A PROCESS AND OUTCOME EVALUATION OF COMMUNITY TAI CHI PROGRAMS FOR OLDER ADULTS

by

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Abstract

While modified beginner Tai Chi classes are now routinely offered by community centres, we know very little about the older adults who enroll and how they benefit. This dissertation consisted of two studies. In the first study, 19 classes from eight community centres and four Taoist Tai Chi Societies were tracked over a full calendar year. Enrollment in community Tai Chi (TC) classes was highest in the fall, average attendance was good (72%) and dropout was low (23%). Surveys were completed by 116 TC, 63 line dancers (LD) and 42 from Taoist classes for comparison purposes. The profile of older adults who tend to join TC and LD classes is predominantly female, Caucasian, mid-60's, relatively healthy and physically active. Personal expectations, past experience and ease of learning the movements were related to subsequent participation.

In the second study, data was collected at program entry and completion (after 10-weeks) from 20 TC and 18 LD beginners, and 14 seniors not enrolled in exercise classes (NE). All groups scored well on the physical and psychophysical measures at baseline, not surprisingly since most were classified as somewhat to already active. Over the 10 weeks, the TC group significantly improved on two indicators of protective balance, while the LD group improved on several indicators of static, dynamic, and protective balance. The NE group showed no significant changes. Trends of improved flexibility emerged for both exercise groups; strength was maintained. These findings are encouraging given limited program duration, but could not be attributed to Tai Chi (or line dancing) per se due to concurrent participation in other exercise classes. Posttest scores of the TC beginners were compared to 20 experienced Taoist practitioners. The latter group scored significantly better on only one indicator, likely due to the fact that both samples were involved in other physical activities.

In conclusion, this project represents the first attempt to profile older adults who enroll in community Tai Chi and line dancing classes and examine the extent of improvement following a single session of participation in beginner classes. Our findings providing a basis of comparison for future studies.

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Chapter 1 Introduction and Overview

1.1 Importance of Physical Activity

The importance of regular physical activity for overall health and wellbeing is now widely accepted (US Surgeon General, 1996). Nonetheless, it is estimated that between 54% and 60% of North American adults are not sufficiently active to achieve health benefits; 25% may be completely sedentary or not active at all (US Surgeon General, 1996). Health planners and promoters have been challenged to develop cost-effective and appealing options targeting the "inadequately or completely inactive" segments of the population (Dunn, Anderson, & Jakicie, 1998). Segments of the population typically characterized as sedentary are older, female, come from ethnic minorities, have lower incomes and education, and are more likely to have disabilities and chronic illnesses (Novak, 1997; US Surgeon General, 1996).

Older adults, in particular, are receiving increased attention for a number of reasons. First and foremost, older adults are the fastest growing segment of the population. In 1998, an estimated 3.7 million Canadians were over the age of 65. By 2010, it is projected that persons over the age of 65 will comprise close to seven million Canadians, over 20% of the total population (Statistics Canada, 1999). From a societal perspective, physical activity is one strategy for reducing the health care costs associated with chronic disease and disability in this target group (World Health Organization, 1997b). From an individual perspective, physical activity has potential physical benefits (such as improved flexibility and strength), psychological benefits (such as enhanced mood and relaxation), social benefits (such as fun and enjoyment), and psychophysical benefits (such as improved sleep and energy levels) (Myers et al., 1999; World Health Organization, 1997a).

The potential benefits of regular physical activity for older adults are well recognized. The challenge is encouraging older adults to adopt and sustain a more physically active lifestyle. First, the large and diverse population of "older adults" must be separated into distinct groups. While 65 has customarily marked the beginning of retirement, due to early retirement and changing work patterns, both commercial fitness clubs and community recreation centres are now targeting adults aged 55 and older with respect to recruitment and programming (Myers, 1999). Age is not the only criteria for segmenting the older population. It has been argued that health, fitness, and physical abilities are more important than age per se in tailoring exercise programming for older adults (Spirduso, 1995; World Health Organization, 1997a). For instance, Spirduso (1995) recommends five segments ranging from the physically elite to the physically dependent older adult. This project will focus on relatively healthy community dwelling older adults (aged 55 and over).

Within the commercial fitness sector, there has been a general shift from traditional aerobic or cardiorespiratory conditioning classes towards comprehensive wellness programming and mind-body classes such as Yoga and Tai Chi (Grantham, Patton, York, & Winick, 1998). Over the past decade, persons over the age of 55 have increased their participation in commercial fitness clubs by 70% (Grantham et al., 1998). While similar tracking has not taken place in the recreational fitness sector, it appears that many community centres are also now offering a wider array of exercise programs, including Yoga and Tai Chi, specifically targeting adults over the age of 55. For instance, all the recreation/senior's centres we contacted in the cities of Hamilton, Burlington, and Kitchener-Waterloo (K-W) were presently offering Tai Chi classes for older adults. According to our contacts, these programs began, for the most part, within the past 10 years.

1.2 Tai Chi

This section will provide a general description of the Tai Chi exercise. It's philosophical basis and origin will be described. Details surrounding the common Tai Chi forms practiced and the adaptations made to the exercise through its introduction into North America will be provided. This section concludes with the suitability of Tai Chi for older adults and the proposed health benefits of Tai Chi practice.

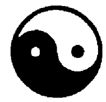
1.2.1 Philosophy of Tai Chi

Tai Chi, most often shortened from Tai Chi Chuan, has been translated from Chinese into the English language as the 'supreme exercise'. The dance-like, graceful movements, consisting of specific patterns and sequencing, engages the body and the mind (Jacobson, Ho-Cheng, Cashel, & Gurrero, 1997). The foundation of Tai Chi is rooted within the philosophies of ancient Chinese medicine; a holistic system for promoting health and healing (Kessenich, 1998). The underlying theory of ancient Chinese medicine is based on the balancing of 'qi' or 'chi'. 'Chi' is defined as "a vital force, differentiated from life force; it is the rhythm of nature, the creative principle that makes life...(it is) an urge or energy, compounded of spirit and in a mysterious way the physical breath" (Delza, 1961, p.6). In a state of good health, 'chi' is believed to be freely flowing through the discrete channels or 'meridians' of the body while ill health is the result of an imbalance or a block in the flow of the 'chi'.

In addition to the influence of Chinese medicine, Tai Chi is also influenced by the philosophical context of Taoism (Kessenich, 1998). Taoism is one of China's oldest belief systems that strives to achieve a harmonious balance between humanity and nature. This balance is represented by the yin and yang symbol (see Figure 1.1) which symbolizes the interactions of two fundamentally opposing, yet balancing principles of nature (Suler, 1991).

According to traditional Chinese medicine, health is based on the balance of yin and yang and similar to the 'chi', an imbalance in the yin and yang forces is believed to result in ill health (Wolf, Coogler, & Xu, 1997b).

Figure 1.1: Ying and Yang Symbol



The interaction of yin and yang are believed to be vital to the practice of Tai Chi. In accordance to the symbols of yin and yang, Tai Chi movements are circular and continuous and consist of opposing passive and active movements. For example, when the right hand pushes forward, the left hand naturally draws back. The breathing patterns are also coordinated with the Tai Chi movements. The body moves forward and up during exhalation (yang) and down and back during inhalation (yin). It is believed that through a continuous series of opposing changes in posture and breathing, a state of physical and mental equilibrium can be achieved (Kessenich, 1998). The Tai Chi movements are also believed to prevent illness by balancing and strengthening the circulation of 'chi' (Koh, 1981). The movements of the Tai Chi set are thought to open up any blockages along the meridians and balance and purify the 'chi' so good health can be attained (Panter & Davis, 1990).

1.2.2 Origin of Tai Chi

Originating in China centuries ago as a disciplined martial art, Tai Chi has evolved into a form of meditation and therapeutic exercise that, today, is widely practiced in China (usually daily in public parks) by all age groups, including older adults (Masley, 1998). Much of what is learned about this martial art has been passed down through the generations by word of mouth, shrouded in myth and secrecy (Lewis, 1986). Thus, many theories exist on the origin of Tai Chi. The most popular theory suggests that Chang San-feng, a Taoist priest during the Yuan dynasty (1279-1368), was responsible for creating the 'Tai Chi Chuan' sequence (Lewis, 1986). Some believe that he developed the sequence after witnessing a fight between a crane and a snake, while others claim that he was taught the exercise by a fairy in a dream (Munyi, 1963). A detailed historical account and other theories of the origins of Tai Chi are reported in Gavin (1999).

Over the centuries, Tai Chi has gradually evolved into different forms, for the most part with a reduced emphasis on the martial arts focus and an increased emphasis on the mind-body interaction (Cerrato, 1999; Delza, 1961). The different Tai Chi forms range from solo forms, with 24 to 108 postures, and Chi Kung[1] breathing exercises to advanced training in 'push hands'[2], and sword and sabre sets[3] (Levandoski & Leyshon, 1990). The most common courses of study focus on the solo forms. Many different forms exist and the differences are believed to have resulted from lay practitioners integrating their own ideas into the techniques taught to them by their teachers. The stylistic changes may have evolved from the different body sizes, personalities, and areas of emphasis of the developers (Alder, 1983). While a detailed description of the various Tai Chi forms are reported elsewhere (Gavin, 1999), Table 1.1 provides a basic description of the three most common solo forms of Tai Chi (Chuck, 1998).

Although differences in the type and number of movements exist, all Tai Chi forms emphasize body relaxation, mental concentration, and movement coordination (Yan, 1995). All forms involve a series of movements that include turning, shifting one's weight from one

[1] Breathing exercises that can be practiced on their own or incorporated into the Tai Chi set (Koh, 1981).
[2] A two person contact exercise aimed at disrupting the opponent's center of gravity. Such training is believed to increase sensitivity and improve reaction time. Push-hands is the key to learning the self-defense techniques.
[3] The sword and sabre sets are Tai Chi forms that incorporate weapons. The Tai Chi Sabre is distinguished from the Tai Chi Sword in that the former has only one sharp edge and the blade broadens towards the tip and is slightly curved. The Tai Chi Sword has two sharp edges and the blade is perfectly straight with parallel sides" (Lin, 1999).

Table 1.1: Description of Three Main Tai Chi Forms

Tai Chi Form	Unique Feature	Number of Movements	Types of Movements	Speed of Movements
Yang Style	Most popular form	108	Practiced in a wide stance. Overall rounded movements appear soft and gentle	Uniformly slow pace with no variation in speed during transitions
Chen Style	Oldest form and most difficult to learn	35	Performed in a low deep stance. Involves constant twisting, turning, and circular movements	Varied pacing from almost a standstill position to explosive powerful movements
Wu Style	Similar to the Yang style	47	Performed in a high, narrow stance with minimal arm movements. Involves small deliberate movements. Feet are kept parallel	Involves one sequential, smooth and continuous movement

Information obtained from Chuck (1998) and Lai et al. (1993).

leg to the other, bending and unbending the legs and various arm movements (Channer, Barrow, Barrow, Osborne, & Ives, 1996; Ross & Presswalla, 1998). While the individual approaches are distinct, they do share the common belief that Tai Chi evolved from the opposing yin and yang forces and the movements seek to balance the 'chi' within the body and reduce the chance of illness (Wolf et al., 1997b). No matter what form of Tai Chi is pursued, prolonged and continuous practice is required to learn the entire sequence and improve individual movement patterns (Yan & Downing, 1998). Often these forms require instruction from a Tai Chi master and take months, if not years, to learn (Alder, 1983).

1.2.3 Adaptation to North America

Interest in Tai Chi has spread to North America possibly due to the perceived and reported health benefits that may be gained through participation (Kurland, 1981). It is unknown precisely when Tai Chi was first introduced in North America, however, we know that a Taoist priest began teaching Tai Chi at a Chinese community centre in Toronto in 1970.

The Taoist Tai Chi Society of Canada -- a non-profit, charitable organization -- now operates in hundreds of locations. This program evolved from the 'Tai Chi Chuan' form, and involves 108 progressive movements (Panter & Davis, 1990). The classes are led by trained volunteers. Participants start by attending a 'beginners' class, offered once or twice a week. The 108 movements usually take four to six months to complete, depending on the frequency of classes and person's capabilities. Participants then attend the 'transition' or 'middle class'. Under the guidance of an instructor, this class provides participants with the opportunity to refine the form and further their understanding of Tai Chi. Participants may attend this class as frequently (several classes are often offered each week) and for as long as they wish. Finally, participants can develop and continually learn the nuances of the art form during the 'continuing' or 'ongoing' class. This class consists of the instructors and those experienced with the set (S. Lawton, personal communication, December 29, 1999). Some locations, such as in K-W and Hamilton-Mountain, also offer open practice classes to their members. Under the supervision of a trained volunteer instructor, students can drop-in to review and practice the movements.

Tai Chi is also offered at community recreation/seniors' centres. Participants at the recreational facilities typically follow an instructor for 60 minutes, once or twice a week for a limited number of weeks. Within these settings, it is not uncommon for North American instructors to modify the Tai Chi movements and/or create simplified Tai Chi forms that are presumably easier for beginners to learn (Schaller, 1996). The beginner classes provide a basic introduction to Tai Chi. Subsequently, interested participants may be encouraged to join the intermediate or advanced Tai Chi classes, if offered at their centre, while others are encouraged to join a Tai Chi club or society to progress further (S. Lawton, personal communication, March 27, 2000).

Tai Chi practitioners may also meet informally in outdoor settings. For instance, Tai Chi practitioners have been observed to frequent locations such as the Spanish banks in Vancouver, the Beaches area of Toronto, and Dundurn Castle Park in Hamilton. In Hamilton, the practitioners meet each morning to practice their form. Various forms are completed at these sites. Onlookers are welcome to follow along and imitate the movements performed in these public settings, however, formal instruction is not provided (G. Waud, personal communication, September, 27, 1999).

1.2.4 The Proposed Health Benefits of Tai Chi Practice

Tai Chi may be a particularly suitable and appealing form of exercise for relatively healthy older adults. It is generally viewed as safe and non-strenuous, involving slow, graceful, and dance-like leg and arm movements (Cerrato, 1999; Chen & Sun, 1997; DeMarco, 1985; Hain, 1999; Kutner, Barnhart, Wolf, McNeeley, & Xu, 1997). The pattern and sequencing of the Tai Chi movements are also believed to enhance relaxation, concentration, and coordination. Tai Chi is thought to have both physical and psychological benefits, including improved balance, flexibility, strength, cardiovascular functioning, motor control, and psychological well-being. A detailed account of the documented benefits of Tai Chi is presented under Section 3.2 – Existing Studies on the Impact of Tai Chi.

1.3 Overall Rationale for the Present Study

Given our increasing aging population, together with the recognized importance of physical activity for healthy aging, the appeal and resulting benefits of various options for physical activity for older adults merit investigation. Tai Chi appears to be increasingly popular in North America judging by the proportion of community recreation/seniors' centres in southern Ontario who are offering this activity. Currently, however, we know little about the types of older adults who choose to take part in community Tai Chi or Taoist Tai Chi Society programs. Older Canadian adults who are not from Chinese backgrounds are extremely unlikely to have been exposed to Tai Chi in their early or middle adult years. As will be discussed in Chapter Two, there is a need to find out why older adults are interested in participating in Tai Chi and their reasons for continuing with this exercise

In addition, we need to investigate the types and nature of outcomes or benefits that can be reasonably expected from community Tai Chi programs for older adults. As will be described in Chapter Three, most of the studies carried out to date have consisted of controlled interventions with either young adults (Jin, 1989; Jin, 1992; Schneider & Leung, 1991; Shih, 1997) or experienced practitioners (Lai, Lan, Wong, & Teng, 1995; Lan, Lai, Wong, & Yu, 1996; Tse & Bailey, 1992). Furthermore, such interventions tend to be offered at a greater frequency and duration than the beginner classes typically found in community locations. Therefore, the results may not be generalizable to community-based Tai Chi programs.

1.4 Overall Study Objectives

This dissertation consists of two studies -- a process and an outcome evaluation. Process evaluation is the systematic appraisal of program delivery and usage under routine or normal operation (Myers, 1999). It is an attempt to understand the strengths and weakness of the program, to solicit participants' experiences, and to find out what is happening within the program (e.g., factors influencing adherence). Outcome evaluation, meanwhile, is the systematic appraisal of the program's impact on clients, in relation to the level of participation and baseline characteristics (Myers, 1999). Outcome evaluation investigates the effects (both positive and negative) of program participation, as well as which participants benefit the most.

Study one, the **process evaluation** (took place from January to December 2000), examined issues of recruitment, attendance, and adherence to community Tai Chi programs directed at older adults. Specifically, this study investigated what attracts older adults to Tai Chi (in comparison to another fairly novel form of exercise, namely line dancing), who is attracted (profile of registrants), and how participant experiences influence patterns of attendance and continuation.

Study two, the **outcome evaluation** (took place from September 2000 to March 2001), examined several potential benefits of participation, including: balance, lower body strength, flexibility, and psychological outcomes. The relative benefits of 10 weeks of participation in the short and/or modified forms of Tai Chi offered at recreation/seniors' centres were compared with line dancing classes and non-exercise classes (including craft, bingo, cards and pool) offered at recreation/seniors' centres, and with a traditional, longer form of Tai Chi (108 movements) offered at Taoist Tai Chi Societies.

Line dancing and Taoist Tai Chi classes were chosen as comparison activities for both the process and outcome evaluation studies. Similar to Tai Chi, line dancing is a fairly recent offering in recreation/seniors' centres and it is unlikely current generations of older adults had been exposed to these activities as younger adults. Both are instructed in a group setting, do not require a partner (unlike other types of dancing), and require learning and practicing a sequence of movements. The contrast is also important—Tai Chi emphasizes slow movements in a meditative mode, usually without accompanying music or with soft music (i.e., classical music or soft nature sounds). To date, little research on line dancing has been published. While used for purposes of comparison in the present project (to assess similarity of adherence patterns and outcomes), this information will also contribute to the sparse literature concerning this alternate type of programming. The Taoist Tai Chi classes, meanwhile, provide a comparison of the more traditional Tai Chi form with 108 movements.

It is important to note that the studies presented in this thesis do not constitute a comprehensive evaluation of Tai Chi programs. For instance, program implementation and cost issues were not addressed. Nor was the evaluation planned in consultation with all relevant stakeholder groups or using a program logic model or theory as recommended in the evaluation literature when the primary objective is to inform program decision-making (Myers, 1999, Patton, 1997; Rossi & Freeman, 1997). Rather, the evaluation approaches, questions and measures were chosen by the researcher to address gaps in the published literature, as well as to assist the programs under examination in learning more about their participants. Therefore, the present studies should be viewed as a starting point in understanding who comes to these community programs, who tends to stay, what are their experiences, and what are some of the possible benefits. The present findings, hopefully, will lay the groundwork for future, more comprehensive, evaluations of community Tai Chi programs, including an examination of critical inputs (Sidani & Braden, 1998) or the contexts and mechanisms necessary to produce the desired outcomes (Pawson & Tilley, 1997).

Chapter Two focuses on the process evaluation study, including the development of a profile of older adults who choose to attend Tai Chi and line dancing programs and their patterns of attendance and adherence. Chapter Three, meanwhile, presents the outcome evaluation of community Tai Chi programs. Each chapter is self-contained. Chapter Three, however, brings in relevant findings from the process evaluation (Study One) to assist with interpretation of the outcome evaluation (Study Two) findings in the discussion section.

Chapter 2 Study One: Process Evaluation

2.1 Introduction

Currently, recreation/seniors' centres offer a large array of exercise programs, some of which may be specifically developed for older adults. The majority of such exercise programs tend to be class or group based initiatives (Mills, Stewart, Sepis, & King, 1997). Recreational programmers have also adapted typically solitary activities (such as walking, gardening, and biking) into clubs or group based programs (Ecclestone, Myers, & Patterson, 1998). Investigating the activity preferences of older adults, as well as their reasons for choosing to adopt a specific activity, and whether they adhere to the exercise program, are important areas of study. As well, tracking participation profiles, seasonal enrolment patterns, and participation rates will assist recreational program planners, marketers, developers, and instructors in targeting the older adult segment of the population and tailoring programs to meet their needs and interests (Myers, 1999). Accordingly, this review will examine research to date concerning the physical activity preferences of older adults, as well as the adoption and adherence patterns of this group.

2.1.1 Activity Preference

Before describing the activity preferences of older adults, it is important to distinguish between the terms 'physical activity' and 'exercise' since they are sometimes confused with one another or used interchangeably in the literature. Casperson, Powell, and Christenson (1985) defined physical activity as "any bodily movement produced by skeletal muscles that results in energy expenditure" (p.126). This includes all physical activity performed while sleeping, at work, and at leisure. 'Exercise', meanwhile, is viewed as a subcategory of physical activity. Exercise has been defined as "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness (i.e., cardiorespiratory endurance, muscular strength, flexibility, body composition) is an objective" (Caspersen et al., 1985, p.128). Since we are interested in our participants' overall level of physical activity, the terms 'exercise' and 'physical activity' are used interchangeably in this project.

Past research has, for the most part, investigated the physical activity preferences of young and middle-aged adults (King, Taylor, Haskell, & Debusk, 1990; Thompson & Wankel, 1980); little is presently known about the exercise preferences of older adults (Mills, Stewart, Sepis, & King, 1997). It is not surprising that researchers note that participants will be more adherent if they are offered physical activity formats that they prefer and enjoy (Dishman, Sallis, & Orenstein, 1985; Mills et al., 1997; Wankel, 1985). Personal preference regarding various features of the activity, such as the type, format, and social aspects surrounding the exercise, may influence the type of activities in which individuals engage.

Some studies have shown that older adults prefer home based-exercise regimens, over structured classes, and low intensity over high intensity exercise programs (King, Haskell, Taylor, Kraemer, & DeBusk, 1991; Lee et al., 1996). Walking has shown higher compliance rates than jogging (Dishman et al., 1985; Mills et al., 1997; Sallis et al., 1986). Of the 113 participants in the Community Health Activities Model Program for Seniors (CHAMPS), some preferred to exercise in a group (28%), others individually (34%), and the remainder had no preference (39%) (Mills et al., 1997). Unlike other exercise interventions, the CHAMPS project did not assign the older adult participants to an exercise program but rather informed them of available classes offered in their community and encouraged them to participate.

The above findings suggest that older adults may be interested in lower intensity activities that can be performed individually and outside a structured, class setting. While the preference for Tai Chi over other types of exercise programs has not been investigated, this activity may have the characteristics that older adults prefer. Activity preferences, however, are only one factor in understanding the exercise adoption and adherence patterns of older adults.

2.1.2 Exercise Adoption and Adherence

Understanding what motivates people to become and remain physically active is critical to designing effective exercise interventions (Dishman et al., 1985). According to population surveys, the most frequently reported reason for engaging in leisure time physical activity is to "feel better mentally and physically" (Stephens, 1988). Whether reasons for joining exercise programs are similar for younger and older adults is unknown. Inactive older adults may initiate an exercise program to relieve common physical complaints such as low energy levels, sleeping disturbances, and muscular stiffness (Myers et al., 1999). Active older adults, on the hand, may only notice such symptoms if their exercise routine is disrupted (Schneider, 1996). An understanding of each phase of physical activity-- adoption, maintenance/adherence, relapse and resumption-- is necessary (Sallis & Hovell, 1990). *Adoption*, or beginning an exercise or physical activity program, is the first step in becoming active. Relatively little research has investigated the factors that influence or predict the adoption of physical activity and most of this research has used retrospective designs (Sallis & Hovell, 1990).

The challenge of sustaining adherence to an exercise program, once participation has begun, is one of the most commonly studied yet least understood aspects of exercise and physical activity (Duncan & McAuley, 1993). Maintenance, or *adherence*, has been defined as the length of time an individual continues with the program regimen (Welsh, Labbe, &

Delaney, 1991). Exercise adherence, however, may not be the same as program adherence as it is not uncommon for older adults to leave, rejoin, and switch exercise classes as their commitments and interests change. Ecclestone, Myers, and Patterson (1998), for example, found that approximately 21% of older participants in their three-year tracking study, tried out or transferred between programs.

Unfortunately, a consistent approach for defining 'dropout' and quantifying the level of adherence does not exist and participants are not commonly followed for extended lengths of time. Dropouts are generally defined as those individuals who discontinue participation in an exercise program (Robison & Rogers, 1994). Most exercise studies compare their dropout rates to Dishman and Sallis's (1994) well known benchmark, i.e., about 50% of beginners to an exercise program can be expected to drop out in the first three to six months. The absence of long-term tracking, however, may mislabel dropouts who are within a state of *relapse* (or temporary discontinuation) as well as sacrifice the valuable information about possible *resumption*, or the return to previously established activity behavior (Sallis & Hovell, 1990). Over their three-year tracking period, Ecclestone et al. (1998) found cases where participants discontinued a particular program, joined another, and later returned to the first program sometimes a year or more later.

In summary, the majority of studies on physical activity adoption and adherence to date have used young and middle aged subjects in clinical and laboratory settings (Dishman, 1988). The research has largely neglected older age groups who may be involved in activity programs in community based locations. As noted by Ecclestone et al. (1998), there may be differences in adherence patterns for participants in community programs, since research subjects are recruited differently and strict eligibility criteria is often enforced. Keeping this in mind, the following sections will describe the known determinants of adoption and adherence, specifically personal, environmental, and program related factors.

2.1.2.1 Personal Factors

Demographic characteristics associated with reduced activity levels in the general population include: advanced age; female gender; obesity; low income and education levels; employment in blue collar occupations; and the presence of a medical problem, injury, or illness (Caspersen, Christenson, & Pollard, 1986; Dishman et al., 1985; Gale, Eckhoff, Mogel, & Rodnick, 1984; Hovell, Hofstetter, Sallis, Rauh, & Barrington, 1992; King, 1997; Sallis et al., 1986). Early life experiences and habitual physical activity may also influence the likelihood of current physical activity. Older adults who report involvement in physical activity at a young age and/or regularly participate in physical activity in their leisure time, are more likely to adopt and adhere to a physical activity program in their later years (Hovell et al., 1992; Sallis, Hovell, & Hofstetter, 1992).

Knowledge of, and beliefs in, the health benefits of exercise participation may initiate involvement (adoption) (King, 1997), but feelings of enjoyment and well-being seem to be stronger motives for continued participation (adherence). Adults who believed that exercise had little value for health and fitness, or those who believed that health outcomes from exercise were outside one's personal control, exercised less frequently and dropped out of programs earlier than peers holding opposite views (Dishman & Gettman, 1980).

Outcome expectations/expectancies (i.e., what people hope to gain from exercise) may also be important in adopting and continuing with an exercise behavior (Clark, 1996). Self-efficacy and self-motivation have been reported to influence outcome expectations/ expectancies. Self-efficacy, or an individual's confidence in being able to perform an activity successfully (Bandura, 1982) has been reported as one of the most important determinants for exercise adoption and adherence (Sallis et al., 1986; Sallis et al., 1992). Desharnais, Bouillon, and Gaston (1986) suggest that self-efficacy can affect physical activity participation in a number of ways, including, whether one attempts a given activity as well as persistence when difficulties are encountered. Li, McAuley, Harmer, Duncan, and Nigel (2001) found significant improvements in the self-efficacy of older adults completing a six-month Tai Chi intervention. Interestingly, the participants who developed higher perceptions of efficacy had attended more class sessions and thus, adhered better to the program.

Self-motivation refers to the attraction to physical activity and perceptions that exercise offers health, fitness, and ascetic value (Dishman & Ickes, 1981). Participants may be motivated to join because they expect certain results or outcomes. Adults are motivated to join activity programs if they expect to feel better, lose or control weight, and gain companionship as a result (Myers, Weigel, & Holliday, 1989). Desharnais et al. (1986) examined the ability of outcome expectancy (the extent of participants' expectations) to predict adherence to an 11-week activity program. Participants with high outcome expectations (expected more benefits) at the program onset were more likely to drop out. Initial expectations alone, however, may not predict future adherence. Neff and King (1995) suggest that initial expectations, in conjunction with whether or not the expectations were met, are better predictors of subsequent adherence.

2.1.2.2 Environmental Factors

Characteristics of the environment, including both physical and social factors, can also influence ones' participation in a physical activity program. Physical factors, such as the convenience of the exercise setting and its proximity to home or the work place, as well as accessible transportation to the program location have been positively related to exercise adherence (Andrew et al., 1981; Sallis et al., 1990). Inclement weather is associated with altered physical activity patterns, while costs associated with participation may influence adoption and continued participation (Dishman et al., 1985; Young & King, 1995).

With respect to social factors, perceived lack of time is the most common reason for not joining and for dropping out of exercise programs (Dishman et al., 1985; Sallis et al., 1992). Life events (such as a medical condition or illness) or disruptions (such as relocation or travel) can interrupt continuous participation, create new barriers, or result in dropout altogether (Oldridge, 1982). The level of social support from family, friends, exercise leaders, and other program participants has been highly correlated with exercise adherence (Gale et al., 1984; Hovell et al., 1989). Individuals may join or adhere to an exercise program because a friend or family member participates, to meet new people, or because of the camaraderie or fellowship that develops in a group setting (Carron, Widmeyer, & Brawley, 1988; Spink & Carron, 1992). The type and amount of social support preferred may differ as individuals move from the adoption to the maintenance phase (Young & King, 1995). For example, social support has been reported to be more important in the adoption process than the maintenance process for women (mean age 50 years) initiating a vigorous activity program (Sallis et al., 1992).

Different factors related to adoption and adherence likely vary by individual. For instance, group fellowship may be appealing to older adults who recently retired or are seeking to meet people. Learning a new skill and the challenge of keeping up may be an incentive or a deterrent. Some may prefer group members and instructors who are similar in age and gender; others may prefer more heterogeneous (less segregated) groups (O'Brien-Cousins & Horne, 1999). When investigating adoption and adherence patterns, it is important to look at the particular features of programs as well as participants' reasons for joining and continuing.

2.1.2.3 Program Factors

Features of the program can also influence adoption and adherence. Associated costs (including participant fees, equipment, or clothing) and program scheduling influence the likelihood of individuals joining and attending exercise programs (Andrew et al., 1981; Myers, 1999; Richter, Macera, Williams, & Koerber, 1993). Personal contact with program personnel can affect adherence. Dropouts frequently reported inadequate personalized attention by program staff as a reason for discontinuing participation (Andrew et al., 1981). Wankel (1985) added that program organization, flexibility, and general administration as attributes the program staff can control. A checklist of many potential barriers for seniors (such as lighting, noise levels and accessibility) inherent in facilities and programs is available in Myers (1999).

Finally, the program itself (i.e., type of activity, duration per session, number of times per week, and level of intensity) is also important to consider. As mentioned earlier, little data is currently available regarding the preferences of older adults and the extent to which such preferences may affect adoption and adherence to exercise programs. Ecclestone et al. (1998) suggests that older women, who may have difficulty finding an exercise companion, may be more attracted to class or group options. However, when a group of older adults, enrolled in an exercise promotion program, were asked whether they prefer to participate in a structured class or on their own, 34% preferred to exercise individually, 28% preferred a group setting, and 39% had no preference (Mills et al., 1997). Firm conclusions are difficult to make, as we do not know whether preferences reported in the Mills et al. (1997) study were related to experience, that is, actually trying the various exercise formats. Further work is needed to determine physical activity programming preferences of older adults and how they effect the adoption and adherence patterns.

2.1.2.4 Long-term Tracking

It is necessary to identify and examine the reasons why some individuals continue to participate while others drop out of exercise programs. Some individuals who quit a formal exercise program may continue to exercise by joining another program or on their own (Dishman, 1982). Long term tracking of participants is necessary to determine patterns of adoption/initiation as well as patterns of continued/discontinued participation.

One of the few longitudinal studies of older adults in community based exercise programs was completed by Ecclestone et al. (1998). Over a three-year period, Ecclestone et al. (1998) tracked 541 older adults involved in 12 different exercise programs offered at the Centre for Activity and Ageing (CAA) in London, Ontario. This study found that many older adults who appeared to 'dropout' rejoined their original program at a later date or switched exercise classes. Secondly, participants who tried out or were involved in more than one class, either concurrently or sequentially, were more likely to continue participating at the centre. An overall attendance rate of 68% was recorded for all 12 programs over the three-year period. Long-term tracking revealed that 51% continued participating at the centre at one-year; 43% over three years. These adherence rates are better than what Dishman and Sallis (1994) reported for younger groups.

One of the 12 exercise classes tracked by Ecclestone et al. (1998) was a Tai Chi program offered at the CAA. This program was offered continuously for 60 minutes, twice a week. Although the initial enrollment of this class was low, enrollment increased over the three-year tracking period, which resulted in the continuation of the class. Of the 12 different classes, the Tai Chi class had the highest participation rate (82%). Although the Ecclestone et al. (1998) study provided valuable information about attendance and adherence patterns, it did not assess the experiences of participants nor inquire into the reasons for dropping out or switching programs. In addition, age and gender were the only participant characteristics recorded in the CAA database at the time of the study. A more detailed profile of user characteristics is needed to further our understanding of the types of adults who begin and continue to participate in various types of programs (Myers, 1999).

2.1.3 Summary

Long-term adherence to structured exercise programs is poor (Dishman, 1988). Most of the research to date, however, has been conducted with younger populations and aerobic exercise programs (Dishman, 1988), resulting in relatively little being known about the adoption and adherence patterns of older adults in various types of community-based exercise programs (Ecclestone et al., 1998). It is necessary to investigate the reasons why older adults join, maintain, drop out, and switch exercise programs. Research evidence has accumulated on the determinants of exercise adherence, but little is known about the predictors of adoption and the future exercise patterns of those who quit specific classes. More long-term tracking studies, like the one by Ecclestone et al. (1998), are needed to guide planners in providing appropriate exercise opportunities for this age group. It has been suggested that all exercise programs should routinely collect background information on all new participants, track program usage, and follow-up with participants who no longer attend (Myers, 1999), such information would assist in the development of a profile of program users as well as program usage.

2.2 Rationale for Study One

The popularity of Tai Chi and line dancing appears to be rising in recreation/seniors' centres in North America. These activities are likely to be novel or new to many older adults. The skill component of Tai Chi and line dancing practice may also be important. While other types of exercise classes (such as aerobic classes) are quite consistent from session to session, Tai Chi and line dancing, on the other hand, involve constantly learning and refining new movements. If people miss a class and/or do not practice outside of class, they may become frustrated and feel left behind. Adherence may be greater to shorter forms of Tai Chi since there are fewer movements to remember and master. This argument has been used to justify the modified and shortened forms of Tai Chi, although the impact on adherence has not been empirically examined to date.

Given their rising popularity, the profile or characteristics of voluntary participants, as well as adoption and adherence patterns to community-based Tai Chi and line-dancing programs, warrants investigation. This profile should include the characteristics of participants, seasonal variation in patterns of enrollment (usage), participation rates, and dropout patterns. Whether the profile of older adults who choose to attend Tai Chi classes at community recreation/seniors' centres differs from the profile of those who chose to attend other exercise classes at such centres (such as line dancing) or classes at Taoist Tai Chi Societies is also interesting to explore.

2.3 Process Evaluation Questions

As previously described, a process evaluation examines program delivery, usage, and user characteristics under routine operation. The overall purpose of this study was to learn more about older adults who choose to take part in community Tai Chi and line dancing classes. The specific evaluation questions were:

1) What attracts older adults to community Tai Chi and line dancing programs?
2) What is the profile of older adults who enroll in such community programs and are there seasonal differences in enrollment patterns?
3) What are their experiences and patterns of attendance and adherence?
4) Is adherence greater for shorter forms of Tai Chi?
5) How do participant profiles and adherence patterns compare to Taoist Tai Chi Society classes?

2.4 Methods

This section first describes the programs examined in this study, including both site and participant recruitment. The data collection procedures and instrumentation are presented next, followed by data management and analyses. This study began in the Winter/2000 programming session (start date January 2000) and continued throughout the Spring, Summer, and Fall 2000 sessions in order to compare seasonal enrollment patterns. Ethical approval was obtained from the University of Waterloo Office of Research Ethics, as well as from the Medical Advisor for the Taoist Tai Chi Society.

2.4.1 Recruitment of Sites

The Leisure Programming Guides for the Cities of Hamilton, Kitchener, and Waterloo, were used to initially locate Tai Chi and line dancing classes offered at the recreation/seniors' facilities in these areas. These guides promote various leisure, culture, and sports opportunities for residents of all ages. The Kitchener and Waterloo guides are produced three times a year (Fall, Winter, and Spring), while the city of Hamilton produces two guides, one for Fall/Winter and one for Spring/Summer. Brochures independently produced by the seniors' recreation centres within the three cities were also obtained to locate additional course offerings and information, as were local newspapers, and telephone directories. A line dancing instructor for two of the seniors' centres in Hamilton suggested another centre in Burlington offering both Tai Chi and line dancing. Finally, inquires were directed at the Taoist Tai Chi Society and numerous Martial Arts Clubs.

As the present study was interested in older adults (defined as persons aged 55 and over for the purposes of the study), we set out to recruit participants from 'adult classes' at recreational facilities and those participating in seniors' centres classes. Age is not a criterion for enrolling into the classes at the recreation facilities and Taoist Tai Chi Societies; participants younger than 55 years of age may enroll. The seniors' centres, however, restrict their membership to those 55 years of age and over. The programs at eight recreation/seniors' centres and four Taoist Tai Chi Societies in the Hamilton, Burlington, and K-W areas were asked to, and agreed to, participate in this study. Although other recreational facilities and martial art clubs in these areas offer Tai Chi and/or line dancing classes, they did not offer classes specifically for seniors and/or reported very low or no enrollment for this population.

The program directors at the respective recreation/seniors' centres were contacted and given a letter explaining the study (see Appendix A). Written permission was obtained from each program director, first to approach the instructors and then to approach the participants in the Tai Chi and line dancing classes. Verbal permission was received from the class instructors. Dr. Goodman, the medical advisor for the Taoist Tai Chi Society of Canada, was provided with a copy of the ethics proposal submitted to the University of Waterloo. His permission was obtained to approach the instructors and participants of the Taoist Tai Chi Societies.

In total, eight recreation/seniors' centres and four clubs located in Hamilton, Burlington, and K-W agreed to take part in the process evaluation study. The 19 specific programs or classes within these 12 centres are as follows:

a) beginner Tai Chi classes at four recreation/seniors' centres in Hamilton: Sackville-Hill Seniors' Centre (two classes offered), Hamilton Seniors' Centre, Ottawa Street YWCA Seniors' Centre, and Huntington Park Recreation Centre and one seniors' centre in Burlington: the Burlington Seniors' Centre (total of 6 classes);

b) beginner Tai Chi classes at one recreation centre in Kitchener: the Breithaupt Centre and the beginner and intermediate Tai Chi classes at two recreation/seniors' centres in K-W: Rockway Seniors' Centre and the Wing 404 Rotary Adult Club (total of 5 classes);

c) beginner classes at four Taoist Tai Chi Societies: Downtown Hamilton, Hamilton Mountain, Stoney Creek, and Kitchener-Waterloo (total of 4 classes);

d) beginner line dancing classes at three centres in Hamilton: Sackville-Hill Seniors' Centre, Hamilton Seniors' Centre, and the Ottawa Street YWCA Seniors' Centre; and one seniors' centre in Burlington: the Burlington Senior's Centre (total of 4 classes).

2.4.1.1 Program Descriptions

Appendix B and Table 2.1 provide a detailed description and summary of each class involved in this study respectively. Eleven Tai Chi programs at recreation/seniors' centres, four Taoist Tai Chi Societies, and four line dancing classes were recruited. It should be noted that one facility, Burlington Seniors' Centre, was recruited later than the other programs so this centre was only involved in the final wave of data collection (Fall 2000). As shown in Table 2.1, the programs generally run for 60 to 90 minutes, once or twice a week for 8 to 12 weeks. A brief description of the classes will now be provided.

2.4.1.1.1 Classes at the Recreation/Senior' Centres

The recreational classes in Hamilton, Burlington, and K-W are generally offered three times a year – Fall (September), Winter (January), and Spring (April). Limited programming is offered at two centres (Sackville-Hill and the Hamilton Seniors' Centre) in the summer

Table 2.1: Description of Each Program in the Study

Location	Type of Class	Class Length	Class Frequency	Session Duration
1.a)Sackville-Hill 1[II]	Taoist Tai Chi (complete first 10-15 movements of 108 set)	60 min.	1/week	10 weeks
b)Sackville-Hill 2[◊ II]	Tai Chi – Yang Style (complete approximately 10 movements of 35 set)	60 min.	1/week	10 weeks
2. Hamilton Seniors[II] 3. Ottawa St.Y Seniors	Tai Chi – Instructor Modified Form (complete 5-8 movements of Yang 24 form)	60 min.	1/week	10 weeks
4. Huntington Park Recreation Centre[I]	Tai Chi – Yang Style (complete 24 movements of 24 simplified form)	60 min.	1/week	12 weeks
5. Breithaupt Community Centre	Tai Chi – Yang Style (6-10 movements of 24 instructor modified form)	60 min.	2/week	8 –10 weeks-Winter/Spring 10 weeks-Fall
6. Wing 404 Rotary Adult Centre [◊] (2 classes)	Tai Chi – Yang Style (6-10 movements of 24 instructor modified form)	60 min.	1/week	10 weeks
7. Rockway Seniors' Centre [◊ I] (2 classes)	Tai Chi – Yang Style (6-10 movements of 24 instructor modified form)	60 min.	1/week	12 weeks
8. Burlington Seniors Centre[{]	Taoist Tai Chi (complete 108 movements over 3 sessions)	60 min.	1/week	10 weeks
1. Hamilton Mountain	**Taoist Tai Chi: 108 movements**	**60 min.**	**2/week**	**Ongoing***
2. Downtown Hamilton	**Taoist Tai Chi: 108 movements**	**90 min.**	**1/week**	**Ongoing***
3. Stoney Creek.	**Taoist Tai Chi: 108 movements**	**60 min.**	**2/week**	**Ongoing***
4. Kitchener-Waterloo	**Taoist Tai Chi: 108 movements**	**90 min.**	**1/week**	**Ongoing***
1. Hamilton Seniors[◊ II] 2. Ottawa St.Y Seniors 3. Sackville-Hill[II] 4. Burlington Seniors Centre[{ ◊ II]	Line Dancing	90 min.	1/week	10 weeks

*Beginner classes run until participants have completed the 108 movement set. Participants then attend a transition or middle class where they further learn and refine the movements.

[{] Participated in only the Fall 2000 session; [I] Participated in only the Winter 2000 session

[◊] Offer beginner and intermediate classes;

[II] Offer a limited program or drop-in session in the summer (July session) months, while another facility (Burlington Seniors' Centre) offers classes on a drop-in basis. At all centres, the 'beginner' Tai Chi and line dancing classes are offered to both first time participants and to those with limited experience--beginners classes are offered at each programming session depending on sufficient enrollment. 'Intermediate' Tai Chi classes are also offered at several facilities. These classes are a continuation of the 'beginner' classes; participants progressively add on to the previously learned Tai Chi movements. Although the classes are labeled as 'intermediate', the instructors believe that the participants are still beginners since they have not learned the complete form. Similarly, the intermediate line dancing classes, offered at several centres (but not included in this study), are promoted to those who have previous dance experience and would like to learn more challenging dance steps and sequences.

The Tai Chi programs offered by the recreation/senior's centres generally offer short-form or modified versions of longer Tai Chi forms. For example, the beginner Tai Chi participants at Sackville-Hill #1 learn the initial movements of the 108 Taoist Tai Chi set. To learn the complete form, the instructor encourages participants to join and attend classes at the Hamilton Mountain Taoist Tai Chi Society. Participants in the beginner Tai Chi Sackville-Hill #2 class learn the initial movements of the Yang style. Upon course completion, the instructor encourages participants to reenroll in the beginner class, if they are unsure of the initial movements, or to advance into the intermediate class offered at that centre. As mentioned earlier, the intermediate class progresses further into the form. The modified versions of Tai Chi, offered at some facilities, were developed out of the instructors' concerns for the limitations or health conditions of older adults. The instructors either modified a previously developed Tai Chi sequence (by limiting the amount of stretching or bending during the Tai

Chi movements) or created their own sequence for instruction that is believed to contain movements that are safe for seniors to complete and less strenuous than other Tai Chi forms. Please refer to Appendix B for a full description of the programs.

The maximal enrollment for all programs was between 20 to 30 people except for the Sackville-Hill line dancing class, which had a maximal enrollment of 100 and the Burlington Seniors' Centre with a limit of 50 Tai Chi participants and 60 line dancers (depending on the amount of gym space, the beginner line dance class can accommodate up to 100 participants however, during the Fall session this class was limited to only half of the gym). Wait lists are not commonly used at the recreation/seniors' centres. Enrollment into the programs varies from session to session and sometimes, due a lack of enrollment, beginner and intermediate classes are combined or classes are cancelled.

During the Winter session the 'intermediate' Tai Chi classes from two K-W centres (Rockway Seniors' Centre and the Wing 404 Rotary Adult Centre) were included in this study. Due to the lack of enrollment and resulting cancellation of the beginner classes at these centres, our initial thoughts were to include the intermediate Tai Chi group so a profile of registrants could be developed. It was later decided to invite this group to consent to an exit interview as the intermediate group may provide valuable information about continuing with the Tai Chi class. During the Spring session, enrollment in the 'beginner' class increased, and this class was included in the study for this phase of tracking. The Tai Chi program at Huntington Park Recreation Centre was cancelled in the Spring session due to the loss of the instructor and did not resume in the Fall because of low enrollment. The Hamilton Seniors' Centre and the Ottawa Street YWCA Seniors' Centre combined their beginner and advanced line dancing classes during the Fall session while the beginner Tai Chi classes at the Ottawa Street YWCA Seniors' Centre and Rockway Seniors' Centre were cancelled because of low enrollment.

2.4.1.1.2 Taoist Tai Chi Society Classes

The 'beginner' classes at the Taoist Tai Chi Societies are for 'new members', defined as those who have not previously practiced Tai Chi, as well as persons with very limited experience. An age restriction is not placed on the classes and no specific 'senior' classes are offered. The instructors note, however, that seniors are most likely to attend the 'beginner' classes offered in the daytime.

Unlike the recreation/seniors' centres, which have specific start and end dates for their programs, the classes at the Taoist Tai Chi Societies are ongoing. At all locations involved in this evaluation, except for Hamilton Mountain, classes for new participants start twice a year--September and January. The Hamilton Mountain site offers three start dates that are similar to the recreation/seniors' centres: Fall (September), Winter (January), and Spring (April).

In the Taoist Tai Chi Society, participants stay in the 'beginner' class until they have progressed through the 108 movements. Depending on class frequency, as well as a person's capabilities, the 108 movements may take anywhere from four to six months to complete (L. Horsky, personal communication, April 2, 2000). Participants then progress into a 'middle' or 'transition' class where they proceed in learning and refining the form. Participants may attend this class as frequently (several classes are often offered each week) and for as long as they wish. Finally, participants can develop and continually learn the nuances of the art form through the 'continuing' or 'ongoing class'; participants consist of both instructors and experienced participants (there is no designated instructor for these classes). Most locations also offer open practice classes to their members. Under the supervision of a volunteer instructor, students can drop by to review and practice the movements. None of the Taoist Tai Chi Societies in this study currently had wait lists.

2.4.2 Participant Recruitment

This process evaluation consisted of four waves of data collection: the Winter/2000 session represents the first wave; the Spring/2000, Summer/2000, and Fall/2000 sessions represent the second, third, and fourth waves respectively. The Tai Chi and line dancing classes were tracked over the four sessions, or one full calendar year. As in section 2.4.1.1.1, not all facilities offer the Tai Chi or line dancing classes over the summer session and some sessions were cancelled due to lack of enrollment or loss of the instructor. Figure 2.1 lists the facilities involved in the four waves of the process evaluation.

Figure 2.1: Facilities Involved in the Different Waves of Data Collection

WAVE 1 (Winter/2000)	Sackville-Hill Seniors Centre, Hamilton Seniors' Centre, Ottawa St.YWCA Seniors' Centre, Huntington Park Recreation Centre, Rockway Seniors' Centre, Breithaupt Community Centre, Wing 404 Rotary Adult Club, All Taoist Tai Chi Societies.
WAVE 2* (Spring/2000)	Same as Wave 1 except for: a) the cancellation of the Tai Chi program at Huntington Park Recreation Centre (no instructor); and b) recruitment at the Hamilton Mountain Taoist Tai Chi Society (the only Taoist location to offer a new beginner class in the Spring).
WAVE 3* (Summer/2000)	Only Sackville-Hill Seniors' Centre and Hamilton Seniors' Centre offer programming during this session.
WAVE 4* (Fall/ 2000)	Same as Wave 1 except for: a) the cancellation of the Tai Chi programs at Huntington Park Recreation Centre, Ottawa Street YWCA Seniors' Centre, and Rockway Seniors' Centre (low enrollment); and b) the inclusion of Burlington Seniors' Centre.

* new participants only

During the Winter recruitment, all new and returning participants of the selected classes were invited to take part in the study. The only exception was the line-dancing class at Sackville-Hill Seniors' Centre, which had 100 enrollees (recruitment was restricted to beginners). Only new participants to the programs were invited to participate in the Spring, Summer, and Fall sessions (many returning participants had participated in earlier waves).

Either the instructor or the evaluator delivered a pre-arranged recruitment speech (refer to Appendix C) at the first class of the session. We specifically mentioned that we were looking for beginners, aged 55 or over. Each volunteer received a package containing an information letter and consent form (refer to Appendix D), as well as a short background survey (see Appendix E). Separate permission was solicited from the volunteers in the Winter, Spring, and Summer sessions to consent to an exit interview and a possible follow-up interview upon program completion (described in the next section).

Volunteers were asked to complete the consent form and survey and return both to their instructor (in a confidential envelope), at their next scheduled class. If participants did not attend the first class, the instructor was asked to try to recruit participants during the second week of class. Instructors reminded volunteers to return package during the second and third weeks of class. The evaluator collected the sealed envelopes from each instructor during the third and fourth week of classes.

2.4.3 Data Collection and Instruments

The data collected during each of the four waves of the process evaluation consisted of: (a) the background survey; (b) an exit interview; (c) a follow-up interview; and (d) attendance recording. Figure 2.2 illustrates the data collection protocol. As noted earlier, the exit interview and follow-up interview were not completed during the Fall/2000 session. Each of the instruments are described in detail below.

Figure 2.2: Data Collection Protocol for the Four Waves

	Wave 1 (Winter/2000)	**Wave 2*** (Spring/2000)	**Wave 3*** (Summer/2000)	**Wave 4*** (Fall/2000)
Background Survey	✓	✓	✓	✓
Exit Interview	✓	✓	✓	-
Follow-up Interview	✓	✓	✓	-
Attendance Recording	✓	✓	✓	✓

✓Was collected; - Was not collected; * New participants only

2.4.3.1 Background Survey

The five-page background survey was modeled after a prototype designed by Myers (1999). Refer to Appendix E for the background survey designed for the Tai Chi participants (an adapted version was given to the line dancers). This survey consisted of four sections: (1) About this class: how they heard about the class, their reasons for joining, prior experience with the exercise, possible reservations or concerns, etc; (2) About other physical activities they were currently doing; (3) About health: diagnosed health problems and limitations; and (4) About them: demographics. Pilot testing showed that the survey was clear and took about five minutes to complete.

2.4.3.2 Exit Interview

The purpose of the structured exit interview (Appendix F contains the script for Tai Chi participants; an adapted version was given to line dancers) was to examine participants' experiences with the recently completed program and intentions to continue. The telephone interview, which took about 15 minutes, asked about general and specific impressions of the class, whether it was difficult to make all the classes or practice at home, what they would like to see changed and whether they planned to reenroll or otherwise continue with the exercise.

All interviews were completed with the evaluator and took place within two weeks of course completion. At the beginning of the call, consent was obtained to tape record the interview (a tape recorder with an attachment for telephone interviewing was used). Originally, we had only planned to interview the beginner group. One line-dancing participant, however, questioned the evaluator as to why those with previous experience were not being included as "we have valuable information to tell you". Consequently, we decided to conduct exit interviews with the experienced participants as well. At this juncture, recruitment had not yet taken place at the K-W locations so the information letter and consent forms were altered to ask for the permission of all volunteers to be contacted upon program completion. Fortunately, the majority of 'experienced' volunteers from the Hamilton locations had provided a contact phone number. The protocol for conducting the interviews was identical for the Winter and Spring sessions. The exit interviews were only conducted after the Winter and Spring sessions for three reasons: (1) saturation was reached (i.e., responses become repetitive and little would have been gained from conducting more interviews (Krueger, 1994)); (2) the summer session had limited class offerings, low enrollment, and many participants had already taken part; and (3) the evaluator did not want to overburden participants in the Fall session as many were also taking part in the outcome study.

2.4.3.3 Follow-up Interview

One-month after the Winter and Spring/2000 programs finished, the evaluator reviewed the class lists with the instructor or program director to identify people who had signed up for the next session. Individuals who had not registered for the subsequent session, but had stated during the exit interview that they planned to reenroll, were contacted for a follow-up telephone interview. Refer to Appendix G for the script designed for Tai Chi participants (again, a slightly modified version was used for line dancers). The purpose of this interview was to inquire into current participation in the specified exercise (whether they joined the activity at another centre), if they plan to reenroll into the activity in the future, other exercise pursuits, and reflections on the completed program. Follow-up interviews were not conducted with the Summer and Fall participants as this interview was built on the exit interview and, as noted earlier, exit interviews were not conducted during these sessions.

2.4.3.4 Attendance Recording

For evaluation purposes, it is critical to obtain individual attendance (participation/ usage) data, and not simply aggregate or total usage rates (Myers, 1999). Aggregate attendance rates indicate the overall usage pattern of the programs; the consistency of attendance over time, and can be used to compare different classes. By tracking individual attendance, however, one can develop a more complete profile of users (i.e., which types of participants attend most often), as well as compare characteristics of adherers and dropouts (Myers, 1999).

All of the classes involved in this project already monitored individual class attendance. Most of the centres provide instructors with a list of registrants for each session for the purpose of checking whether each participant is present or absent. Attendance taking consists of a role call at all recreation/seniors' centres, except for the Hamilton Seniors' Centre, the Burlington

Senior's Centre, and the line dancing class at Sackville-Hill Senior's Centre (in which a sign-in sheet is left at the front desk). All Taoist Tai Chi Societies used a sign-in approach to attendance recording. Most facilities provided the evaluator with a copy of the weekly attendance forms upon course completion. Facilities concerned about confidentiality, however, preferred to provide this information verbally to the evaluator.

2.4.4 Data Management and Analysis

The purpose of this process evaluation was to examine the reasons for joining, continuing, and dropping out of community Tai Chi and line dancing programs, develop a profile of users, and determine whether adherence is greater for shorter forms of Tai Chi. The background survey, exit and follow-up interviews yielded both quantitative and qualitative data. This section will first describe the processes used to ensure confidentiality and then outline how the data was analyzed.

2.4.4.1 Confidentiality of Data

As previously noted, all study volunteers were required to complete an informed consent document approved by the University of Waterloo Office of Research Ethics (refer to Appendix D). Each volunteer was assigned a unique identification code. This code consisted of the class location (e.g., RW for Rockway Seniors' Centre, SV for Sackville-Hill Seniors' Centre, etc.), the session (e.g., W for winter), and an identification number (i.e., 01, 02, 03, 04, etc.). For example, volunteers from the Winter session at the Rockway Seniors' Centre were coded as RWW01, RWW02, RWW03, etc. Each person's unique identification code was transferred to their consent form, survey, and interview tapes and transcripts in order to match the data. All information was secured (stored in a filing cabinet, away for each centre) and will be destroyed upon study completion.

2.4.4.2 Participant Classification

Although we recruited from mainly "beginner classes", we soon discovered that not all participants were always new to Tai Chi (or line dancing). Therefore, for the purposes of this study, participants were categorized into three groups: '*complete beginners*', '*relative beginners*', and '*experienced*'. 'Complete beginners' were identified as those without any prior experience with Tai Chi (or line dancing). Persons with previous experience with the exercise (but not during the last programming session) were classified as 'relative beginners'. Finally 'experienced' individuals were considered those who participated in the previous session and had re-enrolled in the current session. These three groups were compared in terms of their characteristics and their experiences with the classes.

2.4.4.3 Quantitative Data

The Statistical Package for the Social Sciences (SPSS) Version 8 was used for analysis of the quantitative data. Descriptive statistics consisting of measures of central tendency (for the continuous variables) and frequency distributions (for categorical variables) were used to describe or profile the three exercise groups (Tai Chi versus line dancing versus Taoist Tai Chi participants), as well as 'complete' versus 'relative beginners' versus 'experienced' for Tai Chi and line dancing.

From the class attendance sheets, both aggregate and individual attendance rates were calculated, using formulas from Myers (1999). The formula used for calculating aggregate user rates was: (the total number of users ÷ the total number of sessions) x 100. Individual attendance rate was calculated by: (number of sessions attended by the person ÷ total number of sessions offered) x 100.

In order to classify and examine participation patterns for our sample, we needed to define 'adherer' versus 'dropout'. As noted in the literature review, the field is not consistent in defining or measuring dropout (Dishman & Sallis, 1994), and ultimately, each program must establish its own definitions or criteria (Ecclestone et al., 1998; Myers, 1999). Such criteria must be consistent, account for the number or opportunities that are actually provided (i.e., classes may be cancelled), and consider the possibility that participants may be absent for a time and then return (Ecclestone et al., 1998; Myers, 1999).

