Chapter 1

Background and Theoretical Framework

The aging population is rapidly increasing in size and longevity and with that, there will be substantial numbers of older adults facing the challenges of adapting to age related changes, including a decline in physical function. This indicates that there is a growing need for age appropriate physical activity (PA) programs to help them age successfully and prevent or reduce frailty. Consequently, it is imperative to develop interventions to promote adaptation to aging such as increasing PA among older adults.

A primary concern for the aging individual is the decline in physical function, compounded with the increased prevalence of sedentary behavior. In 2005, 47% of the young-old (65 to 74) reported no leisure time activity, with 60% of the old-old (over 75 years old), reporting no leisure time activity (U.S. Department of Health and Human Services, 2006). These data indicate that the aging population is falling short of Healthy People 2010 goals as well as the American College of Sports Medicine and American Heart Association and national guidelines for PA for older adults (Nelson et al., 2007; U.S. Department of Health and Human Services, 2008). Those guidelines recommend at least 30 minutes of moderate intensity PA at least 5 times per week, strength training and flexibility two times a week and balance training. Further, the national PA guidelines state older adults should participate in some form of PA, regardless of their age, weight, health problems or ability. Nelson et al., (2007) recommend that sedentary older adults begin with balance, flexibility and strength training to build endurance prior to participating in moderate to vigorous-intensity aerobic PA.
Background and Significance

The aging population will continue to grow in numbers. The percent of people over the age of 65 is predicted to increase from 12.4 in 2000 to 20.7 in 2030. The life expectancy at birth has increased from 47.3 in 1900 to 77.5 in 2003 and is continuing to rise (U.S. Department of Health and Human Services, 2006). The population of adults over the age of 65 in Arizona increased 35% between 1990 and 2000 (US Census Bureau, 2004). A priority of this population is to maintain physical function and the adaptations needed to age in place (i.e. maintain sufficient function to be able to stay in a community setting rather than having to move to a care facility) (City of Tempe, 2001; National Association of Area Agencies on Aging, 2006; World Health Organization, 2002). Interventions targeting adaptation and physical function will need to expand with our aging society.

Research has demonstrated that PA may enhance adaptation and physical function. For example, moderate intensity, mind-body PA, which combines movement with deep breathing and mental concentration to achieve harmony between body and brain, has positive effects on physiologic variables and selected psychological parameters consistent with adaptation (B. Gallagher, 2003; Taylor-Pilae & Froelicher, 2004). Koltyn reported higher levels of PA associated with higher QOL in older women (2001). However, there has been limited research exploring mind-body PA interventions for adaptation and physical function among older adults.

Aims

This research addressed the National Institute of Health/ National Institute of Nursing Research goals to develop and test community-based interventions that target
preventive behavior in high-risk population subgroups, such as the elderly. This research study focused on the evaluation of the feasibility and efficacy of a theory-based, mind-body intervention to promote adaptation and physical function by increasing PA among sedentary community dwelling older adults. Sign Chi Do (SCD) is a novel form of PA that has multiple health benefits including strengthening muscles and improving balance using a mind-body approach (Borik, 2004). Preliminary research has demonstrated feasibility and acceptability of SCD with older adults (Rogers, 2006). SCD was the PA modality selected for this intervention study.

The Roy Adaptation Model (RAM) provides a theoretical basis for the intervention and has been demonstrated to be effective in promoting adaptation to physical activity and quality of life among other vulnerable populations (Headley, Ownby, & John, 2004; John, 2007; Young-McCaughan et al., 2003; Young-McCaughan et al., 2007). According to the RAM, adaptation is assessed and measured in physical (physiologic) and psychosocial (self-concept, role function, and interdependence) modes (Roy & Andrews, 1999). Physiologic-physical aspects of the model include measures of bodily function and, specific to this study, the level of physical activity and function. Self-concept is the composite of beliefs including spirituality and feelings one has of oneself at a given time. Specific to this study, self-concept related factors were selected based on understanding the unique role of mind-body PA in shifting older adults toward a more meaningful sense of self, and specific to SCD, a grounding in spiritual connection. Role function is a set of expectations about how a person functions and relates with others. Interdependence is giving and receiving love via nurturing relationships. While all of these modes are important, this intervention focused on adaptation in the physiologic-
physical and self-concept modes to evaluate the effect of SCD on physical function and personal beliefs.

**Aim 1.** Evaluate the efficacy of SCD compared with a Wait-list Control group on the physiologic and self-concept modes of adaptation among sedentary community dwelling adults 55 years and older at baseline, 6 and 12 weeks.

Research Question 1a. What is the effect of SCD on the physiologic mode of adaptation as measured by balance with the Timed Up & Go score; function as measured by the 6 minute walk; weekly physical activity as measured by a Seven Day Physical Activity Recall and pedometers; and blood pressure?  
Research Question 1b. What is the effect of SCD on the self-concept mode of adaptation as measured by the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being (FACIT-Sp) instrument and self-efficacy for PA as measured by the Exercise Self-Efficacy Scale?

**Aim 2.** Determine effect size for future study of SCD on improved function and personal self-concept.

**Definition of Terms**

Adaptation: the dynamic process whereby people use conscious awareness and choice to create human and environmental integration (Roy, 1997).

Balance: maintaining equilibrium while stationary or moving (Nieman, 2007).

Cognator subsystem of adaptation: bodily response through four cognitive-emotional channels: perceptual and information processing, learning, judgment and emotion (Roy & Andrews, 1999).

Disuse: cessation of use or practice (Disuse, 2010).
Disuse consequences: predictable physiological and psychological changes resulting from inadequate physical activity and affecting all four adaptive modes (Roy & Andrews, 1999).

Endurance: the capacity to continue a physical performance over a period of time (Nieman, 2007).

Mind-body PA: a combination of movement with deep breathing and mental concentration to achieve harmony between body and brain (Larkey, Jahnke, Etnier, & Gonzalez, 2009).

Physical activity: any form of muscular movement (Nieman, 2007)

Physiologic adaptation: assessment of bodily function including physical function (Roy & Andrews, 1999).


Sarcopenia: age related decline in muscle mass (W. W. Spirduso, Francis, & MacRae, 2005)

Self-concept adaptation: personal beliefs of oneself, including psychic and spiritual integrity (Roy & Andrews, 1999).

Self-efficacy: the confidence a person feels in performing a behavior and overcoming the associated barriers (Baranowski, Perry, & Parcel, 2002).

Spirituality: the personal quest for understanding answers to ultimate questions about life, meaning and a relationship with the sacred or transcendent, which may (or not) lead to or arise from the development of religious rituals and the formation of community (Koenig, McCullough, & Larson, 2001).
Adaptation

Adaptation is the dynamic process whereby people use conscious awareness and choice to create human and environmental integration (Roy, 1997). The level of adaptation changes according to the input of stimuli (Roy & Andrews, 1999). The optimal level of adaptation is consistent with active aging as defined by the WHO and others to include the importance of treating the person as a whole; emphasizing physical and psychological function, as well as spirituality (Crowther, Parker, Achenbaum, Larimore, & Koenig, 2002; Flood, 2005a; Roy & Andrews, 1999). Maladaptive responses occur when coping mechanisms are inadequate, resulting in activity intolerance and disuse consequences for sedentary aging adults (Roy & Andrews, 1999). Disuse and inactivity are primary causes of debilitation and disability in older adults (Vorhies & Riley, 1993). Maintaining independence not only has personal rewards physically and emotionally but has significant implications to society and burden of care and cost (O’Brien & Vertinsky, 1991). The cost of chronic health conditions related to sedentary lifestyle were reported to be in excess of $150 billion, accounting for 15% of the U.S. health care budget (Pratt, Macera, & Wang, 2000).

According to Roy’s theory (RAM), the broad goal of nursing is to focus on promoting health of the individual and group by promoting adaptation in each of the four adaptive modes of physiological-physical, self-concept, role function, and interdependence (1999). This study focused on evaluating the adaptive responses of PA on aging adults in the physiologic and self-concept modes. The physiologic-physical mode assesses bodily function and includes a component of PA. Exercise programs that increase PA have been shown to improve balance and function, and can reverse the effects of disuse on muscles.
(Fiatarone & Evans, 1990; Heath & Stuart, 2002). PA reduces all cause mortality for women over 65 (Gregg et al., 2003) and delays the onset of chronic diseases among men and women (Booth, Chakravarthy, Corbin, & Franks, 2002; Christmas & Andersen, 2000). PA is also associated with fewer days in the hospital and quicker recovery times (M. Y. Martin, Powell, Peel, Zhu, & Allman, 2006). Improving balance and function with PA supports the mind and body approach to adaptation by reversing the effect of disuse. Physiological adaptation is needed for sedentary seniors to recover from disuse which may increase physical function and mobility.

In the RAM, the psychosocial or mind and spirit modes are self-concept, role function, and interdependence (Roy & Andrews, 1999). Self-concept deals with personal aspects of human systems, specifically psychic and spiritual integrity (Roy & Andrews, 1999). It is a composite of beliefs one holds of him-or herself at a given time. In an older adult who has become sedentary, self-concept is characterized by a decreased confidence in the ability to exercise and spirituality. Role function is performing behaviors that are expected of them (Roy & Andrews, 1999). For the aging adult, this includes completion of activities of daily living for oneself and possibly other family members. The interdependence mode focuses on interactive relationships with family members and friends (Roy & Andrews, 1999). These relationships may deteriorate due to loss of function and mobility. A sedentary lifestyle results in disuse, muscle loss, poor balance, loss of function and negative psychological effects among adults over the age of 65. This study used an innovative mind-body-and spirit PA intervention to address measured outcomes of adaptation.
Muscle Loss and Strength Changes with Aging

Muscle strength is known to peak when adults are in their 20’s and 30’s (W. W. Spirduso et al., 2005). As a consequence of aging, the average adult aged 50 to 70 years loses 30% of muscle strength (Butler, 2000). The maxial cross-sectional area of the quadriceps may be 25% lower in 70 year olds compared to 20 year olds (A. Young, Stokes, & Crowe, 1985). A decline in muscle mass is attributed to decreases in the number and size of muscle fibers and the loss of entire motor units (W. W. Spirduso et al., 2005). While muscle mass declines with aging, the decline is minimized in individuals who maintain a routine of resistive training (American Academy of Orthopaedic Surgeons, 2000). The physical inactivity associated with a chronic sedentary lifestyle prompts muscle wasting which declines in strength and function. Roy defines this change in function as a result of inactivity, as disuse consequences (Roy & Andrews, 1999). Sedentary individuals will demonstrate decreased endurance, muscle power as well as an exaggerated increase in blood pressure and heart rate in response to exercise (Brummel-Smith, 1990).

Toulotte, Thevenon, and Fabre (2006) studied the effects of training and disuse on balance in elderly women ($N = 16$) with a history of falling compared to those with no history of falls. They measured outcomes at 4 intervals: (a) before the study; (b) after 3 months of no training; (c) after 3 months of training; and (d) after 3 months of no training. A statistically significant decrease in balance following each period of no training and an increase following the training period was reported. Brach et al. (2004) reported better physical function and strength among a population of black and white adults aged 70-79 ($N = 3,075$) who engaged in 20 to 30 minutes of moderate-intensity PA
most days of the week compared to those who were active in their homes throughout the
day. In this cross-sectional study, physical function was measured by walking endurance,
isokinetic strength, and measures of balance. These studies demonstrate the negative
consequences of sedentary behavior and the benefits of regular PA.

**Physical Activity to Reverse Disuse**

The effects of disuse are reversible with a program of moderate exercise
(American Academy of Orthopaedic Surgeons, 2000; Fiatarone & Evans, 1990; Vorhies
& Riley, 1993). PA enhances physical function among older adults with chronic disease
and reverses the effects of disuse (W. W. Spirduso & Cronin, 2001). PA using large
lower extremity muscle groups are most beneficial for reversing disuse and geriatric PA
programs should focus on strength, flexibility and endurance (Vorhies & Riley, 1993).
Balance and coordination training are key components to reverse the effects of disuse.

PA programs delivered to persons who are older (late life) have reportedly
improved strength, flexibility, and physical function (J. C. Davis, Donaldson, Ashe, &
Khan, 2004; Keysor & Jette, 2001; Texeira-Salmela et al., 2005). Martin and McCann
interviewed women who attended a fitness center to determine why they participate in
regular exercise (2005). They reported that exercise was a socially supportive activity,
exercise maintained wellbeing and independence, and was liberating. Li et al. (2001)
reported improved activities of daily living among sedentary community dwelling adults
ages 65 to 96 who completed a 6 month Tai Chi exercise \((n = 49)\) compared to a wait list
control \((n = 45)\). Previously inactive men and women reported increasing their physical
function \((p < .001)\) and ability to complete activities of daily living which enhanced their
psychological well being.
Studies have shown that twenty to 30 minutes of moderate intensity PA results in better function (S. N. Blair, LaMonte, & Nichaman, 2004; Brach et al., 2004). PA can be broken up into shorter periods such as 15 minute intervals 2 times a day (American Academy of Orthopaedic Surgeons, 2000). Balance training and progressive resistance training of the major muscle groups of upper and lower trunk 2 or 3 days per week are recommended for the frail older adult to promote conditioning prior to beginning an aerobic exercise (Nelson et al., 2007). Once the frail elder has adjusted to a muscle strengthening program, they can progress to an aerobic exercise. This method of starting with a lower intensity PA helps the aging adult adapt to increasing function and mobility which lead to psychological as well as physical benefits. While multiple benefits are related to PA, there are many barriers that create challenges to adaptation as adults age.

**Self-Efficacy and Barriers to Exercise in Older Adults**

There is a belief that health problems are inevitable with aging and this contributes to an unwillingness to engage in PA and maladaptive adaptation (Levy & Myers, 2004). This belief is reinforced by the following reported barriers to PA among older adults: feelings of inability to perform PA; fear of falling; and self-rated poor health accompanied by pain and fear of pain (Rasinaho, Hirvensalo, Leinoen, Lintunen, & Rantanen, 2006; B. Resnick, 2002). Self-efficacy is the confidence a person feels in performing a behavior and overcoming the associated barriers (Baranowski et al., 2002). Environmental factors such as weather, lack of designated rooms, and unsafe neighborhoods along with cost of programs have also been cited as barriers to participation in PA (Aubertin-Leheudre, Rousseau, Melancon, Chaput, & Dionne, 2005; Rasinaho et al., 2006; Salmon, Owen, Crawford, Bauman, & Sallis, 2003). Other sources
of barriers to health promotion PA programs are lack of trained instructors and transportation (Lachenmayer & Mackenzie, 2004). Participation in program offerings increased when the participant enjoyed the PA and had a choice in the selection of activity (Aubertin-Leheudre et al., 2005; Lachenmayer & Mackenzie, 2004; Salmon et al., 2003). Additionally, low socioeconomic status is related to decreased physical function which supports the need for low cost programs (Bruder, 2002; Hemingway, Nicholson, Stafford, Roberts, & Marmot, 1997). Several studies have reported a significant positive relationship between physical activity and self-efficacy ($r = .30 - .70$ and $b = .493$) (K. I. Gallagher, Jakicic, Napolitano, & Marcus, 2006; E. McAuley et al., 2006a; Netz, Wu, Becker, & Tenenbaum, 2005). The intervention employed in this study, SCD, is a low cost program that has been easily replicated with the use of DVD supported facilitators in churches and senior centers to off set these barriers. It was also easy to perform and previous participants reported they would like to continue to participate in this PA which supports the self-efficacy component of self-concept mode of adaptation (E. McAuley et al., 2006a; C. E. Rogers, 2006; C. Roy & Andrews, 1999). SCD is a mind-body PA that may promote adaptation by removing multiple barriers and improving self-efficacy.

**Spirituality and Aging**

Aging adults may experience loss of confidence or negative self beliefs that compound the physiological changes due to sedentary activity and disuse. There is a growing body of knowledge to support the importance of spirituality and religion among the aging population (Eisenhandler, 2005; Flood, 2002; Flood, 2005a; Flood, 2005b; Koenig, 2006; Nelson-Becker, 2005). Nelson-Becker (2005) reported that 43% of their
study group used prayer to cope with loneliness, physical limitations, and pain. Religion is defined as an organized system of beliefs, practices, rituals, and symbols designed to facilitate closeness to the sacred or transcendent (God, higher power, or ultimate truth/reality) (Koenig et al., 2001). Spirituality is defined as the personal quest for understanding answers to ultimate questions about life, meaning and a relationship with the sacred or transcendent, which may (or not) lead to or arise from the development of religious rituals and the formation of community (Koenig et al., 2001). Spirituality is reported to have a high relationship with all cause mortality, OR = 1.29, 95% CI [1.21, 1.39] (McCullough, Hoyt, Larson, Koenig, & Thoresen, 2000). A faith based program (Faithfully Fit Forever) developed to remove barriers and promote successful aging with exercise, has been implemented in more than 150 places of worship in 60 cities, reaching over 1600 community members (White, Drechsel, & Johnson, 2006). The goals of this program are to advocate personal wellness, including physical activity, health education, and spiritual reflection (White et al., 2006). Additional evidence links the promotion of spirituality to improved QOL in aging populations (Moberg, 2005; Riley et al., 1998); yet no research has examined the relationship between mind-body exercise and improved adaptation, specifically physical function. Thus a mind-body exercise was selected for this intervention to evaluate the effect on self-concept and physiologic modes of adaptation.

**Mind-Body Physical Activity, Adaptation**

Good health and independence can be achieved with moderate intensity mind-body PA that promotes adaptation (B. Gallagher, 2003; Taylor-Piliae & Froelicher, 2004). Exercise is defined as any form of PA that is planned or structured (Nieman,
It involves repetitive bodily movement done to improve or maintain one or more of the components of physical fitness, including, but not limited to, muscular strength, muscular endurance, flexibility, and body composition. Healthy People 2010 listed PA as their number one initiative, yet the majority of older adults remain sedentary (U.S. Department of Health and Human Services, 2006). Continued reports of low levels PA in this age group support the need to continue to look at new methods of increasing PA to promote adaptation and improved function in the aging population.

Mind-body PA such as SCD is an inwardly directed activity, with attention to breathing and proprioception (La Forge, 2005). SCD is a novel mind-body exercise that incorporates sign language with movement and breathing resulting in moving language (Borik, 2004). The use of sign language engages the temporal lobe of brain or the communication area, allowing the participant to express emotion through movement contributing to a relaxed and calm state (Carter, 1998). SCD is similar to TC and they will be compared and contrasted in this text for further understanding. Mind-body PA has increased in popularity since the 1990’s and makes up 30% of the exercise programs in fitness centers (La Forge, 2005). Tai Chi (TC) is a PA with multiple health benefits for the elderly population including improving balance and physical health (Adler & Roberts, 2006; K. Chen, 2000; Heath & Stuart, 2002). In addition to improving balance and reducing the frequency of falls, TC has demonstrated psychological and spiritual benefits (K. Chen, 2000; Heath & Stuart, 2002; Macfarlane, Chou, & Cheng, 2005). Mobility is increased, leading to enhanced health and well-being (Jancewicz, 2001).

SCD and TC are similar in structure with some specific differences. SCD and TC both utilize slow, continuous movements of the arms and legs (Borik, 2004; S. L. Wolf,
Coogler, & Xu, 1997). They incorporate balance, postural alignment, concentration, and muscle strengthening (Borik, 2004; G. Wu, 2002). Both forms are generally initiated with a flat foot posture. However, TC movements are performed with the heel forward first and emphasizes perfect form while SCD leg movements are performed with the toe first to stabilize the movement and perfect form is encouraged, but not required. Completion of the form while experiencing the meaning of the word phrase is the goal of SCD. Mind and body are connected with a Chi energy flow for both forms. The meditative effect is achieved differently. Some TC teaching encourages a focus on the flow of the movement and the rhythm of the breath. Using this focus to allow one to reach a state of non-distraction and SCD fills the mind with positive word phrases of prayer, thereby eliminating chatter in the brain (Borik, 2004). Those word phrases are taught in a three step pattern: do the movement (engaging the body), visualize what the phrase means (engaging the mind), and feel the word phrase (engaging the spirit). This three step pattern is consistent with the physical and psychosocial approach to adaptation in the Roy Adaptation Model (Roy & Andrews, 1999).

TC is described as a traditional Chinese exercise that is suitable for older people and persons with chronic disease (Wong, Lin, Chou, Tang, & Wong, 2001). It is a “series of graceful movements linked together in a continuous sequence so that the body is constantly shifting from foot to foot, with a lower center of gravity” (Wong et al., 2001). TC incorporates deep breathing and mental concentration during the movement to achieve harmony between body and brain. A cross-sectional study of TC \( n = 25 \) and control \( n = 14 \) older men and women demonstrates positive effects on postural stability measured by the SMART Balance Master and dynamic balance test \( p = .014 \) (Wong et
A study of 32 adult volunteers (53-64 years of age) following a 6 month TC intervention reported a 9.6 to 18.8% \( (p < .05) \) improvement in physical endurance and 15.1 to 23.7% \( (p < .05) \) increase in physical strength (Lan, Lai, Chen, & Wong, 2000). TC participants \( (N = 45) \) self reported statistically significant benefits of better posture, reduction of fibromyalgia pain, enhanced general sense of well-being, and reduced insomnia (Taggart, 2001). In another study, TC participants reported improved ability to perform activities of daily life and an increase in normal physical activity along with physical benefits, such as improved physical function and ability to complete activities of daily living, from the exercise (Kutner, Barnhart, Wolf, McNeely, & Xu, 1997).

Statistically significant decreases in systolic and diastolic blood pressure ranging from 7-15 and 2.4-8.8 mm hg respectively \( (p < .05) \) have been reported in studies of TC 3 times per week times 12 weeks (Tsai et al., 2003; S. L. Wolf et al., 2003; D. R. Young, Appel, Jee, & Miller, 1999). TC has an immediate effect on arterial blood pressure from 118.4 ± 12.8 to 109.9 ± 11.1 \( (p < .017) \) and increased sympathetic changes measured by normalized high-frequency power from 22.8 ± 14.6 pre TC to 30.6 ± 18.4, 60 minutes after TC \( (p < .05) \) compared to a control group (Lu & Kuo, 2003). Improvements in physical function (6-minute walk increased 135 meters, \( p = .001 \)) have been observed following 1 hour of TC, 2 times a week for 12 weeks compared to usual care (G. Y. Yeh et al., 2004). Slow meditative movements such as TC and SCD may improve physiologic function (blood pressure and 6-minute walk distance) from a mind-body perspective which may promote adaptation on multiple levels.

The aspects of TC that are incorporated into SCD include the form of movement with the low center of gravity, suggesting that many of the same sorts of muscle groups,
 proprioception centers, and level of physical activity may be engaged to produce similar physiological results. While TC is often practiced from a standing position, SCD may be performed from a sitting or standing position. The emphasis of SCD on the sign-meaning and spiritual connection may be somewhat different than TC focus on breath and flowing movement, and thus these aspects of practice may produce different results. The research questions for this study are designed to learn more about which of these results are characteristic of SCD practice.

**Theoretical Framework**

The interplay of mind-body theoretical concepts and PA has increased in popularity since the 1990’s and makes up 30% of the exercise programs in fitness centers (La Forge, 2005). Mind-body practices that blend physical movement or postures, a focus on the breath and mind achieve deep states of relaxation include, but are not limited to, familiar forms such as Yoga, Tai Chi (TC), Qigong, and other less familiar forms such as SCD (Borik, 2004; Larkey et al., 2009; Steiner & Wegman, 2003). SCD, grounded in the principles of traditional Chinese medicine, incorporates deep breathing and mental concentration during the movement to achieve harmony between body and brain, and is a novel form of PA that has multiple health benefits including strengthening muscles and improving balance using a mind-body approach (Borik, 2004). Both the mind-body interactions and the potential for improved functional outcomes resulting from these forms of PA make them particularly appealing for older adults (Beaudreau, 2006; Docker, 2006; Gavin & Myers, 2003; F. Li et al., 2007; Scourfield, 2006).

SCD is particularly suitable for older adults, as it is implemented without the aerobic and musculoskeletal strain that is sometimes associated with higher intensity
exercise, while providing a mild to moderate intensity PA. There is a growing body of research that indicates a wide range of potential health benefits from mind-body exercise (Rogers, Larkey, & Keller, 2009). However, there has been limited research exploring mind-body PA interventions for adaptation and physical function among older adults. The theoretical framework for this study was previously published (see note in Appendix A) (Rogers & Keller, 2009). This discussion is focused on the description of the development of a theory-based intervention to promote successful adaptation to an active lifestyle based on Roy’s Adaptation model and guided by evaluation theory to address theoretical integrity (Sidani & Braden, 1998).

**Theoretical approach.** The broad nature of the Roy Adaptation Model (RAM) developed by Sister Callista Roy, allows an examination of PA and the development of a theory-based intervention from an expanded, integrated, and holistic nursing perspective. According to the RAM, nursing’s biobehavioral knowledge “balances understanding of the person as both a physiologic being in a physical world and as a thinking and feeling being with human experience in a cosmic world.” (Roy & Andrews, 1999). Human beings and groups are perceived as holistic, adaptive systems that constantly change and interact with their environment. Health is a process of being and becoming integrated and whole and reflects environment and person mutually. According to Roy, the overall goal of nursing is to focus on promoting health of the individual and group by promoting adaptation in each of four adaptive modes: physiological-physical, self-concept, role function, and interdependence (Roy & Andrews, 1999).

According to the RAM, adaptation is assessed and measured in physical (physiologic) and psychosocial (self-concept, role function, and interdependence) modes
(Roy & Andrews, 1999). Physiologic-physical measures bodily function and specific to this study, the level of activity and function. Self-concept is the composite of beliefs including spirituality and feelings one has of oneself at a given time. Role function is a set of expectations about how a person functions and relates with others. Interdependence is giving and receiving love via nurturing relationships. While all of these modes are important, this intervention will focus on adaptation to aging using Roy’s theoretical physiologic-physical and self-concept modes to evaluate the effect of SCD on physical function and personal beliefs.

The RAM has been used in studies of physical activity and cancer to promote adaptation and quality of life (Headley et al., 2004; John, 2007; Young-McCaughan et al., 2003; Young-McCaughan et al., 2007). Flood used the RAM to define adaptation to successful aging (Flood, 2005a). The optimal level of adaptation is consistent with active aging as defined by the WHO and others to include the importance of treating the person as a whole; emphasizing physical and psychological function, as well as spirituality (Crowther et al., 2002; Flood, 2005a). The goal of the described intervention was to promote adaptation by enhancing the physiological-physical and self concept modes through a meditative movement (SCD) intervention that enhances physical activity performance, spirituality, and self efficacy. Theory development includes the following key elements: problem definition, critical inputs, mediating processes, extraneous factors, and implementation issues (Sidani & Braden, 1998).

**Problem definition.** Adaptation is the primary concept of interest in the RAM. It is the dynamic process whereby people use conscious awareness and choice to create human and environmental integration. The RAM model depicts the individual as a
biopsychosocial being who is able to adapt to environmental stimuli categorized as focal, contextual, or residual. When assessing physical function, sedentary lifestyle is viewed as the focal stimulus, which leads to maladaptive responses for older adults (disuse consequences and negative beliefs). Contextual stimuli are indirectly related to the focal stimuli such as PA and personal beliefs. The residual are all other stimuli that affect the focal and contextual stimuli such as relationships with family and friends.

Adaptation includes two processes called the regulator and cognator subsystems (Hanna, 2006). The regulator subsystem includes automatic bodily responses through neural, chemical and endocrine adaptation channels. (Roy & Andrews, 1999) The cognator subsystem responds through four cognitive-emotional channels: perceptual and information processing, learning, judgment and emotion (Barrow, Bedford, Ives, O'Toole, & Channer, 2007). The effects of the regulator and cognator interact, but cannot be measured at this level; however, they are measured in behavioral outcomes assessed in adaptation (Barrow et al., 2007). Adaptation occurs when the cognator and regulator subsystems are stimulated, resulting in behavior changes measured in physiologic and psychosocial modes.

The physiologic mode measures all bodily function and specific to this intervention, physical function. In the RAM, the psychosocial or mind and spirit modes are self-concept, role function, and interdependence (Roy & Andrews, 1999). Self-concept deals with personal aspects of human systems, specifically psychic and spiritual integrity (Roy & Andrews, 1999). It is a composite of beliefs one holds at a given time. In an older adult who is sedentary, self-concept is characterized by a decreased confidence in the ability to exercise and spirituality. Maladaptive responses occur when
adaptive mechanisms are inadequate, resulting in activity intolerance and disuse consequences for sedentary aging adults (Roy & Andrews, 1999). The “problem”, then, used to develop the following intervention, is the ‘maladaptive’ response of older persons, sedentary behavior, that is amenable to ‘treatment’ or an intervention that promotes adaptation through SCD.

