therapy to decrease fall risks in older persons. Key words: *balance, gait, fall risk, dance-based therapy*

Introduction

We are facing a crisis; one in three persons 65 and older falls each year. Of those who fall, 20% to 30% suffer injuries that negate independent living and increase chances of early death. The magnitude of the falling crisis in older persons is an escalating economic burden. The Centers for Disease Control and Prevention estimates the direct medical costs of falls among persons ages 65 and older in the United States totaled \$200 million for fall-related fatalities and \$19 billion for nonfatal fall-related injuries in 2000.. Fractures accounted for 35% of nonfatal injuries and 61% of costs..Without effective

interventions to impact this crisis, the financial toll is expected to increase as the population ages, and is projected to reach \$54.9 billion by 2020.

Fall risk factors are multifactorial and can be predetermined; therefore actions can be taken to reduce the occurrence and severity of falls. The major risk factors for falls in older persons include physical, environmental, and psychosocial dimensions. Loss of balance and decreased mobility are major physical risk factors for falls in older persons.

One solution to the emerging fall crisis often suggested is traditional exercise programs to improve balance and mobility. However, traditional exercise has not been readily adopted by older persons due to barriers that include fear of falling, health problems, and motivation to exercise. An alternate choice to traditional exercise is dance-based therapy. Dance engages older people, promoting adherence and enhancing motivation. In addition, evidence suggests that older people are happier dancing than performing aerobic exercise, with measurable increases in quality of life, improved balance, and mobility. This pilot study was designed to explore if a dance-based therapeutic movement intervention makes a difference in the functional status (balance/gait) of community-based frail seniors.

Programs of All-inclusive Care for the Elderly (PACE) have served as interdisciplinary sites to conduct research on community based frail seniors. Participants at PACE are frail elderly adults who meet the state Medicaid requirements for nursing home placement. They choose to live in the community, supported by family caregivers and the comprehensive interdisciplinary services PACE provides. The comprehensive care includes all aspects of acute and long term care under one capitated health delivery system. PACE programs are required to assure that participants are able to be maintained

safely at home. A falls program is generally accepted to be part of this process. Thus, interventions to decrease fall risk are critical for PACE to explore. The PACE philosophy, using a holistic approach to care for frail elderly, provides an ideal setting to conduct a dance-based pilot study to increase balance and gait, thus decrease fall risk. Partnering with research professors at the University of Missouri, this study combined the expertise of the practicing Interdisciplinary Team at PACE with seasoned gerontological researchers to guide the study.

Objectives

Dance is an enjoyable social activity for many older persons. The research on the psychosocial aspects of dance in older persons supports this assertion. Physically, dance promotes movement of the head and trunk; the center of gravity is shifted in every direction from the axis of support. This impacts factors that contribute to balance and joint mobility.

The emerging research on the physical benefits of dance-based therapy supports the proposed intervention. A study using Caribbean dance steps twice weekly for three months reported significant improvements in balance. Another study reported improvements in mobility following 20 Tango sessions for Parkinson's patients, compared to traditional exercise.

A specific type of therapeutic dance, The Lebed Method™ (TLM) was used in this study. TLM, developed by a professional dancer and her physician brothers, was originally created as dance-based therapy for women with lymphedema. The same movements have been found to be beneficial for other persons with conditions that limit upper and lower body movement, range of motion, and balance. TLM was used in a study

with a group of breast cancer survivors to increase range of motion and investigators reported positive results after 18 sessions conducted in 12 weeks. TLM was chosen for the pilot study at PACE because it can be done sitting or standing as noted in Figure 1 and 2, thus providing a safe, feasible intervention for frail seniors as well as healthy seniors.

Figures 5.1 and 5.2 Lebed Method™ (TLM), Standing and Sitting Dance Routine at PACE



TLM combines low impact dance with upbeat participant specific music. A Certified Lebed Method instructor, who was also a master's prepared dancer, choreographed the dance routine for frail seniors to correlate with specific balance and mobility outcomes outlined in Table 5.1. Dance steps can be customized based on the specific interests of the study subjects. In the pilot study, a new step was created and titled *Shoe Shine*, after it was discovered one of the study subjects has been a shoe shine man his entire life.

Table 5.1 The Lebed Method™ Dance Routine for Program of All-inclusive Care for the Elderly Pilot 2008

Routine/ Music	Movements	Intended Outcome
Warm Up	Deep Breathing, head, chin, chest, rolls, ear to shoulder, arm circles, easy marches	Open up chest and lungs; give muscles oxygen to perform well
Dance #1/ <i>Beautiful Morning</i>	Spine Roll Up, sway, step touch, jazz shoulders	Develop balance and strengthen lower extremities
Dance #2/ <i>Sweet Inspiration</i>	Seated: march, touch toe, hand to shoulder, heel lift	Shift weight firm side to side; develop balance
Dance #3/ <i>Ha Hias</i>	Step forward, step back, one arm swim, shimmy with ballet plie, easy swing with ballet plie	Balance and strengthen lower legs
Break/ <i>Grooving</i>	Everyone drinks water, relaxes, rests, visits	Group sharing; benefit of social aspect of dancing
Dance #4/ <i>Hold On</i>	Hips swing side to side, hips push forward, climb the ladder, arms open high/cross, put out the fire, strut your stuff	Accommodate shifting movements; develop balance and flexibility
Dance #5/ <i>Celebration</i>	<i>Shoe Shine</i> , shut the door, side reach, bow and arrow, circle the world, arm swings	Accommodate shifting movements; develop balance and flexibility
Cool Down/ <i>Pennies From Heaven</i>	Each person speaks and shares a blessing, joy, gratitude	Group sharing, benefit of social aspect of dancing

Theoretical Framework

The Roy Adaptation Model (RAM), and Environmental Press Theory (EPT) were used as joint frameworks. The RAM states that a person is an adaptive system with four adaptive modes: physiological, self-concept, role function and interdependence.

Conceptually, adaptation means to adjust to the environment and affect the environment.

Persons adapt by using coping mechanisms. Lawton and Nemohow’s EPT compliments the RAM by saying that the person strives to achieve a “zone of maximum comfort” and physical competence helps adapt to the environment.

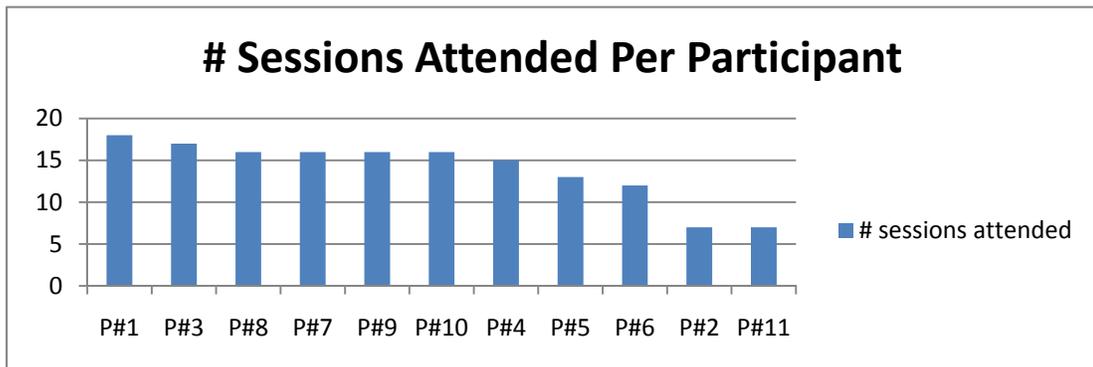
Participants

Following Institutional Review Board approval from the University of Missouri, 11 study subjects, seven women and four men, were recruited from the Alexian Brothers Community Services PACE-St. Louis, Missouri. This small group size could be safely monitored during the dance sessions. All of the subjects met the inclusion criteria of attending the PACE Center three times per week, having a Mini-Mental State Exam (MMSE) of 23 or greater, and the ability to stand with or without an assistive device.

Method

A longitudinal study design was used, with TLM intervention for 45 minutes, three times each week for six weeks. A total of 18 “doses” of dancing were offered, based on the recommended intervention length from related studies. There was no attrition; one study subject completed the intervention but disenrolled from the PACE program prior to post-intervention data collection. The study subjects attended the majority of dance session as noted in Figure 5.3.

Figure 5.3: The Lebed Method Dance Sessions at PACE



Data Collection and Analysis

A Functional Reach (FR) test for balance and Timed Get Up and Go (TGUG) for gait, were measured at three time points. The FR measures the distance a person can reach forward without losing balance; the further one can reach without losing balance, the lower the fall risk. Interrater and test retest reliabilities are high, $r=0.92$, as is intrarater reliability, $r=.98$. Scores with less than 7 inches indicate limited functional balance.

The TGUG measures the time it takes a person to stand up from an arm chair, walk 10 feet, turn around, walk back to the chair, and sit down. Greater than 14 seconds is a predictor of high risk for falls. The interrater reliability of the TGUG is high ($r=.99$).

The baseline value was determined by the mean of all assessments made prior to the intervention. A second value was based on the final assessment at the end of the sixth week of the intervention. A third value was based on the final assessment taken six weeks post-intervention. The values were entered into an excel spreadsheet; improvements from baseline to the end of the intervention period provided an estimate of the effectiveness of the intervention. Improvements from baseline to the end of the post-intervention time provided an estimate of the persistence of the effect of the intervention. Since this was a pilot study, the primary goal was not to show statistically significant differences, but rather to get estimates of the possible effect of the intervention on these outcome measures so they can be used in future planned studies. Therefore, an ultimate measure of FR/TGUG was used to estimate the combined functional effect from the intervention.

Results

Comparison of pre and post-FR and TGUG indicates positive trends in the functional status of the subjects. FR improvements from baseline to the end of the intervention were noted in the majority of the study subjects as noted in Figure 4. The change in FR tends to group into three types of responders: improved (average of 4 inches), no change (average of 1 inch) and worsen (average of -2 inches) as noted in Figure 5.4.

Figure 5.4: Change in Pre-and Post Functional Reach

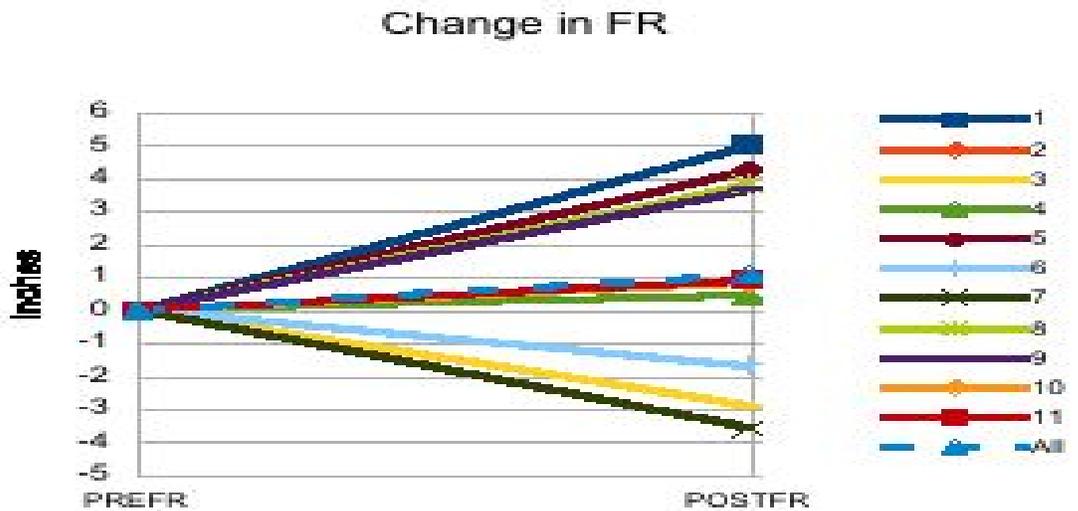
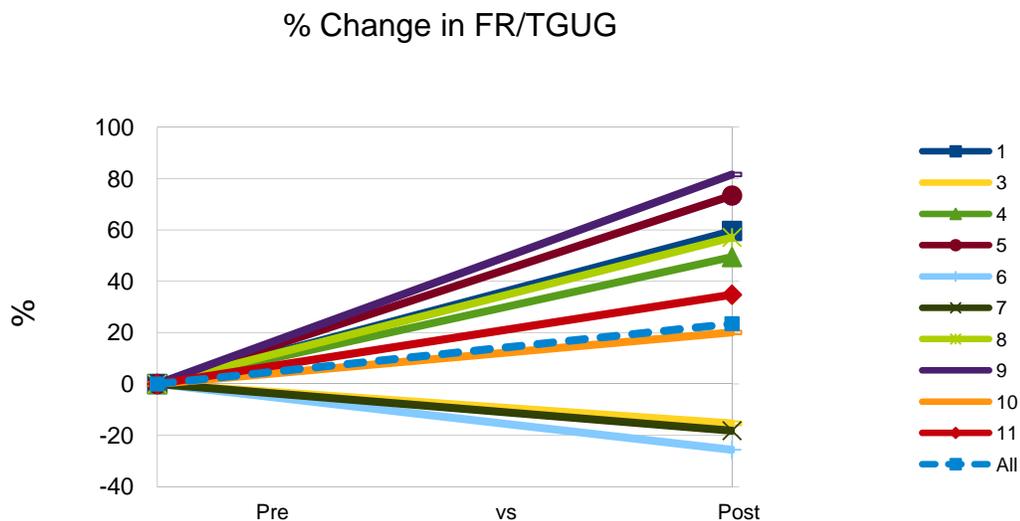


Figure 5.5 displays the overall functional measure related to balance and gait as depicted by percent of change (FR score divided by TGUG) that resulted from the intervention. When combined with TGUG, the majority of subjects showed global improvement of about 50% from baseline in this scoring schema. The six weeks post intervention measurements showed no trends in persistent effects.