Past research has often classified participants as either an 'adherer' or a 'dropout' based on their length of time in a program (Belisle, Roskies, & Levesque, 1987; Desharnais et al., 1986; Dishman & Ickes, 1981; King et al., 1997; Wallace, Raglin, & Jastremski, 1995). In contrast, Gale et al. (1984) and Shephard et al. (1987) have three categories of participation. The participants in Gale et al.'s (1984) six-month exercise program were categorized as: (1) early dropouts (attended less than 10% of the classes), (2) nonadherers (attended 10 to 49%), and (3) adherers (attended 50% or more of the classes). Shephard et al.'s (1987), meanwhile, classified dropouts as those who attended less than 10%, poor attenders participated in 11 to 59%, while attenders participated in 60% or more of the 20-week session. Our categorizations as outlined in Figure 2.3, similarly focused on the extent of participation.

Figure 2.3: Categories of Adherence

'Regular Adherer'	- participated in at least 70% of the class sessions;
'Irregular Adherer'	- participated in less than 70% of the scheduled classes; attending at least one class during the second half of the programming session;
'Dropout'	- enrolled in and participated in at least one class but have not attended during the later half of the programming session.

Our adherer category required a higher attendance record than 50% to 60% used in past research. Unlike other exercise classes that are more consistent from session to session, Tai Chi and line dancing are progressive – movements are added and refined at each class. If people miss classes, they may quickly be left behind according to previous research (Cerrato, 1999; Koh, 1981; Lutz, 1996) and our current instructors (S. Lawton, personal communication, December 29, 1999; L. Horsky, personal communication, April 12, 2000).

With respect to comparative analyses, first, the profiles of the three exercise groups were compared. Next, we compared the profiles of the three participation classifications (complete beginner, relative beginner, and experienced). The adherence categorizations (regular adherer, irregular adherer, and dropout) were then compared to develop a profile of program users and dropouts. Between group comparisons consisted of analysis of variance (ANOVA) for continuous variables and Chi Square analysis for categorical variables. Post hoc comparisons were then used to investigate any significant findings. Significance level was set at $p<.05$. Finally, multiple group comparisons (the Tai Chi and Taoist Tai Chi groups versus the line dancers; the recreation/seniors' centre classes (combined) versus the Taoist Tai Chi participants) involved independent t-tests.

2.4.4.4 Qualitative Data

Qualitative data in this study consisted of the open-ended questions on the background survey, as well as the responses from the exit and follow-up interviews. The answers from the background survey were coded, categorized, and inputted into SPSS. A content analysis was used to examine and categorize the open-ended responses. The first step in this content analysis was the construction of a list of responses from each of the questions in the completed surveys. Common types of responses were identified and grouped together and categories of indigenous and sensitizing concepts were developed (Patton, 1990; Silverman, 1993). Indigenous concepts are categories based on the participants' actual written comments (i.e., fun may be a reason for joining an exercise program and can be used as a category) while sensitizing concepts are terms developed by the analyst to describe categories that participants had not placed labels upon (i.e., a physical fitness category could be developed by the analyst when the participants state improvements in strength and flexibility as reasons for joining a program) (Patton, 1990). Once the categories were complete, a frequency count was performed regarding the number of times that each response for the category was mentioned (Myers, 1999; Silverman, 1993). Frequency distributions and group comparisons, as described under Quantitative Data, were completed.

Content analysis, however, ignores the richness that qualitative data can provide. The fully transcribed exit and follow-up interviews were imported into the software package QSR NUD*IST (Qualitative Solutions Research - Non-numerical Unstructured Data Indexing Searching and Theorizing) version 4 (Scolari, 1995). The code-and-retrieval or indexing system of this software program was used to organize, manage, and explore the data, and facilitate analysis (Richards & Richards, 1991; Scolari, 1995). Using indigenous and sensitizing concepts, many categories were developed based on the respondents' verbal answers. Through the analyst's descriptions of the categories that emerged from the data, and using direct quotes for illustration, a narrative, descriptive approach was used to present the findings for the interview questions (Patton, 1997). Differences found for exercise group, level of experience, or adherence classification are reported in the interview section of the results.

2.5 Results

This section begins with an examination of seasonal enrollment, attendance and dropout patterns over the 12-month tracking period. Overall and study patterns of attendance and dropout are compared. Next, survey response and return rates are presented. Based on the survey information, a comparative profile of the three exercise groups—community Tai Chi, Taoist Tai Chi, and line dancing classes—was constructed with respect to demographics, health, level of physical activity, and factors influencing participation. The sample is then profiled based on level of experience and adherence. Finally, we present the qualitative interview findings concerning participant impressions of the community Tai Chi classes.

2.5.1 Seasonal Enrollment, Attendance and Dropout Patterns

Table 2.2 shows the number of classes tracked, total number of participants enrolled in the classes, and the number of volunteers recruited for this study. As illustrated in Figure 2.4, enrollment for both the community Tai Chi and line dancing classes was highest during the Fall session, declined slightly in the Winter, and sharply in the Spring. Fewer classes tended to be offered in Summer and the average number of participants per class also declined during this season. For instance, average class sizes for the Fall session were 23 and 46 for the community Tai Chi and line dancing programs, respectively. During the Summer session, class size dropped to 14 and 30, respectively, for these two programs.

Comparable enrollment patterns were more difficult to ascertain for the ongoing classes at the Taoist Tai Chi Society, since one attendance record is used for all classes. For this study, the instructors were asked to take attendance for each of their beginner classes. Average class sizes reportedly were 15, 21, and 22 during the Winter, Spring, and Fall respectively.

Table 2.2: Overall Enrollment, Survey Response and Return Rates

	Tai Chi					Taoist Tai Chi					Line Dancing				
	W	Sp	Su	F	Total	W	Sp	Su	F	Total	W	Sp	Su	F	Total
# of classes	8	7	3	6	**24**	4	1	0	(4)'	**5 (9)'**	3	3	2	4	**12**
# enrolled	123	94	41	138	**396**	59	21	0	(66)'	**80 (146)'**	144 (64)*	130 (45)*	59	183 (86)*	**516 (254)***
# recruited	82	40	0	38	**160**	43	19	0	N/A	**62**	53	19	0	40	**112**
Response Rate	67%	42%	0	28%	**40%**	73%	90%	0	N/A	**78%**	83%	42%	0	46%	**44%**
# of surveys returned	59	27	0	30	**116**	32	10	0	N/A	**42**	29	10	0	24	**63**
Return Rate	72%	68%	0	79%	**73%**	74%	53%	0	N/A	**68%**	55%	53%	0	60%	**56%**

W=winter, Sp=spring, Su=summer, F=fall

Note: Response rate is based on the number of people who indicated an interest in the study (i.e., survey packages distributed) divided by the total number enrolled in the classes according to the lists kept by each centre. Return rate is based on the number of surveys returned divided by the number who took a survey package.

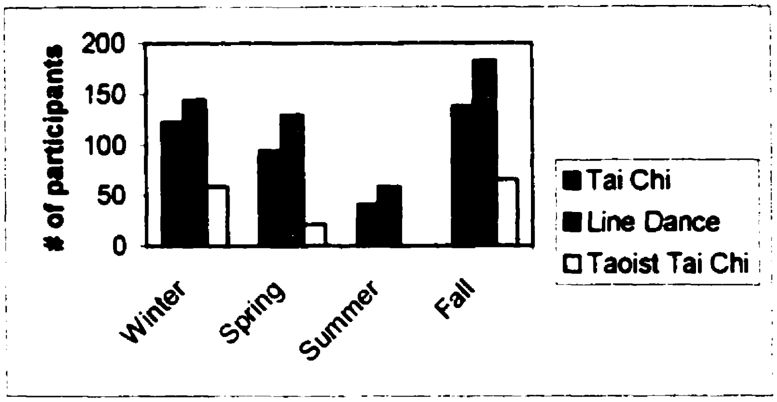
**Given the large sample size of some of the line dancing classes (over 100), we only recruited a sample. In this case, the response rate was calculated on the basis of the number of surveys distributed.*

N/A – This information is not applicable to the process evaluation. An experienced group of Taoist Tai Chi participants were recruited during the Fall session as part of the outcome study (to be described in Chapter Three).

' The Winter values were not used in the calculation of response and return rates as the beginner participants in these classes were not recruited for the process evaluation. During this session an experienced group of practitioners were recruited for the outcome evaluation.

The majority of participants in the summer session were not eligible, as they were already surveyed in previous sessions

Figure 2.4: Seasonal Enrollment Rates



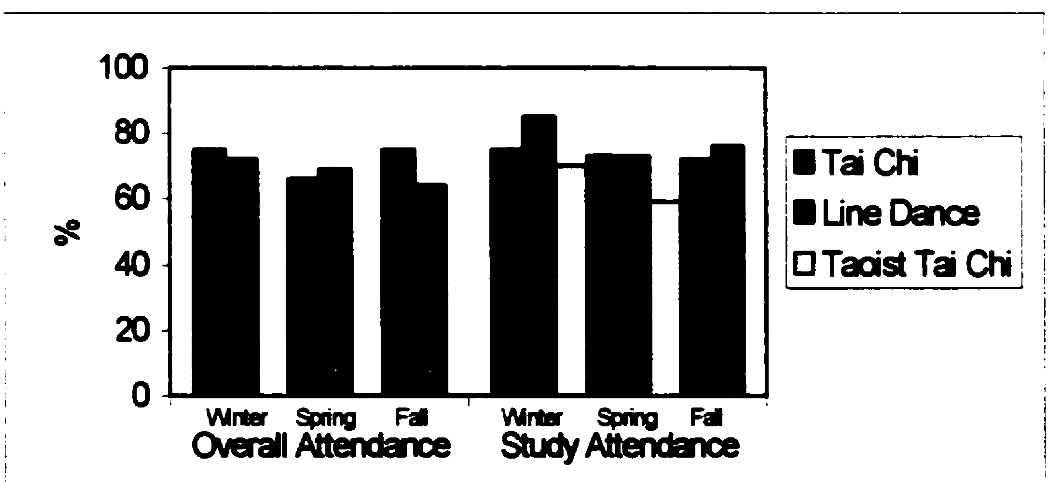
Attendance records for all class participants were obtained from 11(52%) of the 21 Tai Chi classes and 5 (50%) of the 10 line dancing classes. For the remaining classes, attendance information for study participants was provided verbally (to protect confidentiality). Using these records we were able to calculate average, overall attendance rates across the classes in each type of program by session. As presented in Table 2.3 and illustrated in Figure 2.5, overall attendance patterns (versus total numbers) were comparable for the community Tai Chi and line dancing classes in the Winter and Spring sessions (both were higher in the Winter). Fall and Winter attendance was comparable for the Tai Chi classes, but lower in Winter versus Fall for line dancing classes. Aggregate attendance rates could not be determined for the Taoist group as only one attendance sheet is maintained for all club members (precluding separation of beginner classes). We could, however, determine study attendance rates for the Taoist classes using participant names from the consent forms.

Table 2.3: Overall and Study Attendance and Dropout Rate for Each Type of Program

	Tai Chi	Taoist Tai Chi	Line Dancing
Overall Attendance			
Winter	75%	N/A	72%
Spring	66%		69%
Fall	75%		64%
Overall Dropout Rate			
Winter	(n=14) 28%	N/A	(n=10) 10%
Spring	(n=7) 13%		(n=7) 8%
Fall	(n=9) 28%		(n=12) 12%
Study Attendance Rates*	(n=107)	(n=33)	(n=55)
Winter	75%	70%	85%
Spring	73%	59%	73%
Fall	72%	N/A	76%
Study Dropout Rate	(n=25)	(n=8)	(n=26)
Winter	(n=10) 19%	(n=4) 17%	(n=2) 9%
Spring	(n=7) 28%	(n=4) 40%	(n=14) 32%
Fall	(n=8) 27%	N/A	(n=10) 19%

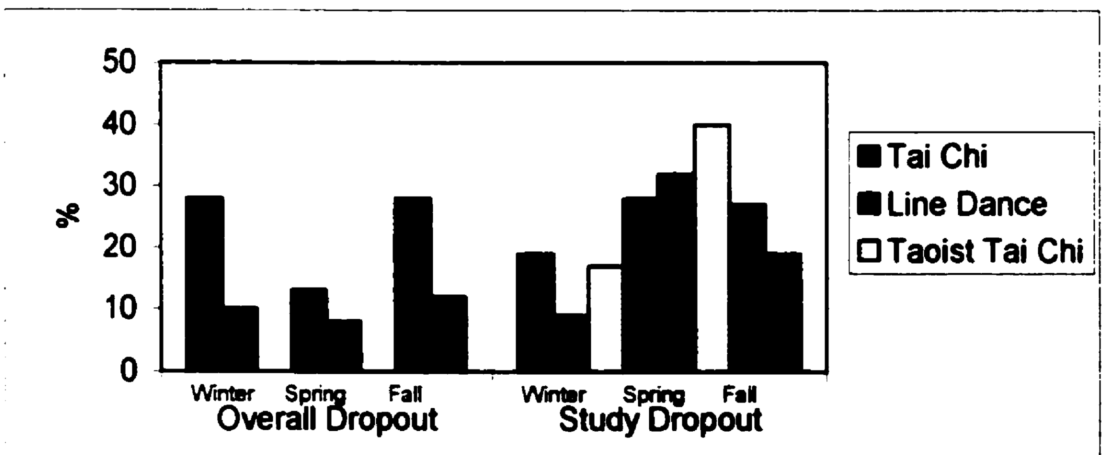
**Of 221 individuals in this study, 26 did not provide their name on the consent form precluding matching with instructor records. The total N for these analyses is 195.*
N/A = Overall attendance and dropout rates could not be calculated for the Taoist group; one attendance sheet was maintained by the Societies, precluding the separation of individual classes. Study attendance and dropout rates were not calculated for the Taoist Tai Chi Society during the Fall session since an experienced group of practitioners, rather than beginners, were recruited for the outcome study.

Figure 2.5: Overall and Study Attendance by Session and Group



A total of 221 individuals completed the survey questionnaire and consent form. Unfortunately, 26 (12%) did not provide their name on the signed consent, precluding matching with instructor attendance records. For the 195 individuals we could match, the overall attendance rate was 72% for the Tai Chi group and 68% for line dancing; study attendance was 73% and 78% respectively (65% for Taoist group). As shown in Table 2.3 and illustrated in Figure 2.5, study attendance rates were quite comparable to the overall attendance rates for the Tai Chi group but higher in all three sessions for the line dancing group. Using the criteria specified previously in the data analysis section, Figure 2.6 presents the overall and study dropout rates by season. Overall dropout was 23% for Tai Chi group and 10% for the line dance group; study dropout was 25% for the Tai Chi group and 20% for the line dancers (29% for the Taoist group). Dropout for the community Tai Chi and line dancing classes was lowest in the Spring. For the study sample, dropout was lowest in the Winter session for all three types of programs.

Figure 2.6: Overall and Study Dropout Rates by Session and Group



2.5.2 Survey Response and Return Rates

Response rates, shown in Table 2.2, for each session, are based on the number of people who indicated an interest in the study (i.e., survey packages distributed) divided by the total number enrolled in the classes according to the lists kept by each centre. Study response rates ranged from 28% to 67% for the Tai Chi classes, 73% to 90% for the Taoist Tai Chi Societies, and 42% to 83% for the line dancing classes. Response rates for the Winter session give the most accurate picture concerning recruitment (67%, 73%, and 83% of the community Tai Chi classes, Taoist Tai Chi Societies, and line dancing classes respectively), since some people in the Spring, Summer, and Fall sessions had already been approached in the prior sessions. We were unable to recruit participants from the Summer session due to the aforementioned reason and limited offerings.

Return rates, also shown in Table 2.2, are based on the number of background surveys returned divided by the number who took a survey package. The return rates ranged from 68% to 79% for the Tai Chi classes, 53% to 74% for the Taoist Tai Chi Societies, and 53% to 60% for the line dancing classes. Overall, the return rate was lowest for the line dancing group (56%) and highest for the Tai Chi group (73%). In total, 221 respondents returned completed surveys--116 from the community Tai Chi group, 42 from the Taoist Tai Chi Societies, and 63 from the line dancing group. The majority of the total sample were female (n=187, 85%), Caucasian (n=206, 97%), and aged 55 and over (n=201, 91%). Half were married (n=111).

2.5.3 Profile of the Exercise Groups

Although we asked for volunteers aged 55 years and over, as shown in Table 2.4, a number of younger individuals from the community Tai Chi (n= 5) and Taoist Tai Chi (n=15) classes completed the surveys. Subsequent analyses were performed for the Taoist Tai Chi

Table 2.4: Demographic Profile of the Three Exercise Groups

	Tai Chi (N=116) n (%)	Taoist Tai Chi n (%)		Line Dancers (N=63) n (%)
		All ages (N=42)	50+ (N=34)	
Age	44-88 years mean = 65.97 55+=111 (97%)	32-82 years mean = 59.0 55+=27(64%)	50-82 years mean = 63.5 50+=27(79%)	55-92 years mean = 67.92 55+ = 63 (100%)
Gender				
Females	96 (83%)	31 (74%)	28 (82%)	60 (97%)
Males	20 (17%)	11 (26%)	6 (18%)	2 (3%) •1 missing value
Marital Status				
Single	7 (6%)	6 (15%)	2 (6%)	0 (0%)
Married	59 (51%)	26 (64%)	24 (73%)	26 (42%)
Separated/Divorce	13 (11%)	3 (7%)	2 (6%)	14 (23%)
Widowed	34 (29%)	5 (12%)	5 (15%)	22 (35%)
Other	3 (3%)	1 (2%)	0 (0%)	0 (0%)
Education				
Elementary School	6 (5%)	2 (5%)	2 (6%)	4 (7%)
Some High School	28 (24%)	3 (7%)	3 (9%)	9 (15%)
High School Diploma	17 (15%)	4 (10%)	3 (9%)	19 (31%)
Some Post Secondary	29 (25%)	9 (21%)	6 (17%)	13 (21%)
College or University	25 (22%)	12 (31%)	9 (27%)	9 (15%)
Graduate or Professional Degree	11 (9%)	11 (26%)	11 (32%)	7 (11%)
Retirement				
Not Retired	6 (5%)	14 (33%)	7 (21%)	0 (0%)
Semi-Retired	15 (13%)	4 (10%)	3 (9%)	4 (7%)
Fully-Retired	93 (80%)	24 (57%)	24 (71%)	57 (93%)
Other (never worked or on disability)	2 (2%)	0 (0%)	0 (0%)	0 (0%)

group with and without individuals under age 50; differences are reported when found. Since only one participant in the community Tai Chi group was under 50 years of age, separate analyses by age were not conducted. When all participants were compared on age, the Tai Chi ($p<.01$) and line dance ($p<.01$) participants were older than the Taoist group. When the younger Taoist sample were removed from the analysis, a significance difference remained only for the line dancers ($p<.05$). As illustrated in Table 2.4, only a few respondents could be considered as "ethnic minorities"—four with West Indian backgrounds (3 Taoist, 1 line dancer) and three with Oriental/Asian backgrounds (all line dancers).

Significant differences between the three groups emerged with respect to the following characteristics. Taoist participants were more likely to be married ($x^2 = 4.56$, $p<.05$) than the line dancers, as well as to have completed some post secondary education ($x^2=6.16$, $p<.05$) and to be currently working ($x^2=15.84$, $p<.05$) compared with both recreation/senior centre groups. The majority of the sample overall perceived that their health was excellent (n=14, 12%) or good (n=73, 63%). As shown in Table 2.5, the most commonly reported health problems were arthritis, high blood pressure, back problems, and osteoporosis. High cholesterol (n=12, 18%), thyroid problems (n=7, 10%), cancer (n=7, 10%), and headache/migraines (n=6, 9%) were the most commonly reported 'other' health problems. The average number of health problems was 2.32 for the Tai Chi participants, 2.11 for the line dancers, and 1.79 for the Taoist group. The Tai Chi participants at the recreation/seniors' centres reported significantly more health problems than the Taoist group ($t=2.06$, $p<.05$). When the younger Taoist participants were removed from the analysis (those 50+ reported an average of 1.94 health problems), group differences were no longer significant.

Most (n=144, 64%) were not limited in the type or amount of physical activity they can do, this included 63% (n=73) of the Tai Chi participants, 75% (n=45) of the line dancers, and 62% (n=26) of the Taoist group. One-third (30%) of the Tai Chi group and approximately one quarter of the line dance (22%) and non-exercise (26%) groups stated that long-term conditions, such as arthritis, heart disease, or back problems, limited activities.

Table 2.5: Health Problems by Group

	Tai Chi (N=116) n (%)	Taoist Tai Chi n (%)		Line Dancers (N=62) n (%)
		All ages (N=42)	50+ (N=34)	
Heart Trouble	15 (13%)	4 (10%)	4 (12%)	4 (6%)
Asthma, Emphysema or Bronchitis	11 (9%)	2 (5%)	2 (6%)	7 (11%)
Diabetes	8 (7%)	2 (5%)	2 (6%)	5 (8%)
Osteoporosis	23 (20%)	5 (12%)	5 (15%)	13 (21%)
Arthritis	49 (42%)	13 (31%)	12 (35%)	21 (34%)
High Blood Pressure	41 (35%)	9 (21%)	8 (24%)	20 (32%)
Back Problems	31 (27%)	12 (29%)	9 (26%)	17 (27%)
Foot Problems	15 (13%)	7 (17%)	6 (18%)	9 (15%)
Hearing Problems	13 (11%)	6 (14%)	5 (15%)	8 (13%)
Cataracts or Vision Disorder	24 (21%)	3 (7%)	3 (9%)	11 (18%)
Other	40 (34%)	12 (29%)	10 (29%)	16 (26%)

2.5.3.1 Physical Activity Patterns

In addition to the Tai Chi and line dancing classes, many participants were also involved in other structured exercise classes (n=94, 43%) or informal physical activities (n=180, 82%). The community Tai Chi (n=47, 41%) and line dancing (n=41, 65%) samples reported significantly greater enrollment in other exercise classes or groups ($x^2 = 17.16$, $p<.05$) than the Taoist sample (n=6, 14%). Dancing (n=34, 39%), aquatics (n=23, 26%), and aerobic classes (n=15, 17%) were popular for the recreation/seniors' centre groups.

Unstructured physical activity, most often walking (n=153, 85%) and swimming (n=21, 12%), were popular among all three groups. Three quarters of the sample (n=146, 75%) reportedly accumulated 30 minutes or more of moderate intensity activity at least three days a week. This included 78% (n=80) of the Tai Chi participants, 67% (n=39) of the line dancers, and 73% (n=27) of the Taoist participants. Over half the sample (all groups) checked that they had been involved in physical activity 'off and on' throughout their life. Almost one third of each group said they had been involved 'all their life'. Only a small proportion (16% Tai Chi, 19% Taoist, 10% line dancers) reported 'not at all'.

2.5.3.2 Factors Related to Participation

As can be seen from Table 2.6, respondents from the recreation/seniors' centres were more likely to have heard of the program through city program guides or senior centre brochures ($x^2 = 16.37$, $p<.05$) or by contacting the centre ($x^2 = 4.84$, $p<.05$) than the Taoist group, who reported word of mouth as their primary source ($x^2 = 22.22$, $p<.05$). Half the sample (n=111, 50%) reported knowing someone in the class, most often a friend (n=88, 79%) or family member (n=19, 17%). Most participants traveled to the centre by car, either driving themselves (n=181, 82%) or receiving a ride from a family member or friend (n=32, 14%), some walked (n=40; 18%), while fewer rode the bus (n=31; 14%) or took a taxi (n=3; 1%). Most needed less than 15 minutes (n=181, 82%) for travel time, few required more than 30 minutes (n=13, 6%).

Table 2.6: Factors Related to Participation

	Tai Chi n (%)	Taoist Tai Chi n (%)	Line Dancers n (%)
Hear about program?	(N=111)	(N=42)	(N=63)
- City guide/brochure	40 (36%)	0 (0%)	25 (42%)
- Contacted the centre	30 (27%)	2 (5%)	14 (24%)
- Word of Mouth	26 (23%)	20 (50%)	19 (32%)
- Newspaper	7 (6%)	7 (6%)	0 (0%)
Know someone in class?	(N=116)	(N=42)	(N=63)
- Yes	50 (43%)	25 (60%)	36 (57%)
- No	66 (57%)	17 (40%)	27 (43%)
Travel to the Centre	(N=116)	(N=42)	(N=63)
- Drive Myself	92 (79%)	41 (97%)	48 (76%)
- Walk	31 (27%)	2 (5%)	7 (11%)
- Ride with other	13 (11%)	9 (21%)	10 (16%)
- Bus	10 (9%)	0 (0%)	21 (33%)
- Taxi	2 (2%)	1 (2%)	0 (0%)
- Cycle	1 (1%)	0 (0%)	0 (0%)

Note: Not all respondents answered each survey question. For some questions, multiple responses were possible.

A total of 183 of the 221 participants answered the survey question on personal reasons for joining the program (refer to Table 2.7 for the five most popular reasons). Physical fitness benefits (e.g., to improve balance, flexibility, coordination, etc.) was the most popular category, followed by health benefits (e.g., to reduce blood pressure, help arthritis, relieve pain, etc.). Interestingly, none of the line dancers reported health or mental health as reasons for joining. The line dancers were significantly more likely than the two Tai Chi groups to report social/ friendship reasons or fun/enjoyment as their primary motive for joining ($x^2 = 71.81, p<.05$).

Table 2.7: Top Five Reasons for Joining the Program

	Tai Chi (N=93) n (%)	Taoist Tai Chi (N=35) n (%)	Line Dancers (N=55) n (%)
Physical Fitness	45 (48%)	27 (77%)	43 (78%)
Health Benefits	29 (31%)	15 (43%)	0 (0%)
Mental Health	19 (20%)	6 (17%)	0 (0%)
Friendship/Social Reasons	8 (9%)	2 (6%)	16 (29%)
Fun/Enjoyment	1 (1%)	0 (0%)	22 (40%)

Note: Not all respondents answered each question on the survey and multiple responses were sometimes provided

Table 2.8 illustrates the confidence and reservations participants reported coming into their respective programs. The vast majority (n=186, 86%) were 'very sure' or 'pretty sure' that they could perform the movements of their chosen exercise; only 11 (5%) were 'not sure'. Over half of each group (52% Taoist, 62% line dancers, 72% Tai Chi) had no reservations about taking the class. Of those with reservations, the Tai Chi and line dancing participants were most concerned with not having the skill; the Taoist group with being able to attend class. Compared to the community Tai Chi participants (mean=0.38), the average number of reservations was higher for the Taoist group (mean=0.67) (t=2.247, p<.05); significance disappeared when younger persons were removed from the analysis. No difference was found between the number of reservations by either Tai Chi group when compared to the line dancers (mean=0.46). It is also interesting to note the 'other concerns' mentioned by the respondents. The Tai Chi group expressed concern over experiencing too much pain (n= 3; 50%), having difficulty remembering the movements (n=2; 33%), and poor coordination (n=1; 17%). The Taoist group stated remembering the movements (n=4; 80%) and poor balance (n=1; 20%) as issues. Finally, a few line dancers stated health concerns (n=4; 80%) and difficulty remembering the movements (n=1; 20%) as reservations.

Table 2.8: Confidence and Reservations by Group

	Tai Chi n (%)	Taoist Tai Chi n (%) All ages	Taoist Tai Chi n (%) 50+	Line Dancers n (%)
Confidence to perform movements?	**(N=114)**	**(N=42)**	**(N=34)**	**(N=61)**
- Very sure	45 (40%)	15 (36%)	11 (32%)	30 (49%)
- Pretty sure	50 (44%)	24 (57%)	21 (62%)	22 (36%)
- Not sure	4 (3%)	2 (5%)	1 (3%)	5 (8%)
- Don't know	15 (13%)	1 (2%)	1 (3%)	4 (7%)
Type of Reservations	**(N=116)**	**(N=42)**	**(N=34)**	**(N=63)**
- None	84 (72%)	22 (52%)	18 (53%)	39 (62%)
- Do not have the skill	15 (13%)	3 (7%)	1 (3%)	12 (19%)
- Not able to attend class	10 (9%)	14 (33%)	11 (32%)	6 (10%)
- Difficulty getting to class	1 (1%)	2 (5%)	2 (6%)	2 (3%)
- Cannot practice at home	12 (10%)	5 (12%)	3 (9%)	4 (6%)
- Other concerns	7 (6%)	4 (10%)	3 (9%)	4 (6%)

Note: Not all respondents answered each question on the survey and multiple responses were sometimes provided.

2.5.4 Level of Experience

Using the classification system previously described, over half the sample were new to this exercise ('complete beginners' n=131, 59%), about a quarter were 'relative beginners' (n=52, 24%); a small proportion were 'experienced' (n=38, 17%). The 'relative beginners' had participated in either Tai Chi or line dancing anywhere from 6 months to over 20 years ago, while the experienced group had practiced their exercise for up to seven years. The most common place to have participated in the activity was at a community recreation/seniors' centre (n=17, 47%). Some had previously participated at the Taoist Tai Chi Society (n=6, 17%); a few had taken either Tai Chi or line dancing at a local school (n=3, 8%).

As illustrated by Table 2.9, the three groups were quite comparable concerning mix of experience levels in the classes. A total of 47 (36%) 'complete beginners', 28 (54%) 'relative beginners', and 19 (50%) 'experienced' were enrolled in other physical activity programs. The 'relative beginners' were significantly more likely to be enrolled in other physical activity programs than the 'complete beginners' ($x^2 = 4.80$, $p<.05$). Although the majority of the sample (n=130; 59%) reported being physically active 'off and on' throughout their life, it is interesting to note that a greater proportion of the 'complete' and 'relative beginners' (n=53, 29%) reported being active 'all of their life' ($x^2 = 5.35$, $p<.05$) compared to the experienced group (n=4, 11%).

Table 2.9: Experience Classification by Exercise Group

	Tai Chi (N=116) n (%)	**Taoist Tai Chi (N=42) n (%)**	**Line Dancers (N=63) n (%)**
Complete Beginner	68 (59%)	27 (64%)	36 (57%)
Relative Beginner	26 (22%)	11 (26%)	15 (24%)
Experienced	22 (19%)	4 (10%)	12 (19%)

*Note: '**Complete Beginners**' are persons without any prior experience with the exercise. Persons with previous experience with the exercise (but not during the last programming session) are classified as '**relative beginners**' while '**experienced**' individuals are considered those who participated in the previous session and had re-enrolled in the next session.*

The 'complete beginners' (n=45, 36%) most often heard about the program from the city guides or centre brochures. Many of the 'relative beginners' (n=16, 33%) contacted the centre, while the 'experienced' group (n=13, 36%) used word of mouth. Not surprisingly, a greater proportion of the 'relative beginners' ($x^2 = 5.06$, $p<.05$) and the 'experienced' group ($x^2=8.74$, $p<.05$) versus 'complete beginners' knew someone in their class.

Finally, those with previous experience with the activity-- both the 'relative beginners' (n=11; 21%) and the 'experienced' group (n=9; 24%)-- had fewer reservations about taking the class than the 'complete beginners' (n=40; 31%). The most common concern of 'complete beginners' (n=20; 15%) was that they would not have the skill; the 'relative beginners' (n=8; 15%) were concerned about not being able to attend class; the experienced group (n=6, 16%) about practicing at home.

2.5.5 Adherence Levels

As described, three adherence levels were developed for this project: 'regular adherers', 'irregular adherers', and 'dropouts'. Of the 195 (88%) respondents who provided their name on the consent form (to enable matching attendance data), most were classified as regular adherers (134, 69%); 21 (11%) as irregular adherers; and 40 (20%) as dropouts. The adherers and dropouts were similar in age, 65.94±8.75 and 64.85±9.58 respectively. As can be seen from Table 2.10, a larger proportion of the line dance group adhered to their program compared with the two Tai Chi groups (although difference was not statistically significant). The two Tai Chi groups were similar in their proportion of adherers and dropouts.

Table 2.10 also provides a comparison of adherence patterns by level of experience. Although significant group differences did not exist, the dropout rate was highest for complete beginners. Health limitations and activity pursuits of the 'adherers' (both regular and irregular) and dropouts were also compared. The adherers reported an average of 2.12 health problems, which was slightly less than the 2.45 health problems reported by the dropouts; over half the sample (69% adherers and 58% dropouts) was not limited in the amount of physical activity they could perform. Level of participation in other physical activities did not differentiate adherers from dropouts.

Table 2.10: Profile of Adherers versus Dropouts

	Regular Adherer	Irregular Adherer	Dropout
Type of Program (N=195)			
Tai Chi (N=107)	71 (66%)	11 (10%)	25 (23%)
Taoist Tai Chi (N=33)	21 (64%)	4 (12%)	8 (24%)
Line Dancers (N=55)	42 (76%)	6 (11%)	7 (13%)
Total	**N=134 (69%)**	**N=21 (11%)**	**N=40 (20%)**
Experience Level (N=195)			
Complete Beginner (N=118)	73 (62%)	16 (14%)	29 (24%)
Relative Beginner (N=45)	37 (82%)	2 (5%)	6 (13%)
Experienced (N=32)	24 (75%)	3 (9%)	5 (16%)
Total	**N=134 (69%)**	**N=21 (11%)**	**N=40 (20%)**

*Note: '**Regular adherers**' participated in at least 70% of the classes; '**irregular adherers**' participated in less than 70% but attended at least one class during the second half of the session; '**dropouts**' participated in at least one class but did not attend during the later half of the session.*
Refer to Table 2.9 for beginner classification.

Although the majority of our sample (n=93, 63%) did not report any reservations about taking the class, adherers and dropouts were compared on this variable (see Table 2.11). The findings indicate that a significantly higher percentage of Tai Chi dropouts compared to adherers had reservations about taking the class ($x^2 = 4.12$, $p<.05$). No difference was found for the Taoist group, and surprisingly in the line dancing group, dropouts had fewer reservations. The most common reservation of the dropout group was not being able to attend reservations. The most common reservation of the dropout group was not being able to attend class (n=7, 18%). Finally, the vast majority of both adherers and the dropouts in all three types of programs were 'very sure' or 'pretty sure' that they could complete the movements required to perform the exercise.

Table 2.11: Reservation and Confidence by Type of Program and Adherence Level

	Adherers n (%)	Dropouts n (%)	Total n (%)
Reservations (Yes/No)			
Tai Chi			
- Yes	19 (23%)	11 (44%)	**30 (28%)**
- No	63 (77%)	14 (56%)	77 **(72%)**
Taoist Tai Chi			
- Yes	13 (52%)	4 (50%)	**17 (52%)**
- No	12 (48%)	4 (50%)	**16 (48%)**
Line Dancers			
- Yes	19 (40%)	2 (29%)	**21 (38%)**
- No	29 (60%)	5 (71%)	**34 (62%)**
Total	155 (79%)	40 (21%)	**195 (100%)**
Confidence to perform the movements?			
Tai Chi			
- Very or Pretty Sure	71 (73%)	19 (100%)	**90 (98%)**
- Not Sure	2 (3%)	0 (0%)	**2 (2%)**
Taoist Tai Chi			
- Very or Pretty Sure	24 (100%)	7 (88%)	**31 (97%)**
- Not Sure	0 (0%)	1 (13%)	**1 (3%)**
Line Dancing			
- Very or Pretty Sure	38 (91%)	7 (100%)	**45 (92%)**
- Not Sure	4 (9%)	0 (0%)	**4 (8%)**
Total	**139 (80%)**	**34 (20%)**	**173 (100%)**

Based on 195 respondents

2.5.6 Participant Impressions

This section begins with a brief description of the sample that completed the exit interview, followed by the findings from the exit and follow-up interviews. As mentioned earlier, exit interviews were only conducted after the Winter and Spring sessions for three reasons: (1) saturation of findings; (2) inability to recruit participants during the Summer session; and (3) the evaluator did not want to overburden participants in the Fall session who also took part in the outcome study. In total, 162 surveys from the three exercise groups were returned during the Winter and Spring sessions: 86 from Tai Chi participants, 34 from line dancers, and 42 from Taoist Tai Chi Society participants. A total of 107 exit interviews were completed as described below.

Of the 86 surveys returned by the community centres' Tai Chi groups, 63 (73%) provided a name, phone number, and consent for follow-up. We were able to contact and complete exit interviews with 57 (91%) participants, ranging in age from 55 to 84 years (mean=68.05±7.82); 86% (n=49) were female. Of this sample, 30 (53%) were classified as 'complete beginners', 16 (28%) as 'relative beginners', and 11 (19%) as 'experienced'. A total of 44 (77%) had adhered to the program while 13 (23%) dropped out.

Of the 34 surveys returned by the line dancers, 30 (88%) provided a name, phone number, and consent for follow-up. A total of 27 (90%) participants, ranging in age from 55 to 92 years (mean age 67.64±8.62); 93% (n=25) were female, were contacted and completed the exit interview. Of this sample, 12 (45%) were 'complete beginners', 6 (22%) were 'relative beginners' and 9 (33%) were classified as 'experienced'. A total of 85% (n=23) had adhered to the program, while 15% (n=4) had dropped out.

Finally, the Taoist Tai Chi Society participants returned a total of 42 surveys. Fifteen surveys were immediately removed from this set, as the respondents were younger than 55 years of age. Of the 27 possible interviews, we were able to contact and complete exit interviews with 23 (85%) participants, ranging in age from 55 to 82 years (mean age

67.88±7.69); 78% (n=18) female. A total of 14 (61%) were classified as 'complete beginners', 7 (30%) as relative beginners, and 2 (9%) were experienced. Of this sample, 18 (78%) had adhered to the program, while 5 (22%) had dropped out.

The findings are based on analysis of the recorded exit and follow-up interviews. Since the follow-up interviews were based on the completion of the exit interviews, the number of follow-up interviews will be provided in this section of the results. The primary findings that emerged from the interviews are presented below in the same order as the topics were raised (see Appendices F and G for the exit and follow-up interview scripts, respectively). Differences in exercise group, level of experience, or adherence classification are presented when they exist. The findings for the exit interview are presented first, followed by the follow-up interview. Selected quotes from participants are provided for illustrative purposes.

2.5.6.1 Attendance Patterns

After providing a brief review of the purpose of the study and noting the number of classes the participant in question had attended (according to the attendance sheet or verbal account obtained from the centre), each person was asked: "Was it difficult for you, at times, to make the classes? (If yes, why?)" Most participants stated that they did not experience any difficulties with attending the classes. One female line dancer stated: "*I don't recall any difficulties. I might have had a little bit of arranging*". A male Tai Chi participant agreed: "*I'm retired now, it is not a problem at all*". Of those reporting attendance difficulties, the most common were:

- not having a ride;
- not feeling well/in pain;
- taking a holiday; and
- poor weather conditions (during the Winter session).

Of those completing the exit interview, the Tai Chi group attended 75.99% of their classes, the line dancers attended 82.40% of their classes, while the Taoist participants reported attending 72.62% of their classes (no significant group difference). To remind the reader, the Tai Chi classes were offered for 8 to 12 weeks (most commonly 10 weeks), line dancing classes were held for 10 weeks, while Taoist participants could attend as many sessions (both instructional and open classes), each week as they wished (their attendance score was based on attending two sessions per week for 10 weeks).

2.5.6.2 Adoption

To explore the reasons why older adults join Tai Chi or line dancing programs, participants were asked: "What appealed to you about Tai Chi/line dancing before you started?" Table 2.12 illustrates the common reasons for joining the classes. Many Tai Chi participants (both at the recreation/seniors' centres and Taoist Tai Chi Society) expressed that the gentle, soft exercise of Tai Chi, attracted them to the program. One lady said: "*Tai Chi is a nice, gentle, stretching exercise*", while another stated that: "*it is not an aggressive type of exercise…its stretching, which as you get older, and I'm 75 years old, is considered to be very beneficial*". Tai Chi was also described as "*gentle-flowing and very relaxing, yet achieving something*". Due to its gentle nature, many participants felt that it is an appropriate exercise for seniors. The following quotes illustrate this viewpoint: "*it was less demanding on the aging body*", "*not too exerting for senior people and yet it was relaxing as well*", and "*I can't do aerobics or anything like that, so it seems like something I might be able to do*".

Similar to the responses obtained from the background survey, Tai Chi participants also mentioned possible physical fitness gains and health benefits. For example, the fitness gains include comments such as: "*…conditioning and toning, that sort or thing, and coordination*", "*to help my balance*" and "*maybe loosen me up a little bit*". While the potential health benefits included comments such as: "*I understood it had somewhat of a healing effect on your system*" and "*I wanted to take it for maintaining good health*". Others were interested in learning more about this exercise or simply wanted to try a new activity. One man stated: "*I read about it, and I didn't know what it was, but it was recommended and the way that the movements were described I wanted to see what it was all about*". Another commented: "*I recently retired so I'm trying everything*".

Similar to the results of the background survey, many line dancers said that fun/ enjoyment and social reasons were attractive features to joining this class. The following remarks were typical: "*I thought it would be a fun thing to do and I've always enjoyed dancing*", "*it's an outing, it's socializing, all those thing. I love music and I love dancing*". Many women agreed that another important feature of the line dancing class is:"*...that you don't need a partner*". One woman stated: "*there are more widows than widowers so we can continue to dance without a partner*" while others mentioned that: "*my husband doesn't enjoy it (dancing) as much as I do*". The exercise achieved through line dancing also appealed to some women. Several commented that: "*I thought that it would be a good exercise*" and "*...aerobics is too much, even jogging and that kind of thing that damages your joints...But the modern dancing that we do is good exercise and doesn't damage your hips or knees*".

Table 2.12: Popular Reasons for Joining Tai Chi and Line Dancing

Tai Chi	Line Dancing
- Gentle, soft, relaxing exercise (appropriate for seniors)	- Fun and enjoyment
- Physical fitness gains	- Social aspects
- Health benefits	- Do not need a partner
- Interested in learning/trying a new activity	- Good exercise, does not cause injury

2.5.6.3 Choice of Programs

Participants were asked why they chose Tai Chi/line dancing over other exercise programs. Several of the responses, such as Tai Chi's gentle nature and its appropriateness for older adults, and not needing a partner for line dancing, were similar to what appealed to respondents about the exercise. Some of the Tai Chi group also mentioned that they chose Tai Chi to accompany friends or family members who were also enrolled in the program. A few responses were: "*...my sister has two artificial knees...I wanted her company*", "*well, my husband's nephew, his wife takes Tai Chi...so I just thought I'd try it*" and, "*my friend was going and she wanted someone to go with her*".

Respondents did not necessarily choose Tai Chi or line dancing over other programs but rather participated in these activities in addition to other classes. One woman stated: "*I chose Tai Chi in addition to other exercises because I started Yoga earlier, and I had been doing a step program, step aerobics, and I'm a committed hiker, and backpacker*". While one line dancer mentioned: "*I already bowled and already swim every morning and I golf, so line dancing seemed the next step*".

The Taoist participants were also asked why they chose to participate in Tai Chi at the Taoist Tai Chi Society instead of at a local recreation/seniors' centre. While some respondents said that: "*my two friends were going there*" and the location was "*very convenient*", others joined to learn the entire form. A gentleman remarked: "*I completed a session at Sackville, but you really don't get deeply into it. There are 108 movements in the Taoist Tai Chi system and there's no way in ten lessons that you are going to complete that and then with the next session after a couple of weeks off... they have to start all over again because there are newcomers*".

2.5.6.4 Relationships With Classmates

From the background survey we learned that many participants reported knowing someone in their class, most often a friend or family member. From the exit interview we learned that some of these fellow participants had previously taken the class (i.e., "*I think she'd been there three or four times*" or "*yes, she had taken it before*") while others were newcomers to the exercise (i.e., "*no, it was her first time*" or "*no, he hadn't*"). Almost the entire experienced group (both Tai Chi and line dancers) reported knowing someone in the class, often someone they met in the class itself. One Tai Chi respondent said: "*I made some friends through it*". Similarly a line dancer also mentioned: "*you make friends...you don't know their last name, but you know them from line dance and as a senior, it's super*".

Mixed responses were received when asked whether their friends or family members influenced their decision to join the program. While some respondents stated that: "*no, I joined on my own*" or "*yes, she kind of encouraged me*', others said: "...we *decided to join together*". Of those who had encouragement to join, many would agree with the statement: "*no, I wouldn't have joined if I hadn't had someone to go with*". When asked if they travel to the class together, most respondents stated "*no, we kind of met there" or "we all come from* *different directions, it's not convenient*". A few stated: "*I use to pick her up because she doesn't drive*" and "*yes, it's only down the road*"

2.5.6.5 Class Experience

The participants were asked on the background survey their reasons for joining either the Tai Chi or line dancing class. Their personal reasons were restated during the exit interview and they were asked, "Was this your experience?" The majority of participants stated that their expectations had been met. The Tai Chi participants had experienced relaxation, felt that they had improved their flexibility, strength, and balance, and/or their overall health. The line dancers stated that they did have fun and met new people.

The expectations of some of the Tai Chi participants, however, were not met. It is noteworthy that these people were complete beginners to the exercise. For instance, one woman said she had joined Tai Chi to improve her mobility and energy level. When asked if this was her experience she stated: "*well, I can't really say about that because I didn't feel that I stayed with it long enough*". Another woman, who joined to improve her overall health stated: "*I can't say for what ailment I have that I felt better, no*". A gentleman noted that: "*I have high blood pressure and I thought the relaxation might do something but it didn't do a thing*". Interestingly, these participants were also all classified as program dropouts.

2.5.6.6 General Impressions of the Tai Chi and Line Dancing Classes

The next part of the interview turned to more general issues. Participants were asked: "What are your overall impressions of the Tai Chi/line dancing class?" The positive and negative impressions of the respondents are summarized in Table 2.13. Not surprisingly, those who adhered to their Tai Chi or line dancing programs reported primarily positive experiences. The Tai Chi respondents made comments like: "*I found it interesting*" and "*it is a good* *exercise ...you are stretching all your arms and muscles*". Many said that the classes "*helped my pain*", "*helped my balance*", "*helped me to be more mobile*" or '*I feel more agile*". The positive impression held by many line dancers was also illustrated through their comments: "*it is fun and beneficial to your health*", "*there is nothing bad about it and you do meet a lot of friends*" and "*oh, I like it. I really enjoy it. I have been in the beginners' class quite a few times. I have tried the advanced class but this is just my speed*".

Table 2.13: Impressions of the Tai Chi and Line Dancing Classes

	Tai Chi	**Line Dance**
Positive Impressions	- interesting activity - a good stretching exercise - physical and health benefits - knowledgeable and interesting instructor	- fun/enjoyable - meet people (socialization) - health benefits - knowledgeable and nice instructor
Negative Impressions	- the exercise is too slow - difficult to remember the movements - instructor teaches too fast (at one centre)	- difficult to remember the movements

Most of the Tai Chi participants felt that Tai Chi is a good form of exercise. One gentleman stated: "*...it is amazing how many parts of the body are involved. Every time you do a movement, how many parts of your body you activate. Invariably, you're moving each arm differently and each hand differently. Your hips move differently, your legs move differently, your feet differently...you are exercising a lot of muscles at the same time which gives you better health*".

Several of the complete beginners, however, felt that Tai Chi was too slow. Illustrative comments in this regard were: "*I didn't get enough exercise from it*", "*It wasn't hard on the body*" and "*(it is) very slow...I guess I want to get places faster*". As expected, some of the Tai Chi participants explained that it was difficult to remember the movements. For example: "*It was a little more difficult to pick up on than we both figured*" and "*the biggest problem is that memory is failing me and I don't remember some of the more complex routines*". Interestingly, the line dancers also mentioned that they had difficulty remembering their steps. The following remarks were typical: "*I still don't have all of the steps down pat but I'm going to re-sign up next week for the same line dancing class*", "*I couldn't catch on to some of the steps right away*", and "*I was really frustrated that I couldn't catch on as well as I wanted to*".

Comments about the class instructors were also made and were generally quite positive. The majority of respondents felt that their instructors were: "*helpful*", "*...very, very good, very knowledgeable*", and "*...the instructors (are) very nice*". A few Tai Chi participants mentioned that their instructor would "*repeat over and over again and she was very reassuring to us that it took a long time to learn all the steps*". There were also some negative remarks. Several Tai Chi participants from the same class (at one senior's centre) believed that their instructor "*teaches too fast*" and that "*she tried to squeeze too much in each session. That's why a lot of people are dropping off*". One woman who dropped out of the program stated: "*I found that I couldn't keep up so, you know, Tai Chi is not meant to get you frustrated...so I decided no, it's not for me*". At a different centre, one Tai Chi participant (a relative beginner who had taken a different form of Tai Chi in the past) did not like the modified form taught at this facility: "*...after doing the authentic Tai Chi, this modified version...there's not as much stretching...I would prefer that a little more*".

2.5.6.7 Impressions of the Tai Chi and Line Dancing Movements

Next, the participants were asked: "What did you think about the Tai Chi/line dancing movements". Most noted that with Tai Chi, "*you have to think*". One beginner said that: "*...at the beginning I was completely bewildered with it...the more you do it the more you can relax and catch on to the movements*". Both adherers and dropouts commented on the challenge in remembering the Tai Chi sequence. For instance, an experienced practitioner stated: "*I cannot remember them all, this is my second or third time taking the class...I just follow along with him (the instructor)*". Others had similar observations, they commented: "*some (movements) were difficult to remember*", "*at first it's a complete puzzle...you have to keep going cause...it takes a long time to make sense and try to remember*", and "*they're not difficult to do, but I find I can't really get a sequence out of them...it's not a set series in say a line dance...I couldn't get to the point where I could go over and over them because I couldn't remember*".

While most did not find the actual Tai Chi movements to be difficult some, who did not adhere to the class, believed that: "*I'm not very well coordinated*" and this made the movements difficult and frustrating to learn and "*we couldn't remember. There wasn't enough practice in between to remember what you took each particular week...when you only go once a week, there's no way you can reinforce what you've learned on any particular day*". As noted earlier, the line dancers were also concerned with remembering their movements. For instance: "*they are hard to remember, all of them*", "*they are frustrating, yes, just the memory part of it, you know, when you get five different steps and you have to coordinate them all into one with the music*", and "*I thought I would never get the routine down but at the end it came together almost effortlessly*".

The next question on the interview script asked: "Did you find it difficult at any time to keep up?" Most of the participants, both Tai Chi and line dancers, stated that did not experience any difficulty with the movements. For example: "*not the actual movement per se*", "*no, they are not hard to do*", and "*no, they are not difficult to do while you are doing them*" were common responses. The difficulty, as mentioned above, was with remembering the movements. This is illustrated by the following quotes: "*It was trying to remember them (the Tai Chi movements) that was difficult*", "*no, they (the Tai Chi movements) are not hard to do. It is just a question of being able to remember them all in one go*" and "*I don't remember it until we start dancing*". A few of the Tai Chi respondents also mentioned that the movements caused them pain (either from arthritis or a previous injury) or they were concerned about doing the movements incorrectly. One woman, who complained about arthritis, mentioned: "*I was afraid of doing things incorrectly and I was afraid I might aggravate some of my joints*" while another said "*with Tai Chi I was, I don't know, I guess inhibited by, afraid of doing things incorrectly*".

2.5.6.8 Feelings After Class

The respondents expressed a number of different views when asked: "How did you feel right after class". Some of the Tai Chi participants agreed that they were "*relaxed*". This feeling of relaxation, however, was not always experienced right away. One woman stated: "*well, towards the end when I started to get the breathing exercises the way I think she wanted them, the relaxation was tremendous*". A few participants also mentioned a relief from pain. For instance: "*you feel lighter…like relief, like if you had pain and after the pain is not severe*" and "*I was just on a high…the pain that was in my body, it erased that pain for that hour and stretching, like oh, I was like in seventh heaven*". Knowing that they had exercised was also mentioned: "*I know I've exercised my knees and body. They are not aching or painful...but I can feel that yes, they've been exercised*". Some Tai Chi respondents also mentioned a feeling of accomplishment. For example: "*I feel good. I've gone out, done something, and seen people, done something for myself and my body*" and "*you have a feeling of relaxation and achievement*". Two respondents, who had dropped out of their class, did not feel any differently after participation. They stated that: "*I felt fine, but I didn't notice any particular difference*" and "*no difference whatsoever*". The line dancers had fewer terms to describe how they felt after class. Most stated: "*I felt good*", "*great, stimulated*" and "*I am never tired. I love dancing so much, I could dance all night*" (comment from a 92 year old line dancer). Only a few participants stated that they felt "*a little bit tired, you know, but I felt good*".

2.5.6.9 Practice at Home

We were interested in finding out whether the participants practiced their activities at home. None of the line dancers practiced at home. A few of their responses and reasons for not practicing were: "*no, I didn't (practice at home). There are too many different dances to remember*", "*no, because I don't have any of her music and I don't know any names of the songs*", "*I don't. I'm such a busy person, I haven't got time*" and "*no, I just go for the social part of it. I'm not interested in being a good line dancer*".

The Tai Chi participants reported different levels of home practice. While some stated: "*I practiced everyday*" or "*just about everyday*" others practiced less frequently. For example: "*(we practiced) when the spirit moved us, let us say...not regularly*", "*I would practice about three times before class*", and "*now and again*". It is surprising to note that a few respondents who said they practiced everyday at home dropped out of their program. Other respondents tried to practice at home but reported difficulty in remembering the movements: "*I tried but I* *found that I just couldn't do it. I really needed someone in front of me, beside me, to follow*" and "*no, I didn't (practice at home). I didn't learn enough to remember*". Difficulty remembering the movements may have been due to the frequency of classes. One gentleman from a seniors' centre remarked: "*...just having it once a week is not enough. They almost need to do it two nights a week. You really need to practice everyday I think*". A few respondents purchased videos or books to help them learn the sequence and to remember the movements when practicing at home. One woman stated: "*I practiced a little bit. I tried to follow a video...I think it helps in a way*" while another mentioned "*I practiced what I could remember. I bought a book and I would dearly love to have it taped so that somebody could talk to me while I try cause you can't read and do*".

2.5.6.10 Activity Comparisons

For those enrolled in other physical activity classes, as indicated on their background survey, we asked: "How does Tai Chi/line dancing compare to other physical activity classes you do?" The respondents reported participation in a variety of different programs. Several Tai Chi respondents participated in a 'Bone Builders' exercise class, which is a progressive strength and muscle-conditioning program. They believed that Tai Chi was "*at a lower pace, more of a relaxing emphasis*", "*less forceful stress on your muscles*", and "*it is a gentler type of exercise*". The gentle, relaxing nature of Tai Chi was also highlighted during the comparisons to various aerobic classes (i.e. 'Gentle Start', 'Motion n' Moderation' and 'Seniors' Fitness'). One woman stated that: "*Tai Chi is more relaxing...and peaceful...you are not worn out and tired*". Differences, such as the music, dance routines, and the higher intensity of aerobics were also mentioned. Illustrative quotes, related to specific classes are listed below:

- "*in Muscles 'n Motion...the girl pushes you...you're just absolutely exhausted by the end of it, but you feel good, you do*";

- *"in Tai Chi you're just completely in a world of your own... in the physical exercises you're so tired at the end of it"*;
- *"with Gentle Start, you're using more your feet and you're going with the music and it's kind of like a dance routine... Tai Chi is a more quiet, relaxing session, where as Gentle Start and Motion 'n Moderation, you're going with the music and you perspire with that class, you know"*; and
- *"the Gentle Start is really quite different... we definitely move to a beat, we have music going all the time and we never stand still... and it takes more out of you... it makes you feel like you're doing something much more energetic, although really, I don't think you are, because I think you don't notice with the Tai Chi, you don't notice so much the movement"*.

Several Tai Chi respondents also participated in various forms of dancing. When comparing Tai Chi to dancing, line dancing was viewed as "*much more active*" and "*more social... in Tai Chi you can't talk all the time, you have to concentrate*". Ballroom dancing was also thought to be "*totally different... you've got music to it ...a partner... it provides a different type of enjoyment*". Tai Chi is also "*a little more relaxing*" than square dancing. One woman noted: "*Tai Chi is similar to square dancing in that you have to remember movements... it is the exact opposite of square dancing where you have a lot of activity and a lot of high impact, whereas Tai Chi... you can go into a trance, and all you have to do is remember the moves*". Finally, when comparing Tai Chi to swimming, several would agree that they felt "*slightly exhausted and worked out after swimming. I don't expect that of Tai Chi*".

Many of the line dancers also participated in other programs. The fun/enjoyment experienced with line dancing was noted in several comparisons. One woman viewed chair aerobics "*like a workout*" while line dancing was more of a fun, social activity. Compared to a fitness club, another commented: "*line dancing is more of a fun thing to do*". Some of the respondents also enjoyed the music played during line dancing, which is not available when swimming, bowling, or golfing. A woman, who roller skated, stated that in line dancing "*you* *need to use your mind a lot*". Another woman described her Yoga class as "*it relaxes, it stretches, it's totally different (from line dancing)...it's all quiet time and peaceful and restful*". Line dancing was also compared to swimming and aquabics. Some believed that "*swimming is an all over exercise, like arms, legs, and everything. Dancing is more from the waist down*" and that "*water exercises, you're going all the time. It's more intense*". Bowling was also an activity reported by some of the line dancers. One woman was concerned about the safety of bowling since she believed that bowling may cause imbalance and result in a fall. She explained: "*...when you stand to bowl, by throwing the ball, I think you kind of lose your balance a little. I've known people that are younger that have fallen...I find bowling a little more strenuous. You have to be more careful. The tiny twists to throw the ball. I think you can lose balance*".