Table 1

*Intervention Components of Roy’s Adaptation Model*

<table>
<thead>
<tr>
<th>Problem</th>
<th>Critical Inputs</th>
<th>Mediating Processes</th>
<th>Expected Outcomes</th>
<th>Exogenous Factors</th>
<th>Implementation Issues</th>
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<tr>
<td>Maladaptation to aging due to sedentary behavior</td>
<td>Regulator and Cognator Subsystem enhancement</td>
<td>Spiritual &amp; Self Efficacy Enhancement</td>
<td>Increased Physical Function: 6 minute walk, Timed Up &amp; Go test; Blood Pressure</td>
<td>Residual Stimuli, SES and cultural considerations</td>
<td>Chronic illness affecting balance, Chronic Illness, Safety, Room set-up, Different levels of physical function</td>
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<td>Personal Belief, spirituality, self efficacy</td>
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**Critical inputs.** Roy’s conceptualization of adaptation defines a sedentary adult as in a maladaptive state due to an inability to regulate their physiological and psychological state. An intervention needs to impact both of these modes. It is theorized that SCD will promote adaptation by enhancing the regulator and cognator subsystems, and influencing the focal and contextual stimuli through the mind, body, and spirit connections of deep breathing and meditation combined with purposeful movements to promote adaptation measured in the selected physiologic and self-concept modes (Figure 1). The regulator subsystem will enhance adaptation through the physical movements that foster spiritual connections, which will improve balance and physical function. The cognitive function of the cognator allows humans to obtain knowledge and promote
adaptation through increased self-efficacy measured in the self-concept mode. In this intervention, a mind, body, and spiritual PA was tested to promote adaptation to aging by improving the personal beliefs of community dwelling older adults and subsequent outcomes of improved physical function.

![Diagram](image)

*Figure 1.* Critical inputs of the intervention. ↑ = increase; and ↓ = decrease.

The dose of the intervention was the primary critical input. Increases in the regulator and cognator critical inputs was achieved through one hour weekly sessions with groups of 5-10 participants each, over 12 weeks; the length was selected based on a review of previous TC programs (Taggart, 2002; Tsai et al., 2003; S. L. Wolf et al., 2003; G. Y. Yeh et al., 2004). Participants were given a copy of an instructional DVD, music CD, flash cards, and a Personal Assessment Log to facilitate practice of movements at
home, between classes. Participants were encouraged to practice at least 10 minutes, 2 times between classes the first week, increasing the time to include up to the recommended 30 minutes at least 5 days per week.

**Mediating processes.** Mediating processes are conceptualized by Roy as the contextual stimuli (Roy & Andrews, 1999). For this intervention, a combination of the physical movement of the SCD and the self-concept enhancement of personal beliefs mediate the adaptation process in sedentary older adults. These activities are the regulator and cognator inputs for the intervention including: spiritual/self-reflection and physical movement; and self-efficacy enhancement strategies.

**Spiritual and physical movement.** The regulator critical input for this intervention included a mind-body-spiritual exercise called SCD. The form of the movement was described earlier. Self-efficacy and spirituality are enhanced through this intervention designed to ask participants to selecting their own picture of the words in their mind, and identifying how the word makes them feel during the intervention.

There is a growing body of knowledge to support the importance of spirituality among the aging population (Eisenhandler, 2005; Flood, 2002; Flood, 2005a; Flood, 2005b; Koenig, 2006; Nelson-Becker, 2005). Spirituality is defined as the personal quest for understanding answers to ultimate questions about life, meaning and a relationship with the sacred or transcendent, which may (or not) lead to or arise from the development of religious rituals and the formation of community (Koenig et al., 2001). Low spirituality is reported to have a high correlation with all cause mortality (McCullough et al., 2000). Spiritual feelings were emphasized during SCD.
**Self-efficacy.** The intervention was anticipated to enhance the cognator mode by improving personal beliefs through increasing self-efficacy with a spiritual focus to improve the way participants feel about themselves. SCD uses a three step technique to engage the mind, body and spirit in physical activity. First, the physical boundaries of word phrases were demonstrated by the instructor and practiced by the group participants, encouraging the participant to visualize and “feel” the word phrase. This three step process also helped the individual remember the movements so they could be repeated, consistent with the learning principles of the RAM (Roy & Andrews, 1999). Self efficacy was enhanced in four ways: demonstration of the SCD movement; seeing the SCD movements performed by others, repeating the SCD movements themselves, and increasing daily participation in the SCD movements.

Assessment of confidence to exercise would also evaluate personal beliefs at a given time. Levy and Meyers write that health problems are inevitable with aging and this contributes to an unwillingness to engage in PA and maladaptive adaptation (Levy & Myers, 2004). This belief is reinforced by the following reported barriers to PA among older adults: feelings of inability to perform PA (low self-efficacy); fear of falling; and self-rated poor health accompanied by pain and fear of pain (Rasinaho et al., 2006; B. Resnick, 2002). Self-efficacy is the confidence a person feels in performing a behavior and overcoming the associated barriers (Baranowski et al., 2002). Several studies have reported a significant positive relationship between physical activity and self-efficacy ($r = .30 - .70$ and $b = .493$) (K. I. Gallagher et al., 2006; E. McAuley et al., 2006a; Netz et al., 2005). Assessment of confidence to exercise was evaluated in this intervention.
**Expected outcomes.** The overarching outcome for this intervention was adaptation. Adaptation was improved physical function and measured by the outcomes that relate to the physiologic mode including: improved BP, 6-minute walk, and Timed-Up-& Go and increased weekly activity. Mind-body exercises have been shown to improve physical function in older adults. Slow meditative movements such as TC and SCD may improve physiologic function (blood pressure and 6-minute walk distance) from a mind-body perspective which may promote adaptation on multiple levels.

**Exogenous factors.** According to the RAM, residual stimuli are environmental factors that have an unclear effect on the current situation and may include family relationships or a previous fall which may be extraneous variables related to adaptation (Roy & Andrews, 1999). For example, it has been reported that situations such as unplanned hospitalizations have contributed to declining functional status among previously active older adults (Creditor, 1993; H. Y. Wu, Sahadevan, & Ding, 2006). Other extraneous factors include age in calendar years, gender (male and female), current chronic illness, level of education in years, ethnicity and race, life crisis, new diagnosis of chronic disease.

**Implementation issues.** Implementation strategies were vital to the success of this theory-based intervention. SCD classes were taught by a trained facilitator and all course materials were available on a DVD and Personal Assessment Log to provide a consistent delivery of the information. The SCD classes were taught in a classroom to provide privacy to the participants who were encouraged to ask questions at any time. In recognition of the safety of participants, chairs were provided, and those who were unstable participated in the class in the seated position. Class size is another concern for
safe implementation of this intervention. There were no more than 10 participants per class allowing monitoring of class participation and individualized coaching.

**Significance of the study.** Sedentary adults over 55 years old are at an increased risk for multiple chronic diseases. Few community-based interventions have addressed the needs of sedentary seniors with a theory-based, mind-body approach to adaptation and none have examined SCD in this way. This research was a mind, body, spirit PA to improve physical function and personal beliefs with a theory-based approach to program development for community dwelling adults over the age of 55.

This discussion of the critical elements of Roy’s Adaptation model in the application of The Roy Adaptation Model to the development of programs and interventions to guide practice in health promotion in older persons gives clinicians several ways to use a theoretical model to guide the development of a physical activity intervention in older persons. First, the elements of enhancing spirituality and self efficacy are described with an alternative form of PA to increase strength and endurance in older persons. Second, carefully detailing the significant elements of the theory increases our understanding of identification of what components ‘work’ in an intervention, and which components are excluded. Continued research of meditative movement in this population is important to understanding the mechanisms of the movement. Studies should include models of implementation and evaluation that consider the broader spectrum of adaptation to aging, including spiritual elements, as well as addressing the fit and applicability of SCD across racial and ethnic groups.
Chapter 2

Literature Review

Few intervention studies have been conducted evaluating the effect of mind-body based PA for the purpose of improved physical function and personal beliefs through adaptation. A literature search for SCD intervention studies revealed no studies conducted with older adults. Tai Chi (TC) and QiGong (QG) exercises have proven to increase physical activity and muscle strength and incorporates many of the same factors as SCD (e.g., flowing motion of arms and legs, stepping and shifting weight using a lowered center of gravity, and a meditative focus while breathing long, slow deep breaths. These similarities with what has been defined as “meditative movement” makes these practices good candidates to review as part of the body of literature that may point to predicted benefits of SCD.

While the focus of this study encompasses adaptation and physical function, an analysis of TC studies with older adults provides the relevant basis for testing this intervention; which builds on the strengths and addresses the limitations of mind-body PA interventions in the literature by evaluating balance, function and personal beliefs including spirituality. The literature was analyzed using two methods: (1) report of all TC and QG randomized controlled trials with community dwelling older adults and (2) report of psychosocial benefits of TC and QG interventions. These literature reviews have been previously published (Appendix A) (Rogers et al., 2009; Rogers, Keller, & Larkey, 2010).
The interplay of mind-body theoretical concepts and PA has increased in popularity since the 1990’s and mind-body based exercise makes up 30% of the exercise programs in fitness centers (La Forge, 2005). Mind-body practices that blend physical movement or postures, a focus on the breath and mind to achieve deep states of relaxation have been recently defined as “Meditative Movement” (MM) (Larkey et al., 2009), and include, but are not limited to, familiar forms such as Yoga, TC, QG, and other less familiar forms such as SCD, Neuromuscular Integrative Action and Eurythmy (Borik, 2004; Kitchner-Bockholt, 1992; Rosas & Rosas, 2005; Steiner & Wegman, 2003). Two of these forms, TC and QG, are grounded in the principles of traditional Chinese medicine and have been described as equivalent in terms of basic forms and principles, and have consistently produced a number of similar health outcomes (Chodzko-Zajko et al., 2006; Larkey, Jahnke, Rogers, Lin, & Etnier, In press).

QG is considered the ancient root (before recorded history) of all traditional Chinese medicine practices (Jahnke, 2002) and many branches of QG have developed over 5000 years. There are hundreds of forms of QG exercises developed in different regions of China that have been created by specific teachers, some designed for specific or general health enhancement purposes. TC, also known as Tai Chi Chuan, was developed in the 12th -14th century and has become one of the best known and most highly choreographed forms of QG. TC is described as a traditional Chinese exercise that is suitable for older adults and patients with chronic disease (Wong et al., 2001). It is a “series of graceful movements linked together in a continuous sequence so that the body is constantly shifting from foot to foot, with a lower center of gravity” (Wong et al., 2001, p. 608). TC incorporates deep breathing and mental concentration during the
movement to achieve harmony between body and brain. Both TC and QG movements can be practiced standing, walking, sitting or lying down. Mind-body interactions as well as the potential for improved functional outcomes resulting from these forms of PA make them particularly appealing for older adults.

The American College of Sports Medicine and American Heart Association guidelines for PA for older adults recommend that sedentary older adults begin with balance, flexibility and strength training to build endurance prior to participating in moderate to vigorous-intensity aerobic PA (Nelson et al., 2007). Further, they recommend the measurement of intensity for older adults be measured on a 10 point scale with an emphasis on slight increases in heart rate and breathing as a measure of moderate-intensity. Both TC and QG are particularly suitable for older adults, as they are implemented without the aerobic and musculoskeletal strain that is sometimes associated with higher intensity exercise as described above, and show a growing body of research that indicates a wide range of potential health benefits (Wong et al., 2001). These two MM forms of PA, TC and QG, were systematically assessed for benefits to the health and quality of life of older adults.

Prior reviews have reported on specific outcomes of TC or QG, primarily addressing only one of these practices, and not considering the similarity of the two forms and the similar outcomes. These reviews have covered a wide variety of outcomes, many focused on specific diseases or symptoms including: hypertension (M. S. Lee, Pittler, Guo, & Ernst, 2007); cardiovascular disease (Cheng, 2006; M. S. Lee, Pittler, Taylor-Piliae, & Ernst, 2007); cancer supportive care (M. S. Lee, Chen, Sancier, & Ernst, 2007; M. S. Lee, Pittler, & Ernst, 2007; Mansky et al., 2006); arthritic disease (M. S. Lee,
Pittler, & Ernst, 2007); stroke rehabilitation (Taylor-Piliae & Haskell, 2007); effect on aerobic capacity (Taylor-Piliae & Froelicher, 2004); falls and balance (Verhagen, Immink, van der Meulen, & Bierma-Zeinstra, 2004; Wayne et al., 2004); maintenance of bone marrow density (Wayne et al., 2007); and shingles-related immunity (M. Irwin, Pike, & Oxman, 2004). Other reviews have addressed a broad spectrum of outcomes to demonstrate how TC (Adler & Roberts, 2006; Hogan, 2005; Kemp, 2004; J. X. Li, Hong, & Chan, 2001; Matsuda, Martin, & Yu, 2005; Wang, Collet, & Lau, 2004; S. L. Wolf et al., 1997) or QG (Lan, Lai, & Chen, 2002; Sancier & Hu, 1991; Sancier, 1996; Sancier, 1999) have improved health across a variety of outcomes among mainly older adults.

While many of these reviews employed strict selection criteria, others use abstracts from research conducted in China (sometimes with limited information on study design) and were not restricted to RCTs.

**Randomized Controlled Trials of Tai Chi and Qigong**

The purposes of this review and synthesis of literature were to: (a) identify the physical and psychological health outcomes shown to be associated with TC and QG practice in older adults participating in randomized controlled trials; and (b) identify gaps in this body of knowledge to substantiate the intervention studied.

**Method.** Research reports were selected for review based on the following criteria: (a) articles were published in a peer reviewed journal between 1993 and 2007; (b) TC or QG described as the primary intervention; (c) participants over 55. While 65 is the lower limit of older adults by definition, the lower age limit of 55 was selected to include older adults with chronic disease and those transitioning to retirement (Eliopoulos, 2005); (d) printed in English; and (e) limited to randomized controlled trials.
The following databases were used to conduct literature searches for potential articles: Cumulative Index for Allied Health and Nursing (CINAHL), Psychological Literature (PsychInfo), PubMed, and Cochrane database. Key words included Tai Chi, Tai Chi Chuan and taiji, qigong; and older adults, aged, and elderly; and were combined, then further narrowed with qualitative and RCT terms separately. Tai Chi, Tai Chi Chuan, taiji, and qigong were entered in Google Scholar search engine with additional hand searches and secondary sources to complete the search for inclusion of articles. Further sorting measures included those studies conducted with a community dwelling population. Residents in independent living facilities were included due to the comparable level of independent living as community dwelling older adults.

Based on the inclusion criteria, 36 RCTs were included in this review. One RCT report was included with a minimal age less than 55 because the age for inclusion in the RCT was over 50, but the reported mean age was 70 (SD = 9.2) with a large majority of study participants within the range of this review (Brismee et al., 2007). The reports were entered into a table for further comparison and analysis; and compared for consistently confirmed (or disconfirmed) health benefits, design, theory, strengths and limitations, and to identify the next steps in research in this important area of study for older adult health.

Findings.

Description of studies. Across the 36 articles selected for inclusion, the number of participants in each study ranged from 14 to 702 for a total of 3799 (Table 2). Participants were mostly women (71.97%). Seven studies conducted in countries outside of the USA reported the lowest proportion of women, with a range between 0 and 50% women. Because many of the studies were international, the country of origin was
emphasized to recognize the potential generalizability of the research across a variety of geographic-bound populations. Some of the authors reported results from the same study in more than one article and were not duplicated in the table.

A variety of TC and QG forms were used in the interventions with sometimes limited descriptions of the duration, frequency and level of intensity of the exercise. The length of intervention ranged from 3 weeks to 12 months, with the preponderance of interventions at 3 to 6 months. Most classes lasted 60 minutes each, meeting 2 to 3 times weekly (ranging from 1 to 7 days/week). The level of intensity was not reported across the studies, however, TC and QG forms were previously defined as a gentle movement which indicates they were performed at a low to moderate intensity. The TC forms included a number of styles, and for many of the styles, the practice was adapted from larger to smaller number of movements (e.g., a Yang form with 108 original movements adapted to a 10 or 24 movement practice): Tai Chi Chih; Taijiquan; Easy Tai Chi; Yang; Sun-style, and a variety of hybrids (e.g., combining Yang and Sun styles). The Qigong forms described were Baduanjin, Guolin, and Medicinsk. Some of the movements were designed for the specific population such as groups with a history of osteoarthritis (Chou et al., 2004; R. Song, Lee, Lam, & Bae, 2003) or diabetes (T. Tsang, Orr, Lam, Comino, & Singh, 2007). Easy Tai Chi was designed specifically for older adults (F. Li, Fisher, Harmer, & Shirai, 2003).

The countries involved in the reports are USA (13); Hong Kong (4); Australia (3); Italy (2); Korea (2), Poland (1); and Sweden (1). Two of the studies conducted in the USA included a significant African American population and none reported inclusion of Hispanic population (F. Li et al., 2005). Several populations have been the target of TC
and QG interventions, including those with a history of: sedentary lifestyle; various forms of arthritis; Parkinson’s disease; depression; frail or at risk for falls; type II diabetes; cardiac disease including chronic stable atrial fibrillation and coronary artery disease; pre-hypertension; and varicella. A few studies were conducted with relatively healthy older individuals. A wide range of outcomes have been addressed in these selected studies of older adults practicing TC and QG: balance and falls; physical function; cardiovascular fitness; psychological; and treatment of disease or symptom.

**Balance and falls.** The most frequently studied outcomes were balance and factors related to risk for falls (Table 2). Of the 18 articles that were included in this review of balance and falls, 16 articles addressed balance directly, showing significant improvements (mostly in response to TC, but two using a combination of TC and QG, 7 directly measured effects of TC on falls and 7 measured the effect of TC and QG on fear of falling. While fear of falling may be considered a psychological factor, it was included in the review of balance and falls due to the relevance to falls.

There are multiple dimensions to balance requiring multiple measures to assess changes (W. W. Spirduso et al., 2005). One leg standing is a common measure and reported significant improvements compared to control groups (Audette et al., 2006; Choi, Moon, & Song, 2005; Gatts & Woollacott, 2006; F. Li et al., 2005; R. Song et al., 2003; Stenlund, Lindstrom, Granlund, & Burell, 2005; Zhang, IshikawaTakata, Yamazaki, Morita, & Ohta, 2006). In some studies with strong control groups (i.e., interventions that included some form of exercise that could be expected to also generate improvements), TC treatment still showed improvements in outcomes such as single leg stance and balance, though not significant (Judge, Lindsey, Underwood, & Winseimius,
The Timed Up & Go test, a common measure of balance, showed significant reductions in time for completion for TC compared to control groups (Gatts & Woollacott, 2006; F. Li et al., 2005). Climbing boxes and coordination improved significantly for those who practiced a combination of TC and QG more than a sedentary control (Stenlund et al., 2005). For two studies, neither group reported changes for tandem standing test (Stenlund et al., 2005; T. Tsang et al., 2007). One study failed to detect significant changes in flexibility and knee strength with TC or control, but significant improvements were found in trunk flexion and abdominal strength with TC (R. Song et al., 2003). The intervention described in this study was minimal compared to others reviewed, with practice 3 times per week in the first two weeks and only once a week thereafter for the remaining 10 weeks.

Gatts and Woollacott (2006) reported significant improvement of tandem stance for TC practitioners. They also reported significant improvements in neural responses among the TC practitioners. Significant improvements in strength and flexibility have also been reported among TC practitioners as well as Berg Balance Scale and Dynamic Gait Index and posturographic parameters of balance (Audette et al., 2006; Choi et al., 2005; Judge et al., 1993; F. Li et al., 2005; Maciaszek, Osinski, Szeklicki, & Stemplewski, 2007; Voukelatos, Cumming, Lord, & Rissel, 2007; Y. Yang et al., 2007). Three studies reported similar changes in balance, function, and strength compared to an exercise control (T. Tsang et al., 2007; S. L. Wolf, Barnhart, Ellison, & Coogler, 1997; Woo, Hong, Lau, & Lynn, 2007). A study evaluating the effect of a combination of QG and TC reported significantly improved activity levels among practitioners compared to sedentary controls (Stenlund et al., 2005).
A few studies directly examine the impact on falls. Some reported a significant reduction in falls comparing TC to a control (F. Li et al., 2005; Voukelatos et al., 2007; S. L. Wolf et al., 2003) and others reported no difference in fall rates between groups (Choi et al., 2005; T. Tsang et al., 2007; S. L. Wolf et al., 2003a; Woo et al., 2007). Changes in fear of falling provide another dimension of TC and QG impact on falls, since improvements in this self-efficacy proxy measure are eventually related to changes in fall events. The remaining studies in this cluster used TC and most reported a significant reduction in fear of falling scores (Choi et al., 2005; F. Li, Fisher, Harmer, & McAuley, 2005; Sattin, 1992; S. L. Wolf et al., 2003; Zhang et al., 2006). One study reported more of a reduction of fear of falls than control groups receiving balance training or education (S. L. Wolf et al., 1997). One QG study reported slight but not significant improvement of fear of falling and falls efficacy scores compared to a sedentary control (Stenlund et al., 2005).

**Physical function.** Table 2 shows a summary of the reviewed studies that improved physical function among sedentary and healthy older adults. A number of the studies included in this group address general perceptions of overall function, health, and self-efficacy for physical function. There were 9 TC studies that showed significant improvements in physical function at three levels of outcomes: functional fitness; functional performance (observed); and functional performance (self-report) (W. W. Spirduso et al., 2005).

**Functional fitness.** Key components of functional fitness include: strength, power, flexibility, balance, and endurance (W. W. Spirduso et al., 2005) One of the earlier TC studies in the United States was reprinted in 2003 (S. L. Wolf et al., 2003). The primary
outcome of this study was to compare TC to balance training for fall reduction. Some of measures of physical function also improve balance. Wolf et al. reported significantly less loss of grip strength among the TC practitioners compared to the balance training or education control group, without changes of other measures of physical fitness such as hip strength or lower extremity range of motion. Muscle strength and peak power increased, but not significantly between TC and a seated calisthenics and stretching program designed for diabetics (T. Tsang et al., 2007).

*Functional performance, observed.* Functional performance is measured by observed field tests that imitate activities of daily living (W. W. Spirduso et al., 2005). One study reporting the use of TC and hydrotherapy showed significant improvements of Up and Go, 50-foot walk time and stair climb for hydrotherapy compared to a wait-list control, and TC group only improved stair climb (Fransen, Nairn, Winstanley, Lam, & Edmonds, 2007). Significant improvements were also reported for 50-foot walk, one leg stand, and chair rise compared to wait-list control groups (F. Li et al., 2003; F. Li et al., 2004). For another group, chair stand time significantly decreased (12.3%) among TC practitioners while it increased (13.7%) among the wellness education control group (S. L. Wolf et al., 2006). Other tests among this group showed similar patterns of change when performing 360° turn and picking up objects, but the results were not significant. Gait speed and functional reach improved among both groups and the one leg stand did not change significantly for either group (S. L. Wolf et al.).

One study was unable to report significant changes in the 6-minute walk or other measures of function following 45 minutes of TC designed for persons with diabetes, 2 times a week for 16 weeks, but this intervention was being compared to a “sham”
exercise program including seated calisthenics and stretching (T. Tsang et al., 2007). However, habitual PA did increase for the TC group and decrease for the control group.

Functional performance, self-report. In addition to observed measures of functional performance, it is also common to utilize self-reported measure of activities (W. W. Spirduso et al., 2005). Using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), significant improvement in physical function was reported for TC practitioners compared to control group following training and a return to normal after a period of detraining (Brismee et al., 2007). Another study reporting the use of TC and hydrotherapy showed similar improvements in the WOMAC and SF-12 physical component compared to a wait-list control group (Fransen et al., 2007). Other studies of TC reported significant improvements in SF-20 physical component and self-efficacy, SF-12 component, and SF-12 instrumental activities of daily living, respectively (F. Li, Harmer, McAuley, Fisher et al., 2001; F. Li et al., 2003; F. Li et al., 2004). The former was compared to a wait-list control and the two latter were compared to a gentle stretching control.

Physical function components of the SF-36 improved significantly for TC compared to a sedentary control (M. R. Irwin, Pike, Cole, & Oxman, 2003; M. R. Irwin, Olmstead, & Oxman, 2007). TC practitioners reported significantly lower Sickness Impact Profile scores (p<.05) compared to a sedentary control group of older adults with osteoarthritis (Greenspan, Wolf, Kelley, & O'Grady, 2007), while self-reported health scores did not change for either group.

Cardiovascular health. The third most frequently published RCTs of TC and QG on older adults on a specific outcome was effects on cardiovascular health. This category
includes measures such as blood pressure, BMI, and VO$_2$ Max. Of the 9 studies in this category, 7 employed TC and 2 used QG.

Statistically significant decreases in systolic and diastolic blood pressure ranging from 7-13.2 and 2.4-4 mm hg respectively ($p < .05$) were reported in studies of TC 3 times per week times 12 weeks (S. L. Wolf et al., 2003; S. L. Wolf et al., 2006; D. R. Young et al., 1999). One study did not report a significant decrease in blood pressure or heart rate, however there was a reported significant increase of pre-ejection fraction following 20 minutes of TC components more than a passive rest period and slow movement which is related to sympathetic nervous system activity (Motivala, Sollers, Thayer, & Irwin, 2006). Heart rate variability was significantly improved for TC practitioners compared to brisk walking and a sedentary control group (Audette et al., 2006).

Measures of body composition were reportedly unchanged when the duration of the study was less than 16 weeks (R. Song et al., 2003; S. L. Wolf et al., 2003; D. R. Young et al., 1999). Another study was unable to report changes following a 12 month intervention, however, the baseline BMI was within normal range (Thomas et al., 2005). A study among transitionally frail older adults who practiced TC for 48 weeks showed a 2.3% ($p < .05$) decrease in measured BMI compared to an increase among the sedentary control group (S. L. Wolf et al., 2006). Two studies were unable to report significant differences between group changes in energy expenditure. Of these two, however, one did report increases in energy expenditure for TC and resistance training verses a sedentary control (Thomas et al.) and the other higher energy expenditure among the Aerobic exercise class compared to TC (D. R. Young et al.). Both of the QG studies
measured 6-minute walk as an outcome. One reported more of an improvement for the
aerobic training than the QG group (Burini et al., 2006) and the other a significant
improvement among the QG group that practiced 90 minutes, 2 times a week for 16
weeks (6-minute walk increased 114 meters, \( p = .001 \)) compared to a wait-list control that
decreased the distance (Pippa et al., 2007). There were no changes in ejection fraction,
BMI, or cholesterol for QG or control for the latter study.

**Psychological outcomes.** A cluster of studies were conducted on outcomes related
to mental and emotional health, including depression, anxiety, mood states and related
biomarkers of these factors. Five studies evaluated the effect of TC and QG on
depression, in older adults using 4 different scales. Of those, two studies reported
significant reductions in depression. One study group practiced QG (Center for
Epidemiological Studies Depression Scale) and one TC (Geriatric Depression Scale)
compared to newspaper reading and wait-list control groups respectively (Chou et al.,
2004; H. W. H. Tsang, Fung, Chan, Lee, & Chan, 2006). Two studies used the Beck
Depression Inventory. One compared QG and aerobic training, reporting no changes in
depression (Burini et al., 2006) and the other compared TC to a health education control
with significant improvements in both groups over time (M. R. Irwin et al., 2007). A fifth
study reported a significant decrease in depression and stress among hydrotherapy
practitioners (Depression Anxiety and Stress 21) while the TC and wait-list control
remained unchanged (Fransen et al., 2007). The SF-12 mental score did improve
significantly for TC practitioners compared to a stretching control group (F. Li et al.,
2003) and both the TC and exercise control group (F. Li et al., 2004) while a third study
reported no changes within or between TC, hydrotherapy or wait-list control group (Fransen et al., 2007).

**Disease outcomes.** A final grouping of studies are listed in Table 2 showing some studies that were conducted to examine effects on specific symptom outcomes associated with specific diseases, including arthritis; Parkinson’s disease; and immune system strength relative to participants with herpes varicella or influenza vaccination (response to vaccination). Changes in bone mineral density and sleep quality were added to this category because the study populations were selected for specific diseases or symptoms. One QG, one combination QG and TC and 6 TC studies are reported here.