Figure 5.5 Overall Changes in Pre-and Post Functional Reach and Timed Get Up and Go



The study results confirm that older persons will 1) initially consent to participate in dance therapy, 2) continue to attend dance sessions, 3) express enjoyment during the dance sessions, 4) demonstrate increased activity during the dance sessions and 5) self report improved balance and gait. 100% of the participants indicated they would recommend this program to other older persons. 90% said they would sign up for the program again. Participants shared how much they enjoyed the social aspect of the program. 50% of the participants self reported their balance and gait had improved. The pilot results revealed trends in the small sample indicating the dance intervention has the potential to improve physical function.

Conclusions

Based on the results of the pilot study, a functional difference was noted in several of the participants before and after TLM intervention in the ability to move their shoulders measured by the FR. The study participants were all frail seniors with multiple

co-morbidities impacting overall function. Further study is warranted using a larger sample size, a control group, and additional measures to explore the impact of this dance based intervention. A study with people who can do the majority of the exercises standing is also warranted to fully explore the potential benefits in older adults.

The lessons learned during the pilot study will be incorporated into future study. The experience working within a PACE setting can be translated into other practice settings that are suitable for conducting therapeutic movement projects. First and foremost, the initial and sustained support from the leadership team was critical to the success of this project. This allowed dedicated team members for the six week commitment to facilitate this project. The individual commitment from the Principal Investigator Nurse and Co-Investigator Physical Therapist provided the momentum to carry this project to completion. Assistance was needed from the Dietary, Activities, Day Center, Nursing, Transportation, Marketing, and Information Technology departments. The assistance ranged from transporting the study subjects to the PACE center three days each week, to providing early lunches for the study subjects, to photographing and videotaping the dance program.

Because of the success of this pilot study, an Alexian Brothers Ministry grant was awarded to the Principal Investigator Nurse and Co-Investigator Physical Therapist to attend a three-day Lebed Method Certification course. The dance program is being expanded and offered to all participants at this PACE facility.

Implications for Nursing Administration

The crisis of older persons falling does not need to continue. We can help bring closure to this crisis by conducting intervention research studies to measure the impact of

programs like dance-based therapy on fall risk, and quickly moving these programs into practice. We can improve balance and gait, thus reducing fall risk and subsequently decreasing the number of costly, life changing, and injurious falls. This study is a step towards measuring improvement in balance and gait following dance-based therapy.

REFERENCES

- Belardinelli R. et al. (2006). Dancing in patients with Chronic Heart Failure: A new form of exercise training. *American Heart Association Scientific Sessions*, Abstract 3957.
- Cohen-Mansfield, J., Marx, M., & Guralnik, J. (2003). Motivators and barriers to exercise in older community-dwelling population. *Journal of Aging and Physical Activity*. 11(2), 242-253.
- Eisdorfer, C.& Lawton, P. (1973). The psychology of adult development and aging. *American Psychological Association: Washington, D.C.*
- Fawcett, J. (1993). *Analysis and Evaluation of Nursing Theories*. F. A. Davis: Philadelphia.
- Federici, A., Bellagamba, S., & Rocchi, M. (2004). Does dance-based training improve balance in adult and young old subjects? A plot randomized controlled trial. *Aging Clinical and Experimental Research*.17(5), 385-389.
- Gillespie, L. D., Gillespie, W. J., Robertson, M. C., Lamb, S. E., Cumming, R. G., & Rowe, B. (2007). Interventions for preventing falls in elderly people. *Cochrane Database of Systematic Reviews*, (4).
- Lebed, S. (n.d.). The Lebed Method: Focus on dance and healing movement. Retrieved February 18, 2008 from <http://www.Lebedmethod.com/WhoWeAre.asp>
- Lees, F., Clark, P., Niggs, C., & Newman, P. (2005). Barriers to exercise behavior among older adults: A focus group study. *Journal of Aging and Physical Activity*. 13, 23-33.

Rawsky, E. (1998). Review of the literature on falls in the elderly. *Image-The Journal of Nursing Scholarship*. 30 (1), 47-52.

Robbins, A., Rubenstein, L., Josephson, K., et al. (1989). Predictors of falls among elderly people: Results of two population-based studies. *Arch Intern Med*. 149(121), 1628-1633.

Tinetti, M., Williams, T., & Mayewski, R. (1986). Fall risk index for elderly patients based on number of chronic disabilities. *American Journal of Medicine*.80,

CHAPTER 6

Dance-Based Therapy to Decrease Fall Risk in Older Persons Jean Krampe, PhD(c)

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ABSTRACT

This article describes a randomized controlled study exploring the use of dance-based therapy to increase balance, mobility and decrease fear falling in older persons. The Disablement Process was used as the theoretical framework. The sample includes 27 residents with mean age 85 (± 7.5) from an aging in place facility in the Midwest. The Multi-Directional Reach Test, GAITRite and Activities-specific Balance Confidence Scale were measured before and after an intervention of 18 sessions of dance-based therapy. A t-test, Wilcoxon and Analysis of Covariance were used to test differences in changes between groups. Although inconclusive, trends indicating improved function were identified in increasing backwards reach, and decreasing step length differential following a dance-based therapy program. Additional research is needed with a larger sample size and case matched treatment and control group. *Key Words: fall risk, balance, mobility, older persons, dance therapy*

Hillary Rodham Clinton admitted that of all the insulting press criticism she received during her husband's 1992 presidential campaign, *the only one that really hurt, and one of the few that was really true, is that I'm middle-aged.... I couldn't believe I saw that in print.* She was 45 (Sheehy, 1995). Even though Clinton may live into her 90's, if she can remain free from heart disease and cancer, the reality of aging and functional decline affects each of us. In addition to functional decline resulting from normal aging, a life changing event, such as a fall, often precipitates functional decline in older persons. Therefore, interventions with efficacy to reduce fall risks are needed.

Dance-Based Research as an Intervention

To address this need, the National Institute on Aging (NIA), one of the National Institutes of Health specifically focused on improving the quality of life for older persons, has identified intervention research studies as one of the ways to impact the challenges the nation will face with the aging population and associated functional decline. The NIA goal specifically calls for research which will add to the body of science *to continue to develop and disseminate information about interventions to reduce disease and disability and improve the health and quality of life of older adults* (National Institute on Aging, 2007). Research to reduce fall risk and ultimately the number of injurious, life changing falls, meets the NIH goal.

Background and Significance

There is evidence that links aging and functional decline with an increased risk for falling (Daly, 1998). One in three persons 65 and older falls each year (Hausdorff & Rios, Edelber 2001). Of those who fall, 20% to 30% suffer injuries that negate

independent living and increase chances of early death (Hornbrook, Stevens, Wingfield, Hollis, Greenlick, & Ory 1994).

The aging population accounts for an ever-increasing percent of the U.S. population. Over the next 50 years, a small decline in the percent of the population under 18 is anticipated, while a sizeable increase in the percent of elderly expected. As a result, it is projected that one in five Americans will be elderly by the year 2030 (U.S. Department of Health and Human Services, 2004).

The American College of Sports Medicine and the American Heart Association have issued recommendations on the types and amounts of physical activity needed to improve and maintain health in older adults. A panel of scientists with expertise in public health, behavioral science, epidemiology, exercise science, medicine, and gerontology reviewed existing consensus statements and relevant evidence from primary research articles and reviews of the literature (Nelson et al., 2007).

Consequently, the recommendation for older adults includes activities that maintain or increase flexibility. Balance exercises are recommended for older adults at risk of falling. In addition, older adults should have an activity plan for achieving recommended physical activity that integrates preventive and therapeutic recommendations (Nelson et. al., 2007). Evidence is beginning to accumulate suggesting that physical exercise based on dance may improve balance, and hence be useful to reduce the risk of falls in older persons (Federici, Bellagamba & Rocchi 2005). A pilot study of therapeutic dance provides some evidence of improvements in physical function in frail older adults (Krampe, et al. 2010). Additional research is needed to explore the benefits of dance-based therapy for the growing aging population.

Dance has been an integral aspect of healing and cultural rituals for many centuries. As a result, forms of dancing as exercise have been used to encourage increased physical fitness of older persons. This results in increasing the number of older persons using dance as a health-related activity and promotes older adults in a positive light through increased participation in a healthy, stimulating, and challenging exercise program (Connor, 2000).

The American College of Sports Medicine and the American Heart Association have issued recommendations on the types and amounts of physical activity needed to improve and maintain health in older adults. A panel of scientists with expertise in public health, behavioral science, epidemiology, exercise science, medicine, and gerontology reviewed existing consensus statements and relevant evidence from primary research articles and reviews of the literature (Nelson et al., 2007).

Consequently, the recommendation for older adults includes activities that maintain or increase flexibility. Balance exercises are recommended for older adults at risk of falling. In addition, older adults should have an activity plan for achieving recommended physical activity that integrates preventive and therapeutic recommendations (Nelson et al., 2007).

Although dance has been an integral aspect of healing and cultural rituals for many centuries, research is emerging about the therapeutic benefit of dance (Connor, 2000). The Lebed Method™ (TLM) 2002, recommended as dance-based therapy for populations with physical difficulties, has recently been the focus of research for its

therapeutic benefit with promising results (Sandel et al, 2005; Choi, Yu, Park, & Lee, 2009; Krampe, Rantz, Dowell, Schamp, Skubic,& Abbott, 2010).

Theoretical Framework

The medical social framework of the Disablement Process, developed by Verbrugge and Jette, (1994) was used as the theoretical framework for this study. The Disablement Process is an elaboration of the Disablement Model, developed by Saad Nagi (1965). Functional Limitations, specifically physiological and psychological, were the focus of this research. Verbrugge and Jette define Functional Limitations as *restrictions in performing fundamental physical and mental actions used in daily life by one's age-sex group: ambulating, reaching, stooping, climbing stairs, producing intelligible speech, see standard print, etc.* This includes balance and mobility (Verbrugge & Jette, 1994). The Disablement Model states that Functional Limitations can be modified with therapeutic regimens to increase capacity. The proposed dance-based therapy is a therapeutic regimen to increase capacity, measured by increased balance, mobility, and decrease fear of falling, thus slowing down the pathway from Functional Limitations to further Disability.

Purpose

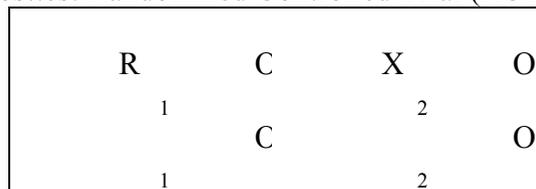
The aim of the proposed study was to test the effect of The Lebed Method™ (TLM) on selected fall risk factors in older persons defined as: a.) balance, b.) mobility, and c). fear of falling. The hypotheses tested were: Participants who are in treatment group compared to the control group will:

1. Demonstrate improved balance, as measured by the Multi-Directional Reach Test (MDRT)
2. Demonstrate increased mobility, as measured by increased velocity, Functional Ambulation Performance (FAP), and decreased step length differential (SLD) on the GAITRite.
3. Experience a decreased fear of falling, as measured by the Activities-specific Balance Confidence (ABCS) scale.

Methods

A single facility pretest/posttest randomized controlled trial (RCT) study design was used (Portney & Watkins, 2000; Polit & Beck, 2006). Two groups formed by random assignment were compared as depicted in Figure 1. (R=Randomization, O=Group, X=Intervention, 1= Baseline measurement and 2=Post measurement)

Figure 6.1: Pretest/Posttest Randomized Controlled Trial (RCT) Study Design



Setting and Sample

Participants were recruited from the TigerPlace retirement community, affiliated with the University of Missouri, Sinclair School of Nursing (SSON). Using the concept of *aging in place* (AIP), rather than forcing residents to move as their needs change, TigerPlace offers varied services as needed. TigerPlace not only promotes the independence of its residents (Rantz, 2003) but helps residents remain healthier and active longer by providing nursing care coordination, direct personal care as needed, ongoing nursing assessment, health promotion activities, and social activities – all within

well-designed housing. This specially built environment is designed to help residents avoid expensive and debilitating hospitalizations, and for most residents, avoid relocation to a nursing home.

TigerPlace has 60 residents 20 men and 40 women, ranging in age from 63 to 99 years. The median age is 89 and the mean is 86. There are 8 married couples, and the remaining residents are widowed or single. About 90% of the residents have at least one chronic illness; 60% have multiple chronic illnesses. Common illnesses include arthritis, heart disease, and diabetes, a few have early stage Alzheimer's. Consequently, 23 residents use a walker; 11 use a wheelchair, one wears leg braces, and four use canes as needed.

Inclusion/Exclusion

The cognitive level was important for inclusion criteria because a routine is taught over the first several weeks; the same routine is used throughout the course of the study (Krampe et al., 2010). A Mini-Mental State Exam (MMSE) of 23 or above was the cut-off necessary to follow the dancing instructions (Foreman, Fletcher, Mion, & Simon, 1996). The second inclusion criteria was the ability to stand up with or without assistance for short periods of time, based on the nature of the intervention intended to be done standing, or seated, or a combination of both.

Recruitment and Allocation to Group

The entire population of residents (n=60) at TigerPlace were reviewed for inclusion criteria with the assistance of the nurse at TigerPlace. From this group, 30 residents met the inclusion criteria, were, interested in participating, and allocated to either treatment (dance plus usual routine) group or control (no-dance plus usual routine) group. A randomization complete block design (RCBD) method was used to assign the

participants to the treatment or control group. A table of random assignment was provided by the biostatisticians at the University of Missouri Medical Research Office to place participants in order of consenting for the researcher to contact each person. To keep a married couple in the same group, 16 subjects were allocated to the treatment group and 14 to the control group. Three subjects verbally consented but chose not to provide a written consent, leaving 15 in the treatment group and 12 in the control group.