2.5.6.11 Program Suggestions

To try to help improve the programs, we asked respondents: "Is there anything about this class you would like to see changed?" A few beginners to the Tai Chi programs wanted to attend class more frequently so they could remember the movements: "*I would like to practice more than once a week*", or "*twice a week would be helpful*". Several experienced Tai Chi practitioners from the recreation/seniors' centres expressed an interest in attending an intermediate class: "*I would like to see it going on further...it was nice when she had the intermediate class*". Some of the beginners would: "*like to know the names of the movements*" and for the classes to be taught "*a bit slower...she (the instructor) was confusing*". Smaller class size was also suggested. One woman stated: "*the numbers halved at least, cause you can't see. When you exercise, you've got to see the person showing you the exercise*". Over the course of the session, however, some participants did drop out resulting in a smaller class.

During the Winter session, one facility combined their beginner and intermediate classes due to low enrollment. Several of the beginners' believed that the two classes should be kept separate. One woman stated: "*...there was an advanced class in the same room at the same time and they're doing something totally beyond us and its kind of distracting when that's going on while we're doing one bit in the one corner and they're doing theirs in the other*". One gentleman in the same class agreed: "*it is better to have the whole class doing the same thing...so we are all at the same level*". This group also offered some advice regarding the modified version taught at their centre. One woman stated: "*although he (the instructor) is very cautious of our straining muscles and so forth, I would like a little more stretching*".

Suggestions were also offered by several of the Taoist Tai Chi Society participants, concerning aspects of the facility and scheduling. A few people did not like the burning of incense during class. One gentleman stated: "*a few people were allergic to incense, so they stopped going*". Another woman gave a suggestion about parking (this Taoist location is located in a small plaza with approximately 15 parking spaces). She explained: "*...they had an experienced group going from 9:30 to 10:30. Our class was from 10:30 to 11:30. Now the 9:30 people weren't out in time for us to find parking spaces. If their class had finished 10 minutes earlier and allowed us to come in then it would have made it a little easier.*"

Most of the line dancers were happy with their program and did not offer any suggestions. One suggestion, given by respondents from both the Tai Chi and line dancing classes, was that the movements (or dance steps) be given to beginners. For instance, a Tai Chi participant stated: "*a hand out of some sort with the movements written down would help me to practice at home*" while a one line dancer stated: "*...it would have been nice to get a copy of a tape with music and her instructions at some point*".

2.5.6.12 Recommended to Others

Since word of mouth can be a strong source of program advertisement, we wanted to find out if participants would recommend their class to others and why. All of the interviewed line dancers stated that they would and have recommended their class to others. Many reasons for promoting the class were provided, such as:

- "*it's easy and it's fun... if you go to dances and weddings and that, sometimes they have line dancing and you can join in*";
- "*I've met a lot of nice people. It's a lot of laughs*";
- "*...for the exercise, I guess, and if they use if in going out socially, that's fine too*"; and
- "*for the exercise and plain light-hearted fun*".

Most of the Tai Chi respondents would recommend their class to others. Similar to the line dancers, this group also provided a variety of reasons. Most of the respondents would recommend Tai Chi for "*relaxation*", "*for the pleasure of the movements*", and "*for the health benefits and mental benefits*". Many felt that "*it is a very good exercise for seniors*". Two respondents, who were also program dropouts, said they would not recommend Tai Chi to others. Their reasons included: "*I really didn't feel I had accomplished that much*" and "*it just didn't appeal to me*". One gentleman, a relative beginner, stated that he prefers the Yang style of Tai Chi to the Taoist style. He explained: "*the breathing and the movements. Some of the moves are the same it just seems to be more breathing and concentration. Like you do a few movements where you just concentrate. I find that helpful*".

2.5.6.13 Future Plans

Of the 107 interviewed, 73 (68%) said they planned to enroll in the next programming session; while 34 (32%) did not. As shown in Table 2.14, substantially more of the experienced versus the inexperienced respondents ($x^2 = 10.13$, $p<.01$) and program adherers versus the dropouts ($x^2 = 12.76$, $p<.01$) planned to enroll in the next session. Those who planned to enroll into the Tai Chi classes attended significantly more classes than those who decided not to continue. The Tai Chi group who planned to continue attended an average of 7.97 versus 6.26 classes (t=2.28, $p<.05$), while those planning to continue with the Taoist Tai Chi program attended an average of 15.50 classes compared to 10.89 classes (t=2.08, $p<.05$). The line dancers who planned to continue attended 8.38 versus 7.83 classes; this difference was not significant. All groups who planned to continue with their program had fewer reservations at program entry. While the line dancers (mean=0.38 versus 0.50) and Taoist participants (mean=0.37 versus 0.77) who planned to continue with their program (versus those who did not) had fewer reservations at program entry, the difference was the only significant difference for the Tai Chi group (mean=0.26 versus 0.68, t =2.40, $p<.05$). In addition, those who planned to enroll had, on average, fewer health problems and were less likely to report that health limited their activities.

Many (n=61, 78%) of those interviewed after the Winter session planned to reenroll into their respective programs. One Tai Chi participant explained: "*oh yes, I plan to enroll next week*" while one line dancer, who really loved to dance, stated: "*oh (I will dance) until I die. Hope to drop dead on the floor. Oh yes, as long as I can walk, I will dance*". Intentions to reenroll following the Spring session (n=12, 41%), however, declined. In fact, significantly more respondents planned to reenroll after the Winter session than the Spring session (x^2 = 11.41, $p<.01$). Although many programs are limited during the summer months, many participants (both Tai Chi and line dancers), also stated that summer holidays and the pursuit of outdoor activities (i.e., golf, gardening) were reasons to postpone reenrollment until the Fall session. Illustrative quotes include: "*no, we are going to take off on June 1st to the east coast* *for four months*", "*summer is too hectic, I play a lot of golf*", "*oh, not now, maybe later on in the fall…over the summer, I'm busy outside*" *and* "*I do a lot of gardening. I get my exercise there*". Additional reasons not to continue are illustrated by the following comments: "*I am going to try Yoga instead*", "*I experienced too much pain*", or "*I was too frustrated*".

Table 2.14: Intentions to Continue with Program

	Tai Chi (N=57)		Line Dance (N=27)		Taoist Tai Chi (N=23)	
	Planned to Enroll (n=38)	**No Plans to Enroll (n=19)**	**Planned to Enroll (n=21)**	**No Plans to Enroll (n=6)**	**Planned to Enroll (n=14)**	**No Plans to Enroll (n=9)**
Experience Classification						
Complete Beginner	17 (57%)	13 (43%)	9 (75%)	3 (25%)	6 (43%)	8 (47%)
Relative Beginner	11 (69%)	5 (31%)	4 (67%)	2 (33%)	6 (86%)	1 (14%)
Experienced	10 (91%)	1 (9%)	8 (89%)	1 (11%)	2 (100%)	0 (0%)
Adherence Level						
Regular Adherer	29 (73%)	10 (27%)	18 (78%)	5 (22%)	13 (72%)	5 (28%)
Irregular Adherer	3 (60%)	2 (40%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Dropout	6 (46%)	7 (54%)	1 (25%)	1 (25%)	1 (20%)	4 (80%)

- Based on 107 participants who completed the exit interview.

After being introduced to the 108 movements, some Taoist Tai Chi participants planned to move into the transition class, for example: "*we go to the transition class once a week*", while others decided to repeat the beginners class, for instance: "*I'm in the beginner's class and I think I'll go back to the beginners*". Some participants, however, were unsure which class to attend. As expressed by one participant: "*I'm scared to go into the transition class because, like I said, my memory ain't good enough. I have been going back to the beginner's but that is a little on the boring side because I do remember that, so I don't know what we'll* *work out*". Several of the Tai Chi participants also stated that they planned to pursue outdoor activities in the warmer months and rejoin the Society in the fall. Other reasons for not continuing with this program included: "*I am having a hip replacement in a few weeks so I will need to take some time off*", "*I'm recently widowed and am too busy trying to maintain my home*" and "*I did not like Tai Chi…it wasn't for me*".

The final question of the exit interview asked whether they had any other comments about the program that they would like to add. Most respondents thought, "*the program is great*", "*I enjoyed it very much*" and agreed that the interview covered the important topics of discussion. When comments were provided they, oftentimes, restated topics discussed earlier. Comments about the "*teacher (being) very good*", the need to increase the frequency of Tai Chi classes at the recreation/seniors' centres and wanting advanced classes at some centres were stated. A few Tai Chi participants also mentioned the lack of male participants in the classes. One gentleman stated: "*It's great the number of people out. The only thing I was disappointed in was I was the only thorn amongst all the roses*", while another said: "*not many guys, mostly women. It's not macho, I guess. I notice from the other guys they wanna go faster. It's not active enough for them*".

2.5.6.14 Follow-up Interviews

Out of the 73 (68%) participants who planned to enroll in the next programming session, class lists revealed that 60 (82%) had in fact registered or, in case of the Taoist Tai Chi group, were continuing with their program. Breakdowns consisted of 29 (76%) of the 38 Tai Chi participants, 17 (81%) of the 21 line dancers and all 14 (100%) of the Taoist participants. The 13 people (9 Tai Chi and 4 line dancers) who stated during the exit interview that they planned to continue with the program but did not (according to class lists) were eligible to complete a follow-up interview (refer to Appendix G for the script). The findings for the Tai Chi and line dancing participants, respectively, are presented below.

Nine Tai Chi participants were eligible to complete a follow-up interview. Due to the cancellation of one program, four Tai Chi participants were unable to reenroll into Tai Chi at their respective centre. Although this group could not be tracked within this facility, no one enrolled into a Tai Chi program at another location. Each of the four respondents had initiated a new program (i.e., yoga, aerobics), but stated that they would reenroll into Tai Chi if it became available at their centre. Of the five remaining follow-up interviews, three people decided to try another form of Tai Chi offered at their centre or advanced into the intermediate class, while two stated that an illness prevented them from enrolling at this time (but both hoped to enroll in Tai Chi in the future). One woman stated: "*oh yes, I would like to try it again, when I feel better I may give it a try*", while the other agreed: "*sure I would give it (Tai Chi) another try*". When asked if they continue to practice the movements, one respondent did not continue to practice, while the other stated: "*well, I don't remember all of the movements, I do try to practice some of the breathing though*". None of the five people had started any new exercise classes or physical activities. When asked for any further reflections of the program, several participants offered positive comments about their experience. For example: "*I really enjoy Tai Chi, the instructor is very patient to try to teach us all the movements... it also is a good exercise*" and "*Tai Chi is a good exercise for us seniors*".

Follow-up interviews were also completed with four line dancers. Impressively, three of these individuals had moved into the intermediate class offered at their centre while one decided to try another form of exercise (she enrolled into the Tai Chi program offered at her centre). When the later respondent was asked if she would try line dancing again in the future, she stated: "*I'm recently retired and I'm trying a bunch of different classes to see what I like best. I may try line dancing again…I quite enjoyed it*". She did not practice the line dancing steps on her own, she believed: "*…if I was going to practice them, I would need the music and the instructor to lead me along and help me remember the different steps*". No one had started any additional or new exercise classes, except for the one Tai Chi class. When asked for further reflections about the line dancing program, all respondents offered positive comments. Those who were continuing to dance all stated that "*I love to dance*" and "*it's a wonderful class, I meet my friends there and we have a great time…it's a lot of fun*". Sample comments about the instructors included: "*she is a great teacher*", "*the instructor is very enthusiastic*" and "*she really knows her dances, we learn so many different steps, it's just wonderful*".

2.6 Discussion

The purpose of this process evaluation was to learn more about older adults who choose to take part in beginner Tai Chi classes offered in community recreation/seniors' centres, including whether their profile differs from older adults who choose another relatively novel type of exercise class (namely, line dancing) and those who choose to participate in classes at the Taoist Tai Chi Society. This section begins by addressing the study's strengths and limitations. Next, the primary findings are discussed in relation to published literature in the field. Based on the present findings, suggestions are offered concerning future promotion, delivery, and evaluation of community Tai Chi and line dancing classes for older adults.

2.6.1 Study Strengths and Limitations

To date, only one study (Ecclestone et al., 1998) has systematically tracked the enrollment, attendance, and adherence patterns of multiple exercise classes for older adults.

Ecclestone et al.'s study examined 12 different classes, including Tai Chi, offered at the Canadian Centre for Activity and Aging (CCAA) in London, Ontario. In contrast, the present study focused on Tai Chi classes, with line dancing classes at the same community centres and classes at the Taoist Tai Chi Societies in the same region serving as a basis of comparison. While restricted to a small region of Ontario, we sampled a total of 19 classes from eight different recreation/seniors' centres and four Taoist Tai Chi Societies in several cities (i.e., Hamilton, Burlington and Kitchener-Waterloo). While the Ecclestone et al. study tracked patterns over three years, our tracking period was only twelve months. Tracking over a full calendar year, however, did permit examination of seasonal variation.

Evaluation of any real-world program entails limitations, including but not restricted to the customary record-keeping practices of the program(s) in question. While all participating centres maintained enrollment records for each session and attendance data for each class, unfortunately, the Taoist Societies did not separate attendance records of beginners and advanced participants. Attendance data was provided verbally by some instructors or program managers wishing to protect client confidentiality. None of the participating centres routinely collected demographic or other information on their clientele. At the time of Ecclestone et al.'s (1998) tracking study, only age and gender were included in the CCAA's database. In order to develop a more complete profile of older adults taking Tai Chi and line dancing classes, we administered a short background questionnaire. Follow-up telephone interviews were used to verify survey findings, as well as to provide a better understanding of why Tai Chi (or line dancing) classes may appeal to older adults and factors that may inhibit or sustain continued participation. Often referred to as 'triangulation', the use of multiple methods, including both quantitative and qualitative data, can assist with interpretation and strengthen the validity of findings (Patton, 1997; Rossi & Freeman, 1993).

Completion of the background survey and consent for exit and follow-up interviews was totally voluntary in the present evaluation study, as is the case in most evaluation projects. Of the classes approached, the response rate (those who took a survey package divided by the total number enrolled) was 40%, 44%, and 78% for the community Tai Chi, line dancing, and Taoist Tai Chi classes respectively. The return rate for those who took a package was 73%, 56%, and 68%, respectively. The total number of study participants from the Tai Chi classes (n=116) represented 29% of the total number enrolled in these classes (n=396) over the study period. More limited recruitment took place for the line dancing and Taoist classes as explained in the results section. Class attendance data could not be matched with survey data for 12% of the sample as 26 people did not put their name on the consent form. Of those who completed the survey, 73% of the Tai Chi group and 88% of the line dancers provided consent and contact information for interviews. Thus, the "profile" of Tai Chi and line dancing participants is restricted to the sample completing the survey and interviews.

While the present study intended to focus on older adults who were taking Tai Chi (or line dancing) for the first time, and purposefully recruited from "beginner" designated classes, we found that not all participants in these classes were older adults, nor were they necessarily new to this form of exercise. Only the senior centres restricted their membership to persons aged 55 and over. Classes comprised of individuals varying in age and level of experience constitute the reality for many community exercise programs in which participation is primarily based on individual choice versus screening or strict eligibility criteria.

2.6.2 Popularity of Tai Chi and Line Dancing

Tai Chi classes, and especially line dancing classes, appear to be attractive to older adults judging by the enrollment patterns of the community centres we examined. Some of our centres had over 100 individuals enrolled in their line dancing classes. Similar to Ecclestone et al.'s (1998) findings, exercise class enrollment was highest in the fall, fairly high in the winter, but declined substantially in the spring and summer due to both availability and demand. Instructors often took summer holidays. Interview data revealed that many participants pursued other activities (such as golfing and gardening) in the summer and/or took holidays

Another indicator of class popularity or appeal is attendance rates. Based on program records, overall attendance rates were quite high, averaging 72% across the three sessions for the Tai Chi and 68% for the line dancing classes, respectively. Similar to enrollment patterns, there were seasonal variations with attendance being higher in the winter than the spring for both types of classes; fall attendance was comparable to winter for Tai Chi but lower for line dancing. Ecclestone et al. (1998) reported a similar average attendance rate of 68% across their 12 classes over a three-year period. Their one Tai Chi class had the highest average attendance rate (82%) of all the programs offered at the CCAA. No line dancing classes were offered at the CCAA and no other published studies are available for comparison purposes.

The overall, average dropout rate for the 8 to12 week programs was 23% for our Tai Chi classes across the three sessions; 10% for the line dancing classes. In comparison, Ecclestone et al. (1998) reported an average dropout rate of 26% across all 12 types of classes over three months. While dropout rates for each class over three months was not reported, it is noteworthy that at three years, the dropout rate for their Tai Chi class was only 34%, considerably lower than the 46% to 52% dropout for the more traditional aerobic classes

(Ecclestone et al. 1998). Many of the people we interviewed following completion of their Tai Chi class (68%) said they intended to enroll in an upcoming session; registration data verified that 80% did so. Factors related to continued participation, which emerged from the present findings, are discussed following the profile of older adults who take part in these classes.

2.6.3 Profile of Participants in Tai Chi and Line Dancing Classes

Sample attendance and dropout rates were very similar to overall rates, providing one indication that the study sample (those who completed the survey) may be representative of program participants as a whole. As previously reported, 29% of those enrolled in the Tai Chi classes over the calendar year completed surveys. Given that the same individuals often enrolled in more than one session, in all likelihood our sample included more than one third of all Tai Chi participants. Comparability of the sample profile to previous studies enhances confidence that our sample was representative of older adults who join such programs.

Based on the survey data, the profile of older adults who tend to join Tai Chi classes held in recreation/seniors' centres in Southern Ontario is predominately female, Caucasian, younger (average age mid-sixties), fully retired, relatively healthy, and physically active. When accounting for the fact that only the senior centre classes were restricted to members aged 55+, the demographic profile of participants in the Tai Chi and line dancing classes was comparable. For example, the slightly higher percentage of females, widows, and retirees likely is due to the slightly higher age of the line dancing sample from the senior centres. Participants in both types of classes had a range of educational backgrounds. In contrast, the somewhat younger Taoist sample was more likely to have post secondary education and still be working.

Evaluation studies of other community exercise programs for older adults (e.g., Ecclestone et al. 1998; Myers & Hamilton, 1985; Sager, 1983; Sepsis et al., 1995), have similarly found that participants tend to be predominantly female, Caucasian, relatively healthy, and active. Seniors who tend to join recreation/seniors' centres in Canada also fit this profile (Novak, 1997). It may be that ethnic minority groups are less likely to join these centres in general; Chinese elders who continue to practice Tai Chi may simply prefer to do so alone or with friends. Interestingly, all three Asian individuals in our sample were in the line dancing classes. In general, community exercise programs have difficulty attracting males and non-white, non-English speaking older adults (Sepsis et al., 1995). Strength and aerobic classes appear to attract a higher proportion of older men, while male only classes (such as the Men's Retirement Group at the CCAA) are the most popular (Ecclestone et al., 1998). The CCAA's Tai Chi class was 85% female, comparable to the Tai Chi classes we examined.

Taken together, our survey and interview findings suggest that many of these older adults did not choose Tai Chi (or line dancing) as their only form of exercise. Many (43%) took part in other exercise classes (often dancing, aquatics, or aerobics), while most (82%) engaged in less formal activities (predominately walking and swimming). Almost half the sample reportedly accumulated at least 30 minutes or more of moderate intensity activity at least three days a week. Over half said they had been physically active "off and on" all their lives; a third had always been active. While Ecclestone et al. (1998) did not obtain a detailed physical activity profile of their participants, they did find that 21% had tried out or transferred between exercise classes at the CCAA over the tracking period. They note that this percentage may have been higher if more classes were not filled to capacity (Ecclestone et al., 1998).

3.6.4 Factors Related to Participation

Similar to Stephens' (1988) population survey findings, "feeling better mentally and physically" captured the most frequent reasons provided by older adults for joining Tai Chi classes. While line dancers also joined to improve physical fitness, they were far more likely to cite friendship, social, fun, and enjoyment as reasons for joining. The higher attendance and adherence rates of the line dancing group may be due to achieving these more short-term expectations. During the interview, many of the continuing line dancers confirmed that the class had met their expectations. In contrast, some of the Tai Chi participants who dropped out of the program said they did not feel any different.

Previous studies have reported that the opportunity to socialize and making new friends is an important feature of exercise classes for some older adults (Myers & Hamilton, 1985; O'Brien-Cousins & Horne, 1999). About half of our sample reportedly knew someone in his or her class at the beginning of the session. Given that a substantial number also participated in other exercise classes and activities at the centres in question, it is also not surprising that many knew someone in their Tai Chi or line dancing class. The interview data revealed that some participants may not have joined without a friend or family member. Another perspective came from some of the line dancers who specifically mentioned that, unlike other forms of dancing, one does not need a partner for line dancing. Over half of our sample of line dancers, and most of our Tai Chi sample were widowed, separated or divorced. Some of the married women in our sample noted that their husbands did not like to dance. Class or group options, particularly those not requiring a partner, may be particularly appealing to older women who have difficulty finding an exercise companion (Curtis & White, 1984).

Although we recruited from beginner classes, we found that the profile of participants in both the Tai Chi and line dancing classes varied with respect to level of experience with the exercise in question. Only half of our sample were complete beginners or totally new to the exercise. About a quarter were 'relative beginners', while the remainder was more experienced.

Not surprisingly, those with previous experience expressed fewer reservations (particularly skill), about taking the class.

Both Tai Chi and line dancing are progressive and involve constantly learning and refining new movements or skills. Self-efficacy or confidence in being able to perform a given activity is a well-known factor related to exercise adherence in general (Dishman, 1994), and may be particularly important in Tai Chi. One study by Li et al. (2001) specifically examined the self-efficacy of a group of older adults completing a six-month Tai Chi program (24-form, Yang style, twice a week). Eighteen percent dropped out, while adherers attended 90% of the sessions. They found that self-efficacy related to Tai Chi performance improved at week 12 and was maintained at six months. Changes in self-efficacy were positively related to program attendance (Li et al., 2001).

If people miss classes and/or do not practice outside of class, they may quickly become frustrated and feel left behind, particularly if classes are only offered once a week, over a short period of time. While we found class attendance to be high, not many individuals reportedly practiced outside of class. And, although the majority of our Tai Chi sample was confident that they would be able to perform the movements at the outset, in the exit interviews several beginners acknowledged difficulty keeping up at times and remembering the movements. It is noteworthy almost a quarter of our complete beginners dropped out of their class, a higher proportion than those with some experience. Those with previous experience know what to expect, may remember some of the steps or sequences from earlier instruction, and likely have higher levels of confidence.

The interview data indicated that some older adults were quite content to repeat the beginner Tai Chi (or line dancing) classes, several times if necessary, in order to learn the movements. A number of people said they would prefer their classes to be held more often (twice a week was suggested). Some of our experienced community participants noted that they would take an intermediate class if offered at their centre.

2.6.5 Participant Impressions

Only one study to date has empirically examined participant impressions of Tai Chi. Based on dichotomous responses from structured interviews at the end of the 15-week intervention, Kutner et al. (1997) found that the Tai Chi group was significantly more likely (than an education group) to report that participation had a noticeable effect on their life, affected their activities of daily living, and changed their pattern of physical activity. In the present study, each interview was fully transcribed and analyzed using recommended strategies to capture the richness of qualitative data. A total of 107 interviews were completed at the end of the program session (57 with Tai Chi, 27 with line dancers, and 23 with Taoist participants). Complete beginners, relative beginners, and experienced participants, as well as adherers and dropouts, were represented in each, similar to the distribution of the larger survey sample. Some of the interview findings have been discussed in previous sections, here we focus on experiences and impressions of Tai Chi and line dancing.

When asked to describe their experiences with Tai Chi (or line dancing), several people believed that both activities were less likely to result to injury or falls. Tai Chi was commonly perceived as a safe and gentle activity, appropriate for older adults. Many described Tai Chi as relaxing and meditative in contrast to more vigorous classes such as aerobic or step classes. While some said they chose Tai Chi because they could not do aerobics, many took part in various classes to fulfill different needs. For instance, line dancing was perceived more as a social, fun activity; many participants said they simply loved music and dancing.

Not surprising, those who adhered to their program reported primarily positive experiences. The Tai Chi adherers found the class interesting and said that it helped them concentrate and relax, and for some, feel more agile, improve balance and mobility, or reduce pain. Several mentioned a feeling of accomplishment. A few did mention that that they were concerned about doing the movements incorrectly and aggravating their arthritis or other health problems. Conversely, the Tai Chi dropouts who were also beginners, did not feel any differently or achieve the results they had anticipated. The line dancers, meanwhile, generally had fun and most said they felt energized after their class. Since several people participated in both Tai Chi and line dancing, they could compare the two forms of activity. Not surprisingly, line dancing was described as much more active, social, and fun; Tai Chi was more relaxing and required more concentration. Both types of exercise were seen as challenging with respect to learning the movement or steps and coordination. A few people, however, commented that Tai Chi was too slow for them or required too much coordination. As reported in the previous section, difficulty or frustration in learning the Tai Chi movements was often reported as a reason for discontinuing the class.

Most of our sample stated that they would, and some said they did, recommend the Tai Chi or line dance class to friends or family. Many of our respondents offered comments about their instructors, mostly positive, and some offered suggestions for improving the program. Participant feedback, as well as findings based on program records and the survey data, constitute the basis for recommendations offered in the next section concerning future promotion, delivery and evaluation of community Tai Chi and line dancing programs. While some of the suggestions are specific to these centres, others are more generally applicable.

2.6.6 Suggestions for Programmers and Instructors

Currently, these recreation/seniors' centres are not attracting a high proportion of males or ethnic minorities to their Tai Chi or line dancing classes. Even Tai Chi and line dancing classes we observed with male instructors did not attract a high percent of male members. Minority groups may need to be reached through their own cultural centers. A broader issue is the extent to which older adults in general are aware of these offerings in their communities. While the recreation/seniors' centres we examined had brochures or guides describing their class offerings, these materials were not distributed, but rather had to be picked up from the centre itself. Only the Taoist Tai Chi Societies advertised through local newspapers. The relative effectiveness of different promotional strategies for community exercise classes targeting older adults warrants empirical examination.

All the centres included in our study routinely collected enrollment and attendance data for their classes. This data can be extremely useful for tracking patterns over time, including seasonal variation. By administering a brief background questionnaire to all new registrants, as was done in this study and generally recommended by Myers (1999), programs can develop a more detailed profile of participants in different types of classes. Furthermore, this information can be used to compare program adherers and dropouts.

With respect to the delivery of Tai Chi classes, community centres should consider offering beginner classes twice a week, or at least periodic drop-in or make-up classes. The vast majority of the centres we examined offered Tai Chi classes only once a week. Many of people in our sample reported frustration in learning the Tai Chi movements and suggested that classes be offered twice a week. Li et al. (2001) found that twice a week was sufficient to increase self-efficacy related to Tai Chi participation. While Tai Chi experts recommend daily practice, daily classes are not feasible for most community centres nor would busy older adults likely attend on a daily basis. While we found that not many people were willing to practice on their own outside class, some did buy books or videos to practice at home, while others suggested that the centres provide handouts or tapes to assist them.

Other aspects of program delivery also require attention in some of the centres. For instance, participants complained that some instructors went too fast, or they could not see the instructor, or were distracted by another class being held in the same room. Instructors need to be sensitive to the needs of older adults, some of whom are likely to have hearing and vision problems. Skill-based activities, like Tai Chi and line dancing, require more concentration than other types of exercise classes, and older participants, particular beginners, may easily become frustrated. Asking participants if they would like to repeat sequences and carefully observing participants are two methods that instructors should use to help pace their classes. Strategic positioning to ensure that all participants can see the instructor is very important. Several centres had a stage that allowed everyone to see the instructor more easily. Another method, employed by one of the large line dancing classes we observed, was to arrange the participants in long rows across the gym. They rotate after each dance so that everyone has the opportunity to practice in the front row. Having multiple demonstrators strategically located around the room, which was the case in some of the centres, also assists older adults in seeing and following the movements. Thus, community programs can learn from one another. In addition, exercise instructors working with older adults are advised to take specialized training through courses, such as those offered by the Canadian Centre for Activity and Aging.

Finally, instructors should provide group and individual feedback to motivate participants. Programs, meanwhile, should provide suggestion boxes, periodically conduct focus groups to obtain in-depth feedback from participants, and routinely conduct short telephone interviews with absentees and dropouts as part of the ongoing evaluation of their programs (Myers, 1999).

2.6.7 Conclusions

This project represents the first attempt to profile older adults involved in community Tai Chi and line dancing programs at multiple recreation/seniors' centres. We found that older adults who tend to join Tai Chi or line dancing classes are predominately female, healthy, and active. Although designated as beginner classes, participants varied in their level of experience. Class enrollment and attendance was high, particularly in the fall and winter, while dropout was relatively low indicating these classes appeal to older adults. Both the survey and interview findings revealed multiple factors related to initial and continued participation.

As more seniors experience this novel form of exercise, the demand for more frequent offerings and more advanced Tai Chi classes may increase. Currently, these centres primarily offer an introduction or exposure to Tai Chi, which is important in and of itself. Ecclestone et al. (1998) found that individuals who tried out or participated in more than one of the CCAA programs (either concurrently or sequentially) were significantly more likely to continue participating at the centre over the long-term. Some of the individuals we interviewed noted that they had recently retired and were trying a variety of different exercise programs. The survey data also supported the pattern of multiple and concurrent class participation. The finding that about one-fifth of the sample were "relative beginners" (i.e., took Tai Chi or line dancing before but not during the previous session) further supports Ecclestone et al.'s (1998) assertion that it is not uncommon for older adults to try out various activities, leave classes for extended periods, and then return to classes, sometimes a year or more later. We concur with their caution that we must be "careful not to infer exercise dropout from program dropout", as well as their conclusion that "restricting ourselves to examining single programs, we will miss the complexity and richness of the older adult experience with physically active lifestyles" (Ecclestone et al., 1998, p. 81). More qualitative and longitudinal studies are needed to examine older adult experiences with various forms of exercise, including Tai Chi and line dancing.

Our findings serve as a basis of comparison for other programs, evaluation and research studies. These process evaluation findings were also helpful in interpreting results from the outcome evaluation study, which is the topic of the next chapter. The outcome study, in turn, allowed us to extend the profile of older adults who enroll in community Tai Chi and line dancing classes to include physical and psychophysical parameters.

Chapter 3 Study Two: Outcome Evaluation

3.1 Introduction

The World Health Organization (WHO) (1997a) has outlined the multiple physical, psychological, and social benefits of regular exercise and physical activity for older adults, both immediate and long term. While the cardiorespiratory benefits of aerobic exercise have received the most research attention to date, strength, balance, and flexibility may be as important, or more important, for maintaining the functional independence of older adults (Pate et al., 1995). Psychological benefits of exercise participation are also important and may represent an important reason for adherence to exercise programs (McAuley & Rudolph, 1995). Research is beginning to address the multiple and relative benefits of various forms of exercise for older adults.

A literature search was conducted to locate published research on the physiological and psychological effects of Tai Chi and line dancing (chosen as a comparison program). Database (Medline, 1966 to present; SPORTDiscus, 1975 to present; and PsycINFO, 1987 to present) and internet searches yielded a total of 58 articles on Tai Chi. Very little empirical work was found on line dancing-- two relevant empirical articles and one abstract.

For the Tai Chi literature, 26 articles provided descriptive reports of the historical and philosophical origin of Tai Chi, personal testimonials, and the proposed benefits of Tai Chi practice. Thirty-two articles constituted empirical studies; nine studies investigated the benefits of Tai Chi for young adults, 23 looked at older adults. The young adult samples ranged in age from 20 to 40 years; average sample age was in the mid-30s. The older adult samples were generally healthy community dwelling residents who ranged in age from 40 to 81 years; all studies in this category reported a mean age of at least 55 years. The literature completed on young adults is not included in this review, since the focus of this study is on the benefits of Tai Chi on older adults. For interested readers, summaries of the studies with younger adult samples are available in Appendix H.

As previously noted in Chapters One and Two, Tai Chi has been practiced for centuries in China and it is being increasingly offered at community recreation/seniors' centres in North America. Tai Chi is believed to have numerous beneficial effects, both physical and psychological. To date, however, the evidence concerning the benefits of Tai Chi is limited and inconsistent. The next section summarizes and critiques the existing empirical literature on physical outcomes (namely; balance, strength, flexibility, cardiorespiratory functioning, and motor control), and psychological outcomes thought to be influenced by Tai Chi practice. A more extensive description of this body of literature can be found in Gavin (1999). Following the review of Tai Chi studies, available articles on the impact of line dancing are examined and the similarities between line dancing and Tai Chi are discussed. The rationale for the present outcome study is presented next, followed by a description of the methods, results, and discussion of the findings.

3.2 Existing Studies on the Impact of Tai Chi

3.2.1 Balance

Age-related changes in the neural, sensory, and musculoskeletal systems can lead to balance impairments. "Balance is required for maintaining a position, remaining stable while moving from one position to another, performing acts of daily living, and moving freely in the community" (Berg, Maki, Williams, Holliday, & Wood-Dauphinee, 1992, p.1073). Loss of balance is a frequent cause of falls and fractures in older adults and can result in severe physical and psychological trauma (Lumsden, Baccala, & Martire, 1998).

One of the most widely touted benefits of Tai Chi for older adults is improved balance. Tai Chi is thought to improve both static and dynamic balance and to reduce the incidence of falls and fall-related injuries (Kessenich, 1998). Static balance involves the ability to stabilize a body position without movement, while dynamic balance involves the ability to maintain balance when the body or base of support is moving (Yan, 1998). Static balance is observed during the Tai Chi movements that require participants to reduce their base of support and stand on one leg. Tai Chi also requires a continuous change in body positioning and shifting between weight bearing and non-weight bearing movements. These positional changes, requiring appropriate weight distribution, and weight shifting from one foot to the other may involve dynamic balance.

3.2.1.1 Tai Chi and Balance Performance

Seven studies (summarized in Appendix I) were located that examined the effect of Tai Chi on balance performance (static and/or dynamic) of older adults. Two studies, Tse and Bailey (1992) and Hong, Li, and Robinson (2000), compared the balance of experienced Tai Chi practitioners (1 to 20 years and an average of 13.2 years of practice, respectively) to non-practitioners. In Hain et al.'s (1999) study, meanwhile, participants with a mild balance disorder completed eight weeks of Tai Chi training. Wolf and colleagues (1997a) randomly assigned older adults into Tai Chi, balance training, or an educational session for 15 weeks. Wolfson et al. (1996), meanwhile, utilized Tai Chi as a maintenance program for three months after completing balance training, strength training, balance and strength training, or an educational session. Participants in Yan's (1998) study voluntarily chose to either participate in a Tai Chi or walking/jogging program for eight weeks. Finally, Schaller's (1996) sample chose to participate in a Tai Chi class or to continue with their usual activities for 10 weeks (Schaller, 1996).

Tai Chi practitioners (both experienced and beginners) were generally able to maintain balance longer than non-participants (Hain, 1999; Hong et al., 2000; Schaller, 1996; Tse & Bailey, 1992; Yan, 1998). Improvements were found in static balance during the single leg stance test when the eyes remained open (Hain, 1999; Schaller, 1996; Tse & Bailey, 1992) and closed (Hong et al., 2000). No improvement in reach (Hain, 1999) or a platform balance measure (Wolf et al., 1997a) were found for Tai Chi participants. The balance training group in Wolf et al.'s (1997a) study, however, reported greater stability compared with the Tai Chi or education groups. Dynamic balance, examined through tandem walking (Tse & Bailey, 1992) or via a stabilometer (Yan, 1998) revealed positive findings for the Tai Chi groups. Finally, although balance gains decreased during the maintenance phase (practiced Tai Chi once a week and at home), the improvements for the balance training interventions were still significant at the nine-month follow-up (Wolfson et al., 1996).

Although the literature generally supports a positive impact of Tai Chi practice on balance, it is difficult to generalize these study findings to community based programs for a number of reasons. First, the duration and frequency of Tai Chi interventions often differ from community programs. Tai Chi programs in community recreation/seniors' centres are typically offered for 60 minutes, once or twice a week for 8 to 12 weeks. In contrast, Yan's (1998) subjects practiced for 45 minutes, three times a week for 8 weeks, while the participants in Wolf et al.'s (1997a) study practiced for 60 minutes, twice a week, for 15 weeks. Only two studies examined interventions similar to programs offered in the community. Schaller's

(1996) participants practiced for 60 minutes, once a week for 10 weeks, Hain et al.'s (1999) group for 60 minutes, once a week, for eight weeks. Secondly, the type of Tai Chi examined in research studies often differs from community settings. For instance, Hain et al.'s (1999) sample practiced seven movements from three different Tai Chi styles (Yang, Pa-Kua, and Wu), Yan's (1998) group practiced the 24 simplified form, while the participants in Schaller's (1996) study practiced Tai Chi Chih. While Tai Chi is often modified in community settings, the modifications typically involve a small number of movements from a single form (typically the Yang style) rather than a combination of movements from several forms.

Neither short-term or long-term balance effects of Tai Chi have been established convincingly to date. Tse and Bailey (1992) compared the postural control of two groups of 12 Chinese elders (aged 65 to 86) who were either practitioners (1 to 20 years of experience) or non-practitioners of Tai Chi. The practitioners performed significantly better on single leg standing with eyes open (but not closed) and heel to toe walking. In contrast to Tse and Bailey's (1992) findings, Hong, Li, and Robinson (2000) found that the scores of their experienced Tai Chi Chuan group (average of 13.2 years of experience) in single leg standing with eyes closed were higher than that of the sedentary group. This discrepancy may be due to long-term practice; some participants in the Tse and Bailey's (1992) study had only one year of Tai Chi experience. As well, the type of Tai Chi performed and the frequency of practice may influence the benefits obtained. Unfortunately, Tse and Bailey (1992) did not provide this information. Finally, although these studies suggest that Tai Chi may improve balance, baseline measures of the experienced groups were not taken before initiating their Tai Chi program and participation in past or current activities were not controlled for.

3.2.1.2 Fear of Falling and Balance Confidence

In addition to balance performance, two studies (see Appendix I) also examined balance confidence or fear of falling (Wolf et al., 1997a; Wolf et al., 1996). Fear of falling has been defined as a "low perceived self-efficacy at avoiding falls during essential, nonhazardous activities of daily living" (Tinetti, Richman, & Powell, 1990, p.239). This heightened anxiety that one will fall, can result in self-imposed activity restriction and a loss of independence (Myers et al., 1996). This fear is prevalent in the older adult population, even among seniors who have not experienced a serious fall or resulting injury (Maki, Holliday, & Topper, 1991). Fear of falling has been assessed by simply asking the person whether or not they are afraid of falling (Maki et al., 1991). Inquiring into the extent of one's self efficacy or confidence to maintain balance within a variety of situations, however, may be a more accurate way of operationalizing fear of falling (Tinetti et al., 1990).

Two studies, using randomized designs, suggest that Tai Chi may prevent falls by promoting confidence or reducing the fear of falling in older participants (Wolf et al., 1997a; Wolf et al., 1996). The participants within these studies were part of the Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT) trials and were assigned to Tai Chi, balance training, or an education group. Wolf et al. (1996) found that the Tai Chi group was more confident than the education group and reduced their rate of falling by almost 48%. As noted under balance performance, Wolf et al.'s (1997a) balance training group showed significantly greater postural stability post-training; the Tai Chi group however, was more confident after training compared to the other interventions. The authors speculated that the reduced rate of falling noted in their earlier study (Wolf et al. 1996) may have been due to improved confidence versus postural stability.

The Falls Efficacy Scale (FES) was used in both studies to assess balance confidence. The FES focuses on simple activities of daily living (mostly indoor activities) and has been criticized as not being sensitive enough to assess loss of balance confidence in higher functioning seniors (Powell & Myers, 1995). The Activity Specific Balance Confidence (ABC), described further under the measurement section, includes greater item difficulty and may more accurately assess balance confidence in healthy, independent, community dwelling older adults (Myers et al., 1996).

3.2.1.3 Summary

The research to date provides preliminary but encouraging findings that Tai Chi may be effective in improving balance and reducing the risk of falls. It remains uncertain, however, whether gains in balance are due to an increased sense of confidence, changes in balance performance, or a combination of both factors. Although a number of studies have found that Tai Chi may improve both static and dynamic balance, this work has often examined different forms of Tai Chi, practiced at a greater frequency and duration compared to community based programs. Variability in balance assessment, from the popular single leg stance to sophisticated platform measures, also exists. Further prospective studies are needed to assess balance performance and balance confidence of Tai Chi participants in real community programs.

3.2.2 Muscular Strength

Muscular strength and endurance have been reported to decrease with advancing age. Strength increases throughout childhood and adolescence, peaks during the mid-twenties, slowly declines until age 50, and then declines more quickly in the later years of life (Wolfson et al., 1993). Declines in muscle strength in older persons may compromise functional tasks such as carrying groceries or climbing stairs. The decline in muscular strength, however, is not inevitable. Research has shown that resistance-training programs can increase the strength and functional ability of older adults (Judge, Lindsey, Underwood, & Winsemius, 1993). Research into less expensive community based exercise initiatives, such as Tai Chi, is needed. Tai Chi has the potential to impact both muscle strength and endurance since various types of contractions are incorporated into the movements. These concepts are explained below.

Muscular strength is the amount of force that a muscle or muscle group can exert against resistance, while muscular endurance is the ability to apply a force repeatedly or to sustain a contraction for a certain length of time (Hockey, 1993). Three types of muscle contractions exist: isometric, isotonic, and isokinetic. During an isometric contraction, no movement takes place at the joint since the force exerted by the muscle is equal to or less than the resistance (Hockey, 1993). Movement occurs at the joint during an isotonic contraction since the force generated by the muscles is greater than the resistance; resulting in a shortening or lengthening of the muscles. The strength of the muscle varies at different angles and the speed of the movement can influence the difficulty of the task. Finally, an isokinetic contraction is a type of isotonic contraction. During an isokinetic contraction the speed of the motion is controlled so that resistance is varied to match the force applied to the muscles. At the points at which muscular force and mechanical advantage are greatest, the resistance will also be greatest, resulting in constant speed. This provides maximum resistance throughout the range of motion (Hockey, 1993).

3.2.2.1 Tai Chi and Muscular Strength

Only four studies to date (described in Appendix J) have specifically examined the impact of Tai Chi on strength. Wolfson et al. (1996) randomly assigned participants into one of four groups: balance training, strength training, balance and strength training, or education, Wolf et al. (1996), meanwhile, randomly assigned older adults into Tai Chi, balance training, or an educational session. Lan et al.'s (1998) sample voluntarily chose to either participate in a Tai Chi training program or to serve as a sedentary comparison group. Finally, in the Kirsteins, Dietz, and Hwang (1991) study, patients with rheumatoid arthritis were assigned to participate in either a Tai Chi program or were asked to continue with their usual activities.

The findings from these four studies were mixed. Two of these studies did not find significant changes in the contractions of the knee, hip, ankle (Wolf et al., 1996), or handgrip strength following 10 weeks (Kirsteins et al., 1991) and 15 weeks (Wolf et al., 1996) of Tai Chi practice. One study reported an increase in both knee extension and flexion following 12 months of Tai Chi training (Lan et al., 1998); while another found that Tai Chi maintained the strength gains for three months following a strength training intervention (Wolfson et al., 1996).

It is difficult to draw conclusions as the four studies used different Tai Chi protocols/interventions and measured different types of muscular contractions, at different sites. As the authors themselves note, 10 to 15 weeks of Tai Chi may not have been sufficient to improve strength (Wolf et al., 1996). Two of these studies assessed handgrip strength using a hand dynamometer (Kirsteins et al., 1991; Wolf et al., 1996). Given that Tai Chi does not focus on strengthening the upper extremities, it is not surprising that handgrip strength did not change. Variations in measurement tools are described below.

The isokinetic strength of the knee (Lan et al., 1998), hip and ankle (Wolfson et al., 1996) was measured with an isokinetic dynamometer. This device is a sophisticated piece of equipment that allows the subject to apply maximum resistance throughout the specified range of motion. The dynamometer is set at a speed similar to that of the contraction performed during the exercise (Canadian Society for Exercise Physiology (CSEP), 1995). Although this technique has a high degree of reliability, there are arguments against its use. The chief amongst them is the fact that acceleration and changes in joint velocities are a feature of virtually all sports, including Tai Chi. Thus, the sport specific movements may not be accurately assessed. The cost of isokinetic dynamometers is also high and they are not readily portable or practical for a field setting.

Wolf et al. (1996) assessed isometric contractions of the hip, knee, and ankle using a Lafayette muscle tester, which measures the amount of force (during a maximal voluntary contraction) exerted against an immovable object (Clarkson & Gilewich, 1989). The use of belt-resisted testing methods may be more appropriate for field testing (portability and low cost), and especially when assessing older subjects (Desrosiers, Prince, Rockett, & Raiche, 1998a). Belt-resisted methods reduce or eliminate possible discomfort since the belt, which is fixed to a stable structure, applies the isometric resistance opposed to resistance being applied by the examiner. The participant has total control over the force exerted and can adjust if pain occurs (Desrosiers et al., 1998a). Older subjects reportedly prefer the belt resisted method over the examiner-resisted method, felt more stable while performing the contraction, and were willing to attempt a stronger contraction (Kramer, Vaz, & Vandervoot, 1991).

3.2.2.2 Summary

Two studies to date indicate that long-term participation (12 months) in Tai Chi may be effective in improving the lower body strength of older participants (Lan et al., 1998), and maintaining strength gains (Wolfson et al., 1996). The two studies, with durations comparable to community programs (10 weeks in Kirsteins et al., 1991; 15 weeks in Wolf et al., 1996), did not find improvements in hand grip strength or isometric contractions of the hip, knee, or ankle. Since Tai Chi movements are not designed to strengthen the upper extremities, it is not surprising that studies have not found changes in handgrip strength (Kirsteins et al., 1991; Wolf et al., 1996). Clearly, more research is required in this area. Future research should use measures of muscle strength that closely match the specificity of Tai Chi training and are appropriate and comfortable for older participants.

3.2.3 Flexibility

Flexibility may be one of the most important, but often neglected, outcomes of physical activity for older adults. Flexibility is defined as "the capacity of a joint to move freely through a full range of motion without undue strain" (Hockey, 1993, p.15) and is essential for many everyday tasks. Flexibility is site specific; good range of motion at one joint does not reflect the flexibility of other bodily joints (Hockey, 1993; O'Brien-Cousins & Horne, 1999). While flexibility has been found to decrease with age, this is more likely the result of reduced physical activity than aging per se (O'Brien-Cousins & Horne, 1999). Regular participation in activities that move a joint through its full range of motion can help to increase and maintain flexibility (Hockey, 1993). The emphasis on stretching during Tai Chi is believed to improve the flexibility of many bodily joints (Yan, 1995).

3.2.3.1 Tai Chi and Flexibility

To date, the effect of Tai Chi on the flexibility of older adults has been examined in seven studies (refer to Appendix K). Four of these studies used an experimental design; three randomly assigned participants into a Tai Chi or control group (Chen & Sun, 1997; Lan et al., 1998; Sun, Dosch, Gilmore, Pembeton, & Searseth, 1996), while Wolf et al. (1996) randomly assigned older adults into balance training, Tai Chi, or an education program. Schaller's (1996) sample voluntarily chose to participate in Tai Chi or to serve as a comparison group.

Finally, the studies by Lan et al. (1996) and Hong, Li, and Robinson (2000) involved static group comparisons of experienced Tai Chi practitioners with sedentary controls. The five interventions for new participants ranged from 10 weeks to 12 months in duration. The experienced practitioners in Lan et al.'s study reported 11.8±5.6 years of experience, while Hong, Li, and Robinson's (2000) group reported 13.2±3.7 years of practice.

Experienced practitioners and beginners who completed a Tai Chi program generally had greater flexibility scores in comparison to non-participants (Chen & Sun, 1997; Hong et al., 2000; Lan et al., 1998; Lan et al., 1996; Sun et al., 1996; Wolf et al., 1996). Improvements in flexibility were reported for the thoracic/lumbar spine (Lan et al., 1998), shoulder and knee (Sun et al., 1996) and the lower extremities (specific joints were not specified) (Wolf et al., 1996). Inconsistent findings were reported for trunk and hamstring flexibility (Chen & Sun, 1997; Hong et al., 2000; Schaller, 1996; Sun et al., 1996). This variability may be due to the method of assessment (sit and reach test versus goniometer) or to a self-selection bias. As noted, the participants in Schaller's study (1996) self-selected into either a Tai Chi or a comparison group (asked to continue with their current level of activity). Baseline data revealed that although their comparison group was more active than the Tai Chi group, no difference in trunk and hamstring flexibility was found.

In the six studies to date, flexibility has been measured in several ways, including: (1) the sit and reach test to assess trunk and hamstring flexibility; (2) electronic, digital inclinometers to measure the flexion of the thoracic/lumbar spine; and (3) goniometers to assess trunk, knee, and shoulder flexibility. The sit and reach test is a simple measure of trunk flexibility (frequently used in large-scale surveys) which provides more reproducible data than simple goniometer measurements (Shephard, Berridge, & Montelpare, 1990). The goniometer (essentially a protractor with two long arms) must be placed on the centre of the joint being measured and the arms aligned with the involved limbs. The angle of the joint is then recorded (CSEP, 1995). The reliability and validity of goniometry has been challenged due the difficulty in locating the true joint centre and aligning the arms properly along the bones of the limbs. As well, the goniometer is unlikely to detect small changes in flexibility (Hubley-Kozey, 1991). When used correctly, the inclinometer may provide a more accurate assessment of flexibility. Some inclinometers use either fluid or gravity to assess joint angles; others are electronic. Inclinometers eliminate the difficulty of aligning the long arms of the protractor type goniometers. This hand-held instrument is placed on the joint to be measured and a reading obtained (CSEP, 1995).

3.2.3.2 Summary

Although there is some evidence to suggest that experienced Tai Chi practitioners have greater flexibility and that older adults can improve their flexibility through Tai Chi training, further research is necessary to examine the impact of different forms of Tai Chi on the flexibility of various joints. Studies to date vary in terms of both the frequency and duration of the intervention, as well as the methods (sites examined and instruments used). Joint specificity, related to the exercise in question is a critical issue when examining flexibility as an outcome measure. Future research needs to verify existing findings and extend the examination of flexibility to other areas of the body, specifically the joints that move through their full range of motion during Tai Chi practice.

3.2.4 Cardiorespiratory Functioning

Research has demonstrated that regular participation in vigorous aerobic type exercise (even when started in later life), can be beneficial in slowing the decline of the cardiorespiratory system (O'Brien-Cousins & Horne, 1999). Cardiorespiratory fitness, which involves the ability of the cardiovascular and respiratory systems to take in and deliver oxygen utilized by the working muscles (CSEP, 1995), can reduce the risk of cardiovascular disease and increase the efficiency of everyday tasks (such as climbing stairs or cleaning the house) (Hockey, 1993). Many well-known aerobic exercises such as jogging, swimming, and cycling are believed to be the exercises of choice to improve the cardiorespiratory system.

Perhaps surprisingly, it is also believed that Tai Chi (considered a low intensity form of exercise) may have cardiorespiratory benefits. The steady, rhythmical, large muscle movements of Tai Chi are thought to develop the cardiorespiratory system when the set is performed in a 'low' position (knees bent as much as possible) and when practitioners maintain a constant muscular tension or contraction throughout the sequence of movements (Jin, 1989). The 'low' position is most characteristic of the Chen Style (refer back to Table 1.1) while all Tai Chi forms encourage muscular control throughout the set. Some researchers have argued, however, that months, if not years, of practice may be required before the proper technique is developed and cardiorespiratory gains are achieved (Alder, 1983; Wolf et al., 1997b).

3.2.4.1 Tai Chi and Cardiorespiratory Functioning

Thirteen studies to date (summarized in Appendix L) have addressed the cardiorespiratory benefits of Tai Chi and/or questioned whether the exercise intensity of Tai Chi is high enough to elicit a beneficial effect. Four studies assessed the cardiorespiratory functioning of experienced Tai Chi practitioners and found superior functioning (Hong et al., 2000; Lai et al., 1993; Lan et al., 1996), or a slower cardiorespiratory decline (Lai et al., 1995) compared to sedentary groups. The nine prospective studies assessing pre-post changes for beginning participants, meanwhile, had mixed results. Five studies found significant gains

(Brown et al., 1995; Lan et al., 1998; Lan et al., 1999; Sun et al., 1996; Young et al., 1999), two reported no change (Chen & Sun, 1997), and three found a decline in cardiorespiratory functioning (Sun et al., 1996; Wolf et al., 1996; Young et al., 1999). Variability in methods of assessment (maximal tests versus changes in heart rate or blood pressure), duration of the exercise intervention (from 10 weeks to 12 months), and type of Tai Chi (Yang style versus Tai Chi Chuan, versus, 'a Tai Chi type activity') may explain the mixed results.

There is controversy in the literature concerning whether Tai Chi is intense enough to produce cardiorespiratory benefits. Exercise intensity refers to how vigorous an exercise must be in order to contribute towards cardiorespiratory fitness (Hockey, 1993). Due to the slow, smooth, and relaxing movements practiced during the Tai Chi set, this form of exercise is usually considered as low intensity. Many practitioners claim, however, that the intensity of Tai Chi is actually much greater given the semi-squatting postures and the various concentric and eccentric muscular contractions (Lai et al., 1995). To address this issue, the exercise intensity of Tai Chi was assessed by monitoring the heart rate of experienced Tai Chi practitioners during completion of the Yang form of Tai Chi (Lai et al., 1995; Lai et al., 1993; Lan et al., 1996). Since heart rate increases in proportion to the intensity of exercise, it is considered to be the universal and standard method of determining exercise intensity (CSEP, 1995). The heart rates of study participants performing the classical Yang style often exceeded 70% of their maximal heart rate (Lai et al., 1993; Lan et al., 1996). These results support the claim that Tai Chi should be considered to be a moderate intensity activity, equivalent to walking at a rate of about six kilometers per hour (Schneider & Leung, 1991). Therefore, this exercise should be sufficient to elicit cardiorespiratory gains in the older population or in individuals with a relatively low VO_2 max (Lai et al., 1993).

3.2.4.2 Summary

The majority of studies indicate that Tai Chi training may have cardiorespiratory benefits for older practitioners, both experienced and beginners. Additional research, however, is needed to further substantiate these findings. The incremental benefits of Tai Chi should be examined to determine the course of such improvements (since some researchers have argued that it may take years of practice to achieve cardiorespiratory gains (Alder, 1983; Wolf et al., 1997b). As noted, the exercise intensity of the popular Yang style may be appropriate to improve the cardiorespiratory functioning of older adults and those with a low VO_2 max. Some forms of Tai Chi may not be equivalent to the classical Yang style since they may consist of fewer postures or exclude the strenuous movements emphasized in this form. Other forms of Tai Chi, such as the Chen style, which is characterized by its low position, may provide additional benefits not achieved by the Yang style. Further work is needed to examine the comparative and incremental cardiorespiratory benefits of different forms of Tai Chi.

3.2.5 Motor Control

As noted by Yan (1999), cooking, dining, dressing, and driving are examples of daily activities that require normal hand and arm movements. The movements of older adults have been reported to be slower and less smooth than younger adults (Yan, Thomas, Stelmach, & Thomas, 1997) and force variability has been found to increase as individuals' age (Yan, 1999). These changes can affect the reaching, grasping, and handling of objects commonly a part of everyday life. While laboratory motor task training has been shown to reduce force variability (Keen, Yue, & Enoka, 1994), little is known about effects of real life physical activities for maintaining or improving motor control.

3.2.5.1 Tai Chi and Motor Control

Only two studies to date (described in Appendix M) have examined the effect of Tai Chi on aspects of motor control. Yan (1998, 1999) investigated the effect of the 24-simplifed form of Tai Chi on the arm movement performance (Yan, 1998) and force (Yan, 1999) of a group of nursing home residents. Participants chose to engage for eight weeks in one of two types of exercise programs: Tai Chi or walking/jogging. Speed and smoothness in a rapid aiming task (both linear and curvilinear aiming) was used to determine pre-post changes in motor control. These two studies showed that Tai Chi practice significantly reduced arm movement jerk (Yan, 1998) and force variability when performing the curvilinear arm performance (Yan, 1999) to a greater extent than the walking/jogging program. Since Tai Chi is characterized as a slow moving exercise, it is not surprising that no changes in arm movement speed were observed (Yan, 1998). Two characteristics of Tai Chi are thought to explain its beneficial effect on motor control. First, Tai Chi involves a variety of linear and curvilinear arm movements. Secondly, remembering and performing the slow, smooth, and graceful movement patterns and sequencing requires a high degree of mental concentration (Cerrato, 1999; Levandoski & Leyshon, 1990).

3.2.5.2 Summary

Overall, the effect of Tai Chi on motor control is encouraging. The two studies to date in this area suggest that nursing home residents may improve their movement force and accuracy from participating in three sessions (45 minutes in length) of Tai Chi a week for eight weeks. Additional research is needed to verify these findings and extend the investigation. Future work should include different populations (i.e., healthy, community dwelling older adults) and various forms of Tai Chi (other than the 24 simplified form practiced in this work) practiced at a frequency and duration often found in community settings.

3.2.6 Psychological Outcomes

In addition to physical benefits, regular physical activity is widely believed to promote psychological well-being. Although the findings have been mixed for older adults (O'Brien-Cousins & Horne, 1999), exercise has been associated with improving psychological health (Spirduso, 1995). As mentioned, the WHO (1997b) guidelines for promoting physical activity among older persons suggest that regular physical activity may help to avoid, minimize, and/or reverse the psychological decline that often accompanies advancing age. More immediate psychological benefits are thought to include relaxation, reduction in stress and anxiety, and enhanced mood state. Long-term benefits are thought to include improving ones' general well-being, mental state and cognition, and the ability to learn new skills (WHO, 1997b).