Among studies with arthritis patients, relief of pain and stiffness were examined in response to interventions. Reports of pain (Brismee et al., 2007) and stiffness (R. Song, Lee, Lam, & Bae, 2007) significantly improved more for TC participants compared to sedentary or wait-list control groups. Another study reported a trend towards significant reductions in pain among TC, mean change 5.2, 95% CI [-0.8, 11.1] and significant improvement for hydrotherapy, mean change 6.5, 95% CI [0.4, 12.7] participants compared to wait-list control group following 12 weeks (Fransen et al., 2007). While the latter study did not report significant improvements, the trend towards improvement indicates TC may improve joint pain among TC practitioners.

The effect of QG compared to aerobic training on self-report of symptoms of Parkinson’s disease reported no change among both groups (Burini et al., 2006). Both groups showed low scores at baseline. Immune function was also studied. One study reported the increased immunity from the varicella zoster vaccine among healthy TC practitioners and the other reported the effect of TC on varicella zoster virus immunity
(M. R. Irwin et al., 2003; M. R. Irwin et al., 2007). Measures have included significantly improved symptoms related to the disease and quality of life. The VZV-RCF increased significantly more for TC practitioners ($p < .05$) than those receiving health education or wait-list control (M. R. Irwin et al., 2003; M. R. Irwin et al., 2007). A third study reported a significantly higher response to the 2003-2004 influenza vaccination among participants who practiced a combination of QG and TC compared to a sedentary control group (Y. Yang et al., 2007).

Bone mineral density loss was significantly different for female TC and resistance training participants compared to a sedentary control group, but no reported differences for men (Woo et al., 2007). Bone loss at the hip was relatively unchanged for female TC ($0.07 \pm 0.64$) and resistance training ($0.09 \pm 0.62$) participants compared to a sedentary control group ($-2.25 \pm 0.6$). Sleep latency (time needed to fall asleep) was significantly reduced by 18 minutes and sleep duration was increased by 48 minutes among TC participants compared to low-impact exercise (Li et al., 2004).
### Table 2

**Tai Chi and Qigong Randomized Controlled Trials**

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Country</th>
<th>N of subjects</th>
<th>Exercise duration (minutes x days per week)</th>
<th>Exercise group (n)</th>
<th>Control group (n)</th>
<th>Reported outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audette Jin Newcomer Stein Duncan &amp; Frontera, 2006 USA</td>
<td>27 Sedentary women 71.4 years 0/27</td>
<td>12 weeks (60 minutes x 3 days)</td>
<td>TC 10 movement Yang (11)</td>
<td>BW (8); UC later recruited and not randomized (8)</td>
<td>Falls and Balance: Strength, hand grip and knee extension ↑ TC only* and left knee extension ↑ in TC more than BW <em>; flexibility, only toe touch flexibility ↑ in TC more than BW</em>; and balance, only non-dominant OLS with eyes closed ↑ in TC more than BW* Cardiovascular Health: VO2 max ↑ in TC more than BW and UC*; heart rate variability, high frequency ↑ and low frequency↓ in TC only* no between Physical Function: WOMAC ↑ in TC more than HL* with ↓ for detraining period Disease Outcomes (Arthritis): Pain ↓ in TC more than HL*; adverse outcomes ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brismee Paige Chyu Boatright Hagar McCaleb Quintela Feng Zu Shen, 2007 USA</td>
<td>41 History of knee osteoarthritis 70 years 7/34</td>
<td>12 week TC and 6 week no training (40 minutes x 3 days /6 weeks group training and 6 weeks home training; and 6 weeks detraining)</td>
<td>TC Yang 24-form simplified (18)</td>
<td>6 weeks of HL followed by no activity same as exercise group (13)</td>
<td></td>
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</tr>
<tr>
<td>Burini Farabollini Ianucci, Rimatori Riccardi Capecci</td>
<td>26 History of Parkinson’s disease 65 years 9/17</td>
<td>7 weeks each of Aerobics (45 min x w days) and Qigong (50 min x 3 days)</td>
<td>QG (11)</td>
<td>AT sessions (11)</td>
<td>Cardiovascular Outcomes: 6-minute walk and Borg scale for breathlessness ↑ and spirometry and cardiopulmonary exercise test ↓ for AT more than QG* Psychological Outcomes: Beck Depression Inventory ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study Authors</td>
<td>Setting</td>
<td>Participants</td>
<td>Intervention Duration</td>
<td>Intervention Details</td>
<td>Outcomes</td>
<td></td>
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<tr>
<td>Provinciali &amp; Ceravolo, 2006</td>
<td>Italy</td>
<td>20 sessions each with 8 weeks between sessions</td>
<td>Disease Outcomes (Parkinson’s): Parkinson’s Disease Questionnaire ns for both; Unified Parkinson’s Disease Rating Scale ns; Brown's Disability Scale ns</td>
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<tr>
<td>Choi Moon &amp; Song, 2005</td>
<td>South Korea</td>
<td>59 Living in care facility, ambulatory with at least 1 fall risk factor 77.8 years 15/44</td>
<td>Falls and Balance: Falls ns, but falls efficacy for TC ↑ and ↓ UC*; knee and ankle strength, OLS eyes open, and toe reach ↑ and 6 meter walk ↓ more than UC*; OLS eyes open ns</td>
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<td>Chou Lee Yu Macfarlane Cheng Chan &amp; Chi, 2004</td>
<td>Hong Kong</td>
<td>14 Chinese with depression from a psycho-geriatric clinic 72.6 years 7/7</td>
<td>Psychological Outcomes: Center for Epidemiological Studies Depression Scale ↓ TC more than WL*</td>
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<td>Fransen Nairn Winstanley Lam &amp; Edmons, 2007</td>
<td>Australia</td>
<td>152 History of chronic symptomatic hip or knee osteoarthritis 70.13 years 40/112</td>
<td>Physical Function: WOMAC: Pain and function ↓ TC and H ns with treatment effect for physical function moderate*; pain score ↓ for H compared to WL*, TC ns; Physical performance: TUG, 50-foot walk, and stair climb ↓ more for H than WL*; timed stair climb for ↓ TC and H ns; and SF-12 Physical ↑ H more than WL* and TC more than WL borderline* Psychological Outcomes: Depression Anxiety &amp; Stress 21 ↓ in H* and TC ns; and SF-12 Mental ns</td>
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<td>Gatts and Woollacott, 2006</td>
<td>USA</td>
<td>19 Balance impaired seniors 68-92 years 2/17</td>
<td>Disease Outcomes (Arthritis): Pain and function ↓ TC and H ns Falls and Balance: TUG ↓ more for TC than TCB*; FR ↑ for TC and TCB; OLS and tandem stance both legs ↑ more TC than TCB*; tibialis anterior more ↑ for TC than TCB*; and gastrocnemius ↑ only TC after TCB time*</td>
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<td>Study</td>
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<td>Physical Function:</td>
<td>Psychological Outcomes:</td>
<td>Disease Outcomes (Immune Function):</td>
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<td>Greenspan Wolf Kelley O’Grady 2007 USA</td>
<td>269 Congregate independent living, transitionally frail women with at least 1 fall in past year &gt;70 years and 50% over 80</td>
<td>48 week (60 increasing to 90 min x 2 days)</td>
<td>TC 6 simplified forms (03)</td>
<td>WE (102)</td>
<td>SIP for physical function and ambulation ↓ more TC than WE*; SIP and physical and ambulation perceived health status ↓ TC more than WE* and self-rated health TC and WE ns</td>
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<tr>
<td>Irwin Olmstead &amp; Oxman, 2007 USA</td>
<td>112 Healthy older adults 70 years 41/71</td>
<td>16 weeks (40 min x 3 days)</td>
<td>TC (59)</td>
<td>HE (53)</td>
<td>SF-36 improved for physical functioning, bodily pain, vitality and mental health for TC more than HE*; Role emotional ↓ for HE more than TC*; Role physical, general health, and social functioning both groups ns</td>
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<tr>
<td>Irwin Pike Cole &amp; Oxman, 2003 USA</td>
<td>36 Healthy older adults 60 years 5/13</td>
<td>15 week (45 min x 3 days)</td>
<td>TC (14)</td>
<td>WL (17)</td>
<td>SF-36 only role-physical and physical functioning improved more for TC than WL*</td>
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<td>Judge Lindser Underwook &amp; Winsemius, 1993 USA</td>
<td>21 Sedentary women 68 years 0/21</td>
<td>6 months( 20 min walking plus other exercise x 3 days for TC and no exercise for 12 weeks, then 30 min x1 day for FT)</td>
<td>TC simple with strength training and walking (12)</td>
<td>FT (9)</td>
<td>VZV cell-mediated immunity CMI ↑ more for TC than WL*</td>
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Falls and Balance: OLS ↑ more for TC than FT ns; knee extension ↑ more for TC than FT*; and sitting leg press improved TC and FT ns
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<th>Researchers</th>
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<td>Li Fisher, Harmer &amp; McAuley, 2005</td>
<td>256 Sedentary over 70</td>
<td>6 month (60 min x 2 days)</td>
<td>TC eight form Easy (125)</td>
<td>Falls and Balance: ABC ↑ and Survey of Activities and Fear of Falling ↓ more for TC than SC*; falls self-efficacy↑ (mediator)</td>
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<tr>
<td>USA</td>
<td>77.48 years</td>
<td></td>
<td>SC (131)</td>
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<tr>
<td>Li Fisher, Harmer &amp; Shirai, 2003</td>
<td>48 Older adults</td>
<td>3 months (? min x 3 days)</td>
<td>TC Yang 8-form easy Tai Chi (26)</td>
<td>Physical Function: SF-12 physical, instrumental activities of daily living, OLS, 50-ft walk, and chair rise all improved TC more than SC* Psychological Outcomes: SF-12 mental ↑ more TC than SC*</td>
</tr>
<tr>
<td>USA</td>
<td>68.88 years</td>
<td></td>
<td>SC (22)</td>
<td></td>
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<tr>
<td>Li Fisher, Harmer &amp; Weimer, 2004</td>
<td>118 History of moderate sleep complaints over 60</td>
<td>24 week (60 min x 3 days)</td>
<td>TC Yang (62)</td>
<td>Physical Function: Physical Function: \OLS and SF-12 \physical ↑; and chair rise and 50-ft walk ↓ TC more than SC* Psychological Outcomes: SF-12 mental ↑ both ns Disease Outcomes (Sleep): Sleep duration and efficiency ↑ and sleep quality, latency, duration, and disturbances; Epworth Sleepiness Scale and Pittsburgh Sleep Quality Index ↓ more for TC than SC*; and sleep dysfunction both and medication ↓ TC only ns Falls and Balance: Fewer falls and fewer injurious falls for TC than SC*; and Berg Balance Scale, Dynamic Gait Index, FR and OLS ↑ and 50 ft walk and TUG ↓ more for TC than SC* all sustained at 6 month follow-up</td>
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<tr>
<td>USA</td>
<td>75.4 years</td>
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<td>SC (56)</td>
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<tr>
<td>Li Harmer, Fisher &amp; McAuley, 2005</td>
<td>256 Sedentary over 70</td>
<td>6 month (60 min x 2 days)</td>
<td>TC Yang Style 24 forms (125)</td>
<td>Physical Function: SF-20 physical Function and self-efficacy ↑ among TC more than WL over time* r scores</td>
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<tr>
<td>USA</td>
<td>77.48 years</td>
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<td>SC (131)</td>
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<tr>
<td>Li Harmer, Chaumeton, Eckstrom &amp;</td>
<td>94 Sedentary over 65</td>
<td>6 month (60 min x 2 days)</td>
<td>TC Yang style 24 forms (49)</td>
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<tr>
<td>Wilson, 2005 USA</td>
<td>72.8 years</td>
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<td>WL (45)</td>
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<tr>
<td>Li Harmer, Fisher &amp; Duncan, 2001</td>
<td>77/179</td>
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<tr>
<td>USA</td>
<td>9/85</td>
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<tr>
<td>Study Authors</td>
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<td>Intervention Duration</td>
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<tr>
<td>Maciaszek, Osinski, Szeklicki, Stemplewske, 2007, Poland</td>
<td>49 Sedentary men with osteopenia or osteoporosis, 60 to 82.1 years</td>
<td>TC 24 form (25) for 18 weeks (45 min x 2 days)</td>
<td>UC (24)</td>
<td>Falls and Balance: Posturographic parameters: T ↓; E and TW ↑ for TC*; and E and TW ↑ for TC than UC*</td>
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<td>Motiava, Sollers Thayer, &amp; Irwin, 2006, USA</td>
<td>32 Out of 63 who completed RCT for Herpes Zoster risk in aging study, 68.5 years</td>
<td>PR and slow moving physical movement (13) for 37 weeks (? min x 1 day)</td>
<td>TC (19)</td>
<td>Cardiovascular Health: Pre-ejection period ↑ post task more for TC than PR*; BP and HR for TC and PR ns</td>
</tr>
<tr>
<td>Pippa Manzoli, Corti Congedo, Romanazzi, &amp; Parruti, 2007, Italy</td>
<td>43 History of atrial fibrillation, 68 years</td>
<td>QG (22) for 16 weeks (90 minutes x 2 days)</td>
<td>WL (21)</td>
<td>Cardiovascular Health: 6-minute walk ↑ for TC and ↓ for WL*; Ejection fraction, BMI, cholesterol ns</td>
</tr>
<tr>
<td>Sattin Easley, Wolf Chen, &amp; Kutner, 2005, USA</td>
<td>217 History of 1 or more falls in past year and over 70 (55 African Americans) 70-97 years</td>
<td>TC 6 of 24 Simplified (158) for 48 weeks (60-90 min x 2 days)</td>
<td>WE (153)</td>
<td>Falls and Balance: ABC ↑ and FES ↓ more among TC than WE*; Psychological Symptoms: FES ↓ more among TC than WE*</td>
</tr>
<tr>
<td>Song Lee Lam, &amp; Bae, 2003, Korea</td>
<td>72 History of osteoarthritis and no exercise for 1 year prior, 63 years</td>
<td>TC Sun Style modified for arthritics (22) for 12 weeks (60 min x 3 days for 2 weeks then x 1 day for 10 weeks)</td>
<td>UC (21)</td>
<td>Falls and Balance: OLS, trunk flexion and sit ups ↑ more for TC than UC*; Flexibility and knee strength TC and UC ns; Cardiovascular Health: BMI, 13 min ergometer TC and UC ns; Disease Outcomes (Arthritis): Pain, joint stiffness, and perceived less difficulty in performance of activities of daily living ↓ more for TC than UC*</td>
</tr>
<tr>
<td>Study Authors</td>
<td>Location</td>
<td>Duration details</td>
<td>Intervention Details</td>
<td>Control Group</td>
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<tr>
<td>Song Lee Lam &amp; Bae, 2007</td>
<td>Korea</td>
<td>12 weeks (60 min x 3 days for 2 weeks then x 1 day for 10 weeks)</td>
<td>TC Sun Style modified for arthritis (22)</td>
<td>UC (21)</td>
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<tr>
<td>Stenlund Lindstrom Granlund &amp; Burell, 2005 Sweden</td>
<td>Sweden</td>
<td>12 weeks (60 min QG and 120 min of discussion on various themes)</td>
<td>TC &amp; QG (TC &amp; Medicinsk Qigong) (48)</td>
<td>UC (47)</td>
</tr>
<tr>
<td>Thomas Hong Tomlinson Lau Lam Sanderson Woot, 2005 Hong Kong</td>
<td>Hong Kong</td>
<td>12 months (60 min x 3 days)</td>
<td>TC Yang style 24 forms (64)</td>
<td>RT (65) or UC (78)</td>
</tr>
<tr>
<td>Tsang H.W. Fung Chan &amp; Chan, 2006 Hong Kong</td>
<td>Hong Kong</td>
<td>16 weeks (30-45 min x 3 days)</td>
<td>QG Baduanjin (48)</td>
<td>NR group with same intensity (34)</td>
</tr>
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Tsang T. Orr, Lam Comino & Singh, 2007  
Australia  
38 History of type 2 diabetes and sedentary 65.4 years 8/30  
16 week (45 min x 2 days)  
TC for diabetes (12 movement hybrid from Yang and Sun (17))  
SE (20)  
Falls and Balance:  
Balance index ↓ TC and SE ns; OLS open ↑ TC more than SE ns; OLS closed and tandem walk ↓ TC and SE ns; Falls 0-2 TC and SE ns  
Physical Function:  
6-minute walk, habitual and maximal gait speed, muscle strength and peak power ↑ TC more than SE ns; Endurance ↓ more for SE than TC ns; and Habitual PA ↑ TC and ↓ SE*; SF-36 (except Social Function ↑ for TC and ↓ SE*) and ATT19 TC and SE ns  

Voukelatos Cumming Lord Rissel, 2007  
Australia  
702 Adults >60 69 years 112/589  
16 weeks (60 min x 1 day)  
TC: 38 Programs mostly Sun-style (83%) Yang (3%) (271)  
WL (256)  
Falls and Balance:  
Sway on floor and foam mat, lateral stability, coordinated stability, and choice stepping reaction time improved TC more than WL*; Maximal leaning balance range ↑ TC more than WL ns; Fall rates less for TC (n = 347) than WL (n = 337)*  
Physical Function:  
Gait Speed and FR ↑ TC and WE ns; Chair stands ↓ 12.3% TC and ↑ 13.7% WE*; 360° turn and pick up object similar change TC and WE ns; and OLS ns Cardiovascular Health:  
BMI ↓ TC and ↑ WE*; SBP and HR ↓ TC and ↑ WE*; DBP ↓ TC more than WE*  

Wolf O'Grady Easley Guo Kressig & Kutner, 2006  
USA  
311 History of transitonally frail with average of 5.6 comorbidities  
48 weeks (60-90 min x 2 days)  
TC 6 of 24 simplified forms (158)  
WE (153)  
Falls and Balance:  
TC lower risk for falls from month 4 to 12 RR falls TC and WE 0.75, CI [0.52, 1.08] ns  
Physical Function:  
Gait Speed and FR ↑ TC and WE ns; Chair stands ↓ 12.3% TC and ↑ 13.7% WE*; 360° turn and pick up object similar change TC and WE ns; and OLS ns Cardiovascular Health:  
BMI ↓ TC and ↑ WE*; SBP and HR ↓ TC and ↑ WE*; DBP ↓ TC more than WE*  

Wolf Sattin Kutner O'Grady Greenspan & Gregor, 2003  
USA  
291 History of at least 1 reported fall 80.85 years 20/291  
48 weeks (60-90 min x 2 days)  
TC 6 of 24 simplified forms (145)  
WE (141)  
Falls and Balance:  
Balance: Dispersion for OLS (eyes open), toes up (eyes open and closed), COB X with toes up (eyes open) and COB Y (OLS eyes open and closed) ↓ more BT than WE and TC*; Dispersion for toes up (eyes open), COB X OLS (eyes open and closed) and Toes up (eyes closed), and COB Y for toes up (eyes open and closed) TC, BT, and WE ns; Fear of falling ↓ more TC than BT and WE ns
<p>| Study 1: Barnhart, Kutner, McNeelly, Coogler &amp; Xu, 2003 USA | Participants: 200 Adults over 70 years old&lt;br&gt;Age: 76.2 years&lt;br&gt;58/242&lt;br&gt;15 weeks (45 minutes weekly in class plus 15 min 2 x daily) | TC (72) | BT (64) and WE (64) | Falls and Balance:&lt;br&gt;Fear of falling ↓ more for TC than BT and WE*; Intrusiveness↓ more for TC than WE ns; RR for falls in TC 0.632, CI [0.45, 0.89]* using FICSIT fall definition and for BT and other fall definitions ns&lt;br&gt;Physical Function:&lt;br&gt;Left hand grip strength ↓ more in BT and WE than TC*; Strength of hip, knee and ankle via Nicholas MMT 0116 muscle tester, lower extremity ROM changes TC, BT and WE ns&lt;br&gt;Cardiovascular Health:&lt;br&gt;BP↓ more for TC than BT and WE*; 12-minute walk ↑ 0.01 mile for BT and WE and ↓ 0.02 for TC*; Body composition changes for TC, BT and WE ns |&lt;br&gt;Study 2: Lau &amp; Lynn, 2007 China | Participants: 180 Older adults 65-75 / 68.91&lt;br&gt;Age: 90/90&lt;br&gt;12 months (?min x 3 days) | TC Yang style 24 forms (30) | RT (29) and UC (29) | Falls and Balance:&lt;br&gt;Muscle strength (grip strength and quadriceps) ns; Balance (SMART Balance Master, stance time, gait velocity, and bend reach); and falls for TC, RT and UC ns&lt;br&gt;Disease Outcomes (Bone Density):&lt;br&gt;Women: BMD loss at hip less for TC and RT than UC*; BMD loss at spine less for TC and RT than UC ns; Men: no difference in % change in BMD |&lt;br&gt;Study 3: Verkuilen, Rosengren, Grubisich Reed &amp; Wecksler, 2007 USA | Participants: 49 Healthy adults over 60 80.4 years&lt;br&gt;Age: 10/39&lt;br&gt;6 months (60 min x 3 days) | QG (sitting and standing) and Taiji Chen style Essential 48 movement form (33) | WL (16) | Falls and Balance:&lt;br&gt;Sensory Organization Test vestibular ratios and Base of Support measures ↑ more for TC than WL*↑; Sensory Organization Test visual ratios and feet opening angle for TC and WL ns&lt;br&gt;Disease Outcomes (Immune Function):&lt;br&gt;Hemagglutination Inhibition assay ↑ 109% for TQ compared to ~10% for WL*&lt;br&gt;Study 4: Verkuilen, Rosengren, Mariani Reed Grubisich &amp; Woods, 2007 USA | Participants: 50 History of flu immunization and sedentary 77.2 years&lt;br&gt;Age: 13/37&lt;br&gt;20 weeks (60 min x 3 days) | QG (sitting and standing) and Taiji Chen style Essential 48 movement form (27) | WL (23) | Disease Outcomes (Immune Function):&lt;br&gt;Hemagglutination Inhibition assay ↑ 109% for TQ compared to ~10% for WL* |</p>
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<tr>
<th>Study</th>
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<th>Intervention</th>
<th>Duration</th>
<th>Main Outcomes</th>
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<tr>
<td>Young Appel, Jee Miller, 1999</td>
<td>USA</td>
<td>62: BP between 130 and 159 and not taking medications for hypertension or insulin (45.2% black)</td>
<td>Tai Chi</td>
<td>12 weeks (60 min x 2 days class with goal of 30-45 min/4-5 days/week)</td>
<td><strong>Cardiovascular Health:</strong> BP ↓ TC and AE *; BMI ↑ slightly TC and AE ns; and time in moderate activity, weekly energy expenditure, and leisurely walking ↑ for AE more than TC ns</td>
</tr>
<tr>
<td>Zhang, Ishikawa-Takata, 2006</td>
<td>China</td>
<td>47: History of poor balance and over 60</td>
<td>Tai Chi</td>
<td>8 weeks (60 min x 7 days)</td>
<td><strong>Falls and Balance:</strong> OLS, trunk flexion, and FES ↑ more TC than UC*; 10 min walk ↓ TC and UC ns</td>
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</table>

*Note. * = Significant < 0.05; ns = not significant; ↑ = increase; ↓ = decrease; TC = Tai Chi; BW = brisk walking; UC = usual care; OLS = one leg standing; HL = health lecture; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; QG = Qigong; AT = aerobic training; WL = waitlist; H= hydrotherapy; TUG = Timed Up & Go; TCB = TC based and axial mobility program; FR = functional reach; WE = wellness education; SIP = Sickness Impact Profile; HE = health education; VZW = varicella zoster virus; FT = flexibility training; SC = stretching control; ABC = Activities Specific Balance; PR = passive-rest; HR = heart rate; BMI = body mass index; FES = Falls Efficacy Scale; RT = resistance training; NR = newspaper reading; SE = seated calisthenics and stretching; CI = confidence interval, reported at 95%; BT = balance training; COB = center of balance; FICSIT = Frailty and Injuries: Cooperative Studies of Intervention Techniques; RT = resistance training; BMD = bone marrow density; AE = aerobic exercise.
Discussion.

Strengths. There are several strengths of the reviewed RCTs. First, a number of studies clustered around similar designs and outcomes, and provided high quality evidence of effects on particular health parameters. For example, balance was assessed across 16 studies and one leg stance was used in 8 of them. Physical function was assessed in 11 articles. In 6 of these articles, variations of the timed walk test, such as the 6-minute and 50-foot walk was measured, most showing significant effects for QG (Pippa et al., 2007) and TC (F. Li et al., 2003; F. Li et al., 2004; S. L. Wolf et al., 2006). Nine articles assessed cardio-pulmonary effects with 2 studies using the 6-minute walk test as a fitness measure, and 5 studies measuring blood pressure. These clustered studies of outcomes using the same means of measurement and showed similar results when inactive control groups were used, and provided the basis for defining more conclusive benefits of TC&QG in the older adult.

Balance and falls. The risk factors for falls are multifaceted, therefore a falls prevention program must address all of these risks (W. W. Spirduso et al., 2005). The types of exercises selected should include components of balance, flexibility, strength and some aerobic conditioning (Rubenstein & Josephson, 2006). Because older adults may have been sedentary for some time, it is suggested that participants begin with balance and muscle strengthening exercises and gradually advance to the aerobic activities (Nelson et al., 2007). One of the major components of TC and QG is body posture adjustment (Chodzko-Zajko et al., 2006), thus it is not surprising to review multiple studies designed to evaluate outcomes of falls and balance.
Interventions that reported improved components of balance were designed to screen for sedentary or transitionally frail older adults and compared the TC or QG intervention to a wait list control group. Many of the multiple outcomes reported significant improvements. For example, balance was assessed across 16 studies and one leg stance was used in 8 of them. Other studies used various combinations of outcomes to measure balance. Fear of falling is equally important as older adults who are afraid of falling are reportedly sedentary. A group of TC studies reported reductions in fall rates compared to the control groups (F. Li et al., 2005; Voukelatos et al., 2007; S. L. Wolf et al., 2003) and others no difference between the groups (Choi et al., 2005; T. Tsang et al., 2007; S. L. Wolf et al., 2003a; Woo et al., 2007). While no changes were reported in some of the studies, it is important to note that older adults may increase their risk for falls in the initial phases of engaging in physical activity and it is notable that they did not report higher fall rates than their control groups.

Physical function. One goal of our aging population is to maintain functional independence and ability needed to age in place (National Association of Area Agencies on Aging, 2006; W. W. Spirduso et al., 2005; World Health Organization, 2002). Improvement of physical function is also a component of fall reduction strategies, resulting in some cross-over of information between the two categories of outcomes. In addition to the previously described measures to improve balance, studies to improve physical function also show significant results, especially when compared to inactive controls such as wait-list or usual care (Brismee et al., 2007; Greenspan et al., 2007; M. R. Irwin et al., 2003; M. R. Irwin et al., 2007; F. Li, Harmer, McAuley, Fisher et al., 2001). Even when compared to an active control, TC participants were able to show
improved physical function (F. Li et al., 2003; F. Li et al., 2004; S. L. Wolf et al., 2003a). In one study, both TC and control group tended to improve to indicate that the TC intervention is just as effective as the previously known interventions to improve physical function (Fransen et al., 2007). One intervention failed to report significant improvements among TC compared to seated calisthenic, with the investigators reporting the limitation of a weak study design (T. Tsang et al., 2007).

Cardiovascular health. Common measures of cardiovascular health include blood pressure, BMI, and VO₂ Max. Exercise is known to reduce blood pressure among people with mild hypertension within the first few weeks (Mazzeo et al., 1998). Interventions using TC and QG have reported statistically significant changes in these parameters over time (S. L. Wolf et al., 2003; S. L. Wolf et al., 2006; D. R. Young et al., 1999). One study did not report changes in blood pressure, but the measurement was different from the others (Motivala et al., 2006). For this study, blood pressure was measured before and after a 20 minute session of TC to determine the immediate effects. Motivalta et al. (2006) were able to report a decrease of the pre-ejection fraction. One study reported a significant improvement in VO₂ Max (Audette et al., 2006).