The final sample included 17 female and 10 male participants in the study group. Twenty-six participants were Caucasian and one was participant of Asian ethnicity. Of the 27 participants, 4 were couples. The groups were not otherwise matched. Age or functional limitations were not used as factor in assigning the groups. Subsequently, the participant ages ranged from a broad 63 to 96, mean age 85.

Measurements

The multi-directional reach test (MDRT), GAITRite and activities specific balance confidence scale were used to measure balance, mobility and fear of falling, respectively. Table 6.1 outlines the specific measurements.

Table 6.1: Measurements and Instruments

Measure	Instrument	Reported As
Mobility	GAITRite	Velocity cm/sec Functional ambulation performance (FAP) score 1-100 Step length differential (SLD) difference between right and left step length in cm
Fear of Falling	Activities-specific balance confidence scale	Confidence level 1-100%

The Multi-Directional Reach Test (MDRT)

The Multi-directional reach test (MDRT), an extension of the functional reach (FR) test, is a measure to assess balance that may contribute to risk of falling among older persons. It is a functional test that measures the difference, in inches, between the participant's arm's length and maximal forward, right, left and backwards reach; the further one can reach without losing balance, the lower the fall risk (Duncan, Weiner, Chandler, Studenski, 1990; Newton, 2000). The interclass correlation for the MDRT were FR=0.92, BR=0.93, RR=0.09 and LR =0.09; Cronbach's Alpha was 0.84 (Newton, 2000). The MDRT is valid tool for measuring the limits of stability as derived by reach in four directions.

Functional reach was measured using a leveled yardstick secured to a tripod at shoulder height. The subjects are asked to perform maximal reaches with the outstretched arm forward, to the right, to the left and leaning backward, with feet flat on the floor. Reach was measured by the participants total hand excursion along a yardstick affixed a telescoping tripod (Newton, 2000). Figures 2 and 3 provide a visual of this measurement.

Two trials are recorded and the greater of the two are used. Scores with less than six or seven inches indicate limited functional balance, along with an increased fall risk. Most healthy individuals with adequate functional balance can reach ten or more inches (Duncan et al., 1990). Interrater and test retest reliabilities are high, $r=.92$, as is intrarater reliability, $r=.98$ (Duncan et al., 1990).

Figure 6.2: Forward Reach

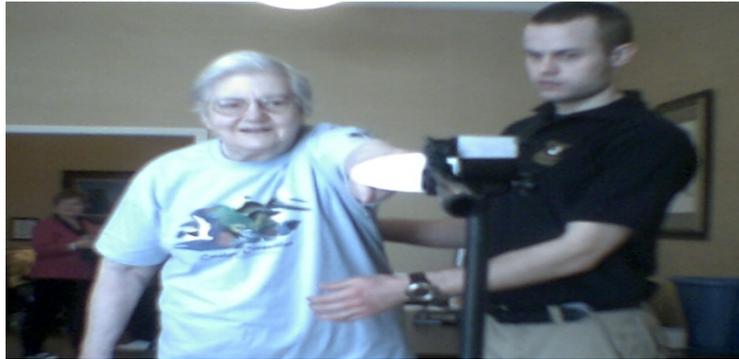


Figure 6.3: Right Reach



GAITRite

The GAITRite provides an objective measurement of key parameters of timing and distance via an electric walkway connected to the serial port of a Windows personal computer. The 20-foot portable carpet captures gait elements without use of additional sensors or placement of any devices on the participant (GAITRite Manual, 2007).

Encapsulated within the electronic walkway are sensor pads. Each sensor pad has an active area of 24 inches square (61cm square) and contains 2,304 sensors arranged in (48x48) grid pattern. The sensors are placed on .5 inch (1.27cm) centers. Multiple sensor pads are connected to form the desired length of the walkway. As the subject ambulates across the walkway, the pressure exerted by the feet onto the walkway

activates the sensors (GAITRite Manual, 2007). The walkway does not only sense the geometry of the activating objects but also the relative arrangement between them in a two dimensional space and reports multiple measures of mobility (GAITRite Manual, 2007) Figure 6.4 visually depicts the GAITRite walk.

Figure 6.4: GAITRite Walk



The GAITRite portable gait analysis system provides measurements in real time of temporal and spatial parameters of gait including step length (cm) and velocity (cm/sec). Using a normal stride with shoes on, the participant was to walk the length of the walkway and step off (GAITRite Manual, 2007).

Velocity, defined as habitual gait speed and measured by the GAITRite velocity score, was used as one of the measures of mobility for the study. Velocity is automatically calculated by the GAITRite, by dividing the distance traveled by the Ambulation Time. It is expressed in centimeters per second (cm/sec). Ambulation Time is the time elapsed between the first contact of the first and last footfalls. It is measured in seconds.

The normal velocity is 127.2-138 cm/sec for ages 20-79. A person needs to ambulate with 98 cm/s velocity to need to cross an intersection. Velocity scores <54 cm/sec (Guralnik et al., 2000; VanSwearingen, Paschal, Bonino, & Yang, 1996).

The GAITRite system has strong concurrent validity and test retest reliability. The GAITRite has been reported to have high reliability (ICCs ≥ 0.85) and high concurrent validity when compared with video-based motion analysis systems (ICCs ≥ 0.93) for spatial and temporal parameters of gait such as velocity and stride length (Bliney, Morris & Webster, 2003; McDonough, Batavia, Chen & Kwon, 2001).

SLD was a second measure used for mobility. The GAITRite measures step length along the line of progression, from the heel center of the current footprint to the heel center of the previous footprint on the opposite foot. The step length can be a negative value if the subject fails to bring the landing foot heel point forward of the stationary foot heel point. The unit of measure is centimeters and the step length difference from the right to left foot upon ambulating is measured on the horizontal axis of the walkway from the heel point of the current footfall to the heel point of the previous footfall on the opposite foot. Asymmetries in ambulation that impact fall risk can be accessed through the SLD (Montero-Odasso, 2005; Callisaya, 2009).

A third measure of mobility used was the GAITRite FAP score. The FAP is a quantitative means of assessing gait based on specific spatial and temporal gait parameters. The FAP score is generated automatically by the GAITRite and integrates specific components of locomotion to provide a single, numerical representation of gait. Scores range from zero to 100 (GAITRite Manual, 2007). The FAP is a reliable measure of gait modalities and abnormalities when walking at a preferred gait (Nelson et al., 2002;

Titanvona, Pitkanen, Paakkonen & Tarkka, 2003). Thus, subjects were instructed to walk at a normal pace during a GAITRite analysis.

Activities-specific Balance Confidence Scale (ABCS)

The Activities-specific balance confidence (ABC) scale was created to include situation-specific measures of balance confidence and assess seniors at various levels of functioning, particularly more active seniors. The ABC scale assesses a wide continuum of activity difficulty and detailed activity descriptors (Powell & Myers, 1995).

The scale, a self report instrument comprised of 16 questions, asks an older person how confident they are that they will not lose their balance or become unsteady performing normal activities e.g., walk inside the house, up and down stairs, or bend over. For this study, the questions were read to each participant with a request to respond using the defined scale for 0-100%. The score is tabulated to reflect the continuum from no confidence to completely confident (0-100%) The ratings (possible range = 0 to 1600) are totaled and divided by 16 (or the number of items completed) to get each person's ABC score. If they do not currently do the activity in question, they are asked to try and imagine how confident they would be doing the activity. Total scores can be computed if at least 12 of the items are answered (Powell & Myers, 1995; Myers et al., 1998).

Scores of less than 80 are indicative of a moderate level of functioning, characteristic of persons with chronic conditions. ABC scores above 50 and less than 80 are indicative of a moderate level of functioning characteristic of persons with chronic conditions. Scores above 80 indicate higher functioning, usually active older adults and are achievable through exercise and rehabilitative therapy. Well older people have been reported to score 90-100% (Myers, Fletcher, Meyers, & Sherk, 1998). Cronbach's alpha

was high for the ABCS 0.95 and the instrument demonstrated strong internal consistency, reliability and validity when self administered (Talley, Wyman, & Gross, 2008).

Protection of Safety

There was minimal risk involved with participation in this study. All movements in the dance therapy program were developed for people with potential physical difficulties (Lebed Davis, 2002). TLM can be done sitting or standing. Each dancer had a chair at their side so they can stop and rest at any time. Although this study was focused on persons able to stand for short periods, both seated and standing options were available for each dance. Breaks were included in each session with water served. The participants were reminded each session to drink extra water throughout the day. Participants were encouraged to participate in the entire session either, seated, standing, or a combination of both (Lebed Davis, 2002).

The Lebed MethodTM (TLM) Intervention

The principal investigator was Lebed MethodTM Certified in 2009 and led the dance therapy sessions. TLM therapeutic dance routine, specifically choreographed for older persons, was used (Lebed Davis, 2002). TLM can be done sitting or standing. Although this study was focused on persons able to stand for short periods, both seated and standing options were available for each dance. This is important because an older person's energy level varies from day to day. Participants in the intervention group were encouraged to participate in the entire session either, seated, standing, or a combination of both. Figures 6.5 and 6.6 provide a visual of seated and standing dance moves.

Figure 6.5: The Lebed Method™ Sitting at TP



Figure 6.6: The Lebed Method™ Standing at TP



A total of forty dance-based therapy sessions were conducted in January and February. The treatment group was asked attend 18 dance sessions, three sessions weekly

for six weeks.. Multiple sessions were offered at various times and additional make-up sessions were offered. The number of sessions in the intervention is based on a pilot conducted in 2008, related literature to impact balance and mobility, and other studies using TLM (Federici, Bellagamba, & Rocchi, 2005; Hackney, Kantorovich, Levin, & Earhart, 2007; Sandel et al, 2005; Choi et al., 2009 and Krampe et al., 2010,).

TLM combines gentle low impact jazz and ballet movements repeated several times as a dance routine using a range of tempos. The movements were choreographed to music older persons enjoy; classic and contemporary upbeat tunes were included. Each session began with a lymphatic warm up to encourage deep breathing. Dance steps were targeted to specific outcomes outlined in Table 2 to improve balance by shifting the body and relocating the center of gravity. The same set of movements that were used in the pilot study with frail elders (Krampe et al., 2010) was used at TigerPlace, with the music revised to include Big Band Music.

Slow and easy jazz side arm swings repeated to music were be interjected to help the treatment group learn to accommodate shifting movements. A combination of dance marches, including step touch forward and side-to-side were included to impact the fall risk factors of decreased balance and impaired mobility. Participants were encouraged to do as much as they could, while striving to increase movement each session, and most importantly, have fun. The same dance sequences were used throughout the 18 session intervention, so the participants develop confidence in performing the routine and experienced a cumulative effect (Lebed Davis, 2002). An incentive of a \$25.00 Wal-Mart gift certificate was given to each participant who completed the study and post-measurements.

Table 6.2: The Lebed Method™ Dance Routine for the Elderly Persons and Intended Outcomek

Dance Based Therapy	Specific Movements	Intended Outcome	Intended Effect on Fall Risk
Lymphatic Warm Up	Deep Breathing, head, chin, chest, rolls, ear to shoulder, arm circles, easy marches	Open up chest and lungs; give muscles oxygen to perform well	Increase balance and mobility
Dance #1	Spine Roll Up, sway, step touch, jazz shoulders	Develop balance and strengthen lower extremities	Increase balance and mobility
Dance #2	Seated: march, touch toe, hand to shoulder, heel lift	Shift weight from side to side; develop balance	Increase balance and mobility *
Dance #3	Step forward, step back, one arm swim, shimmy, easy swing	Balance and strengthen lower legs	Increase mobility
Break	Everyone drinks water, relaxes, rests, visits	Group sharing; benefit of social aspect of dancing	Attendance rate indirectly related to physical outcome measures**
Dance #4	Hips swing side to side, hips push forward, climb the ladder, arms open high/cross, put out the fire, strut your stuff	Accommodate shifting movements; develop balance and flexibility	Increase balance*
Dance #5	Shoe Shine, shut the door, side reach, bow and arrow, circle the world, arm swings	Accommodate shifting movements; develop balance and flexibility	Increase balance*
Cool Down	Closing comments	Group sharing, benefit of social aspect of dancing	Attendance rate indirectly related to physical outcome measures**

*Ultimately decrease Fear of Falling

**The group component of dance is intended to increase the social benefits of exercise. Although the social impact was not measured directly in this study, limited attrition and high attendance rates are indirect measures of this component.

A total of forty dance-based therapy sessions were conducted in January and February. The intervention group was asked attend 18 dance sessions, three sessions weekly for six weeks. Multiple sessions were offered at various times and additional make-up sessions were offered to meet the dose requirements of the intervention. The number of sessions in the intervention is based on a pilot conducted in 2008, related

literature to impact balance and mobility, and other similiar studies(Federici, Bellagamba, & Rocchi, 2005; Hackney, Kantorovich, Levin, & Earhart, 2007; Sandel et al, 2005; Choi et al., 2009 and Krampe et al., 2010).