3.2.6.1 Tai Chi and Psychological Well-being

While most exercise programs emphasize physical benefits first and foremost, Tai Chi clearly has both a mind and body focus. Tai Chi combines deep diaphragmatic breathing and relaxation with slow, gentle movements. Tai Chi is often referred to as a form of moving meditation since the mind must focus on the specific movement patterns throughout the set (Levandoski & Leyshon, 1990). Regular participation in Tai Chi is popularly believed to evoke improvements in relaxation, concentration, and creativity while releasing emotional tension, anxiety, and reducing mental confusion (Alder, 1983; Koh, 1981).

Seven studies to date (summarized in Appendix N) have examined various psychological outcomes in relation to Tai Chi participation (Brown et al., 1995; Chen & Sun, 1997; Kutner et al., 1997; Li et al., 2001; Schaller, 1996; Sun et al., 1996; Wolf et al., 1996).

All of these studies utilized a randomized, pre-post design; a few conducted follow-up assessments. A wide range of psychological variables were assessed including: mood (Brown et al., 1995; Schaller, 1996); anxiety (Chen & Sun, 1997); stress (Sun et al., 1996); self-efficacy (Li et al., 2001); self-esteem (Brown et al., 1995; Kutner et al., 1997); perceived health status (Kutner et al., 1997; Schaller, 1996); and depression (Wolf et al., 1996). A few found positive changes in stress (Sun et al., 1996), self-efficacy (Li et al., 2001), and mood (Brown et al., 1995), but most reported no change.

The different training protocols (type of Tai Chi, frequency, and duration) may help to explain the findings. For example, Schaller (1996) found no difference in the mood of study participants practicing the 20 movements of Tai Chi Chih for 60 minutes, once a week, for 10 weeks. Meanwhile, Brown et al.'s (1995) study participants reported a significant improvement in mood after practicing a 'Tai Chi type activity' for 45 minutes, three times a week for 16 weeks. It is also interesting to note that those completing the simplified Tai Chi Chuan form for 60 minutes, twice a week showed no change at posttest (after 16 weeks) in anxiety, but improved at the nine month follow-up. This group was asked to continue to practice their Tai Chi at home, received phone calls to verify compliance and monthly booster training to assist with remembering the sequence. Finally, it is not surprising that the positive changes in self-efficacy in Li et al.'s (2001) Tai Chi group were associated with higher attendance.

In the literature on the psychological benefits of exercise for older adults, method variance is viewed as a primary concern. A review by McAuley and Rudolph (1995) found that over 85 different psychological tools had been used by various researchers. McAuley and Rudolph (1995) further argued that the majority of psychological scales were not designed for the exercise experience and healthy older adults will not show change on measures (such as depression and anxiety) developed for clinical populations.

Kutner et al. (1997) completed the only qualitative study in this area to date, although many examples of anecdotal reports and personal testimonials are available regarding the psychological benefits of Tai Chi by instructors and practitioners. A structured interview was conducted with study participants (Tai Chi group, balance training, and education group) at a four-month follow-up. Unfortunately, only the binary (yes or no) responses from the six questions were reported, losing the valuable qualitative information that could have been reported. Nonetheless, the Tai Chi group was significantly more likely than the education group to report that participation in the Tai Chi program had a noticeable effect on their life, affected their activities of daily living, and changed their normal physical activity. The Tai Chi and balance training groups also reported an increase in self-confidence.

3.2.6.2 Summary

Overall conclusions regarding this body of evidence are impossible given the method variance in the studies to date. Studies that investigate the frequency, duration, and type of Tai Chi practice in relation to psychological outcomes are needed. Future research needs to examine community-based Tai Chi programs using measures that are relevant to healthy adults and specific to the exercise experience (one such tool, the Vitality Plus Scale, is described in section 3.6.4.3.4). Qualitative methods (such as the interviews conducted in the current process evaluation) are also needed to learn about older adults' experiences with Tai Chi.

3.2.7 Overall Summary and Conclusions

Tai Chi appears to be increasingly popular in North America. Many recreation and seniors' centres are offering such classes, often in modified form, specifically for older adults.

As the popularity of this form of exercise increases, so should the research in this area. Studies conducted to date have, for the most part, provided encouraging findings. Some research has found improvements in static and dynamic balance, balance confidence, lower body strength, flexibility, cardiorespiratory functioning, motor control, as well as psychological outcomes. But the findings have been mixed. In any case, it is difficult to draw conclusions due to the limited number of studies, and equally important, due to the method variance (form, duration, and frequency of Tai Chi, as well as the measures used to assess the various outcomes) across studies. Within the body of Tai Chi literature, some studies used no intervention control or comparison groups, others compared experienced practitioners to non practitioners, involved residents of nursing homes, or individuals treating or recovering from a health impairment (i.e. arthritis, myocardial infraction).

The potential benefits or outcomes of Tai Chi practice requires further exploration, particularly evaluation studies examining the benefits of real-world programs. Five studies to date (Channer et al., 1996; Hain, 1999; Kirsteins et al., 1991; Schaller, 1996; Young et al., 1999) examined interventions similar to those offered in the community (60 minutes, once or twice a week, for 8 to 12 weeks). Participants learned various forms of Tai Chi, both original and modified versions. In addition to examining the outcomes or benefits that can be reasonably expected from participation in real-world programs, it is also important to profile older adults who voluntarily choose to enroll in such programs. Baseline scores on balance, confidence, strength, flexibility, and psychological well-being may already be high in such individuals given the findings of our process evaluation. As detailed in Chapter Two, older adults who come to community recreation/senior centre programs tend to be quite active and healthy. Finally, the comparative benefits of Tai Chi relative to other exercise programs should be examined. The next section reviews the available literature on the outcomes of line dancing which was used as a comparison program in the present outcome study.

3.3 Existing Studies on the Impact of Line Dancing

The rationale for selecting line dancing as a comparison program for the present study is described in the next section (3.4). This section summarizes the existing empirical findings in this area of exercise programming. Although many articles on the benefits of aerobic dance are available, little empirical work exists concerning other dance classes for older adults--only two studies were found on tap and country line dancing respectively. This section will provide a brief description of the proposed benefits of dancing, review the two empirical studies published in this area, and describe the comparability of line dancing and Tai Chi.

3.3.1 Potential Benefits of Dance

Dance is considered one of the oldest forms of creative human expression (Picard, 1993) and has been used for therapeutic, educational, and recreational purposes. Dance therapy attempts to promote the release of emotions and assist in the redevelopment of the personal self (Boyle, 1994). Educationally, dance is believed to contribute to fitness, skill development, and creative abilities (Hanstein, 1990; Howe, 1990; Lapointe-Crump, 1990; Nichols, 1990; Schmitz, 1990). Dance has also been viewed as a recreational pursuit, people may join recreational dance classes for various reasons including: enjoyment, stress reduction, to learn a new skill, for the social experience, or the physical benefits (Hanna, 1995).

Many community-based dance clubs and recreational facilities offer various forms of dance instruction to people of all ages. Most seniors' centres also offer dance classes (both individual and partner dances) as part of their recreational programming. For instance, some of the dance classes offered to older adults at the recreation/seniors' centres in the Hamilton region include: line, ballroom, belly, Latin, tap, jazz, square dancing, and clogging.

Dancing is believed to offer multiple physical and psychological benefits (Berryman-Miller, 1986). The physical benefits of dance are believed to include improvements in muscle tone, flexibility, mobility, coordination, reaction time, balance, weight control and body image (Hanna, 1995; Milhan-Pruett, 1983). Psychologically, dance can stimulate creative thought and cognitive processes (through learning sequences of dance steps), and enhance self-esteem (Berryman-Miller, 1986). The benefits of dancing, however, may vary according to the type of dance, level of difficulty, characteristics of the person involved, and whether the dance is solo or with a partner (Hanna, 1995).

Two articles were located that examined tap (Noble & Howley, 1979) and country line dancing (Overend, 1999). Nobel and Howley (1979) measured the energy requirement of selected tap dance routines in both beginner and intermediate dancers (aged 17 to 26 years) and found that the energy requirement was similar between the routines and between the dancers. Overend (1999), meanwhile, examined whether country line dancing is a valid alternative to walking as a form of low impact exercise for older women. Participants (aged 70±6 years) were asked to complete a 12-minute walk test and a 60-minute country line dancing class. A representative 12-minute period of country line dancing, extracted from the 60-minute performance, was used for comparison with the walk test. Average (73.6% and 74 % of predicted heart rate max.) and peak (79% and 83% heart rate max) heart rates, as well as rating of perceived exertion, were similar for the walking and dancing groups. This finding suggests that country line dancing is a valid alternative form of low impact aerobic exercise for older women (Overend, 1999).

3.3.2 Similarities between Line Dancing and Tai Chi

Prior to describing the similarities between line dancing and Tai Chi, the distinction between country western line dancing and general line dancing (the focus of this study) should be clarified. While many of the steps performed in both styles of line dancing are similar (such as the 'grape vine' or 'kick ball chain'), country western line dancing involves greater movement of the hips, tapping of the heels, and stomping of the feet. The music also differs for the two styles: country western music is used for the former, while show tunes and big band music (such as 'New York, New York' or 'Puttin on the Ritz'), are typically used for the latter type of classes (Seager, personal communication, January, 2000).

Line dancing shares many similarities with Tai Chi. Both are instructed in a group setting and do not require a partner (unlike many other types of dancing). Participants are required to learn and practice a sequence of movements or steps in both types of activity. Both activities can be performed with little equipment and in a variety of locations. There are hundreds of different line dances as there are many different forms of Tai Chi that have evolved over the years. The contrasts are also important. Tai Chi emphasizes slow movements in a meditative mode, usually performed without music (or with soft music such as classical or soft nature sounds). Line dancing is a rhythmical sequence of steps performed at various paces and incorporating different types of movements. The dances are performed to music of an up-beat nature. While Tai Chi can be performed individually or in a group setting, line dancing is typically practiced in a group setting (although the group is not needed to complete the dance).

3.3.3 Summary

While dancing is believed to have multiple physical and psychological benefits, there has been little empirical evidence to support these claims. Only two empirical studies (one with young tap dancers; and one with older women involved in a country line dancing program) were located in the published literature. It is important to examine the outcomes or benefits that can be reasonably expected from participation in community dance programs and whether the benefits are comparable to other exercise programs. More direct comparisons of the relative benefits of various forms of exercise for older adults are needed. It is also worth examining the profile of older adults who are attracted to different types of exercise programs, for example, who tends to join Tai Chi versus line dancing classes.

3.4 Rationale for the Study Two

As previously noted, both Tai Chi and line dancing are becoming increasingly popular recreational activities in North America. Many recreation/seniors' centres now routinely offer Tai Chi and line dancing classes as part of their regular programming. Taoist Tai Chi Societies, meanwhile, exist across the country. Although researchers have begun to investigate the benefits of Tai Chi, no empirical studies currently exist for line dancing. Most of the research to date on Tai Chi has been conducted under controlled conditions in which Tai Chi is practiced at a greater frequency and duration than is the case for community based programs. These exercise training studies show what can be achieved under ideal conditions but not under representative conditions. It is important to examine the outcomes or benefits that can be reasonably expected from participation in community Tai Chi and line dancing programs and whether such benefits are comparable.

While Study One, the process evaluation, provided demographic information on who comes to community Tai Chi programs, as well as patterns of attendance and adherence, a complete profile should also include physical and psychological status. It seems possible (from the process evaluation) that older adults who enroll in community Tai Chi (or line dancing) classes may be younger, more robust individuals who are already quite physically active. Programs are likely to be relatively beneficial for some participants more than others, based on frequency and duration of participation, as well as baseline levels of physical and psychological functioning (Myers, 1999). This study will provide a more complete profile of older adults who chose to enroll in community Tai Chi versus line dancing programs, as well as a comparison of the relative benefits derived from participation. These results will not only contribute to the scholarly literature in the exercise field, but may assist planners in marketing and promoting such programs.

3.5 Outcome Evaluation Questions

As previous described, an outcome evaluation investigates the outcomes or impacts of a given program (both positively and negatively) on participants, as well as the types of participants who tend to benefit the most. The primary aim of this outcome study was to examine the benefits of community Tai Chi programs. The specific questions were:

1. What is the physical and psychological profile of older adults who enroll in Tai Chi programs and is the profile similar for persons who enroll in line dancing classes and non-exercise classes?

2. What benefits can reasonably be expected from a single session (10 weeks) of a beginner community Tai Chi program and are the benefits comparable for line dancing?

3. How does the physical and psychophysical profile of experienced Tai Chi participants' compare to the physical and psychophysical profile of community Tai Chi participants after a single session (10 weeks)?

The rationale for including comparison samples of 'non-exercise' classes and experienced Tai Chi practitioners is provided in the subsequent section on study design. The rationale for comparing Tai Chi and line dancing classes has already been outlined in the previous section. While the battery of measures is fully described in section 3.6.4 Data

Collection, a brief overview of the outcomes or benefits of interest in this evaluation study is warranted. As can be seen from the study questions above, baseline values on these measures were used to profile enrollees in Tai Chi and line dancing classes, while change on these measures were used to examine resulting benefits from participation.

The outcomes or potential benefits under investigation consisted of: balance, balance confidence, strength, flexibility, and psychophysical well-being. A cardiovascular assessment was also considered but was not included in this study for a number of reasons. First, the components of balance, strength, flexibility, and psychological well-being have not received as much attention as cardiorespiratory functioning. Second, the medical advisor of the Taoist Tai Chi Society expressed a concern that the members should not be overburdened with too many measures. Since, balance, flexibility, and strength may be as important or even more important for maintaining the functional independence of older adults (Pate et al., 1995), the evaluator felt that they should remain the focus of the study. Finally, the present evaluation was restricted to measurement tools that were portable and easily administered in the field. Since many cardiorespiratory measures require technical or specialized equipment or rigorous protocols, the evaluator did not feel that they were appropriate for the settings where testing was conducted. The physical and psychological battery of measures is fully described in section 3.6.4 Data Collection.

3.6 Methods

This section will begin by describing the outcome study design, followed by the study setting and procedures for both site and participant recruitment. Data collection procedures and protocols are presented next, followed by the results of pilot testing, and a description of data management and analyses.

3.6.1 Design

The outcome evaluation began in September 2000 (Fall programming session) and was completed in March 2001. The outcome study consisted of a pretest versus posttest, quasi-experimental comparison group.

Originally, we had planned to compare three groups: (1) new participants enrolled in modified or short-form beginner Tai Chi classes at community recreation/seniors' centres; (2) new participants enrolled in beginner line dancing classes at the same centres; and (3) new participants enrolled in the beginner classes at the Taoist Tai Chi Societies (long form; 108 movements). It was recommended by the advisory committee (during the dissertation proposal), that the third group from the Taoist Tai Chi Society should consist of experienced (rather than new) participants, given that the literature suggests that continued practice of Tai Chi over a long term may be necessary to attain substantial balance gains and improvements in other areas. Assessing this group of experienced practitioners at one point in time allowed us to compare their scores on the primary measures to the posttest scores (after a single session) of the new Tai Chi participants in the community programs. The downside is that we were unable to obtain a physical profile of new participants in the beginner Taoist Tai Chi classes.

It was further suggested that a non-exercise group of older adults who participate in other activities at the same recreation/seniors' centres be included. Inclusion of this non-exercise comparison group allowed us to compare the physical and psychological functioning profiles of the various groups, as well as to ascertain stability over time in scores on the outcome measures (with no exercise intervention taking place in the interim). Thus, the final four study groups (all aged 55+) for the outcome study consisted of:

(1) new participants in beginner Tai Chi classes at recreation/seniors' centres;

(2) new participants in beginner line dancing classes at recreation/seniors' centres;

(3) non-exercise comparison group from the recreation/seniors' centres; and

(4) experienced participants from the Taoist Tai Chi Society classes.

The first three groups were assessed at baseline (at the start of the Fall session) and upon completion of the programming session (after 10 weeks). The experienced Taoist Tai Chi group was assessed at one point in time; upon completion of the recreation/senior centre posttest assessments. A detailed description of the recruitment process, procedures, and measurements is provided in the following sections.

3.6.2 Recruitment of Sites

The same seniors' centres and Taoist Tai Chi Societies described in Chapter Two (section 2.4.1 Recruitment of Sites) were approached to participate in the outcome study. Unfortunately, the beginner Tai Chi classes at Huntington Park Recreation Centre, Ottawa Street YWCA Seniors' Centre, and Rockway Seniors' Centre were cancelled in the Fall session due to low enrollment. The Burlington Seniors' Centre (not included in the Winter, Spring, or Summer sessions of study one) was added to increase the sample sized for the Tai Chi and line dancing programs. A total of eight sites, consisting of six Tai Chi, four line dancing, fourteen non-exercise classes, and five Taoist Tai Chi ongoing/transitional classes, participated in the outcome evaluation. The classes were located at the following sites:

a) beginner Tai Chi classes at two seniors' centres in Hamilton: Sackville-Hill Seniors' Centre (two classes), and Hamilton Seniors' Centre; and one in Burlington: Burlington Senior's Centre;

b) beginner Tai Chi classes at two recreation/seniors' centres in K-W: Breithaupt Community Centre, and the Wing 404 Rotary Adult Club;

c) beginner line dancing classes at three centres in Hamilton: Sackville-Hill Seniors' Centre, Hamilton Seniors' Centre, and the Ottawa Street YWCA Seniors' Centre and one in Burlington: Burlington Senior's Centre;

d) non-exercise groups or classes (i.e. cards, crafts, bingo, and pool) at three seniors' centres in Hamilton: Sackville Seniors' Centre, Ottawa Street YWCA Seniors' Centre, and Hamilton Senior's Centre and one in Burlington: Burlington Seniors' Centre

e) experienced Taoist Tai Chi Society participants at two locations in Hamilton: the Hamilton Mountain and the downtown Hamilton branches. A sufficient sample size was recruited from these locations so the branches in K-W and Stoney Creek were not approached.

As in the process evaluation study, written permission was obtained from the program directors of all participating recreation/seniors' centres, as well as from the Medical Advisor of the Taoist Tai Chi Society of Canada. Permission was also secured from the Hamilton branch council of the Taoist Tai Chi Society for the outcome study. Ethical approval was obtained from the University of Waterloo Office of Research Ethics prior to recruitment. Details concerning participant recruitment at each of the sites are described in the next section.

3.6.3 Participant Recruitment

Volunteers were recruited from the Tai Chi and line-dancing programs at the designated centres in the Hamilton, Burlington, and K-W regions. Originally, we had hoped to recruit volunteers during the registration period, which takes place one to two weeks before classes begin. The program managers, however, felt that recruitment should take place during the scheduled classes themselves, since the registration period is hectic and potential volunteers may be missed. Accordingly, the evaluator attended the first scheduled Tai Chi and line dancing classes of the Fall/2000 session, to describe the study and solicit potential volunteers. A standard recruitment script and screening protocol was used for this purpose (see Appendix O). Study eligibility for the Tai Chi and line dancing participants at the recreation/seniors' centres consisted of:

a) age (must be 55 years of age or older);

b) no previous experience or have not participated in Tai Chi (or line dancing) in the past 12 months and;

c) were not enrolling in any new exercise classes during the current programming session.

The Tai Chi and line dancing participants were recruited based on their registration into the 'beginner level' exercise classes offered during the Fall programming session. Both 'complete beginners' (those who have never taken a Tai Chi or line dancing class) and 'relative beginners' (those who have previously taken a Tai Chi or line dancing class, but not in the previous year) were invited to participate. The rationale for including the relative beginners was to increase sample size. As we discovered during the process evaluation (Winter and Spring sessions) those in the 'beginner' classes were not necessarily totally new to the exercise. Unfortunately, no studies have been conducted to date documenting the length of time in which benefits from either Tai Chi or line dancing are maintained following cessation of the exercise. Twelve months of self-reported non-participation seemed to be a relatively safe criteria for inclusion of the "relative beginner" group.

When examining the benefits of specific types of physical activity, concurrent participation in other types of physical activity constitutes a threat to internal validity. From the process evaluation, we learned that many participants were involved in other forms of physical activity, either structured classes (42%) or informal exercise pursuits (82%). Excluding such individuals would have extremely limited our sample size. Most importantly, such a sample would not be representative of individuals who actually enroll in community Tai Chi and line dancing programs. Accordingly, for the purposes of this study, we asked for volunteers who were not beginning any new exercise classes over the study period (but they certainly could be continuing with other classes or physical activities). A total of 30 Tai Chi participants and 28 line dancers were eligible to participate in the study.

During the second and third week of classes (week one and part of week two were needed to recruit and assess the Tai Chi and line dancing participants), the non-exercise group was recruited from a variety of card, craft, bingo, and pool groups offered at the Hamilton and Burlington recreation/seniors' centres. The evaluator approached 14 classes and using a standard recruitment script and screening protocol (see Appendix P) obtained 16 eligible volunteers. Study eligibility criteria for the non-exercise group consisted of:

(a) age (must be 55 years of age or older);

(b) not currently enrolled in a formal exercise class (at the current centre or elsewhere); and

(c) had not participated in a formal exercise program over the past 12 months.

As can been seen in Table 3.1, over half (n=24, 60%) of our 'non-exercise' volunteers did not meet our study eligibility, and therefore, were not included in this study. Although all class participants were over 55 years of age, this group was either enrolled in an exercise class or had participated in an exercise program (often at their centre) in the past year. Out of 40 volunteers from non-exercise classes, 16 were eligible and agreed to participate in this study.

Recruitment and assessment of the experienced Taoist Tai Chi participants took place from January through March 2001 at two Taoist Tai Chi Society branches in Hamilton--the Hamilton Mountain and the Downtown Hamilton locations. At five ongoing/transitional classes (participants sometimes attend more than one of these classes) the evaluator read the pre-arranged recruitment script and screening protocol (refer to Appendix Q). Study eligibility for the experienced Taoist group consisted of:

a) age (must be 55 years of age or older); and

b) participating in an ongoing/transitional class at the Taoist Tai Chi Society.

Out of the 22 individuals who were recruited during the class sessions, 20 scheduled an assessment appointment.

Table 3.1: Summary of Enrollment, Volunteers, and Eligibility of Senior Centre Groups

Location	Type of Class	# enrolled	# of volunteers	# ineligible	# completing baseline assessment
Sackville-Hill #1	Tai Chi	20	6	2	4
Sackville-Hill #2	Tai Chi	28	7	1	6
Hamilton Seniors' Centre	Tai Chi	11	5	2	3
Breithaupt Centre	Tai Chi	18	7	2	5
Wing 404 Adult Centre	Tai Chi	13	5	0	5
Burlington Seniors' Centre	Tai Chi	50	10	3	7
TOTAL	**Tai Chi**	**140**	**40**	**10**	**30**
Sackville-Hill	Line Dancing	100	7	0	7
Hamilton Seniors' Centre	Line Dancing	18	6	1	5
Ottawa Street YWCA Seniors'	Line Dancing	10	3	0	3
Burlington Seniors' Centre	Line Dancing	50	15	2	13
TOTAL	**Line Dancing**	**178**	**31**	**3**	**28**
Sackville-Hill	2 Card groups* 5 Craft classes¨ Pool group* Bingo*	~ 50 92 unknown ~ 35	7 6 2 4	5 3 0 4	2 3 2 0
Hamilton Seniors' Centre	2 Card groups* Bingo*	~ 30 ~ 15	9 4	6 3	3 1
Ottawa Street YWCA Seniors'	Card group*	~12	3	1	2
Burlington Seniors' Centre	Craft group* (Boutique ladies)	~22	5	2	3
TOTAL	**Non-exercise**	**~256**	**40**	**24**	**16**

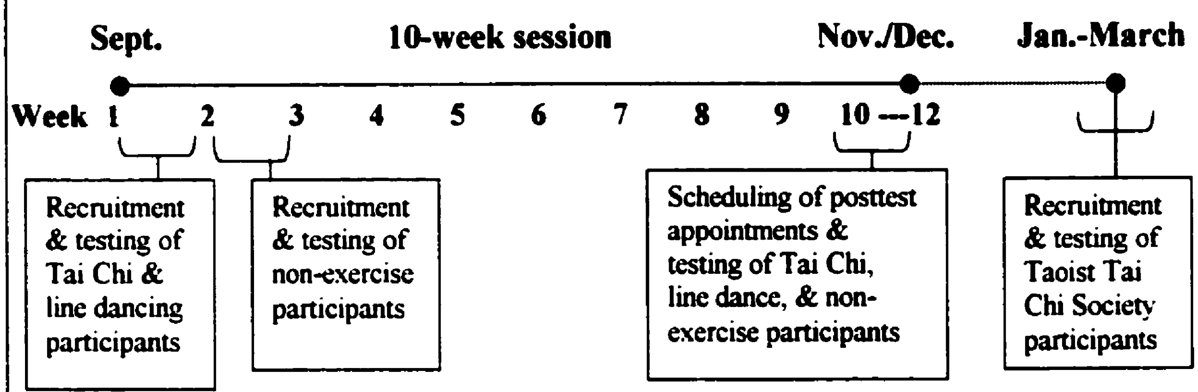
*Formal registration is not required, number enrolled is based on average attendance. Participants in cards and bingo may attend the activity if they hold a seniors' membership card and pay a small fee (i.e., 25 cents per bingo card). The craft group at Burlington Seniors' Centre meets once a week to make crafts to sell at an annual bazaar (fund raising for the centre). No formal instruction or fee exists.
¨Craft classes included: Crochet/Knitting, Folk Art, Quilting, Paper Tole, Painting and Drawing

3.6.4 Data Collection

3.6.4.1 Study Timeline

Data collection took place during the Fall/2000 programming session for the recreation/seniors' centres and from January through March 2001 for the Taoist Tai Chi group. As displayed in Figure3.1, the recreation/senior centre participants were asked to complete the assessment battery twice (at pre and posttest), while the experienced Taoist Tai Chi participants were assessed only once.

Figure 3.1: Study Timeline



As described under Participant Recruitment, the Tai Chi and line dancing participants at the recreation/senior centres were recruited and tested during the first and second week of classes. The second and third weeks of the Fall programming session were needed to recruit and assess the non-exercise group. The evaluator had prearranged with the participating recreation/seniors' facilities, dates and times when testing could take place on site. Participants could sign-up (during recruitment) for an assessment time that was convenient for them.

The volunteers from the recreation/senior centres then participated in their 10-week program. In Study One (the process evaluation), the Tai Chi programs were offered from 8 to

12 weeks at the various recreation/seniors' centres (refer to Table 2.1). Due to low enrollment in the Fall session, the recreation/seniors' centres offering the eight and twelve week sessions were cancelled; thus only programs offered for 60 minutes, once a week for 10 weeks were included in the outcome evaluation study.

The evaluator attended the last Tai Chi, line dance, and non-exercise classes (week 10) of the Fall session to schedule an appointment for the posttest assessment. The Tai Chi and line dancing participants were assessed during weeks 10 and 11, while the non-exercise groups were assessed during weeks 11 and 12. The non-exercise groups were delayed until weeks 11 and 12 to ensure that 10 weeks had passed from their original assessment.

The experienced group of Taoist Tai Chi Society participants were recruited and tested in late January through early March 2001. Testing could not be completed at the same time as the recreation/senior centre assessments since additional permission had to be obtained from the Taoist Tai Chi Society – Hamilton Branch council. Unlike the recreation/seniors' centres, the Taoist Tai Chi Society locations are only open during scheduled classes. Thus, all assessments were individually scheduled with each volunteer and completed either immediately before or during their class time (assessments were not completed after class due to the possibility of fatigue). All facilities had suitable rooms for the assessment.

3.6.4.2 Procedures

3.6.4.2.1 Baseline Assessments

At the time of recruitment, each eligible Tai Chi, line dance, and non-exercise participant (refer to Table 3.1 for a summary of volunteers and eligibility by class) who volunteered to participate were provided with an information letter and two consent forms (see Appendix R for exercise groups; and Appendix S for non-exercise group). Separate permission was secured for study participation and permission to arrange the post-test assessment. For those who did not want to make a commitment at that time, a consent form (shown in Appendix T) soliciting permission to contact the volunteer to arrange an assessment appointment was completed.

Volunteers from the Taoist Tai Chi Societies were also provided with an information letter and consent form (see Appendix U). This group was also asked to complete a consent form for follow-up contact (refer to Appendix T) in order to obtain their name, telephone number and a convenient time to schedule an assessment appointment. As described under the Timeline section, the Taoist Tai Chi Society locations are only open during scheduled classes; all assessments were individually scheduled with the volunteers and completed either immediately before or during class time.

At the time of recruitment, volunteers from the recreation/senior centres were also invited to sign up for a pre-arranged testing date (within the next week) at their centre and given a reminder notice (refer to Appendix V). Volunteers were given a package containing four self-report questionnaires, (1) the background survey; (2) the Vitality Plus Scale (VPS); (3) the Activity Specific Balance Confidence Scale (ABC); and, (4) the CHAMPS Physical Activity Questionnaire. Each of these tools are described under the Instrument section – 3.6.4.3. Each participant was asked to complete the consent forms and the four questionnaires at home and return them to the evaluator at their scheduled pretest date. The Taoist volunteers were also given the package containing the four self-report questionnaires. The questionnaires were identical to those given to the recreation/senior centre participants, except for some slight modifications to the background survey (described in the next section).

Volunteers from the recreation/seniors' centres returned to their participating facility within three weeks of program start-up (Tai Chi and line dancers were recruited and tested during weeks one and two; the non-exercise groups during weeks two and three). The one-time assessments of the experienced Taoist Tai Chi volunteers were arranged around their class schedules. Upon arriving at the testing session, participants were asked for their consent forms and four self-report questionnaires. The evaluator asked the volunteer if they had any difficulty completing the survey package and answered any questions or concerns the participants may have had. A summary of the assessment battery is illustrated in Table 3.2, details on each tool are provided in the next section (Instruments).

Table 3.2: Assessment Battery for the Outcome Study

Self-Report Questionnaires	Physical Assessments	Measures
Background Survey* **CHAMPS** **ABC** **VPS** **Posttest Survey***	Basic Assessment	Height Weight Body Mass Index (BMI) calculated from height and weight scores
	Balance	Single leg Stance Time Tandem Walk Multi-Directional Reach Test Maximal Step Length
	Flexibility	Sit and Reach Shoulder Extension and Flexion Ankle Dorsi and Plantarflexion
	Strength	Knee Extension Ankle Dorsi and Plantarflexion Back Extension

The recreation seniors' centre participants completed this battery twice (at pre and posttest) while the experienced Taoist Tai Chi participants were assessed once.
**All measures conducted at both pre and posttest except for the background survey (pretest only) and posttest survey (posttest only)*

The evaluator was trained by an expert committee member on how to administer each of the assessments; the evaluator then trained two research assistants (K.P. and M.W) to assist with the height, weight, and balance assessments. When possible, two participants were scheduled to complete the assessment at a time. Two stations were set up: station #1 consisted of the height, weight, and balance assessments, while the strength and flexibility assessments comprised station #2. The evaluator and the research assistant (K.P. or M.W.) each manned a station (one assessor at each station). Participants were first instructed and shown what was involved in each assessment and advised that they could decline any assessment if they felt uncomfortable. When the participants had completed their station, they would change stations and complete the remainder of the battery. Refreshments were available before, during, and after testing. At the end of the session, the Tai Chi and line dancing participants were given a practice log (refer to Appendix W) and shown how to complete this log (which asked people to indicate whether or not they attended their scheduled class each week, as well as to record all practice sessions in terms of day and number of minutes).

3.6.4.2.2 Posttest Assessment

The evaluator attended the last class of the Fall session to distribute the questionnaire package and to schedule an appointment for the post-assessment (with all participants who provided baseline data). Tai Chi and line dancing participants were also reminded to return their practice logs at their scheduled assessment. Individuals absent from this class were contacted by telephone to schedule an appointment. These individuals were provided with their surveys at the post assessment and had the option of either completing them at that time or taking them home and returning them to the centre in the next few days.

At the posttest appointment, the self-report questionnaires were collected and participants completed the assessment battery summarized in Table 3.2. Participants were again instructed on how to perform each of the tests and advised that they may decline any assessment if they felt uncomfortable. Upon completion, each participant was provided with a letter of appreciation (see Appendix X).

3.6.4.3 Instruments

All measures chosen for the study had to be feasible to administer in a field setting and relevant to Tai Chi. As previously argued, training specificity is important. Another criteria for measurement selection was an appropriate level of difficulty, as this is a highly functioning group of seniors. Pilot testing, described under section 3.6.5, helped to determine both the appropriateness and difficulty level of the measures, as well as the feasibility and time for administration. Each instrument and protocol selected for this study are described below.

3.6.4.3.1 Background Survey

A background survey (see Appendix E) was used to profile study participants and be able to relate client characteristics to improvements in physical and psychophysical outcomes. The background survey (for the recreation/senior centre volunteers) was identical to Study One (the Process Evaluation) described in Chapter Two, with the addition of one question: "Are there any daily activities that you would like to do but are not currently doing". This question was intended to assess whether participants were transferring the skills learned in Tai Chi (or line dancing) to their activities of daily living.

The background survey was also modified for the experienced Taoist Tai Chi participants (see Appendix Y for this version). For instance, we asked this group when they first joined the Society, when they moved from the beginner to the transition class, how often they attended, and the amount they practiced outside class.

3.6.4.3.2 Level of Physical Activity

Baseline level of physical activity is a critical factor to consider in any outcome evaluation of physical activity programs (Myers, 1999) in order to profile the sample and assist in interpretation of the findings. Participants who are less physically active at the outset may be expected to improve more as a result of Tai Chi (or line dancing) participation than those who are more active to begin with.

Several tools were considered for assessing overall level of physical activity. Tudor-Locke and Myers (2001) recommend the use of pedometers as a direct measure of physical activity for individuals who are typically sedentary. Although pedometers cannot capture participation in all activities (i.e. swimming), they are ideal for measuring intermittent activity behaviors (namely walking) that are often missed by self-report measures. Pedometers are also easy to administer and score, are relatively inexpensive, and acceptable to participants (Tudor-Locke & Myers, 2001). A number of factors, however, influenced our decision not to use pedometers in this study. First, data collection took place over a relatively short time period, which would require a large number of pedometers. In addition, subjects would need to wear the pedometers (sealed for blinding purposes) for a three-day period at both pre and posttest to determine average number of steps per day. Given the cost and subject demand, we decided not to use pedometers to assess the level of physical activity of our sample.

Numerous standardized self-report measures are available for determining level of physical activity. For instance, more than 30 such instruments are contained in a special supplement of the American College of Sports Medicine (ACSM) journal (Kriska & Casperson, 1997). Initially, the Bouchard Three-Day Physical Activity Record (Bouchard et al., 1983) and the Physical Activity Scale for the Elderly (PASE) (Washburn, Smith, Jette, &

Janney, 1993) were considered. The Bouchard Three-Day Physical Activity Record, however, is very time consuming to complete. Participants are asked to record their activity every 15 minutes for three consecutive days. In addition, this tool was developed for a younger population. The PASE, while developed for older adults, has an expensive user fee, is limited to activities over the past week, and excludes moderate intensity activities, such as walking to do errands.

We decided to use questions on the background survey and the CHAMPS (Community Healthy Activities Model Program for Seniors) Questionnaire for older adults (refer to Appendix Z) to assess the level of physical activity in the present study. Developed by Stewart and colleagues (2001) for community dwelling older adults, the self-report CHAMPS questionnaire inquires into the past four weeks of daily and recreational physical activity. Standardized scoring protocols permit the calculation of several variables, including: caloric expenditure per week and frequency per week in all physical activities and activities of a moderate intensity (MET value >3.0). During its construction, the test's developers considered several conceptual and methodological issues concerning measuring level of physical activity in older adults. Such issues included: inclusion of appropriate types and amounts of activities, designing questions and methods to facilitate accurate reporting, minimizing socially desirable reporting, and enhancing sensitivity to change (Stewart et al., 2001). This instrument was found to be reliable, have high construct validity, to be sensitive to change, and discriminated well between sedentary, low active, and active older adult groups (Stewart et al., 2001).

3.6.4.3.3 Balance Confidence

The Activities-specific Balance Confidence (ABC) Scale (Powell & Myers, 1995) was chosen to assess balance confidence (refer to Appendix AA). Prior research, using the Falls Efficacy Scale (FES), found participants who completed a Tai Chi program had higher confidence (Wolf et al., 1996). Both the FES and the ABC are modeled after Bandura's self-efficacy framework (Bandura, 1982) and operationalize fear of falling as a continuum of balance confidence (Myers, Fletcher, Myers, & Sherk, 1998). The ABC, however, is considered a more appropriate tool in higher functioning older adults given greater item/situation difficulty (Myers et al., 1998; Myers et al., 1996; Powell & Myers, 1995). The ABC scale has high internal consistency (Cronbach's alpha was .96) and test-retest reliability (.92). Strong convergent and criterion validity have been reported for the scale, as well as the ability to distinguish between fallers and non-fallers and low versus high mobility groups (Powell & Myers, 1995). This psychological indicator of balance confidence also corresponds with balance performance measures of average walking speed and static posturography of anterior-posterior and medial-lateral sway (Myers et al., 1996).

The rating format for the 16-item ABC scale ranges from 0% or no confidence to 100% or complete confidence. Low mobility groups (such as home care or day care users) have been found to have the lowest ABC scores (mean score of 36%), while active, community dwelling seniors, with no chronic health conditions scored above 90% (Myers et al., 1998). For this outcome evaluation, study participants completed the ABC at both baseline and program completion. While we expected the present sample to score high on this measure, the ABC was useful to verify balance confidence and to assess the maintenance of balance confidence over the study period (Medell & Alexander, 2000; Myers et al., 1998).

3.6.4.3.4 Psychophysical Well-being

Psychophysical well-being was assessed with the Vitality Plus Scale (VPS). More than 85 different psychological scales that have been used in exercise studies (McAuley & Rudolph, 1995) to assess overall health, well-being, and quality of life, however these measures failed to capture the perceived health benefits attributed to exercise participation. The VPS was chosen over more global measures, such as self-esteem or life satisfaction, and measures that may not be appropriate for psychologically healthy older adults, such as anxiety or depression.

The VPS was specifically designed for older adults to measure psychophysical benefits specific to the exercise experience such as energy level, sleep quality, and appetite (Myers et al., 1999). The VPS was developed in collaboration with regularly exercising older adults and their instructors and displays good psychometric properties. The VPS shows good internal consistency (0.81) and test-retest reliability (interclass correlation coefficient of 0.87). The VPS has been related to subscales of the SF-36 and two physical measures of functional mobility (Timed Up and Go (TUG) and fast-paced walk speed). The developers reported preliminary evidence that VPS scores may be responsive to change in individuals (with low to moderate scores prior to participation) participating in a variety of exercise programs, including Tai Chi (Myers et al., 1999).

The VPS scale and instructions for scoring are shown in Appendix BB. This 10-item, self-report scale takes only a few minutes to complete. Each item is scored from 1 to 5 based on the respondents' rating. The total summary score can range from 10 to 50, with a higher score indicating greater well-being. Similar to the ABC scale, the VPS was used to assess and verify psychophysical well-being as this sample was expected to score high on the VPS scale.

3.6.4.3.5 Posttest Questionnaire

A brief (9-item) posttest questionnaire was also developed, modeled after Myer's (1999) prototype. Appendix CC contains the posttest survey for the Tai Chi participants; a modified version substituted line dancing for Tai Chi. The follow up survey was specially designed for this study and was used to examine the participants' general impressions of the class and to ask whether any new physical activities or exercise classes were initiated during the study period.

3.6.4.3.6 Attendance Recording

As described in Chapter Two (section 2.4.3.4), all classes involved in this project routinely collected individual attendance data for their classes. While most of the centres provide instructors with a list of registrants for each session, a few use daily sign-in sheets to monitor attendance. Similar to Study One, the evaluator obtained a copy of the attendance form (preferable) or a verbal account (total number of classes and pattern of attendance for each study participant), from the instructor or program director. Individual attendance rates were tracked during the outcome study period to relate extent of improvement concerning the various outcome measures to rate of participation.

3.6.4.3.7 Practice Logs

A practice log was used to track the study participants' Tai Chi or line-dancing practice, both at the centre and at home. The Taoist Tai Chi participants did not receive a log since they were assessed only once. As explained earlier, their participation rate was solicited on their background survey. The practice log consists of a calendar with each day of the week for the 10-week duration of the program. Appendix W provides an example of the log that was distributed to the Tai Chi participants. The practice log was included for two reasons. First, the log was used to cross-check with the attendance sheets; instructors sometimes forget to fill in the attendance record or the record may be lost. Second, the logs were used to determine total rate of participation (class and home practice). Participants who practice consistently at home may experience greater benefits than those who just attend their scheduled classes.

3.6.4.4 Physical Battery

3.6.4.4.1 Basic Physical Assessment

Height and weight were assessed following the Canadian Physical Activity and Fitness Appraisal protocol (CSEP, 1996). The protocol for height and weight assessment is described in Appendix DD. Height and weight are basic physical measures that are commonly assessed during physiological assessments and take less than five minutes to complete. These values are also used to calculate body mass index (BMI) (weight in kg/height in meters^2) and used to describe the sample in the present study.

3.6.4.4.2 Balance Ability

The balance assessments for this outcome study included: (1) Single Leg Stance Time (SLST); (2) Tandem Walk; (3) Multi-Directional Reach Test (MDRT); and (4) the Maximal Step Length Test. Additional measures were piloted (refer to section 3.6.5), however, these four assessments were chosen to represent static and dynamic balance, limits of stability, and the protective balance response. While each is briefly described below, the complete testing protocol is available in Appendix DD.

Single-Leg Stance Time (SLST)

The SLST, a measure of static balance, has been used extensively in studies of balance and exercise with older adults (Bohannon, Larkin, Cook, Gear, & Singer, 1984; Judge et al., 1993; Topp, Mikesky, Wigglesworth, Holt, & Edwards, 1993), including Tai Chi participants (Schaller, 1996; Tse & Bailey, 1992; Wolfson et al., 1996). Some have argued that the SLST may be too easy for healthy seniors (Duncan, Weiner, Chandler, & Studenski, 1990). Others, meanwhile, argue that it is a reliable measure for older adults (Judge et al., 1993) and a good single clinical marker to predict who is more likely to fall and who may benefit from an intervention (Vellas et al., 1997). Internal consistency reliability coefficients of .85 to .95 have been reported for the SLST (Rikli & Edwards, 1991).

During the SLST assessment, the participant was asked to choose a leg to stand on (whichever they felt the most comfortable with), and balance on one leg for as long as possible (to a maximum of 60 seconds). The length of time the participant was able to stand was recorded. A stopwatch was used to record the duration of standing (in seconds). Three trials with the 'eyes open' were completed, with the maximal time being used in the analysis. Less than five minutes was needed to complete this test. Timed double stance was not assessed since double stance postures are not challenging to healthy older persons and would not be expected to improve. As well, SLST with the 'eyes closed' was not measured since both Tai Chi and line dancing are practiced with the eyes open (Schaller, 1996; Tse & Bailey, 1992).

Tandem Walk

The Tandem Walk is an assessment of dynamic balance, which is easy to administer in a field setting. This protocol is suitable for this investigation since Tai Chi movements reduce the base of support by drawing the feet close together to perform small steps, poses, or to change direction. The Tandem Walk test has been used in one previous study involving Tai Chi practitioners (Tse & Bailey, 1992). In this study, experienced Tai Chi practitioners were able to perform a greater number of heel-to-toe steps (to a maximum of 15 steps) along a straight line than non-practitioners.

For the Tandem Walk, participants were asked to stand heel to toe with his/her preferred foot position for placement of the front and back foot. Persons were asked to walk heel to toe along a 10-foot line (approximately 15 steps can be completed in this distance) as quickly as they can and without a misstep. A misstep occurred when the participant failed to walk along the line or to follow a heel-to-toe pattern. The number of missteps and the walk time were recorded and averaged over three trials. Less than five minutes was needed to complete this test.

Multi-Directional Reach Test (MDRT)

While highly sophisticated balance measures (such as balance platforms and force plates) are used in laboratory settings, researchers have also developed balance assessments that are more clinically feasible. One such measure is the Functional Reach test which assesses "the maximal distance one can reach forward beyond arm's length while maintaining a fixed base of support and in a standing position" (Weiner, Bongiorni, Studenski, Duncan, & Kochersberger, 1993, p.796). This test has been shown to have good psychometric properties, discriminative and predictive capabilities, and to correlate with walking speed, instrumental activities of daily living, single leg stance, and tandem walking (Duncan et al., 1990; Weiner, Duncan, Chandler, & Studenski, 1992a; Weiner, Duncan, Chandler, & Studenski, 1992b).

An adaptation of the Functional Reach is the more recent Multi-Directional Reach Test (MDRT). In contrast to the Functional Reach, which only measures the ability to lean in the forward direction, the MDRT examines the limits of stability in all directions (Newton, 2001). This test measures the distance in inches to reach forward, lean backward, reach to the right and to the left without taking a step (Newton, 1997) and is thought to be more challenging for participants than the Functional Reach since no wall is available to provide perceived security (Newton, 2001). While both the Functional Reach and MDRT measures are intended for use with older adult populations and in community settings, the MDRT considered a highly suitable measure for the present study as several Tai Chi movements require reaching or leaning forward, backward, to the sides, as well as upwards.

To assess the reliability and validity of the MDRT, Newton (2001) administered the MDRT, Berg Balance Test, and Timed Up and Go Test (TUG) to 254 community-dwelling older adults. The interclass correlation coefficient (ICC) was used to estimate test-retest reliability. The ICC was 0.94 for forward reach and 0.09 for the backward lean and sideways reaches (indicating that a practice effect may occur for the later directions, however, effect sizes were small). Cronbach's alpha indicated good internal consistency (0.84); coefficients between 0.80 to 0.90 are very good. As expected, scores on the MDRT correlated positively with scores on the Berg Balance Test and inversely with the TUG. Newton (2001), however, suggests that the significant but low correlation between the three tools may indicate that they measure similar but unique aspects of balance but more than one assessment of balance may be needed to obtain a comprehensive assessment of balance abilities. Finally, activity level contributed significantly to the scores in the forward, right, and left directions (Newton, 2001).

For the MDRT protocol, an apparatus was constructed -- a yardstick, mounted on a tripod at shoulder height (refer to Appendix DD for a picture of the apparatus). Assessment of forward reach, backward lean, and reach to the right and left sides was performed in a standard order following Newton's (1997) protocol. Upward reach was added to the MDRT protocol for this study since as previously noted, this movement is relevant to Tai Chi. Participants were asked to complete three trials in each of the five directions, the average of the three trials (in inches) was used in the analysis (refer to Appendix DD for a full description of the testing protocol). This test required about five minutes to complete.

Maximal Step Length (MSL)

Medell and Alexander (2000) argue that both corrective and protective aspects of balance be addressed when assessing balance maintenance and fall risk. Assessments of the corrective responses, similar to that of static balance, "involve either the ability to stay within one's base of support with minimal movement or the ability to move maximally without taking a step" (Medell & Alexander, 2000, p.3). When corrective responses are insufficient, protective responses occur. Protective responses require alterations in the base of support; typically a stepping response is the transition when static balance is no longer sufficient. To prevent a fall, the stepping response involves shifting support from both feet to one foot, moving the centre of mass outside the initial base of support, and creating a new support position (Patla et al., 1993). The MSL test was included in this study since Tai Chi practice commonly requires participants to take steps or lunge in different directions and return to the starting position. This training may be sufficient to improve the protective balance response.

Researchers from the Mobility Research Centre from the University of Michigan recently developed the Maximal Step Length (MSL) test as a measure of protective balance. "Maximum Step Length" is defined as the ability to step maximally with one leg while keeping the other (base) leg on the floor and then return to the initial position in one step" (Medell, unpublished, excerpt from Protocol for Testing). Refer to Appendix DD for a diagram displaying foot positioning. Preliminary psychometric evidence, including within-week reliability (0.87-0.90) has been collected on the MSL (Medell & Alexander, 2000).

The MSL of each participant was performed in the front, side, and back directions. A full description of the testing protocol is available in Appendix DD. As suggested by the test's developers (Medell & Alexander, 2000) each of the step directions was tested five times and measured in inches; the average score was used in the analysis. Approximately ten minutes was needed to complete this test.

3.6.4.4.3 Strength Measures

For the present study, we decided to measure the strength of knee extension, ankle dorsiflexion, and back extension. Assessments of the lower extremities (knee and ankle) were chosen since it is believed that Tai Chi movements may be sufficient to increase strength of the lower extremities (Jacobson et al., 1997). Tai Chi practice requires participants to lift and support their own weight, as well as to shift their weight from one leg to the other; Tai Chi movements are not designed to strengthen the upper extremities. The strength of the back, meanwhile, can provide an indication of posture for older adults; age-related strength loss in the spine can result in kyphosis (Milne & Lauder, 1974). The specific poses and postures that are practiced and maintained during Tai Chi, may influence back strength and ones' posture.

Past research has assessed the lower extremity strength of Tai Chi participants using an isokinetic dynamometer (mixed results) (Lan et al., 1998; Wolfson et al., 1996) and a muscle tester (no change in strength) (Wolf et al., 1996). A Microfet oynamometer, using the belt-resisted method, however, was used to assess isometric strength (no movement takes place at the joint since the force exerted by the muscle is equal to or less than the resistance (Hockey, 1993)) of the knee and ankle in this outcome study. As previously discussed (section 3.2.2.1) the belt-resisted method requires the use of a dynamometer and a nylon belt; thus it portable and easy to use at various recreation/senior centre locations. The nylon belt is fixed to an immovable object and positioned around the joint to be assessed. The participant, who has complete control over the amount of force exerted, performs a maximal voluntary contraction against the resistance of the belt (Desrosiers et al., 1998b). The dynamometer records the peak (highest) force over a six-second maximal voluntary contraction; the amount of strength applied against the instrument is displayed in Newtons (Desrosiers et al., 1998b).

For the assessment of knee extension, participants were asked to sit on a chair (with arms) and their feet flat on the floor. Using a goniometer, their knee joint was positioned at 40° and the dynamometer placed above the ankle (on the shin) (Desrosiers et al., 1998a). The 40° angle was chosen for this study based on relevance to daily activities. For example, when rising from a chair, participants may use the arms of the chair for assistance, however, they will reach a point (at approximately 40°) where their knee strength is required to bring them completely upright. After determining the angle of the knee, the nylon belt was secured around a wooden board, slated for the purpose of this test. The participant was asked: "try to straighten the knee and push as hard as you can, until I say stop". Participants held the position for six seconds and received 60 seconds of rest between each of the three trials

Participants remained seated in the same chair for the assessment of ankle dorsiflexion. With their foot resting comfortable on the ground and their knee at a 90° angle (positioned with the goniometer), the dynamometer was aligned with the third toe and placed on the dorsal surface of the foot (Desrosiers et al., 1998a). The belt was wrapped snuggly around the dynamometer and secured by the board. Participants were asked to raise their foot, while keeping their heel on the ground. Approximately 60 seconds of rest was provided between the three trials and the average of three trials was used in the analysis (less than 10 minutes was needed to complete the strength assessment).

Back strength was also assessed in this outcome study. The Flexicurve was considered to assess spinal curvature and posture, however, the scores would not be expected to change in the limited time of this study (Lazowski, personal communication, April 24, 2000). Therefore, back strength was assessed by measuring the range of motion of the lower back and then manually grading muscle strength to determine the grade of back strength. The conventional method for assessing and grading muscle strength, as described by Clarkson and Gilewich (1989) and Clarkson (2000), was followed. This method, as further described and pictured in Appendix DD, is based on three factors: evidence of a contraction, the use of gravity as a resistance, and the amount of manual resistance applied (Daniels & Worthingham, 1986). The grade of strength can range from 1 (trace of contraction) to 5 (full range of motion with maximal resistance). A description of each grade in the Conventional Grading system is provided in Appendix EE.

3.6.4.4.4 Flexibility

Flexibility of the lower back and hamstrings, shoulders, and ankles were assessed. These sites were chosen for two reasons. First, range of motion is highly specific to individual joints; the flexibility of one joint cannot predict the range of motion of other joints in the same person (CSEP, 1995). Therefore, a flexibility assessment should include a variety of joints. Secondly, the movements of Tai Chi encourage the participants to move many of their bodily joints through their full range of motion. While flexibility of the lower back and hamstrings have been examined in previous Tai Chi studies (mixed results), flexibility of the shoulders and ankles have not received as much attention. Various arm positions and movements (often through the full range of motion) are performed in Tai Chi. Thus, it is surprising that shoulder flexibility was assessed in only one previous Tai Chi intervention (Sun et al., 1996). Although an improvement in shoulder flexibility was reported, the type of shoulder flexibility (i.e., flexion or extension) was not mentioned. Past research with Tai Chi has not examined flexibility of the ankle. This is surprising since plantarflexion and dorsiflexion of the ankle are common foot movements performed during Tai Chi. Participants are often required to raise their toes off the floor, pivot their foot, and position their foot on the ground at a different angle. Ankle flexibility may be improved by this repositioning. The flexibility of lower back and hamstrings were assessed using the Sit and Reach Test, while a Flexometer was used in the assessment of shoulder and ankle flexibility. The complete protocols for each of these tests is provided in Appendix DD; a brief description of each test follows.

Sit and Reach Test

The Sit and Reach test has long been a popular objective field test of static flexibility, is a standard part of CSEP's protocol, and has been used in previous Tai Chi studies. This test provides a simple measure of flexibility of the lower back and hamstring muscles (Wells & Dillon, 1952). Test-retest reliability of .83 and interclass reliabilities of .98 and .99 have been reported with older adults (aged 45-75 years) (Shephard et al., 1990).

During the sit and reach assessment, the participant was instructed to sit on the floor, without shoes, legs extended, and feet approximately ten centimeters (cm) apart and heel flush against the flexometer (borrowed from the Canadian Centre for Activity and Ageing (CCAA) in London). Keeping the knees fully extended, arms evenly stretched, and palms down, participants were instructed to bend and reach, without jerking, as far forward as possible. The maximum flexion must be held for about two seconds. Participants were advised that lowering the head would maximize the distance reached. If the knees flexed then the trial was not counted. Three trials were completed (taking less than five minutes to complete) and recorded to the nearest 0.5-cm. The maximal reading was used for data analysis (CSEP, 1996).

Shoulder and Ankle Flexibility

The Leighton Flexometer was used to assess ankle (dorsi and plantarflexion) and shoulder (extension and flexion) flexibility. This instrument has received universal acceptance for range of motion measurement (Maud & Cortez-Cooper, 1995) and remains the protocol of choice for feasible, accurate, and reliable flexibility assessments (CSEP, 1995). Good test-retest reliability has been reported, ranging from .89 to .98 (Leighton, 1942). Developed by Leighton in the early 1940's, the Flexometer consists of a rotating circular dial marked off in degrees of rotation (360°); a weighted needle is attached to the center of the dial so that zero degrees directly opposes gravity (Leighton, 1942). To determine range of motion, the Flexometer is strapped to a landmark and a zero reference point established. The instrument is zeroed and the dial is locked. The participant slowly moves through their full range of motion in one direction and the pointer is locked when steady (CSEP, 1995).

The protocols for shoulder flexion and extension, dorsi and plantarflexion of the ankle are described in the CSEP's – Certified Fitness Appraiser Manual (1995) (refer to Appendix DD). Each assessment was completed three times (the maximal reading in degrees of rotation was used in the analysis) and a 15 second rest interval given between the assessments. Approximately eight to ten minutes was needed to complete the flexibility assessments.

3.6.5 Pilot Testing

Pilot testing was used to determine the final assessment battery for the current outcome study (described above). This section briefly outlines the results of pilot testing and provides support for the measures used in the questionnaire battery and physical assessment. Pilot testing took place during August 2000. The purpose of the pilot test was to assess the length of time needed to complete each measure and the entire assessment battery, check the difficulty level of each measure, and identify any problems with the assessment. A convenience sample of seven active community-dwelling older adults (five males and two females) ranging in age from 61 to 72 years (mean age 65.5 years) volunteered for the pilot testing.

3.6.5.1 Questionnaire Battery

The questionnaire battery remained as originally proposed, namely the background and posttest surveys, the ABC, VPS, and CHAMPS. The background survey had been previously piloted for clarity prior to the process evaluation study. The three standardized questionnaires required minimal time to complete (approximately 10 to 15 minutes) and were used to verify balance confidence (the ABC), assess the psychophysical benefits of exercise for older adults (the VPS) and determine the level of physical activity (the CHAMPS). As described previously, each tool was specifically designed for and tested with older adults and, according to our sample, the instructions were clear and easy to complete on their own.

3.6.5.2 Physical Battery

In addition to the tests selected (described in section 3.6.4.3), we also piloted other tests of balance, strength, and flexibility, before making our final selections for the present study. Approximately two hours per person was needed to complete all the tests in the pilot. Many participants felt tired and frustrated with the length of testing. Our goal was to reduce the total time of the physical battery to no longer than 45 minutes. We also wanted a battery that was interesting to participants and manageable for administration by the evaluator and a research assistant. The measures considered and eliminated through pilot testing are presented below.

3.6.5.2.1 Balance Measures

Three tests of balance were removed from our battery following pilot testing: (1) the Clinical Test of Sensory Interaction on Balance (Foam and Dome); (2) the Dynamic Gait Index; and (3) the Rapid Step Test. The first two tests were considered as possible measures of reactive balance responses to unexpected situations which require more sensory inputs and the transference of skills learned in Tai Chi or line dancing to everyday activities.