Changes in BMI are difficult to measure. Wolf et al. (2006) was able to report a reduction of BMI following a 48 week TC intervention compared to a sedentary control among a transitionally frail population. Improved time for completion of the 6-minute walk improved for QG practitioners. One group improved significantly compared to a sedentary control (Pippa et al., 2007) and the second improved significantly, but not as much as the aerobic training control group (Burini et al., 2006).
Psychological outcomes. There is clearly a need to evaluate the effect of TC and QG on psychological outcomes such as depression. Nearly 20% of older adults experience depression which is a major risk factor for suicide (National Institute of Mental Health, 2003). Exercise, particularly mindful-movement PA, is a low risk treatment that has been reported to decrease depression rates among older adults (Blumenthal et al., 1999; Lawlor & Hopker, 2001).

The studies reporting changes in depression showed varying results, with a small cluster of studies reporting conflicting results. Only two studies reported significant reductions in depression (Chou et al., 2004; H. W. H. Tsang et al., 2006). Of the studies that failed to report results, two were shorter in duration (Burini et al., 2006; Fransen et al., 2007) and the third reported significant improvement in both the intervention and a health education control group. More evidence is needed to draw conclusions regarding the efficacy of TC or QG on psychological outcomes.

Disease outcomes. Many of the previous reviews were disease outcome focused. The outcomes introduced in this category offer new areas of research, especially for older adults. The studies of TC among a population of older adults with a history of arthritis are promising with two reporting improved symptoms of pain and a third article showing a trend towards improvement. Research is needed in populations with diagnosed disorders that specify specific perceived physical symptom improvements (such as function and sleep duration) with repeated measures of dose-response. Additional research is needed to provide conclusions regarding the effectiveness of TC or QG on the diseases.

Most of the 36 studies were conducted in a community group format. A group format for older adults provided social contact and was consistent with the ways most
older adults learn, practice, and maintain new behaviors. The reviewed studies were completed in a wide range of populations including African Americans within the USA and reports from many nationalities participating in Hong Kong, Australia, Korea, and Sweden. While most of the studies were conducted in the United States, 6 countries reported on various outcomes of TC&QG; that context contributed to the generalizability of meditative movement across geographic populations. These factors, the community group format and the wide range of populations studied, support generalizability of findings across populations in naturalistic settings.

**Limitations.** There were a few limitations to the reviewed RCTs. Although the previous studies did focus on a range of physical and psychological health outcomes, they did not provide an evaluation of spirituality which is an important component of the mindful-movement PA interventions. Much of the written and oral teachings regarding TC and QG emphasize the spiritual components of these practices, suggesting that spiritual connection is critical to the aspects expected to initiate healing (Jahnke, 2002; Y. Yang & Grubisch, 2005).

Aging adults may experience loss of confidence or negative self beliefs that compound the physiological changes due to sedentary activity and disuse. There is a growing body of knowledge to support the importance of spirituality and religion among the aging population (Eisenhandler, 2005; Flood, 2002; Flood, 2005a; Flood, 2005b; Koenig, 2006; Nelson-Becker, 2005). Additional evidence links the promotion of spirituality to improved QOL in aging populations (Moberg, 2005; Riley et al., 1998); yet no research has examined the relationship between mind-body exercise and improved aging, specifically physical function.
Studies reporting the psychological impact of TC and QG lack consistent measures of outcomes. While five studies evaluated depression, four different scales were used to assess this outcome (Burini et al., 2006; Fransen et al., 2007; M. R. Irwin et al., 2007) with two studies finding significant results (Chou et al., 2004; H. W. H. Tsang et al., 2006). For the other disease specific studies, the effects of TC and QG on bone marrow density and immune function are recent areas of interest and those studies need to be replicated so the strength of the outcomes measured can be more effectively evaluated. Third, there was a noted lack of theoretical underpinning aside from the principles of TC and QG across all of the studies. For example, theoretical approaches that addressed mind-body interactions that might guide a TC or QG intervention were not included in the reviewed reports.

Fourth, lack of detail in design of the studies was a significant limitation. Most of the studies employed a convenience sample and did not screen for the population at risk for those studies showing improvement in disease symptoms. Many of the studies were pilot studies, thus did not have a large enough sample size for statistical power. Those with large sample size were able to report significant findings (Greenspan et al., 2007; F. Li et al., 2005; Sattin, Easley, Wolf, Chen, & Kutner, 2005; Voukelatos et al., 2007). Although nearly all of the outcomes measured found significant results when TC and QG were compared to inactive or weak controls, the range of intervention duration varied from 3 weeks to 12 months. It is suggested that learning TC takes a long time and if all elements are not incorporated into the practice, the potential benefits may not be evidenced (Y. Yang & Grubisich, 2005). Not all of the research reviewed discussed the inclusion of all elements of traditional TC that includes body, mind, and breath. This is a
fundamental problem in the interpretation of the results of interventions using TC or QG. Duration of intervention, dose (amount of time practiced, level of intensity, and frequency) were often not reported consistently, making it difficult to know exactly what dose of intervention might be needed to achieve similar results.

Fifth, there are limitations in generalizability. This review showed significant improvement in a variety of outcomes and some disease symptoms, but the results were demonstrated on relatively narrow gender and ethnic groups. For instance, most of the studies in the United States include mostly women in contrast to those conducted in other countries. This limits the findings to women. While there was a global distribution of findings, none of the populations included a sample of Hispanics.

**Conclusion.** Following this review of the current literature on TC and QG in the older adult population, it appears that participants are impacted from multiple perspectives. To date, the studies have evaluated physical and psychological outcomes and even quality of life, but none of the RCT studies have explored the spiritual influence of meditative movement such as TC and QG. Spirituality is important to successful aging (Flood, 2005a; Flood, 2005b), yet few studies of TC have reported on the spiritual components that underpin the mindful movement PA of TC and QG.

This review focused on efficacy in outcomes. Continued research of meditative movement in this population is important to understanding the mechanisms of the movement. Studies should include models of implementation and evaluation that consider the broader spectrum of adaptation to aging, including spiritual elements, as well as addressing the fit and applicability of TC&QG across racial and ethnic groups.
Perceived Benefits of Meditative Movement

In spite of research evidence of the efficacy of mind-body PA interventions, there is limited research exploring the psychosocial benefits of such interventions designed to improve physical function among older adults. Significant research, both exploratory and experimental has evaluated the efficacy of TC interventions on health and functional outcomes in older persons (Larkey et al., In press; C. E. Rogers et al., 2009). Evaluation of reports that assess individual perceptions of psychosocial benefits and health outcomes of participation in MM are needed. The issue for clinicians in gerontology is to evaluate mind-body physical activity interventions for their acceptability and effectiveness in specific populations for enhancing well-being in older persons. Evaluation of such interventions includes the assessment of such exercise strategies in their effectiveness as well as their appeal in older persons. Of importance is the notion that a significant number of the efficacy outcomes in experimental designs reported psychosocial data that should be examined more closely to determine the impact of intervention effects on individual perceptions of (1) improved outcomes; (2) perceived changes in mediators for engaging in TC; and (3) perceived factors for initiating and maintaining engagement in TC.

**Method.** A comprehensive research literature search was conducted to explore the impact of TC on perceived improvement parameters following participation in meditative movement interventions among older persons. Criteria for inclusion of articles included: (a) published in a peer reviewed journal between 1998 and 2008; (b) cited in nursing, medical, or psychological literature; (c) included mind-body PA as the primary outcome; (d) participants primarily over 65; and (e) research methods that included
planned measurement of self-report psychosocial outcomes. Cumulative Index for Allied Health and Nursing (CINAHL), Psychological Literature (PsychInfo), PubMed, and Cochrane database were used for this search. Key words used included Tai Chi, and taiji, qigong; and older adults, aged, and elderly; and were combined, then further narrowed with the criteria of the use of inductive methods. Tai Chi, Tai Chi Chun, taiji, and qigong were entered in Google Scholar search engine with additional hand searches to complete the search for inclusion of articles. Further sorting measures resulted in including those studies conducted with a community dwelling population. Based on the inclusion criteria, 58 studies out of 153 studies were gathered and descriptive results of 37 studies were used in this review. All articles reported on studies of Tai Chi interventions with the exception of two studies of Qigong (Jouper et al., 2006; W. W. N. Tsang & Hui-Chan, 2005). The content analysis undertaken approximated the conventional content analysis described by Hsieh and Shannon (Hsieh & Shannon, 2005). The findings of studies were extracted to form a synthesis of findings and specific psychosocial outcomes using reported subjective data, and these represented initial coding categories. These statements were linked to form broad thematic categories. Emphasis was placed on understanding conceptual grouping of psychosocial intervention effects predicated on the purpose of the search and analysis: perceived improved outcomes, mediators and acceptability in initiation and maintenance of TC physical activity methods. Table 3 displays detailed findings for reported research employed in this review with an emphasis on the description of the methods of data collection undertaken in each study. As noted, some of the RCT designs used qualitative methods to assess participants’ beliefs before and after the study.
Findings.

Participant characteristics. A total of 1856 participants were represented in the 37 studies (mean age 67.76). Participants were mostly women (n = 1435). Over 50% (n = 20) of the studies did not report ethnicity. Of those that did, participants were mostly white (n = 808). Minority populations reported were: Taiwanese (n = 117), non-white (n = 72), Chinese (n = 39) and African American (n = 28). None of the studies reported inclusion of Hispanic participants. Most of the studies were conducted in community centers (n = 33) and the remaining in specific group settings such as retirement communities (n = 3) or Qigong community (n = 1). The studies were conducted in 9 different countries: United States (n = 22); Australia, Hong Kong, and United Kingdom, (n = 3 each); South Korea and Taiwan (n = 2 each); and Canada, China, and Sweden (n=1 each). One study reported that the instructor was of the same age as the participants (Beaudreau, 2006).

Perceived improved outcomes. Most participants of the research reported in this review began TC due to perceived benefits to health and with a desire to exercise in a group setting for socialization. The desire to increase socialization was also related to why they continued to attend TC classes. Those who continued to participate were changing their attitude towards aging; several reports showed references to improved beliefs or self-concept. The perceived improvements in outcomes were reported as improved function that accompanies chronic diseases, additional benefits and self-report ratings of Quality of Life (QOL).

Perceived improved function and QOL related to chronic diseases were the most common reasons for initiating the TC classes. TC is a physical activity with multiple
health benefits for the elderly population including improving balance and physical health (Adler & Roberts, 2006; Chodzko-Zajko et al., 2006). Most of the studies reporting reasons to initiate and maintain TC used qualitative methods and a few used quantitative methods. Qualitative results will be discussed first. Reasons reported for initiating TC classes among the reviewed qualitative studies included: (a) improve function and strength (Beaudreau, 2006; Scourfield, 2006); (b) decrease pain (Beaudreau, 2006; K. M. Chen, Snyder, & Krichbaum, 2001); (c) maintain fitness or health (Beaudreau, 2006; K. M. Chen et al., 2001; Docker, 2006; Jouper et al., 2006); (d) psychological well being (Docker, 2006; Scourfield, 2006); and (e) recuperate from illness (K. M. Chen et al., 2001; Jouper et al., 2006). Quantitative questionnaires reported similar findings: (a) improve function and strength; (b) maintain fitness or health (Hill, Choi, Smith, & Condron, 2005); (c) psychological well being; and (d) to reduce blood pressure and help arthritis (Gavin & Myers, 2003). One study TC among a population of patients with chronic heart failure ($N = 30$) reported both TC and control expected that TC would help them recuperate from symptoms using a visual analog scale at baseline (G. Y. Yeh et al., 2004).

The investigators of many studies interviewed participants following participation in TC interventions to report what outcomes participants believed were improved. Qualitative reports of outcomes from focus group discussions and personal interviews included: (a) feeling relaxed or mood changes (Docker, 2006; Jouper et al., 2006; Scourfield, 2006; Yau & Packer, 2002); (b) concentration and memory (Docker, 2006; Jouper et al., 2006; Yau & Packer, 2002); (c) feeling invigorated (Docker, 2006; Jouper et al., 2006); (d) fitness (Docker, 2006; Jouper et al., 2006; F. Li, Harmer, Mack et al.,
reduced pain (Taggart, 2001); (f) improved sleep (Jouper et al., 2006; Scourfield, 2006; Taggart, 2001); (g) global benefits (Yau & Packer, 2002); (h) more effective than medications (Taggart, 2001); and (i) increased social support (Table 3) (Yau & Packer, 2002). Quantitative methods using pre-post comparisons or post surveys reported similar results with the exception of concentration and memory; and more effective than medications: (a) feeling relaxed or mood changes (Gavin & Myers, 2003; Hackney & Earhart, 2008; Hill et al., 2005; Taylor-Piliae, Haskell, Waters, & Froelicher, 2006; G. Y. Yeh et al., 2004); (b) feeling invigorated (Taylor-Piliae et al., 2006); (c) fitness (Gavin & Myers, 2003; Hackney & Earhart, 2008; Hill et al., 2005; F. Li, Harmer, Glasgow et al., 2008; H. W. H. Tsang et al., 2006; G. Y. Yeh et al., 2004); (d) reduced pain (Gavin & Myers, 2003); (e) improved sleep (M. R. Irwin, Olmstead, & Motivala, 2008; F. Li et al., 2004); (f) global benefits (R. Song et al., 2007; H. W. H. Tsang et al., 2006); and (g) increased social support (Taylor-Piliae et al., 2006; H. W. H. Tsang et al., 2006).

As people age, their QOL is determined by their ability to maintain independence and autonomy; and participation in regular physical activity such as TC or QG can delay functional decline. Changes in QOL were reported in findings from quantitative surveys. Throughout the literature reviewed, various surveys were selected for use in the TC and QG studies, and included: SF-36, 20, and 12; Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC); Sickness Impact Scale; and Minnesota Living with Heart Failure. The SF-36, 20, and 12 are shorter variations of the Medical Outcomes Study questionnaire to assess QOL. The SF-36 and 12 include 2 summary measures with four subscales each: (a) physical health (physical functioning, role-
physical, bodily pain, and general health; and (b) mental health (vitality, social function, role-emotional, and mental health (Ware & Sherbourne, 1992; Ware, Kosinski, & Keller, 1996). The SF-20 represented 6 domains: physical, role and social functioning; mental health, health perceptions, and pain (Stewart, Hays, & Ware, 1988). These surveys were often analyzed as a composite score and subsequently according to the domain specific areas. Occasionally, based on the desired outcomes of a study, domain specific components were selected for sole analysis. For example, studies reported improvements in the physical health domain of the SF-12 and SF-20 respectively (Fransen et al., 2007; F. Li, Harmer, McAuley, Duncan et al., 2001) and in other studies, both physical and mental health components of the SF-12 improved (F. Li et al., 2003; F. Li, Harmer, Glasgow et al., 2008; F. Li et al., 2004). Improvements in QOL according to the SF-36 were reported in studies (M. R. Irwin et al., 2003; M. R. Irwin et al., 2007; Lam, Dennis, Diamond, & Zwar, 2008).

Using the WOMAC, significant improvement in physical function and decreased arthritic pain was reported (Brismee et al., 2007; Fransen et al., 2007; Shen et al., 2008; R. Song et al., 2007). TC practitioners reported significant improvements in body care and movement, mobility, and ambulation measured by the Sickness Impact Profile (Greenspan et al., 2007). Two pre-post studies reported improvements in the Minnesota Living with Heart Failure survey (Barrow et al., 2007; G. Y. Yeh et al., 2004). Satisfaction with life among a group of older adults with osteoarthritis (Hartman et al., 2000); and well being and general health (H. W. H. Tsang et al., 2006) also improved.

*Perceived improved mediators.* Another reported common thread for participating in TC classes was the availability of or enhanced social support. Previous studies have
reported the importance of social support and exercise maintenance among older adults (Conn, Isaramalai, Banks-Wallace, Ulbrich, & Cochran, 2002; McReynolds & Rossen, 2004; C. Toulotte, Fabre, Dangremont, Lensel, & Thevenon, 2003). All of the qualitative studies made some reference to social support in their discussion of why individuals joined TC classes. In the Beaudreau (2006) study, all of the participants (N = 12) reported they practiced TC at the senior centers because they liked the social atmosphere. While Docker (2006) reported other reasons for initiating TC, being part of a group was important once they joined the class (N = 7). Scourfield (2006) reported that the TC provided a holistic experience that provided a comfortable environment that was social in nature and the participants enjoyed that atmosphere (N = 7). Participants in the Chen, Snyder, and Krichbaum (2001) study (N = 80) reported increased participation in social events as a result of practicing TC. Two studies addressed social aspects of participation in written surveys. Gavin and Meyers (2003) reported that knowing someone in class was a common reason for joining and the social aspects were important for the continued participation (N = 107). Yet another study reported that social and friendship aspect of the class was beneficial (Hill et al., 2005).
Table 3

*Perceptions of Tai Chi and Qigong Practice*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample</th>
<th>Intervention description/method</th>
<th>Reported Outcomes</th>
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<tbody>
<tr>
<td>Barrow et al. 2007 UK</td>
<td>32 Older adults with history of chronic heart failure; 68.4 years; 26/6 Ethnicity (NR)</td>
<td>16 weeks (55 min x 2 days) RCT Pre-post survey</td>
<td>QOL: Perceived physical disability (Minnesota Living with Heart Failure) improved</td>
</tr>
<tr>
<td>Beaudreau 2006 USA</td>
<td>12 community dwelling; 65 to 88 years; 1/11 White (92) and African American (8)</td>
<td>5 weeks (60 min TC plus focus group x 2 days) Focus Group</td>
<td>To explore initiating and maintenance of exercise and perceptions of TC: • Wanted to improve balance, strength, coordination, or decrease pain. • Compliment regular exercise program; time and location were convenient • Liked small group size • Instructor was older adult and participants felt that helped with understanding their needs • Taught at a slow pace and repetition was important</td>
</tr>
<tr>
<td>Brismee et al. 2007 USA</td>
<td>22 History of knee osteoarthritis; 70.8 years; 3/19 Ethnicity (NR)</td>
<td>12 week TC and 6 week no training (40 min x 3 days /6 weeks group training and 6 weeks home training; and 6 weeks detraining) RCT Pre-post surveys</td>
<td>QOL: Physical function increased during TC with a decrease during the detraining period (WOMAC) Arthritic pain decreased with an increase during the detraining period (WOMAC and a 10 point VAS)</td>
</tr>
<tr>
<td>Study</td>
<td>Sample Characteristics</td>
<td>Intervention</td>
<td>Methods</td>
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</table>
| Chen et al. 2001 Taiwan | 80 (40 TC and 40 not TC) community dwelling with chronic disease 74 years 30/50 Taiwanese (100) | Cross-sectional Individual interviews with open ended questions TC practitioner vs no TC and no exercise past year | Average of 15.4 years TC (at least 30 min x 2 days for 1 year) | Explored facilitators and barriers to practice of TC among older adults:  
  • Reasons initiated participation included:  
    o Encouragement from others, perceived benefits to health, pain relief and treatment of illness, have time after retirement, graceful movements of TC, interested in TC, keep active and close to home  
  • Reasons for continued practice:  
    o Positive health outcomes, became habit, social rewards, relaxed and less moody, clear headed, filled free time.  
  • Barriers to practice among those who want to practice include no time, location inconvenient, and too weak to practice (n=5)  
  • Reasons never considered TC:  
    o Too weak to practice, memorizing movements too complicated, too old, no time, not interested, no patience to learn, too fat, do not know where to go to learn. |
| Choi et al. 2005 South Korea | 29 Living in care facility, ambulatory with history of at least 1 fall risk factor 76.96 years 6/23 Ethnicity (NR) | 12 weeks (35 min x 3 days) RCT pre-post survey | | Self-efficacy:  
Falls efficacy (Falls Efficacy Scale) increased |
Docker 2006 UK

7 Community dwelling older adults
52-71 years
1/6
Ethnicity (NR)

At least 3 months
Ethnography, observation and interview
Purpose to identify factors that influence their attraction to attend TC groups

Reasons for initiating:
• Response to physical or mental health problem
• Wanted to keep active and do gentle exercise, suitable for older adults
• Enjoyed being part of a group
• Learning something new

Perceived Benefits:
• Invigorating, body feels warm, whole body work out, forget about other things, relaxing
• Concentration improved, increased body awareness, memory in general improved, arms and ankles stronger, coordination, fitness, balance, calmness improved; general balance, posture, breathing habits, circulation, and improved suppleness.
• Special Effects
  o Involved body and mind, hidden depths, etc
• Perceived Transfers into everyday life:
  o Posture improvement
  o Breathing for relaxation, coping with anxiety, strength and fitness, learning to fall more safely
• Mysticism:
  Appears to be important to the experience and awareness of the spiritual nature of TC.

Fransen et al. 2007 Australia

56 Older adults, history of chronic symptomatic hip or knee osteoarthritis
70.8 years
18/38
Ethnicity (NR)

TC for Arthritis 12 week (60 min x 2 days)
RCT pre-post surveys

QOL:
Physical health (SF-12) improved

Physical function improved and arthritic pain decreased (WOMAC)
Gavin et al. 2003
Canada
158 mostly beginner exercisers at community classes
62.5 years
31/127
White (94) and non-white (2)
Note, some did not report ethnicity
8-12 week sessions (60-90 min x 1-2 days)
Descriptive Written surveys and additional telephone interviews Purpose to learn more about older adults who join beginner TC classes offered in community recreation centers and senior centers.
Factors related to participation:
• Written surveys
  o Knew someone in class (47%), drove self to class (84%), joined for fitness, health, mental health, social, or fun; pretty sure could perform (97.5%); Concerned about taking class (30%)
• 107 exit interviews:
  o TC gentle, relaxing and safer (compared to aerobics classes)
  o Many joined to benefit balance or healing effects on system
  o Those who adhered stated TC helped relax and interesting. More agile and helped balance or pain and others felt sense of accomplishment
  o Dropouts reported TC did not meet expectations: too slow and not enough exercise, TC did not improve mobility or energy
  o TC seen as less taxing on joints and when compared to line dancing, not as social
  o Majority of participants confident they would be able to perform the movements, yet acknowledge difficulty keeping up at times.

Greenspan et al. 2007
USA
103 Congregate independent living, transitionally frail with at least 1 fall in past year >70 years and 50% over 80
0/103
White (82) and African American (18)
48 week (60 increasing to 90 min x 2 days)
RCT pre-post surveys
QOL:
Perceived health status (Sickness Impact Profile) improved in areas of body care and movement, mobility and ambulation

Hackney et al. 2008
USA
13 History of Parkinson’s
64.9 years
11/2
Ethnicity (NR)
13 weeks(60 min x 2 days and at least 20 lessons)
RCT Pre-post surveys with exit interview survey scored 1-5
Perceived Benefits:
Improved balance, walking, mood, and endurance. Neither agree or disagree with strength improved.
Reason to maintain:
Enjoyed the class
<table>
<thead>
<tr>
<th>Study</th>
<th>Duration</th>
<th>Sample Description</th>
<th>Intervention Details</th>
<th>Measures &amp; Findings</th>
</tr>
</thead>
</table>
| Hartman et al.   | 12 weeks | 68.6 years 3/15 White (94) and African American (6) | RCT Pre-post surveys | **Satisfaction with life (Arthritis Impact Measurement Scale) improved**  
**Arthritis self-efficacy (Arthritis Self-Efficacy Scale) improved** |
| Hill et al.      | 12 weeks | Community dwelling and able to walk independently outside home 71.1 years 7/16 Ethnicity (NR) | 60 min x 3 days Single group intervention with survey questions at 8 weeks | **Reasons to initiate TC:**  
- Involvement in research  
- Improve aspect of health  
- Location  
- Cost  
**Perceived Benefits:**  
- Improved health status  
- Improved flexibility  
- Social/friendship aspect  
- Relaxation |
| Irwin et al.     | 16 weeks | Healthy older adults with Pittsburg Sleep Quality Index (PSQI) ≥5 70 years 8/22 White (70) and non-White (30) | RCT Pre-post survey scores and 25 week follow-up | **PSQI reduced to less than 5 at 25 weeks global sleep score and sleep parameters of rated sleep quality, habitual sleep, sleep duration, and sleep disturbance (PSQI) improved** |
| Irwin et al.     | 16 weeks | Healthy older adults 69.6 years 18/41 White (81) and non-white (19) | RCT pre-post survey scores and 25 week follow-up | **Physical functioning, bodily pain, vitality and mental health improved significantly and role physical and emotional, general health, and social functioning improved slightly (SF-36)** |
Irwin et al. 2003
USA
18 Healthy older adults
70.9 years
6/12
White (94) and non-white (6)
15 week (45 min x 3 days)
RCT Pre-post surveys
QOL:
Only role-physical and physical functioning (SF-36) improved more for TC participants who reported low health function at baseline

Jouper et al. 2006
Sweden
253 members of Green Dragon association
58 years
38/215
Ethnicity (NR)
Average of 5 years (37 min x 4.8 days)
Descriptive, mail surveys with open and closed questions
Reason for initiation:
Curiosity, sought low-impact activity, health promotion and recuperation from illness
Reason for maintenance:
Improved psychological well-being, health preservation, recuperation from illness.
Outcomes:
General calmness and relaxed (emotionally and physically), increased mobility and smoother joints, less stress, better sleep, harmony, more energy, and improved concentration
Compared to before practice, health-now was improved. Specifically, now fewer common colds and infections, breathing easier, quicker recovery, gastrointestinal improvements, maintenance of mind-body balance. Also fewer pains, migraines and headaches, less dizziness, increased blood circulation; improved fibromyalgia, burnout, incontinence, drug abuse, allergies, medicine use, tinnitus, blood pressure, depression and recovery after cancer treatment. General feeling of improved spirit and timelessness and self-esteem.
Reason for not practicing daily:
• Lack motivation (competing priorities)
• Time allocation
• Travel or work schedules
• Finding a place to practice
• Temporary unhealthy state
• Instructor absent