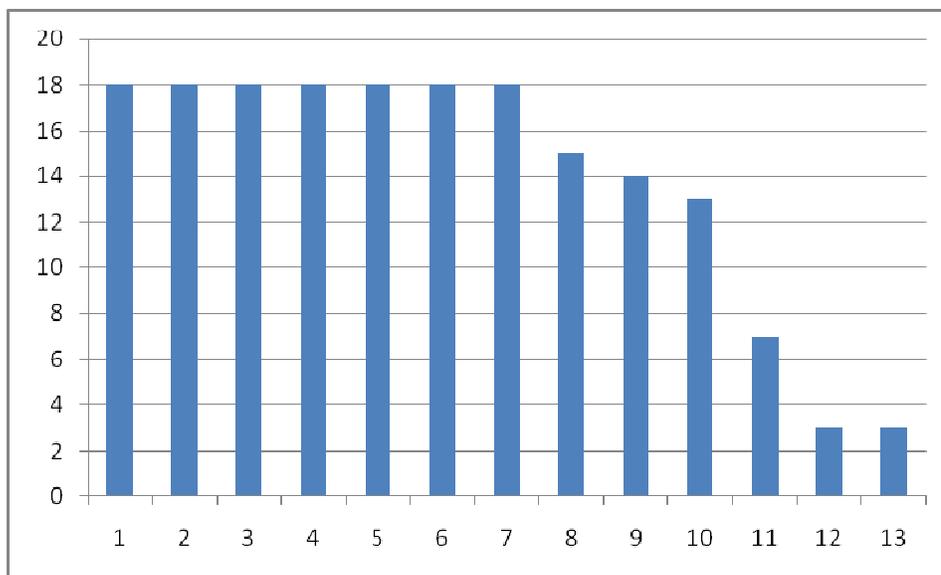
A notice was posted weekly by the Activity Director at TigerPlace to remind the study group of the days and times for dancing. In addition, the Dance-Based Therapy was posted on the monthly and daily TigerPlace calendar, with other diverse facility activities, The participants in the treatment and control groups were encouraged to continue with their normal routines. The attendance was tracked for each session. Reasons for not attending were not recorded daily, however, the PI checked weekly with the TigerPlace nurse and activities staff to identify if continued participation was feasible from a functional status point of view for participants who did not attend. This proved to be beneficial and guided the approach to encourage continued participation or take a break from the treatment.

Seven of the thirteen participants in the treatment group who completed the study attended eighteen sessions, compared to one of eleven participants in the pilot study. Figure#6.7 identifies the number of session attended per participant. Similar to the results of the pilot study that revealed most older persons who joined dance-based therapy sessions will continue to attend. Moreover, a personal communication from the TigerPlace administrator reinforced the finding that the activity was a very positive experience for the residents.

The reasons for limited attendance by some of the participants in the treatment group were related to medical frailty issues, including hospitalizations, depression, falls,

and pain issues. One person required a break of two different weeks during the eight week study, due to medical issues, but returned to complete a total of 13 sessions. Two participants who completed three sessions the first two weeks were not able to continue due to medical reasons, but were included in the post-measurements. One person in the treatment group who completed eighteen sessions was not able to complete the GAITRite post-data collection due to frailty issues that increased from the pre-measurement period.

Figure 6.7. # of Sessions Attended Per Participant



Data Analysis

The aim of the proposed study was to test the effect of TLM on selected fall risk factors in older persons defined as: a.) balance, b.) mobility, and c). fear of falling.

Treatment and control groups were compared with respect to the baseline and post intervention multi-directional reach test, GAITRite measurement of mobility (habitual gait defined as velocity), FAP, SLD, and total score on the ABC scale.

To assure data quality, all data were double-entered in the spreadsheet and the dataset was used only after a cleaning process of files. Comparison of the baseline value of each outcome was used as the covariate. Since the sample size is relatively small, it was difficult to evaluate whether or not each outcome measures follows normal distribution. Therefore, both parametric and nonparametric tests were used to evaluate both within and between group differences. For parametric test, a paired t-test and a two sample t-test were used to test changes within a group, difference in changes between groups, respectively.

For nonparametric tests, the Wilcoxon signed rank test and the Wilcoxon rank sum test were used. In order to account for differences in baseline values, the Analysis of Covariance (ANCOVA) was used to test difference in changes between groups. The assumption of homogeneous random errors in ANCOVA was visually checked in the residual plot for each outcome measure and no serious violation was found (Jackson & Hewett, 2001) The general linear model procedure in SAS was used for ANCOVA. Statistical significance was set at alpha level = 0.05. Statistical support was provided by biostatisticians at the University of Missouri Medical Research Office.

Results

The following Tables 6.3 and 6.4 display the paired T-test by group and a two sample T-test to test changes within a group, difference in changes between groups, respectively. Table 6.5 shows the results of the ANCOVA analysis. Even though there was a distributional difference in pre-measures between two groups, the data did not show post-measures in the treatment group improved significantly as compared to the control, after controlling for the pre-measures. There is no significant difference in the

comparison post ABC scores between groups. The mean, after controlling for pre-measures in the control group is slightly higher than the one for the treatment group, but inconclusive. This insignificance might be due to the small sample size. The study was projected to have about 80% power to detect a difference of 3 inches between the two Functional Reach group means with a level of significance of .05 and a total sample size of 28. The post-measurement sample size of 24, not factoring in missing data for the ABCS, did not result in enough power for significance.

Table 6.3 Data Analysis Paired T- Test by Group

Measure	Group 1=Treatment 2=Control	n	Mean of Premeasures (SD)	Mean of Postmeasures (SD)	Mean Difference	p1	p2
Forward Reach (FR)	1	13	9.88 (4.28)	9.02 (2.62)	-0.87	0.39	0.62
	2	11	13.20 (3.06)	11.45 (1.57)	-1.75	0.089	0.15
Right Reach (RR)	1	13	6.90 (2.33)	7.71 (2.73)	.81	0.24	0.28
	2	11	8.73 (2.56)	9.34 (1.76)	0.61	0.24	0.32
Left Reach (LR)	1	13	7.96 (2.94)	8.58 (2.91)	0.62	0.34	0.33
	2	11	9.59 (2.31)	9.57 (1.93)	-0.02	0.98	0.98
Backwards Reach (BR)	1	13	4.75 (2.31)	2.50 (1.06)	-2.25	0.00	0.00
	2	11	5.48 (2.23)	2.27 (1.23)	-3.20	0.00	0.00
Functional Ambulation Profile (FAP)	1	12	71.85 (19.93)	72.92 (14.47)	-1.42	0.44	0.65
	2	11	75.82 (15.87)	78.00 (14.50)	2.18	0.45	0.66
Velocity	1	12	61.84 (32.10)	65.00 (28.13)	-1.60	0.76	0.91
	2	11	67.80 (22.42)	71.77 (21.51)	3.97	0.22	0.39
Step Length Differential (SLD)	1	12	2.88 (2.45)	2.67 (2.28)	-0.21	0.71	0.73
	2	11	3.91 (2.35)	3.72 (2.47)	-0.19	0.77	0.70

p-value¹ are based on a paired T-test by group while p-value² are based on a Wilcoxon rank sum test

FR Mean of pre-measure = clinical difference

FR and BR=both groups decreased; T decreased less than C

SLD= negative is better

The mean pre-measurement Forward Reach for the treatment group was 9.88 (SD 4.29), versus the control group 13.20 (SD 3.06). The treatment group had more baseline functional difficulties related to balance: less than 6 or 7 inches indicating limited functional balance, along with an increased fall risk (Duncan et al., 1990) ..The other measurements, although inconclusive, did not support dance-based therapy.

Table: 6.4 Data Analysis Two- Sample T-Test

Measure	Group	N	Mean of Difference (±SD)	95% Confidence Interval For Mean of Differences	P-value ¹	P-value ²
FR	1	13	-0.87 (±3.49)	(-2.97, 1.24)	0.52	0.39
	2	11	-1.75 (±3.09)	(-3.82, 9.32)		
RR	1	13	0.81 (±2.36)	(-0.62; 2,23)	0.82	0.95
	2	11	0.61 (±1.64)	(-0.49;1.72)		
LR	1	13	0.62 (±2.25)	(-0.74;1.97)	0.52	0.51
	2	11	-0.02 (±2,59)	(-1.76;1.72)		
BR	1	13	-2.25 (±1.68)	(-3.26; -1.23)	0.23	0.48
	2	11	-3.20 (± 2.29)	(-4.75; -1.66)		
FAP	1	12	-1.42 (±6.19)	(-5.35; 2.51)	0.27	0.72
	2	11	2.18 (±9.11)	(-3.94; 8.30)		
Velocity	1	12	-1.60 (±17.84)	(-12.94-9.74)	0.37	0.45
	2	11	3.97 (±10.09)	(-2.81; 10.75)		
SLD	1	12	-0.21 (±1.89)	(-1.41;0.99)	0.98	0.95
	2	11	-0.19 (±2.04)	(-1.56-1.18)		
ABCS	1	6	3.93(±7.93)	(-4.40; 12.25)	0.80	1.00
	2	9	5.35(±13.26)	(-4.84; 15.54)		

P-value¹ are based on a two sample t-test while P-value² are based on a Wilcoxon rank sum test.

FR =less decline in T versus C

BR showed both groups decreased; T decreased less than C

SLD show both groups declined; neg is better, so T showed more improvement than C

Small trends were noted in FR, BR, and STL, despite functional difference in groups. A decline in both groups may be due to seasonal declines in older persons related to winter months (CDC, 2010)

Table 6.5 Data Analysis ANCOVA by Group

Measure	N	parameters	Estimates	Standard Error	p-value
FR	24	PREFR	0.29	0.11	0.02
		Group (1-2)	-1.48	0.89	0.11
RR	24	PRERR	0.60	0.16	0.00
		Group (1-2)	-0.53	0.82	0.52
LR	24	PRELR	0.54	0.17	0.00
		Group (1-2)	-0.17	0.81	0.90
BR	24	PREBR	0.25	0.10	0.02
		Group (1-2)	0.41	0.42	0.35
FAP	23	PREFAP	0.86	0.09	0.00
		Group (1-2)	-3.80	3.15	0.24
Velocity	23	PREVelocity	0.82	0.12	0.00
		Group (1-2)	-5.79	2.00	0.34
Step Length Differential	23	PRESLD	0.65	0.17	0.00
		Group (1-2)	-0.38	0.78	0.63

Data analysis using both t-test and ANCOVA support improvement in BR and SLD following dance-based therapy. Although non-significant, trends were noted. These two areas were not measured in the pilot study.

The ABCS requires that at least 12 out of 16 questions are answered in order to maintain the established reliability of 0.95 (Talley, Wyman, & Gross, 2008). Nine participants did not answer at least 12 questions, excluding these from the final analysis. The questions most frequently not answered, were questions representing activities that higher functioning older persons may feel confident doing e.g. shopping in a busy mall. A person with a lower functioning level may no longer be performing these activities and never anticipate performing them again, thus would answer zero. Two other

questions not answered are related to getting on or off an escalator. During the course of the study it was discovered, that there is only one escalator in the area where the participants lived. Thus, the participants would most likely not be exposed to this activity, making the question difficult to answer. Tables 6.6 and 6.7 display the ABCS T-test and Wilcoxon Rank Sum Test. The study does not have enough power to detect the small group difference with a total of 15 sample size. Additional study confirmed there is no way to deal with the missing data if the situations were not relevant for some of the subjects (Personal correspondence with Myers, 2010)

Table 6.6 Data Analysis ABCS Independent Paired T Test by Group

Measure	Group: 1=Treatment 2-Control	Pre-Mean	Post-Mean	Mean Difference	p value
ABCS	1=6	8.40	8.74	3.37	.72
	2=9	7.36	7.71	5.54	

Table 6.7: ABCS Data Analysis using Wilcoxon Rank Sum Test.

Group	N	Mean Difference	SD	p
1	6	3.93	7.93	0.99
2	9	5.35	13.25	

Interpretation

The change in the mean BR increased by 2.25 inches in the treatment group, while the SLD mean, decreased by .21 cm. Both of these were new trends in the

treatment group not measured in the pilot study. The other measures did not support the efficacy of the study, and while showing trends with improved balance mobility and increased mobility in the control group, compared to the treatment group, but were inconclusive.

Extreme examples of mean changes were further analyzed. Although the age difference is not significant between the treatment and control group, the treatment group appears to be at a lower level of function, prior to the dance intervention. Table 6.3 reports a difference in the mean pre-measurements for the treatment group, compared to the control group, representative of a lesser level of function and higher level of frailty. The mean pre-measurement Functional Forward Reach for the treatment group was 9.88 inches, versus the control group 13.20 inches. This measurement is very important to function in older persons and supports the assumption that the treatment group had more functional difficulties prior to the intervention. Scores with less than six or seven inches in Functional Reach indicate limited functional balance, along with an increased fall risk. Most healthy individuals with adequate functional balance can reach ten or more inches (Duncan et al., 1990). Conversely, the PreFR in the treatment group is significantly different at 0.43 at baseline. Furthermore, the PreRR is very close to being significant at .082. Although an alternate form of therapy was not provided to the control group, the normal activities of many of this group include a regular exercise routine of walking on the treadmill and attending community exercise sessions outside of TigerPlace.

The study design was chosen to compare a treatment and control group. The facility which is the aging in place model, representing the continuum of aging from an active older person to frail, demonstrates a disparity between the levels of function in the

two groups at baseline. The only physical inclusion criteria, being able to stand with or without assistance, did not identify the extreme continuum of aging representative of the study subjects.

A randomized method was used to assign the groups, but a match on functional level was not included. Three persons in the treatment group reported falls during the study, which is another representation of decreased function at baseline, compared to none in the control group. The reasons for attrition and limited attendance by some of the participants in the treatment group were related to medical frailty issues, including hospitalizations, depression, falls, and pain issues. Furthermore, one person in the treatment group discontinued dancing after the first session due to a perception that he was much healthier than the rest of the group and the dance sessions would not increase his balance or mobility. One person required breaks of two different weeks during the eight week study, due to medical issues, but returned and completed the study.

Limitations

The study did not meet the projected power due to the attrition and loss of data from the ABC scale. Since all of the participants were recruited from the same facility, the results may not be generalizable. Although the TigerPlace population is representative of the older population as a whole, it is anticipated further study will be needed based on the results of this research to include other populations of older persons socioeconomically different.

Members in the intervention group were at risk for the Hawthorne effect when completing the ABC scale post intervention. Since fear of falling is a subjective measurement and this group may be considered special due to being in the dance group, a

tendency to report the desired outcome may have occurred. All participants were asked to complete the ABCS as honestly as possible, regardless of group assignment (Portney & Watkins, 2000). Members in the control group were also at risk for the reverse Hawthorne effect when completing the ABC scale post intervention. The dance-based therapy sessions were created decrease fear of falling, thus the group not dancing may have thought that they were at a higher risk of falling by not receiving the intervention, compared to the treatment group. There was disappointment expressed by members of the control group not being placed in the treatment group, therefore the self-reported scores on the ABC may have been biased.