The Foam and Dome test (described in Appendix FF) requires participants to maintain balance under six different sensory conditions that eliminate input or produce inaccurate visual and surface orientation inputs (Shumway-Cook & Wollacott, 1995). Several difficulties were experienced with this test. First, there was uncertainty regarding the participants' stance. In the original source, three stance positions (normal, tandem, and one-foot) are described (Shumway -Cook & Horak, 1986). A subsequent article, written by one of the test's developers (Horak, 1987), however, excluded the one-foot stance without providing a rationale. The technique for quantifying the level of sway during the test was also inconsistent. Shumway-Cook and Horak (1985) used a subjective approach to quantifying the level of sway, while Horak (1987) recorded the length of time (to a maximum of 30 seconds) on balance using a stopwatch.

Due to the inconsistencies in the literature, both techniques for quantifying level of sway, as well as the three stance positions (normal, tandem, and one-foot), were pilot tested. Our sample was able to complete the assessments while maintaining a normal stance (stayed on balance for 30 seconds), tandem stance was more difficult (many were unable to reach the 30 second limit resulting in a loss of balance), and all participants lost their balance during the one-footed stance. Several participants completed only one or two trials of the later conditions and some refused to complete the one-legged stance conditions. The participants explained that they disliked the feeling of imbalance, the uncertainty of their surroundings, and complained of dizziness. Many expressed a concern that when losing their balance they would be unable to regain stability and might fall, even with the evaluator's support.

Additional concerns with the Foam and Dome were the total time to complete the assessment (approximately 40 minutes; each stance position required 10 to 15 minutes). The evaluator was also concerned with the participants' safety. It was difficult to record the length of time, observe the level of sway, and safely spot participants all at the same time.

The Dynamic Gait Index (see complete protocol in Appendix FF) was considered to assess the reactive assessment of balance and the transference of skills learned in Tai Chi to everyday activities. Concern was raised that this test may not provide a true reactive balance measure as the instructions are provided to participants prior to initiating the eight tasks. To address this concern, three participants were given the instructions for the tasks requiring a change in gait speed or head turns during the completion of the task, while four participants completed the assessment as originally developed. All participants, completing either the original or modified version, achieved a maximal score. This test was removed from our battery due to the ceiling effect for healthy, older adults.

The Rapid Step Test (RST) was also included piloted (see protocol in Appendix FF). The stepping protocol for the RST requires participants to step at least 80% of their Maximal Step Length (included in our final battery) as fast as possible and return to the starting position. The total time to complete 24 steps (four steps in each leg direction – left-front, right back, left side, etc.) and any errors completed during the set are recorded. As noted by Medell and Alexander (2000), an error is defined as: 1) loss of balance; 2) failure to return to the starting position; 3) multiple steps; or 4) non-compliance with direction or side. Although the quick pace of the RST is unlike Tai Chi, being conscious of the direction and leg for stepping is an important part of the Tai Chi sequence. Unfortunately, too much time was required to set up and complete this test (15 minutes, plus five minutes for warm-up). It was decided to remove the RST from the final battery and simply include the MSL as it is a strong predictor of protective balance on its own (J. Medell, personal communication, September 25, 2000)

The tests of balance included in the final assessment battery were chosen for several reasons. First, the measures assessed different aspects of balance: single leg stance measured static balance, tandem walk measured dynamic balance, range of stability was assessed with the Multi-Directional Reach Test while protective balance was assessed with the Maximal Step Length test. Secondly, the measures were quick and easy to complete; approximately five minutes was needed to complete each test (a total of 20 minutes for the four protocols). Thirdly, the measures addressed types of balance that may be expected to improve during Tai Chi practice (training specificity) and the skills can be transferred to activities of daily living (i.e., reaching or stretching to obtain objects). Finally, the pilot participants were receptive to the tests, as they felt safe during their performance.

3.6.5.2.2 Strength Measures

Knee extension, ankle dorsiflexion, and back strength were included in the final assessment battery due to the limited time needed to complete the assessments (less than 10 minutes for the three tests), participants' acceptability, and ease of administration. We also piloted hip extension, flexion, abduction, and adduction using the dynamometer and belt resisted method. An important part of the belt-resisted method is to find a stable structure in which to secure the belt. While the belt, during the assessments of the knee and ankle, is secured around a board and held in place by the weight of the chair and the participant, this protocol cannot be followed with the hip assessment as participants must lie flat on their side or back (refer to Appendix FF). Past work, has used bed rails to secure and stabilize the belt (Lazowski et al., 1999), however, these are not portable and were not available in the testing sites. The evaluator tried to secure the belt around herself during testing; many different positions and locations were attempted. Unfortunately, the evaluator was not strong enough to hold the belt; when resistance was applied the evaluator was pulled off balance or felt that additional resistance was added from pulling against the belt. For this reason, the assessments of the hip were removed from our final assessment battery.

3.6.5.3.3 Flexibility Measures

The flexibility measures remained as originally proposed; including the 'sit and reach', extension and flexion of the shoulder and dorsi and plantarflexion of the ankle. The measures were appropriate for this population, safe and easy to complete, and assessed a variety of different joints. Less than ten minutes was needed to complete all the flexibility assessments and the participants were receptive to the protocols. The removal of the 'sit and reach' test was considered to help reduce the length of time to complete the assessment, however, it was ultimately included for comparison purposes with past work. The flexibility of the shoulder and ankle had not been previously assessed with a flexometer in the Tai Chi literature (Sun et al. (1996) used a goniometer assess shoulder flexibility) and would provide novel findings.

3.6.6 Data Analyses

To reiterate, the purpose of this outcome study was to develop an in-depth physical and psychophysical profile of older adults, aged 55+ who choose to enroll in community Tai Chi programs, and to examine the extent to which benefits or gains in specific areas (namely, balance, strength, flexibility, and psychophysical well-being) can reasonably be expected from a single session of participation. The relative effectiveness of different types of Tai Chi programs offered at the individual recreation/senior centres could not be compared due to small number of participants recruited from each of the facilities. Therefore, our community Tai Chi sample is made up of a multitude of classes. Line dancing classes were chosen to examine whether benefits were comparable to Tai Chi, and to examine benefits from line dancing in their own right. The non-exercise group allowed us to compare the physical and psychological profiles of various groups and to ascertain the stability over time in scores on the outcome measures. Finally, inclusion of the experienced Taoist Tai Chi group allowed us to compare their scores on the primary measures to the posttest scores (after a single session) of the Tai Chi participants in community programs.

The statistical package SPSS (Version 8), was used for data analysis. To ensure that the participants in the outcome study were similar to our larger sample who completed the process evaluation, their characteristics were compared. Descriptive statistics consisting of measures of central tendency (for continuous variables) and frequency distributions (for categorical variables) were used to examine the background survey responses of the 94 participants (30 community Tai Chi, 28 line dancers, 16 non-exercise, and 20 experienced Taoist Tai Chi) involved in the outcome study. Between group comparisons, consisting of Chi Squares for the categorical variables and one-way analysis of variance (ANOVA) for continuous variables were performed. The post hoc Tukey Test was used for between group comparisons and $p<.05$ was considered statistically significant. Results were analyzed in a similar manner for the posttest survey.

Next, a physical and psychophysical profile of each of the three recreation/senior centre groups (community Tai Chi, line dance, and non-exercise) was developed using baseline scores. Groups were compared using a one-way ANOVA for each outcome variable. When significance was found, post hoc tests were used to identify between group differences. The Taoist Tai Chi participants, who were measured at only one point in time, were not included in this analysis.

Following a description of the baseline data, participants returning versus those not returning for posttesting were separated into two groups. Chi Squares (for categorical variables) and unpaired *t*-tests (for continuous variables) were used to identify differences in their physical profiles at baseline. Participants not returning for posttesting were then removed from the analysis. The baseline physical and psychophysical profile of participants who completed pre and posttesting were then compared using a one-way ANOVA for each outcome variable. Tukey's test was used for the post hoc comparison of any significant variables.

The next step was to compare change from pre to posttest for each of the outcome variables. A repeated measures ANOVA using group as a between subject factor with 3 levels (Tai Chi, line dance and non-exercise) and time as a within subject factor with 2 levels (pre and posttest) was performed to examine group differences. For variables in which a significant group by time interaction or a significant main effect of group emerged, one-way ANOVAs were used to analyze group differences at posttest (pretest differences were already completed). Tukey's post hoc comparisons were performed when significance warranted. For variables having a significant group by time interaction, paired *t*-tests were also run to examine within group pre-post change. For variables having a significant main effect of time, paired *t*-tests were used to examine whether the entire sample improved or declined on the variable of interest. Finally, for variables having a significant interaction effect or main effect of time, magnitude of change was examined via the calculation of Effect Size (Kazis, Anderson, & Meenan, 1989). The effect size for each group was calculated for variables having an interaction effect; while the effect size for the total sample (all groups combined) was calculated for variables having a main effect. The formula used for calculating the effect size was: [posttreatment mean – pretreatment mean] ÷ pretreatment standard deviation. An effect size of 0.2 was considered a 'small' effect, 0.5 a 'moderate' effect, and greater than or equal to 0.8 was considered a 'large' effect (Cohen, 1977).

In an attempt to synthesize the findings, we also created composite scores where appropriate across multiple indictors of the same construct. Concerning balance, a composite score for upper body reach was calculated by adding each participants' average score (across the three trials) for the five directions of the Multidirectional Functional Reach Test (MDRT). Similarly, a composite score for step length was calculated by adding each participants' average score (across the five trials) for the six components of the Maximal Step Length (MSL) test. The single-leg stance test (SLST) and Tandem Walk scores were not combined since they assess different aspects of balance (i.e., static versus dynamic) and have different objectives (i.e., maximal versus fastest time). A composite strength variable was constructed adding each person's average score (across the three trials) for knee extension and ankle dorsiflexion. Finally, a composite flexibility score was calculated by adding each person's average score (across the three trials) for shoulder extension and flexion and ankle dorsi and plantar flexion. Sit and reach scores were not included in the aggregate flexibility calculation due to metric differences (centimeters versus degrees). Using these composite scores, as well as the stand-alone variables, we then examined group differences across balance, flexibility and strength, respectively. Change scores (posttest – pretest) were calculated for each variable. Groups were compared using a one-way multivariate analysis of variance (MANOVA) for the balance and flexibility parameters; a one-way ANOVA was used for the single composite strength score. Two MANOVAs models were examined for balance, consisting of: (1) SLST, Tandem Walk, MDRT and MSL composite scores; and (2) SLST, Tandem Walk, and combined total of the MDRT and MSL scores (total reach). The MANOVA for flexibility included the composite flexibility and sit and reach scores. When an overall significant effect emerged, Bonferroni post hoc comparisons were used to examine group differences while adjusting for the overall error rate due to multiple tests.

In addition to investigating group change, we further examined individual change on each of the outcome variables. Individual change scores were calculated using a formula proposed by Lord and colleagues: ([posttest-pretest score] ÷ pretest score) X 100 (Lord et al., 1996). This formula provides the percentage of improvement achieved by each individual. This approach has been used to examine changes in gait patterns (Lord et al., 1996) recovery of injured workers (Williams & Myers, 1998), and changes in balance confidence (ABC scale) and vitality (VPS scale) following an exercise program (Myers et al., 1999). Based on individual change scores, participants who showed improvement were compared to those who did not using independent samples *t*-tests. A total of at least five participants in the groups were needed for the *t*-tests to be completed. Finally, independent samples *t*-tests were used to compare the posttest scores of the community Tai Chi group (completing the modified or short -form versions at the recreation/senior centres) to the scores of the experienced Taoist group.

3.6.7 A Priori Expectations

Based on the findings from previous Tai Chi studies, as well as the general literature on exercise and older adults, we had several a priori expectations concerning the findings that might emerge from the current study. First, we were skeptical about the extent of improvement that was reasonable to expect as the result of a single, 10-week session of participation. The Tai Chi literature states that the movements take months, if not years, to learn and that long-term practice is needed before benefits can be achieved (Alder, 1983). While some research studies have documented various gains, community Tai Chi programs are typically offered over a shorter duration and less frequently than research protocols. Practicing for approximately 60 minutes, once a week, for the limited 10-week session may not be long enough to show substantial physical and psychological gains.

Our choice of outcome indicators was based on training specificity of Tai Chi, suitability for older adults, sensitivity to change, and feasibility of administration at the centres. Nonetheless, given previous descriptions (e.g., Novak, 1997) that older adults who come to recreation/seniors' centers tend to be relatively educated, healthy, and active, we suspected that our sample might score quite high on many of the measures at baseline, allowing little room for improvement. Accordingly, only trends towards improvement or slight improvement were expected for both the Tai Chi and line dancing groups for the majority of the outcome measures. The exercise groups were expected to score better than the non-exercise group at posttest; scores for the latter group were expected to remain stable over the 10-week period.

More specifically, for the community Tai Chi participants, slight improvements were expected on all balance (Single-leg Stance, Tandem Walk, MDRT, and MSL) and flexibility (sit and reach, shoulder and ankle flexibility) measures, as well as balance confidence (ABC) and vitality (VPS). The movements performed during Tai Chi often challenge balance ability or require movements through a full range of motion. Knee and ankle strength, however, were not expected to improve given the limited duration and frequency of the program; strength maintenance was more likely.

Similar to the Tai Chi participants, the line dancers were expected to show improvements in their vitality and balance confidence scores, and on the majority of the physical balance measures. Slight improvements in static (Single-leg Stance), dynamic (Tandem Walk), and protective (MSL) balance were expected due to the steps and sequences performed during the various dances. The line dancers, however, were not expected to improve on the MDRT scores as this activity does not normally involve reaching or bending. Similarly, flexibility (hamstrings, lower back, and shoulders) was not expected to improve as line dancing does not require movement through the full range of motion. Improvements in ankle flexibility, on the other hand, may occur due to the various foot positioning and movements during the dances. Similar to the Tai Chi participants, line dancers were expected to maintain, but not improve, in strength over the 10-week period.

Finally, we expected that experienced Taoist Tai Chi practitioners (in the "transition classes" after completing the full set of 108 movements, normally requiring 6 months or more) would have superior scores on all the measures in comparison to the 10-week scores (posttest) of the community Tai Chi group. Previous, cross-sectional studies (for instance Tse & Bailey (1992), Lan et al. (1996), and Lan (1998)) have demonstrated that experienced Tai Chi practitioners have superior balance and other abilities compared to non-practitioners, although the amount of experience needed to achieve these abilities has not been documented to date.

3.7 Results

To reiterate, the purpose of this study was to develop an in-depth physical and psychophysical profile of older adults (age 55+) who participate in community Tai Chi programs and to examine the benefits that can be reasonably attained after a single session (10-weeks) of participation. This section begins by describing our baseline sample characteristics (comparisons with line dancing, non-exercise, and experienced Taoist participants are made) followed by the physical and psychophysical profile of each recreation/senior centre group. Next, the characteristics of participants returning (study completers) versus those not returning (study dropouts) for posttesting are presented. Class attendance and the amount of home practice are described, followed by a description and comparison of the study completers. The recreation/senior centre groups' change from pre to posttesting on each of the outcome measures and their extent of improvement are then presented, followed by the findings of the posttest survey. Finally, the differences and similarities of the community and experienced Tai Chi groups are presented.

3.7.1 Baseline Sample Characteristics

3.7.1.1 Demographics

A total of 94 participants agreed to participate in the outcome study -- 30 from the community Tai Chi group, 28 from the line dancing group, 16 from non-exercise group, and 20 from the Taoist Tai Chi Society. The demographic profile of the groups is shown in Table 3.3. The total sample ranged in age from 55 to 84 years (mean age 67.65±7.18). The non-exercise group was significantly older than the community Tai Chi ($p<.01$), line dance ($p<.01$) and Taoist ($p<.01$) participants. The line dancers were significantly older than the Tai Chi participants ($p<.05$). The majority of the total sample was female (n=80; 85%), fully retired (n=77, 86%), married (n=53, 59%), and Caucasian (n=84, 97%). A significant group difference emerged with respect to education; Tai Chi ($x^2 = 7.26$, $p<.05$), line dancers ($x^2 = 4.31$, $p<.05$), and Taoist participants ($x^2 = 8.92$, $p<.05$) were more likely to have completed some post secondary school education than the non-exercise group.

Table 3.3: Demographic Profile of the Four Groups

	Tai Chi (N=30) n (%)	Line Dancers (N=28) n (%)	Non-Exercise (N=16) n (%)	Taoist Tai Chi (N=20) n (%)
Age	55-75 years mean = 63.86	62-76 years mean = 68.33	68-84 years mean = 76.38	57-79 years mean = 65.42
Gender				
Females	20 (67%)	28 (100%)	14 (90%)	18 (90%)
Males	10 (33%)	0 (0%)	2 (10%)	2 (10%)
Marital Status				
Single	3 (10%)	0 (0%)	0 (0%)	0 (0%)
Married	17 (57%)	13 (54%)	10 (63%)	13 (65%)
Separated/Divorce	4 (13%)	9 (38%)	0 (0%)	1 (5%)
Widowed	6 (20%)	(8%)	6 (37%)	6 (30%)
		*4 missing values		
Education				
Elementary School	3 (10%)	2 (8%)	0 (0%)	0 (0%)
Some High School	5 (17%)	1 (4%)	5 (31%)	0 (0%)
High School Diploma	2 (6%)	7 (29%)	7 (44%)	5 (25%)
Some Post Secondary	6 (20%)	4 (17%)	1 (6%)	3 (15%)
College or University	9 (30%)	7 (29%)	3 (19%)	9 (45%)
Graduate or Professional Degree	5 (17%)	3 (13%)	0 (0%)	3 (15%)
		*4 missing values		
Retirement				
Not Retired	0 (0%)	0 (0%)	0 (0%)	1 (5%)
Semi-Retired	9 (30%)	1 (4%)	0 (0%)	2 (10%)
Fully-Retired	21 (70%)	23 (96%)	16 (100%)	17 (85%)
		*4 missing values		

The majority of the overall sample perceived that their health was excellent (n=18, 21%) or good (n=58, 66%); this included 80% (n=24) of the Tai Chi group, 92% (n=22) of the line dancers, 86% (n=12) of the non-exercise participants, and 90% (n=18) of the experienced Taoist participants . As shown in Table 3.4, the most commonly reported health problems were arthritis, back trouble, high blood pressure, hearing, and vision. Out of the 27 (29%) participants reporting 'other' problems, the most common were high cholesterol (n=7, 26%), allergies (n=4, 15%), and fibromyalgia (n=3, 11%). The average number of health problems was 2.67 for the Tai Chi participants, 2.50 for the line dancers, 2.31 for the non-exercise group and 2.35 for the Taoist group (no significant group differences existed). The majority of each group (56% Tai Chi, 75% line dancers, 68% non-exercise, and 55% Taoist) was not limited in the type or amount of physical activity they can do. Approximately a quarter of the recreation/senior centre groups (27% Tai Chi, 25% line dancers, 24% non-exercise) and 35% of the Taoist group stated that long-term conditions, such as arthritis, heart disease, or knee problems limited their activities.

Table 3.4: Health Problems by Group

	Tai Chi (N=30) n (%)	Line Dancers (N=24) n (%)	Non-exercise (N=16) n (%)	Taoist Tai Chi (N=20) n (%)
Heart Trouble	1 (3%)	2 (8%)	2 (13%)	5 (25%)
Asthma, Emphysema or Bronchitis	1 (3%)	5 (21%)	0 (0%)	2 (10%)
Diabetes	1 (3%)	2 (8%)	1 (6%)	2 (10%)
Osteoporosis	0 (0%)	4 (17%)	7 (44%)	6 (30%)
Arthritis	9 (30%)	9 (38%)	6 (38%)	7 (35%)
High Blood Pressure	12 (40%)	7 (29%)	2 (13%)	5 (25%)
Back Problems	9 (30%)	9 (38%)	5 (31%)	5 (25%)
Foot Problems	3 (10%)	6 (25%)	3 (19%)	1 (5%)
Hearing Problems	3 (10%)	5 (21%)	6 (38%)	4 (20%)
Cataracts or Vision Disorder	6 (20%)	6 (25%)	5 (31%)	1 (5%)
Other	14 (47%)	4 (17%)	0 (0%)	9 (45%)

3.7.1.2 Physical Activity Level and Patterns

Several questions on the background survey and the CHAMPS questionnaire were used to examine the physical activity level and patterns of our groups. Based on the background survey, many of the Tai Chi and line dancing participants were involved in other forms of activity, either structured classes (n=31, 42%) or informal exercise pursuits (n=72, 80%). A total of 11 (37%) Tai Chi, 13 (54%) line dancers, and 7 (35%) Taoist participants reported involvement in other structured activity classes; the most popular were dancing (n=11, 35%) and aquatics (n=7, 23%). All groups, including the non-exercise group, reported participation in informal exercise pursuits. Out of the 90 (96%) people who provided a response, 27 (90%) of the community Tai Chi group, 18 (75%) of the line dancers, 16 (80%) of the experienced Taoist participants, and 11 (69%) of the non-exercise group reported informal activities; the most popular were walking (n=53, 71%) and swimming (n=7, 10%).

Most of the sample (n=61, 76%) reportedly accumulated 30 minutes or more of moderate intensity activity at least three days a week. This included over 80% of the two Tai Chi (82% (n=22) of the community Tai Chi and 84% (n=16) of the Taoist participants) and non-exercise groups (83% (n=10)), and 59% (n=13) of the line dancers. The Tai Chi participants accumulated 30 minutes or more of moderate intensity activities an average of 4.33 (SD=2.18) days per week, the line dancers had an average of 3.32 (SD=2.48) days, the non-exercise reported 4.25 (SD=2.45) days, while the Taoist participants reported an average of 4.37±2.14 days per week. Over half the sample (n=52, 58%) checked that they had been involved in physical activity 'off and on' throughout their life; almost one third of each group checked 'all their life'; only a small proportion (3% Tai Chi, 10% Taoist, 13% line dancers, 19% non-exercise) reported 'not at all'.

While an increased level of physical activity can be an outcome in and of itself, the CHAMPS scores, in the present study, were used to verify the level of physical activity (at baseline) against the results of the background survey. Since we selected people who were not enrolling in any new exercise classes over the study period (except for their Tai Chi or line dance class), we would not expect any major changes in the CHAMPS scores; except the new Tai Chi or line dancing class should be reported at posttest. Each questionnaire was checked to ensure that the Tai Chi and line dancing classes were not reported at baseline.

Table 3.5 provides the baseline CHAMPS scores for the total number of calories expended per week and the frequency per week of all activities and activities of a moderate intensity for each of our groups; comparative values reported by Stewart et al. (2001) are also provided. No group differences were found for total calories expended in all activities or activities of a moderate intensity, the non-exercise group, however, reported a greater frequency per week of all activities than the line dancers ($p < .05$). The CHAMPS scores for frequency per week of moderate intensity activities are comparable to the findings of our background survey. For example, on the background survey (described above), our Tai Chi group participated in moderate intensity activities an average of 4.33 days per week, while an average of 4.69 days per week were found on the CHAMPS questionnaire. Finally, compared to Stewart et al.'s (2001) classifications of 'initially sedentary', 'somewhat active' and 'already active', our groups (even the non-exercise group) were already quite active at baseline, falling within the somewhat active and already active values (comparisons will be elaborated on in the discussion). The posttest survey and readministration of the CHAMPS questionnaire at 10-weeks were both used to check stability or consistency of the samples' physical activity patterns over the study period.

Table 3.5: Comparison of CHAMPS Scores

Present Samples	All Activities Calories/week	All Activities Frequency/week	Moderate Intensity Activities Calories/week	Moderate Intensity Activities Frequency/week
Tai Chi	3162±2472 (2203-4121)	18.08±6.81 (15.20-20.96)	1502±1723 (834-2171)	4.08±4.32 (2.25-5.90)
Line Dance	2593±2833 (1396-3789)	13.83±7.29 (10.75-16.91)	1393±1865 (605-2181)	3.50±4.20 (1.73-5.27)
Non-exercise	2621±1295 (1873-3369)	19.57±7.27 (15.37-23.77)	1113±906 (590-1637)	5.86±3.48 (3.84-7.86)
Experienced Taoist	2773±1613 (1995-3551)	18.28±9.98 (13.31-23.24)	975±978 (503-1446)	5.56±6.71 (2.21-8.89)
Stewart et al. (2001) Scores				
Initially Sedentary*	1843∀198	8.45∀0.7	1057∀149	3.19∀0.4
Somewhat Active*	2116∀157	13.52∀0.8	1163∀125	5.27∀0.42
Already Active*	3386∀219	17.33∀0.9	2328∀181	8.81∀0.5

Note: mean±SD (95% CI)
*Scores from Stewart et al. (2001); Stewart's classification: *Initially Active* does not set aside time for exercise or recreational sports; *Somewhat active* does set aside time for exercise but does not meet ACSM's guidelines for exercising three times per week in moderate intensity exercise for at least 20 minutes per time and has been doing so for at least three months; *Already Active* meets ACSM's guidelines.

3.7.1.3 Factors Related to Participation

As can be seen from Table 3.6, respondents from the recreation/seniors' centres were more likely to have heard of the program through city program guides or senior centre brochures (x^2 = 15.87, *p*<.05) than the Taoist group, who reported word of mouth as their primary source (x^2 = 12.45, *p*<.05). Almost half the sample (n=41, 49%) reported knowing someone in the class, most often a friend (n=32, 78%), acquaintance from the centre (n=8, 20%), or family member (n=1, 2%). The Taoist group was more likely to report knowing someone in class than those in the Tai Chi and line dancing classes (x^2 = 12.34, *p*<.05). Interestingly, all of the non-exercise respondents reported knowing someone in their class.

Most participants traveled to their centre by car; most needed less than 15 minutes (n=81, 92%) for travel time.

Table 3.6: Factors Related to Participation

	Tai Chi n (%)	Taoist Tai Chi n (%)	Line Dancers n (%)	Non-Exercise n (%)
Hear about program?	(N=30)	(N=19)	(N=24)	(N=9)
- City guide/brochure	15 (50%)	1 (5%)	14 (58%)	7 (78%)
- Word of Mouth	7 (23%)	12 (63%)	6 (25%)	0 (0%)
- Contacted the centre	4 (13%)	1 (5%)	3 (13%)	0 (0%)
Know someone in class?	(N=30)	(N=20)	(N=24)	(N=10)
- Yes	9 (30%)	15 (75%)	7 (29%)	10 (100%)
- No	21 (70%)	5 (25%)	17 (71%)	0 (0%)
Travel to the Centre	(N=30)	(N=20)	(N=24)	(N=14)
- Drive Myself	25 (83%)	17 (85%)	17 (71%)	9 (64%)
- Walk	7 (23%)	1 (5%)	3 (13%)	6 (43%)
- Ride with other	0 (0%)	2 (10%)	3 (13%)	2 (14%)
- Bus	1 (3%)	2 (10%)	6 (25%)	2 (14%)

Note: Not all respondents answered each survey question. For some questions, multiple responses were possible.

A total of 71 of the 94 participants provided reasons for joining their program. The five most popular responses, which emerged for the open-ended question, are listed in Table 3.7. Physical benefits (e.g., improve balance, strength, flexibility, coordination) and health benefits (e.g., improve circulation, relieve aches, pain, or general fatigue) were popular for the Tai Chi groups; none of the line dancers or the non-exercise group reported health benefits (physical or mental). The latter groups most often cited fun/enjoyment. Some of the non-exercise group (n=3, 33%) also stated they joined for interest or to learn a new skill.

Table 3.7: Top Five Reasons for Joining the Program

	Tai Chi (N=22) n (%)	Taoist Tai Chi (N=18) n (%)	Line Dancers (N=22) n (%)	Non-Exercise (N=9) n (%)
Physical Fitness	13 (59%)	8 (44%)	17 (77%)	0 (0%)
Health Benefits	9 (41%)	9 (50%)	0 (0%)	0 (0%)
Mental Health	5 (23%)	2 (11%)	0 (0%)	0 (0%)
Friendship/Social Reason	0 (0%)	0 (0%)	4 (18%)	1 (11%)
Fun/Enjoyment	0 (0%)	1 (6%)	8 (36%)	3 (33%)

Note: Not all respondents answered each question on the survey and multiple responses were sometimes provided.

The majority (n=28, 93%) of the community Tai Chi and 21 (88%) and line dancers (n=21, 88%) were 'complete beginners'. Two (7%) Tai Chi and three (12%) line dancers were 'relative beginners', taking Tai Chi three to four years ago or line dancing over one year ago. Over half (n=9; 56%) of the non-exercise respondents had participated in their program in the past and therefore were classified as 'experienced' participants. The remaining respondents in this group either did not respond to the question or were confused as to the reference of 'program'. Some believed the program was this project instead of their card, bingo, craft, or pool group. Finally, the experienced Taoist participants had 1.5 to 15 years (mean 5.62±3.9 years) of experience and had moved into the transition class from 9 months to 12 years (mean 4.44±4.08 years) ago.

The community Tai Chi and line dancing participants were asked about their confidence in performing their activity, and all three recreation/senior centre groups were asked about their reservations with taking the class (see findings in Table 3.8). The majority (n=46, 87%) were 'very sure' or 'pretty sure' that they could perform the movements; only 3

(13%) line dancers were 'not sure'. The majority of each group (83% Tai Chi, 58% line dancers, and 100% non-exercise participants) had no reservations with taking the class. Of those with reservations, they were most concerned with not having the skills to keep up and not being able to practice at home. The 'other' concerns reported by the groups were health related such as experiencing pain or shortness of breath.

Table 3.8: Confidence and Reservations by Group

	Tai Chi n (%)	Line Dancers n (%)	Non-exercise n (%)
Confidence to perform the movements?	(N=30)	(N=23)	
- Very sure	13 (43%)	9 (39%)	N/A
- Pretty sure	14 (47%)	10 (44%)	N/A
- Not sure	0 (0%)	3 (13%)	N/A
- Don't know	3 (10%)	1 (4%)	N/A
Type of Reservations	(N=30)	(N=24)	(N=12)
- None	25 (83%)	14 (58%)	12 (100%)
- Do not have the skill	3 (10%)	5 (21%)	0 (0%)
- Not able to attend class	0 (0%)	3 (13%)	0 (0%)
- Difficulty getting to class	0 (0%)	0 (0%)	0 (0%)
- Cannot practice at home	3 (10%)	3 (13%)	0 (0%)
- Other concerns	2 (7%)	3 (13%)	0 (0%)

Note: Not all respondents answered each question on the survey and multiple responses were sometimes provided.

3.7.1.4 Physical and Psychological Profile

Recall that 30 community Tai Chi, 28 line dancing, and 16 non-exercise participants took part in the baseline assessment. A few participants failed to complete the surveys or did not want to complete some of the physical measures (i.e., the back extension and sit and reach).

The number who completed each measure are shown in Table 3.9. This table also presents the mean scores, standard deviation, and 95% confidence intervals for each measure, the F values and level of significance for group comparisons, as well as the results of the multiple comparisons. The findings for each measure are presented below.

3.7.1.4.1 Balance Confidence and Vitality

As can be seen from Table 3.9, the Tai Chi ($p<.01$) and line dancing groups ($p<.05$) both had significantly higher balance confidence (ABC) scores at baseline than the non-exercise group. Recall that possible scores on the ABC range from 0% (no confidence) to 100% (complete confidence). No significant group differences, however, were found on VPS.

3.7.1.4.2 Height, Weight, and BMI

Everyone completed the height and weight assessments. The Tai Chi group was significantly taller than both the line dance ($p<.001$) and non-exercise groups ($p<.05$). The Tai Chi group also weighed significantly more than the line dancers ($p<.05$). Most importantly, however, the groups did not differ in body mass index (BMI). For BMI, CSEP (1996) separates individuals into either healthy or unhealthy categories. This classification is based on the estimated health benefit zone according to trends in morbidity and mortality data. For individuals between 60 to 69 years of age, a healthy BMI ranges from 21 to 27 for both males and females. The exercise and non-exercise groups in our sample fell between 26 and 27.

Table 3.9: Baseline Profile of Total Sample

Measure	Tai Chi N		Line Dance n		Non-exercise n		F	p	Multiple Comparisons
ABC	28	89.18±15.35 (83.22-95.13)	25	87.68±14.10 (81.72-93.64)	15	73.51±20.65 (61.58-85.44)	4.78	**.01**	TC vs. NE** LD vs. NE*
VPS	28	36.18±8.93 (32.72-39.64)	25	38.25±4.76 (36.24-40.26)	15	37.23±8.18 (32.50-41.95)	0.49	.61	
CHAMPS Calories expended in all activities	28	3162.56±2472.55 (2203.8-4121.32)	25	2593.09±2833.80 (1396.48-3789.70)	15	2621.39±1295.98 (1873.11-3369.67)	0.43	.65	
Frequency/week in all activities	27	18.08±6.81 (15.20-20.96)	25	13.83±7.29 (10.75-16.91)	15	19.57±7.27 (15.37-23.77)	3.56	**.03**	LD vs. NE*
Calories expended in moderate activities	28	1502.95±1723.06 (834.82-2171.08)	25	1393±1865.76 (605.78-2181.47)	15	1113.98±906.79 (590.41-1637.54)	0.26	.77	
Frequency/week in moderate activities	27	4.08±4.32 (2.25-5.90)	25	3.50±4.20 (1.73-5.27)	15	5.86±3.48 (3.85-7.87)	1.49	.23	
Height	30	167.67±9.60 (164.38-171.55)	28	159.17±5.52 (157.03-161.31)	16	161.48±7.30 (157.58-165.37)	9.77	**.00**	TC vs. LD *** TC vs. NE*
Weight	30	78.21±16.42 (72.07-84.33)	28	67.07±16.75 (60.58-73.55)	16	68.69±16.01 (60.16-77.23)	3.71	**.03**	TC vs. LD*
BMI	30	27.60±4.38 (25.96-29.24)	28	26.23±5.27 (24.19-28.28)	16	26.32±5.55 (23.36-29.28)	0.64	.53	

Note: values are mean±SD (95% CI). TC= Tai Chi, LD= line dance, NE=non-exercise; * = $p<.05$; ** = $p<.01$; *** = $p<.001$

Table 3.9: Baseline Profile of Total Sample (continued)

Measure	Tai Chi n		Line Dance n		Non-exercise n		F	p	Multiple Comparisons
Balance Assessments									
Single leg stance	30	30.85±23.91 (21.92-39.78)	28	32.74±21.49 (24.41-41.07)	16	20.94±14.39 (13.27-28.61)	1.68	.19	
Tandem Time	28	10.89±2.85 (9.74-12.04)	28	12.42±4.24 (10.77-14.06)	16	10.83±3.08 (9.19-12.47)	1.63	.20	
Missteps		1.44±2.08 (0.59-2.27)		1.02±0.90 (0.67-1.37)		2.62±1.80 (0.59-2.27)	4.97	**.01**	LD vs. NE**
Tandem Walk		12.33±3.45 (10.93-13.72)		13.69±4.79 (11.83-15.54)		13.70±4.42 (11.34-16.06)	0.84	.44	
Forward Reach	30	14.70±3.06 (13.55-15.83)	28	15.18±2.69 (14.14-16.23)	16	10.83±2.09 (9.72-11.94)	14.3	**.00**	LD vs. NE*** TC vs. NE***
Backward Lean	30	7.84±1.94 (7.11-8.56)	28	9.11±2.51 (8.13-10.08)	16	7.26±1.35 (6.54-7.98)	4.74	**.01**	LD vs. NE*
Right Side Reach	30	11.81±3.32 (10.57-13.06)	28	11.35±2.50 (10.39-12.32)	16	9.97±3.32 (8.20-11.74)	1.96	.15	
Left Side Reach	30	11.94±3.38 (10.68-13.20)	28	11.33±2.79 (10.25-12.41)	16	9.62±2.89 (8.08-11.16)	3.02	.06	
Upwards Reach	30	2.23±0.94 (1.88-2.58)	28	2.51±0.96 (2.14-2.88)	16	1.87±0.68 (1.51-2.24)	2.58	.08	
Left Forward Step	30	27.20±5.45 (25.16-29.24)	28	24.05±6.70 (21.46-26.65)	16	23.44±6.16 (20.16-26.73)	2.75	.07	
Right Forward Step	30	27.45±5.29 (25.47-29.42)	28	23.11±6.69 (20.52-25.71)	16	23.65±3.84 (21.60-25.69)	4.87	**.01**	TC vs. LD**
Left Backward Step	30	25.41±5.80 (23.24-27.57)	28	28.38±5.21 (26.36-30.40)	16	23.22±4.022 (21.08-25.37)	5.31	**.01**	LD vs. NE**
Right Backward Step	30	26.86±5.56 (24.78-28.94)	28	30.30±4.95 (28.38-32.22)	16	24.53±4.59 (22.08-26.97)	7.03	**.00**	LD vs. TC* LD vs. NE**

Note: values are mean±SD (95% CI). TC= Tai Chi, LD= line dance, NE=non-exercise; * = $p<.05$; ** = $p<.01$; *** = $p<.001$
Tandem Walk = Tandem time/10 (number of feet in test) x number of missteps + Tandem time

Table 3.9: Baseline Profile of Total Sample (continued)

Measure	Tai Chi n	Tai Chi	Line Dance n	Line Dance	Non-exercise n	Non-exercise	F	p	Multiple Comparisons
Left Side Step	30	31.30±6.45 (28.89-33.72)	28	32.33±6.64 (29.76-34.91)	16	27.13±5.86 (24.00-30.24)	3.53	**.03**	LD vs. NE*
Right Side Step	30	30.99±6.41 (28.59-33.38)	28	33.02±6.63 (30.45-35.59)	16	26.89±5.77 (23.82-29.96)	4.72	**.01**	LD vs. NE**
Strength Assessments									
Knee Strength	30	167.42±73.89 (139.83-195.02)	28	161.64±44.15 (144.52-178.76)	16	156.98±45.67 (132.64-181.32)	0.18	.83	
Ankle Strength	30	138.04±47.81 (120.18-155.90)	28	109.24±38.72 (94.22-124.25)	16	109.37±37.64 (89.31-129.43)	4.09	**.02**	TC vs. LD*
Back Strength†	20		24		10				
Baseline		14.15±3.24 (12.63-15.66)		14.71±3.53 (13.21-16.19)		14.40±1.96 (13.00-15.79)	0.16	.84	
Grade 3 assessment		7.85±2.04 (6.89-8.80)		6.79±2.48 (5.74-7.83)		7.40±1.08 (6.63-8.16)	1.36	.26	
Grade of Strength (categorical)		2+ (n=5) 3- (n=15)		2+ (n=9) 3- (n=15)		2+ (n=4) 3- (n=6)	$\Pi^2 =$ 0.68	.71	
Flexibility Assessments									
Sit and Reach	19	21.16±13.45 (14.67-27.64)	24	23.31±8.28 (19.81-26.80)	12	21.42±9.73 (15.23-27.59)	0.25	.78	
Shoulder Extension	30	45.06±8.53 (41.88-48.25)	28	46.07±9.22 (42.49-49.64)	16	47.75±11.96 (41.37-54.13)	0.41	.67	
Shoulder Flexion	30	144.47±14.60 (139.02-149.92)	28	150.18±9.28 (146.58-153.78)	16	141.88±10.64 (136.21-147.54)	2.89	.06	
Ankle Dorsiflexion	30	14.00±4.98 (12.13-15.86)	28	14.03±4.89 (12.14-15.93)	16	12.00±4.81 (9.43-14.56)	1.06	.35	
Ankle Plantarflexion	30	44.83±10.00 (50.57-58.00)	28	54.28±9.57 (50.57-58.00)	16	46.63±4.69 (44.13-49.12)	8.65	.00	LD vs. TC***

Note: values are mean±SD (95% CI). TC= Tai Chi, LD= line dance, NE= non-exercise; * = p<.05; ** = p<.01; *** = p<.001

† Chi square analysis rather than ANOVA. Mean±SD are presented, the Π^2 is based on strength grade categories.

3.7.1.4.3 Balance

All participants completed the Single-leg Stance test; no statistical difference was found between the groups. Two Tai Chi participants were unable to complete the Tandem Walk, one participant had very poor balance (the evaluator and research assistant assisted one gentleman by holding his arms as he walked the line) while another man declined this test due to his sore knees. As described under the measurement section, during the Tandem Walk test, both time and number of missteps are recorded. The objective is to perform the test as quickly as possible, while minimizing the number of errors or missteps. Accordingly, we created a total Tandem Walk score by penalizing each person's time for the 10-foot test by their missteps. For example, person A had an average time of 13.87 seconds and an average of one misstep over the three trials. Her time was divided by 10 to receive a value of 1.387. This value was then multiplied by the average number of missteps (in this case 1) to obtain a penalty score of 1.38. This penalty was added to 13.87 to yield a Tandem Walk score of 15.25 seconds. Conversely, person B was faster (taking an average of only 10.33 seconds) and had fewer missteps (average of 0.67-one misstep on each of the first two trials, none on third trial). Person B's Tandem Walk score was 11.02 seconds (10.33 divided by 10 = 1.033 X .67 = .69 + 10.33 = 11.02). As shown in Table 3.9, our groups did not differ significantly at baseline, taking on average 12 to 13 seconds to complete the Tandem Walk when penalized for missteps.

All participants completed the Multi-Directional Reach Test (MDRT) and Maximal Step Length (MSL) Test. The Tai Chi ($p<.001$) and line dancing ($p<.001$) groups had significantly greater scores on the forward reach than the non-exercise group. The line dancers also had significantly greater backward lean scores than the non-exercise group ($p<.05$). No group differences were found in the sideways or upward reaches. On the MSL, Tai Chi participants had greater right forward step scores than the line dancers ($p<.01$). The line dancers, meanwhile, had greater right back step scores than the Tai Chi ($p<.05$) and non-exercise ($p<.01$) groups; as well as greater left back step scores than the non-exercise group ($p<.01$). The line dancers also had greater sideways steps (both left, $p<.05$, and right, $p<.01$) than the non-exercise group.

3.7.1.4.4 Strength

All participants completed the knee and ankle strength assessments. No difference was found between the groups for knee strength. The ankle strength, however, was significantly better in Tai Chi versus the line dance group ($p<.05$) at baseline. Only 20 (67%) Tai Chi, 24 (86%) line dancers, and 10 (63%) of the non-exercise group completed the assessment of back strength. Those refusing to try cited back pain or difficulty getting up off the floor as reasons. Of those who completed this assessment, 14 (70%) Tai Chi, 14 (58%) line dancers, and 6 (60%) non-exercise participants obtained a strength grade of 3- (fair). All others obtained a 2+ strength grade (poor). There was no significant difference between the groups.

3.7.1.4.5 Flexibility

Nineteen people refused to complete the sit and reach test (due to recent hip or knee replacements and/or fear of not being able to get up off of the floor). No significant group difference emerged.

All participants completed the shoulder and ankle flexibility tests. No group differences were found for shoulder flexion and extension or ankle dorsiflexion. The ankle plantarflexion of the line dancers, however, was significantly greater than for the Tai Chi participants ($p<.001$).

3.7.1.5 Study Completers versus Dropouts

A total of 52 (70%) out of the 74 recreation/senior centre participants returned for the posttest assessment: 20 (67%) from the Tai Chi group; 18 (64%) from the line dance group; and

14 (88%) from the non-exercise group. A total of ten participants from each exercise group, and two participants from the non-exercise group, did not return for the final assessment. Of the 10 Tai Chi and 10 line dancing dropouts, the majority (90%) were complete beginners to the exercise; only two dropouts (one Tai Chi participant and one line dancer) were relative beginners.

Three Tai Chi participants could not be contacted; their instructor or classmates stated that these individuals were on holidays for several weeks. Six Tai Chi participants, who had dropped out of the class due to health-related concerns or limitations (such as knee or back pain, headaches, or unable to coordinate the movements due to a previous stroke), said they did not want to return to complete the assessment. One woman, who adhered to the program, said her cancer had returned and she needed to undergo chemotherapy. Of the nonreturnees from the line dancing group, four were on holidays, while two had dropped out of the program and this study due to health related concerns (one hurt her back, while another woman was caring for her husband after a recent heart attack). The remaining four line dancers did not attend the final class when posttest recruitment took place and did not provide a follow-up phone number. Finally, two non-exercise participants did not return for the final assessment. One stated that she found the tests too hard, while another stated that her son was ill.

The baseline scores of participants returning for the posttest assessment versus those not returning (study dropouts) were compared. The demographic and psychophysical profiles of the study completers versus the dropouts were similar. Completers had an average age of 68.46±7.25 years compared to the study dropouts mean age of 67.67±7.84 years. Both groups had similar proportions of female (85% and 82% respectively), married persons (58% and 56%), those who completed some post secondary education (53% and 66%), and fully (87% and 78%) or semi retired (13% and 22%) individuals. The two groups did not differ significantly in their confidence to perform the activity, reservations with taking the class, or limitations affecting physical activity (either temporary or long term). Number of reservations and health problems were also similar as well as balance confidence and vitality.

No significant group differences were found between the study completers and dropouts with respect to their level of physical activity. Of those providing a response, 38% (n=19) of the study completers and 28% (n=5) of the dropouts were enrolled in other structured classes. A total of 77% (n=40) of the completers and 89% (dropouts) reported participation in informal exercise pursuits. The majority of each group (77% completers, 64% dropouts) accumulated 30 minutes or more of moderate intensity activity at least three days a week. Most (58% completers, 72% dropouts) checked that they had been involved in physical activity 'off and on' throughout their life; while 35% of the completers and only 11% of the dropouts checked 'all their life'. The findings from the CHAMPS questionnaire confirm that both the study completers and dropouts were active. Based on Stewart et al.'s (2001) classifications (see Table 3.5), our study completers and dropouts were 'already active' according to their total calories expended (2711 and 3321 respectively) and frequency per week in all activities (16.36 and 18.50 respectively).

While their demographic profiles were quite similar, differences emerged in their physical profiles. As shown in Table 3.10, those not returning for the posttest assessment had a greater BMI ($p<.05$), did not lean as far backwards ($p<.01$) during the MDRT, and had shorter left ($p<.05$) and right ($p<.05$) side steps during the MSL than the returnees. Finally, the shoulder extension of those not returning ($p<.01$) was significantly less than those returning for the final assessment. Since these groups were compared on all of the outcome measures, the number of differences found is quite small, relatively speaking.

Table 3.10: Differences in Study Completers versus Dropouts

Measure	Returned for Posttesting Yes	No	t	p
Body Mass Index	25.94±4.84 (24.59-27.30)	28.83±4.76 (26.72-30.95)	2.36	**.02**
Backwards Lean	8.60±2.18 (8.00-9.26)	7.22±1.90 (6.89-7.66)	2.58	**.01**
Left Side Step	31.80±6.13 (30.56-33.89)	28.40±7.28 (24.40-31.38)	2.06	**.04**
Right Side Step	32.04±6.29 (30.40-34.02)	28.11±6.92 (24.77-31.57)	2.38	**.02**
Shoulder Extension	48.65±9.28 (46.26-51.58	39.81±7.01 (35.89-42.50)	4.00	**.00**

Note: values are mean±SD (95% CI).

3.7.1.6 Class Attendance and Home Practice

As a reminder, all classes at the recreation/senior centres in the outcome study were offered once a week over a 10-week session (therefore participants could have attended a maximum of 10 classes). Table 3.11 illustrates the attendance rates for the Tai Chi and line dancing classes, the average number of classes attended by the entire sample, and for those completing and not completing the study. The attendance rate of the non-exercise group could not be determined, as many of these classes did not monitor attendance. As can be seen from Table 3.11, those returning for the posttest assessment attended significantly more classes than those not returning for both the Tai Chi (t=3.86, p<.01) and line dance (t=5.142, p<.01) groups.

Unfortunately, few participants returned the practice logs. Several of both the Tai Chi and line dancing participants told the evaluator that they did not practice at home (since they needed the instructor and/or music). A total of 5 (25%) community Tai Chi and 3 (17%) line dancing participants returned their practice log. All recorded some home practice ranging from 1 to 4 times per week and from 10 to 15 minutes each time. Due to the small number of practice logs returned there was no further analysis using this data.

Table 3.11: Class Attendance for Outcome Study

	Tai Chi	**Line Dance**
Entire Sample	7.37∀2.41	7.29∀2.02
Participants Not Returning for Posttesting	5.10∀2.64	5.40∀1.58
Participants Returning for Posttesting	8.50∀1.24	8.33∀1.37

Note: mean ∀SD

3.7.2 Group Comparisons

While Table 3.9 provided a baseline profile for the total sample, Table 3.12 displays the baseline profile of participants in each group who completed both the pre and posttest assessments. As explained above, 20 Tai Chi, 18 line dancers, and 14 non-exercise participants completed both pre and posttesting. Similar to the total sample, the groups differed at baseline on a number of different variables. These group differences are described below and compared with findings using the total sample.

3.7.2.1 Physical and Psychological Profile of Study Participants

3.7.2.1.1 ABC, VPS, and CHAMPS

As can be seen from Table 3.12, the Tai Chi group reported significantly greater balance confidence (ABC score) than the non-exercise group ($p<.01$); however, unlike the scores of the total sample, the balance confidence of the line dancers and non-exercise group did not differ. Similar results were obtained for the VPS and CHAMPS questionnaire as in the total sample; no significant group differences emerged for VPS or in total calories expended in all and in moderate intensity activities. The non-exercise group, however, reported a greater frequency per week in all activities than the line dancers ($p<.05$).

Table 3.12: Baseline Profile of Participants Completing Pre and Posttest Assessments by Group

Measure	n	Tai Chi	n	Line Dance	n	Non-exercise	F	p	Multiple Comparisons
ABC	18	89.55±15.82 (81.69-97.42)	18	84.34±14.86 (76.95-91.73)	14	72.51±20.65 (61.58-85.44)	3.58	**.04**	TC vs. NE**
VPS	18	35.86±9.14 (31.32-40.41)	18	36.56±3.94 (34.59-38.52)	14	37.23±8.18 (32.50-41.95)	0.14	.87	
CHAMPS									
Calories expended in all activities	18	3553.91±2915.09 (2082.7-4704.64)	18	2022.52±1676.86 (1188.64-2856.41)	14	2621.39±1295.98 (1873.11-3369.67)	2.35	.11	
Frequency/week in all activities	17	17.75±8.08 (13.45-22.05)	18	12.78±7.27 (9.16-16.39)	14	19.57±7.27 (15.37-23.77)	3.56	**.04**	LD vs NE*
Calories expended in mod. Activities	18	1763.5±1960.00 (788.79-2738.20)	18	1048.18±1230.36 (436.33-1660.02)	14	1113.98±906.79 (590.41-1637.54)	1.26	.29	
Frequency/week in moderate activities	17	4.69±4.81 (2.12-7.25)	18	3.11±3.70 (1.26-4.96)	14	5.86±3.48 (3.84-7.86)	1.85	.17	
Height	20	168.89±9.69 (164.35-173.42	18	158.42±6.53 (155.17-161.67)	14	161.96±7.71 (157.50-166.41)	8.03	**.01**	TC vs LD*** TC vs NE*
Weight	20	75.23±11.52 (69.84-80.62)	18	64.74±18.40 (55.59-73.89)	14	68.11±17.11 (58.23-78.00)	2.21	.12	
BMI	20	26.39±3.12 (24.91-27.84)	18	25.48±5.73 (22.63-28.33)	14	25.93±5.85 (22.54-29.31)	0.16	.85	

Note: values are mean±SD (95% CI). TC= Tai Chi, LD= line dance, NE=non-exercise; * = $p<.05$; ** = $p<.01$; *** = $p<.001$

Table 3.12: Baseline Profile of Participants Completing Pre and Posttest Assessments by Group (continued)

Measure	n	Tai Chi	n	Line Dance	n	Non-exercise	*F*	*p*	Multiple Comparisons
Balance Assessments									
Single leg stance	20	40.07±20.08 (30.67-49.78)	18	28.64±18.26 (19.56-37.72)	14	23.50±13.51 (15.71-31.31)	3.92	**.03**	TC vs NE*
Tandem Walk	19	11.45±2.89 (10.12-12.89)	18	14.08±4.06 (12.07-16.11)	14	12.86±4.10 (10.51-15.25)	2.29	.11	
Forward Reach	20	14.37±2.34 (13.27-15.47)	18	15.41±3.11 (13.86-16.96)	14	11.02±2.15 (9.78-12.26)	12.0	**.00**	TC vs NE** LD vs NE ***
Backward Lean	20	8.23±1.22 (7.66-8.81)	18	10.03±2.69 (8.69-11.37)	14	7.30±1.44 (6.47-8.14)	8.62	**.00**	LD vs TC* LD vs NE***
Right Side Reach	20	12.21±3.79 (10.44-13.99)	18	11.34±2.67 (10.00-12.66)	14	10.19±3.50 (8.17-12.22)	1.48	.24	
Left Side Reach	20	11.89±3.59 (10.20-13.56)	18	11.76±3.05 (10.23-13.27)	14	9.80±3.06 (8.04-11.57)	1.95	.15	
Upwards Reach	20	2.27±0.89 (1.85-2.68)	18	2.56±1.08 (2.03-3.10)	14	2.00±0.64 (1.63-2.36)	1.58	.21	
Left Forward Step	20	27.78±5.04 (25.42-30.13)	18	25.00±6.52 (21.75-28.42)	14	23.96±6.44 (20.24-27.68)	1.92	.16	
Right Forward Step	20	28.50±4.70 (26.31-30.70)	18	23.74±6.22 (20.64-26.83)	14	24.12±3.76 (22.03-26.39)	4.99	**.01**	TC vs NE* TC vs LD*
Left Backward Step	20	27.16±5.17 (24.74-29.57)	18	27.63±6.16 (24.57-30.69)	14	23.92±3.80 (21.73-26.12)	2.27	.11	
Right Backward Step	20	28.54±4.33 (26.51-30.57)	18	30.12±5.43 (27.42-32.83)	14	25.48±4.05 (23.15-27.83)	3.93	**.03**	LD vs NE*
Left Side Step	20	32.40±6.27 (29.46-35.34)	18	34.50±3.94 (32.54-36.46)	14	27.48±6.21 (23.89-31.06)	6.48	**.00**	TC vs NE* LD vs NE**
Right Side Step	20	32.68±5.72 (29.99-35.35)	18	35.24±4.56 (32.97-37.51)	14	27.02±6.18 (23.45-30.59)	9.05	**.00**	TC vs NE** LD vs NE***

Note: values are mean±SD (95% CI). TC= Tai Chi, LD= line dance, NE=non-exercise; * = $p<.05$; ** = $p<.01$; *** = $p<.001$
Tandem Walk = Tandem time/10 (number of feet in test) x number of missteps + Tandem time

Table 3.12: Baseline Profile of Participants Completing Pre and Posttest Assessments by Group (continued)

Measure	Tai Chi n	Tai Chi	Line Dance n	Line Dance	Non-exercise n	Non-exercise	F	p	Multiple Comparisons
Strength Assessments									
Knee Strength	20	175.30±64.87 (144.94-205.66)	18	166.70±47.00 (143.33-190.08)	14	159.17±48.64 (131.07-187.25)	0.36	.69	
Ankle Strength	20	138.57±41.93 (118.94-158.19)	18	122.26±41.33 (101.70-142.81)	14	115.71±35.90 (94.96-136.44)	1.50	.23	
Back Strength† **Baseline**	15	13.67±3.32 (12.12-15.80)	16	15.62±2.52 (14.27-16.97)	10	14.40±1.96 (13.00-15.80)	1.51	.23	
Grade 3 assessment		7.76±1.85 (6.74-8.79)		6.94±2.56 (5.57-8.30)		7.40±1.07 (6.63-8.17)	0.65	.53	
Grade of Strength (categorical)		2+ (n=4) 3- (n=11)		2+ (n=8) 3- (n=8)		2+ (n=4) 3- (n=6)	Π^2 = 1.78	.41	
Flexibility Assessments									
Sit and Reach	13	27.91±10.89 (20.99-34.83)	17	23.06±8.43 (18.56-27.55)	11	20.59±9.75 (14.03-27.14)	0.21	.80	
Shoulder Extension	20	46.30±9.58 (41.81-50.79)	18	51.00±5.20 (48.41-53.58)	14	49.00±12.31 (41.89-56.11)	1.24	.29	
Shoulder Flexion	20	141.15±13.08 (135.03-147.27)	18	151.61±10.63 (146.32-156.90)	14	144.71±7.82 (140.20-149.23)	4.34	**.02**	LD vs TC**
Ankle Dorsiflexion	20	14.35±4.58 (12.21-16.49)	18	15.11±3.92 (13.16-17.06)	14	12.57±4.89 (9.74-15.40)	1.32	.27	
Ankle Plantarflexion	20	47.35±10.51 (42.43-52.27)	18	50.89±9.79 (46.01-55.75)	14	46.63±4.68 (44.13-49.12)	1.24	.30	

Note: values are mean±SD (95% CI). TC= Tai Chi, LD= line dance, NE=non-exercise; * = $p<.05$; ** = $p<.01$; *** = $p<.001$

† Chi square analysis rather than ANOVA. Mean±SD are presented, the Π^2 is based on strength grade categories.

3.7.2.1.2 Height, Weight, and BMI

Similar to the findings for the total sample, the Tai Chi participants were taller than both the line dancers ($p<.001$) and the non-exercise group ($p<.05$). No difference in weight was reported when those not completing the study were removed from the analysis, and similar to the findings with the total sample, no difference in BMI was found

3.7.2.1.3 Balance

The Tai Chi group had a significantly greater baseline single-leg stance time than the non-exercise group ($p<.05$). Although the Tai Chi group had a faster Tandem Walk score, no significant group differences emerged. The findings for the MDRT were similar to the total sample. The Tai Chi ($p<.01$) and line dance ($p<.001$) groups had greater forward reach scores than the non-exercise group, while the line dancers had greater backward lean scores than the non-exercise group ($p<.001$). In contrast to the findings on the total sample, the line dancers also had greater backward lean scores than the Tai Chi participants ($p<.05$) when only study completers were examined.