Lam et al. 2008
Australia
28 History of Type II diabetes and HbA1c ≥ 7%
63.2 years
15/13
Ethnicity (NR)
6 months (60 min x 2 days for 3 months then x1 day for 6 months)
RCT Pre-post surveys
QOL:
Role due to physical function, social function, and general health (SF-36) improved
<table>
<thead>
<tr>
<th>Year</th>
<th>Study</th>
<th>Sample Description</th>
<th>Duration</th>
<th>Study Type</th>
<th>Outcomes:</th>
<th>QOL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Li et al.</td>
<td>26 Older adults 68.88 both groups</td>
<td>3 months (NR min x 3 days)</td>
<td>RCT pre-post survey</td>
<td>QOL: Physical and mental health (SF-12) improved</td>
<td></td>
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<td>2004</td>
<td>Li et al.</td>
<td>62 History of moderate sleep complaints and community dwelling adults 75.30 years 10/52 White (94) and non-white (6)</td>
<td>24 week (60 min x 3 days)</td>
<td>RCT pre-post survey</td>
<td>Outcomes: Sleep duration, efficiency, sleep quality, latency, duration, and disturbances (PSQI) and Epworth Sleepiness Scale improved QOL: Mental and physical health (SF-12) improved</td>
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<tr>
<td>2005</td>
<td>Li et al.</td>
<td>125 Sedentary 76.94 years 38/125 White (90) and non-white (10)</td>
<td>6 month (60 min x 2 days)</td>
<td>RCT pre-post survey</td>
<td>Self-efficacy: Falls self-efficacy (Activities-Specific Balance Confidence scale) increased (as mediator) and fear of falling (SAFFE) decreased</td>
<td></td>
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<tr>
<td>2001a</td>
<td>Li Harmer et al. AND Li McAuley et al.</td>
<td>49 Sedentary and community dwelling 72.8 years 6/43 White (94) and non-white (6)</td>
<td>6 month (60 min x 2 days)</td>
<td>RCT pre-post survey</td>
<td>Physical Function: (2001a) Physical function (SF-20) improved Self-efficacy: (2001b) Barrier and performance Self-efficacy (Scales) improved (2002) Self-esteem relative to physical self-esteem (Domain Specific self-esteem) and global self-esteem (Rosenberg self-esteem) improved Exit survey: Program appropriate, understood movement instructions, enjoyed program, Perceived confidence in ability to perform reported as easy to learn and perform, safe to perform, intend to continue Perceived benefits: Improved balance, functional independence, confidence, specifically walking</td>
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<tr>
<td>Study</td>
<td>Participants</td>
<td>Intervention</td>
<td>Outcomes</td>
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</table>
| Li Harmer et al. 2008 | 140 physically mobile, cognitive function, community dwelling (6 senior centers), 71 years | 12 week (60 min x 2 days) One group pre-post with exit survey scored on 4-point likert | QOL: Physical and mental score (SF-12) improved  
Exit survey: Program appropriate, understood movement instructions, enjoyed program  
Perceived confidence in ability to perform reported as easy to learn and perform, safe to perform, intend to continue  
Perceived benefits: Improved balance, functional independence, confidence, specifically walking confidence. |
| Li Harmer et al. 2008 | 20 community dwellers (n=10 experienced and n=10 novice TC practitioners) | 2 weeks (NR min x 2 days and encouraged to practice at home) Exit interviews scored on 0-10 scale | Exit survey: Movements appropriate, understood movement instructions, enjoyed program, easy to learn and perform, safe to perform, intend to continue,  
Perceived confidence in ability to perform reported as easy to learn and perform, safe to perform, intend to continue  
Perceived benefit: Improved balance  
All indicated an intention to continue  
Videotape and users guide useful |
<p>| Sattin et al. 2005 | 108 Transitionally frail with history of 1 or more falls in past year | 48 weeks (60-90 min x 2 days) RCT pre-post survey | Self-efficacy: Confidence at avoiding falls indoors (Falls Efficacy Scale) and confidence in engaging in activities of daily living including those outside the home (Activities Specific Balance Confidence) both improved for whites, but not for African Americans (may be due to low percentage of African Americans) |
| Study                  | Country | Sample Description                                                                 | Duration | Methodology                                                                 | Reasons for initiating:                                                                                     | Reasons to adhere:                                                                                       | Benefits of participation:                                                                                   |
|------------------------|---------|------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Scourfield, 2006 UK    |         | non-white (20) (mostly African American) Community dwelling older adults who practiced TC. | 3 months to 3 years | Individual interviews with thematic analysis | To improve balance and reduce falls, reduce depression, and unable to keep up with regular TC class; | Group practice with instructor; see other people                                                      | One felt she could get out of a chair easier, another felt he improved balance; one described becoming a tai chi person; relaxing for another person; general well-being; improved posture; able to move joints better; improved sleep |
| Shen et al., 2008 USA  |         | Diagnosis of osteoarthritis 64.4 years 6/42 | 6 week (60 min x 2 days) | One group pre-post surveys | QOL: All domains improved (WOMAC) | Outcome: Pain decreased (VAS) | Self-efficacy: Pain management, physical function and coping with symptoms (Chronic Pain Self-Efficacy Scale) improved |
| Song et al., 2007 Korea|         | History of osteoarthritis and no exercise for 1 year prior 64.8 years 0/22 | 12 week (60 min x 3 days for 2 weeks then x 1 day for 10 weeks) | RCT Pre-post surveys | QOL: Arthritic pain and stiffness (Korean-WOMAC) decreased | Perceived benefits: Perceived benefits increased significantly | Self-efficacy: Self-efficacy (Motivation Scale for Health Behaviors), improved but not significantly |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Intervention Duration</th>
<th>Exit Interviews/ Perceived Benefits/ Self-efficacy</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taggart 2001 USA</td>
<td>45 mostly active with 1-4 types of PA, 2 or more chronic health problems, self reported health good, community aged 82 years</td>
<td>3 months (30 min x 2 days)</td>
<td>Exit interviews following TC class with open ended question</td>
<td>Exit interviews: 31% self-reported health somewhat better. Open ended “Do you feel you benefitted from the t’ai chi exercise program?” Various benefits (88%); better postural control 25%; 77% of those who used walker at baseline discontinued use indoors; balance improved; more relaxed and better able to sleep at night (11%); pain associated with fibromyalgia reduced (4%), urinary incontinence improved (2%), BP, BS and cholesterol better than past 5 years (2%); and better results than pills and exercises from the doctor.</td>
</tr>
<tr>
<td>Taylor-Piliae et al. 2006 USA</td>
<td>39 Chinese born, living in USA with CVD risk aged 66 years</td>
<td>12 week (60 min x 3 days)</td>
<td>One group Pre-post surveys</td>
<td>Perceived benefits: Improved mood [decreased tension-anxiety, confusion, depression, anger, and fatigue and increased vigor (Profile of Mood States)]; reduced stress (Perceived Stress Scale); and improved social support [from family and significant other (Multidimensional Scale of Perceived Social Support)] Self-efficacy: Increased self-efficacy to overcome barriers to perform TC, confidence to perform TC (Tai Chi exercise self-efficacy) improved</td>
</tr>
<tr>
<td>Tsang et al. 2005 Hong Kong</td>
<td>24 healthy older adults who practiced TC and lived in community aged 69.3 years</td>
<td>Minimum of 90 min per week x 3 years</td>
<td>Cross Sectional Surveys with scale 0-100</td>
<td>Self-efficacy: TC participants perceived more balance confidence in performing daily tasks (Activities Specific Balance Confidence Scale) than TC naïve group</td>
</tr>
<tr>
<td>Study</td>
<td>Participants</td>
<td>Intervention Details</td>
<td>Outcomes</td>
<td>Reasons for Continued Practice</td>
</tr>
<tr>
<td>---------------</td>
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</tr>
<tr>
<td>Tsang H.W. et al. 2006 Hong Kong</td>
<td>48 history of depression and chronic illness 82.4 years 10/38 Ethnicity (NR)</td>
<td>16 weeks (30-45 min x 3 days) RCT pre-post surveys</td>
<td>QOL: Well being (Personal Well Being); and psychological and general health (General Health Questionnaire) improved Self-efficacy: Chinese General Self-efficacy; and self-esteem (Self-concept Scale) improved</td>
<td></td>
</tr>
<tr>
<td>Wallsten et al. 2006 USA</td>
<td>41 healthy independent living in retirement community 81.2 years (both groups) 10/31 Ethnicity (NR)</td>
<td>20 weeks (60 min x 2) RCT pre-post surveys</td>
<td>Self-efficacy: Confidence to perform activities of daily living (Activities Specific Balance Confidence) improved</td>
<td></td>
</tr>
<tr>
<td>Yau &amp; Packer 2002 Hong Kong</td>
<td>18 TC practitioners (8.5 years range 3-26), 3 with visible disabilities 67 years Gender and ethnicity (NR)</td>
<td>TC practitioners (8.5 years range 3-26) [most practice 60 min x 7 days (66%)] Focus group discussion with thematic analysis of results</td>
<td>Reason for continued practice: Participation provides meaning and a pattern to daily life ('good fit' for older adults and soft, less vigorous with gentle movements, effortless and in slow motion)</td>
<td>Perceived benefits: Promotes health and well being; source of social support and encourages inner calmness; improved physical, cognitive, and mental health Perceived relationship between TC and QOL focused on psychological, social and lifestyle benefits more than physical benefits Self-efficacy:</td>
</tr>
<tr>
<td>Yeh et al. 2006 Taiwan</td>
<td>37 healthy older adults from senior centers 55.41 years 14/23</td>
<td>12 weeks (60 min x 3 days) One group pre-post surveys</td>
<td>Self-efficacy: Overall outcome expectations for exercise score (confidence in ability to improve function) improved</td>
<td>Perceived Benefits: Improved mood, gives a sense of accomplishment and increased mental</td>
</tr>
</tbody>
</table>
Taiwanese (100)  

alertness  
Other areas improved but not significantly: feel better physically, muscles and bones stronger, and improved endurance in performing daily activities

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Site</th>
<th>Diagnosis</th>
<th>Duration (Freq)</th>
<th>Study Design</th>
<th>TC Interventions</th>
<th>QOL</th>
<th>Reasons for Initiation</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yeh et al.</td>
<td>2004</td>
<td>USA</td>
<td>Chronic stable heart failure</td>
<td>12 weeks (60 min x 2 days)</td>
<td>RCT pre-post surveys and baseline expectations</td>
<td>QOL: QOL (Minnesota Living with Heart Failure total score) improved</td>
<td>Reasons for initiation: (2004)</td>
<td>Expected TC to be helpful prior to intervention (6.5 on 0-10 VAS)</td>
<td>All rated classes highly for enjoyment, and expressed interest in receiving additional instruction (4 on a 0-4 VAS) and 14 of 15 plan to continue TC.</td>
</tr>
<tr>
<td>Yeh et al.</td>
<td>2008</td>
<td>USA</td>
<td>66 years</td>
<td>10/5</td>
<td>White (53) and African American (47)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zhang et al.</td>
<td>2006</td>
<td>China</td>
<td>History of poor balance</td>
<td>8 weeks (60 min x 7 days)</td>
<td>RCT Pre-post surveys</td>
<td>Self-efficacy:</td>
<td>Falls efficacy (Falls Efficacy Scale) improved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. NR = not reported; min = minutes; RCT = Randomized Controlled Trial; QOL = Quality of Life; TC = Tai Chi; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; VAS = Visual Analog Scale; SF-12, 20, and 36 = short versions of Medical Outcomes Study; PSQI = Pittsburg Sleep Quality Index; SAFFE = Survey of Activities and Fear of Falling in the Elderly.
Studies in which self-efficacy was considered, 95% (n=19) showed participants had an improvement in self-efficacy. Improved self-efficacy and confidence in ability to perform exercises was reported using both qualitative and quantitative methods during interviews (Docker, 2006; Gavin & Myers, 2003); written exit surveys (Gavin & Myers, 2003; F. Li, Harmer, Glasgow et al., 2008; F. Li, Harmer, Mack et al., 2008; F. Li et al., 2007); and pre-post surveys (F. Li, McAuley, Harmer, Duncan, & Chaumeton, 2001; R. Song et al., 2007; Taylor-Piliae et al., 2006; H. W. H. Tsang et al., 2006; S. Y. Yeh, Chuang, Lin, Hsiao, & Eng, 2006) following 5 days of intense practice, at least 3 months of TC and 6 month TC interventions. One study specifically reported improved arthritis self-efficacy (Hartman et al., 2000) and another chronic pain management (Shen et al., 2008). Reports of significantly improved falls efficacy or confidence in ability to perform ADLs without falling, were measured by the Activities-Specific Balance Confidence scale (F. Li et al., 2005; Sattin et al., 2005; W. W. N. Tsang & Hui-Chan, 2005; Wallsten, Bintrim, Denman, Parrish, & Hughes, 2006). Fear of falling while performing ADLs and instrumental ADLs (F. Li et al., 2005) and confidence in avoiding falls also improved following a TC intervention (Choi et al., 2005; Sattin et al., 2005; G. Y. Yeh et al., 2004; Zhang et al., 2006). Participants also reported improved barrier and performance self-efficacy (F. Li, McAuley et al., 2001; Taylor-Piliae et al., 2006) and self-esteem (Jouper et al., 2006; F. Li, Harmer, Chaumeton, Duncan, & Duncan, 2002; H. W. H. Tsang et al., 2006). Chen, Snyder and Krichbaum supported the importance of confidence to exercise and reported that participants who did not want to practice TC believed they were too weak to practice and that memorization of the movements would be too hard (2001).
**Perceived factors for initiating TC.** The most frequently used designs that evaluated initiation and maintenance of TC used a variety of methods such as: (a) ethnography, focus group discussion (Beaudreau, 2006; Yau & Packer, 2002); (b) personal interviews (K. M. Chen et al., 2001; Scourfield, 2006); (c) participant observation combined with personal interviews (Docker, 2006); (d) quantitative surveys combined with personal interviews (Gavin & Myers, 2003); and (e) surveys (Hackney & Earhart, 2008; Jouper et al., 2006; G. Y. Yeh et al., 2004). The overall goal of these studies was to understand why older adults initiate and continue to practice TC from the participant’s perspective.

The perceived belief that exercise would improve chronic disease was often reported as a reason for initiating TC classes (see Perceived Outcomes section). One study of TC practitioners with over 5 years of practice ($n=253$) reported that maintaining health and recuperating from illness was important for both initiating and maintaining TC practice (Jouper et al., 2006). The intervention setting was an important factor for older persons engaging in TC and provided more specific information to what was appealing and is just as important as the content of a course. For example, Beaudreau (2006) reported that participants particularly liked the age of the instructor who they believed to be close in age to them. They found this reassuring and felt that was why the instructor knew how to meet the need of older adults by presenting the content in small segments and repetition. Another study reported that TC was a good fit for older adults as the movements are soft and gentle (Yau & Packer, 2002). Participants with Parkinson’s disease ($n=13$) simply enjoyed the class (Hackney & Earhart, 2008). Gavin and Meyers
(2003) found the instructor to be important in the process as well. Reported characteristics of a good instructor included: instructor was reassuring and repeated movements. Conversely, participants in Gavin and Meyers study reported that the instructor went too fast and tried to squeeze too much into one hour.

Spirituality, another important reflection of self, is very different from religion and is important in the context of the MM approach to PA (Koenig, 2006). One participant reported a “wholesome” feeling from practicing TC that was believed to be a spiritual meaning to the practice (Docker, 2006). Another study reported improved spirit and timeliness (Jouper et al., 2006).

Perceived safety was critical to the initiation and maintenance of an exercise intervention for older adults in the research reviewed for this report. Several articles provided subjective reports of safety. Some were reported during open ended interviews (Docker, 2006; Gavin & Myers, 2003) and others were self-report responses in exit surveys (F. Li, Harmer, Glasgow et al., 2008; F. Li, Harmer, Mack et al., 2008; F. Li et al., 2007).

**Discussion.** Previous research emphasized the importance of self-efficacy expectation and outcome expectations on performance of PA (B. Resnick, 2001) as well as the impact of social support from friends (B. Resnick, Orwig, Magaziner, & Wynne, 2002). These represent the psychosocial influence related to initiating and maintaining PA for older adults. The findings in this review contribute to further research design in identifying: (1) factors related to initiation and adherence of MM; (2) participant specific benefits resulting from an effective intervention i.e. Quality of Life, perceived safety, and
self-efficacy. Improved psychosocial benefits contribute to the application of research findings that identify benefits and barriers to a mind-body exercise program for older persons. Such programs can be tailored to individuals. For example, those who need more confidence in their ability to exercise or perceive they can/ or will only engage in safe exercise.

First, this review showed that the research reports the persons benefiting from TC interventions include both men and women, a significant number of minorities, all from a wide range of community settings and group settings. These findings were consistent with the known benefits of TC among older adults measured by functional outcomes (Chodzko-Zajko et al., 2006; C. E. Rogers et al., 2009). Because of the significant evidence that TC strategies improve perceived functional outcomes that range from attitudes towards exercise to quality of life outcomes that include pain reduction and improved psychological well-being, it is a strategy that may be an important recommendation by clinicians to improve activity in diverse older persons.

Second, this review showed that older persons who might benefit from TC strategies might include persons who are looking for an exercise that is easy to perform as evidenced by the many studies that reported increased confidence (self efficacy) in their perceived capabilities to exercise. MM strategies, with repetitive movement can be tailored to enhance exercise confidence in older persons. It is noteworthy to state that a positive attitude towards aging, while remaining physically active, was consistent with increasing perceived function resulting from TC strategies in older adults.
Attitude towards aging was a salient perception related to why the individuals continued to practice TC. Docker (2006) wrote that older adults may have a particular view on aging that was expressed through TC. Yau and Parker added that TC provided meaning and pattern to daily life (2002). The participants in the Chen Snyder and Krichbaum study reported a desire to stay active as a reason for joining TC classes (2001). Scourfield (2006) described older adults as being on the cusp between independence and dependency, with their TC practice was a method of retaining independence.

How older adults feel about themselves is an important component to aging. For example, confidence in performing exercises and walking is important to increasing physical activity. Self-efficacy is the confidence a person feels in performing a behavior or overcoming associated behaviors (Bandura, 1977). Many of the studies evaluated self-efficacy and the positive results may be due to the self-selection of those who agreed to participate in the classes and actually attended them. Additional findings outlined the perceptions of improved confidence in ability to perform ADLs and reduced fear of falling as a result of participation in TC.

Last, increasing levels of PA among older persons, particularly more frail older persons, may be enhanced by tailoring TC strategies to include an emphasis on health benefits of participation, class design, instructors’ characteristics, and monitoring or reassuring participants of safety measures employed in TC classes. Group classes in the community were important for social support and modeling behavior. Participant preferences for instructors were often discussed, such as being familiar with working
with older adults, presenting content in small segments, reassuring participants, repeating content, and being of the same age as the participants. Modeling behavior is another important component. Measures to promote participation may be improved by emphasizing the known and perceived benefits of participation in TC class.

**Strengths and limitations.** Several strengths of this review have been identified. The research designs were well balanced with representation of both genders. There was a global representation of a significant number of minorities from a wide range of community and group settings. This review identified several key strategies for designing MM exercise programs in the community setting. Many of the reports, both qualitative and quantitative, resulted in specific strategies that can target initiating and maintaining MM in older persons.

A few limitations were identified. Where ethnic diverse populations were represented, none of the studies reported inclusion of Hispanic men and women which limits generalizability to this minority group. The thoroughness of the unique findings of psychosocial benefit excluded the core value of MM, spirituality, and oddly enough, there was a paucity of studies that included this spiritual exploration of the MM intervention.

**Preliminary Research**

The proposed study builds on preliminary research that evaluated the effect of a one month Sign Chi Do class on balance, physical activity, and participant satisfaction among men (n=3) and women (n=24), 68% white and 18% Hispanic, over the age of 50. The median age range was between 70 and 79. The median level of education was
reported at a High School Graduate level with the lowest level of education grade school or less and the highest post graduate school. There was a 32% attrition rate. The exercise class was offered at 2 community centers in an urban setting in the southwest. Balance was evaluated using the TUG (Podsiadlo & Richardson, 1991; C. E. Rogers, 2006) and physical activity was measured using the Seven Day Physical Activity Recall record (PAR) (S. N. Blair et al., 1985). A tool was created to evaluate participant satisfaction with the program and process as well as perception of benefits. The survey tool was evaluated by 2 faculty members and 3 community members prior to implementation.

Outcome measures were the Timed Up & Go (TUG) as a measure of balance and Seven Day Physical Activity Recall (PAR) a measure of physical activity. TUG score from pre- to post program did not significantly improve, t(20) = 0.87, p > .05, but indicated a trend towards decreasing TUG scores. There was a significant increase in PAR scores from pre to post, t(19) = -3.01, p < .05. There was however a trend towards decreasing TUG scores and a longer intervention time may demonstrate significant changes. This preliminary research demonstrated feasibility and acceptability of this program in the community (C. E. Rogers, 2006). Of those who completed the satisfaction survey, 85% reported they enjoyed the class and 79% would take the class again.

The proposed study incorporated the following changes based on the pilot results: (a) focus on improved physical function; (b) increase the intervention to 3 months to measure physiologic changes (physical function and BP); and (c) plans to retain participants to decrease dropout rates. Additionally, the participants in this research study
were screened for sedentary behavior to increase ability to detect significant changes in a population not already active.
Chapter 3

Methods

This chapter provides an overview of the research design, including analytical methods of the Sign Chi Do (SCD) study. The purpose of the study was to evaluate intervention effects of SCD intervention in promoting physiologic and self-concept adaptation to aging among sedentary community dwelling adults over 55. A discussion of the intervention structure is presented first.

Intervention

The intervention was based on the design of Dr. Anne Borik, the originator of the practice, and ongoing review of literature related to this type of exercise. SCD is a mind-body-spiritual exercise that uses slow, continuous movements of the arms and legs (similar stances and movements to Tai Chi [TC]) while signing word phrases that reflect spiritual ideas and ideals (Borik, 2004; Rogers et al., 2009). The movements incorporate concentration (meditation); balance, postural alignment, and muscle strengthening; and diaphragmatic breathing. Completion of the form while experiencing the meaning of the word phrase is the goal of SCD. The meditative effect is achieved by concentrating on personal meaning of word phrases with intention (setting aside time to practice with purpose and thought), attention (feeling and visualizing the meaning of the words), and attitude (without judgment, but recognition of the feelings experienced) (Borik, 2004). Those word phrases are taught in a three-step pattern: do the movement (engaging the body), visualize what the phrase means (engaging the mind in the spiritual exploration), and feel the word phrase (engaging the emotional and spiritual exploration) while
connecting through the breath. The intervention followed a manualized protocol designed to promote spiritual meditation.

In addition to relying on the focus of the flow of the movement and rhythm of the breath to receive the benefits of meditation, the mind is filled with positive words, proposed to provide the body with quicker physiologic responses (Borik, 2004). This three step process also helps the individual remember the movements so they can be repeated. SCD is an exercise designed to increase physical function and personal beliefs, including spiritual enrichment from feeling the emotion of the word phrases. An intervention needs to impact all of these modes, thus it was theorized that a mind, body, and spiritual PA would improve the physical mode directly by stimulating the regulator subsystem which will improve balance and function (Roy & Andrews, 1999). The intervention was thought to stimulate the cognator mode by improving personal beliefs by increasing self-efficacy with a spiritual focus to improve the way participants feel about themselves. This mind-body approach achieves integrated adaptation from a multilevel approach.

The following principles of Social Cognitive Theory were integrated into the intervention design as outlined in Table 4: (a) self-efficacy, (b) behavioral capability, (c) observational learning, (d) environment, (e) outcome expectancies, (f) self control, and (g) coping responses (Baranowski et al., 2002).
Table 4.

*Definition of Social Cognitive Theory Constructs and Applications*

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>The person’s confidence in performing a particular behavior and in overcoming barriers to that behavior</td>
<td>Changes in behavior will occur in small steps to ensure success. Build on previous session movements. Small groups to ensure appropriate instructor to participant ratio for continual support</td>
</tr>
<tr>
<td>Behavioral Capability</td>
<td>Knowledge and skill to perform a given behavior</td>
<td>Participants will promote mastery of the exercise through skills training. Instructors demonstrate the movements. Participants give return demonstration.</td>
</tr>
<tr>
<td>Observational Learning</td>
<td>Behavioral acquisition that occurs by watching the actions and outcomes of other’s behaviors</td>
<td>The use of credible instructors to model behavior, watching others in class, and viewing the testimonials of current Sign Chi Do practitioners.</td>
</tr>
<tr>
<td>Environment</td>
<td>Factors physically external to the person</td>
<td>Opportunities for social support include attending class and monthly telephone calls.</td>
</tr>
<tr>
<td>Outcome Expectations</td>
<td>Occur when a persons’ behavior is likely to cause a specific outcome</td>
<td>Discuss outcomes of improving strength, balance and function in class.</td>
</tr>
<tr>
<td>Self-control</td>
<td>Personal regulation of goal-directed behavior or performance</td>
<td>Utilization of a Personal Assessment Log. Instructors can help by providing opportunities for: Decision making Self-monitoring Goal setting Self-Reward</td>
</tr>
<tr>
<td>Emotional Coping Responses</td>
<td>Strategies or tactics that are used by a person to deal with emotional stimuli</td>
<td>Exploration of the meaning of Sign Gestures includes emotional focus via the three step process. Strategies to remove barriers will be discussed during monthly phone calls and calls to participants who miss classes.</td>
</tr>
</tbody>
</table>

**Sample**

A total of 135 older adults were screened at 5 sites between May 20 and November 2, 2009. Of these, a total of 67 met inclusion criteria. Inclusion criteria
included: community living, adults between ages 55 and 89, cognitively normal, sedentary (< 60 minutes planned physical activity [PA] per week) with accompanying compromise to physical function (Timed Up & Go [TUG] > 10), ability to participate in light to moderate-intensity PA (Physical Activity Readiness Questionnaire [PAR-Q]), and able to speak English. Exclusion criteria included: living in an assisted living or care facility, under the age of 55 and over 89, cognitively impaired, active (> 60 minutes of planned PA per week), no compromise to physical function (TUG < 10), unable to participate in light to moderate-intensity PA, and unable to speak English. Participants were able to respond to written or spoken words. Hearing impaired participants were able to read lips for verbal communication and read printed materials. Efforts were made to recruit a sample representative of the older metropolitan Phoenix ethnic population (64% white, 21% Hispanic, and other 15%) by recruiting from a Hispanic support group at one of the senior centers and recruiting from one senior center with an ethnically diverse population.

A total 11 participants were lost to attrition, thus the total sample consisted of 56 adults between the ages of 55 and 89 who were served by the East Valley Senior Services and Senior Opportunities West. This sample size was appropriate for a pilot study to determine effect sizes in order to calculate sample size needed for a full scale randomized controlled trial. It was initially proposed that 78 participants would be recruited for the study to allow for a 30% drop out rate consistent with PA programs in this population (F. Li et al., 2005; Sattin et al., 2005; Taggart, 2002). In this study the attrition rate was 19% with 13 drop outs.
Setting

The setting included the East Valley Adult Resources and City of Phoenix senior centers. They provide comprehensive programs to promote the independence of adults over 50. Individual sites included: Mesa, Red Mountain and Apache Junction Senior Centers, and Discovery Point Retirement Apartments for East Valley Adult Resources; and Senior Opportunities West for the City of Phoenix. At the Discovery Point Retirement Apartment, there are 182 apartments for independent living older adults. The mean age of residents is 85. The Senior Centers and apartment offer many opportunities to people living in the Mesa community: meals, recreational programs, special events, educational and special internet classes, health/wellness classes and screenings, crafts and hobbies, multigenerational activities, and volunteer opportunities. Overall, the health and wellness programs have served over 13,400 people annually. Transportation to the centers is available through public transit, Dial A Ride, and some offer a free shuttle. The Senior Opportunities West senior center provides similar services. The population served is 21% Hispanic, 56% female over the age of 65, and 27% live under the national poverty level. The study purpose was presented to program coordinators at all of the sites to facilitate recruitment.

Design

A randomized experimental design with repeated measures was used (SCD or Wait-list control). An experimental design was chosen to rule out bias due to history, maturation or selection bias. A Wait-list Control group was utilized to control for potential cross contamination of intervention to control groups (Kazdin, 2003). This
study design had one between-subjects treatment factor (SCD intervention verses Wait-list Control), and two within-subjects time factors (T1, pre intervention; T2, 6 weeks; and T3, 12 weeks). The study evaluated outcomes pre, 6 weeks and post 12 week intervention because the Taggart and Wolf et al TC studies demonstrated significant changes at 3 months (Taggart, 2002; S. L. Wolf et al., 2003b). The mid point was measured to determine if there was a peak effect during the intervention.

**Recruitment and Retention**

Recruitment was conducted by the investigator in collaboration with the staff at the senior centers. Strategies for recruitment included scheduled presentations to senior center participants, demonstration of SCD during lunch announcements, and by posting fliers at the sites. Presentations included a discussion of the health benefits of PA, demonstration and description of SCD, description of study background, purpose, and procedures. Interested participants provided name and telephone numbers following presentations and sign up rosters were posted at the senior centers. A demonstration of SCD was given during information sessions prior to obtaining signed consent to improve retention rates from the preliminary research. Frequency and duration of expected participation was clarified with all individuals prior to the screening and baseline data collection sessions, at the time of signing consent and with random assignment notifications. Weekly attendance at class was emphasized during every step of recruitment and at the weekly classes. A Wait-list control design was employed to facilitate recruitment by offering the class to all interested participants. Telephone calls were utilized to remind participants of scheduled data collection times. Attendance
rosters were checked weekly, and if a participant missed a class, he or she received a phone call in an effort to bring them back on schedule as soon as possible by (a) identifying the reason for the absence; (b) resolving possible problems; and (c) to cover content missed in class. Participants in the Wait-list control group received bi-weekly newsletters to maintain interest in the study. Participants were compensated with a $10.00 gift card following completion of each data collection session.

Procedures

This research study was approved by the Institutional Review Board of Arizona State University (Appendix B). All original questionnaires were stored in a locked cabinet and participant personal information was kept in a separate locked file. Each participant was assigned a study number to maintain confidentiality. Following recruitment presentations and posting of flyers, participants who provided their name and telephone number were called by the investigator. At that time, all interested participants were pre-screened for age, sedentary behavior (PA history), and PAR-Q. Further screening was then scheduled for cognitive level (Mini-Cog) and TUG. Following completion of all screening criteria, qualifying adults were asked to participate in the study. Informed consent was obtained from those interested in participation. The participants were randomly assigned to SCD or Wait-list Control group by site using a 2 x 2 block group method. See Table 5 for timeline of recruitment and Table 6 for detailed activities completed at each visit. Participants were informed of their group assignment to SCD intervention or Wait-list control group with instructions regarding when to meet for further data collection and future meeting times after baseline data collection at each site.
All participants, including the Wait-list Control group were told that their class assignment was determined by chance.