The disappointment did not cause attrition, but was a point of discussion among the TigerPlace residents during the study. The residents communicate freely with each other about activities occurring at the facility. The discussion may have introduced bias into the study. (Polit & Beck, 2008).

Discussion

Twenty seven subjects mean age 85, participated in a study testing the effect of dance-based therapy in January and February, 2010. The subjects were randomly assigned to a treatment and control group. The treatment groups were asked to attend 18 dance sessions over a two-month period. The high attendance rate, with over 50% of the treatment group attending 18 sessions, demonstrates an interest in this type of dance-based therapy. Similar to the results of the pilot study, most older persons who joined dance-based therapy sessions continued to attend (Krampe et al., 2010). Furthermore, the intervention received positive feedback from the manager of the facility.

Although Wilcoxon, T-tests and ANCOVA analysis did not reveal significant effect of the dance-based therapy, trends increased in backwards reach and decreased step length differential were noted. Although inconclusive, these trends add to the trends noted in the pilot study (Krampe, 2010).

The research on the physical benefits of dance-based therapy in older persons continues to emerge (Jacobson et al., 2005). Although the concept of dance-based therapy for older persons has been around for 30 years, previous research has been focused primarily on increasing quality of life with older persons (Beal & Berryman-Miller, 1988). DMT tends to focus on improving psychological outcomes over traditional physiological outcomes (Cotter 1999). The idea of using dance to benefit seniors in a formalized, physical therapeutic way is growing attention as the population ages. To my knowledge, the first systematic review on the benefits of dancing for healthy older adults was recently reported (Keogh, Kilding, Pidgeon, Ashley & Gillis, 2009). The results of eighteen studies using various styles of dancing as an intervention report evidence for healthy older adults to improve balance and gait. Keogh calls for further research to determine the efficacy of different forms of dance, the relative effectiveness of these forms of dance, compared with other exercise modes, and how best to engage older adults in dance participation. Furthermore, continued research for older persons across the continuum of functional capabilities and limitations is needed.

This study facilitated a regular exercise routine for persons who may have otherwise chosen not to exercise during the study period. Individuals with a sedentary life history are the most difficult to motivate with respect to exercise adherence. This can be aided by selecting activities that are enjoyable and by allowing individuals to select

some of their own activities. Equally, it is important not to discourage participation by overzealous prescription that may cause adverse events. Dance as therapeutic therapy comes in many forms and levels of intensity. The intervention used for the eight weeks of dance based therapy was based on the routine choreographed for the pilot study. The nursing doctoral student was sensitive to the fall risk and functional limitations of some of the participants in the treatment group. A future study with stratified groups based on function is necessary.

The participants who were recruited for this study have greater opportunities to be involved in other daily activities, compared to the participants in the pilot project. There was an attempt to compensate for this by offering multiple opportunities to attend dance sessions, so the three sessions per week can be achieved. The availability of dance needs to be customized in further study to support similar results with good attendance.

TLM allows the leader to customize the group sharing component of the sessions as appropriate to the group. The TigerPlace residents enjoyed reminiscing about the music chosen from the Big Band era, and discussed some of the dancing activities they enjoyed during those years. They were interested in the stories behind some of the music, so these were discussed during breaks.. In addition, the residents were interested in TLM, and expressed enjoyment receiving information about this method.

During the course of the study, visitors were allowed to participate as room allowed. This included TigerPlace residents who did not meet the study criteria or who were available to participate after the recruitment period had ended. Two residents in this category regularly joined the group. One of these resident's daughter was pleased that she was participating and said her mother used to dance on the Lawrence Welk Show.

During the month of February, Sinclair School of Nursing students joined the group on Wednesdays and Thursdays, as part of their clinical experience at TigerPlace. The students were similarly involved with other activities involving the control group, thus a bias was not introduced to the study. In addition, several family members attended the dance sessions with the residents over the course of the study, including, daughters and sisters.

Although this study was focused on fall risk, a broader issue related to maintaining physical function is relevant to the aging population. Future study researching the impact of dance-based therapy on function in older persons would be valuable.

The lack of significance discussed in the previous section may be due to the sample size. Although attrition was low, each participant lost to follow up is important in a small sample. Thus, future study should include a larger sample and factor in attrition due to medical issues inherent to this population.

The missing data measuring fear of falling could be avoided in the future by selecting an instrument relevant to the entire study population. For example, the Activities -Specific Fall Caution Scale, (AFC) may be a better tool to measure fear of falling for older persons across the continuum of functional capacity (Blanchard, Myers, & Pearce, 2007).

Furthermore, the gender mix was initially balanced with 17 females and 10 males. Only one male attended 18 sessions. Future qualitative studies focused on men's interest in dance-based therapy would be helpful in providing insight into a successful program to engage men in this activity.

This study is the first randomized clinical trial using The Lebed Method with older persons. This success of recruiting participants for this study reinforces the results reported in the pilot study, that older persons will consent to participate and will continue to attend dance sessions. This dance method has merit in serving as dance-based therapy with an aging population, both the well older persons and persons with functional limitations. Future study is needed to build evidence of the benefits of dance-based therapy in this growing population.

References

- Alexander, B., Rivara, F., & Wolf, M. (1992). The cost and frequency of hospitalization for fall related injuries in older adults. *American Journal of Public Health*. 82(7), 1020-3.
- Belardinelli R. et al. (2006). Dancing in patients with Chronic Heart Failure: A new form of exercise training. *American Heart Association Scientific Sessions*, Abstract 3957.
- Blanchard, R., Myers, A., & Pearce, N. (2007). Reliability, construct validity, and clinical feasibility of the Activities-Specific Fall Caution Scale for residential living seniors. *Archives of Physical Medicine Rehabilitation*. 88, 732-739.
- Blinney, B., Morris, M., & Webster, K. (2003). Concurrent related validity of the GAITRite Walkway System for quantification of the spatial and temporal parameters of gait. *Gait and Posture*, 17, 68-74.
- Centers for Disease Control and Prevention (2008). Cost of falls among older adults. Retrieved September 23, 2008 from <http://www.cdc.gov/ncipc/factsheets/fallcost.htm>
- Chang, J. (2004). Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomized clinical trials. *British Medical Journal*. 328(7441), 680-683.
- Chang, H. J. (2010). Falls and older adults. *The Journal of American Medical Association*, 303(3), 288.

- Cohen-Mansfield, J., Marx, M., & Guralnik, J. (2003). Motivators and barriers to exercise in older community-dwelling population. *Journal of Aging and Physical Activity*. 11(2), 242- 253.
- Duncan, P., Weiner, D., Chandler, J., & Studenski, S. (1990). Functional Reach: A new clinical measure of balance. *Journal of Gerontology*, 45, M192-197.
- Englander, F., Hodson, T., & Terregrossa, R. (1996). Economic dimensions of slip and fall injuries..*Journal of Forensic Science*. 41(5), 733–46.
- Eyigor, S., Karapolat, H., Durmaz, B., Ibisoglu, U., & Cakir, S. (2007) A randomized controlled trial of Turkish folklore dance on the physical performance, balance, depression and quality of life in older women, *Arch Gerontol Geriatr*. doi:10.1016/j.archger.10.008.
- Federici, A., Bellagamba, S., & Rocchi, M. (2005). Does dance-based training improve balance in adult and young old subjects? A pilot randomized controlled trial. *Aging Clinical and Experimental Research*.17 (5), 385-389.
- Foreman, M.D., Fletcher, K., Mion, L.C., & Simon, L. (1996). Assessing Cognitive Function. *Geriatric Nursing*, 17; 228-233.
- Gillespie, L., Gillespie, W., Robertson, M., Lamb, S., Cumming, R., & Rowe, B. (2007). Interventions for preventing falls in elderly people. *Cochrane Database of Systematic Reviews*, (4).
- Guralnik, J., Ferrucci, L., Pieper, C., Leveille, S., Markides, K., Ostir, G., et al. (2000). Lower extremity function and subsequent disability: Consistency across studies, predictive models, and value of gait speed alone compared with the short physical performance battery. *J Gerontol A Biol Sci Med Sci*, 55(4), M221-231.

- Hackney, M., Kantorovich, S., Levin, R., & Earhart, G. (2007). Effects of Tango on functional mobility in Parkinson's disease: A preliminary study. *Journal Neurological Physical Therapy*. 31, 173-179.
- Hamburg, J. & Clair, A. (2003). The effects of a Laban-based movement program with music on measures of balance and gait in older adults. *Activities, Adaptation & Aging*. 28(1), 17-33.
- Hausdorff, J., Rios, D., & Edelber, H. (2001). Gait variability and fall risk in community-living older adults: A 1-year prospective study. *Archives of Physical Medicine and Rehabilitation*. 82(8), 1050–6.
- Hornbrook M., Stevens V., Wingfield D., Hollis J., Greenlick M., & Ory, M. (1994). Preventing falls among community-dwelling older persons: Results from a randomized trial. *The Gerontologist*. 34(1), 16–23.
- Huang, H., Gau, M., Kernohan, G., & Lin, W. (2003). Assessing risk of falling in older adults. *Public Health Nursing*. 20(5), 399-411.
- Institute of Medicine. (1992). Falls in older persons: Risks, fears, and prevention. *The second fifty years: Promoting health and preventing disability*, Retrieved June 22, 2005 from <http://www.nap.edu/books/309046815/html>.
- Jackson, J. & Hewett, J. (2001). Evaluation of Power of Tests Involving Covariates Under Nonconstant Variance. *Communications in Statistics – Theory and Methods*, 30, 2005-2021.
- Keogh, J., Kilding, A., Pidgeon, P., Ashleu, L & Gillis, (2009). Physical benefits of dancing for healthy older adults; A review. *Journal of Aging and Physical Activity*. 17, 479-500.

- Krampe, J, Rantz, M., Dowell, L., Schamp, R., Skubic, M. & Abbott, C. (2010) *Nurse Admin Q* 34 (2), 156–161 Lippincott Williams & Wilkins
- Lach, H. (2002). Fear of falling: An emerging public health problem. *Generations*, 3, 33-37.
- Lees, F., Clark, P., Niggs, C., & Newman, P. (2005). Barriers to exercise behavior among older adults: A focus group study. *Journal of Aging and Physical Activity*. 13, 23-33.
- Lebed Davis, S. (2002) *Thriving after breast cancer: Essential healing exercises for body and mind*. Broadway Books; New York.
- Lebed, S. (n.d.). The Lebed Method: Focus on dance and healing movement. Retrieved February 18, 2008 from <http://www.Lebedmethod.com/WhoWeAre.asp>
- Nagi, S. (1965). Disability concepts revisited: Implications for prevention. *Disability in America: Toward a National Agenda for Prevention*. Institute of Medicine National Academy Press, Washington DC, 309-307.
- National PACE Association (2008). About us. Retrieved November 20 from <http://www.npaonline.org/website/article.asp?id=5>.
- Nikolaus, T. & Bach, M. (2003). Preventing falls in community-dwelling frail older people using a Home Intervention Team (HIT): Results from the Randomized Falls-HIT Trial. *Journal of the American Geriatrics Society*, 51(3), 300-5.
- Nelson, A., Certo, L., Lembo, L., Lopez, D., Manfredonia, S., Vanichpong, D.Z. (1999). The functional ambulation performance of elderly fallers and non-fallers walking at their preferred velocity. *NeuroRehabilitation*. 13(3), 141-146..
- Polit, D. & Beck, C. (2006). *Nursing Research: Principles and Methods*, 7th edition.

Lippincott Williams & Wilkins: Philadelphia.

Portney, L. & Watkins, M. (2000). *Foundations of Clinical Research, 2nd edition.*

Prentice Hall Health, New Jersey

Powell, L. & Myers, A. (1995). The Activities-specific Balance Confidence Scale

(ABCS). *J Gerontol Med Sci.* 50(1), M28-34

Rantz, M. J. (2003). Aging in place. *Nurseweek, Midwest/Heartland Edition*, 4(2), 7.

Rantz, M. J., Skubic, M., Miller, S.J., & Krampe, J. (2008). Using Technology to

Enhance Aging in Place, Smart Homes and Health Telematics of Lecture Notes in

Computer Science. http://dx.doi.org/10.1007/978-3-540-69916-3_20

Rawsky, E. (1998). Review of the literature on falls in the elderly. *Image-The Journall*

of Nursing Scholarship. 30(1), 47-52.

Robbins, A., Rubenstein, L., Josephson, K., et al. (1989). Predictors of falls among

elderly people: Results of two population-based studies. *Arch Intern Med.*

149(121), 1628-1633.

Roma, A., Chiearello, L., Barker, S., & Brenneman, S. (2001). Examination and

comparison of the relationships between strength, fall history, and ambulatory

function in older adults. *Issues on Aging.* 24(2), 21-30.

Sandel, S., Judge, J., Landry, N., Faria, L., Ouellette, R., & Majczak, M. (2005). Dance

movement program improves quality-of life-measures in breast cancer survivors.

Cancer Nursing. 28(4), 301-309.

Sheehy, G., (1995). *New passages: Mapping your life across time.* Ballantine : New

York p138.