With regards to the Maximal Step Length (MSL) Test, the Tai Chi participants had greater right forward step scores in comparison to the line dancers ($p<.05$) and, unlike the total sample, with the non-exercise group ($p<.05$). Right backwards step scores were greater for the line dancers than the non-exercise group ($p<.05$), however, the difference between the line dancers and Tai Chi groups was not significant. Finally, the left ($p<.01$) and right ($p<.001$) side step scores were greater for the line dancers than the non-exercise group. Significant left ($p<.05$) and right ($p<.01$) side step score differences were also found between the non-exercise and Tai Chi groups, which was not evident in the analysis of the total sample.

3.7.2.1.4 Strength and Flexibility Assessments

No group differences emerged for knee strength and, unlike for the total sample, regarding ankle strength. For the flexibility assessments, the line dancers had greater shoulder flexion than the Tai Chi participants ($p<.01$), which was not evident for the total sample. Finally, a significant group difference emerged for ankle plantarflexion in the total sample, but not with only study completers.

3.7.3 Change on Outcome Measures

Change on each of the outcome measures was examined using a repeated measures ANOVA with group as a between subject factor (3 levels: Tai Chi, line dance or non-exercise) and time as a within subject factor (2 levels: pre and posttest). Appendix GG displays the means, standard deviations, and 95% confidence intervals for all pre and posttest scores broken down for each of the three recreation/senior centre groups. The outcomes for which a significant class by time interaction or a main effect of group or time emerged, are reported below. A main effect of time identifies the outcome variables that consistently increased or decreased from pre to posttest for all study groups (significant group differences did not exist). When the study groups differed at pre and/or post test, but there was no significant change over time, a main effect of group was reported. Finally, an interaction effect occurred when the outcome varied across the three groups over time. Table 3.13 provides a summary of the outcome variables having an interaction or main effect. This table also illustrates group differences at pre and posttest, individual group pre-post change, as well as resulting effect sizes.

Table 3.13: Summary of the Interaction and Main Effects, Pre-post Differences, Change and Effect Size

Measure	GroupxTime Interaction	Main Effect		Differences at:		Pre-post Change		Effect Size
	F	Group *F*	Time *F*	Pretest	Posttest	*t*	*p*	
ABC		5.85** (2, 47)		TC vs NE**	TC vs NE**			
				Balance Assessments				
Single-leg Stance	20.97*** (2, 49)			TC vs NE*	TC vs NE** LD vs NE**	LD=5.1	.00	-.05 (TC) .79 (LD) -.24 (NE)
Tandem Walk	7.18** (2, 47)				TC vs NE*** LD vs NE**	LD=2.9	.03	.41 (TC) .52 (LD) -.76 (NE)
Forward Reach		17.18*** (2, 49)		TC vs NE** LD vs NE***	TC vs NE*** LD vs NE***			
Backward Lean	20.38*** (2, 49)			LD vs TC* LD vs NE***		LD=4.6	.00	.22 (TC) -.71 (LD) .20 (NE)
Left Side Reach		3.60* (2, 49)						
Upwards Reach		3.22* (2, 49)	6.26* (1, 49)		LD vs NE**			-.16 (all groups)
Right Forward Step	6.75** (2, 49)			TC vs NE* TC vs. LD*	TC vs NE***	TC=5.2 LD=4.7	.00 .00	.45 (TC) .61 (LD) .11 (NE)
Left Forward Step		4.27* (2, 49)	16.69*** (1, 49)		TC vs NE***			.37 (all groups)
Right Back Step		4.56* (2, 49)		LD vs NE*	LD vs NE*			
Left Back Step			6.33* (1, 49)					.21 (all groups)

Note: TC=Tai Chi, LD=line dance, NE=non-exercise, *=$p<.05$, **=$p<.01$, ***=$p<.001$.
Tandem Walk = Tandem time/10 (number of feet in test) x number of missteps + Tandem time
Effect size of .20 is small, .50 is moderate, and .80 is large (Cohen, 1977).

Table 3.13: Summary of the Interaction and Main Effects, Pre-post Differences, Change and Effect Size (continued)

Measure	GroupxTime Interaction *F*	Main Effect Group *F*	Main Effect Time *F*	Differences at: Pretest	Differences at: Posttest	Pre-post Change *t*	Pre-post Change *p*	Effect Size
Right Side Step	9.25*** (2, 49)			TC vs NE** LD vs NE**	TC vs NE*	TC=2.2 LD=3.2	.03 .01	.25 (TC) -.64 (LD) .30 (NE)
Left Side Step	6.17** (2, 49)			TC vs NE* LD vs NE**	TC vs NE*	LD=2.5	.02	.22 (TC) -.56 (LD) .20 (NE)
Flexibility Assessments								
Shoulder Flexion		4.93** (2, 49)		LD vs TC**				
Ankle Dorsiflexion			11.47*** (1, 49)					.49 (all groups)

Note: TC=Tai Chi, LD=line dance, NE=non-exercise, *=$p<.05$, **=$p<.01$, ***=$p<.001$.
Effect size of .20 is small, .50 is moderate, and .80 is large (Cohen, 1977).

3.7.3.1. ABC Scale (Balance Confidence)

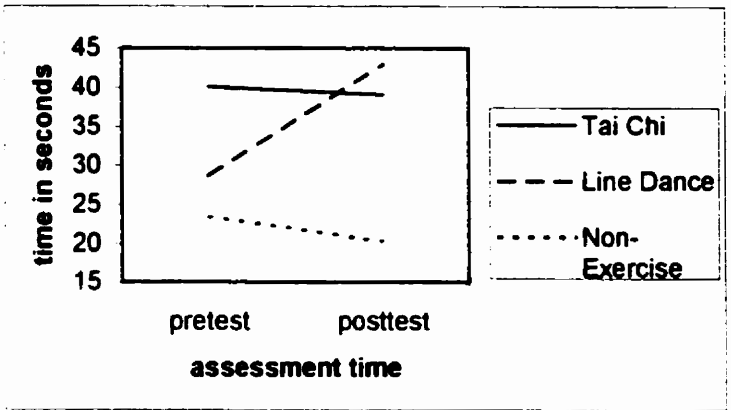
A total of 50 pre and post ABC scales (18 from Tai Chi participants, 18 from the line dancers, and 14 from the non-exercise group) were collected and analyzed. No significant interaction effect or main effect of time were found. As can be seen in Table 3.13, a significant group effect emerged for balance confidence. As can be seen from Appendix GG, the Tai Chi group had the highest balance confidence at both pre and post, the line dancers had slightly less balance confidence than the Tai Chi group, while the non-exercise group had the lowest score at both pre and post. As shown in Table 3.13, the Tai Chi group had significantly better balance confidence than the non-exercise group at both pre and posttest.

3.7.3.2 Balance

3.7.3.2.1 Single-leg Stance Time (Static Balance)

A significant group by time interaction was observed for Single-leg Stance Time. As shown in Table 3.13, the Tai Chi group had a higher SLST score at pretest than the non-exercise group, while at posttest both the Tai Chi and line dancers could maintain their static balance longer than the non-exercise group. As illustrated in Figure 3.2, the Tai Chi and non-exercise groups SLST declined minimally over the 10-week study period, while the line dancers significantly improved from pre to posttest. The magnitude of change was fairly large for the line dancers. It is noteworthy that the posttest scores of the line dancers were only slightly higher (mean 43 versus 40) than the pretest scores of the Tai Chi group (refer to Appendix GG).

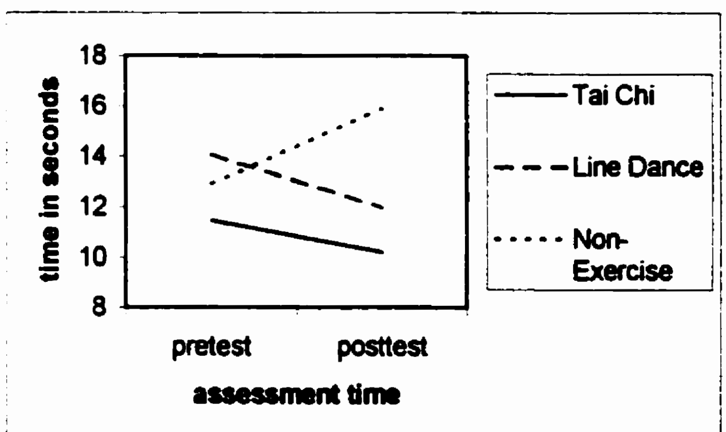
Figure 3.2: Interaction Effect for Single-leg Stance Time



3.7.3.2.2 Tandem Walk (Dynamic Balance)

A significant group by time interaction was observed for the Tandem Walk. Both the Tai Chi and line dance groups had better scores than the non-exercise group at posttest. As shown in Figure 3.3, both the exercise groups improved from pre to posttest (i.e., took less time, including misstep penalty); effect size was moderate for both groups (refer to Table 3.13). Conversely, the non-exercise group performed worse at posttest.

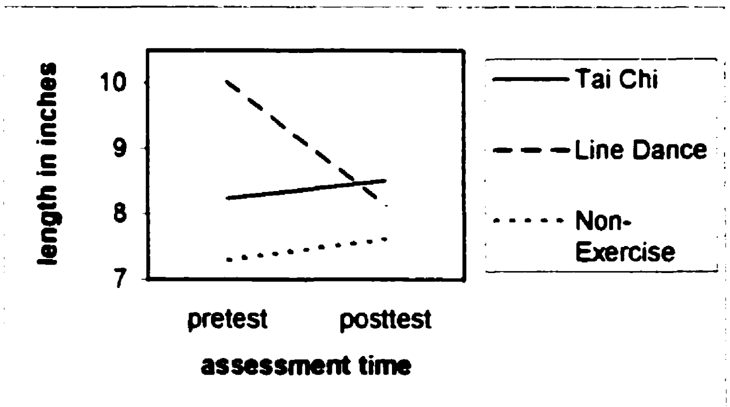
Figure 3.3: Interaction Effect for Tandem Walk Time



3.7.3.2.3 Multi-Directional Reach Test (MDRT) (Limits of Stability)

The only significant group by time interaction effect for the MDRT concerned the backward lean scores. As displayed in Table 3.13, the line dancers had a significantly greater backward lean scores than the Tai Chi and non-exercise groups at pretest; no group difference existed at posttest. As illustrated in Figure 3.4, backward lean scores of the Tai Chi and non-exercise groups remained relatively stable from pre to posttest, while scores of the line dancers declined significantly over the 10-week study period. The magnitude of change was small for the Tai Chi and non-exercise groups and moderate for the line dancers.

Figure 3.4: Interaction Effect for Backward Lean

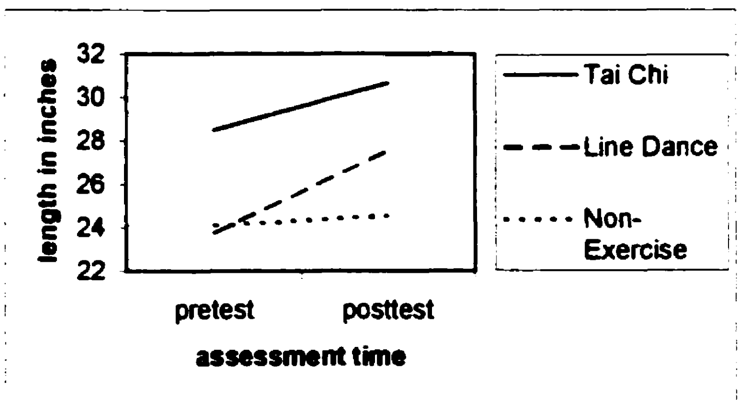


A significant group effect emerged for forward reach, left side reach, and upward reach. As shown in Table 3.13, the Tai Chi and line dance groups had better forward reach than the non-exercise group at both pre and posttest; the line dancers (although minimal according to Appendix GG) had the furthest reach at both assessment times. For the left side reach, no significant difference existed between the groups at either pre or posttest although the Tai Chi and line dance groups did appear to have a greater left side reach than the non-exercise group. Finally, while upward reach scores of the groups were similar at baseline, the line dancers had a greater upward reach than the non-exercise group at posttest. The Tai Chi group also had greater upward reach than the non-exercise group, but their reach was not as high as the line dancers. A significant decline from pre to posttest (time effect) was found for upward reach, but the magnitude of change was minimal.

3.7.3.2.4 Maximal Step Length (Protective Balance)

A significant group by time interaction or main effect occurred for all six directions of the Maximal Step Length (MSL) test (refer to Table 3.13). Figure 3.5 illustrates the findings for the right forward step. The Tai Chi group had better scores on the right forward step component than the line dancers and the non-exercise groups at pretest. The Tai Chi group was also better than the non-exercise group at posttest. Both the Tai Chi and line dance groups significantly improved their right forward step scores from pre to posttest, while the non-exercise group remained the same. Magnitude of change was moderate for both the Tai Chi and line dance groups.

Figure 3.5: Interaction Effect for Forward Right Step

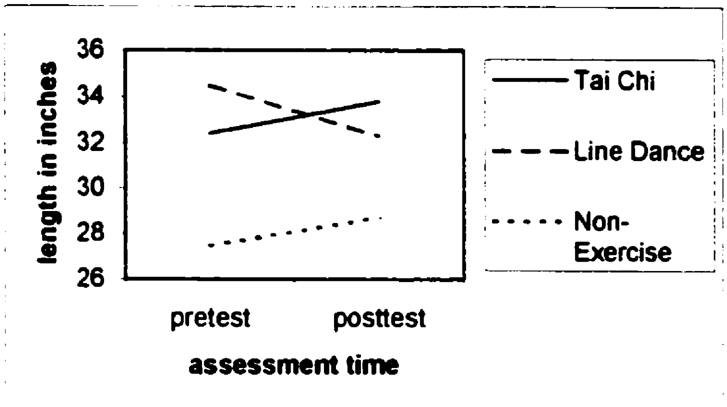


Significant main effects of both group and time emerged for the left forward step. The group effect revealed no group differences in step length at pretest but greater left forward step scores at posttest emerged for the Tai Chi group compared to the non-exercise group. The line dancers had better left forward step than the non-exercise group but not as far as the Tai Chi group at both assessment times. For the time effect, participants in all classes had greater left forward step scores at posttest, but the magnitude of change was minimal.

For the backward steps, a significant group effect was found for the right backward step. At both pre and posttest the line dancers had greater right backward step scores than the non-exercise group. Overall, the line dancers stepped further than the Tai Chi group who stepped further than the non-exercise group. A significant effect of time was found for the left backward step; the groups had greater left backward step scores at posttest; the magnitude of change was small.

A significant group by time interaction occurred for the left and right side steps. Figure 3.6 illustrates the findings for the left side step; the pattern was similar for the right side. As presented in Table 3.13, the Tai Chi and line dance participants had greater side step scores (both left and right) at pretest than the non-exercise group. At posttest the Tai Chi group had better side step scores than the non-exercise group. While the Tai Chi and non-exercise participants improved both their side steps scores from pre to posttesting (the Tai Chi had significant improvement on their right side), the line dancers had a significant decline in both their left and right side step scores. For both the left and right side steps, the magnitude of change was small for the Tai Chi and non-exercise groups and moderate for the line dancers.

Figure 3.6: Interaction Effect for the Left Side Step



3.7.3.3 Flexibility

Significant main effects were found for two measures of flexibility (see Table 3.13). A significant group effect emerged for shoulder flexion (line dancers had greater shoulder flexion at pretest than the Tai Chi group). A significant time effect was found for ankle dorsiflexion. All groups had greater ankle dorsiflexion at posttest and a moderate effect size was observed.

No significant change over time or group differences emerged for the strength measures or the VPS.

3.7.3.4 Composite Scores

As described in the data analysis section, composite scores were created for several variables (i.e. total MDRT, total MSL, total knee and ankle strength, and total shoulder and ankle flexibility). Separate MANOVAs were run using pre-post change scores first for all the balance (composite and stand-alone) variables, then for all the flexibility variables. A one-way ANOVA was run for the single, composite strength variable. While repeated measures analysis of variance examines the amount of change overtime within each group separately for each variable, the MANOVA looks at whether the amount of change is different for the groups and allows us to look at all the balance (or flexibility indicators) together in the same model.

Two one-way MANOVAs were used to examine amount of change (pre to post) in balance. The first model included four variables (SLST, Tandem Walk, MDRT total, and MSL total), while the second included three variables (SLST, Tandem Walk, Total Reach--MDRT and MSL combined). Similar results were obtained for both models; a significant overall effect ($F(2, 27) = 8.48$, $p<.001$) was found. As shown in Table 3.14, with respect to all the balance measures, the groups differed significantly with respect to only two variables: the SLST and Tandem Walk. Bonferonni post hoc comparisons revealed that the line dancers had a greater positive change in their single-leg stance time than the Tai Chi ($p<.001$) and non-exercise groups ($p<.001$). With respect to Tandem Walk, the non-exercise group had a greater change (performed worse) than the Tai Chi ($p<.05$) and line dance ($p<.01$). No significant differences emerged for the composite strength score or the flexibility model (including sit and reach and total flexibility).

Table 3.14: Change Scores on Composite and Remaining Variables

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	p
Single-leg Stance **Pretest**	40.07±20.08 (30.67-49.78)	28.64±18.26 (19.56-37.72)	23.50±13.51 (15.71-31.31)		
Posttest	39.10±21.68 (29.03-49.32)	43.06±16.64 (34.78-51.34)	20.31±10.19 (14.44-26.21)		
Change	-.89±4.84 (-3.14-1.36)	14.42±11.87 (8.51-20.32)	-3.64-7.64 (-8.05-.77)	20.85	**.001**
Tandem Walk Pretest	11.45±3.05 (10.09-13.12)	14.08±4.06 (12.06-16.11)	12.86±4.10 (10.51-15.25)		
Posttest	10.27±1.02 (9.76-10.78)	11.97±3.21 (10.37-13.57)	15.93±5.58 (12.70-19.15)		
Change	1.33±2.78 (2.71-5.06)	2.11±3.91 (1.62-4.06)	-3.04±5.37 (-5.78-6.14)	7.17	**.002**
MDRT Total† Pretest	49.08±9.02 (44.60-53.57)	51.12±10.17 (46.05-56.17)	40.33±8.25 (35.57-45.10)		
Posttest	50.54±10.41 (44.19-57.18)	49.00±9.82 (44.11-53.88)	38.91±7.82 (34.39-43.43)		
Change	1.56±6.88 (-1.66-4.78)	-2.10±8.62 (-6.39-2.18)	-1.42±8.25 (-6.19-3.34)	2.26	.16
MSL Total†† Pretest	177.06±28.44 (163.75-190.38)	176.25±27.42 (162.61-189.89)	152.09±29.06 (135.31-168.88)		
Posttest	185.82±24.70 (163.41-196.96)	178.39±27.22 (164.85-191.93)	156.56±26.80 (141.08-172.04)		
Change	8.75±7.34 (5.32-12.19)	2.13±8.44 (-2.06-6.33)	4.46±19.85 (-6.99-15.92)	1.16	.32

Note: values are mean ± SD (95% CI); F values are MANOVAs or one-way ANOVA
*p<.05, **p<.01
† MDRT total = forward + backward + left side + right side + upward reach scores
†† MSL total = forward, backward, and sideways steps (average of 3 trials: left and right direction)

Table 3.14: Change Scores on Composite and Remaining Variables (continued)

Measures	Tai Chi	Line Dance	Non-exercise	F	p
Total Reach‡ Pretest	226.04±33.21 (210.50-241.58)	227.36±34.59 (210.16-244.56)	192.43±33.71 (172.96-211.90)		
Posttest	236.36±32.70 (210.00-251.75)	227.39±36.07 (209.45-245.32)	195.47±31.08 (177.52-213.42)		
Change	10.32±8.59 (6.30-14.34)	0.66±16.06 (-7.96-8.01)	3.04±27.56 (-12.87-18.95)	1.86	.17
Strengthᴵᴵ Pretest	313.86±100.77 (266.70-361.03)	288.96±72.04 (253.13-324.79)	274.88±79.38 (229.05-320.71)		
Posttest	315.77±80.50 (267.04-388.06)	281.00±71.13 (245.62-316.37)	268.33±60.63 (233.32-303.34)		
Change	1.91±44.84 (-19.07-22.90)	-7.96±23.67 (-19.73-3.80)	-6.54±66.90 (-45.17-32.08)	.25	.78
Flexibility¶ Pretest	249.30±24.13 (238.00-260.59)	268.61±11.63 (262.82-274.39)	252.42±14.64 (243.97-260.88)		
Posttest	260.15±21.49 (237.61-264.60)	269.39±18.72 (260.08-278.70)	253.07±10.95 (246.74-259.40)		
Change	10.85±13.62 (4.47-17.22)	0.78±18.01 (-8.17-9.73)	0.64±16.61 (-8.94-10.23)	2.35	.11
Sit and Reach Pretest	27.91±10.89 (20.99-34.83)	23.06±8.43 (18.56-27.55)	20.59±9.75 (14.03-27.14)		
Posttest	27.25±10.24 (20.74-33.75)	24.06±9.17 (19.18-28.94)	21.75±9.55 (15.31-28.14)		
Change	1.00±3.11 (-2.98-.98)	1.00±3.86 (-1.06-3.06)	1.13±2.30 (-.41-2.68)	1.65	.21

Note: values are mean ± SD (95% CI); F values are MANOVAs or one-way ANOVA

*p<.05, **p<.01

‡ Total Reach = MDRT total (upper body reach) + MLS total (step length)

ᴵᴵ Strength = knee extension + ankle dorsiflexion

¶ Flexibility = shoulder extension + shoulder flexion + ankle dorsiflexion + ankle plantarflexion

As noted previously, a number of participants in the current study from both the Tai Chi and line dancing classes were enrolled in other exercise classes at the time of the study (two in each group also joined new classes during the study period). To explore the impact of concurrent class involvement on change in the outcome indicators, we separated those involved (11 Tai Chi and 12 line dancers) from those not involved (9 Tai Chi and 6 line dancers) in other classes and compared their pre and post scores. Paired *t*-tests were used to examine pre to post change. The findings are displayed in Table 3.15.

A mixed pattern of findings emerged. Those enrolled in other classes did not consistently perform better at baseline, however there were notable exceptions. As can be seen from Table 3.15, the line dancers enrolled in other classes had much better SLST, MSL total, and strength total scores at baseline. The Tai Chi people enrolled in other classes, conversely, stood out in having worse Total MSL and flexibility scores at baseline. Similarly, those enrolled in multiple classes did not show consistently greater improvement over the 10-weeks. Within the Tai Chi group, those enrolled in other classes improved more only in MSL total; those enrolled only in Tai Chi improved more in Tandem Walk and total Flexibility. Within the line dancing group, both those enrolled and not enrolled in other classes significantly improved their SLST; those enrolled in other classes were more likely to show improvements in MSL; while those not enrolled significantly improved on the Sit and Reach test.

Table 3.15: Comparison of those Enrolled and Not Enrolled in Other Exercise Classes

Measure	Tai Chi				Line Dance			
	Pretest	Posttest	*t*	*p*	Pretest	Posttest	*t*	*p*
Single-leg Stance								
Enrolled	41.3±22.6	39.2±24.5	1.94	.08	36.5±16.9	46.8±16.8	3.1	**.01**
Not Enrolled	38.6±17.8	39.2±19.2	.28	.78	12.9±7.4	35.5±14.8	6.4	**.01**
Tandem Walk								
Enrolled	9.5±1.5	9.9±1.4	.86	.41	14.0±4.3	12.56±3.7	1.4	.18
Not Enrolled	13.4±2.6	10.5±0.6	3.21	**.01**	14.2±3.8	10.8±1.6	1.8	.13
MDRT Total								
Enrolled	48.9±11.0	47.9±12.2	.58	.57	50.4±10.1	50.87±10.9	.27	.79
Not Enrolled	49.0±4.6	53.7±8.4	2.07	.07	52.5±11.1	45.2±6.1	1.6	.17
MSL Total								
Enrolled	169.4±34.2	180.9±30.5	5.17	**.01**	184.1±30.7	188.9±28.6	3.1	**.01**
Not Enrolled	186.5±16.8	186.7±15.7	.15	.88	160.6±6.87	159.8±11.9	.14	.89
Strength Total								
Enrolled	330.5±113.5	327.6±94.0	.20	.84	307.6±66.9	302.5±70.9	.72	.49
Not Enrolled	293.6±84.6	301.3±63.2	.53	.61	251.8±72.9	237.9±52.8	1.5	.21
Flexibility Total								
Enrolled	243.4±27.2	253.0±27.0	1.98	.08	265.0±10.6	269.7±17.8	.92	.38
Not Enrolled	256.6±18.7	268.3±11.5	2.79	**.02**	275.8±10.9	268.8±22.2	.97	.38
Sit and Reach								
Enrolled	26.7±12.7	27.8±13.7	1.27	.26	21.45±9.8	21.3±9.6	.16	.88
Not Enrolled	27.2±9.9	26.8±6.5	.28	.79	26.6±2.3	30.2±4.4	3.2	**.03**

3.7.3.5 Extent of Improvement

While effect size provides an estimate of magnitude of change, this estimate considers the group as a whole. As previously argued, it is also important to examine the extent of improvement (i.e., the proportion of participants who benefit) for each program.

Table 3.16 presents the change scores for the Tai Chi, line dance, and non-exercise participants after 10-weeks of program participation. This section describes the findings from the individual change score analysis. The number of people who had a positive change versus those showing no positive change are separated into two groups and their baseline values, average amount of change, and range of change are presented. Programs are often 'relatively beneficial' (for some participants more than for others); level of functioning at entry and participation rates as well as other factors need to be considered in examining program benefits (Myers, 1999). The results of the *t*-test analysis, comparing the baseline scores and attendance rates of those showing improvement versus no improvement are described for each of the recreation/senior centre groups.

3.7.3.5.1 Psychophysical Measures

ABC Scale (Balance Confidence)

As displayed in Table 3.16, half (25 out of 50) of our recreation/senior centre sample showed some positive change in their balance confidence: 44% of the Tai Chi participants, 56% of the line dancers, and 50% of the non-exercise group. The Tai Chi and line dancing participants improved, on average, by approximately 8% while the non-exercise group had an average improvement of 10%. When the Tai Chi participants (t=2.81, p<.05) and line dancing participants (t=2.14, p<.05) who had a positive change were compared with those showing no positive change, significantly lower average baseline ABC scores were found for the former groups; no difference class attendance rate was found. For those who had no positive change, the non-exercise group had the largest decline, averaging 17%, with one participant having a 50% decline in balance confidence.

Table 3.16: Individual Change Scores After 10 Weeks of Practice

Measure	Tai Chi			Line Dance			Non-exercise		
	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0
ABC **Total** **x ±SD** **x Change±SD** **Range**	 n=18 89.55±15.8	 10 (56%) 98.1±2.3 -1.5±2.6 -6.5-0.0	 8 (44%) 78.9±19.2 8.4±10.6 0.6-25.2	 n=18 84.3±14.8	 8 (44%) 91.4±5.6 -4.0±4.6 -11.4--0.8	 10 (56%) 78.7±17.7 8.7±16.9 0.3-40.7	 n=14 72.5±20.6	 7 (50%) 81.7±9.9 -17.6±16.9 -50.5- -5.7	 7 (50%) 67.3±24.9 10.7±10.6 0.7-25.6
VPS **Total** **x ±SD** **x Change±SD** **Range**	 n=18 35.9± 9.1	 5 (28%) 32.8±14.5 -11.6±0.3 -11.9- -11.6	 13 (72%) 37.0±6.6 7.9±5.7 1.4-19.4	 n=18 36.5±3.9	 10 (56%) 37.4±3.5 -10.1±6.6 -19.4- -3.1	 8 (44%) 35.5±4.4 7.9±3.0 4.9-12.5	 n=14 37.2±8.1	 7 (50%) 43.2±3.4 -11.8±14.0 -36.7-0.0	 7 (50%) 32.8±7.9 10.9±6.2 2.6-19.05
Balance Assessments									
Single Leg Stance **Total** **x ±SD** **x Change±SD** **Range**	 n=20 40.0±20.0	 19 (95%) 40.8±21.1 -10.1±12.2 -33.9-0.0	 1 (5%) 33.3±0.0 31.0±0.0 31.0-31.0	 n=18 28.6±18.3	 3 (17%) 44.2±18.2 -4.9±0.6 -5.4- -4.4	 15 (83%) 24.2±16.2 117.1±78.8 16.4-245.9	 n=14 23.5±13.5	 9 (64%) 29.5±11.9 -29.1±19.5 -73.4- -6.9	 5 (36%) 12.6±8.9 20.1±10.9 1.0-27.6
Tandem Walk **Total** **x ±SD** **x Change±SD** **Range**	 n=18 11.4±2.8	 8 (44%) 9.1±1.4 12.2±2.6 8.1-14.7	 10 (56%) 13.6±2.5 -22.1±13.3 -35.5- -.89	 n=18 14.1±4.1	 6 (33%) 12.5±2.9 17.2±10.5 9.5-30.7	 12 (67%) 14.8±4.4 -25.6±14.5 -48.5- -5.9	 n=14 12.8±4.1	 11 (79%) 13.0±4.6 42.6±56.0 .36-149.6	 3 (21%) 12.3±.89 -15.7±6.2 -22.9- -12.1

Note: The positive change score for Tandem Walk is negative because a faster time (lower score) indicates improvement.

Table 3.16: Individual Change Scores After 10 Weeks of Practice (continued)

Measure	Tai Chi			Line Dance			Non-exercise		
	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0
Forward Reach **Total** **x ±SD** **x Change±SD** **Range**	n=20 14.3±2.3	5 (25%) 14.6±1.8 -4.1±0.3 -4.4- -3.9	15 (75%) 14.3±2.5 10.1±7.7 0.4-19.6	n=18 15.4±3.1	8 (44%) 16.6±4.1 -10.2±9.2 -25.0- -4.0	10 (56%) 14.5±1.8 13.3±10.3 6.3-32.3	n=14 11.0±2.1	7 (50%) 10.6±2.9 -17.1±18.7 -51.7- -2.4	7 (50%) 11.3±1.5 4.0±2.5 0.3-8.7
Backward Lean **Total** **x ±SD** **x Change±SD** **Range**	n=20 8.2±1.2	9 (45%) 9.1±1.2 -4.6±3.6 -10.4- 0.0	11 (55%) 7.5±0.7 11.3±10.1 0.9-27.5	n=18 10.0±2.6	17 (94%) 10.2±2.8 -22.4±18.2 -55.6- -5.8	1 (6%) 8.4±0.0 4.9±0.0 4.9-4.9	n=14 7.3±1.4	3 (21%) 7.3±0.9 -2.6±2.4 -4.8- -0.5	11 (79%) 7.3±1.6 5.2±2.2 1.8-8.0
Left Reach **Total** **x ±SD** **x Change±SD** **Range**	n=20 11.8±3.5	8 (40%) 12.2±1.2 -23.8±20.7 -46.0- -2.8	12 (60%) 11.7±4.6 27.1±32.2 2.7-90.2	n=18 11.7±3.0	7 (39%) 13.8±4.1 -22.6±16.8 -41.8- -4.4	11 (61%) 10.7±1.8 19.0±17.3 1.1-61.8	n=14 9.8±3.0	8 (57%) 11.7±2.3 -19.9±19.6 -62.5- -0.3	6 (43%) 7.4±2.1 6.45±5.22 1.69-12.13
Right Reach **Total** **x ±SD** **x Change±SD** **Range**	n=20 12.2±3.8	8 (40%) 14.2±4.7 -23.6±20.1 -49.9- -1.5	12 (60%) 10.9±2.4 19.4±15.1 2.3-41.3	n=18 11.3±2.6	9 (50%) 12.0±3.2 -20.7±19.3 -48.9- -3.2	9 (50%) 10.5±1.5 20.5±15.8 1.8-39.9	n=14 10.1±3.5	9 (64%) 12.3±2.3 -18.3±23.1 -65.9- -0.5	5 (36%) 7.3±2.7 6.9±2.8 2.4-11.5
Upward Reach **Total** **x ±SD** **x Change±SD** **Range**	n=20 2.2±0.8	13 (65%) 2.7±0.7 -12.5±21.7 -57.9-0.0	7 (35%) 1.6±0.6 17.8±9.4 11.5-40.4	n=18 2.5±1.0	17 (94%) 2.7±1.1 -3.5±5.3 -16.4-0.0	1 (6%) 1.7±0.0 35.0±0.0 35.0-35.0	n=14 2.0±0.6	13 (93%) 2.0±0.7 -17.7±16.2 -47.3-0.00	1 (7%) 1.9 4.4 4.4-4.4

Table 3.16: Individual Change Scores After 10 Weeks of Practice (continued)

Measure	Tai Chi			Line Dance			Non-exercise		
	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0
Right Forward Step Total x ±SD x Change±SD Range	n=20 28.5±4.7		20 (100%) 28.5±4.7 8.3±7.8 1.0-25.3	n=18 23.7±6.2	3 (17%) 31.3±7.7 -0.56±0.14 -0.68- -0.44	15 (83%) 21.6±3.7 24.3±16.4 5.3-55.3	n=14 24.1±3.7	7 (50%) 26.1±3.2 -7.3±4.7 -14.4- -1.8	7 (50%) 22.8±3.7 9.3±7.8 3.1-23.9
Left Forward Step Total x ±SD x Change±SD Range	n=20 27.7±5.0		20 (100%) 27.8±5.0 11.9±8.9 1.9-29.0	n=18 25.0±6.5	3 (17%) 31.5±7.2 -4.7±0.6 -5.3- -4.2	15 (83%) 23.1±5.2 21.6±24.1 1.8-69.8	n=14 23.9±6.4	3 (21%) 29.9±7.9 -24.3±7.7 -33.2- -19.1	11 (79%) 22.3±5.3 8.3±7.2 1.5-22.2
Right Back Step Total x ±SD x Change±SD Range	n=20 28.5±4.3	9 (45%) 30.7±4.7 -8.0±7.7 -21.6-0.0	11 (55%) 26.4±2.8 5.1±5.2 0.3-14.2	n=18 30.1±5.4	9 (50%) 31.4±5.5 -9.3±6.7 -20.4- -1.9	9 (50%) 28.5±5.2 8.7±6.3 2.9-18.2	n=14 25.4±4.0	9 (64%) 26.1±4.4 -5.9±10.2 -32.1-0.0	5 (36%) 24.4±3.6 3.8±3.4 1.3-9.63
Left Back Step Total x ±SD x Change±SD Range	n=20 27.1±5.1	7 (35%) 30.7±3.1 -4.7±5.7 -12.9-0.0	13 (65%) 25.3±5.1 11.9±6.5 3.3-23.3	n=18 27.6±6.1	6 (33%) 29.9±5.9 -4.6±5.8 -11.9-0.0	12 (67%) 26.5±6.2 10.4±7.4 1.4-20.5	n=14 23.9±3.8	9 (64%) 25.7±1.3 -6.5±13.2 -38.8-0.0	5 (36%) 21.6±4.8 11.4±4.8 2.7-17.3

Table 3.16: Individual Change Scores After 10 Weeks of Practice (continued)

Measure	Tai Chi			Line Dance			Non-exercise		
	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0
Right Side Step **Total** **x ±SD** **x Change±SD** **Range**	n=20 32.6±5.7	7 (35%) 35.9±7.7 -4.0±2.9 -10.1- -1.4	13 (65%) 30.9±3.6 10.2±9.2 2.3-27.4	n=18 35.2±4.5	14 (78%) 36.8±3.9 -11.9±8.3 -26.9- -2.5	4 (22%) 29.8±0.9 6.8±3.4 3.8-9.8	n=14 27.0±6.1	5 (36%) 32.0±4.0 -8.5±13.0 -31.5- -0.8	9 (64%) 24.2±5.4 12.97±4.77 5.4-18.63
Left Side Step **Total** **x ±SD** **x Change±SD** **Range**	n=20 32.4±6.2	8 (40%) 35.5±6.0 -4.3±3.7 -8.9-0.00	12 (60%) 29.9±5.5 13.5±9.5 2.8-23.7	n=18 34.5±3.9	15 (83%) 36.5±2.6 -10.5±7.4 -23.2- -0.8	3 (17%) 28.7±0.8 10.6±4.9 6.3-14.9	n=14 27.4±6.2	5 (36%) 32.5±4.6 -6.8±10.8 -26.0- -1.9	9 (64%) 24.7±5.3 9.14±6.03 4.0-17.95
Strength Assessments									
Knee Extension **Total** **x ±SD** **x Change±SD** **Range**	n=20 175.3±64.8	10 (50%) 207.8±50.1 -9.2±6.4 -19.5- -1.0	10 (50%) 142.8±63.4 19.7±15.6 0.7-40.0	n=18 166.7±47.0	7 (39%) 202.5±43.4 -11.2±10.1 -33.1- -3.0	11 (61%) 143.9±34.1 5.7±4.4 1.6-12.7	n=14 159.1±48.6	7 (50%) 182.2±50.1 -5.1±9.1 -27.1- -0.7	7 (50%) 128.5±25.8 15.8±3.5 9.8-18.1
Ankle Dorsiflexion **Total** **x ±SD** **x Change±SD** **Range**	n=20 138.5±41.9	8 (40%) 166.4±39.1 -12.9±12.7 -32.4- -0.2	12 (60%) 120.0±33.5 15.6±20.7 0.6-55.4	n=18 122.2±41.3	11 (61%) 132.2±42.4 -10.6±8.0 -30.2- -2.8	7 (39%) 102.2±33.7 19.6±27.3 0.4-54.8	n=14 115.7±35.9	7 (50%) 139.8±27.6 -12.3±17.1 -51.1- -0.0	7 (50%) 83.7±11.1 12.9±5.6 6.9-18.6
Back Extension (categorical strength grade)	n=15 2+ (n=4) 3- (n=11)	n=15 2+ (n=4) 3- (n=11)		n=16 2+ (n=8) 3- (n=8)	n=16 2+ (n=8) 3- (n=8)		n=10 2+ (n=4) 3- (n=6)	n=10 2+ (n=4) 3- (n=6)	

Table 3.16: Individual Change Scores After 10 Weeks of Practice (continued)

Measure	Tai Chi			Line Dance			Non-exercise		
	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0	Baseline Value	No Positive Change <0	Positive Change >0
Right Side Step **Total** **x ±SD** **x Change±SD** **Range**	n=20 32.6±5.7	7 (35%) 35.9±7.7 -4.0±2.9 -10.1- -1.4	13 (65%) 30.9±3.6 10.2±9.2 2.3-27.4	n=18 35.2±4.5	14 (78%) 36.8±3.9 -11.9±8.3 -26.9- -2.5	4 (22%) 29.8±0.9 6.8±3.4 3.8-9.8	n=14 27.0±6.1	5 (36%) 32.0±4.0 -8.5±13.0 -31.5- -0.8	9 (64%) 24.2±5.4 12.97±4.77 5.4-18.63
Left Side Step **Total** **x ±SD** **x Change±SD** **Range**	n=20 32.4±6.2	8 (40%) 35.5±6.0 -4.3±3.7 -8.9-0.00	12 (60%) 29.9±5.5 13.5±9.5 2.8-23.7	n=18 34.5±3.9	15 (83%) 36.5±2.6 -10.5±7.4 -23.2- -0.8	3 (17%) 28.7±0.8 10.6±4.9 6.3-14.9	n=14 27.4±6.2	5 (36%) 32.5±4.6 -6.8±10.8 -26.0- -1.9	9 (64%) 24.7±5.3 9.14±6.03 4.0-17.95
Strength Assessments									
Knee Extension **Total** **x ±SD** **x Change±SD** **Range**	n=20 175.3±64.8	10 (50%) 207.8±50.1 -9.2±6.4 -19.5- -1.0	10 (50%) 142.8±63.4 19.7±15.6 0.7-40.0	n=18 166.7±47.0	7 (39%) 202.5±43.4 -11.2±10.1 -33.1- -3.0	11 (61%) 143.9±34.1 5.7±4.4 1.6-12.7	n=14 159.1±48.6	7 (50%) 182.2±50.1 -5.1±9.1 -27.1- -0.7	7 (50%) 128.5±25.8 15.8±3.5 9.8-18.1
Ankle Dorsiflexion **Total** **x ±SD** **x Change±SD** **Range**	n=20 138.5±41.9	8 (40%) 166.4±39.1 -12.9±12.7 -32.4- -0.2	12 (60%) 120.0±33.5 15.6±20.7 0.6-55.4	n=18 122.2±41.3	11 (61%) 132.2±42.4 -10.6±8.0 -30.2- -2.8	7 (39%) 102.2±33.7 19.6±27.3 0.4-54.8	n=14 115.7±35.9	7 (50%) 139.8±27.6 -12.3±17.1 -51.1- -0.0	7 (50%) 83.7±11.1 12.9±5.6 6.9-18.6
Back Extension (categorical strength grade)	n=15 2+ (n=4) 3- (n=11)	n=15 2+ (n=4) 3- (n=11)		n=16 2+ (n=8) 3- (n=8)	n=16 2+ (n=8) 3- (n=8)		n=10 2+ (n=4) 3- (n=6)	n=10 2+ (n=4) 3- (n=6)	

Scores on the ABC scale can range from 0% (no confidence) to 100% (complete confidence). The average baseline scores for those showing no positive change were high for all of the groups: over 90% for the Tai Chi and line dancing groups and over 80% for the non-exercise group. Even the participants showing improvement for the exercise groups had high baseline scores (almost 79%). Due to the high baseline scores, it is not surprising that the balance confidence of many people did not improve or only slightly improved.

VPS (Psychophysical Well-being)

The score for the VPS can range from 10 to 50, with a higher score indicating greater well-being. In contrast to the high ABC scores, VPS scores were moderate for this sample at baseline (i.e., more room for improvement). Over half (56%) of our sample showed an improvement in their psychophysical well-being over the 10-week study period. The Tai Chi (n=13) and line dancing (n=8) participants improved, on average, by almost 8%; the non-exercise group (n=7) by almost 11%. Participants in the non-exercise group who had a positive improvement had a significantly lower baseline score than those showing no positive change (t=3.08, p<.01); the non-exercise participants who had no positive change, had higher baseline VPS scores (mean=43.2) than all other groups. Interestingly, the average VPS baseline score for the Tai Chi group having no positive change (32.8±14.5) was less than the participants showing an improvement (37.0±6.6). Class attendance did not distinguish between participants who improved and those who did not.

3.7.3.5.2 Balance Assessments

Single-leg Stance Time (Static Balance)

Table 3.16 clearly illustrates the improvements in static balance for the majority (83%) of line dancers. While one Tai Chi and five non-exercise participants had average improvements of 33% and 20% respectively, the line dancers who improved had an average improvement of 117%. One line dancer improved by 255% (from 10.49 seconds at pretest to 36.29 seconds at posttest). Other line dancers showed large improvements (e.g., 204%, 186%, and 116%). It is interesting to note that the line dancing group had the smallest decline in their SLST. The line dancers who reported no positive change decreased on average by almost 5%, the Tai Chi participants by 10% and the non-exercise participants by 29%.

It should be recognized that the Tai Chi (n=19, 95%) and line dance (n=3, 17%) participants having no positive change scored quite high at baseline (over 40 seconds) and may not have had much room for improvement (maximal time of this test was 60 seconds). As presented in the discussion, values over 40 seconds are comparable to long-term Tai Chi practitioners. The line dancers (t=2.13, p<.05) showing a positive change had significantly lower baseline scores than those who reported a no positive change; no difference was found for class attendance.

Tandem Walk (Dynamic Balance)

The Tandem Walk test assesses the time to walk heel to toe along a 10-foot line, taking into consideration whether participants make errors (i.e., missteps). As described in section 3.7.1.4.3, in calculating the Tandem Walk score, each person's time was penalized for missteps. In interpreting the values in Table 3.16, lower (faster) scores are desirable. Values are reversed; positive change is a negative value (indicating improvement, i.e., faster times from pre to post).

Over half (56%) of the Tai Chi participants and 67% of the line dancers improved their Tandem Walk score; the average change was 22% and 26%, respectively for the two groups. Only 3 (21%) of the non-exercise group improved, by an average of 15%. Tai Chi individuals with a positive change had significantly slower baseline scores than those reporting no positive change (t=4.52, p<.001).

Multi-Directional Reach Test (MDRT) (Limits of Stability)

The MDRT assesses the distance in inches to reach forward, backward, and to the sides (both left and right). The majority of the Tai Chi (75%) and line dance (56%) participants had a positive change in the forward reach; 50% of the non-exercise group also improved. Average improvement was 4% for the non-exercise group, 10% for the Tai Chi participants, and 13% for the line dancers. Newton (2001) reported an average forward reach of 8.9±3.4. Our average baseline scores (for those showing and not showing improvement), were higher. Thus there may not be much room for improvement. Finally, when those who improved were compared with those showing no improvement, no difference in the baseline forward reach score or attendance were found.

While 55% of the Tai Chi participants and almost 80% of the non-exercise participants reported improvements in their backward lean, only one (6%) line dancer had a positive change. The Tai Chi participants improved, on average, by 11%, while the non-exercise group improved by only 5%. Tai Chi individuals showing a positive change were more likely to have a lower backward lean at baseline than those having no positive change (t=3.62, p<.01); attendance rates did not distinguish the groups.

The majority of participants in the two exercise groups reported a positive change in the left and right sideways reaches (refer to Table 3.16). For the left sideways reach, 60% of the Tai Chi and line dance participants reported a positive change; the Tai Chi participants averaged a 27% improvement while the line dancers averaged 19%. While 43% of the non-exercise participants had a positive change, the average amount of change was small (6%). For the right sideways reach, a total of 12 (60%) Tai Chi, 9 (50%) line dancer, and 5 (36%) non-exercise participants reported a positive change. The average improvement was approximately 20% for the two exercise groups, but only 6% for the non-exercise group. While no significant differences were found for the left sideways reach, the Tai Chi participants (t=2.08, p<.05) who experienced a positive change had lower baseline right sideways reach scores than those who did not improve their sideways reach. For those reporting no positive change, all groups reported an approximately 20% decline for both the left and right sideways reaches. No group difference in the number of classes attended was found.

Positive change in upward reach occurred for 35% of Tai Chi participants but for only 1 (6%) line dancer, and 1 (7%) non-exercise participant. The Tai Chi participants had an 11% to 40% improvement (average 17.8%) while the line dancer improved by 35% and the non-exercise participant by 4%. The baseline scores of those showing improvement in the Tai Chi group were significantly lower than the Tai Chi participants who did not have a positive change (t=3.79, p<.01) and for all groups, those having a positive change and not having a positive change had similar attendance scores.

Maximal Step Length (MSL) (Protective Balance)

Recall that Six maximal steps (forward, backward, and sideways in the left and right directions) were included in the MSL test. For the left and right forward steps, 100% of Tai Chi participants showed positive change. The amount of improvement ranged from 1% to 25% (average 8%) for the right forward step and from 2% to 29% (average 12%) for the left forward step. The majority of line dancers (n=15, 83%) also had a positive change. Their average improvement was over 20% for both steps, ranging from 5% to 55% for the right forward step and 2% to 70% for the left forward step. One line dancer who improved by 70%, stepped almost 10 inches further at posttesting compared to their baseline score. For the non-exercise group, 7 (50%) improved their right forward step and 11 (79%) improved their left forward step; an average of 20% improvement was found for the two step lengths. No differences in the groups' baseline or attendance scores for those improving and not improving were found.

The majority of participants in the two exercise groups had a positive change in their backward steps. For the right backward step, an average improvement of 5% was found for 11 (55%) Tai Chi participants, almost 9% for 9 (50%) line dancers and slightly less than 4% for 5 (36%) non-exercise participants. The improvements for the left backward step were slightly greater than the right backward direction. A 12% improvement was revealed for the 13 (65%) Tai Chi participants and a 10% improvement for the 12 (67%) line dancers. Five (36%) non-exercise participants had an average positive change of 11%. The baseline scores for both the left (t=2.52, p<.05) and right (t=2.47, p<.05) backwards steps were significantly less for the Tai Chi participants showing improvement than those not improving. No difference was found between those improving and not improving for the number of classes attended.

While over 60% of Tai Chi and non-exercise participants reported a positive change in both left and right sideways steps, few line dancers (17% to 22%) improved. The maximal improvement for both side steps was over 20% for two Tai Chi participants (average 10% to 13%) and slightly less than 20% for several non-exercise participants (average 9% to 13%). For the left side step, the Tai Chi participants having a positive change had significantly lower baseline scores than those having no positive change (t=2.17, p<.05). Similarly, the baseline scores for the left and right side steps were also significantly lower for the non-exercise (t=2.75, p<.05, t=2.79, p<.05) and line dancing participants (t=9.49, p<.01, t=6.01, p<.01) showing improvement than those having no positive change. No group difference in class attendance was found.

3.7.3.5.3 Strength Assessments

Knee Extension

Half of the Tai Chi (n=10) and non-exercise (n=7) participants and over 60% of the line dancers (n=11) improved in knee extension strength. The line dancers improved by an average of 5%, the non-exercisers by 15% and the Tai Chi participants by almost 20%. One Tai Chi participant had an improvement of 40%. The baseline scores for those showing improvement for all groups; the Tai Chi (t=2.54, p<.05), line dance (t=3.20, p<.01), and non-exercise (t=2.60, p< .05), were significantly less than for those having a positive change compared to those having no change, no difference in attendance was found.

Ankle Dorsiflexion

Ankle strength improved, on average, by 15% for the Tai Chi participants (n=12, 60%), 20% for the line dancers (n=7, 39%), and 13% for the non-exercise group (n=7, 50%). Three Tai Chi and two line dance participants had over a 40% improvement, with one Tai Chi and one line dance individual having a 55% improvement. The non-exercise group, who had a positive change, ranged from almost 7% to 19%. The Tai Chi (t=2.81, p<.01) and non-exercise (t=5.20, p<.01) participants showing a positive change had a significantly lower baseline scores in ankle strength than those having no change. The Tai Chi participants who had a positive change attended significantly more classes (mean 9.25 versus 8.00) than those showing no change (p<.05).

Back Strength

The categorical grade of strength for the back extension assessment for the exercise and non-exercise groups are provided in Table 3.16. As can be seen from this table, 4 (27%) Tai Chi, 8 (50%) line dancers, and 4 (40%) non-exercise participants achieved a 2+ grade of strength while 11 (73%) Tai Chi, 8 (50%) line dancers, and 6 (60%) non-exercise participants achieved a 3- grade of strength at baseline. Completing the 10-week exercise or non-exercise program did not affect the grade of back strength the participants had started with.

3.7.3.5.4 Flexibility Assessments

Sit and Reach

Approximately 60% of the line dance and non-exercise participants had a positive change in their sit and reach scores. The line dancers improved, on average, by 15% while the non-exercise group by less than 10%. The extent of improvement ranged from approximately 4% to 25% for the line dancers and 2% to 15% for the non-exercise participants. Only 3 (23%) Tai Chi participants had a positive change; with one participant having a 66% change (going from 9 cm at pretest to 14 cm at posttest). Interestingly, the majority of Tai Chi participants (n=10, 77%) had no positive change in their sit and reach score. No difference existed in the baseline scores or attendance rates of those having and not having a positive change.

Shoulder Flexibility

Shoulder flexion and extension were used to examine the flexibility of the shoulder. A total of 12 (60%) Tai Chi participants had, on average, a 6% improvement for shoulder flexion while 11 (55%) participants had an 11% improvement in shoulder extension. The baseline scores for those showing a positive improvement in shoulder flexion were significantly lower than the Tai Chi participants having no change (t=2.80, p<.01). Fewer line dancers showed improvement in shoulder flexibility; 5 (28%) for shoulder flexion and 7 (39%) for shoulder extension. Extent of improvement ranged from 2% and 9% with an average of approximately 5% for both extension and flexion. The line dancers who had a positive change in both flexion (t=11.26, p<.01) and extension (t=2.57, p<.05) had significantly lower baseline scores than those showing no change. Finally, 21% (n=3) of the non-exercise participants had a positive change (average 6%) in shoulder flexion and 4 (29%) participants showed an improvement (averaged 11%) for shoulder extension. Over 70% of the non-exercise group had no positive change, averaging a 3% decline in shoulder flexion and 10% in shoulder extension. For all groups, no difference was found for the number of classes attended for those having and not having a positive change.

Ankle Flexibility

Dorsi and plantarflexion of the ankle were used to assess ankle flexibility. The majority of the two exercise groups (55% Tai Chi and 61% line dancers) had a positive change in ankle flexibility. The Tai Chi group improved, on average, by almost 55% for ankle dorsiflexion and by 20% for ankle plantarflexion, while both dorsi and plantarflexion for the line dancers improved by approximately 27%. The baseline scores for the Tai Chi participants who showed improvement in ankle dorsiflexion were significantly lower than those who did not improve (t=2.39, p<.05) and the line dancers who improved attended significantly more classes (9.23 versus 7.14) than those having no positive change (t=6.24, p<.01) (no difference in Tai Chi attendance was found). For the non-exercise group, 5 (36%) participants improved their ankle dorsiflexion by 21% and 3 (21%) participants improved by 7% for plantarflexion. The baseline scores for dorsiflexion were significantly lower for the non-exercise participants reporting positive change than those showing no change (t=4.92, p<.01).

3.7.4 Findings from the Posttest Survey and CHAMPS Questionnaire

3.7.4.1 Physical Activity

The posttest survey and CHAMPS questionnaire were administered at posttessting to check the stability of the samples physical activity patterns over the 10-week study period. Based on the posttest survey, two participants from each program (representing 11% to 14% of their group) stated that they had started participating in other physical activity classes or exercising on their own. One Tai Chi participant took-up Yoga, another line dancing (both once a week at their seniors' centre). One of the line dancers started a tap dancing class (once a week at their centre) while another started riding a stationary bike (six times a week at home). One of the non-exercise participants said she now climbs stairs at a nursing home (her husband was moved to a higher floor and she does not like to take elevators) twice a week; another reported that she now lifts weights (at a program at Mc Master University twice a week). Participants initiating new activities were not removed from the repeated measures or individual change score analysis. Except for one of the line dancers (who started riding a bike) who greatly improved her CHAMPS scores most of the sample stayed relatively the same.

All (n=20, 100%) of the Tai Chi group and the majority of the line dance (n=10, 62%) and non-exercise participants (n=12, 86%) accumulated at least 30 minutes or more of moderate intensity physical activity on three or more days of the week. The non-exercise group reported an average of 4.57 (SD=1.99) days, the Tai Chi participants had an average of 4.10 (SD=1.21) days, while the line dancers accumulated an average of 3.13 (SD=1.20) days per week. The non-exercise group participated in significantly more days per week in moderate intensity activity than the line dancers ($p<.05$). Compared to the baseline scores of the study completers (Tai Chi averaged 4.56±1.75 days; line dancers averaged 3.00±2.40 days, and non-exercise averaged 4.55±2.34) all groups remained relatively the same over the 10-week study. Finally, two Tai Chi participants reported events that had caused a major disruption in their normal patterns of activity over the 10-week study period. The mother of one Tai Chi participant was in the hospital and the participant chose to spend time visiting her mother than pursing additional activities. The second participant stated that her husband was diagnosed with cancer and felt that her time was better spent with him.

The CHAMPS questionnaire asks respondents how physically active they have been over the past four weeks. While used as a 'context' variable (not scored), the findings are of interest. The majority of our sample reported being a little active (n=14, 28%) at pretest and fairly (n=15, 30%) or quite active (n=13, 26%) at posttest. The Tai Chi group reported being 'fairly active' at both pre and posttest (n=7, 35%). An equal number of line dancers reported 'a little active' or 'very active' at pretest (n=6, 30%) and at posttest 'fairly active' was most commonly reported (n=6, 33%). Finally, half of our non-exercise participants were 'quite active' at both pre (n=8, 57%) and posttest (n=7, 50%).

Recall that the CHAMPS questionnaire yields scores for total calories expended per week and frequency of participation for all physical activities and for activities of a moderate intensity over the past four weeks. As shown in Table 3.17, all groups expended significantly fewer total calories per week at posttest compared to pretest in all activities ($F(1, 47)=15.50$, $p<.01$) (ES small (-.23)) and activities of a moderate intensity ($F(1, 47)=11.92$, $p<.01$) (ES small (-.29)). The groups also had a decline in their frequency per week in all and moderate intensity (ES small (-.26)) activities from pre to posttest. While the effect size for frequency per week in all activities was minimal for the Tai Chi (ES=-.13) and line dance (ES=-.02) groups, a moderate negative effect (ES=-.65) was found for the non-exercise sample. The decline for all activities was significant for the non-exercise group (t=4.73, p<.01).