Table 5

Recruitment and Intervention Timeline

<table>
<thead>
<tr>
<th>Site</th>
<th>Recruitment start</th>
<th>Intervention Start</th>
<th>Intervention End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovery Point</td>
<td>May 20, 2009</td>
<td>June 15, 2009</td>
<td>August 31, 2009</td>
</tr>
<tr>
<td>Red Mountain</td>
<td>May 27, 2009</td>
<td>July 6, 2009</td>
<td>September 28, 2009</td>
</tr>
<tr>
<td>Mesa</td>
<td>August 21, 2009</td>
<td>September 17, 2009</td>
<td>December 10, 2009</td>
</tr>
<tr>
<td>Apache Junction</td>
<td>September 10, 2009</td>
<td>October 13, 2009</td>
<td>January 5, 2010</td>
</tr>
<tr>
<td>Senior Opportunities West</td>
<td>September 30, 2009</td>
<td>November 9, 2009</td>
<td>January 25, 2010</td>
</tr>
</tbody>
</table>

Table 6

Schedule for Data Collection

<table>
<thead>
<tr>
<th>Data Collection Activities</th>
<th>Eligibility Screen</th>
<th>Baseline</th>
<th>Week 6</th>
<th>Week 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mini-Cog</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly exercise minutes</td>
<td>X</td>
<td></td>
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<td>Timed Up &amp; Go</td>
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Note. PAR-Q = Physical Activity Readiness Questionnaire.

* Demographics = age, gender, education, race/ethnicity, health conditions, height and weight

** Surveys = Functional Assessment of Chronic Illness Therapy-Spiritual Well-being and Exercise Self-efficacy
Baseline data collection was completed by the investigator. Participants and investigator were blinded to group assignment until after baseline data collection. Subsequent data collection was conducted by two doctoral students who were blinded to the participants’ study group assignment (intervention or Wait-list control) and trained to adhere to the procedures detailed in a protocol manual. Both doctoral students completed Collaborative Institutional Training Course in the protection of human research subjects. The doctoral students asked the questions and mark the answers on the forms during face-to-face interviews for most participants. A few preferred to complete the surveys individually and those were self-administered and reviewed for completion. Data collection was simultaneous for SCD and Wait-list Control groups. Data collection occurred at T1 (baseline), T2 (6 weeks), and T3 (12 weeks). A room with comfortable table and chairs was used and a sign was placed on the door indicating no interruptions for the data collection. The participants were allowed access to water and bathrooms during the completion of the surveys.

**Intervention Structure**

Intervention structure followed protocol established in a detailed intervention guide. One hour weekly sessions included groups of 5-10 participants each, over 12 weeks. Program length was selected based on a review of previous TC programs (Taggart, 2002). Each session included a 5 minute warm up and cool down time with 50 minutes for instruction and participation in SCD according to the protocol established by Dr. Borik, a board certified Internal Medicine physician with a background in exercise physiology (2006; Taggart, 2002). Participants were given a copy of an instructional
DVD, music CD, flash cards, and a Personal Assessment Log to facilitate practice of movements at home, between classes. Word phrases were written on a grease board in the classroom for each class. Participants were encouraged to practice at least 10 minutes, 2 times between classes the first week, increasing the time to include up to the recommended 30 minutes five days of the week. They were also asked to record weekly practice on an activity log.

**Evaluation of Intervention Fidelity**

Intervention fidelity refers to the extent to which the delivery of the SCD intervention adheres to the protocol and theoretical premises (Kazdin, 2003). Two certified SCD instructors were used to teach the classes (one full time and one substitute). Their demonstration of movements was observed and rated for consistency of performance by Dr. Anne Borik, with the expectation that the movements would be performed with at least 90% accuracy (Polit & Beck, 2004). The observation forms were scored by one of the trained doctoral students. SCD instructors practiced the word phrases between sessions and continually reviewed all of the guiding principles of SCD. The guidelines for the SCD intervention were clearly outlined in the SCD Intervention Manual. Random class sessions were videotaped by the substitute instructor as she was trained in the intervention purpose and delivery. The video tapes were reviewed for adherence to program presentation and content according to the weekly checklist by one of the trained doctoral students. Additionally, SCD instructors completed a checklist of completion of program content following each session. Those reports were submitted to one of the trained doctoral students for review. SCD instructors were certified in CPR.
Wait-list Control Group

Participants in the Wait-list Control group received bi-weekly mailings during 12 week intervention time to maintain interest in the study. The content for the newsletters was exclusive of physical activity and meditation materials to avoid introducing information that was included in the intervention. Participants from the Wait-list Control group received contact from the investigator every six weeks to schedule data collection meetings. The Wait-list control groups were given the intervention after the initial 12 week wait period.

Study Instruments and Data Collection Methods

Screening assessment tools included age, the Mini-cog, a Seven Day Physical Activity Recall, TUG, and PAR-Q. Variables were categorized as independent and dependent outcome variables. Table 7 outlines the relationship between theoretical constructs and outcome variables. SCD class participation was identified as the independent variable. Dependent variables included selected measures to evaluate physiologic and self-concept adaptation. Physiologic adaptation was measured using objective and subjective performance measures and self-concept adaptation was measured with self report psychometric scales.

Measurement of variables occurred following agreement to participate in the study at baseline (T1), at midpoint (6 weeks, T2), and at completion of program (3 months, T3) through measures of standardized questionnaires, performance measures and behavioral outcome. The investigator and doctoral students assisted in the completion of assessment forms. Baseline measurement was completed by the investigator prior to
randomization to treatment condition and measurement at T2 and T3 was completed by doctoral students trained in measurement techniques. All were blinded to intervention condition at time of measurement. Participants completed the measures at the same time points.

Table 7

*Description of Theoretical Measures of Adaptation*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Physiologic Adaptation</th>
<th>Self-Concept Adaptation</th>
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<tr>
<td>Operational</td>
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<td>Spirituality</td>
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<td>Functional Assessment</td>
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<td></td>
<td>Blood Pressure</td>
<td>Repeated Measure ANOVA</td>
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**Sign Chi Do participation.** The independent variable of SCD class participation was measured by class rosters. Participants signed a roster when they attended SCD classes. Instructor call logs were used to record reasons for missed classes. Class attendance and reasons for missing classes were recorded in SPSS.

**Demographic variables.** Demographic variables included (a) age in calendar years; (b) gender (male and female); (c) current chronic illness; (d) level of education in years; (e) height and weight; (f) ethnicity and race per NIH guidelines; and clinical site.

**Height.** Height was measured using a 60 inch tape measure. The tape was taped vertically on the wall with the zero end positioned exactly 20 inches up from the floor. The participant stood with their back of their head against the wall (the middle of the head is lined up with the tape measure) and the eyes looking straight ahead. A ruler was
placed on top of the participant’s head, and it was extended straight back to the tape measure, keeping it level. The person’s height was the score in inches indicated on the tape plus 20 inches (the distance from the floor to the zero point on the tape measure). Height was recorded to the nearest half inch.

**Weight.** Weight was measured with a calibrated scale. Participants removed all heavy clothing such as jackets and shoes. The weight was recorded in pounds.

**PA history.** Each participant was asked the type and how many minutes of planned or scheduled PA they performed in the previous week. Planned PA was defined as participation in an activity such as walking or exercise class that was structured, repetitive, and purposeful for improving or maintaining physical fitness. Results were recorded on an activity record developed for this class and summed as minutes for the week. The instrument has not been evaluated for validity and reliability.

**Cognitive function.** Cognitive function was assessed by the Mini-cog exam. The Mini-Cog exam screens for cognitive impairment (Borson, Scanlan, Chen, & Ganguli, 2003). A decline in cognitive function can affect the ability of older adults to complete surveys and participate in the intervention. The Mini-Cog takes an estimated three minutes to administer and is not influenced by education, culture, or language (Borson, Scanlan, Watanabe, Tu, & Lessig, 2005). This survey determines if cognitive impairment is present. Participants were asked to listen to and repeat three words, complete a Clock Drawing, and then repeat the three words.

**Physical Activity Readiness Questionnaire (PAR-Q).** Prior to the encouragement of activity during the intervention, all participants were screened by the
PAR-Q. The purpose of the PAR-Q is to rule out the presence of physiological or physical symptoms and conditions that may place the participant at risk for an adverse event during exercise (Canadian Society for Exercise Physiology, 1998).

**Timed Up & Go (TUG).** The TUG measures the time it takes one to stand from a seated position, walk 10 feet, turn, return to the chair, turn and sit down. For this test the participants were asked to sit with their back against a chair with arms resting on the chair’s arms and any walking aid at hand. At the word ‘go’, they rose from the chair, walked 10 feet at a comfortable and safe pace, turned around, walk back to the chair and sat down. The TUG was demonstrated one time. Participants gave one return demonstration and repeated the test 3 times. The participants practice score and all three trials were recorded on the data collection form.

The TUG has documented reliability ($\alpha=0.96$) and validity (Podsiadlo & Richardson, 1991). A positive relationship was reported between TUG scores and scores on the Berg Balance Scale ($r = -0.72$), gait speed ($r = -0.55$), and scores on the Barthel Index of ADL ($r = -0.51$) for validity measures. Reliability was tested by comparing the test scores of three raters in two different locations and found an intraclass correlation coefficient of 0.99 (Podsiadlo & Richardson, 1991).

**Six minute walk (6-MW).** The 6-MW is a safe measure of functional status for older adults. It measures the distance one can walk in 6 minutes. A rectangular walking track was set up with cones marking the turning points. The total distance around the track and midpoints at the cones was measured in feet. Chairs were placed around the track for the participants’ safety. Two stopwatches were used to time the test in case one
stopped working. Two to six participants were allowed to complete this test simultaneously. When more than one participant walked at a time, they were started and stopped 10 seconds apart. Two stop watches were used to time the 6 minute walk in the event that one stopped working during the test.

Participants were instructed to walk around the track at a comfortable pace the word “Go” and that they could rest in the chairs as needed. The time on the clock continued while they were resting. Participants received a tongue blade as a device to mark the completion of each completed lap during the six minutes. At the end of six minutes, participants were asked to stop and continue walking in place for a minute to cool down and then rest in a chair near their stopping point. A measurement was taken from the starting line to the cone closest to the stopping point. The tongue blades were collected from the participants, summed, and multiplied by the distance around the track and the distance to the stopping point for the last lap was added to create a total score.

The 6-MW has a strong correlation with self-reported physical function (.55) and general health perceptions (.39) (Harada, Chiu, & Stewart, 1999). Harada, Chiu & Stewart (1999) also reported high one-week test-retest reliability ($r = .95$) and significantly greater distance walked for active verses sedentary older adults ($p < .0001$).

**Pedometer steps.** Participants were given a pedometer (New-Lifestyle 2000) to wear for one week at each data collection point (T1, T2, and T3). The NL-2000 is an objective measure of PA, and was used to confirm the self report PAR scores by comparing the reported amount of accumulated physical activity to the amount of activity recorded on the pedometer in steps. The NL-2000 pedometer uses a piezo-electric
accelerometer mechanism to record accumulated steps and estimated calories and is initialized with the participants’ age, gender, height, and weight to provide an accurate energy expenditure estimate of physical activity and resting energy expenditure (Schneider, Crouter, & Bassett, 2004). The pedometer can record data for seven days in 1 day epochs and re-sets to zero at midnight to provide daily recordings of steps taken (Crouter, Schneider, & Bassett, 2005).

At the end of the baseline interview and one week prior to subsequent assessments, the New Lifestyle-2000 (NL-2000) pedometer was programmed with the participant’s age, gender, height and weight. The pedometer was placed on the participants’ waistband according to manufacturers’ recommendations. Participants were instructed to wear the pedometer during all waking hours, except during bathing or other water activities. Participants were instructed to document the time they wore the NL-2000 daily on a pedometer log and to return the pedometers and logs the following week at a specified time. The daily steps from the NL-2000 were recorded in a log on the return day to avoid losing data. Pedometer logs were coded for data entry using the following procedures: (1) assign a data entry code for the weekday the steps were completed (Sunday- Saturday); (2) enter number of steps recorded for each corresponding day; and (3) enter estimated calories computed by the NL-2000 and recorded for each corresponding day.

Convergent validity for the use of pedometers has been established through reviewing the literature of studies comparing pedometers to accelerometers, observation and self-report measures of PA (C. Tudor-Locke, Williams, Reis, & Pluto, 2002). It was
reported that pedometers correlate with accelerometers ($r = .86$) and time in activity ($r = .82$). Reliability was measured by comparing hand counted steps to recorded steps while participants (mean age $40 \pm 13.0$ and BMI $32.6 \pm 4.8$) walked at varying speeds (Crouter et al., 2005). The NL-2000 underestimated steps within 3% at speeds of 67, 80, 94 and 107 meters per minute ($p = <.05$). A recent study reported significantly less error in counts using a moderately expensive ($\sim$ $60$) electronic pedometer, the New Lifestyle 2000 (NL-2000) and a costly ($\sim$ $5000$) sophisticated motion-capture system compared to a less expensive ($\sim$ $15$) mechanical pedometer, the YX200 ($1.7\pm2.5$, $2.5\pm3.7$, and $10.3\pm$ % respectively) among older adults (Marsh, Vance, Frederick, Hesselmann, & Rejeski, 2007). The investigators also reported a significant correlation between gait speed and the NL-2000 ($\rho = -0.62$, $p = .001$). Pedometers are designed to measure vertical movement of the hips during ambulation, thus are unable to measure non-ambulatory activities such as cycling or the hand movements of SCD (Corder, Brage, & Ekelulnd, 2007). The steps recorded by the pedometer readings are considered to be a representation of lifestyle PA in the analysis.

**Physical activity records.** Weekly physical activity was measured by a Physical Activity Recall (PAR) developed for this study. The changes in weekly PA and daily steps were represent PA during the intervention. The PAR was adapted from the Stanford Seven Day Recall developed for use in epidemiological research to assess PA (Blair et al., 1985). The PAR used in the current study records information about the amount and type of PA performed. The one week, the data collection period was used to represent typical daily activity patterns.
The PAR was interviewer administered. On the day the pedometers were returned, the participants were asked to report the type, frequency, and duration of activities for each day in the preceding seven days. The type of PA recorded in the log included the specific mode of activity including planned and unplanned activities which were categorized according to the Compendium of Physical Activities (Ainsworth et al., 2000). All reported activities were categorized by MET intensity levels. A MET is defined as the activity metabolic rate divided by the resting rate. One MET is defined as 3.5 ml O_2/kg/minute (Nieman, 2007). The frequency of PA was documented as the number of activity sessions per week. The duration of each activity was reported in minutes. Participants in the intervention group were instructed not to report time spent practicing SCD when they reported weekly activity on the PAR to retain blinding of the data collection in the study investigators. Occasionally, in person interviews were not possible and participants were asked to report the amount and type of PA during a telephone phone interview. PA records were coded for data entry using the following methods: (1) assign a data entry code for the weekday the activity was completed (Sunday- Saturday); (2) estimate if the PA occurred in the lying, sitting or standing position based on description of activity; (3) estimate if the PA was planned or unplanned based on description of activity; (4) determine intensity of the PA; and (5) assign a 5-digit code for the activity from the Compendium of Physical Activities (Ainsworth et al., 2000). The 5-digit code reflects the type and category of PA for use in data analyses to identify the total minutes spent in PA types and intensity. Data from PAR and SCD logs were entered into SPSS.
Validity of the PAR adopted for this study has not been established. Construct validity of the Stanford PAR has been established through relationships between the phone PAR and TriTrac-R3D accelerometer for total minutes per week of PA and moderate intensity activities \( r = 0.43 \) and \( r = 0.31 \) respectively (Hayden-Wade, Coleman, Sallis, & Armstrong, 2003). Convergent validity has been examined by comparing the Stanford PAR against time-matched activity logs and other self-report measures of activity (Dishman & Steinhardt, 1988). Studies have generally supported the validity and reliability of the PAR as a measure of physical activity in adults (Sallis et al., 1985).

**Blood pressure.** An aneroid sphygmomanometer (Mccoy portable model # 160-000) blood pressure cuff and stethoscope were used to measure systolic and diastolic blood pressure. Participants were seated quietly in a chair for 20 minutes in a chair before measurements were taken. Blood pressure was taken two times on right arm except when participants reported history of right axillary lymph node dissection or other health condition that prevented use of the right arm, with feet on the floor and uncrossed using standardized methods recommended by the American Heart Association (Pickering et al., 2005). An appropriate-sized cuff (cuff bladder encircling at least 80% of the arm) was used to ensure accuracy. Both readings were recorded for data entry and analysis.

**Spirituality.** Spirituality was measured with the FACIT-SP. This survey was designed to measure spirituality for use in research of people with chronic and/or life-threatening illnesses (Peterman, Fitchett, Brady, Hernandez, & Cella, 2002). The FACIT-Sp was developed with input from religious/spiritual experts, psychotherapists, and
cancer patients. The FACIT-Sp is part of the Functional Assessment of Cancer Therapy-General, a widely-used measurement of quality of life among patients in cancer therapy and reported high internal consistency ($\alpha = m.72-.85$). Reliability was reported at $\alpha.81-.88$ (Peterman et al., 2002). Spearman Correlations between FACIT-Sp and the FACIT-G, Profile of Mood States, and Marlowe-Crowne Social Desirability Scale on Meaning ranged between .25 - .58 ($p <.05$). This survey includes 12 items on a 5-point Likert scale (ranging from 0, "Not at all" to 4, “Very much”). The FACIT-Sp has 2 subscales of Meaning/Peace (items 1-8) and Faith (9-12). Scores were recorded in SPSS.

**Self-confidence.** The Exercise Self-Efficacy Scale measures the individuals’ beliefs in their ability to accumulate 30 minutes of PA per day on 5 days or more per week in the future (E. McAuley et al., 2006a). Participants were asked to indicate how confident they were that they could continue to exercise in the future from one week to eight weeks, on a scale of 0 (Not confident) to 100% (Highly confident). Scores were recorded in SPSS.

**Source of Data, Coding and Scoring Methods**

Sources of data, coding and scoring methods for study variables, hypotheses, and analytic methods are described below.

**Independent variable.** The SCD intervention was the independent variable for this intervention.

**Sign Chi Do participation.** Random assignment to SCD or Wait-list control was used as a categorical variable (1 = SCD class and 2 = Wait-list control). Attendance at
SCD classes was summed for all participants. Class attendance rates were used as categorical data (1 = attended class and 2 = did not attend).

**Screening variables.** Screening variables for inclusion criteria included age, exercise history, cognitive function, PAR-Q, and TUG. Age was reported in years and is further defined in descriptive variables.

**PA history.** Sedentary behaviors were defined as planned PA <60 minutes per week because that is the most commonly used definition in the literature and this level of inactivity is well below the recommended guidelines of 150 minutes per week (Bennett, Winters-Stone, Nail, & Scherer, 2006; Nelson et al., 2007). Participants who reported >60 minutes of planned PA during the previous week were excluded from the study. Participation in planned PA was reported as a continuous variable with minutes of scheduled PA for the week.

**Cognitive function.** For the Mini-cog exam, recall of all three words after the Clock Drawing or unsuccessful recall of one to two words with a normal Clock Drawing was recorded as a normal score. Unsuccessful recall of all three words after the Clock Drawing was considered an abnormal score. A normal score indicated absence of dementia or cognitive impairment and abnormal indicates individual with dementia. For the safety of the individuals, program directors at the senior centers were consulted when volunteers did not pass the Mini-cog exam. In all instances, the directors were aware of the cognitive function of the individuals. Individuals with abnormal scores were excluded from the study. Cognitive function was used as categorical data (1= normal and 2 = abnormal).
**Physical Activity Readiness Questionnaire.** Written physician or nurse practitioner approval and clearance to participate in PA was obtained from participants who answered “yes” to one or more of the seven screening questions or who were over the age 69 at baseline (American College of Sports Medicine, 2006; Canadian Society for Exercise Physiology, 1998). Individuals who did not receive permission from their physician were excluded from participation in the study. Receipt of physician letter was coded as categorical (1 = not returned, 2 = yes, returned, and 3 = not required as responded no to all questions).

**Timed Up & Go.** A TUG score was used as a screening criterion. Active adults demonstrating higher levels of fitness were not expected to demonstrate a physiologic change in outcomes. Thus screening for disuse or a sedentary lifestyle was part of the inclusion criteria. A TUG < 10 reports free mobility (Podsiadlo & Richardson, 1991). Participants with a TUG score > 30 are considered to have impaired mobility. During the screening interview, the TUG was administered. Scores were averaged. Individuals with a score < 10 were excluded from the study. Participants with scores > 30 were not excluded, but for safety reasons, were asked to participate in the SCD classes from a seated position.

**Dependent variables.** Dependent variables for the study were defined as physiologic adaptation: TUG, 6-MW, weekly physical activity, pedometer steps, and systolic and diastolic blood pressure; and self-concept adaptation: spirituality and exercise self-efficacy.
Timed Up & Go. The three TUG scores were averaged in SPSS for outcome measures at T1, T2, and T3. Lower scores indicate higher levels of balance and function. TUG was used as a continuous variable in seconds.

Six minute walk. The 6-MW scores were entered into SPSS. A higher score indicates a higher level of function. 6-MW was used as a continuous variable in feet.

Weekly physical activity. Weekly PA recorded on the PAR were scored by multiplying the minutes of activity by its associated MET value to calculate a MET-minute score (Ainsworth et al., 2000). The MET-minute score reflects the minutes an activity was performed at a specific MET intensity. MET-minute score was summed each day to create MET-minute daily scores. In turn, these were summed to create MET-minutes per week. Weekly activity was used as a continuous variable measured in MET-minutes.

Pedometer steps. Recorded daily steps were reviewed. Steps < 500 were scored as missing. Average weekly steps were calculated by summing steps from at least three days and dividing by the number of days. At least three days of steps were required per Tudor-Locke et al. (2005) to reflect a weekly step average. The pedometer steps per week were used as a continuous variable as average steps per week.

Blood pressure. Systolic and diastolic blood pressure readings were averaged in SPSS to create the average score. Systolic and diastolic blood pressure were used as a continuous variable measured in mmHg.

Functional Assessment of Chronic Illness Therapy- Spiritual Well-Being. Items 4 and 8 were reverse scored. According to scoring guidelines, at least 50% of the scores
must be present. Scores were summed and divided by the number of responses when at least 7 scores were recorded. This accounts for missing scores as participants are allowed to refuse response to items. A higher score indicates better spiritual well-being. Spirituality was used as a continuous variable.

**Exercise Self-Efficacy.** The responses were summed and divided by eight in SPSS to calculate final score. Higher scores indicate higher levels of self-confidence to continue to exercise. Self-confidence was used as a discrete variable with 0 = not at all and 100 = very much.

**Demographic variables.** Demographic variables included age, gender, ethnicity and race, health conditions, and site of intervention. All of these variables were obtained from the demographic and screening survey.

**Age.** Age was recorded in years and was used as a continuous variable.

**Gender.** Gender was used as categorical data (1 = male and 2 = female).

**Race and ethnicity.** Race and ethnicity were used as categorical variables. Race: 1 = African American, 2 = Asian, 3 = American Indian or Alaska Native, 4 = White, and 5 = other. Ethnicity: 1 = Latino and 2 = not Latino.

**Health conditions.** Health conditions were used as categorical data. Each condition was entered separately as a discrete variable (1 = Yes) for (1) heart; (2) respiratory; (3) diabetes; (4) cancer; (5) arthritis or orthopedic; (6) chronic pain; and (7) other. Presence of health conditions were summed for total number of conditions as a continuous variable.
Site of intervention. Site of intervention was used as categorical data (1 = Mesa, 2 = Red Mountain, 3 = Discovery Point, 4 = Apache Junction, and 5 = Senior Opportunities West). Note, Senior Opportunities West was added as a fifth site after the survey form was created so it was hand written on the form.

Intervention feasibility measure. Data from feasibility measures provide support for future design of intervention studies. An attendance log was used to record the number of sessions attended weekly. The attrition log recorded the data and reason why participants left the study. Identification of reasons for attrition provides information for researchers to determine what components of the intervention are acceptable or unacceptable to participants for the purpose of modifying the intervention for the future (Sidani & Braden, 1998). Reasons for missing classes were used as categorical data according to reason for missed class (1 = health condition, ill; 2 = health condition, health care provider visit, 3 = non health, vacation; 4 = non-health family; 5 = non-health, conflicting event at center; 6 = non-health, transportation; 7 = non-health, forgot or no specific reason; and 8 = attending SCD facilitator class). Reasons for missing classes were used as categorical data (1 = health condition and 2 = non-health condition).

Data Management and Analysis

Coded data collection forms were completed at each measurement and reviewed for missing information. Participants were asked to respond to the missing questions of the form. Their right to refuse to provide information was emphasized. The level of significance was set at .05.
**Study aim 1.** Evaluate the efficacy of SCD compared with a Wait-list Control group on the physiologic and self-concept modes of adaptation among sedentary community dwelling adults 55 years and older at baseline (T1), 6 (T2) and 12 (T3) weeks.

Research Question 1a. What is the effect of SCD on the physiologic mode of adaptation as measured by balance with the Timed Up & Go score; function as measured by the 6 minute walk; weekly physical activity as measured by Seven Day Physical Activity Recall and pedometers; and blood pressure?

Research Question 1b. What is the effect of SCD on the self-concept mode of adaptation as measured by the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being (FACIT-Sp) and Exercise Self-Efficacy Scale?

**Analytic methods.**

1. All data were entered into SPSS 17
   a. One case per participant was used for demographics, screening measures, and outcome variables except PAR and pedometer steps.
   b. Three cases per participant was used for each data collection time (T1, T2, and T3) for PAR and pedometer steps. Total scores were restructured to one case per participant after data for those variables were combined.

2. Verification of 10% of the data records to explore for discrepancies in data entry using SPSS update procedure described by UCLA Academic Technology Services was performed.
3. A table of descriptive statistics for demographics of age, gender, education, ethnicity/race, health conditions, height, and weight was created.

4. Shapiro-Wilk was performed to determine if data were normally distributed.

5. Analysis of frequencies, mean, median, and mode and kurtosis and skewness for all data was performed.

6. Based on Levine’s Test of Equality of Error Variances, Met-minute, pedometer steps and FACIT-SP total scores were log transformed.

7. T-tests and chi-square tests were performed between SCD intervention and Wait-list control groups on baseline demographics and dependent variables.

8. T-tests and chi-square tests were performed between drop outs and completed participants for demographics of age, gender, education, ethnicity/race, health conditions, height, and weight; with dependent variables of Timed Up & Go, six minute walk, activity logs, pedometer steps, systolic blood pressure, diastolic blood pressure, Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being, and Exercise Self-efficacy.

9. A table of Pearson’s correlations between demographic variables of age, gender, years of education, ethnicity/race, health conditions, height, and weight; and dependent variables of Timed Up & Go, six minute walk, activity logs, pedometer steps, systolic blood pressure, diastolic blood pressure, Functional Assessment of Chronic Illness-Spiritual Well-Being, and Exercise Self-efficacy was created.
10. An analysis of Functional Assessment of Chronic Illness-Spiritual Well-Being, and Exercise Self-efficacy surveys included: Cronbach’s alpha, kurtosis, skewness, and correlations.

11. Repeated Measures analysis with within subjects factor of time and between subjects factor of assignment to intervention or wait-list control of Timed Up & Go, six minute walk, activity logs, systolic blood pressure, diastolic blood pressure, Functional Assessment of Chronic Illness-Spiritual Well-Being, and Exercise Self-efficacy was performed.

12. A table of mean, standard deviation, F ratio for main effect and interactions, Cohen’s $d$, and Partial Eta Squared for dependent variables of Timed Up & Go, six minute walk, activity logs, pedometer steps, systolic blood pressure, diastolic blood pressure, Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being, and Exercise Self-efficacy was created.

13. Between group simple effects for significant 6-MW and time within group for significant TUG and MET-minute main effects were explored.

14. Repeated Measures analysis with within subjects factor of time and between subjects factor of assignment to intervention or wait-list control of pedometer steps were performed separately due to missing data.

15. Post-hoc comparisons were explored for significant time and group interaction assignment for TUG.

**Study aim 2.** Cohen’s $d$ (Aim 2) was calculated at post intervention to look at final effect size (Cohen, 1988). Effect size was calculated for dependent variables by
subtracting mean of control group from mean of intervention group and dividing by pooled standard deviation.