- Song, R., June, K., Kim, C., & Jeon, M. (2004). Comparisons of motivation, health behaviors, and functional status among elders in residential homes in Korea. *Public Health Nursing*. 21(4), 361-371.
- Stevens, J., Corso, P., Finkelstein, E. & Miller, T. (2006). The costs of fatal and nonfatal falls among older adults, *Injury Prevention*, 12, 290-5.
- Talley, K., Wyman, J., & Gross, C. (2008). Psychometric properties of the Activities-Specific Balance Confidence Scale and the Survey of Activities and Fear of Falling in older women. *Journal of the American Geriatric Society*. 56, 328-333
- Titianova, EB, Pikanen, Paakkonen, A., Sivenius, J. & Tarkka, IM. (2003). Gait characteristics and functional ambulation profile in patients with chronic unilateral stroke.. *American Journal of Physical Medicine Rehabilitation*..82(10), 778-786.
- Tinetti, M., Williams, T., & Mayewski, R. (1986). Fall risk index for elderly patients based on number of chronic disabilities. *American Journal of Medicine*.80, 429-434.
- Tinetti, M., Richman, D., & Powell, L. (1990). Falls efficacy as a measure of fear of falling. *Journal of Gerontology*. 45(6), P239-43.
- Tinetti, M., Mendes de Leon, C, Doucette, J.,& Baker, D., Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *Journal of the Gerontological Medical Society*, 49A, M140-147
- U.S. Department of Health and Human Services (2007). *National Institute on Aging*. NIH Publication # 07.6252

- VanSwearingen, J., Paschal, K., Bonino, P., & Yang, J. (1996). The modified Gait Abnormality Rating Scale for recognizing the risk of recurrent falls in community-dwelling elderly adults. *Phys Ther*, 76(9), 994-1002.
- Verbrugge, L. & Jette, A. (1994). The disablement process. *Social Science Medicine*. 38(1,) 1-14.

References

- Alexander, B., Rivara, F., & Wolf, M. (1992). The cost and frequency of hospitalization for fall related injuries in older adults. *American Journal of Public Health*. 82(7), 1020-3.
- Belardinelli R. et al. (2006). Dancing in patients with Chronic Heart Failure: A new form of exercise training. *American Heart Association Scientific Sessions*, Abstract 3957.
- Blanchard, R., Myers, A., & Pearce, N. (2007). Reliability, construct validity, and clinical feasibility of the Activities-Specific Fall Caution Scale for residential living seniors. *Archives of Physical Medicine Rehabilitation*. 88, 732-739.
- Bliney, B., Morris, M., & Webster, K. (2003). Concurrent related validity of the GAITRite Walkway System for quantification of the spatial and temporal parameters of gait. *Gait and Posture*, 17, 68-74.
- Centers for Disease Control and Prevention (2008). Cost of falls among older adults. Retrieved September 23, 2008 from <http://www.cdc.gov/ncipc/factsheets/fallcost.htm>
- Chang, J. (2004). Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomized clinical trials. *British Medical Journal*. 328(7441), 680-683.
- Cohen-Mansfield, J., Marx, M., & Guralnik, J. (2003). Motivators and barriers to exercise in older community-dwelling population. *Journal of Aging and Physical Activity*. 11(2), 242-253.

- Duncan, P., Weiner, D., Chandler, J., & Studenski, S. (1990). Functional Reach: A new clinical measure of balance. *Journal of Gerontology*, 45, M192-197.
- Englander, F., Hodson, T., & Terregrossa, R. (1996). Economic dimensions of slip and fall injuries. *Journal of Forensic Science*. 41(5), 733-46.
- Eyigor, S., Karapolat, H., Durmaz, B., Ibisoglu, U., & Cakir, S. (2007) A randomized controlled trial of Turkish folklore dance on the physical performance, balance, depression and quality of life in older women, *Arch Gerontol Geriatr*. doi:10.1016/j.archger.10.008.
- Federici, A., Bellagamba, S., & Rocchi, M. (2005). Does dance-based training improve balance in adult and young old subjects? A pilot randomized controlled trial. *Aging Clinical and Experimental Research*. 17 (5), 385-389.
- Foreman, M.D., Fletcher, K., Mion, L.C., & Simon, L. (1996). Assessing Cognitive Function. *Geriatric Nursing*, 17; 228-233.
- Gillespie, L., Gillespie, W., Robertson, M., Lamb, S., Cumming, R., & Rowe, B. (2007). Interventions for preventing falls in elderly people. *Cochrane Database of Systematic Reviews*, (4).
- Guralnik, J., Ferrucci, L., Pieper, C., Leveille, S., Markides, K., Ostir, G., et al. (2000). Lower extremity function and subsequent disability: Consistency across studies, predictive models, and value of gait speed alone compared with the short physical performance battery. *J Gerontol A Biol Sci Med Sci*, 55(4), M221-231.
- Hackney, M., Kantorovich, S., Levin, R., & Earhart, G. (2007). Effects of Tango on functional mobility in Parkinson's disease: A preliminary study. *Journal Neurological Physical Therapy*. 31, 173-179.

- Hamburg, J. & Clair, A. (2003). The effects of a Laban-based movement program with music on measures of balance and gait in older adults. *Activities, Adaptation & Aging*. 28(1), 17-33.
- Hausdorff, J., Rios, D., & Edelber, H. (2001). Gait variability and fall risk in community-living older adults: A 1-year prospective study. *Archives of Physical Medicine and Rehabilitation*. 82(8), 1050–6.
- Hornbrook M., Stevens V., Wingfield D., Hollis J., Greenlick M., & Ory, M. (1994). Preventing falls among community-dwelling older persons: Results from a randomized trial. *The Gerontologist*. 34(1), 16–23.
- Huang, H., Gau, M., Kernohan, G., & Lin, W. (2003). Assessing risk of falling in older adults. *Public Health Nursing*. 20(5), 399-411.
- Institute of Medicine. (1992). Falls in older persons: Risks, fears, and prevention. *The second fiftyyears: Promoting health and preventing disability*, Retrieved June 22, 2005 from <http://www.nap.edu/books/309046815/html>.
- Jackson, J. & Hewett, J. (2001). Evaluation of Power of Tests Involving Covariates Under Nonconstant Variance. *Communications in Statistics – Theory and Methods*, 30, 2005-2021.
- Keogh, J., Kilding, A., Pidgeon, P., Ashleu, L & Gillis, (2009). Physical benefits of dancing for healthy older adults; A review. *Journal of Aging and Physical Activity*. 17, 479-500.
- Krampe, J, Rantz, M., Dowell, L., Schamp, R., Skubic, M. & Abbott, C. (2010) *Nurse Admin Q* 34 (2), 156–161 Lippincott Williams & Wilkins

- Lach, H. (2002). Fear of falling: An emerging public health problem. *Generations*, 3, 33-37.
- Lees, F., Clark, P., Niggs, C., & Newman, P. (2005). Barriers to exercise behavior among older adults: A focus group study. *Journal of Aging and Physical Activity*, 13, 23-33.
- Lebed Davis, S. (2002) *Thriving after breast cancer: Essential healing exercises for body and mind*. Broadway Books; New York.
- Lebed, S. (n.d.). The Lebed Method: Focus on dance and healing movement. Retrieved February 18, 2008 from <http://www.Lebedmethod.com/WhoWeAre.asp>
- Nagi, S. (1965). Disability concepts revisited: Implications for prevention. *Disability in America: Toward a National Agenda for Prevention*. Institute of Medicine National Academy Press, Washington DC, 309-307.
- National PACE Association (2008).About us. Retrieved November 20 from <http://www.npaonline.org/website/article.asp?id=5>.
- Nikolaus, T. & Bach, M. (2003). Preventing falls in community-dwelling frail older people using a Home Intervention Team (HIT): Results from the Randomized
- Nelson, A., Certo, L., Lembo, L., Lopez, D., Manfredonia, S., Vanichpong, D.Z. (1999). The functional ambulation performance of elderly fallers and non-fallers walking at their preferred velocity. *NeuroRehabilitation*, 13(3), 141-146..
- Falls-HIT Trial. *Journal of the American Geriatrics Society*, 51(3), 300-5.
- Polit, D. & Beck, C. (2006). *Nursing Research: Principles and Methods*, 7th edition. Lippincott Williams & Wilkins: Philadelphia.

- Portney, L. & Watkins, M. (2000). *Foundations of Clinical Research, 2nd edition*.
Prentice Hall Health, New Jersey
- Powell, L. & Myers, A. (1995). The Activities-specific Balance Confidence Scale (ABCS). *J Gerontol Med Sci.* 50(1), M28-34
- Rantz, M. J. (2003). Aging in place. *Nurseweek, Midwest/Heartland Edition*, 4(2), 7.
- Rantz, M. J., Skubic, M., Miller, S.J., & Krampe, J. (2008). Using Technology to Enhance Aging in Place, Smart Homes and Health Telematics of Lecture Notes in Computer Science. http://dx.doi.org/10.1007/978-3-540-69916-3_20
- Rawsky, E. (1998). Review of the literature on falls in the elderly. *Image-The Journal of Nursing Scholarship.* 30(1), 47-52.
- Robbins, A., Rubenstein, L., Josephson, K., et al. (1989). Predictors of falls among elderly people: Results of two population-based studies. *Arch Intern Med.* 149(121), 1628-1633.
- Roma, A., Chiearello, L., Barker, S., & Brenneman, S. (2001). Examination and comparison of the relationships between strength, fall history, and ambulatory function in older adults. *Issues on Aging.* 24(2), 21-30.
- Sandel, S., Judge, J., Landry, N., Faria, L., Ouellette, R., & Majczak, M. (2005). Dance movement program improves quality-of life-measures in breast cancer survivors. *Cancer Nursing.* 28(4), 301-309.
- Sheehy, G., (1995). *New passages: Mapping your life across time*. Ballantine : New York p138.

- Song, R., June, K., Kim, C., & Jeon, M. (2004). Comparisons of motivation, health behaviors, and functional status among elders in residential homes in Korea. *Public Health Nursing*. 21(4), 361-371.
- Stevens, J., Corso, P., Finkelstein, E. & Miller, T. (2006). The costs of fatal and nonfatal falls among older adults, *Injury Prevention*, 12, 290-5.
- Talley, K., Wyman, J., & Gross, C. (2008). Psychometric properties of the Activities-Specific Balance Confidence Scale and the Survey of Activities and Fear of Falling in older women. *Journal of the American Geriatric Society*. 56, 328-333
- Tinetti, M., Williams, T., & Mayewski, R. (1986). Fall risk index for elderly patients based on number of chronic disabilities. *American Journal of Medicine*.80, 429-434.
- Tinetti, M., Richman, D., & Powell, L. (1990). Falls efficacy as a measure of fear of falling. *Journal of Gerontology*. 45(6), P239-43.
- Tinetti, M., Mendes de Leon, C, Doucette, J.,& Baker, D., Fear of falling and fall-related efficacy in relationship to functioning among community-living elders. *Journal of the Gerontological Medical Society*, 49A, M140-147
- Titianova, EB, Pikanen, Paakkonen, A., Sivenius, J. & Tarkka, IM. (2003). Gait characteristics and functional ambulation profile in patients with chronic unilateral stroke.. *American Journal of Physical Medicine Rehabilitation*..82(10), 778-786.
- U.S. Department of Health and Human Services (2007). *National Institute on Aging*. NIH Publication # 07.6252

- VanSwearingen, J., Paschal, K., Bonino, P., & Yang, J. (1996). The modified Gait Abnormality Rating Scale for recognizing the risk of recurrent falls in community-dwelling elderly adults. *Phys Ther*, 76(9), 994-1002.
- Verbrugge, L. & Jette, A. (1994). The disablement process. *Social Science Medicine*. 38(1,) 1-14.

Appendix A



David Oliver
Assistant Director
MU Interdisciplinary Center on Aging
M239 Medical Sciences Building
Columbia, Missouri 65211

October 2, 2008

Dear Dr. Oliver,

I am pleased to write this letter of support on behalf of TigerPlace. The Research Enrichment and Dissemination grant application submitted by Jean Krampe, MSN, RN, Doctoral Nursing Student titled "Dance-Based Therapy in Older Persons: Does Participation Improve Balance and Mobility?" has the full support of TigerPlace.

This project is an innovative and interdisciplinary study lead by Jean Krampe, under the advisement of Dr. Marilyn Rantz and Dr. Marjorie Skubic. I am excited about the efforts of this outstanding interdisciplinary team to provide a therapeutic dance based intervention for the residents at TigerPlace. I believe this project will demonstrate measurable results related to balance and mobility in older persons. This project has my full support and encouragement to recruit participants for the study to be conducted in late 2009-2010.

Jean has successfully supported interdisciplinary research projects at TigerPlace for the past two years. She is familiar with the residents and the model of care. I believe her experience with the aging population combined with the expertise of her advisors will ensure the success of this project.

The risk for sustaining a life changing fall is a real concern for older persons aging in place at TigerPlace, in the community, across the nation, and the world. To that end, an intervention to increase balance and mobility, with the goal to decrease injurious falls has the potential for making a significant impact in the aging population.

It is my pleasure to ask for your strong consideration in funding this project. Thank you for this opportunity to make a difference.

Sincerely,

A handwritten signature in black ink that reads "Brian Donner".