Table 3.17: Comparison of CHAMPS Pre and Posttest Scores

Present Samples	All Activities		Moderate Intensity Activities	
	Calories/week	Frequency/week	Calories/week	Frequency/week
Tai Chi				
Pretest	3553±2915 (2082-4704)	17.75±8.08 (3.45-22.05)	1763±1960 (788-2738)	4.69±4.81 (2.12-7.25)
Posttest	2717±1902 (1771-3663)	16.69±8.86 (11.97-21.41)	1135±1169 (553-1717)	3.69±4.85 (1.10-6.27)
Line Dance				
Pretest	2022±1676 (1188-2856)	12.78±7.27 (9.16-16.39)	1048±1230 (436-1660)	3.11±3.70 (1.26-4.96)
Posttest	1756±989 (1264-2248)	12.67±7.45 (8.96-16.37)	1026±739 (659-1394)	3.00±1.75 (2.13-3.87)
Non-exercise				
Pretest	2621±1295 (1873-3369)	19.57±7.27 (15.37-23.77)	1113±906 (590-1637)	5.86±3.48 (3.84-7.86)
Posttest	1548±895 (1031-2065)	14.79±7.55 (10.43-19.14)	375±291 (207-543)	3.50±2.68 (1.95-5.05)
Experienced Taoist	2773±1613 (1995-3551)	18.28±9.98 (13.31-23.24)	975±978 (503-1446)	5.56±6.71 (2.21-8.89)

Note: mean±SD (95% CI)

3.7.4.2 Level of Exertion and Feelings After Class

All participants from the recreation/senior centres who returned for the posttest assessment completed the posttest survey. There were no differences between the groups concerning how physically exerting they found their classes or how they felt once their classes were over. A total of 13 (65%) Tai Chi, 13 (72%) line dancers, and 3 (21%) non-exercise participants (all from a craft class) found their classes to be 'moderately exerting', while the remaining participants indicated that their classes were 'not all exerting'. Approximately 45%

of the Tai Chi (n=9), 44% line dancers (n=8) and 36% (n=5) of the non-exercise participants were reportedly 'pleasantly tired' right after class participation; 30% of the Tai Chi (n=6), 45% of the line dancers (n=8) and 5 non-exercise (36%) participants were 'not at all tired'.

3.7.4.3 Perceived Gains

The sample was asked what they had personally gained from participating in their program. A total of 50 out of the 52 recreation/senior centre participants provided responses to this question (often multiple responses). The most frequent responses are listed in Table 3.18. Physical fitness gains were commonly reported by the Tai Chi participants; improvements in balance, flexibility, and coordination were mentioned. Relaxation, fun/enjoyment, a sense of accomplishment (including commitment and self-assurance) and mental health gains (including concentration/focus and relaxation) were also commonly reported. The majority of line dancers mentioned fun/enjoyment and social interaction, a few mentioned physical gains (improvement in balance) and mental health (such as concentration). Finally, most of the non-exercise group noted social benefits (interaction with the instructor and other participants), fun/enjoyment and a sense of accomplishment (including satisfaction). One Bingo player also noted: "Bingo gives a little tingle when you are close to winning. But, whow when you win!"

Table 3.18: What Participants Personally Gained from Program Participation

	Tai Chi (N=20) n (%)	Line Dancers (N=16) n (%)	Non-Exercise (N=14) n (%)
Physical Fitness	15 (80%)	3 (19%)	0 (0%)
Relaxation	7 (35%)	0 (0%)	0 (0%)
Fun/Enjoyment	6 (30%)	8 (50%)	4 (29%)
Accomplishment	3 (15%)	0 (0%)	5 (36%)
Mental Health	2 (10%)	2 (13%)	4 (29%)
Social Interaction	0 (0%)	6 (30%)	10 (71%)

Note: Two line dancers did not provide a response to this question. Multiple responses were sometimes provided by the respondents.

3.7.4.4 Suggestions for Program Improvements

Only one Tai Chi participant and one line dancer provided a response to the question: Is there anything you would like to see changed in your program. Similar to that of the process evaluation findings, the Tai Chi participant believed that the instructor 'taught too fast' and that they would like to learn fewer movements each class. Similarly, a line dancer suggested repetition to help in learning and remembering the movements; she would like to practice the dances more than once each session.

3.7.4.5 Perceived Changes in Health and Physical Abilities

Only one participant reported changes in their health during the study period, however, some reported changes in their physical abilities. One non-exercise participant stated that since participating in the craft class she experiences numbness in the ends of her first and middle fingers and thumb. Three participants from each of the exercise groups, and one non-exercise participant, indicated that they had noticed a change in their physical abilities as a result of being apart of their program. One Tai Chi participant felt more limber, while two felt that their balance had improved. Two line dancers also thought that their balance had improved, while the third dancer believed that she could now stand for longer periods of time without becoming tired. Since completing the line dancing program, one person reportedly now attempts to walk around the block, which was too physically challenging for her before taking the class.

3.7.5 Comparison of Community and Experienced Tai Chi Groups

The literature suggests that long-term Tai Chi practice may be needed before physical and psychological benefits can be obtained. A priori, we ourselves were skeptical that a single 10-week session of Tai Chi could result in dramatic balance, strength, flexibility, confidence, or vitality gains. Accordingly, we compared the posttest scores of the beginning Tai Chi participants (completing a 10-week modified or short-form version of Tai Chi at the recreation/senior centres) to scores of a group of experienced Taoist Tai Chi Society participants. The primary purpose was to explore whether long-term practice is needed to achieve benefits. It also allowed us to examine whether older adults who join a Taoist Tai Chi Society are different from those who take Tai Chi at recreation/senior centres.

3.7.5.1 Profile

A total of 20 community Tai Chi participants completed the posttest assessment, while 20 experienced Taoist Tai Chi Society participants were recruited and tested at one point in time. Recall that the Taoist participants were recruited from five classes in two locations; recruitment was based on their age (55+) and their enrollment in an ongoing/transition class. As illustrated in Table 3.19, the two groups were quite similar in age and other characteristics. The majority of each group was female, married, had completed some post-secondary school education, and were fully retired.

Table 3.19: Demographic Profile of the Tai Chi Groups

	Tai Chi (N=20) n (%)	Experienced Taoist Tai Chi (N=20) n (%)
Age	55-75 years mean = 63.30	57-79 years mean = 65.42
Gender		
Females	15 (75%)	18 (90%)
Males	5 (30%)	2 (10%)
Marital Status		
Single	3 (15%)	0 (0%)
Married	11 (55%)	13 (65%)
Separated/Divorce	2 (10%)	1 (5%)
Widowed	4 (20%)	6 (30%)
Education		
Elementary School	3 (15%)	0 (0%)
Some High School	3 (15%)	0 (0%)
High School Diploma	0 (0%)	5 (25%)
Some Post Secondary	3 (15%)	3 (15%)
College or University	7 (35%)	9 (45%)
Graduate or Professional Degree	4 (20%)	3 (15%)
Retirement		
Not Retired	0 (0%)	1 (5%)
Semi-Retired	7 (35%)	2 (10%)
Fully-Retired	13 (65%)	17 (85%)

The majority of both groups perceived their health as excellent (n=9, 23%) or good (n=27, 68%). Several of the Taoist Tai Chi participants reported heart trouble (n=5, 25%), asthma, emphysema, or bronchitis (n=2, 10%), diabetes (n=2, 10%), and osteoporosis (n=6, 30%) while none of the community Tai Chi participants reported these health conditions. The majority of each group (65% community Tai Chi and 55% Taoist Tai Chi) were not limited in the type of amount of activities they can do, however, 4 (20%) Tai Chi and 8 (40%) Taoist participants stated that they were limited by long-term conditions.

When asked about their involvement in other forms of physical activity, almost half (n=9, 45%) of the community Tai Chi group were enrolled in other exercise classes (most often at their centre), while 19 (95%) participated in informal physical activity. A smaller percentage (35%, n=7) of the Taoist participants were enrolled in other exercise classes (often at a recreation/senior centre), however 80% (n=16) did informal physical activities, usually walking. Of the 19 experienced Taoist participants that provided a response, a total of 16 (84%) accumulated 30 minutes or more of moderate intensity activity at least three days a week (average 4.37±2.14). This is similar to the 20 (100%) community Tai Chi participants who reportedly accumulated, at posttest, an average of 4.10±1.21 days per week.

Those enrolled in the community Tai Chi classes attended 6 to 10 classes (out of a 10-week session); an average of 8.5 classes. As mentioned earlier, 5 (25%) community Tai Chi participants returned their practice log (home practice ranging from 1 to 4 times per week; 10 to 15 minutes a session).

The experienced Taoist participants were asked on their background survey when they first joined the Society, when they moved from the beginner to the transition class, the proportion of classes attended, and whether they practiced at home. The experienced Taoist participants had been practicing Tai Chi from 1.5 to 15 years (average 5.62∀3.90) and moved from the beginner to the transition class from 9 months to 12 years ago (average 4.44∀4.08 years). Based on two classes offered per week, since September the experienced Taoist participants reportedly attended 89.45% (SD=19.57) of the available classes. Three (15%) participants reportedly attended only once a week (50% of their available classes) while 1 (5%) participant attended more than twice a week (reportedly attending 125% of the classes). A total of 7 (35%) experienced Taoist participants stated they practiced at home from one to seven days a week (average 3.57±2.70 days); 2 (29%) individuals practiced daily. This group practiced anywhere from less than 5 minutes up to 60 minutes at a given time.

3.7.5.2 Physical Profile

Table 3.20 provides the mean, standard deviation, and 95% confidence interval for the posttest scores of the community Tai Chi groups and the one-time scores of the experienced Taoist participants. Group contrasts (*t*-test analysis) and level of significance are also provided. It should be mentioned that one experienced Taoist participant suffers from Primary Lateral Sclerosis, which effects her strength, flexibility, and control of her left-hand side. Due to this limitation, her Tandem Walk, left sideways reach, and left forward, backward, and side step scores were removed from the analysis. As well, four experienced Taoist participants refused to complete the assessment of back strength due to complaints of the lower back.

As illustrated in the Table 3.20, the two groups did not differ significantly on the majority of measures. Their BMI and CHAMPS scores were comparable. The Taoist participants did report a higher frequency per week in moderate intensity activities than the Tai Chi group, but their difference was not significant. The beginners and experienced Tai Chi practitioners did not differ significantly on their total scores for the MDRT, MSL, strength, and flexibility. Only two measures were significantly different. The Tai Chi participants at the recreation/seniors centres had a significantly greater upwards reach than the experienced Taoist participants ($p<.05$). The Taoist participants, however, had significantly greater shoulder flexion than the community Tai Chi participants ($p<.01$). The right back step of the Taoist group approached significance ($p=.06$). Although few significant differences were found, the experienced Taoist Tai Chi participants seemed to perform slightly better on almost all of the measures than the community Tai Chi group. One exception was the sit and reach test, in which the community group scored higher.

Table 3.20: Comparison of Posttest Tai Chi Scores vs. Experienced Taoist Tai Chi

Measure	Tai Chi		Experienced Taoist Tai Chi		t	p
	n	Posttest Score	n	Score		
ABC	18	91.03±11.76 (85.18-96.88)	19	94.46±13.11 (83.33-100.00)	.85	.40
VPS	18	36.83± 9.17 (32.01-41.66)	19	39.79±4.85 (37.45-42.16)	1.18	.25
CHAMPS Calories in all activities	18	2717.9±1902.3 (1771.9-3663.9)	19	2773.3±1613.8 (1995.8-3551.1)	.96	.92
Frequency/week in all activities	17	16.69±8.86 (11.97-21.41)		18.28±9.98 (13.31-23.24)	4.88	.63
Calories in mod. Intensity activities	18	1135.0±1169.9 (553.9-1717.6)		975.34±978.23 (503.84-1446.8)	.45	.65
Frequency/week in moderate activities	17	3.69±4.85 (1.10-6.27)		5.56±6.71 (2.21-8.89)	.92	.37
BMI	20	26.58±3.31 (25.02-28.14)	20	26.88±5.40 (24.35-29.42)	2.17	.83
Single Leg Stance	20	39.10±21.68 (29.03-49.32)	20	42.12±22.91 (31.39-52.83)	.42	.68
Tandem Walk	18	10.27±1.02 (9.76-10.78)	19	11.07±2.99 (9.12-12.71)	.17	.87
Forward Reach	20	15.34±2.38 (14.23-16.44)	20	14.64±1.96 (13.72-15.56)	1.01	.32
Backward Lean	20	8.51±0.98 (8.03-8.96)	20	8.65±2.47 (7.49-9.81)	.26	.80
Right Reach	20	12.27±4.63 (10.10-14.44)	20	12.72±2.67 (11.46-13.97)	.37	.71
Left Reach	20	12.27±4.72 (10.06-14.49)	19	12.55±3.44 (10.89-14.21)	2.04	.84
Upwards Reach	20	2.15±0.81 (1.76-2.53)	20	1.58±0.58 (1.31-1.85)	2.54	**.02**
MDRT Total	20	50.54±10.41 (44.19-57.18)	20	50.38±9.05 (46.02-56.75)	.05	.96

Note: values are mean±SD (95% CI)

Table 3.20: Comparison of Posttest Tai Chi Scores vs. Experienced Taoist Tai Chi (cont.)

Measure	Tai Chi		Experienced Taoist Tai Chi		t	p
	n	Posttest Score	n	Score		
Right Forward Step	20	30.63±4.01 (28.75-32.51)	20	30.65±4.35 (28.61-32.68)	.01	.99
Left Forward Step	20	30.76±4.37 (28.71-32.81)	19	31.94±4.48 (29.78-34.11)	.83	.41
Right Backward Step	20	28.04±4.23 (26.06-30.02)	20	31.09±5.75 (28.39-33.78)	1.91	**.06**
Left Backward Step	20	28.47±4.24 (26.48-30.45)	19	30.07±5.03 (27.65-30.50)	1.08	.29
Right Side Step	20	34.14±5.12 (31.74-36.54)	20	34.38±4.00 (32.51-36.26)	.17	.87
Left Side Step	20	33.77±5.43 (31.23-36.31)	19	34.52±4.58 (32.31-36.73)	.47	.64
MSL Total	20	185.82±24.70 (163.41-196.96)	19	191.46±26.97 (178.46-204.46)	.96	.34
Total Reach	20	236.36±32.70 (210.00-251.75)	19	241.85±31.58 (226.62-257.08)	.76	.45
Knee Extension	20	177.84±56.93 (151.20-204.49)	20	177.41±69.75 (144.77-210.06)	.02	.98
Ankle Dorsiflexion	20	137.93±25.80 (125.85-150.00)	20	126.58±45.86 (105.11-148.05)	.97	.34
Total Strength	20	315.77±80.50 (267.04-388.06)	20	303.99±106.56 (250.86-356.40)	.38	.70
Back Strength† Baseline	15	15.61±1.95 (14.44-16.79)	16	15.65±2.27 (14.44-16.87)	.05	0.96
Grade 3 assessment		9.00±0.97 (8.40-9.59)		7.56±2.26 (6.16-8.96)	2.02	0.06
Grade of Strength		2+ (n=4)3- (n=11)		2+ (n=9) 3- (n=7)	$x^2 = 2.78$	0.09
Sit and Reach	13	27.25±10.24 (20.74-33.75)	20	22.13±10.21 (17.35-26.90)	1.68	0.10
Shoulder Extension	20	48.35±8.94 (44.16-52.53)	20	45.35±8.26 (41.48-49.21)	1.10	0.27
Shoulder Flexion	20	142.70±11.57 (137.28-148.12	20	153.55±11.42 (148.20-158.90)	2.98	**0.01**
Ankle Dorsiflexion	20	17.55±5.54 (14.95-20.14)	20	16.15±7.23 (12.76-19.54)	0.68	0.49
Ankle Plantarflexion	20	51.30±8.60 (47.27-55.32)	20	54.15±8.54 (50.15-58.14)	1.05	0.30
Total Flexibility	20	260.15±21.49	20	269.20±20.62	1.37	.18

Note: values are mean±SD (95% CI); † Strength grade was determined by subtracting the grade 3 assessment score from the baseline score. Values were compared to the conventional method for grading muscle strength (Clarkson, 2000).

3.8 Discussion

While Tai Chi is widely believed to offer both physiological and psychological benefits, most studies to date have consisted of controlled interventions in which Tai Chi classes were held more often and for a longer period than those typically offered in a community setting. Previous findings are inconsistent and comparison across studies is difficult due to variation in training protocols, forms of Tai Chi, and outcome measures.

The process evaluation, described in Chapter 2, is the first study to provide a detailed profile of older adults who enroll in Tai Chi classes at community recreation/seniors' centres. Using program attendance records, a background survey, and telephone interviews, we were able to document patterns of attendance and adherence, develop a demographic profile of participants, and explore participant impressions of the program and factors related to continued participation. Data collected for the outcome study, the focus of this chapter, allowed us to extend the profile of older adults who take part in community Tai Chi classes to include a number of physical and psychophysical parameters. Most importantly, this study allowed us to examine the extent of improvement that can reasonably be expected from participating in a single, 10-week session of a beginner Tai Chi class, typical of community offerings.

This outcome study consisted of pre and post assessments (at the beginning and end of the program session) with a sample of older adults (aged 55+) recruited from six different beginner Tai Chi classes at various community recreation/seniors' centres in Southern Ontario. To compare the relative benefits of Tai Chi and line dancing, we recruited a sample of similar aged participants from four line dance classes held at the same centres. A comparison group from non-exercise classes at these centres (aged 55+, not currently enrolled in an exercise class, and had not participated in a formal exercise program over the past 12 months) was recruited to document the stability of scores on the outcome indicators. Since the literature argues that long-term practice is necessary to achieve the benefits of Tai Chi, we also recruited a sample of experienced participants (aged 55+) from five ongoing, transitional classes at the Taoist Tai Chi Societies. The profile of this group was compared to the profile and posttest scores of the beginner community Tai Chi sample (after a single session of participation).

The discussion begins by examining the strengths and limitations of the present study. The next section describes the profile of the different groups involved in this study in comparison to previous samples. Study completers are then compared to study dropouts. The findings concerning extent of improvement (i.e., change from pre to post) are discussed in the following section. Subsequently, the profile of beginners from the community Tai Chi classes is compared to the profile of experienced Taoist Tai Chi practitioners. Overall conclusions and directions for future research comprise the final section of the thesis.

3.8.1 Study Strengths and Limitations

The evaluation approach may be viewed as a limitation in this study. Although the program managers and instructors were contacted to obtain permission to recruit participants from their recreation/seniors' centre programs or Taoist Tai Chi Society classes, we did not solicit information about their program goals or ideas for evaluation. Although some of our contacts informally stated their program expectations (i.e., introduce people to Tai Chi, teach them dance steps), the program participants were the only stakeholders involved in formal data collection. We utilized a highly participant-based approach and focused our research questions on the cultural beliefs and previously reported benefits in the Tai Chi literature.

Random assignment, which controls for many threats to internal validity, is frequently not a viable option for evaluation of real-world programs in which participants freely choose which programs they wish to join. Oftentimes, outcome evaluation studies employ quasi-experimental designs involving repeated measures and comparison groups (from wait-lists or alternate programs) when possible. Evaluators must also deal with the real-world issue of concurrent program involvement during the study period. Furthermore, not all program participants may agree to take part in the evaluation of their programs, which entails additional time and effort such as completing questionnaires or undergoing assessments. The present study confronted all of these obstacles, as well as having limited resources at our disposal. In addition, we had to choose a battery of measures that was feasible to administer in community settings and did not overburden participants (to secure volunteers, as well as to obtain approval from the university's ethics committee and the medical director of the Taoist Tai Chi Society). Although we carefully piloted our measures, nonetheless, some individuals refused to do some of the assessments, particularly the tests of back strength and sit and reach.

Unfortunately, we were unable to compare the relative effectiveness of different types of Tai Chi classes offered at the various recreation/seniors centres given the relatively small number of individuals from each class who volunteered for the study. Accordingly, our community Tai Chi sample consisted of individuals from a variety of classes adapted and taught by different instructors. In addition, we were unable to recruit a truly sedentary group of older adults from the "non-exercise" groups (craft classes, card groups, bingo, etc.) at four senior centres', despite our recruitment criteria and efforts. Although this sample was not participating in any formal exercise classes during the study period and had not enrolled in a formal exercise class in the past 12 months, our findings indicate that this group was quite physically active through informal pursuits. Finally, we were only able to assess "experienced" Taoist Tai Chi participants at one point in time to provide a comparative profile with beginners from the community classes. Following Taoist Tai Chi participants from the beginner to the experienced level (which typically takes a year or more) was beyond the scope of this study.

Despite the inherent limitations, this study nevertheless has several strengths. In comparison to previous studies, the evaluation did not manipulate the Tai Chi program, but rather, examined the program as it was normally offered in the various centres. While we were unable to compare different forms and instructional techniques, the sampling of multiple classes is preferable to examining a single class, which is the norm in previous Tai Chi studies.

While the outcome indicators selected for this study had to be feasible to administer in a community setting, we used multiple measures to assess balance, strength, and flexibility, respectively. Training specificity of Tai Chi was considered in measurement selection. The measures chosen were designed by the developers for healthy, community dwelling older adults and further pilot-tested to ensure appropriate level of difficulty and feasibility. Finally, the evaluator is a Professional Fitness and Lifestyle Consultant (fitness appraiser certification from CSEP) and received additional training concerning the reliable administration of the balance, strength, and flexibility protocols used in this study.

3.8.2 Profile of the Study Groups

A total of 30 individuals from the community Tai Chi classes, 28 from the line dancing classes, and 16 from the non-exercise groups were assessed at baseline. Of these, 67% (n=20) of the Tai Chi sample, 64% (n=18) of the line dancers, and 88% (n=14) of the non-exercise group were further assessed at the 10-week posttest. This section begins by comparing the general characteristics of the three groups, followed by a comparison of physical activity profiles, psychophysical and physical characteristics using the baseline data of all study participants. Characteristics of study completers versus dropouts conclude this section.

3.8.2.1 General Characteristics

Similar to previous evaluation studies of community-based exercise programs for older adults (Ecclestone et al., 1998; Myers & Hamilton, 1985) and the profile of seniors who tend to join recreation/seniors' centres in general (Novak, 1997), our sample was predominantly female, Caucasian, and relatively healthy. Characteristics of the sample who participated in the outcome study were similar to the larger sample who completed the background survey for the process evaluation, although a slightly higher percentage of men from the Tai Chi group took part in the outcome phase. Our sample consisted of younger seniors (average age mid-60s); the non-exercise sample in the outcome study was older than the exercise groups. Reasons for joining Tai Chi or line dancing, general confidence in performing the movements, and few reservations at the outset were comparable to the findings of the process study.

3.8.2.2 Physical Activity Profile

Information from the background survey, as well as attendance data, was used to construct a physical activity profile of both the process and outcome study samples. The CHAMPS questionnaire was also administered to the outcome study groups at both baseline and after 10-weeks to verify their level of physical activity and to examine stability over time. A posttest questionnaire was used to check whether there had been any major disruptions in their physical activity patterns over the study period due to illness or other life events.

Consistent with the process study findings, many of the individuals enrolled in the Tai Chi and line dancing classes were involved in other structured exercise classes (37% and 54%, respectively) and/or informal activity pursuits (90% and 75%, respectively). The majority had been involved in physical activity throughout their lives, consistent with Novak's (1997) assertion that people who enjoy physical activities will continue being active when they retire.

The CHAMPS scores confirmed these findings; according to Stewart et al.'s (2001) classification, our Tai Chi sample was classified as "already active", while our line dancers were "somewhat active" at baseline.

For those who completed the CHAMPS measure at both time points, we expected that scores might increase slightly for both the Tai Chi and line dancing groups given that they were taking the once a week class over the Fall session. In fact, scores on all the CHAMPS variables significantly declined from pre to posttest, especially for the Tai Chi group. There are two plausible explanations for this finding. First, popular summer activities (such as golfing and gardening) were captured in the baseline CHAMPS (administered in September), but not in the posttest CHAMPS (administered in November or December). Secondly, dancing is classified as a moderate intensity activity on the CHAMPS (metabolic weight of 4.5), while Tai Chi is considered low intensity (metabolic weight of 2.0). Some Tai Chi researchers (e.g. Schneider & Leung, 1991), however, have classified Tai Chi as a moderate intensity activity; equivalent to walking at a rate of about six kilometers per hour. Given the CHAMPS classification, it is not surprising that even though the line dancers declined on the all activity variable (discontinuing many summer activities), they maintained their moderate intensity activity caloric expenditure by taking the line dancing class in the Fall, while the Tai Chi group declined on both variables. It is noteworthy, however, that overall, the Tai Chi group still had higher activity scores (on all the CHAMPS variables) at posttest than the line dancing sample (at either pre or post).

While we attempted to recruit a 'non-exercise' comparison group from the seniors' centres, as we discovered, this group was actually quite physically active according to both the background and CHAMPS questionnaires. Most said they had been involved in physical activity throughout their lives and were currently engaged in unstructured activities. They were classified as "somewhat" and "already active" on the CHAMPS questionnaire. While CHAMPS scores declined for all study groups from September to December, the non-exercise group declined the most dramatically in their frequency per week in all activities. The cessation of summer activities and not initiating a new activity may help to explain this finding.

In summary, the profile of older adults who enroll in beginner Tai Chi and line dancing classes at community recreation/seniors' centres can be considered "somewhat to already active" according to Stewart et al.'s (2001) classification system. For most, the exercise class in question was not their only pursuit, but rather one of several activities. Structured exercise classes in the fall appear to replace informal summer activities, and overall, these individuals tend to be somewhat less active in late versus early fall. Our comparison group recruited from non-exercise groups at these seniors' centres was certainly not "sedentary". Almost 70% were found to engage in informal physical activities. Interestingly, their level of physical activity (CHAMPS scores) declined the most from pre to post. These findings must be considered when interpreting the change scores on the psychophysical and physical measures for the three groups in this study.

3.8.2.3 Psychophysical Characteristics

The ABC and VPS scales were used to verify balance confidence and psychophysical well-being, respectively. A priori, given the profile of older adults who tend to take part in community programs, we expected that our sample would score relatively high on both these indicators at baseline. Appendix HH provides comparison values from previous samples of older adults for these two measures, as well as for the physical indicators used in this study.

Comparative values from prior studies suggest that healthy, active, older adults can be expected to score 90% or higher on the ABC (Myers et al., 1998). Both our Tai Chi and line dancing samples had comparable baseline values, which were significantly higher than the non-exercise group (average score of 74%). It is possible that older adults who have more balance confidence are attracted to Tai Chi and line dancing classes.

Scores on the VPS were moderately high for all three groups at baseline, comparable to values obtained on previous samples of older adults from exercise classes and walking groups (Myers et al., 1999) shown in Appendix HH. Given that the non-exercise group was more physically active than anticipated, it is not surprising that their VPS scores did not differ from the other two groups at baseline.

3.8.2.4 Physical Parameters

A priori, we expected the sample as a whole to score relatively high on all our physical indicators at baseline. No group differences were expected. Appendix HH provides comparative values available from previous studies. This section highlights the group differences that emerged at baseline for the balance, strength, and flexibility measures, respectively.

3.8.2.4.1 Balance

Static balance was assessed using the single-leg stance test. Although not significant, the exercise groups maintained their static balance for approximately 10 seconds longer at baseline than the non-exercise group. As illustrated in Appendix HH, the scores of our exercise groups were similar to a group of healthy older adults (serving as a control group for a Tai Chi intervention) but less than the experienced Tai Chi practitioners (with 1 to 20 years of experience) in the same study (Tse & Bailey, 1992). The non-exercise group's score was comparable to groups of healthy non-institutionalized men and women (see Appendix HH).

Dynamic balance was assessed via the Tandem Walk. Our line dancers took longer to complete the walk at baseline than the Tai Chi and non-exercise groups. We developed a penalty score for the missteps completed during the walk and calculated this penalty on the time and misstep scores of a group of healthy older women reported in the literature (Medell & Alexander, 2000). As illustrated in Appendix HH, the healthy older woman performed better on the Tandem Walk (with our penalty time scoring included) than our groups.

For the MSL, our sample showed greater variability in their stepping direction and length than prior samples and, surprisingly, were similar to a previous group of balance impaired older women (Medell & Alexander, 2000). It is uncertain why our step length was less than the healthy sample. As expected, for the MDRT, participants had a greater forward reach compared to backward lean; sideway reaches were symmetrical (Newton, 2001). As displayed in Appendix HH, our forward reach scores were greater than a group of older adults (with a mild balance disorder) who completed Duncan's Functional Reach (Hain et al., 1999). Weiner et al. (1992b) suggest that allowing participants to raise their heels from the floor (in Duncan's Functional Reach) may result in a greater forward reach (it also reduces the base of support and moves the participant into an unsteady position). Although this reason may be used to explain Hain et al.'s (1999) scores, our participants kept their feet flat on the floor during testing. The higher scores of our exercise participants may be due to participation in prior activities and not having a balance disorder (although not formally assessed). Our reach scores, for all directions, were also greater than a group of healthy community dwelling older adults from seniors' centres (Newton, 2001). Newton's sample, however, was older (mean age 74.1±7.9 years) than our exercise groups and their activity patterns were not reported.

3.8.2.4.2 Strength

At baseline, the ankle strength of our Tai Chi group was significantly better than the line dancers, while the knee strength of all three groups was similar. As presented in Appendix HH, the ankle strength of our sample was lower than a group of healthy community dwelling older adults (Desrosiers et al., 1998a). Comparisons could not be made for knee extension due to different joint angles. Previous research has assessed the knee, using the belt-resisted method, at 20°, 90°, and 120° of flexion (Connelly & Vandervoort, 1995; Desrosiers et al., 1998a; Lazowski et al., 1999), we assessed the knee at 40° of flexion.

Based on the conventional method for manually grading muscle strength, a grade of 3 is interpreted as fair and a grade of 2 is considered poor (Clarkson, 2000; Clarkson & Gilewich, 1989); no age distinctions were provided. Based on clinical experience our scores for back strength are normal for most older people (Lazowski. personal communication, August 8, 2001)

3.8.2.4.3 Flexibility

Based on CSEP's (1996) flexibility norms for individuals aged 60 to 69, our Tai Chi group's performance on the sit and reach test at baseline would be classified as 'very good'; the other two groups as 'good'. The average sit and reach scores for our sample were comparable to a group of healthy adults, aged 45 to 75 years (Shephard et al., 1990) and better than a group of adults completing a 16-week Tai Chi program (Chen & Sun, 1997) (see Appendix HH).

Although widely used clinically, few studies have published values for the Leighton Flexometer, which was used to assess shoulder and ankle flexibility in this study. Our baseline values for shoulder flexion were comparable to a group of long-term care residents who completed a four-month exercise program, 45 minutes, three times per week (Lazowski et al., 1999). Our shoulder flexion and extension scores were about 10° to 20° less than a group of young, non-athletic adult males; our ankle dorsi and plantarflexion scores were comparable to this group (Hubley-Kozey, 1991).

3.8.2.4.4 Summary

The Tai Chi and line dancing groups outperformed the non-exercise comparison sample on some measures (i.e., single-leg stance, forward reach, some of the MSL variables) but not others. The Tai Chi and line dancing groups, meanwhile, performed similarly on some measures, but had relative advantages on other measures. Baseline values were similar to those obtained in previous studies with healthy, older adults for BMI, the sit and reach test, and the single-leg stance. Unfortunately, little comparative data is currently available for the MDRT and MSL measures (only one study conducted by the test developers in each case). Comparisons regarding performance on the strength tests were difficult given variation in joint angle for the knee extension test and absence of published values for back strength grading. In addition, variation in sample age and health status, and failure to report sample activity profiles, make comparisons to previous research studies difficult for many of our outcomes. Thus, while we suspect that our sample performed well at baseline (particularly given their level of physical activity at study entry), for many of the measures we have little evidence to either support or refute this notion.

3.8.2.5 Study Completers versus Dropouts

Posttest assessments at 10-weeks were completed for 67% (n=20) of the Tai Chi sample, 64% (n=18) of the line dancers, and 88% (n=14) of the non-exercise group. While some participants dropped out of the Tai Chi or line dancing program, others adhered to program but were unavailable for the posttest assessment; distinguishing those who were program versus study dropouts. The program dropout rate for the present sample was 20% for the Tai Chi group (6 of 30) and 7% of the line dancers (2 of 28). In contrast, the overall program dropout rate based on multiple class records for the fall was 28% for Tai Chi and 12% for line dancing. Ecclestone et al. (1998) reported an average dropout rate of 26% across the 12 types of classes over three months; the dropout rate for the Tai Chi class was 34%. Multiple factors, as discussed in the Chapter Two, can influence program adherence.

While the demographic profiles of study completers versus dropouts were similar, as was level of physical activity, the groups differed in attendance rates and in some of the physical measures at baseline. Those returning for posttesting, both from the Tai Chi and line dancing groups, attended significantly more of their respective classes (on average, eight versus five classes). Study dropouts scored significantly higher on BMI, and had poorer scores on backward lean, left and right side steps, and shoulder extension. While study dropouts performed worse on the tests mentioned, it should be kept in mind that they did not differ significantly on the majority of the balance, flexibility, or strength measures (24 indicators in total) at baseline.

3.8.3 Extent of Improvement

A priori, we expected our exercise groups to perform better at posttest than the non-exercise group, however we were skeptical about the extent of improvement that could realistically take place over such a short duration (10 weeks), especially given that these beginner Tai Chi and line dancing classes were only held once a week. More specifically, we expected the Tai Chi group to show slight improvement on the balance and flexibility indicators, as well as balance confidence and vitality; maintenance of strength was anticipated. Similarly the line dancers were expected to show slight improvements on the balance indicators, balance confidence and vitality. While ankle flexibility, specifically dorsiflexion, was expected to improve with line dancing, this activity should not result in change in other areas of flexibility or strength.

The significant changes and trends towards improvement found for the Tai Chi group, and particularly for the line dancing group, are encouraging given that these beginner classes were only offered once a week over a limited, 10-week session. Our Tai Chi participants significantly improved on the right forward and side steps of the MSL, while the line dancers improved their single-leg stance time, Tandem Walk, and right forward step of the MSL. Our non-exercise group did not significantly improve on any of our outcomes over the study period. Programs are likely to be relatively beneficial, for some participants more so than for others, depending on individual rate of participation, baseline level of physical activity, concurrent involvement in other forms of physical activity and room for improvement on the outcome indicators (Myers 1999). All these factors are important in interpreting the present findings.

While our study completers had a relatively high attendance rate (attending on average 8 of the possible 10 classes), few practiced at home (according to the practice logs and verbal accounts). While it is possible that those who practiced at home might have achieved better gains, small numbers precluded such an examination in the present study. Varying degrees of effort expended during participation is also an issue. For instance, in the interviews, some participants stated that they were afraid of aggravating arthritic joints.

Baseline level of physical activity was certainly a factor in the present study. Recall that our groups were classified, according to CHAMPS, as being 'somewhat or already active' at baseline. While CHAMPS scores declined for all three groups from September to December, the non-exercise group declined the most. This decrease in physical activity over the study period may explain their decreased times on the single-leg stance, Tandem Walk, MDRT total, and overall strength tests. In general, however, the comparison group maintained most of their balance, flexibility, and strength scores likely due to the high percentage (69%) who continued to participate in informal physical activities such as walking and swimming over the study period.

Concurrent participation in exercise classes, in addition to Tai Chi or line dancing, may provide an alternative explanation for the significant improvements and trends towards improvement found in these groups. Further analyses showed that individuals enrolled in other classes did not consistently perform better at baseline or improve to a greater extent. Unfortunately, we could not examine the various combinations of exercise classes (i.e., Tai Chi plus Yoga versus Tai Chi plus aerobics), nor could we factor in the duration of participation in other classes. In any case, it is difficult, if not impossible, to attribute improvements specifically to Tai Chi or line dancing. Although the non-exercise group was not taking formal classes, they were comparable to Tai Chi and line dance in terms of informal physical activities. The reality is that older adults who come to these centres tend to be physically active and engage in multiple forms of physical activity.

Room for improvement on the various outcome measures must also be considered. For example, our Tai Chi group scored 89% and our line dancers scored 84% (out of a possible 100%) on the ABC (balance confidence) measure at baseline. Myers et al. (1998) state that individuals who score in the mid-80s or better on the ABC tend to be highly functioning, already physically active, and unlikely to show further improvement in balance confidence. Our Tai Chi group also scored fairly high on the single-leg stance test at baseline (40 seconds out of a possible 60 seconds); scores were maintained at posttest. The line dancers, on the other hand, averaged 28 seconds at baseline and improved significantly to 43 seconds at posttest. Thus, the latter group had more room for improvement.

The meaningfulness of the changes found must be considered. For instance, although the line dancers improved their SLST, their average posttest score was similar to the pretest score of the Tai Chi participants. Our overall results would be easier to explain if our exercise and non-exercise groups had similar baseline scores and if the non-exercise participants stayed the same from pre to posttest on our outcome measures. We found that differences existed between our non-exercise and exercise group at baseline and that our non-exercise group sometimes improved slightly on various measures.

It is also important to consider that our physical battery consisted of indicators most relevant to Tai Chi training. For example, Tai Chi participants routinely practice various lunge positions, which challenge isometric strength in the lower extremities. No movement occurs at the joint during an isometric contraction, the force exerted by the muscle is equal to or less than the resistance (Hockey, 1993). We specifically assessed the isometric strength of the lower body using the belt-resisted method. Although a significant improvement was not found, our Tai Chi sample performed better than the line dance and non-exercise groups. If we had assessed isotonic strength, where movement takes place at the joint and there is a shortening and lengthening of the muscles (Hockey, 1993), the line dancers may have scored better since their activity involves a constant movement of the lower limbs. Another example is shoulder flexibility. Unlike line dancing, Tai Chi movements emphasize shoulder rotation thus, as expected, the Tai Chi group, but not the line dancers improved on this measure. Conversely, both Tai Chi and line dancing may influence Tandem Walk. For instance, line dancing involves the grapevine and other crossover steps, while Tai Chi involves frequent changes in base of support. Both groups improved on this measure.

Finally, it must be acknowledged that we did not assess all the possible benefits or adverse effects of participation in beginner Tai Chi or line dancing programs. For instance, during the exit interviews and on the posttest survey, several individuals reported feelings of relaxation, improved concentration, enjoyment, or a sense of accomplishment from Tai Chi and/or line dancing. Conversely, a few noted that the movements were painful.

3.8.4 Comparison to Experienced Taoist Practitioners

Since it has been argued that long-term practice may be needed to learn the Tai Chi movements and achieve many of the benefits (Alder, 1983), we compared our profile and posttest scores of the community Tai Chi sample (following their 10-week beginner session) to a group of experienced practitioners of the same age (who had been practicing Tai Chi an average of four years). The two samples were similar with respect to their demographic, health, and activity profile. Contrary to our expectations, although the experienced Taoist participants had somewhat better scores on several of the measures, they were only significantly better on one indicator, namely, shoulder flexion. The most plausible reason for this finding is that both samples concurrently participated in other exercise classes and informal physical activities. The community sample was also active prior to enrolling in their Tai Chi program. Previous research has often compared the scores of experienced Tai Chi practitioners to a sedentary control group or failed to report the activity level of the comparison group (Lai et al. 1993; Lan et al. 1996; Lan 1998; Tse & Bailey, 1992), and not surprisingly, has found differences.

3.8.5 Conclusions and Directions for Future Research

This project represents the first attempt to profile older adults who take part in beginner Tai Chi and line dancing classes at community recreation/seniors' centres and document the benefits that can be realistically obtained after a single session of participation. We found that older adults who tend to join such programs are predominantly Caucasian, female, relatively healthy, and physically active. Even our non-exercise group was not sedentary, rather, they were quite active via walking, swimming and gardening. Attendance was high for both the Tai Chi and line dancer groups and dropout was low. All groups generally scored well on the psychophysical and physical measures at baseline. Significantly lower balance confidence scores for the non-exercise group raise the possibility that older adults with greater balance confidence are more predisposed to Tai Chi or line dancing classes.

The findings from our outcome study suggest that participation in a 10-week beginner Tai Chi or line dancing program may result in some improvement in various balance and flexibility indicators, as well as maintenance of strength. No significant change was found for the non-exercise group, many of who participated in informal activities but not structured exercise classes during the study period. While the findings are encouraging, particularly for the line dancers, it is impossible to attribute the effects to Tai Chi or line dancing per se given concurrent participation in other structured exercise classes. The influence of overall exercise patterns is also evident when comparing our beginning Tai Chi sample to the experienced Taoist practitioners. Although it may take months of practice to learn Tai Chi, many of the potential benefits may be achieved through other forms of structured exercise. In any case, it appears difficult to find healthy older adults who participate in one exclusive form of physical activity and to separate the relative contributions of sequential and concurrent participation in multiple classes and activities.

Despite all the difficulties in conducting real-world evaluations of exercise classes for older adults, further studies are needed. For instance, the relative benefits of the different forms of Tai Chi practiced in the community warrant investigation. Relative benefits of classes offered once versus twice a week should also be compared. Tracking participants of ongoing programs longitudinally (e.g., through the Taoist Societies) and documenting rates of participation as well as incremental change on various outcome indicators is recommended. Qualitative studies are also needed to better understand the experience of older adults trying novel forms of exercise such as Tai Chi and line dancing. Together, the current process and outcome studies provide a starting point for further evaluations of Tai Chi and line dancing programs for older adults. More comprehensive evaluations are needed to examine issues of recruitment, implementation, and delivery. Program directors and instructors should be involved in evaluation planning to inform decision-making. Future outcome evaluations also need to examine contextual factors (such as setting, class size, age, and gender mix and instructor characteristics) in relation to desired outcomes.

Our study focused on a relatively healthy group of older adults (55+) who were participating in community recreational classes; other populations such as frail seniors should also be examined. Therapeutic effects of Tai Chi for people with osteoporosis, Parkinson's, arthritis, and other chronic illnesses, have been advocated (Cerrato, 1999; Kutner et al., 1997; Lane & Nydick, 1999), although few empirical studies have been carried out to date.

In conclusion, our findings provide a fairly comprehensive profile of older adults who enroll in community Tai Chi classes and line dancing programs. This profile includes:

demographic characteristics, physical activity patterns, baseline values, and change scores on various psychophysical and physical parameters. The study also provides a comparison of beginner community Tai Chi participants (following 10-weeks of participation) and an experienced group of Taoist practitioners. Our findings constitute a valuable basis of comparison for future evaluation and research studies on exercise programs for older adults.

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Appendix A:

Centre Information Letter for Study One

Dear Program Manager:

My name is Trisha Gavin and I am conducting a study as part of my doctoral dissertation. I am working with my faculty advisor, Dr. Anita Myers, and we are from the Department of Health Studies and Gerontology at the University of Waterloo.

We are conducting a study on why older adults are interested in different types of exercise programs offered in the community and the health benefits that may be achieved through such participation. In particular, we are interested in two novel exercise approaches, Tai Chi and line dancing for older adults. We are hoping to look at several classes at different recreational and seniors' centers and clubs across the Hamilton and Kitchener-Waterloo areas. I am interested in both the tai chi and line dancing classes offered at your center.

Our study consists of two parts. The first phase is an adherence study, which I hope to start in the winter session. This study will explore the reasons why participants are attracted to the tai chi and line dancing programs, why they continue or discontinue participation, and their overall personal experiences with the class. The second study will start in the spring session and will measure various health outcomes such as balance, flexibility, strength, and psychological well-being.

I am asking for your permission to conduct study one at your facility in January with the possibility of continuing into study two in the spring session. Since study one is quickly approaching, I will keep this study as the focus of this letter.

The study will be explained to the program participants during the first class of the winter session. Those who volunteer to participate will be asked to sign an informed consent and will be given a background questionnaire to complete and return to the instructor at the second class. The questionnaire should take no longer than 10 minutes to complete and asks general questions about how they heard about the program, why they enrolled, their past and current levels of physical activity, and a basic health history.

Upon completing and returning the questionnaire, the participants will <u>not</u> be approached again until one week after the end of the program. Approximately one week after program completion, I plan to call the participants on the telephone to complete a 10 to 15 minute interview about their thoughts and experiences towards the recently completed program. I will have voluntarily acquired their phone number on the consent form completed at the first session.

After the telephone interview, most of the participants will have completed all of the requirements for the project. A second telephone interview will only be given to participants who stated that they would reenroll in the next session but did not. This interview will take place approximately one month after the winter session has completed. During this interview, I will ask for their reasons for not returning to their enrolled program and their physical activity levels at that time.

Program participants will be told that their involvement in this project is completely voluntary and as mentioned, I will require their consent prior to participation. The results of the questionnaires and interviews will be kept totally confidential. No individual will ever be identified in the results. The collected information will be summarized across all groups to provide a general description of the participants taking part in such recreational programming.

The Office of Research Ethics at the University of Waterloo is currently reviewing this project and I hope to receive approval to start in January. However to assist with this, they have asked that I receive approval from the recreational centers from which I hope to draw my sample.

At the bottom of this page, I have designed a form for you to sign that I may submit to the ethics board at the University of Waterloo. It simply states that you are aware of the project and have given me permission to approach the tai chi and line dancing classes at your center. If you do not feel comfortable signing this form, I ask that you write an official letter to the Office of Human Research at the University of Waterloo giving me formal permission to complete this study.

I am hoping that your recreational center will agree to help me with this study. I would be willing to speak with you regarding any questions you may have and provide you with a complete written proposal if requested. I can also give you a copy of the University of Waterloo ethical approval once obtained. I can be reached at tsgavin@healthy.uwaterloo.ca or (905) 679-3985.

Thank you for considering this project.

Trisha Gavin
Ph.D. Candidate
Department of Health Studies and Gerontology
University of Waterloo

As the program manager of the Rockway Seniors Center, I am aware of the adherence study described above. I understand that volunteers must sign an informed consent prior to participation in the study, which includes the completion of a questionnaire, an exit interview, and a possible follow-up interview. No individual will ever be identified in the finding. I give Trisha Gavin permission to conduct this study at the Rockway Seniors Center.

____________________________ ____________________

Name Date

Appendix B:

Program Descriptions and Membership Fees

Program Descriptions

Tai Chi at the Wing 404 club, Rockway Seniors' Centre, and Breithaupt Centre

One instructor (T.A) teaches the beginner and intermediate classes at the Wing 404 club, Rockway Senior's Centre, and the Breithaupt Community Centre in K-W. All groups are instructed in the Yang style. The beginner groups commonly complete the first 10 movements of the form while the intermediate groups refine the movements learned in the beginner class and progress further into the set. The group at the Breithaupt Community Centre meets for 60 minutes, twice a week for eight weeks with the option of continuing for 10 weeks (decided by the group during the course of the program). The groups at Rockway Seniors' Centre and the Wing 404 Club meet for 90 minutes, once a week for 10 weeks. All groups are encouraged to practice at home.

Each week the groups begin with 15 to 20 minutes of basic qi gong or chi kung exercises. The instructor explained that chi kung is a simplified form of Tai Chi. Chi kung is the art of developing vital energy within the body, particularly for health, vitality, mind expansion, and spiritual cultivation. By enhancing the flow and balancing the chi, one can overcome illnesses and live a more healthy life. There are various schools of chi kung that can be followed. Some of the chi kung movements resemble those of Tai Chi, while other movements are totally different. The instructor chooses the movements most appropriate for his class, which are performed in either a sitting or standing position. During the chi kung exercises the instructor demonstrates the movements and explains how the movement will help the participants' health. Everyone is then asked to join in by copying the movements of the instructor.

Once the chi kung movements are complete, the participants are instructed in Tai Chi. The instructor demonstrates each movement to the group who then practice the movements under the instructor's guidance. The participants imitate the motions at the same speed as the instructor. During the classes the instructor constantly monitors the subjects to ensure correct body positions and movement to movement transitions. The instructor adds on movements as the group progresses. Often times the instructor will divide the class into small groups based on their experience and level of practice. The groups practice the form and the individuals within each group assist each other in learning and refining the movements. The instructor visits each group to offer instruction and assistance in learning and correcting the movements.

Tai Chi at Huntington Park Recreation Centre

The participants at Huntington Park Recreation Centre strive to learn the 24 movements of the Yang form, also know as the Short 24 Form. Past groups have completed 20 to 24 movements. This group meets for 60 minutes, once a week for 12 weeks. The instructor (R.P), hired by the recreation centre, leads this group through the sequence of movements. Each participant imitates the movements at the same speed as the instructor, who continually practices the movements in short sets, and adds on movements until the full form is complete.

Tai Chi at Hamilton Seniors' Centre and Ottawa Street Seniors' Centre

The participants at the Hamilton Senior's Centre and Ottawa Street Seniors' Centre learn a modified version of the Yang style, developed specifically for seniors by the instructor. The participants practice this form of Tai Chi for 60 minutes, once a week, for 10 weeks. All sessions are supervised and lead by the instructor (L.C) who is hired by the senior centres. Each participant imitates the movements at the same speed as the instructor, who continually practices the movements in short sets, and adds on movements as the group progresses.

Tai Chi at Sackville-Hill Seniors' Centre

Two forms of Tai Chi are offered at Sackville-Hill Seniors' Centre; Taoist Tai Chi and Yang Style Tai Chi. Participants enrolled in Sackville-Hill 1 learn the initial movements of the Taoist Tai Chi set. During their instructional session, the participants become members of the Taoist Tai Chi Society, a membership form is signed by all participants during their first week of class. This group meets with the instructor (S.L) from the Taoist Tai Chi Society of Hamilton for 60 minutes each week. The participants will progress as far as they can through the 108-movement set during the 10-week session, usually completing 10 to 15 movements. A full wall mirror is available in the training room so participants can monitor their personal performance.

Participants in Sackville-Hill 2 learn the Yang style of Tai Chi taught by an instructor (O.D.) hired by the centre. Past participants have often completed 10 movements in the 10-week session. Similar to Sackville-Hill 1, this group meets for 60 minutes once a week. During the sessions of both Sackville-Hill 1 and 2, the participants imitate the motions at the same speed as the instructor. The instructors monitor the participants and correct body positions and movement to movement transitions whenever needed.

Tai Chi at Burlington Seniors' Centre

The participants at Burlington Seniors' Centre practice the Taoist Tai Chi 108 movement set. They meet for 60 minutes, once a week, for 10 weeks. Similar to the class at Sackville-Hill 1, the participants at the Burlington Seniors' Centre become members of the Taoist Tai Chi Society. The instructor (O.G.) is a member and instructor from the Taoist Tai Chi Society. Additional instructors (usually two to three) also attend the classes to assist the participants in learning the form. The extra instructors intermingle with the new participants so that more than one expert can be followed. The Tai Chi program at the Burlington Senior's Centre is unique to the other recreational/seniors' centres. New participants are accepted only in September as the January (Winter) and April (Spring) sessions are a continuation of the program where participants continue to learn, refine, and progress through the Tai Chi form.

Tai Chi at the Taoist Tai Chi Society

The groups at the Taoist Tai Chi Societies are instructed on the 108 movements of the Taoist Tai Chi set. This is not a limited program, as in most of the recreational/seniors' centres, but rather a monthly membership is followed. The beginner classes commonly run for 4 months as many instructors have noted that this is the average length of time needed to learn the complete form. Once the participants have acquired the basic movements, they are encouraged to continue with the society in a continuing class to further refine and develop their skills. Volunteers from the society teach all of the beginner classes. Often times three or four volunteers are available at each beginner class to assist with instruction. During the exercise, the group will imitate the motions at the same speed as the instructor. The instructors will constantly monitor the subjects and correct body positions and form-to-form transitions.

The class time and frequency of attendance varies within the societies. Participants at the Downtown Hamilton location practice once a week for 90 minutes, the participants at the Hamilton Mountain and Stoney Creek locations practice for 60 minutes, twice a week, while those in K-W practice for 90 minutes once a week with an optional practice class once a week. The variation in class offering is due to instructor availability at the individual branches.

Line Dancing In Hamilton and Burlington

Line dancing is taught for 90 minutes, once a week, for 10 weeks at Sackville-Hill Seniors' Centre by an instructor (S.G) who is hired by the centre. Another instructor (A.S) teaches line dancing at the Burlington, Hamilton, and Ottawa Street Seniors' Centres for an identical timeframe. The instructors teach a variety of different line dances to the group. During the exercise, the group will imitate the steps at the same speed as the instructor. She sequentially adds on new movements until the full dance is practiced and repeated. The participants first learn the steps without music and then music is added so the participants can practice their steps and eventually complete the dances.

Membership and Program Fees

Purchasing a seniors' membership is mandatory for all participants at the senior's centres in Burlington (Burlington Seniors' Centre) and Hamilton (Sackville-Hill Seniors' Centre, Ottawa Street Seniors' Centre and Hamilton Senior's Centre). Reaching the age of 55 years is the only criteria for purchasing a seniors' membership in Burlington. The City of Hamilton requires: a) the participant to be at least 60 years of age; or b) be the age of 55 years and able to provide proof of being on a fixed income (i.e., retired); or c) the spouse of an individual who has met one of the first two criteria. The senior's memberships are valid for one year and both residents and nonresidents of these cities may obtain a membership, although different fee rates apply. In addition to the membership fees, individual program fees must be paid (refer to Table B.1 for a fee listing)

Purchasing a senior's membership is not required for participants at the recreational facilities in Hamilton (i.e. Huntington Park Recreation Centre) and K-W (Wing 404 Rotary Adult Centre, Breithaupt Community Centre, and Rockway Seniors Centre). Acquiring a membership entitles the cardholder to receive a reduced program fee. For example, nonmembers in Hamilton must add a 50% surcharge to their program fee (i.e. members would pay $15.00 for a Tai Chi program while nonmembers would pay $22.20). In K-W, those holding a senior's membership would pay the reduced senior rate instead of the adult rate.

Finally, the Taoist Tai Chi Society requires that all participants purchase a membership upon joining the society. New members receive a t-shirt upon enrolling and may attend as many sessions as they wish (although it is recommended that they attend the scheduled beginner classes with the same instructor until they have learned the form). In addition to the annual membership, participants must also pay a monthly fee. The reduced monthly rate for seniors' and students can be found in Table B.1.

Table B.1 Membership and Program Fees

Location	Program	Membership Fee	Cost of Program
Huntington Park Recreation Centre*	Tai Chi	No (50% surcharge)	$15.00
Hamilton Seniors' Centre	Tai Chi Line dance	$25.00 residents $37.00 nonresidents	$15.00 $12.00
Ottawa St. Seniors' Centre	Tai Chi	$25.00 residents $37.00 nonresidents	$15.00
Sackville-Hill Seniors Centre	Tai Chi Line dance	$25.00 residents $37.00 nonresidents	$14.00 $8.00
Burlington Seniors' Centre	Tai Chi Line Dance	$25.00 residents $33.56 nonresidents	$20.00 $15.00
Breithaupt Centre*	Tai Chi	$20.00	$30.00
Rockway Seniors Centre*	Tai Chi	$20.00	$32.80 member $42.80 nonmember
Wing 404*	Tai Chi	$20.00	$36.00
Taoist Tai Chi Society	Tai Chi	$22.00	$15.00/ month

*membership not required

Appendix C:

Instructor Recruitment Speech for Study One

Instructor Recruitment Speech

We are ending a little early today so I can tell you about a research project our centre is involved in. What we learn through this project will help our centre tailor our classes to better meet the needs and expectations of participants such as yourselves.

Trisha Gavin (who is here with us today) is a Ph.D. student in the department of Health Studies and Gerontology from the University of Waterloo. She is conducting a study on the reasons why older adults are interested in different types of exercise programs offered in the community, particularly Tai Chi and line dancing.

She is surveying participants across several programs at different seniors' centers, recreational facilities, and clubs in the Hamilton and Kitchener-Waterloo areas. All results will be **totally confidential** and in **summary form**.

Everyone is invited to consider **volunteering** as a participant in this study. Your decision to participate is completely voluntary and will in no way impact on your relationship with the recreation center. Interested persons will receive an information letter, a consent form (which is required by the University of Waterloo), and a brief survey. This **short survey can be completed at home** (which will only take about 10 minutes) and returned in the confidential envelope provided to me at next week's class (or as soon as possible).

As the letter explains, **new participants only,** or those who have never taken this type of exercise class before, will also be asked to take part in a brief (15-20 minute) telephone interview at a convenient time after the session ends, and possibly a month later, to find out more about peoples' experiences.

Your participation in this project is completely voluntary, but I hope you will all take part. I will hand out the packages now to interested participants so you can look at them, if you have a few minutes, and ask Trisha or myself any questions. If you don't have time to look at these now, take them home and you can call Trisha if you have questions. Please bring the survey and consent form to next week's class if possible.

Thank you for helping us with this important project.

Appendix D:

Information Letter and Consent Form for Study One

University of Waterloo

Waterloo, Ontario, Canada
N2L 3G1

Faculty of Applied Health Sciences
Department of Health Studies
and Gerontology
519/885-1211 or 519/888-4567
Fax 519/746-2510

Dear Participant:

My name is Trisha Gavin and I am conducting this study as part of my doctoral dissertation. I am working with Dr. Anita Myers at the Department of Health Studies and Gerontology at the University of Waterloo.

The purpose of this study is to learn more about why older adults are interested in different types of exercise programs offered in the community. We are looking at several programs at different recreation and senior's centers and clubs across the Hamilton and Kitchener-Waterloo areas. In particular, we are interested in two fairly recent approaches, Tai Chi and line dancing. We are trying to find out what makes these programs appealing to older adults and how the recreational centers can better meet the needs and expectations of participants, such as yourself.

We are inviting **everyone** in your class to complete a short survey at home and return it to their instructor at their next class if possible. This survey should only take about 10 minutes to complete. Your decision to participate is completely voluntary and will in no way impact on your relationship with the recreation center.

At the end of this session, I will be calling **new participants** (those who have never taken this type of exercise class before) to arrange a brief (15 to 20 minute) interview over the phone. The purpose of these interviews is to get feedback about peoples' initial experiences taking either Tai Chi or line-dancing. When I call you, we will try and arrange a convenient time for this phone interview. I hope to tape record these conversations for later analyses and I will check with each person before we begin to make sure this is alright.