**Summary**

A randomized controlled trial with repeated measures was used to examine the effects of SCD on physiologic (physical) and self-concept modes of adaptation among sedentary community dwelling adults over 55 over time. The intervention structure and measures described are supported by preliminary research findings and a review of the literature in the population of older adults.
Chapter 4

Findings

The primary purpose of this study was to test the efficacy of Sign Chi Do exercise intervention compared to a Wait-list control group on adaptation to aging. The focus was on physical function and self-concept adaptation. Both intervention and Wait-list control groups were tested for the variables of TUG, 6-MW, PA and pedometer steps, systolic and diastolic blood pressure, spirituality, and exercise self-confidence. Two main effects were studied: group (intervention and Wait-list control), time (T1, T2, and T3), and group by time interaction. Significant interactions were investigated using a Bonferroni correction. Significance was set at $p < .05$. All means are reported with standard deviations in parenthesis. The second aim was to calculate an effect size for future studies. Those findings will be discussed in this section. A third discussion of ancillary findings of acceptability and feasibility will also be reported.

Data Entry Verification

Data entry accuracy was checked by double entry of 10% of the total sample. The cases were selected randomly. The procedure for comparison defined by UCLA was used (UCLA: Academic Technology Services, Statistical Consulting Group, 2010). After comparing files, an error rate of less than 0.3% was calculated. Thus the accuracy of data entry was confirmed.

Sample Description

Sixty-seven older adults who met the inclusion criteria were enrolled in the study.
For the total sample, the age ranged from 62 to 88 years, mean 74.46 (8.15). Most of the participants were white (81%) and some African American (12%), American Indian or Alaska Native (5%) and Asian and other (2% each). In addition, 18% of the overall group reported Latino ethnicity. Most of the participants were female (85%).

Years of education completed ranged from 0 to 24, mean 12.98 (3.64). Weight ranged from 48.64 to 136.36 kilograms, mean 83.67 (20.93) and height ranged from 1.33 to 1.78 meters, mean 1.6 (.09). Presence of chronic conditions ranged from 0 to 7, mean 3.36 (1.56). There was not a significant difference between groups for demographic variables except for presence of diabetes. Participants in the Wait-list reported 50 % with diabetes while the intervention group reported 23%. The comparison frequencies with percentages and means with standard deviations at baseline are reported in Table 8.

Thirteen participants were dropped from the analysis and compared to those who completed the study. There was no significant difference between groups for baseline measures except for Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being scores, means (with standard deviation in parenthesis) were 38.56 (7.85) and 30.54 (12.65), $p = .005$ for completers and drop-outs respectively). Ten individuals were withdrawn from the study; one was asked to stop participation due to a health condition; and two were deleted from the analysis due to low class attendance and reporting no SCD practice at home (Table 9). The consort screening and randomization process is reported in Figure 2.
### Table 8

**Mean (standard deviation) and Frequency (%) of Sample Demographics (N=67)**

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Intervention (n=35)</th>
<th>Control (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (years)</td>
<td>72.77 (8.24)</td>
<td>76.31 (7.75)</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4 (11)</td>
<td>6 (19)</td>
</tr>
<tr>
<td>Female</td>
<td>31 (87)</td>
<td>26 (81)</td>
</tr>
<tr>
<td>Years completed education</td>
<td>13.07 (4)</td>
<td>12.88 (3)</td>
</tr>
<tr>
<td>Race/Ethnicity (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>28 (80)</td>
<td>26 (80)</td>
</tr>
<tr>
<td>White Hispanic*</td>
<td>5 (14)</td>
<td>7 (22)</td>
</tr>
<tr>
<td>African American</td>
<td>4 (11)</td>
<td>4 (13)</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>2 (6)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Asian</td>
<td>0</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (2.9)</td>
<td>0</td>
</tr>
<tr>
<td>Chronic Disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart (%)</td>
<td>3.08 (1.63)</td>
<td>3.65 (1.45)</td>
</tr>
<tr>
<td>Respiratory (%)</td>
<td>7 (20)</td>
<td>11 (34)</td>
</tr>
<tr>
<td>Diabetes (%)**</td>
<td>8 (23)</td>
<td>16 (50)</td>
</tr>
<tr>
<td>Cancer (%)</td>
<td>8 (23)</td>
<td>7 (21.9)</td>
</tr>
<tr>
<td>Arthritis/Orthopedic (%)</td>
<td>23 (66)</td>
<td>23 (72)</td>
</tr>
<tr>
<td>Chronic Pain (%)</td>
<td>15 (43)</td>
<td>15 (47)</td>
</tr>
<tr>
<td>Other (%)</td>
<td>16 (43)</td>
<td>19 (59)</td>
</tr>
<tr>
<td>Height in Meters</td>
<td>1.61 ( )</td>
<td>1.60 (0.07)</td>
</tr>
<tr>
<td>Weight in Kilograms</td>
<td>82.34 (21.53)</td>
<td>85.13 (20.48)</td>
</tr>
</tbody>
</table>

* Hispanic White also reported in other Race category.
** Chi-Square significant, $p = .04$.

### Table 9

**Reported Reasons for Attrition (N = 13)**

<table>
<thead>
<tr>
<th>Prior to week 6</th>
<th>Prior to week 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>Wait-list Control</td>
</tr>
<tr>
<td>Unknown leg pain</td>
<td></td>
</tr>
<tr>
<td>MD request to participate in research plan for rheumatoid arthritis</td>
<td></td>
</tr>
<tr>
<td>Need faster pace PA to lose weight per MD (pre-diabetes and if no weight loss will require medication)</td>
<td>Fell and physician ordered balance training</td>
</tr>
</tbody>
</table>
Participants screened  
$N = 135$

Participants randomized  
$N = 67$

Intervention  
$n = 35$

Intervention attrition  
week 6  
$n = 3 (32 \text{ remaining})$

Intervention attrition  
week 12  
$n = 5^* (27 \text{ remaining})$

Wait-list control  
$n = 32$

Wait-list control attrition  
week 6  
$n = 3 (29 \text{ remaining})$

Wait-list control attrition  
week 12  
$n = 2 (27 \text{ remaining})$

Total completion  
$N = 54$

Figure 2. Flow of Randomization and Attrition

* One withdrawn due to health reasons and two dropped due to not attending class or practicing at home.

Pearson’s Correlations of baseline characteristics are reported in Table 10. Higher TUG scores were associated with increased age and systolic blood pressure; and lower 6-MW and weekly steps. Lower 6-MW distance walked was associated with women,
increased number of health conditions, systolic blood pressure, and spirituality; and fewer weekly steps. Fewer weekly steps were also associated with increased age. A higher level of weekly physical activity was associated with higher spirituality and confidence in ability to exercise. A higher level of spirituality was associated with higher level of confidence in ability to exercise. Based on these findings, age and health were entered as covariates, but there was no main effect, therefore they were removed from the model.

Table 10

Pearson’s Correlations of Demographics and Outcomes (N = 54 except Steps N = 52)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td></td>
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<td></td>
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<tr>
<td>2. GEN</td>
<td>.108</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. EDU</td>
<td>- .288*</td>
<td>-.193</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4. Race</td>
<td>-.068</td>
<td>.067</td>
<td>.149</td>
<td></td>
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<tr>
<td>5. Health</td>
<td>.039</td>
<td>-.070</td>
<td>.111</td>
<td>.160</td>
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</tr>
<tr>
<td>6. TUG</td>
<td>.227*</td>
<td>.073</td>
<td>-.101</td>
<td>.018</td>
<td>.222</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>7. 6-MW</td>
<td>-.012</td>
<td>-.253*</td>
<td>.077</td>
<td>.163</td>
<td>-.288*</td>
<td>-.529**</td>
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<tr>
<td>8. PA</td>
<td>-.056</td>
<td>-.129</td>
<td>.014</td>
<td>-.126</td>
<td>-.051</td>
<td>.049</td>
<td>-.048</td>
<td></td>
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<tr>
<td>9. Steps</td>
<td>-.308*</td>
<td>-.177</td>
<td>.083</td>
<td>.076</td>
<td>-.033</td>
<td>-.503**</td>
<td>.450**</td>
<td>-.116</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10. SBP</td>
<td>.200</td>
<td>.151</td>
<td>-.082</td>
<td>-.153</td>
<td>.099</td>
<td>.274*</td>
<td>-.277*</td>
<td>-.075</td>
<td>-.124</td>
<td></td>
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<td></td>
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<tr>
<td>11. DBP</td>
<td>-.080</td>
<td>.196</td>
<td>.030</td>
<td>-.210</td>
<td>-.097</td>
<td>.050</td>
<td>-.095</td>
<td>-.126</td>
<td>-.187</td>
<td>.421**</td>
<td></td>
<td></td>
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<tr>
<td>12. SWB</td>
<td>-.264*</td>
<td>.009</td>
<td>-.100</td>
<td>-.092</td>
<td>-.154</td>
<td>-.174</td>
<td>.278*</td>
<td>.251*</td>
<td>.059</td>
<td>-.086</td>
<td>.130</td>
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<tr>
<td>13. ESE</td>
<td>.145</td>
<td>.048</td>
<td>.064</td>
<td>-.030</td>
<td>-.022</td>
<td>.087</td>
<td>.170</td>
<td>.390**</td>
<td>-.047</td>
<td>-.069</td>
<td>.042</td>
<td>.247*</td>
</tr>
</tbody>
</table>

Note: * Correlation is significant at the level of 0.05 (1-tailed). ** Correlation is significant at the level of 0.05 (1-tailed). GEN = gender; EDU = education; Health = health conditions; TUG = Timed Up & Go; 6-MW = six minute walk; PA = weekly MET-minutes; Steps = weekly pedometer steps; SBP = systolic blood pressure; DBP = diastolic blood pressure; SWB = Functional Assessment of Chronic Illness-Spiritual Well-being; ESE = Exercise Self-efficacy.

Psychometrics

The FACIT-SP and Exercise Self-Efficacy scales were evaluated, reporting Cronbach’s alpha of .709 and .985 respectively. All of the individual scores were significantly correlated with the total scores (FACIT-SP range, .454 to .743, p < .05 and
Exercise Self-efficacy range .863 to .984, $p < .05$). Generally, the scores for skewness and kurtosis were $< 1$ for FACIT-SP, however there was little variability for having a reason for living, life being productive, and finding comfort and strength in spiritual beliefs. These scores tended to be reported as 4 with the range from 0 to 4. The total score skewness was -.78 and kurtosis was -.063. All scores were $< 1$ for Exercise Self-efficacy.

**Study Aim 1**

Findings for physiologic and self-concept adaptation are reported for specific aim 1. Two participants refused to complete performance measures at T2 and two at T3 due to physical complaints and one participant was unavailable to complete the performance measures at T2. Therefore, the findings are reported for a total $N$ of 49 (Intervention $n = 26$ and Wait-list control $n = 23$). Mauchley’s test of Sphericity was significant for TUG and Spirituality, and the Greenhouse-Geisser adjustment for degrees of freedom were reported for these main effects. Levine’s Test of Equality of Error Variances was not significant for all scores except for PAR at T2, $F(1,47) = 5.06, p = .03$; and Spirituality at T1, $F(1,47) = 4.81, p = .03$ and T2, $F(1,47) = 6.23, p = .02$. All PAR and Spirituality scores were log transformed to adjust for these unequal variances in the analysis. Actual change scores were reported in addition to the log transformed scores to provide a meaningful finding. Mean scores, standard deviations, $F$ ratio, Cohen’s $d$, and Partial Eta Square for all main effects and interactions are reported in Table 11.

**Physiologic adaptation.** Physiologic mode was measured using the Timed Up & Go (TUG); six minute walk (6-MW); adapted Physical Activity Recall (PAR) score and pedometer readings; and systolic and diastolic blood pressure.
Table 11

Mean and Standard Deviation scores, $F$-ratios, Partial Eta Sq, and Cohen’s $d$ for Main Effects and Group by Time Interaction ($N = 49$)

<table>
<thead>
<tr>
<th>Item</th>
<th>Baseline</th>
<th>Week 6</th>
<th>Week 12</th>
<th>F-ratio Group</th>
<th>F-ratio Time</th>
<th>F-ratio Time* Group</th>
<th>Partial Eta Squared</th>
<th>Cohen's $d$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>TUG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCD</td>
<td>13.55 (4.7)</td>
<td>11.96 (3.82)</td>
<td>11.02 (3.17)</td>
<td>2.528</td>
<td>9.83**</td>
<td>3.62*</td>
<td>0.173</td>
<td>-0.57</td>
</tr>
<tr>
<td>Wait-List</td>
<td>14.16 (3.59)</td>
<td>14.5 (5.2)</td>
<td>13.28 (4.83)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-MW</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCD</td>
<td>939.97 (293.84)</td>
<td>900.85 (339.26)</td>
<td>985.19 (339.55)</td>
<td>4.409*</td>
<td>1.382</td>
<td>1.72</td>
<td>0.028</td>
<td>0.7</td>
</tr>
<tr>
<td>Wait-List</td>
<td>791.22 (374.36)</td>
<td>719.74 (447.86)</td>
<td>713.96 (447.86)</td>
<td></td>
<td></td>
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<tr>
<td>Activity</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>SCD</td>
<td>6 (1.61)</td>
<td>6.4 (2.15)</td>
<td>7.17 (1.71)</td>
<td>0.004</td>
<td>6.28*</td>
<td>0.56</td>
<td>0.118</td>
<td>0.2</td>
</tr>
<tr>
<td>Wait-List</td>
<td>6.13 (1.61)</td>
<td>6.8 (0.83)</td>
<td>6.82 (1.78)</td>
<td></td>
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<td></td>
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<tr>
<td>SBP</td>
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<td></td>
</tr>
<tr>
<td>SCD</td>
<td>127.76 (17.79)</td>
<td>128.6 (14.09)</td>
<td>125.46 (14.14)</td>
<td>0.007</td>
<td>2.63</td>
<td>0.44</td>
<td>0.053</td>
<td>0.18</td>
</tr>
<tr>
<td>Wait-List</td>
<td>128.67 (13.61)</td>
<td>130.74 (16.71)</td>
<td>123.22 (10.381)</td>
<td></td>
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</tr>
<tr>
<td>DBP</td>
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</tr>
<tr>
<td>SCD</td>
<td>71.13 (8.98)</td>
<td>69.86 (10.94)</td>
<td>68.17 (8.3)</td>
<td>0.528</td>
<td>2.53</td>
<td>0.77</td>
<td>0.051</td>
<td>0.27</td>
</tr>
<tr>
<td>Wait-List</td>
<td>68.37 (9.37)</td>
<td>70.63 (8.67)</td>
<td>65.87 (9.14)</td>
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</tr>
<tr>
<td>SCD</td>
<td>3.64 (0.2)</td>
<td>3.7 (0.16)</td>
<td>3.69 (0.19)</td>
<td>1.059</td>
<td>2.2</td>
<td>0.22</td>
<td>0.045</td>
<td>0.27</td>
</tr>
<tr>
<td>Wait-List</td>
<td>3.6 (0.27)</td>
<td>3.62 (0.27)</td>
<td>3.64 (0.23)</td>
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<td>ESE</td>
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</tr>
<tr>
<td>SCD</td>
<td>67.93 (26.69)</td>
<td>65.1 (31.5)</td>
<td>60.43 (36.34)</td>
<td>0.22</td>
<td>0.17</td>
<td>1.92</td>
<td>0.004</td>
<td>-0.38</td>
</tr>
<tr>
<td>Wait-List</td>
<td>66.36 (29396)</td>
<td>64.89 (37.73)</td>
<td>73.42 (31.18)</td>
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</table>

Note: * significant $p < 0.05$ and ** significant $p < 0.001$; df group (1, 47), time and interactions (2, 94) except TUG (1.67, 78.535) and Spirituality (1.58, 74.125). Natural log transformed scores reported for Activity and FACIT-SP. TUG = Timed Up & Go, SCD = Sign Chi Do intervention group ($n = 26$); Wait-List = control group ($n = 23$); 6-MW = six minute walk; activity = weekly PA in MET-minutes; SBP = systolic blood pressure; DBP = diastolic blood pressure; FACIT-SP = Functional Assessment of Chronic Illness- Spiritual Well-being; ESE = Exercise Self-efficacy.
Timed Up & Go (TUG). The TUG is measured in seconds. There was not a significant main effect between groups for TUG scores, \( F(1, 47) = 2.58, p = .119 \). There was a significant main effect of time on TUG, \( F(1.67, 78.53) = 9.83, p = .000 \), and a significant interaction for week by group, \( F(1.67, 78.53) = 3.62, p = .039 \). Because of the significant interaction, the simple effects of group assignment within time and time within group assignment were explored. There was not a significant effect for group within time (T1, T2, and T3 \( p > .05 \)). The calculated effect size at T3 between groups was \( d = -.57 \). Pairwise comparisons were completed to explore direction and significant changes by group assignment. There was a significant decrease in TUG scores from T1 to T2 (-1.59, \( p = .003 \)), T2 to T3 (-.94, \( p = .038 \)) and T1 to T3 (-2.53, \( p = .000 \)) for the intervention group (Figure 3). For the Wait-list control group, there was a non significant increase in TUG from T1 to T2 (.34, \( p = .53 \)) and decrease from T1 to T3 (-.872, \( p = .203 \)) and significant decrease from T2 to T3 (-1.21, \( p = .012 \)).
Figure 3. Line graph of estimated marginal means of Timed Up & Go (TUG) between groups and across time.

**Six minute walk (6-MW).** The 6-MW is measured in feet. There was a significant main effect for the 6-MW between groups, $F(1, 47) = 4.412, p = .041$. There was no difference for time ($p = .256$) or for a group by time interaction ($p = .185$) of the intervention on 6-MW, $F(2,94) = 1.38, p = .256), d = .70$. Pairwise comparison between groups showed a significant mean difference of 200.38, $p =.041$ (Figure 4). Pairwise comparisons of groups within time showed a non significant mean difference for T1 and
T2 (148.56, \( p = .127 \) and 181.45, \( p = .078 \) respectively). There was a significant mean difference of 271.236 feet between groups at T3, \( F(1, 47) = 5.785, p = .02 \).

Figure 4. Line graph of estimated marginal means of the Six Minute Walk between groups and across time.

*Adapted Seven Day Physical Activity Recall (PAR).* Weekly physical activity was reported with the PAR. The activities reported were: conditioning exercises; grocery shopping; household activities such as cleaning, yard work, caring for children; walking for transportation and exercise; occupation; recreation; and church attendance. Activities were expressed in MET-minutes. Actual mean and standard deviation scores for weekly
MET-minutes were 769 (738), 1,752 (1,481) and 2,282 (1672) for the intervention group and 824 (699), 1,234 (1,026), and 1,778 (1,643) for the Wait-list control group (T1, T2, and T3 respectively). Weekly MET-minutes between intervention and Wait-list control group were not statistically different, F(1, 47) = .004, p = .953. There was a main effect over time from pretest and posttest comparisons, F(2,94) = 6.285, p = .003. Pairwise comparisons among time within groups showed a significant increase in MET-minutes for the intervention group between and T1 and T3 (1.178, p = .001). The actual change score was 1512.71. The wait-list control group did not show a statistically significant change over time (Figure 5).
Figure 5. Line graph of weekly physical activity between groups and across time. Data displayed were log transformed.

**Pedometer.** Many of the participants chose not to wear pedometers every day; however, \( n = 36 \) wore them at least 3 days per week. After averaging scores as described in the methods section, there were complete weekly scores of \( n = 43 \) at T1, 37 at T2 and 36 at T3. Due to multiple missing scores, pedometer data was not included in the overall repeated measures analysis.

The pedometer data were compared to physical activity MET-minute scores to determine if there was a significant relationship between the two variables. The results
are presented in Table 12. The T1 scores were not significantly correlated, but T2 and T3 were positively correlated, \( p = .94, .20, \) and \( .012 \).

Table 12

*Spearman’s rho Correlations of PA Record Physical Activity Met-minutes/Week and Pedometer Steps/Week*

<table>
<thead>
<tr>
<th></th>
<th>T1 PA</th>
<th>T2 PA</th>
<th>T3 PA</th>
<th>T1 Steps</th>
<th>T2 Steps</th>
<th>T3 Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 PA</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>43</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>T2 PA</td>
<td>.367**</td>
<td>-</td>
<td>-</td>
<td>.204</td>
<td>.245</td>
<td>.148</td>
</tr>
<tr>
<td>N</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>43</td>
<td>43</td>
<td>43</td>
</tr>
<tr>
<td>T3 PA</td>
<td>.383**</td>
<td>.579**</td>
<td>-</td>
<td>.153</td>
<td>.208</td>
<td>.373**</td>
</tr>
<tr>
<td>N</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>T1 Steps</td>
<td>.204</td>
<td>.245</td>
<td>.148</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 Steps</td>
<td>.140</td>
<td>.338*</td>
<td>.265</td>
<td>.731**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>37</td>
<td>37</td>
<td>37</td>
<td>33</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>T3 Steps</td>
<td>.153</td>
<td>.208</td>
<td>.373**</td>
<td>.792**</td>
<td>.735**</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>34</td>
<td>28</td>
<td>36</td>
</tr>
</tbody>
</table>

PA = Weekly MET-minute scores; N = Total sample size.

* Correlation is significant at the .05 level (1-tailed).

** Correlation is significant at the .01 level (1-tailed).

The intervention group showed an increase in the median steps at T2 with a return to baseline at T3. The Wait-list control group showed a steady decline in median steps from T1 to T3 (Figure 6). The median and 25\(^{th}\) to 75\(^{th}\) interquartile ranges were 22,167
(16,061, 34,989), 19,825 (15,022, 33,610), and 20,766 (11,721, 34,369) for the intervention group and 17,332 (11,700, 21,723), 21,948 (16,762, 27,124), and 16,834 (9,156, 23,582) for the Wait-list control group. The actual untransformed step means were 24,365 (11,221), 28,213 (11,472), and 23,641 (13,210) for the intervention group and 21,627 (10,175), 19,947 (11,184), and 20,631 (14,509) for the Wait-list control group. The repeated measures ANOVA for the weekly steps between intervention and Wait-list control groups are presented in Table 13. There was not a significant difference between groups ($p = .108$), over time ($p = .091$), or for a group by time interaction ($p = .134$). See Figure 7 for a line graph of the estimated marginal means between groups and across time.

*Figure 6. Bar graph of pedometer steps accumulated per week by group and time.*
Table 13

*Mean and Standard Deviations scores and F ratios, Partial Eta Sq and Cohen's d for main effects of Weekly Steps (N = 39)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Baseline (M)</th>
<th>Week 6 (M)</th>
<th>Week 12 (M)</th>
<th>F-ratio Group</th>
<th>F-ratio Time</th>
<th>Partial Eta Squared</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCD</td>
<td>10.003 (0.455)</td>
<td>10.172 (0.394)</td>
<td>9.916 (0.59)</td>
<td>2.705</td>
<td>2.482</td>
<td>0.063</td>
<td>0.22</td>
</tr>
<tr>
<td>Wait-List</td>
<td>9.833 (0.636)</td>
<td>9.74 (0.595)</td>
<td>9.702 (0.712)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * significant p < .05 and ** significant p < .001; df group (1, 37), time and interactions (2, 74). Natural log transformed scores reported for weekly steps. Steps = total weekly steps; SCD = Sign Chi Do intervention group (n = 20); Wait-List = control group (n = 19).
Figure 7. Line graph of log transformed weekly pedometer steps between groups and across time.

Blood pressure. There was not a significant main effect of intervention between groups for systolic blood pressure \( (p = .933) \), \( d = .18 \); or diastolic blood pressure, \( (p = .471) \). There was not a significant main effect for time \( (p = .077 \text{ and } .085 \text{ respectively}) \) or for a group by time interaction \( (p = .645 \text{ and } .466 \text{ respectively}) \). The line graphs of the estimated marginal means between groups and across time for systolic blood pressure (Figure 8) and diastolic blood pressure (Figure 9) are displayed below.
Figure 8. Line graph of systolic blood pressure between groups and across time.
Figure 9. Line graph of diastolic blood pressure between groups and across time.

**Self-concept Adaptation.** Self-concept was measured with the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being (FACIT-Sp) and the Exercise Self-Efficacy Scale (McAuley et al., 2006a).

**Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being.** There was not a significant main effect between groups for FACIT-SP. There was not a significant difference for time, $F(1.58, 74.125) = 2.20, p = .13$ or for a group by time interaction, $F(1.580, 74.125) = 0.224, p = .747$. Actual mean scores were 38.92 (6.77), 40.731 (5.61), and 40.857 (6.923) for the intervention group and 37.747 (9.111), 38.587
(9.124), and 38.846 (8.148) for T1, T2, and T3 respectively. See Figure 10 for a line graph of the estimated marginal means between groups and across time for spirituality. Exploration of the distribution of scores showed 45% of ranged from 40 to 48 with 48 being the maximum possible score.

Figure 10. Line graph of spirituality between groups and across time. Data displayed were log transformed.

**Exercise Self-Efficacy Scale.** The Exercise Self-Efficacy scale measured confidence in ability to continue to exercise. There was no significant main effect between the intervention and control groups for self-confidence ($p = .642$), over time, $F(2, 94) = .17, p = 0.86$ or for a group by time interaction ($p = .152$). Pairwise comparisons were not significant for Exercise Self-Efficacy mean change scores. See
Figure 11 for a line graph of the estimated marginal means between groups and across time for self-confidence. Exploration of the scores showed approximately 50% of the scores ranged from 80 to 100 with 100 as the maximum possible score.

![Estimated Marginal Means of Self-Confidence](image)

*Figure 11.* Line graph of exercise self-confidence scores between groups and across time.

**Ancillary Aims**

**Intervention feasibility.** The reasons reported by the study participants were documented. Reasons for dropping from the study included: health reasons (7), wanted or needed faster pace exercise (2), physician request to participate in another research study (1), too busy (1). One of the participants who dropped due to health reasons was asked to
drop by the researcher based on observed health problems. Attrition was computed as percentage of the total number of participants who provided consent and completed baseline data collection measures. Of the 67 participants a total of 11 dropped prior to completing T3, (16%). Attrition was computed and compared between the SCD (6) and Wait-list Control (5). Two participants were dropped from the intervention group due to low class attendance rates and no practice of SCD outside of the classroom. They reported conflicting work schedules as their reason for not attending class. The final attrition rate was 19% with 13 dropped participants.

Of those who completed the intervention, there was an overall 69% attendance rate. An examination of weekly attendance reported the following: week 1 (100%), week 2 (70.4%), week 3 (59.3%), week 4 (66.7%), week 5 (74.1%), week 6 (63.0%), week 7 (63.0%), week 8 (66.7%), week 9 (63%), week 10 (70.4%), week 11 (70.4%), week 12 (66.7%).

Intervention dosage to determine the percentage of participants who completed all 12 sessions included 27 participants. Of those, none completed all 12 sessions. Five participants (19%) completed 11 sessions, 4 participants (15%) completed 10 sessions, 4 participants (15%) completed 9 sessions, 7 participants (26%) completed 8 sessions, 3 participants (11%) completed 7 sessions, 2 participants (7%) completed 5 sessions, and 2 participants (7%) completed 4 sessions. Health care needs were the most frequent reason for missing sessions (Table 14). Health care needs reported were either illness or visit to health care provider. The remaining non-health care reasons included forgot to come to
class, family needs, conflicting event at senior center, working at the senior center, vacation, or lack of transportation.

Table 14

*Reasons for Missing Class*

<table>
<thead>
<tr>
<th>Reason</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Health Care</strong></td>
<td></td>
</tr>
<tr>
<td>Ill</td>
<td>25 (25.2)</td>
</tr>
<tr>
<td>Health Care Provider visit</td>
<td>22 (22.2)</td>
</tr>
<tr>
<td><strong>Non Health Care</strong></td>
<td></td>
</tr>
<tr>
<td>Forgot or no reason</td>
<td>11 (11.1)</td>
</tr>
<tr>
<td>Busy with family</td>
<td>8 (8)</td>
</tr>
<tr>
<td>Conflicting event at center</td>
<td>6 (6)</td>
</tr>
<tr>
<td>Work at center</td>
<td>4 (4)</td>
</tr>
<tr>
<td>Vacation</td>
<td>13 (13.1)</td>
</tr>
<tr>
<td>Transportation</td>
<td>8 (8)</td>
</tr>
</tbody>
</table>

**Intervention acceptability.** Acceptability of the SCD intervention was determined based on a review of participant questionnaire responses, instructor field notes, attendance logs, and self-report home practice. A 69% attendance rate was reported. The minutes of home practice ranged from 30 to 375 at T2 and 0 to 1110 at T3 (mean 138.71, SD = 92.77 and 158.96, SD = 215.85 respectively). Exit surveys reported how participants enjoyed the class and how likely they were to take the class again or tell a friend about the class. The question “How did you enjoy the class?” was scored on a 5 point likert scale (“Not at all” to “Extremely”). Participants enjoyed the class overall, mean 4.48 (0.64). The next two questions were also scored on a 5 point likert scale (“Never” to “Extremely likely”). When asked “Would you take the class if it were offered here in the future, most were very likely, mean 3.63 (1.49). In response to “Would you tell a friend about the class?” most were extremely likely to tell a friend, mean 4.3 (0.78). In addition, participants were asked how the class could be improved,
what they liked the most, and least about the class and comments. The following is a summary of 18 responses to the question “How can this class be improved?"