Brian Donner
Executive Director
TigerPlace

Dance-Based Therapy Research Study Coming Soon

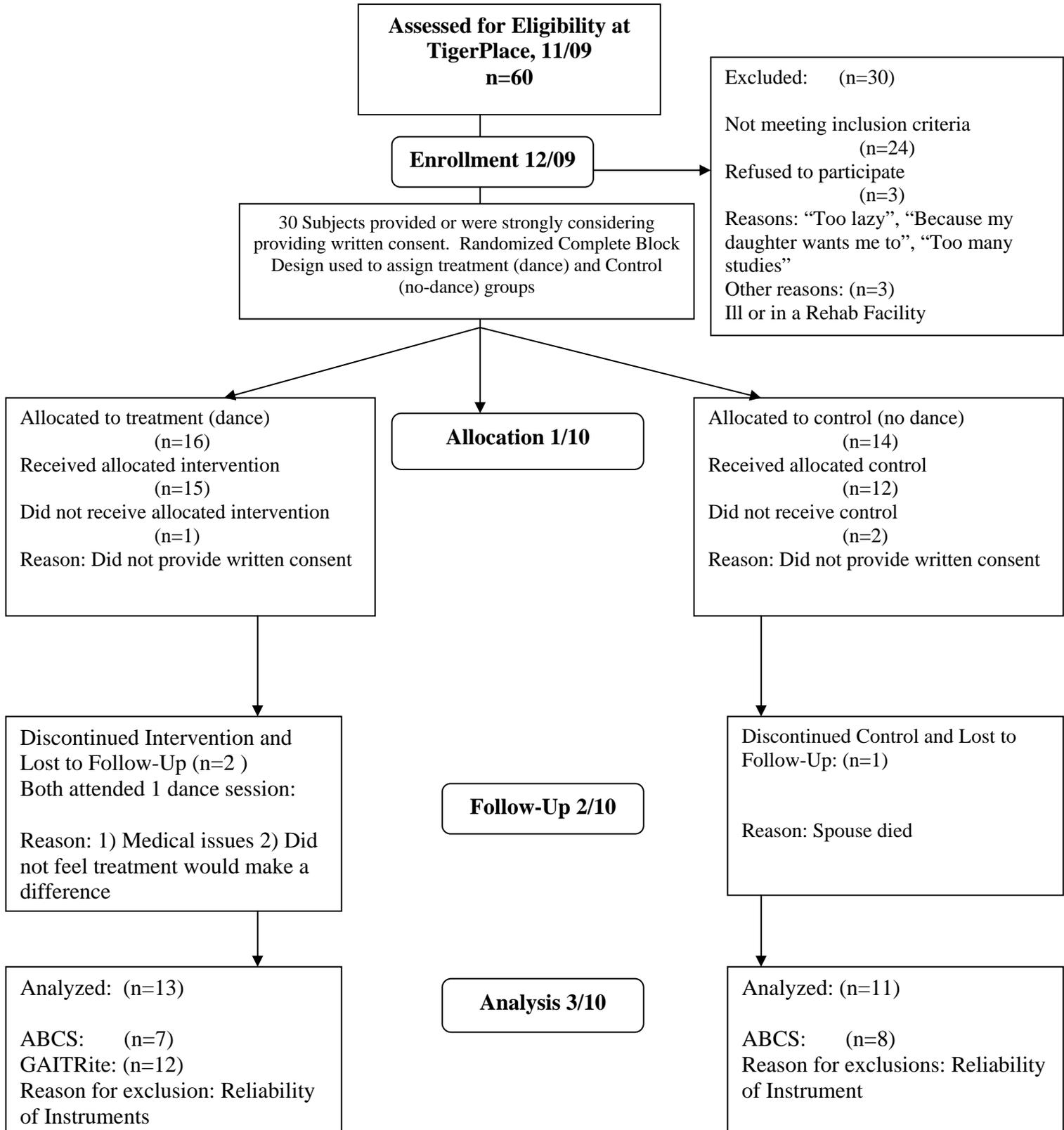
- ❖ Combines low impact dance steps with upbeat music
- ❖ Created by a dance movement specialist and her two physician brothers
- ❖ Lead by a Certified Instructor
- ❖ Uses easy jazz steps and fun props
- ❖ Includes stretching, strengthening, and breathing movements
- ❖ May improve older adult's balance and walking
- ❖ Includes dances that can be done sitting or standing
- ❖ Does not require a partner
- ❖ Recommended by others who have tried it
- ❖ Dancing scheduled for January-February, 2010.
- ❖ Coming to TigerPlace soon with more information



Jean Krampe, PHD(c) RN, CLM
MU Sinclair School of Nursing
Dissertation Project



**Dance-Based Therapy to Decrease Fall Risk on Older Persons
Subject Flow Diagram: Eligibility, Enrollment, Allocation,
Follow-Up and Analysis**



Dance-Based Therapy to Decrease Fall Risk in Older Persons
Jean Krampe, PhD(c)
Sinclair School of Nursing
University of Missouri-Columbia

Dear _____

Thank you for your participation in my dissertation research project to decrease fall risk. As we discussed, I am using 2 groups in my study, a dance group compared to a non-dance group. Both groups are equally important for this study.

A scientific method was used to assign the groups. As a result, you have been assigned to the DANCE GROUP. In addition to the dancing program, please continue with your normal activities during January and February 2010.

The schedule for all of the dance sessions is on the attached page. Please try to attend 3 each week. I will be keeping track of the number of sessions you attend, and hope you will try to attend a total of 18 sessions in January and February. You can come to any sessions that are convenient for you, but not more than a total of 18.

We will meet in the exercise room. You do not need to wear any special clothing, just something comfortable. It is also important to wear comfortable shoes.

I will be at TigerPlace on Tuesday, January 5, 2010 to begin the dance sessions. I look forward to dancing with you!

Jean Krampe, PhD(c), RN, CLM
University of Missouri-Columbia



Dance-Based Therapy to Decrease Fall Risk in Older Persons

**Jean Krampe, PhD(c)
Sinclair School of Nursing
University of Missouri-**

Dance Sessions Schedule for TigerPlace

- **Sessions will begin Tuesday January 5**
- **6 sessions are offered each week**
- **Please try to attend 3 sessions each week**
- **Try to attend make up sessions if possible, for a total of 18 sessions**
- **Sessions will run a total of 8 weeks**

**Schedule from Tuesday Jan 5 through
Saturday February 27, 2010**

<i>Day</i>	<i>Time</i>
Tues	7 pm
Wed	10:30 am
Thu	10:30 am and 3 pm
Fri	10:30 am
Sat	1 pm

Dance-Based Therapy to Decrease Fall Risk in Older Persons
Jean Krampe, PhD(c)
Sinclair School of Nursing
University of Missouri-Columbia

Dear _____

Thank you for your participation in my dissertation research project to decrease fall risk. As we discussed, I am using 2 groups in my study, a dance group compared to a non-dance group.

A scientific method was used to assign the groups. As a result, you have been assigned to the NON-DANCE GROUP. Both groups are equally important for this study. This project would not be possible to do without your participation.

Please continue with your normal activities during January and February 2010. I will let you know when it is time to take measurements again on your balance, walking, and the falling questionnaire. This will in late February. I will be comparing this information to your measurements that we just completed.

I will be at TigerPlace during the week of January 5, if you have any questions or anything you would like to talk to me about.

Again, thank you for your participation. I appreciate your help and look forward to seeing you at TigerPlace.

Jean Krampe, PhD(c), RN, CLM
University of Missouri-Columbia



CONSENT FORM TO PARTICIPATE IN A RESEARCH STUDY

INVESTIGATOR'S NAME: JEAN KRAMPE, PhD (C), RN
PROJECT # 1123897
DATE OF PROJECT APPROVAL: 10/24/08

Study Title: Dance-Based Therapy to Decrease Fall Risk in Older Persons

INTRODUCTION

This consent may contain words that you do not understand. Please ask the investigator or the study staff to explain any words or information that you do not clearly understand.

This is a research study. Research studies include only people who choose to participate. As a study participant you have the right to know about the procedures that will be used in this research study so that you can make the decision whether or not to participate. The information presented here is simply an effort to make you better informed so that you may give or withhold your consent to participate in this research study.

Please take your time to make your decision and discuss it with your family and friends.

You are being asked to take part in this study because you are a resident at TigerPlace. This is a study to explore the impact of a dance based activity that could potentially be useful in the future for people with who have functional impairments that make it difficult for them to get around.

In order to participate in this study, it will be necessary to give your written consent.

WHY IS THIS STUDY BEING DONE?

The purpose of this study is to find out if a dance based movement activity will make a difference in the balance and walking gait of older persons. Improved balance and walking gait help prevent falls. This helps seniors stay independent longer.

HOW MANY PEOPLE WILL TAKE PART IN THE STUDY?

About 36 people will take part in this study at TigerPlace.

WHAT IS INVOLVED IN THE STUDY?

If you take part in this study, you will be randomly asked to be either in a group that will participate in a dance based activity three times a week for six weeks at TigerPlace, or be group that will go about usual activities for six weeks. The two groups will be compared to see if the dance therapy makes a difference in balance and mobility. The dance sessions will last for a total of 45 minutes each time, including a warm up and cool down, and will be scheduled at a time to not interfere with other group activities. There is no special attire for the dance sessions, just comfortable clothes and shoes.

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The type of dance being used for this study is called The Lebed Method™. It was created by a dance expert named Sherry Lebed and her relatives who are doctors. This type of dance has been studied for people who want to increase movement. It includes slow movements of the upper and lower body that are set to music. It is popular in other senior centers and known worldwide.

Some simple measurements will be taken by a Nurse, Physical Therapist and Research Assistant to see if this dance program makes a difference in your movement. These tests will be done one time before the dance activity begins to see the beginning measurement and one time after the last week of the dance activity, to see if the dance activity made a difference.

The tests will be the 1) Multi-Directional Reach Test, that measures the distance that you can stretch your arms without losing your balance, 2) GAITRite portable walking measurement system, that measures walking step length, stride and speed, and 3) Activities-specific Balance Confidence Scale is a questionnaire with 16 questions asking your level of confidence in doing an activity without losing your balance or becoming unsteady.

To assist in documenting this activity and sharing the results with others, pictures may be taken throughout the study and /or a video of the dance sessions may be recorded.

HOW LONG WILL I BE IN THE STUDY?

The dancing part of the study will be 45 minutes, three times a week for six weeks. The dance sessions will be offered several times each week in the exercise room at TigerPlace. You will be asked to attend three per week. Make-up sessions will be available.

Measurements will be taken before and after the study as discussed above. You can stop participating at any time. Your decision to stop being in the study will not affect in any way your relationship with TigerPlace.

WHAT ARE THE RISKS OF THE STUDY?

There is minimal risk involved with your participation in this study. The dance leader is a Registered Nurse with twenty years of experience working with older people. The dance leader is also a Certified Lebed Method™ instructor, with experience doing this project with older persons. All movements in the dance therapy program have been developed for people with potential physical difficulties. You will be guarded during the pre-and post-dance session measurements activities in case of loss of balance.

The dance movements can be performed sitting or standing. Each dancer will have a chair at their side so they can stop and rest at any time.

If at any point during the study you are worried about the impact of your participation on yourself, notify the investigator Jean Krampe immediately. Jean's telephone number is (314) 838-8782.

ARE THERE BENEFITS TO TAKING PART IN THE STUDY?

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If you agree to take part in this study, there may or may not be direct medical benefit to you. You may expect to benefit from taking part in this research to the extent that you are contributing to overall knowledge and future generations of senior citizens who might be able to benefit from this dance movement activity and stay independent for a longer time. We hope the information learned from this study will benefit other senior citizens in the future.

WHAT OTHER OPTIONS ARE THERE?

An alternative is to not participate in this research study.

WHAT ABOUT CONFIDENTIALITY?

Information produced by this study, including all test measurement scores, will be stored in the investigator's file and identified by a code number only. The code key connecting your name to specific information about you will be kept in a separate, secure location. Information contained in your records may not be given to anyone unaffiliated with the study in a form that could identify you without your written consent, except as required by law.

The results of this study may be published in a book or journal or used for teaching purposes. However, your name or other identifying information will not be used in any publication or teaching materials without your specific permission.

WHAT ARE THE COSTS?

There is no cost to you for the study.

WILL I BE PAID FOR PARTICIPATING IN THE STUDY?

All participants who complete the study, including the post-dance therapy measurements, will receive a \$25.00 Wal-Mart gift certificate

WHAT IF I AM INJURED?

All of the dance movement activity will be conducted at TigerPlace. The Principle Investigator is a nurse and will assist you should any unforeseen need arise.

WHAT ARE MY RIGHTS AS A PARTICIPANT?

Participation in this study is voluntary. If you decide to participate, you can change your mind and drop out of the study at any time without affecting your present or future relationship with the TigerPlace. Leaving the study will not result in any penalty or loss of benefits to which you are entitled. In addition, the investigator of this study may decide to end your participation in this study at any time after she has explained the reasons for doing so.

You will be informed of any significant new findings discovered during the course of this study that might influence your welfare, or willingness to continue participation in this study.

WHOM DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?

If you have any questions regarding your rights as a participant in this research and/or concerns about the study, or if you feel under any pressure to enroll or to continue to participate in this study, you may contact the University of Missouri Campus Institutional Review Board (which is a group of people who review the research studies to protect participants' rights) at (573) 882-9585.

You may ask more questions about the study at any time. For questions about the study or a research-related injury, contact Jean Krampe at (314) 838-8782.

A copy of this consent form will be given to you to keep.

SIGNATURE

I confirm that the purpose of the research, the study procedures, the possible risks and discomforts as well as potential benefits that I may experience have been explained to me. Alternatives to my participation in the study also have been discussed. I have read this consent form and my questions have been answered. My signature below indicates my willingness to participate in this study.

_____	_____
Subject	Date
_____	_____
_____	_____

Appendix G

UNIVERSITY OF MISSOURI-COLUMBIA
Institutional Review Board

HIPAA AUTHORIZATION FORM

**Authorization for the Use and Disclosure of Personal Health Information
Resulting from Participation in a Research Study**

FOR IRB USE ONLY	
APPROVED	
<hr/>	
IRB Authorized Representative	Date

**Principal Investigator’s Name: Jean Krampe
Project # 1123897**

Project Title: Dance-Based Therapy to Decrease Fall Risk in Older Persons

You have agreed to participate in the study mentioned above. This authorization form gives more detailed information about how your health information will be protected.

1. Description of the information

My authorization applies to the information described below. Only this information may be used and/or disclosed in accordance with this authorization: Mini-Mental Score Exam, (obtained from last reassessment at TigerPlace) measurement of balance (obtained from the Multi-Directional Reach Test), ability to stand for short period of time (obtained from last reassessment at TigerPlace), measurement of fear of falling (obtained from the Activities – specific Balance Confidence Scale), information about walking velocity-speed (obtained from the GAITRite assessment), and information about any falls.