- No changes offered
- Have class twice a week
- Larger room/room with mirrors all the time
- More song-exercise pairing, learn the motion-song
- Shorter time

There were 16 responses to the question “What did you like the most about the class?”

- Instructor was excellent
- It was different from other classes
- Easy to perform
- Music with the exercise
- People in class now friends
- Learning to slow down and relax
- Set exercises week by week

There were 20 responses to “What did you like the least about the class?”

- Class too long
- Too short in number of classes
- Time of day
- Practicing at home

General comments

- Exercises were very relaxing and inspirational
• I’ve tried other classes before but never liked it. I find I have more energy and my breathing is better since doing these exercises
• I fell the second week of class and that slowed me down
• The class was very helpful to me
• I liked the choreography between motion and song
• I feel fortunate to have had the opportunity to participate
• Would like to continue the class
• Thank you for this experience and the learning experience
• Very fun
• Very reflective

**Fidelity.** The instructors’ ability to demonstrate the SCD movements were scored, and reported 93% for the primary instructor and 98% for the substitute instructor. All but 3 classes were taught by the primary instructor. The classes were taught according to the intervention manual. Weekly checklists were 100% complete. Videotaped sessions were also 100% complete.

**Manipulation checks.** Participants were asked how active they were before and after the class, if the class improved their strength and balance, and how difficult it was to complete the surveys. They were all scored on a 5 point likert scale (“Not at all” to “Extremely”). Eighty-five percent of the participants self-reported an increase in their level of activity from before to after the SCD intervention. Many were some or moderately active before class, mean 2.41 (1.85) and this changed to moderate to very active after the 12 weeks, 3.52 (0.89). The participants reported moderate changes in
strength, mean 3.04 (1.06) and some to moderate improvements in balance, 2.89 (1.21).

There was an overall belief that there was little difficulty in completing the surveys, mean 1.73 (1.51) and performance measures, mean 1.88 (1.18).
Chapter 5

Discussion

This chapter provides an interpretation of the findings of the study aims, and includes a discussion of the strengths, limitations, and clinical relevance of the project. The purpose of this feasibility study was to determine the efficacy of a theory based intervention on measures of physiologic and self-concept adaptation. A two group comparison design was used. The intervention was Sign Chi Do exercise compared to a sedentary Wait-list control. The specific aims of the study were to determine the effect of a SCD intervention compared to a Wait-list control group on physiologic and self-concept adaptation and feasibility, and compute effect size.

The acceptability and feasibility of the SCD intervention among sedentary community dwelling older adults was explored. The following material includes a discussion of results for Specific Aim 1 which includes a test of the efficacy of SCD compared to the Wait-list Control group in increasing physical function and personal beliefs including spirituality and exercise self-efficacy.

Aim 1

Physiologic adaptation. After completing the SCD intervention, participants in the intervention group were compared to the Wait-list Control group. Outcome measures included: TUG, six minute walk (6-MW), adapted Physical Activity Recall (PAR) score and pedometer readings, and Blood Pressure. The TUG, 6-MW, and PAR improved over time for the intervention group while pedometer steps, systolic and diastolic blood pressure did not. Each measure will be discussed separately.
**Timed Up & Go.** The TUG scores improved over time. While the Wait-list control group changed from T2 to T3, the intervention group reported a greater improvement overall from T1 to T3. The SCD participants self-reported reported some improvement in balance after completing the class. This improvement in balance is consistent with previous studies of similar forms of exercise such as Tai Chi (TC) as reported in an earlier comprehensive review (Rogers et al., 2009). For example, the TUG showed significant reductions in time for completion for TC compared to control groups (Gattas & Woollacott, 2006; F. Li et al., 2005; Taggart, 2002) and one single sample study (S.-H. Yeh et al., 2006). In those studies, the timing of intervention delivery varied from 30 to 90 minutes per session, two to five times a week. Li et al. (2005) reported a significant improvement in TUG with TC compared to a stretching control group ($N = 256$), following a 60 minutes/two times a week/six month intervention among sedentary adults over 70 years of age. Gatts and Woollacott (2006) compared TC to axial mobility exercises, education and stress reduction among mostly women who were balance impaired ($N = 19$) with an intense 1.5 hours a day/5 days a week/3 week intervention time. The intense training schedule employed in their intervention may not be practical for currently sedentary older adults. Taggart (2002) compared scores between participants who served as their own controls for 3 months prior to receiving the TC intervention. That study included women ($N = 45$) and did not screen for activity or balance impairment. Likewise, Yeh et al. (2006) did not screen for sedentary behavior in a group of men and women ($N = 37$). Their TC intervention included 60 minute sessions for three times a week. The timing of this SCD intervention was one hour of weekly
sessions for 12 weeks with home practice encouraged. The results of this study indicate that weekly sessions have comparable results as TC interventions that meet more often.

The lack of a significant main effect difference between the intervention and control groups for TUG in this study may be indicative of the TUG being a less sensitive measure of improvement among a sedentary population with low starting levels of function. SCD is a novel exercise form that uses slow, continuous movements of the arms and legs (similar stances and movements to TC) while signing word phrases that reflect spiritual ideas and ideals (Borik, 2004; Rogers et al., 2009). The differences between SCD and TC were discussed in the description of this SCD intervention.

Previous research including TC interventions included mostly healthy older adults and set a much more rigorous inclusion criteria (Rogers et al., 2009; Taylor-Piliae & Froelicher, 2004; Verhagen et al., 2004). For example, Rogers et al. reported that most of the populations studied were healthy individuals and many recruited populations with a history of one specific chronic disease (2009). Another review of the effectiveness of TC on fall prevention and physical function reported 95% \((N = 505)\) of the participants were healthy older adults (Verhagen et al., 2004). Taylor-Piliae and Froelicher reported 86% \((N = 7)\) of the studies exploring the effect of TC on aerobic capacity included healthy older adults (2004). Another study excluded individuals with mobility impairment or known cardiovascular disease for their study of the effectiveness of TC compared to resistance training and usual activity \((N = 207)\) on cardiovascular risk factors including blood pressure (Thomas et al., 2005). For this SCD intervention, over 50% of the participants reported four or more chronic conditions. Further, for safety reasons,
physician approval was required for participants who reported yes to one or more of the PAR-Q questions.

Previous studies of TC often required participants to stand independently to enroll in the class (Rogers et al., 2009). For example, Brismee et al. (2007) excluded older adults who could not walk at least 25 feet in their study evaluating the effects of TC compared to an education control group among older adults with a history of knee osteoarthritis ($N = 41$). Fransen et al. (2007) excluded older adults who could not walk indoors without a walking aide in their study comparing TC to hydrotherapy on improved physical function among older adults with a history of chronic symptomatic hip or knee arthritis ($N = 152$). Taggart (2002) included participants who could ambulate independently or with a cane or walker and excluded those who were told not to walk or exercise by their health care provider. Another study excluded individuals who were unable to walk across the room without assistance in a study of the effects of TC compared to a wait-list control on falls and balance among healthy older adults ($N = 702$) (Voukelatos et al., 2007). For this SCD intervention, participants were allowed and encouraged to participate in classes from a seated position or maintain support by assistive devices including holding onto a chair when standing to maintain stability.

The inclusion criterion for this study was TUG $> 10$ seconds to identify individuals with the problem. Preventing further decline in function measured by the TUG is equally critical in this aging population. On the other hand, there was a trend in the expected direction, and with the small numbers in this study and a medium effect size
of $d = .57$, the TUG may have performed better in a larger study and should be considered in the future for an expanded trial of this nature.

**Six minute walk.** There was a significant difference between groups for the distance walked in the 6-MW at T3. The intervention group walked 271.24 more feet than the Wait-list control group. While not significant, the intervention group increased the distance walked and the Wait-list control group decreased over time. This between group finding is similar to previous studies. In the exit surveys, participants in the intervention group for this SCD intervention self-reported moderate changes in strength which may have contributed to the increased walking distance.

Similar to this study, a group of rehabilitation patients with a history of stable chronic atrial fibrillation ($N = 47$) reported a 27% increased distance in 6-MW scores following a 16 week qi gong class while a sedentary group remained the same (Pippa et al., 2007). The baseline distance walked in six minutes for both groups was 1292 feet and the difference between groups post intervention was 495 feet. A study of TC for cardiac rehabilitation ($N = 30$) reported baseline distance walked of 1092 feet and a difference between groups of 442 feet following a 12 week intervention (G. Y. Yeh et al., 2004). Again, the intervention group increased distance walked and the non-exercise control group decreased their walking distance. One study reported non-significant changes in the 6-MW following 45 minutes of TC designed for persons with diabetes, 2 times a week for 16 weeks, but the intervention was being compared to a “sham” exercise program that included seated calisthenics and stretching (T. Tsang et al., 2007). Additionally, the baseline mean distance walked for the TC group was 1,555 feet
compared to the baseline mean of 939 feet for the SCD intervention study. Rikli and Jones (2001) reported normative data for the 6-MW. For older adults between 60 and 89, the lower end of the range was 1020 feet for 85 to 89 year olds and 1980 feet was the higher end of the range for those 60 to 64 years of age.

A possible explanation for why the intervention employed in this feasibility study did not achieve the same amount of increased distance walked in six minutes as the Pippa et al. (2007) and G. Y. Yeh et al. (2004) studies may be related to the fact that these previous studies’ classes were assisted by a physician and Pippa et al. (2004) included the presence of a therapist; and the classes in this study were taught by a nurse. The presence of a physician and therapist in the may have encouraged participants to perform at higher intensity levels than participants in this SCD study. Additionally, lower baseline scores for the population used in this study indicate the participants had lower levels of endurance than the reference groups. More importantly, the SCD intervention group in this study improved endurance while the sedentary Wait-list control group lost endurance measured by the 6-MW.

**Physical activity.** There was a significant increase in the MET-minutes per week of physical activity performed between T1 and T3 for the intervention group and no change for the Wait-list control group. In the exit survey, participants in the intervention self-reported changes in level of activity from 2.41 to 3.52 on a 5 point likert scale (1 = Not at all, 5 = Extremely). Levels of PA were not typically reported in the TC studies which were reviewed. However, one study did report a significant increase in weekly PA in the TC group compared to the sedentary control group among older adults with a
history of coronary artery disease \((N = 95)\) (Stenlund et al., 2005). The timing of that TC intervention was similar to the one hour per week for 12 weeks of this study.

**Pedometer.** Despite a positive correlation (Table 13) between steps and weekly PA, indicating a positive association between PA and steps, the reported increase in steps between time points was not significant for either intervention or Wait-list control group.

Pedometers were selected as an objective measure of physical activity because they are a good measure of activity in free living older adults, easy to wear and inexpensive (C. Tudor-Locke & Lutes, 2009; C. Tudor-Locke & Myers, 2001). It is possible the pedometers did not detect all steps taken by the participants. The New Lifestyle 2000 (NL-2000) was selected specifically because it uses an accelerometer-type piezo-electric crystal that detects the step and intensity as opposed to a spring-suspended lever arm pedometer (Schneider et al., 2004). The ability to detect steps at slower gait speeds is an important criteria for this population of sedentary older adults. One study examined the effect of gait disorders and gait speed on the accuracy of the YX200 between frail nursing home residents and senior recreation center participants (mean ages 79.4±8.2 and 70.6±5.5 respectively) (Cyarto, Meyers, & Tudor-Locke, 2004). There was a statistically significant difference in the reported gait speeds and error rates between the two groups. For example, nursing home residents wearing the YX200 pedometer failed to report 74%, 55%, and 46% of steps taken at gait speeds of .42, .64, and .80 m/s whereas the senior recreation center group failed to report 25%, 13%, and 7% at gait speeds of .95, 1.27, and 1.61 m/s respectively (Cyarto et al., 2004).
One study reported significantly less error in counts using the (NL-2000) compared to a less expensive mechanical pedometer, the YX200 (1.7 ± 2.5, 2.5 ± 3.7, and 10.3 ± 25.4% respectively) among older adults (Marsh et al., 2007). They also reported a significant correlation between gait speed and the NL-2000 ($\rho = -0.62$, $p = .001$). In another study, the NL-2000 was not affected by increasing BMI, waist circumference, tilt angle, or gait speed (Crouter et al., 2005). Based on these findings, it is assumed the NL-2000 accurately reflects daily steps in this population of community dwelling older adults. Some of the pedometers were returned with recordings of less than 500 steps per day and the participants stated they did indeed wear the pedometer for the entire day according to the time recorded in their log. After comparing the 6-MW data to scores reported in previous studies and the normative data, it appears is the sample used in this SCD study were not as active as the typical older adult reported in the literature.

Participants reported they did not wear the pedometers each day for their seven day recording period. Despite previous reports in the literature that pedometers are easy to use (C. Tudor-Locke & Lutes, 2009; C. Tudor-Locke & Myers, 2001), pedometer measurements were difficult to collect for this population; some data were missing. For example, many participants reported discomfort wearing the pedometers, some forgot to put them on, and some stated that the pedometer fell off multiple times during the week. When participants stated they did not remember to wear the pedometer for several days of the week, they were asked to wear it for a second week to collect the data. Some of the participants continued to return the unit with missing days of use. Scheduling time to collect the pedometer to avoid missing information collected for the previous seven days
was often difficult. Occasionally, readings were collected over the telephone to avoid missing data. The NL-2000 pedometers have a closed cover and some participants were not able to open the unit or follow directions on how to read the output.

**Systolic and diastolic blood pressure.** SBP and DBP did not change over time for either group. The mean SBP was 128.19 (15.81) and DBP was 69.84 (9.18). These findings are not consistent with previously reviewed research. For example, statistically significant decreases in systolic and diastolic blood pressure ranging from 7-15 and 2.4-8.8 mm hg respectively ($p < .05$) have been reported in studies of TC 3 times per week times 12 weeks (Tsai et al., 2003; S. L. Wolf et al., 2006; S. L. Wolf et al., 2003b; D. R. Young et al., 1999). The Wolf et al. (2003; 2006) studies included large populations ($N = 311$ and 200 respectively), providing the power to report significant changes in systolic and diastolic blood pressure. Young et al. (1999) screened for participants ($N = 62$) with a systolic blood pressure between 130 and 159 and excluded those taking medication for hypertension.

This SCD intervention did not exclude participants who were taking medications to treat hypertension or cardiovascular disease. The American Heart Association defines hypertension stage 1 as SBP 140 to 159 and DBP 90 to 99 (Pickering et al., 2005). Baseline measures were below these recommended levels, thus it is not surprising as the baseline measures did not change over time.

**Self-concept adaptation.** To determine efficacy of SCD on self-concept adaptation, participants completed surveys of spirituality and self-confidence. It was theorized personal beliefs would change following the 12 week intervention. Spirituality
was measured with the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being (FACIT-Sp) and self-confidence to exercise with the Exercise Self-Efficacy Scale (ESE).

*Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being.* The FACIT-Sp was used to measure changes in spirituality beliefs over time. FACIT-SP did not change between groups or over time. However, FACIT-SP was positively associated with higher 6-MW distance walked and PA (Table 11). In other research statistically significant improvement of FACIT-SP was reported following participation in an eight week mindfulness-based stress reduction program among adults (N =44, mean age 47.8 years) who were either referred to the class by a health care provider or self-referred (Carmody, Reed, Kristeller, & Merriam, 2008). The meditative component of that intervention focused on intention, attention, and attitude, similar to the SCD meditative component. The baseline scores in the Carmody et al. study were significantly lower than those reported in this study (2008).

*Exercise Self-Efficacy Scale.* ESE did not significantly improve over time or between groups. However, there was a trend for ESE scores to decrease for the intervention group and increase for the Wait-list control group from T1 to T3. Baseline ESE scores were positively correlated with FACIT-SP scores (Table 11). Exercise self-confidence was indirectly measured in the exit surveys for the SCD intervention group. All of the participants responded they most likely would take the class again (mean 3.63, SD = 1.49 on a 5 point scale) and hand written comments included “It was easy to perform”. These self-report findings were similar to those reported in an earlier
comprehensive review (Rogers et al., 2010). For example, one feasibility study of TC among older adults (N = 20) reported the TC was easy to learn and perform (mean 7.5 on a 0 to 10 scale) and 85% plan to continue practice (F. Li, Harmer, Mack et al., 2008).

It was theorized that ESE would be enhanced in four ways: demonstration of the SCD movement; seeing the SCD movements performed by others, repeating the SCD movements themselves, and increasing daily participation in the SCD movements. The inability to detect significant changes may be due to the recorded baseline ESE scores in the upper range, indicating a ceiling effect. Of interest was the decline in ESE for the intervention group and increase for Wait-list Control group at T3. Perhaps this was due to a response that was due to the anticipatory confidence in ability to perform SCD in the class at baseline for all participants and as the formal class time came to an end, that confidence was lost. The scheduled 12 week course may have been the motivation to exercise and once that time ended, many of the participants were not confident they would continue to practice SCD. Conversely, as the participants in the Wait-list control group were planning on starting their class the week after T3 assessments, their confidence increased.

According to Bandura (2004), self-efficacy beliefs influence health directly and indirectly. Mcauley et al. (2006b) reported a significant correlation between self-efficacy and being physically active. The majority of scores for both FACIT-Sp and Exercise Self-Efficacy in this SCD study were in the upper range at baseline; indicating the inability to record significant improvement of personal beliefs reflecting self-concept adaptation appear to be due to a ceiling effect. Another explanation may be that participants
volunteered to participate in this mind-body intervention due to their spiritual beliefs and confidence in ability to practice SCD following the demonstration of the movement during recruitment.

**Aim 2.**

The calculation of effect size is critical to future intervention design. The calculated effect sizes were medium for the TUG and 6-MW ($d = -0.57$ and 0.7 respectively), and small for PA, pedometer steps, SBP, DBP, FACIT-SP, ESE ($d = 0.2$, 0.22, 0.18, 0.27, 0.27, and -0.38 respectively). Further interventions should have a sample size of 100 to achieve power of 80 with a medium effect size to report changes in physiologic adaptation measured by TUG and 6-MW. In addition, future studies should plan for a 19% attrition rate.

**Ancillary Aims**

Exploring feasibility and acceptability of intervention studies provides essential information for future design of interventions. Fidelity and manipulation checks provide information regarding the delivery of the intervention. Intervention feasibility and acceptability as well as fidelity and manipulation checks were measured for this intervention. Each measure will be discussed separately.

**Intervention feasibility.** The purpose of feasibility is an essential component of all interventions. Measures of feasibility included: drop out rates and class and home participation. The goal of the intervention was to increase SCD practice.
The drop out rate of the intervention was 19%. This was less than reviewed research reports of TC studies in the population of sedentary older adults which ranged from 21 to 30% (F. Li et al., 2005; Sattin et al., 2005; Taggart, 2002).

The participation rates were of concern. However, when looking at the reasons for missed sessions, many were due to health reasons. Participants were either ill or had physician appointments. The appointments needed to be scheduled based on participant and physician availability. The weekly content was designed to be reviewed weekly to accommodate missed sessions. All of the Senior Centers were asking community members to stay home if they felt ill due to the outbreak of H1N1 flu virus during the study. Many of the participants had more than three chronic health conditions which require health care. There is a high correlation between chronic health disease and pre-frail and frail syndrome. By definition, many of the participants met the criteria for the pre-frail phenotype defined by Fried et al. including slowness measured by TUG and low activity measured by previous exercise history (Fried et al., 2001). While not asked in the screening process or intervention surveys, many participants reported exhaustion and weakness at the beginning of the intervention.

There also were non-health related reasons for missing scheduled classes. During recruitment, some individuals declined participation due to the date and time selected for classes. Some participants forgot to come to class or simply were not available on the class day due to family needs. Telephone calls the evening prior to the first class with a reminder to plan to attend at the same time each week may improve attendance for some participants.
Family needs are also an important consideration for changing behavior. Some of the participants missed classes to care for retired family members with debilitating health conditions. A few of the participants reported they practiced SCD with family members at home. They enjoyed sharing with their sons, daughters, and grandchildren. Perhaps inviting family members to attend classes would increase participation in the future.

Lack of transportation to the center was another reason for missing classes. Some of the participants lived outside of the determined area for free transportation offered by the senior centers and could not afford to pay for Dial-A-Ride. Providing gift cards for transportation may reduce this barrier in the future. Conflicting events at the senior centers was also reported as a reason for missing classes. Consulting with the centers to re-schedule classes during those times may be beneficial in the future. A few individuals reported they were unable to attend due volunteering at the centers. Two participants were dropped from the analysis due to multiple missed sessions related to conflicting work schedules. The centers stated they would support volunteer participation in the by relieving them from their work schedule during the scheduled classes. Written confirmation between the center director and participant prior to class initiation may reduce this barrier to participation.

Some participants reported missed classes due to vacations. For most participants, it was one or two sessions. Following randomization to the study, one participant traveled to stay with family during the summer. The weekly content was reviewed over the telephone. This participant was faithful in her attendance prior to this event.
Consistent practice at home was dependent upon the availability of DVD and CD players in the home and ability to use the technology. Use of the DVD was demonstrated in during classes. A few participants reported they did not have a DVD or CD player at home. One made plans to practice with another class participant and others were not able to do so. The printed materials were not enough to support weekly practice outside of class. Providing DVD or CD players for use during the intervention on an as needed basis may reduce this barrier in the future.

**Intervention acceptability.** Acceptability of the SCD intervention was determined based on a review of participant questionnaire responses, instructor field notes, and attendance logs. Participants reported they enjoyed the class, would take it in the future and would tell a friend. Most reported they felt the surveys and performance measures were easy to complete. The exception to the performance measures was the pedometer use. Many forgot to wear their pedometer and complained that they fell off or were uncomfortable to wear. Scheduling times to deliver and collect the pedometers presented many challenges. Many liked the design of the weekly sessions and there were a few suggestions for future classes, such as meeting more often, warming up more before being asked to do the one legged stance. Participants at most of the sites asked for continued classes and all were invited to participate in the follow-up class for the Wait-list Control group. Participants asked if there were additional movements they could learn in the future.

Acceptability was assessed through verbal and written comments about the SCD intervention. Each session began with questions and comments regarding the prior weeks
practice. Many reported how much they enjoyed the weekly reflection and found they were playing the CD most of the day and they were reciting the word phrases in their mind without the aid of the CD or DVD. One woman stated she placed the flash cards on her refrigerator as an affirmation. In addition, participants reported how useful the stress reduction techniques were in daily situations. For example, one woman used the mantras when she was experiencing verbal abuse from her husband. Another woman used her SCD practice to cope with the death of a close family member.

A few participants reported improved sleep as a result of their SCD practice. For example, one participant stated she practiced her movements and focused on the word phrase reflections at bedtime to promote sleep. She reported that she was not only able to go to sleep faster, but she slept longer. Another woman stated that she still woke up at night but was able to return to sleep faster and felt more rested during the day. This was important to her because she was more alert when providing care for her granddaughter. Another woman stated she often woke up during the night due to leg and feet cramping that required her to get up and soak in the bath to relieve the cramping and pain. After a few weeks of SCD practice, she used her movements and reflections and the cramping and pain dissipated quickly and she was able to return to sleep.

Other benefits reported during class sessions included less leg pain during waking hours; balance and leg strength improved; walking farther; relief from headaches and fibromyalgia pain; and joint pain (especially hand and shoulder) decreased with increased range of motion. A few participants stated it was hard to find time to practice, but once they did, they felt better. Many participants started practicing from a seated position and
progressed to standing while holding onto their chairs during the leg movements to standing independently by the end of the 12 week classes. The participants who did not have DVD or CD players at home focused on the physical form of the movement in class more than others as the weeks progressed. After several weeks, they began to perform the movements with more confidence and were able to reflect in class on their feeling of the meaning of the sign gestures.

**Fidelity.** Delivery of the intervention was assessed initially using ratings of the performance of teachers, and then monitored by weekly logs of class content and taping of sessions throughout the 12 weeks. The weekly content was covered consistently over the course of the 12 week intervention. Future 1 hour sessions for 5-10 older adults should continue to focus on 1 to 2 key elements each week and start with the introduction of 3 signed words each week.

**Manipulation checks.** In addition to the performance measures, participants were asked to report changes in how active they were before and after completing the SCD classes as well as how much the classes improved their balance and strength. These perceived benefits are important to the interpretation of the findings. Many participants (85%, n = 24) reported they were more active after completing the class. This was consistent with the self-report PAR scores for the SCD group. They also reported improved balance and strength.

**Summary**

**Strengths.** In summary, the strengths of this intervention included: (a) measures of physiologic adaptation improved over time; (b) the population represented the Phoenix
metro community; (c) feasibility and acceptability provided positive findings; (d) fidelity of the intervention delivered was high; (e) attrition rates were lower than previous studies in this field; (f) no reports of injuries associated with the intervention; and (g) attendance rates were fair for this population.

**Limitations.** The limitations of this intervention included: (a) the small sample size limits generalizability of findings to the population (and perhaps limits power to detect significant differences between groups on a number of outcome variables); (b) data collected did not control for changes in antihypertensive medications of participants during the intervention or presence of clinical hypertension; and (c) rigid inclusion criteria may have excluded older adults who may benefit from this intervention.

**Implications**

Sedentary older adults are at risk for decreased physical function. SCD is a low cost, safe intervention for sedentary community dwelling older adults. It was highly acceptable and feasible. The RAM was used as the theoretical framework for this intervention to facilitate adaptation to an active lifestyle among sedentary community dwelling older adults, thus reducing the risk for developing frailty syndrome. It was measured by physiologic and self-concept adaptation. Measures of physiologic adaptation improved for TUG, 6-MW, and PA. Further exploration of the effect of SCD on blood pressure should target individuals with diagnosed hypertension. The self-report exit surveys indicate that participants in the SCD intervention group believe they were more active and their balance and strength. The self-concept mode of adaptation was measured with the FACIT-Sp and ESE surveys. Participants recorded high scores for both surveys
at baseline. Higher levels of spirituality were correlated with ESE, weekly PA, and 6-MW. Participants also reported feeling reduced stress, relief of symptoms of pain, and improved sleep during class participation.

In summary, SCD appears to be a theory based intervention that will facilitate adaptation to an active lifestyle for sedentary community dwelling older adults. Continued practice in SCD has the potential to improve physical function needed to remain physically active and continuing to live independently. What remains to be explored is the possible mechanism of change to mental and physical processes attributed to the spiritual meditation component of SCD. This exploration will build a framework for future research studies.
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APPENDIX A

PERMISSION TO USE PREVIOUSLY PUBLISHED ARTICLES
The theory of the intervention in Chapter 1 and two literature reviews in Chapter 2 were previously published by the student and mentors. The articles were cited as references in this document and have been included in the reference page. The student was the first author for all three publications.

The *Roy Adaptation Model to Promote Physical Activity Among Older Adults* was co-authored with Dr. Keller. The literature reviews were co-authored by both Drs. Keller and Larkey. Both Dr. Keller and Larkey have granted permission to incorporate those publications into this dissertation.
APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL
To:       Colleen Keller
         NHL

From:     Carol Johnston, Chair
         Biosci IRB

Date:     10/24/2008

Committee Action: Amendment to Approved Protocol

Approval Date: 10/24/2008

Review Type: Expedited F12

IRB Protocol #: 0712002421

Study Title: Sign Chi Do Exercise for Adaptation to Aging

Expiration Date: 12/05/2008

The amendment to the above-referenced protocol has been APPROVED following Expedited Review by the Institutional Review Board. This approval does not replace any departmental or other approvals that may be required. It is the Principal Investigator’s responsibility to obtain review and continued approval of ongoing research before the expiration noted above. Please allow sufficient time for reapproval. Research activity of any sort may not continue beyond the expiration date without committee approval. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol on the expiration date. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study termination.

This approval by the Biosci IRB does not replace or supersede any departmental or oversight committee review that may be required by institutional policy.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Biosci IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Biosci IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.