2. Who may use and/or disclose the information

I authorize the following persons (or class of persons) to make the authorized use and disclosure of my Personal Health Information (PHI): The research study team.

3. Who may receive the information?

I authorize the following persons (or class of persons) to receive my personal health information
Only those persons working on the collection, data entry, or data analysis may see my individual data. It will be de-identified so my name will not be included. When it is shared with others, it will be included with a group of other study participant’s data, so mine will not be able to be identified.

4. Purpose of the use or disclosure

My PHI will be used and/or disclosed upon request for the following purposes:

- Auditing My treatment during the study
- Study outcomes including safety and efficacy Administrative and billing
- Submission to government agencies that may monitor the study
- Publications and presentation of results that may identify me as a subject

X Publications and presentation of results that will NOT identify me as a subject

X Other: A picture of me dancing may be used _____

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5. Expiration date or event

This authorization expires upon:

The following date: _____

End of research study

X No expiration date

Other: _____

6. Right to revoke authorization

I understand that I have a right to revoke this authorization at any time. My revocation must be in writing in a letter sent to the Principal Investigator at the Alexian Brothers Community Services, 3900 South Grand, St. Louis, MO 63118. I am aware that my revocation is not effective to the extent that the persons I have authorized to use and/or disclose my PHI have already acted in reliance upon this authorization.

7. Statement that re-disclosures are no longer protected by the HIPAA Privacy Rule

I understand that my personal health information will only be used as described in this authorization in relation to the research study. I am also aware that if I choose to share the information defined in this authorization to anyone not directly related to this research project, the law would no longer protect this information. In addition, I understand that if my personal health information is disclosed to someone who is not required to comply with privacy protections under the law, then such information may be re-disclosed and would no longer be protected.

8. Right to refuse to sign authorization and ability to condition treatment, payment, enrollment or eligibility for benefits for research related treatment

I understand that I have a right not to authorize the use and/or disclosure of my personal health information. In such a case I would choose not to sign this authorization document I understand I will not be able to participate in a research study if I do not do so. I also understand that treatment that is part of the research project will be conditioned upon my authorization for the use and/or disclosure of my personal health information to and for use by the research team.

9. Suspension of right to access personal health information

I agree that I will not have a right to access my personal health information obtained or created in the course of the research project until the end of the study.

10. If I have not already received a copy of the University of Missouri Healthcare Privacy Notice, I may request one. If I have any questions or concerns about my privacy rights I should contact, the HS Privacy Officer at 573-882-9054 or the Campus Privacy Officer at 573-882-7254.

11. Individuals' signature and date

I certify that I have received a copy of the authorization.

Signature of Research Participant

Date

Research Participant's Legally Authorized Representative

Date

Describe Representative Authority to Act for the Participant

Functional Reach*

Item #8 in the Berg Balance Scale

Directions:

Using a yardstick mounted on the wall at shoulder height, ask the subject to position themselves close to, but not touching the wall with their arm outstretched and hand fist. Take note of the starting position by determining what number the MCP joints line up with on the yardstick. Have the subject reach as far forward as possible in a plane parallel with the measuring device. Instruct them to "Reach as far forward as you can without taking a step." They are free to use various reaching strategies. Take note of the end position of the MCP joints against the ruler, and record the difference between the starting and ending position numbers. If they move their feet, that trial must be discarded and the trial repeated. Guard the subject as the task is performed to prevent a fall. Subjects are given two practice trials, and then their performance on an additional three trials is recorded and averaged.

Scores less than 6 or 7 inches indicate limited functional balance. Most health individuals with adequate functional balance can reach 10 inches or more.

Instructions to the patient:

Please reach as far forward as you can without losing your balance. Keep your feet on the floor. You are not allowed to touch the wall or the ruler as you reach. You will have two practice trials and then I will record the distance that you reach forward.

Criteria to stop the test:

The patient's feet lifted up from the floor or they fell forward. Most patients fall forward with this test. The therapist should guard from the front as that is the direction that you reach forward.

*Duncan P, Weiner D, Chandler J, et al. Functional reach: a new clinical measure of balance. *J of Gerontol* 1990; 45: M192-197.

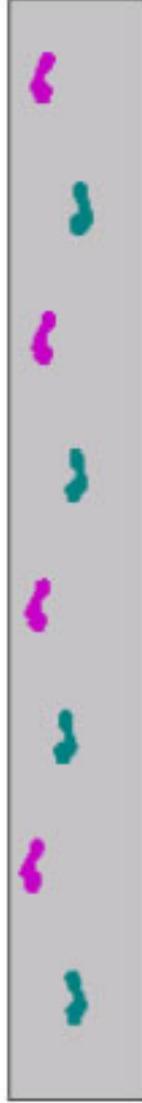
Tested on: 5/30/2008 9:25:47 AM

Eldertech

School of Nursing
ECE Dept
Columbia MO 65211

Jean A Krampe	

Age	Gender	Left LEG	Right	Height	Weight
52	F	80	80	0	0

**Functional Ambulation Profile: 99****Parameters**

Distance (cm)	406.7
Ambulation Time (sec)	4.10
Velocity (cm/sec)	99.2
Mean Normalized Velocity	1.24
Number of Steps	7
Cadence (Steps/Min)	102.4
Step Time Differential (sec)	.04
Step Length Differential (cm)	1.69
Cycle Time Differential (sec)	.01

FAP Deduction From	100
Step Functions Left	
Step Functions Right	
Diff Step Extr. Ratio	

Bilateral Parameters Left Right

Step Time (sec)	.61/1.8	.56/3.2
Cycle Time (sec)	1.16/2.1	1.17/1.5
Step Length (cm)	58.82/2.6	57.14/.0
Stride Length (cm)	116.47/1.2	116.10/1.6
H-H Base Support (cm)	13.51	13.73
Single Support (%GC)	36.6/2.1	38.3/2.9
Double Support (%GC)	24.9/3.5	25.3/6.1
Swing (%GC)	38.5/2.9	36.4/2.1
Stance (%GC)	61.5/1.8	63.6/1.1
Step/Extremity Ratio	.74	.71
Toe In / Out (deg)	-2	9

The Activities-specific Balance Confidence (ABC) Scale

For each of the following activities, please indicate your level of self-confidence by choosing a corresponding number from the following rating scale:

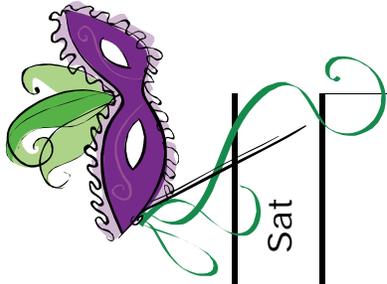
0%	10	20	30	40	50	60	70	80	90	100%
No										Completely
Confidence										Confident

"How confident are you that you can maintain your balance and remain steady when you....

1. walk around the house? _____ %
2. walk up or down stairs? _____ %
3. bend over and pick up a slipper from the front of a closet floor? _____ %
4. reach for a small can off a shelf at eye level? _____ %
5. stand on your tip toes and reach for something above your head? _____ %
6. stand on a chair and reach for something? _____ %
7. sweep the floor? _____ %
8. walk outside the house to a car parked in the driveway? _____ %
9. get into or out of a car? _____ %
10. walk across a parking lot to the mall? _____ %
11. walk up or down a ramp? _____ %
12. walk in a crowded mall where people rapidly walk past you? _____ %
13. are bumped into by people as you walk through the mall? _____ %
14. step onto or off of an escalator while holding onto a railing? _____ %
15. step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing? _____ %
16. walk outside on icy sidewalks? _____ %

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February 2010



	Mon	Tue	Wed	Thu	Fri	Sat	
February Birthdays	1 11:00—Coffee Talk 1:00—Tai Chi 2:00—Movie—7:00	2 11:00—Happy Feet 1:00—Yoga 2:00—BINGO 3:00—Pawsitive Visit 4:00—Bible Study 7:00—Dance Therapy	3 10:30—Dance Therapy 11:00—Happy Feet 1:00—Tai Chi 2:00—Movie-7:00 Ladies Tea at Jean's House	4 8:30—Visit with Colleen 9:30—Wal-Mart 10:30—Dance Therapy 1:00—Yoga 2:00—Bandage Wrapping 3:00—Dance Therapy	5 10:00—Dance Therapy 1:00—Tai Chi 2:00—MOVIE 7:00—MOVIE	6 1:00—Dance Therapy 2:00—MOVIE 7:00—MOVIE	
7 1:00—BINGO 4:30—Super Bowl Happy Hour	8 11:00—Coffee Talk 1:00—Tai Chi 2:00—Movie—7:00	9 11:00—Happy Feet 1:00—Yoga 2:00—Science & Me 3:00—Pawsitive Visit 4:00—Bible Study	10 10:30—Dance Therapy 11:00—Happy Feet 1:00—Tai Chi 2:00—Movie-7:00 4:30—Reception for Mary Kay	11 8:30—Visit with Colleen 9:30—Wal-Mart 10:30—Dance Therapy 1:00—Yoga 3:00—Dance Therapy 3:00—Mark w/Beltone	12 Chinese New Year Year of the TIGER 10:00—Dance Therapy 1:00—Tai Chi 2:00—MOVIE 7:00—MOVIE	13 1:00—Dance Therapy 2:00—MOVIE 7:00—MOVIE	
14 1:00—BINGO Happy Valentine's Day	15 11:00—Coffee Talk 1:00—Tai Chi 2:00—Movie—7:00	16 11:00—Happy Feet 1:00—Yoga 2:00—BINGO 3:00—Pawsitive Visit 4:00—Bible Study 4:30—Mardi Gras Happy Hour	17 10:00—Concert @ Jesse 10:30—Dance Therapy 11:00—Happy Feet 12:00—Book Mobile 1:00—Tai Chi 2:00—Movie-7:00 6:30 VA Benefits program	18 8:30—Visit with Colleen 9:30—Wal-Mart 10:30—Dance Therapy 1:00—Yoga 3:00—Dance Therapy	19 10:00—Dance Therapy 1:00—Tai Chi 2:00—MOVIE 2:00—Sewing 7:00—MOVIE	20 1:00—Dance Therapy 2:00—MOVIE 7:00—MOVIE	
21 1:00—BINGO	22 11:00—Coffee Talk 1:00—Tai Chi 2:00—Movie—7:00	23 11:00—Happy Feet 1:00—Yoga 2:00—BINGO 3:00—Pawsitive Visit 4:00—Bible Study	24 10:30—Dance Therapy 11:00—Happy Feet 1:00—Tai Chi 2:00—Movie-7:00 5:00—Community Meeting	25 8:30—Visit with Colleen 9:30—Wal-Mart 10:30—Dance Therapy 1:00—Yoga 3:00—Dance Therapy	26 10:00—Dance Therapy 1:00—Tai Chi 2:00—MOVIE 4:30— Monthly Birthday Party 7:00—MOVIE	27 1:00—Dance Therapy 2:00—MOVIE 7:00—MOVIE	
28 1:00—BINGO							

Appendix L

From: Tigerplace Admin [tigerplace@americareusa.net]
Sent: Friday, February 05, 2010 8:51 AM
To: Krampe, Jean Ann (MU-Student)
Subject: RE: Final weeks- Dance Therapy at TP

That sounds great – if you could let me know when Dr. Skubic commits to the presentation I will put on my calendar and have Helen and I attend if possible – this way you do not have to present twice!

It has been a very, very positive experience for TigerPlace!

Thanks,
Brian

From: Krampe, Jean Ann (MU-Student) [mailto:jakck5@mail.mizzou.edu]
Sent: Friday, February 05, 2010 8:39 AM
To: Tigerplace Activities
Cc: Rantz, Marilyn; Tigerplace Admin
Subject: Final weeks- Dance Therapy at TP

Brian and Helen

I'm sorry to hear that budget restraints prohibit supporting Certified Lebed Method (CLM) training at this time. If you are interested, I will keep you posted on the training opportunities in St. Louis/Columbia later this year and be happy to assist in developing this program, should the situation change in the future.

I will be continuing the dance sessions through the end of February, allowing for make up times and for the control group to join us after their post-measurements are completed. I have a detailed post-measurement plan beginning 2/13 and continuing on weekends through 2/28. I have reserved the conference room, enlisted student helpers, communicated this plan to Helen and the participants in the dance project at TP. The last dance session I will be conducting at TP will be Sat Feb 27.

I appreciate all of your support and assistance with my project. Everyone at TigerPlace has been so kind and supportive. Brian-I want to especially thank you for allowing me to do this project at TP. I have asked Dr. Skubic to allow me to present the results at one of the Monday 4pm meetings in April. Please let me know how you would like the results presented to you, and I will make arrangements to do this.

Best Regards,
Jean

VITA

Jean Krampe was born November 29, 1955 in Belleville, Illinois. After attending private schools in Missouri, Jean completed the Practical Nursing Program at Jefferson College in Hillsboro, Missouri in 1975. Jean continued with her education and received her Associate Degree in Nursing in 1996 from the Deaconess College of Nursing in St. Louis Missouri and Bachelor of Nursing in 2006 from the University of Missouri-St. Louis. Jean continued through graduate school, earning her Masters of Science in Nursing in 2007 from the University of Missouri-St. Louis. Finally, Jean completed her PhD in nursing from 2007-2010 at the University of Missouri-Columbia.

Jean is married to William E. Krampe of St. Louis, Missouri, and is the mother of Timothy Krampe, Kristina Krampe, and the late Karla Krampe. Jean is also the mother-in-law of Vanessa Krampe, daughter of Betty Lou and the late Richard Rice, and daughter-in-law of Imogene and the late William A. Krampe.

Jean has experiences in gerontology nursing. She is a member of Midwest Nursing Research Society and Nu Chi Chapter of Sigma Theta Tau International Honor Society of Nursing. She is currently an Assistant Professor at St. Louis University, St. Louis, Missouri.