A small number of new participants may also be asked to take part in a second brief follow-up phone interview (approximately one month after the class is over).

(please turn over)

Your participation in this project is **completely voluntary**. You can choose not to fill out any part of the survey or not respond to any part of the interview. Everyone will be given an identification code based on the programs' location and session. This code will protect your confidentiality and allow us to match up the survey and interview data for analyses.

The results of all surveys and interviews will be kept **totally confidential**. No individual will ever be identified in the results. The information collected will be summarized across all groups to provide a general description of the people taking part in various types of recreational programs. Information will be kept secured at all times. Once the data has been analyzed and published, it will be shredded and the tape recordings erased. No known or anticipated risks are expected to result from your participation.

This project is fully supported by the director of your recreational facility and your program instructor. If you have **any questions** about the survey or the study in general, please call Trisha Gavin at (905) 679-3985. The Office of Research Ethics at the University of Waterloo has approved this project and requires that we obtain your signed consent prior to participation. If you have any concerns resulting from your participation in this study, please contact Dr. Sykes at the Office of Research Ethics at the University of Waterloo at (519) 888-4567 ext. 6005.

Thank you for considering our request. We hope you will take the time to **complete the survey and consent form and return these (in the confidential envelope provided) to your instructor next week,** or as soon as possible. Please be advised that you can withdraw your consent at any time and/or request that your information be destroyed without any penalty or impact on your relationship with the centre. Please keep this letter of information.

Sincerely,

Trisha Gavin
Ph.D. Candidate
Department of Health Studies and Gerontology
University of Waterloo
(905) 679-3985

Participant Consent Form

I feel that the purpose of this project has been explained to my satisfaction. I understand that any information I provide will be kept totally confidential. I have had the opportunity to ask questions and, if so, have received acceptable answers.

All participants: By signing below, I am agreeing to having the information from my survey analyzed and reported in the study in summary form, together with the results from other people in other classes.

New participants Only: By providing my phone number, I am allowing Trisha Gavin to contact me by phone after the session ends to arrange a brief interview. If a convenient time cannot be arranged, or should I decide at that time not to take part for any reason, no further contact will be attempted and this form will be destroyed. Before the interview begins, my verbal permission to tape the interview will be requested.

I understand that personal contact information (name and phone number) will only be used for this study. My name and phone number will be kept totally secured by the researcher and will not be given to any other parties.

Participant's name (please print):________________________________

Signature:__________________________**Date:** __________________

Phone number (new participants only):____________________________

Please indicate the most convenient times to call (3 check the boxes).

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Morning							
Afternoon							
Early evening							

Please return this consent form, together with the survey, in the confidential envelope provided, to your instructor next week or as soon as possible.

Appendix E:

Background Survey

Background Survey for Tai Chi Participants

Instructions: The purpose of this survey is to learn more about who is interested in certain forms of exercise such as Tai Chi, and why. Simply check 4 the box or write in a brief response. We would like people to answer all of the questions if they feel comfortable doing so. Feel free to make any additional comments in the margins.

Section A: First, A Few Questions About This Class

1) How or from whom did you **hear about** this Tai Chi class?

____

2) Do you **know anyone** in this class? ☐ No ☐ Yes

If yes, what is your **relationship** to this person(s) (example, spouse, friend, etc.)

____

____

3) How do you **normally travel** to this center?

☐ Car ☐ Drive myself

■ Taxi ☐ Ride with a family member or friend

☐ Bus ☐ Other: ______________________

4) How **long** does it take you, on average, to get from your home to this center?

__________ minutes

5) What are **your reasons for joining** (or continuing with) this Tai Chi class?

____

6) Have you **ever taken** Tai Chi before?

☐ No

☐ Yes, at this center

When? Year______ Season_________ (Fall, Winter, or Spring)

☐ Yes, at a different center

When? Year______ Season_________ (Fall, Winter, or Spring)

Where? ________________________

7) How **sure** are you that you will be **able to do** the Tai Chi movements? (circle number)

0	1	2	3
Very Sure (no problem)	Pretty sure	Not very sure (may be too much)	Don't know (never tried it before)

8) Do you have **any reservations or concerns** about taking this Tai Chi class? (Check all that apply)

_____ No
_____ I may not have the skills or be able to keep up
_____ I may not be able to attend all classes
_____ I may have difficulty getting to the classes
_____ I may not be able to find the time to practice at home
_____ Other concerns (specify) ______________________________

B: Tell Us About Other Physical Activities You Are Involved In.

1) Are you **currently enrolled** in any other physical activity **classes** or **groups**?

☐ No

☐ Yes
If yes, what type(s)? ____________________________________

Number of times per week? ______________________

Where? ____________________________________

2) Do you **currently** do any **other types** of physical activity, at least once a week, for example: walking, swimming, biking, tennis, curling?

☐ No

☐ Yes
If yes, what are the activities? ________________________________

Number of times per week? __________________________________

3) How many **days in an average week** do you accumulate at least 30 minutes or more of moderate intensity physical activity (equivalent to a brisk walk)? (Note: the 30 minutes can be done as a single bout or several shorter bouts.)

_____ days a week

4) Would you describe yourself as a person who has **always** been involved in **exercise and/or sports?**

☐ Yes, all of my life ☐ Off and on ☐ Not at all

5) Are there any daily activities that you **would like to do but are not** currently doing? (Not included in process evaluation – Outcome evaluation only)

☐ No

☐ Yes. If yes, what are the activities? ______________________________

Section C: Tell Us About Your Health

1) In **general**, how would you describe your **current, overall state of health**?

☐ Excellent
☐ Good
☐ Fair
☐ Poor

2) As **diagnosed by a health professional** do you currently have any of the following? (Check all that apply)

☐ Heart trouble
☐ Chronic asthma, emphysema, or bronchitis
☐ Diabetes
☐ Osteoporosis
☐ Arthritis
☐ High blood pressure
☐ Back problems
☐ Foot problems
☐ Hearing disorder
☐ Cataracts or other vision disorder
☐ Other health problems (Please specify: ____________________________)

3) Are you **currently limited** in the type or amount of physical activity (work or leisure) you can do because of an illness, injury, or disability?

☐ No

☐ Yes, because of a **temporary** illness or injury (example: flu, fracture)

Please specify ____

☐ Yes, because of a **long-term** illness, injury, or disability (example: diabetes, arthritis, chronic foot, back or joint problems, heart disease)

Please specify ___________________________________

Section D: Finally, Tell Us A Little About Yourself

1) Are you? ☐ **Female** ☐ **Male**

2) What is your **age**? _______

3) What is your **current marital status**?

☐ Single ☐ Separated or divorced

☐ Married ☐ Widowed ☐ other ________________

4) What is your **ethnic/cultural** heritage? ____________________

5) What is the **highest level of education** you have **completed**?

☐ Elementary school
☐ Some high school
☐ High school diploma
☐ Some post-secondary school
☐ College or university diploma
☐ Graduate or Professional Degree

6) Are you **currently retired**?

☐ Yes, fully retired
☐ Semi-retired
☐ No

If yes, do you consider yourself to be a **busy** person?

☐ Very much so
☐ Somewhat
☐ Not at all

Thank you for completing this survey. If you found any questions unclear, please call Trish at (905) 679-3985, or write comments in the margin beside the questions. **Please return this survey to your instructor in the envelope, along with your signed consent form, at the next class if possible.**

Appendix F:

Exit Interview for Study One

Exit Interview for Tai Chi Participants

Session date: ____________ Program location: ______________ Instructor: ___________

Preparation

Interviewer will have **attendance tracking sheets** (for the number of classes attended/ missed and attendance pattern) and **individual survey** (how they heard about the class, and reasons for joining) available during the interview.

Opening Remarks

Hello Mr./Mrs. ______________________, this is Trisha Gavin calling from the University of Waterloo. I hope you remember me. I was the one who came to your first Tai Chi class and asked you to complete a survey. At this time, you gave me permission to call you. The purpose of this phone call is to ask you a few questions about your experiences with the program. This should only take 15 to 20 minutes.

Do you have **time now** to answer a few questions for me?

If **yes**, continue with permission to tape record.
If **no**, can I arrange another time to call you?

Arranged Time: ____________________ Reasons for refusal: ________________________

Contact Attempts

Date:____________ Time:_____________ Person Spoken to: _________________
Date:____________ Time:_____________ Person Spoken to: _________________
Date:____________ Time:_____________ Person Spoken to: _________________
Date:____________ Time:_____________ Person Spoken to: _________________

Permission to Tape Record

Before we begin, I wonder whether you would mind if I tape-record our conversation? I don't want to miss any of your comments and it will save me having to take notes as we talk. Please remember that whether or not we tape this interview, your comments will be kept totally confidential. Only group responses will be reported and no one will hear the tapes but me. At the end of the study, all tapes will be erased. I will check with you again at the end of the interview today, and if you change your mind I can erase this tape immediately.

Do I have your **permission** to tape this interview?

Agrees _________ Disagrees (reason if given) _________________________

Interview Date: _____________________ Tape Label: __________________

Exit Interview Script

Now let's begin.

Part A: Attendance Patterns
As you may recall, the purpose of my study was to find out about peoples' experiences with Tai Chi programs. As you know, your instructor asked everyone to sign-in each class (or took attendance). In order to examine why some people are able to, or interested in attending more often than others, we have asked the various participating centres to allow us to examine attendance sheets from different classes in order to examine the attendance patterns across the classes. I want you to know that the reason we did not tell participants we would be looking at attendance data at the beginning of the study is that we did not want to influence or pressure people to attend the classes. Keep in mind that all of this data will be summarized across the classes, no one individual's attendance, or any other information, will be reported in isolation.

However, we do want to explore why some people were able to get to more of the classes than others. For instance, in your case, I noticed that you were able to attend _____ (number of classes) classes from the 8 (or 10) week session and you attended ______________________ (refer to attendance pattern, for example, the first four classes but missed the remainder, off and on throughout the entire program, only missed one class at the end, etc.)

*Was it **difficult** for you, at times, to make the classes? (if yes, why?)*

Part B: Adoption
From the survey that you completed, you said you heard about the program through _________ (refer to how they heard about the program) and you joined Tai Chi because _______________ (refer to reasons for joining)

*What **appealed** to you about Tai Chi before you started?*

*Why did you **choose Tai Chi** over other exercise programs?*

*** For only those who indicated on the survey that they knew someone in the class.**
You said on the survey that your ______________ (fill in who the participant identified, spouse, friend, etc) was in the class.

Had this person taken Tai Chi before?

*Did this person **influence your decision** to join Tai Chi? (Prompt: do you think you would have joined if they had not been there?)*

*Did you **travel** to this class together?*

Part C: General Impressions:

You said in the survey that you joined Tai Chi because you thought it would be ___________ (fill in reason for joining, for example: relaxing)

Was this your experience?

What are your overall ***impressions*** *of the Tai Chi class, both good and bad? (Prompts: did you enjoy it?)*

Part D: Specific Impressions

What did you ***think*** *about the* ***Tai Chi movements****? (Prompt: did you find them difficult or frustrating to learn, were there too many?)*

Did you find it difficult at any time to keep up?

How did you ***feel right after the class****? (Prompt: did you feel tired, relaxed?)*

The instructor encouraged everyone to ***practice at home****. Did you* ***practice at home****? Tell me about this? (Prompts: How often? Was it difficult to remember the movements?)*

*** For those enrolled in other physical activity classes**
I see from the survey that you are also _____________ (refer to other classes, physical activities or sports).

How does Tai Chi compare? (Prompt: what makes this class ***different****?)*

Program Suggestions:

Is there anything about this class you would like to see ***changed****? (Prompts: was the class scheduling convenient, class size, movements covered?)*

Would you ***recommend*** *this class to others? (Prompts: why or why not, to whom would you recommend it to?)*

Future Plans:

Do you plan to enroll in another Tai Chi session in the future? (Prompts: why or why not? if yes, at this center, at another center)

Final Comments:

Do you have any other comments about the program that you would like to add?

Ending:

We have finished our interview. I just want to make sure that you are okay with me using the tape recording to assist in analyzing the findings. I will be interviewing many people from your program as well as others from different Tai Chi programs at recreational facilities and seniors' centers in Kitchener-Waterloo and Hamilton. No individual will ever be identified in my report. Are you okay with this? (Make notes of anyone with concerns and assure them that this tape will be erased immediately) _____ Yes _____ No

Thank you for taking the time to speak with me today. I would like to thank you for your time in answering the questionnaire at the beginning of the program and completing this interview today. The comments made by yourself and others have been very helpful and will provide constructive feedback to the program planners.

- **If they plan to enroll into the next Tai Chi session**
  - I may call you in about a month to ask a few more questions. Is this time _______________ (time of this interview) a convenient time for me to call?

If you are interested, I will be leaving a summary of the results at the information desk at each recreational facility (or seniors' center) within the next few months. Please check with them and I know they would be happy to show you the report.

Thank you and good bye

Interviewer's comments/ remarks:

Appendix G:

Follow-Up Interview for Study One

Follow-up Interview for Tai Chi Participants

Session date:____________ Program location: ______________ Instructor: ___________

Opening Remarks

Hello Mr./Mrs. _______________________, this is Trisha Gavin calling from the University of Waterloo. I hope you remember me. It has been about one month since we last spoke. As you may recall, you enrolled into a Tai Chi class in __________ (give session date) and completed a questionnaire for me at that time. About a month ago we completed the first interview about your experiences with the Tai Chi program. The purpose of **this phone call** is to ask you what you are involved in now. This will only take about 10 minutes.

Do you have time to answer a few questions for me?

> If yes, continue with permission to tape record.
> If no, can I arrange another time to call you?

Arranged Time: ____________________ Reasons for refusal:________________________

Contact Attempts

Date:____________ Time:_____________ Person Spoken to: ________________
Date:____________ Time:_____________ Person Spoken to: ________________
Date:____________ Time:_____________ Person Spoken to: ________________
Date:____________ Time:_____________ Person Spoken to: ________________

Permission to Tape Record

Before we begin, I wonder whether you would mind if I tape record our conversation? I don't want to miss any of your comments and it will save me having to take notes as we talk. Please remember that whether or not we tape this interview, your comments will be kept totally confidential. Only group responses will be reported and no one will hear the tapes but me. At the end of the study, all tapes will be erased. I will check with you again at the end of the interview today, and if you change your mind I can erase this tape immediately.

Do I have your permission to tape this interview?

Agrees _________ Disagrees (reason if given) _________________________

Interview Date: ____________________ Tape Label __________________

Follow-up Script

Now let's begin.

Tai Chi Participation:
Last time we spoke, you mentioned that you were going to take Tai Chi again. We are following up to see if some people have chosen to enroll in other classes instead. To avoid calling everyone, we hope you don't mind that we checked the registration lists at the various centres to see who was able to sign-up for another session and who was not. As mentioned at the end of our last interview, we were going to call some people again with their permission.

> *We were wondering whether you were able to enroll in a Tai Chi program somewhere else? (Prompts: if yes, where, why did you change locations?, if no, what made you **decide not to continue** with the Tai Chi classes at this center?)*
>
> *Do you think you will **take Tai Chi again**, sometime in the future?*
>
> *Do you still do any of the **Tai Chi movement on you own**? (Prompt: tell me about this, how often?)*

Other Physical Activity:
I am also interested in other forms of physical activity that you may be participating in.

***For those previously involved in other forms of exercise**
On the survey you stated that you also participate in _____________ (refer to other physical activities that they do).

> *Are you **still doing** this exercise? (if yes, at the same location? If no, why not?)*
>
> *Have you **started** any other exercise classes or physical activities on your own?*

Final Comments:

> *Do you have any **further reflections** about the Tai Chi program that you would like to add?*

Ending:

We have finished our interview. I just want to make sure that you are okay with me using the tape recording to assist in analyzing the findings. I will be interviewing many people from your program as well as others from different Tai Chi programs at recreational facilities and seniors' centers in Kitchener-Waterloo and Hamilton. No individual will ever be identified in my report. Are you okay with this? (Make notes of anyone with concerns and assure them that this tape will be erased immediately) _____ Yes _____ No

Thank you for taking the time to speak with me today. I would like to thank you for your time in answering the questionnaire at the beginning of the program and completing the interviews. The comments made by yourself and others have been very helpful and will provide constructive feedback to the program planners.

If you are interested, I will be leaving a summary of the results at the information desk at your recreational facility (or seniors' center) within the next few months. Please check with them and I know they would be happy to show you the report.

Thank you and good bye

Interviewer's comments/ remarks:

Appendix H:

Studies Examining Tai Chi Outcomes with Young Adults

Studies Examining the Outcomes of Tai Chi Practice with Young Adults

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Schneider & Leung (1991)	Case-control	20 healthy male Tai Chi practitioners Wing chum age 30± 5 yrs Tai Chi age 35.5± 3.9 yrs	1.Wing chun (WC) 2.Tai Chi Chuan (TC)	TC & WC represent the two ends of physical continuum	Not reported	Not reported	TC trained m=81.6 mons. WC for m=50.2 mons.	Treadmill test with Bruce protocol to measure VO_2, VCO_2, VO_2max V_E max, & HR	No significant difference in VO_2 max, V_E max, HR max, or mean HR, Significant difference in minute ventilation & metabolic costs – WC 6.6 mets, TC 4.6 mets TC – low to moderate intensity – may not ↑ aerobic fitness, WC may ↑ aerobic fitness in those with low initial levels
Zhuo et al. (1984)	Case control	11 male Tai Chi practitioners age 24-35 yrs (28.4± 4.2)	Tai Chi (TC)	Long form of Yang Style	108 mvmts	Not reported	3-8 years experience	Grip force of dominant hand, flexibility by sit & reach, skinfolds Resting spirometry - FVC, FEV1.0, FEV1.0/FVC, PF. VO_2, VCO_2, V_E, fR, BP & HR	Body fat 13.9% - greater than some types of athletes Flexibility scores in 90^{th} percentile for Canadian pop. Low ventilatory equivalent A moderate intensity activity
Brown et al. (1989)	Within Subjects single group design	6 male Tai Chi practitioners age 29-39 yrs (34.3± 4.1)	Practitioners completed 2 experimental tests 1.Tai Chi (TC) 2.Cycle ergometry	Long form of Yang style	108 – during test repeated cloud hand mvmt – constant intensity	Two testing sessions 24 hours apart	m=8.3 years experience	Standard open spirometry used for V_E, VO_2, VCO_2, Vf, VT, & RER, Q, SV & HR	TC practitioners show significantly different ventilatory responses leading to more efficient use of the ventilatory volume when practicing TC. No difference. in Q, SV & HR of TC & cycling

mvmts=movements, mons=months, ↑ =increase, FVC=forced vital capacity, FEV1.0= forced expiratory volume in the first second, FEV1.0/FVC=forced expiratory ratio, PF=peak expiratory flow, VO2=oxgen intake, VCO2=carbon dioxide elimination, VE=respiratory minute volume, V_E max=minute ventilation, fR=breathing frequency, BP=blood pressure, HR= heart rate, Vf=ventilatory frequency, VT=tidal volume, RER=respiratory exchange ratio, SV=stroke volume, Q=cardiac output

Studies Examining the Effect of Tai Chi Practice with Young Adults (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Shih (1997)	Within subjects single group Pre & post	11 healthy Tai Chi practitioners 4 men 7 women age 20-43 yrs (30.8±7.8)	Tai Chi (TC)	Basic Beijing	24 mvmts	50 mins. 3 sessions per week 15 mins a day at home	16 weeks	AMTI stain gauge force platform used to measure velocity of sway in anterior & posterior directions under static & dynamic conditions	No difference in the average velocity of sway on static condition. Significant difference on average velocity of sway in dynamic condition. Significant difference in average velocity of sway between static & dynamic conditions before & after training.
Jin (1989)	Three way factorial design Random assignment to morning, afternoon & evening testing	33 healthy practitioners 20 males 13 females age 16-75 yrs (37.7±14.3) 33 healthy beginners 16 males 17 females age 16-75 yrs (33.2±9.0)	1.Practitioners >1 year experience 2. Beginners < 8 mons experience	25 pract & 23 beg practiced yang long form 8 pract & 10 beg. practiced Wu Chian Chuan	Forms the same Except Wu mvmts are compact & change more freq. Pilot – no difference in HR	60 mins	Pract. > 1 year experience Beginner < 8 mons experience	Trait anxiety, HR, POMS, saliva & urine samples Measures completed pre, post, & 60 mins post of performing 60 mins of TC with 2, 3 min breaks	TC practice ↑ HR, noradrenaline excretion in urine & ↓ salivary cortisol concentration. Reported less tension, anger, depression, fatigue, confusion & state-anxiety & felt more vigorous Time of day did not exert significant influence as a main or interaction effect
Jin (1992)	Experimental Random assignment	96 healthy Tai Chi practitioners 48 males age 27–47yrs (34.6±8.5) 48 females (37.8±10.1)	1.Tai Chi (TC) 2.Brisk walking 3.Meditation 4.Reading	Yang style or the Wu variation of the Yang style	Mental challenges (math ?s) &watched stressful film then completed 60 mins. of activity	60 mins	Males 46.4 mons Females 57.5 mons of experience	HR, BP, saliva & urine samples, state anxiety form, POMS, & 3 questions regarding the effectiveness of the exercise in reducing stress	All treatments equally effective in reducing mood disturbance caused by stress. HR, BP, & urinary catecholamine changes for TC were similar for walking. TC superior to reading in reducing state anxiety & enhancing vigor.

Mvmts=movements, mons=months, mins=minutes, ↑=increase, ↓=decrease, pract=practitioner, beg=beginner, ?s=questions, POMS=Profile of Mood State, HR=heart rate, BP= blood pressure

Studies Examining the Effect of Tai Chi Practice with Young Adults (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Szabo et al. (1998)	Experimental Pre, post, & 3 hours post exercise	195 habitual exercisers 104 males age 28± 9.1 yrs 91 females age 29.9± 11.9 yrs	1.Aerobic (aerobic dance) 2.Anaerobic (body-building) 3.Mixed (martial arts) 4.Low exertion (Tai chi/Yoga) 5. No exertion (music appraisal)	Not reported	Not reported	60-75 mins	Once	Exercise induced feeling inventory Subjective Exercise Experience Scale Rate of Perceived Exertion Scale	Low-exertion group reported greater tranquillity than others & lesser distress, fatigue, & exhaustion than individuals in the martial arts group. Weight training group scored higher on revitalization in contrast to the martial arts group.
Slater & Hunt (1997)	Experimental Pre & post Matched on dream recall & frequencies of nightmares, lucid & archetypal dreams	22 undergrad women in psychology Mean age 20.2 yrs for experimental group Mean age 22.3 yrs for control group	1.Tai Chi (TC) 2.Control stationary leg & arm stretching exercises - no vestibular stimulation	Tai Chi Chuan	13 of the beginning dynamic mvmts	Perform the 5 min. sequence before bed	20 days	Questionnaire of mystical experiences, absorption & balance beam performance, given a score on bizarreness from dream diaries Estimated frequency of dream occurrence	No significant difference between groups on age, mystical experiences, absorption or balance measures. TC group showed a significant ↓ in nightmares.
Jacobson et al. (1997)	Experimental Pre & post	24 healthy volunteers 12 men 12 women age 20-45 yrs (30.4±4.3)	1.Tai Chi (TC) 2.Control	Yang style	3 sections of mvmt from 108 set	90 mins. 3 sessions per week	12 weeks	Lateral stability, kinesthetic sense in the glenohumeral joint Strength of knee extension	Significant different lateral body stability, kinesthetic sense at 60° & strength of the dominant knee extensor. No significant difference found for kinesthetic sense at 30 & 45° rotation of the glenohumeral joint

Mvmts=movements, mins=minutes, mons=months, expt=experimental

Appendix I:

Studies Examining Balance Outcomes of Tai Chi

Studies Examining Balance Outcomes of Tai Chi

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Tse & Bailey (1992)	Static Group Comparison	18 healthy Chinese elderly 12 men 6 women age 65-86 yrs	1.Practitioners 2.Non practitioners	Not reported	Not reported	Not reported	1 to 20 years	5 balance tests – Single right & left leg standing with eyes open & closed, heel to toe walking	Significant group difference on 3 balance tests – single right & left leg standing with eyes open & heel to toe walking of practitioners.
Hong et al. (2000)	Cross-sectional	28 male practitioners 30 sedentary healthy men mean age 67.5 yrs	1. Tai Chi Chuan practitioners 2. Sedentary comparison group	Tai Chi Chuan	Not reported	5.1 ± 1.1 times per week for 55.6 ± 10.3 mins.	13.2 ± 3.7 years	Single right & left leg standing with eyes closed	The Tai Chi Chuan group achieved significantly higher scores in right & left single leg stance with eyes closed then the sedentary group.
Hain et al. (1999)	Within subject single group design	22 persons mild balance disorder 5 men 17 women age 20-70 yrs (mean age not reported)	Tai Chi (TC) 3 age groups 20-60 yrs (6 subjects) 61-75 yrs (7 subjects) 75+ years (9 subjects)	7 mvmts selected from Yang, Pa-Kua & Wu Tai Chi schools	7 mvmts	60 mins. 1 session per week	8 weeks	1. posturography, 2. Romberg test 3. Reach testing 4. .modified Medical Outcome Survey (MOS) 5. Dizziness Handicap Inventory	Significant improvements on both the posturography test & the Dizziness Handicap Inventory. Trends towards improvement were noted in Romberg test & the MOS Reach did not improved.
Schaller (1996)	Quasi-experimental Pre & post	46 well elderly gender not reported age 70±5.9 yrs	1.Tai Chi (TC) 2.Comparison – continue with previous activities -self selected	Tai Chi Chih	20 mvmts	60 mins. 1 session per week	10 weeks	Single leg stance timed test	TC group reported significant improvements in the eyes-open balance test but no difference with eyes closed

expt=experimental, mins.=minutes, mvmts=movements

Studies Examining Balance Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Yan (1998)	Quasi experimental Pre, 4 weeks, & post (8 weeks)	38 nursing home residents 9 males 29 females age 76-89 yrs (78.8±2.1)	1.Tai Chi (TC) 2.Locomotor Activity - self selected	24 form simplified	24 mvmts	45 mins 3 sessions per week	8 weeks	A stabilometer used to measure maintenance of dynamic balance.	TC participants improved their length of time on balance more than the locomotor group.
Wolf et al. (1996) FICSIT study	Randomized Control Trial Pre, post & 4 mon. follow up	200 well adults 38 men 162 women age 70+ yrs (m=76.2)	1.Tai Chi (TC) 2.Balance Training (BT) (platform training visual feedback) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week; 15 mins a day at home BT & ED 1 session per week	15 weeks	Falls efficacy scale (FES) Fall risk factors – FICSIT common data base (i.e. gender, age, feeling rested, fall history, etc.)	TC group increased confidence (FES) After adjusting for fall risk factors, TC group ↓ the risk of multiple falls.
Wolf et al. (1997a) FICSIT study	Randomized Control Trial Pre, post & 4 month follow up	72 residents independent living center 12 men 60 women age 70+ yrs	1.Tai Chi (TC) 2.Balance Training (BT) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week; 15 mins a day at home BT & ED 1 session per week	15 weeks	Chattecx Balance System Conditions - quiet standing and toe up with eyes open & closed. Completed 3 times for 20 sec. Falls efficacy scale (FES)	Platform balance measures revealed ↑ stability after training among subjects in BT. Little change in stability in TC & ED groups. TC group more confident (FES).

Mons=months, mvmts=movements, ↑=increase, ↓=decrease

Studies Examining Balance Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Wolfson et al. (1996) FICSIT study	Randomized Control trial. Pre, post (3 mons) & post maintenance (9 mons)	110 healthy adults 64 men 46 women mean age 79.5± 5 yrs	1.Balance Training (BT) 2.Strength Training (ST) 3.Balance & Strength Training (B+S) 4.Education (ED)	Chang style received as maintenance phase after 3 months of training	Not reported	60 minutes of Tai Chi once a week Asked to practice at home twice a week for 5-15 mins. per session	6 months	Loss of balance during Sensory Organization Testing, (platform to assess ability to use visual, tactile-proprioceptive & vestibular inputs to coordinate motor responses on unstable support surfaces) One legged stance	Subjects who participated in BT improved on all balance measures ST resulted in an ↑ in single stance time During maintenance phase, balance gains ↓ although still significant. at 9 months.

Mons=months, mvmts=movements, ↑=increase, ↓=decrease

Appendix J:

Studies Examining Strength Outcomes of Tai Chi

Studies Examining Strength Outcomes of Tai Chi

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Kirsteins, Dietz, & Hwang (1991)	Experimental Pre & post Matched on age & level of functioning	Out patients with rheumatoid arthritis Study 1 5 males 42 females age 37-70 yrs Study 2 7 males 21 females age 38-72 yrs	1. Tai Chi (TC) 2. Control - previous activities 9 patients in study 1 in study 2 to investigate the safety of continuing	Tai Chi Chuan	15 mvmts extracted from the Yang style short form	60 mins - study 1 once/ wk - study 2 twice/ wk -20 mins a day at home	10 weeks	Handgrip strength measured by a caliper	No significant changes in handgrip strength
Lan et al. (1998)	Experimental Pre & post	38 healthy adults 18 men 20 women age 58-70 yrs	1.Tai Chi (TC) 2.Sedentary Comparison - self selected	Yang Style	108 mvmts	55 mins. every day	11.2 ∀ 1.4 mons - self selected length of practice	Strength of the dominant knee extensor & flexor measured by isokinetic dynamometer	TC showed significant improvements in the strength of knee extension & flexion.

Mvmts=movements, mons=months; mins=minutes

Studies Examining Strength Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Wolfson et al. (1996) FICSIT Study	Randomized Control Trial Pre, post (3 mons) & post maintenance (9 mons)	110 healthy adults 64 men 46 women mean age 79.5± 5	1.Balance Training (BT) 2.Strength Training (ST) 3.Balance & Strength Training (B+S) 4.Education (ED)	Chang style received as maintenance phase after 3 mons of training	Not reported	60 mins once a week Asked to practice at home twice a week for 5-15 mins per session	6 mons	Isokinetic peak joint mvmts of the hip, ankle, & knee measured by isokinetic dynamometer. Flexion & extension measured at all joints; abduction & adduction measured at hip	Resistance training groups (ST & B+S) achieved significant ↑ in all joint movements with the exception of hip abduction & ankle dorsiflexion. During maintenance phase, resistance-training groups maintained much of their strength improvement.
Wolf et al. (1996)	Randomized Control Trial Pre, post & 4 mons. post	200 well adults 38 men 162 women Age 70+ yrs (m=76.2)	1.Tai Chi (TC) 2.Balance Training (BT) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week 15 mins a day at home	15 weeks	Handgrip strength (dynamometer). Average force generated from isometric contractions of hip, knee & ankle (muscle tester)	Grip strength ↓ in all groups but more in BT & ED than TC. No significant changes in isometric contractions of hip, knee & ankle.

Mvmts=movements, mons=months; mins=minutes, ↑=increase, ↓=decrease.

Appendix K:

Studies Examining Flexibility Outcomes of Tai Chi

Studies Examining Flexibility Outcomes of Tai Chi

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Lan et al. (1996)	Static Group Comparison Matched on age & body size	76 healthy adults 22 men 19 women age 65-73 yrs (69.3±3.9)	1.Tai Chi (TC) 2.Comparison - no exercise program for at least 5 years	Yang style	108 mvmts	60 mins. at least 3 times per week	11.8±5.6 years	Electronic digital inclinometer to measure flexion angle of thoracic/ lumbar spine	TC group had greater flexibility than comparison group
Hong et al. (2000)	Cross-sectional	28 male practitioners 30 sedentary healthy men mean age 67.5 yrs	1. Tai Chi Chuan practitioners 2. Sedentary comparison group	Tai Chi Chuan	Not reported	5.1 ± 1.1 times per week for 55.6 ± 10.3 mins.	13.2 ± 3.7 years	Truck & hamstring flexibility tested by modified sit & reach test Total body rotation to the left & right.	Tai Chi Chuan group (experienced group) had better trunk & hamstring flexibility & total body rotation to the left & right than sedentary comparison group
Schaller (1996)	Quasi-experimental Pre & post	46 well elderly gender not reported age 70 ±5.9 yrs	1.Tai Chi (TC) 2. Comparison – continue past activities -self selected	Tai Chi Chih	20 mvmts	60 mins. 1 session per week	10 weeks	Truck & hamstring flexibility tested by modified sit & reach test	No difference in flexibility.
Lan, (1998)	Experimental Pre & post	38 healthy adults 18 men 20 women age 58-70 yrs	1.Tai Chi (TC) 2.Control	Yang Style	108 mvmts	55 mins. every day	11.2 ∀ 1.4 mons	Electronic digital inclinometer to measure flexion angle of thoracic/ lumbar spine	Significant ↑ in thoracic/ lumbar flexibility

Mvmts=movements, mons=months, ↑=increase.

Studies Examining Flexibility Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Sun et al. (1996)	Experimental Pre & post	20 Hmong adults 7 males 13 females age 60-74 yrs	1.Tai Chi (TC) 2.Control	Tai Chi Chuan	Not reported	2 hours a week (+ health lecture)	10 weeks	Truck, shoulder & knee with a measuring tape & a goniometer.	Significant ↑ in shoulder & knee flexibility of the TC group.
Chen & Sun (1997)	Experimental Pre, post & expt grp at 9 mons	36 healthy older adults 16 males 20 females age 50-74 yrs	1.Tai Chi (TC) 2.Control	Simplified Tai Chi Chuan	24 forms were adapted for this study	60 mins twice a week	16 weeks	Sit & reach	Significant ↑ in flexibility at posttest & 9 mon. follow up.
Wolf et al. (1996) FICSIT report	Randomized Control Trial Pre, post & 4 mons. post	200 well adults 38 men 162 women age 70+ yrs (m=76.2)	1.Tai Chi (TC) 2.Balance Training (BT) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week 15 mins a day at home	15 weeks	Lower extremity ROM - exact measures not reported	Lower extremity ROM showed limited but statistically significant ↑.

Mvmts=movements, mons=months, ↑=increase, ROM=range of motion

Appendix L:

Studies Examining Cardiorespiratory Outcomes of Tai Chi

Studies Examining Cardiorespiratory Outcomes of Tai Chi

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Lansheng et al. (1981)	Case control	100 Taijiquan practitioners 54 males 46 females age 46-80 yrs (16 > 70 yrs)	Taijiquan (TC)	Simplified form	Not reported	Daily for 20 mins	1 to 20 years	HR, BP, & ECG	No significant changes in HR, BP, or ECG during TC practice. Beneficial effect of TC on cardiovascular system cannot be solely attributed to TC practice.
Lai et al. (1993)	Static Group Comparison Matched on age, gender, & body size	90 healthy adults 44 males 46 females age 50-64 yrs	1. Experienced Tai Chi (TC) group from club 2. Comparison – sedentary for at least 5 years	Yang style	108 mvmts	60 mins. at least 3 times per week	6..3 ∀ 3.3 years of experience	Cycle ergometry to measure CR function Mean HR during TC practice to estimate intensity	TC practice may be beneficial to the CR function of older adults. At max. exercise level, the VO_2, O_2 pulse, & WR of TC group was significantly. higher as well as ventilatory threshold. Mean HR exceeded 70% of HRmax – moderate intensity
Lan et al. (1996)	Static Group Comparison Matched for age & body size	76 healthy adults 22 men 19 women age 65-73 yrs (69.3±3.9)	1.Tai Chi (TC) 2.Comparison - sedentary for at least 5 years	Yang style	108 mvmts	60 mins. at least 3 times per week	11.8±5.6 years	Cycle ergometry test to measure CR function. FVC, FEV1 for pulmonary function Mean HR during TC practice to estimate intensity	TC group showed higher VO_2 peak, VO_2 max, & ventilatory threshold than controls. Mean HR exceeded 70% of HRmax – moderate intensity exercise

expt=experimental, mvmts=movements, mins=minutes, mons=months, HR=heart rate, BP=blood pressure, ECG=electrocardiogram, CR=cardiorespiratory. Tests to measure cardiorespiratory function include: VO_2=oxygen uptake, VCO_2=cardon dioxide production, VO_2max=maximal oxygen uptake V_E=minute ventilation, V_T=tidal volume, RER=respiratory exchange ratio, V_E/VO_2=ventilatory equivalent for oxygen, V_E/VCO_2=ventilatory equivalent for carbon dioxide, WR=workrate, VeT=ventilatory threshold

Studies Examining Cardiorespiratory Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Hong et al. (2000)	Cross-sectional	28 male practitioners 30 sedentary healthy men mean age 67.5 yrs	1. Tai Chi Chuan practitioners 2. Sedentary comparison group	Tai Chi Chuan	Not reported	5.1 ± 1.1 times per week for 55.6 ± 10.3 mins.	13.2 ± 3.7 years	Resting HR Three minute step test	TC group had significantly better scores for HR both at rest & after a three minute step test. Time of recovery of HR in TC group was faster than in the sedentary comparison group.
Lai et al. (1995)	Prospective Matched on age & body size	84 healthy adults 44 males 40 females age 55-74 yrs (64 ± 9)	1.Tai Chi (TC) - with 6.7 ∀3.3 yrs experience 2.Comparison -sedentary for at least 5 years	Classical Yang style for at least 1 year.	108 mvmts	60 mins 5∀1.1 times per week	2 years assess ability to maintain CR function	Cycle ergometry test to measure CR function Mean HR during TC practice to estimate intensity	TC may delay the decline of CR function in older adults. Tai Chi group expressed a slower ↓ in VO_2 max Yang style is of a moderate intensity & is aerobic in nature - HR 53-57 % of HR max
Lan et al. (1999)	Prospective	27 male low risk coronary bypass who completed cardiac rehab (cycling 3 times a week for 3 mon.) age 53-64 yrs (56.5± 7.4)	1.Tai Chi (TC) - practiced as a maintenance program 2.Unsupervised control recommended a walking program	Yang style	108 mvmts	55 mins every morning	1 year	Cycle ergometry test to measure CR function Mean HR during TC practice to estimate intensity	TC showed ↑ in CR function – increase in VO_2 peak, peak WR At VeT the TC group also showed significant ↑ in VO_2 & WR.

expt=experimental, mvmts=movements, mins=minutes, mons=months, ↑=increase, ↓=decrease, HR=heart rate, BP=blood pressure, CR=cardiorespiratory ,
Tests to measure cardiorespiratory function include: VO_2=oxygen uptake, VCO_2=cardon dioxide production, VO_2max=maximal oxygen uptake V_E=minute ventilation, V_T=tidal volume, RER=respiratory exchange ratio, V_E/VO_2=ventilatory equivalent for oxygen, V_E/VCO_2=ventilatory equivalent for carbon dioxide, WR=workrate, VeT=ventilatory threshold

Studies Examining Cardiorespiratory Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Brown et al. (1995)	Experimental Pre & post Random assignment	127 healthy sedentary adults 66 men 69 women age 40-69 yrs	1.Moderate Intensity Walking (MW) 2.Low Intensity Walking (LW) 3.Low Intensity walk + relaxation (LWR) 4.Mindful exercise (ME) (Tai Chi type activity) 5. Control	"Tai Chi type activity"	Not reported	45 mins. three times a week	16 weeks	Aerobic capacity measured during a maximal graded walking treadmill test	Small but significant ↑ in VO_2max among women in MW & LW groups & among men in MW & LWR groups.
Sun et al. (1996)	Experimental Pre & post Random assignment	20 Hmong adults 7 males 13 females age 60-74 yrs	1.Tai Chi (TC) 2.Control	Tai Chi Chuan	Not reported	2 hours once a week (+ a health lecture)	10 weeks	Resting HR & BP	Significant improvements were found in TC group in resting BP.

Mvmts=movements, mins=minutes, ↑=increase, HR=heart rate, BP=blood pressure, VO_2max=maximal oxygen uptake.

Studies Examining Cardiorespiratory Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Lan et al. (1998)	Experimental Pre & post	38 healthy adults 18 men 20 women age 58-70 yrs	1.Tai Chi (TC) 2.Sedentary Comparison - self selected	Yang Style	108 mvmts	55 mins. every day	11.2 ∀ 1.4 mons	Cycle ergometry test to measure CR function	TC group showed significant ↑ in CR function (↑ in VO_2 max., O_2 pulse & WR).
Channer et al. (1996)	Experimental Pre, post & after end of support group Random assignment	126 patients experienced an acute MI - 3 wks after discharged 90 males 36 females age 39-80 yrs (m=56 years)	1.Tai Chi (TC) 2.Aerobic exercise 3.Non-exercise support	Wu Chian-Ch'uan style Also learned chi kung	47 postures by the end of trial 12 postures had been learnt	60 mins twice a week for 3 weeks then weekly for a further 5 weeks	8 weeks	HR, BP	Both exercise groups caused significant immediate ↓ in systolic & diastolic BP & significant ↑ in HR but aerobic exercise was much greater Negative trend in diastolic BP & RHR in TC group but no trend in aerobic exercise
Chen & Sun (1997)	Experimental Pre, post & expt group at 9 mons.	36 healthy older adults 16 males 20 females age 50-74 yrs	1.Tai Chi (TC) 2.Control	Simplified Tai Chi Chuan	24 form adapted for this study	60 mins twice a week	16 weeks	Resting HR, BP	No difference in resting HR & BP at post test. Resting BP improved at follow-up (9 mons)

expt=experimental, mvmts=movements, mins=minutes, mons=months, ↑=increase, ↓=decrease, MI=myocardial infraction, HR=heart rate, BP=blood pressure, RHR= resting heart rate, CR=cardiorespiratory. Tests to measure cardiorespiratory function include: VO_2=oxygen uptake, VCO_2=cardon dioxide production, VO_2max=maximal oxygen uptake V_E=minute ventilation, V_E/VO_2=ventilatory equivalent for oxygen, V_E/VCO_2=ventilatory equivalent for carbon dioxide, WR=workrate, VcT=ventilatory threshold

Studies Examining Cardiorespiratory Outcomes of Tai Chi (cont.)

Authors	**Design**	**Sample**	**Comparison Conditions**	**Tai Chi Form**	**# of mvmts**	**Length & Frequency**	**Duration**	**Outcome Measures**	Findings
Wolf et al. (1996) FICSIT study	Randomized Control Trial Pre, post & 4 mon. post	200 well adults 38 men 162 women age 70+ yrs (m=76.2)	1.Tai Chi (TC) 2.Balance Training (BT) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week + 15 mins a day at home BT & ED 1 session per week	15 weeks	Cardiovascular endurance - time to complete 12 min walk test - HR & BP before & after test	BT & ED ↑ their walking distance whereas TC reduced the distance traveled. Lowered BP after 12-mins walk was seen following TC participation.
Young et al. (1999)	Randomized Clinical Trial	62 sedentary adults with systolic BP 130-159 mmHg & diastolic BP <95 13 men 49 women age 60-80 yrs	1.Tai Chi (TC) 2.Aerobic Exercise	Yang style	13 mvmts	60 mins twice a week	12 weeks	BP during screening & every 2 weeks. Estimated VO_2 max on cycle ergometer	BP ↓ to an extent similar to a program of moderate intensity aerobic exercise No changes in VO_2 max in TC group

expt=experimental, mvmts=movements, mins=minutes, mons=months, ↑=increase, ↓=decrease, HR=heart rate, BP=blood pressure, CR=cardiorespiratory, VO_2max=maximal oxygen uptake.

Appendix M:

Studies Examining Motor Control Outcomes of Tai Chi

Studies Examining Motor Control Outcomes of Tai Chi

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Yan (1998)	Quasi experimental Pre, 4 weeks & post	38 nursing home residents 9 males 29 females age 76-89 yrs (78.8±2.1)	1.Tai Chi (TC) 2.Locomotor activity - self selected	24 form simplified Tai Chi	24 mvmts	45 mins 3 sessions per week	8 weeks	Tablet used to test arm movement performance along a rapid curvilinear aiming arm task	TC group significantly reduced movement jerk. No difference in movement time. TC improved smoothness but not speed.
Yan (1999)	Quasi experimental Pre, 4 weeks & post	20 nursing home residents 5 males 15 females age 76-88 yrs (78 ± 2.3)	1,Tai Chi (TC) 2.Locomotor activity (walking or jogging) - self selected	24-form simplified Tai Chi	24 mvmts	45 mins 3 sessions per week	8 weeks	Motor control by assessing the linear & curvilinear manual aiming movements & vertical pressure of the arm	TC improved consistency in force output during curvilinear arm performance.

Appendix N:

Studies Examining Psychological Outcomes of Tai Chi

Studies Examining Psychological Outcomes of Tai Chi

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Schaller (1996)	Quasi-experimental Pre & post	46 well elderly gender not reported age 70±5.9 yrs	1.Tai Chi (TC) 2.Comparison – continue with previous activities -self selected	Tai Chi Chih	20 mvmts	60 mins. 1 session per week	10 weeks	Mood (POMS) & health status with SF-36	No difference in mood, or health status.
Brown et al. (1995)	Experimental Pre & post Random assignment	127 healthy sedentary adults 66 men 69 women age 40-69 yrs	1.Moderate Intensity Walking (MW) 2.Low intensity walking (LW) 3.Low intensity walk + relaxation (LWR) 4.Mindful exercise (ME) (Tai Chi type activity) 5.Control	"Tai Chi type activity"	Not reported	45 mins. three times a week	16 weeks	Mood (POMS), self esteem, anxiety (PANAS) & life satisfaction	Women in ME group experienced significant improvement in general mood (↓ in tension, depression, anger, confusion disturbance)
Sun et al. (1996)	Experimental Pre & post Random assignment	20 Hmong adults 7 males 13 females age 60-74 yrs	1.Tai Chi (TC) 2. Control	Tai Chi Chuan	Not reported	2 hours once a week (+ a health lecture)	10 weeks	Perceived stress & stress level (skin temperature)	Significant differences in self-perceived stress scores & stress level.

mvmt=movement, mins=minutes, psych=psychological, ↓=decrease, POMS=profile of mood state.

Studies Examining Psychological Outcomes of Tai Chi (cont.)

Authors	Design	Sample	Comparison Conditions	Tai Chi Form	# of mvmts	Length & Frequency	Duration	Outcome Measures	Findings
Chen & Sun (1997)	Experimental Pre, post & expt grp at 9 mons	36 healthy older adults 16 males 20 females age 50-74 yrs	1.Tai Chi (TC) 2.Control	Simplified Tai Chi Chuan	24 forms adapted for this study	60 mins twice a week	16 weeks	Taylor Manifest Anxiety Scale & State Anxiety Scale.	No significant difference at post test but improvements at follow-up (9 mons)
Kutner et al. (1997) FICSIT study	Randomized Control Trial Pre, post & 4 mons post	200 healthy adults 40 men 160 women age 70+ yrs (mean= 76.2)	1.Tai Chi (TC) 2.Balance training (BT) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week encouraged to practice at home BT & ED 1 session per week	15 weeks	6 exit interview questions at 4 mon. follow up, measures of self esteem, & 5 scales from SF-36	TC group significantly more likely than ED to report a noticeable effect on their life, effects on ADL, changes in normal physical activity & a sense of having benefited from exercise. TC & BT report change in sense of confidence. No significant difference on self esteem or health status.
Wolf et al. (1996) FICSIT report	Randomized Control Trial Pre, post & 4 mon. post	200 well adults 38 men 162 women age 70+ yrs (m=76.2)	1.Tai Chi (TC) 2.Balance Training (BT) 3.Education (ED)	Tai Chi Quan	10 modified mvmts from 108 set	60 mins 2 sessions per week + 15 mins a day at home BT & ED 1 session per week	15 weeks	Psychosocial well-being (CES-D scale), & well-being questions – personal health, control over future health, mastery index, & intrusiveness	Trend toward significant changes on intrusiveness (↑ sense of being able to do what want to do) responses between TC & ED group.
Li et al. (2001)	Randomized Control Trial Pre, Week 12, & post (6 mon.)	94 low active health adults age 72.8 yrs	1. Tai Chi(TC) 2. Wait list control group	Classical Yang Style	24 forms	60 mins 2 sessions per week	6 months	Two aspects of self efficacy: barriers & performance efficacy	Tai Chi group experienced significant improvements in self-efficacy. Changes in self efficacy were associated with higher levels of program attendance.

mvmt=movement, mins=minutes, mons=months, ↑=increase, CES-D=Center for Epidemiological Studies Depression

Appendix O:

Recruitment Speech and Screening Protocol for Tai Chi and Line Dancing Participants at the Seniors Centres

Recruitment Speech and Screening Protocol for Exercise Participants

Good morning (or afternoon). My name is Trisha Gavin and I am a certified fitness instructor, currently working on my Ph.D. with Dr. Myers at the University of Waterloo in the Department of Health Studies & Gerontology. I appreciate the opportunity to speak to your group today about my thesis study.

My thesis is looking at the benefits of participating in Tai Chi and line dancing classes - which are fairly new types of exercise, but becoming increasingly popular in seniors' and recreational centres in Canada. This project has been approved by your program director and the Office of Research Ethics at the University of Waterloo. Participation is completely voluntary. All information will be kept confidential and results summarized across participants from centres in Hamilton, Burlington, and K-W.

For this study, I am looking for volunteers aged 55 and over who have not taken a Tai Chi (or line dancing) class before, or not within the past year.

So what is involved? We are asking for an hour of your time at the beginning, as well as at the end of the current session. There are a few short questionnaires on your exercise, sleep and energy patterns and balance confidence---which will take only 15 minutes or less to complete. Stations will be set up in a room at this centre to assess your balance, strength, and flexibility, which will take about 45 minutes in total. As you go through each assessment, I or my assistant will explain how each component is important for the things you normally do everyday. Two people can go through the stations together, so if you do it with a friend, you will have even more fun! Refreshments will be served.

If you are interested in learning more about the study, please come and speak to me now for a few minutes. I have an information sheet and consent form that explains the study in more detail and would be pleased to answer all your questions. I am hoping to get volunteers over the next few days so we can assess people at the beginning of their classes. We have already booked times and rooms at your centre that we hope will fit with your schedules. Your decision to participate or not or if you decide to withdraw from the study will in no way impact your relationship with this centre.

Besides helping me with my thesis, it is an opportunity to learn more about your own functional abilities and how these change as a result of Tai Chi (or line dancing). We believe you will find this an interesting and fun experience.

Thank you very much for listening and I hope you will consider taking part.
For Interested Persons who come up to speak to me:

Answer their questions and give each the letter of information. Also show them the consent form and package of questionnaires. If interested, determine eligibility through the screening questions below.

Tell them about the blocks of time already booked at their centre if they would like to book an appointment today (if so, give them a reminder postcard). If they cannot make these times, but would like to participate, have them sign the consent form giving permission to call them to try and arrange an appointment.

Screening Questions:

a) As I mentioned, this study is designed to include persons 55 years of age or older. May I ask if your age falls into that group?

If yes, go to B

If no, thank them for their interest

b) Have you previously taken a Tai Chi or (line dancing) class?

If yes, ask: "was it during the past year?

If no, go to C

If no, go to C

if yes, "thank you but we are looking for new participants

c) "Are you enrolling in any other exercise programs or classes this fall?"

If yes, ask "have you participated in these exercises before?

If no, eligible

If yes, eligible

if no, "we are looking for people who are not starting any other new programs."

Appendix P:

Recruitment Speech and Screening Protocol for Non-exercise Class Participants at the Seniors' Centres

Recruitment Speech and Screening Protocol for Non Exercise Participants

Good morning (or afternoon). My name is Trisha Gavin and I am a certified fitness instructor, currently working on my Ph.D. with Dr. Myers at the University of Waterloo in the Department of Health Studies & Gerontology. I appreciate the opportunity to speak to your group today about my thesis study.

My thesis is looking at the benefits of participating in various types of recreational classes. This project has been approved by your program director and the Office of Research Ethics at the University of Waterloo. Participation is completely voluntary. All information will be kept confidential and results summarized across participants from centres in Hamilton, Burlington, and K-W.

For this study, I am looking for volunteers, aged 55 and over, who are not involved in a formal exercise program.

So what is involved? We are asking for an hour of your time at the beginning, as well as at the end of the current session. There are a few short questionnaires on your exercise, sleep and energy patterns and balance confidence---which will take only 15 minutes or less to complete. Stations will be set up in a room at this centre to assess your balance, strength, and flexibility, which will take about 45 minutes in total. As you go through each assessment, I or my assistant will explain how each component is important for the things you normally do everyday. Two people can go through the stations together, so if you do it with a friend, you will have even more fun! Refreshments will be served.

If you are interested in learning more about the study, please come up and speak to me now for a few minutes. I have an information sheet and consent form that explains the study in more detail and would be pleased to answer all your questions. I am hoping to get volunteers over the next few days so we can assess people at the beginning of their classes. We have already booked times and rooms at your centre that we hope will fit with your schedules. Your decision to participate or not to participate or if you decide to withdraw from the study, will in no way impact the relationship that you have with this centre.

Besides helping me with my thesis, it is an opportunity to learn more about your own functional abilities. We believe you will find this an interesting and fun experience.

Thank you very much for listening and I hope you will consider taking part.

For Interested Persons who come up to speak to me:

Answer their questions and give each the letter of information. Also show them the consent form and package of questionnaires. If interested, determine eligibility through the screening questions below.

Tell them about the blocks of time already booked at their centre if they would like to book an appointment today (if so, give them a reminder postcard). If they cannot make these times, but would like to participate, have them sign the consent form giving permission to call them to try and arrange an appointment.

Screening Questions:

a) As I mentioned, this study is designed to include persons 55 years of age or older. May I ask if your age falls into that group?

If yes, go to B

If no, thank them for their interest

b) Are you enrolled in any exercise programs or classes this fall?

If no, eligible – try to arrange an appointment

If yes, 'thank you but we are looking for those not in an exercise class

Appendix Q:

Recruitment Speech for Experienced Tai Chi Participants from the Taoist Tai Chi Society

Recruitment Speech for Experienced Participants at the Taoist Tai Chi Society

Good morning (or afternoon). My name is Trisha Gavin and I am a certified fitness instructor, currently working on my Ph.D. with Dr. Myers at the University of Waterloo in the Department of Health Studies and Gerontology. I appreciate the opportunity to speak to your group today about my thesis study.

My thesis is looking at the benefits of participating in Tai Chi and line dancing classes—which are fairly new types of exercises, but becoming increasingly popular in seniors' and recreational centres in Canada. This project has been approved by the medical advisor of the Taoist Tai Chi Society, Dr. Jess Goodman and the Office of Research at the University of Waterloo. Participation is voluntary. All information will be kept confidential and results summarised across participants from centres in Hamilton, Burlington, and K-W.

For this study, I am looking for experienced Tai Chi volunteers who are enrolled in the transition or continuing classes and are aged 55 and over.

So what is involved? We are asking for an hour of your time within the next few days. There are a few short questionnaires on your exercise, sleep and energy patterns and balance confidence – which will take only 15 minutes or less to complete. Stations will be set up in a room at this centre to assess your balance, strength, and flexibility, which will take about 45 minutes in total. As you go through each assessment, I or my assistant will explain how each component is important for the things you normally do everyday. Two people can go through the stations together, so if you do it with a friend, you will have even more fun! Refreshment will be served.

If you are interested in learning more about the study, please come up and speak to me now for a few minutes. I have an information sheet and consent form that explains the study in more detail and would be pleased to answer all your questions. I am hoping to get volunteers over the next few days. We have already booked times and rooms at your centre that we hope will fit with your schedules. Your decision to participate or not to participate or if you decide to withdraw from the study, will in no way impact the relationship that you have with this centre.

Besides helping me with my thesis, it is an opportunity to learn more about your own functional abilities and the long-term benefits of Tai Chi practice. We believe you will find this an interesting and fun experience.

Thank you very much for listening and I hope you will consider taking part.

For Interested Persons who come up to speak to me:

Answer their questions and give each the letter of information. Also show them the consent form and package of questionnaires. If interested, determine eligibility through the screening questions below.

Tell them about the blocks of time already booked at their centre if they would like to book an appointment today (if so, give them a reminder postcard). If they cannot make these times, but would like to participate, have them sign the consent form giving permission to call them to try and arrange an appointment.

Screening Questions:

a) As I mentioned, this study is designed to include persons 55 years of age or older. May I ask if your age falls into that group?

If yes, go to B

If no, thank them for their interest

**** only one screening question as I will be specifically recruiting from the transition and continuing classes ****

Appendix R:

Information Letter and Consent Forms for Exercise Participants

Information Letter for Participants at the Seniors' Centres

Dear Participant:

My name is Trisha Gavin and I am a certified fitness instructor, currently working on my Ph.D. with Dr. Myers in the department of Health Studies and Gerontology at the University of Waterloo. My thesis is looking at the benefits of participating in Tai Chi and line dancing classes—which are fairly new types of exercise, but becoming increasingly popular in seniors' and recreational centres in Canada.

For this study, I am looking for volunteers aged 55 and over who have not taken a Tai Chi (or line dancing) class before, or not within the past year.

We are asking volunteers for an hour of their time at the beginning, as well as at the end of the current session. If you volunteer, you will be asked to complete a few short questionnaires which will be used to gather background information (such as gender and reasons for joining the program) as well balance confidence, energy level and sleep patterns. These will take no more than 15 minutes and can be completed either here or at home.

We would also like to schedule an appointment with each volunteer to return to this centre over the next week. Stations will be set up to assess your balance, strength, and flexibility, which will take about 45 minutes in total. For example, we will assess the flexibility and strength of your upper and lower body and your balancing abilities (such as the distance you can step and reach). All assessments will be conducted by myself and my assistant. One-on-one supervision will be provided to ensure your safety. As you go through each assessment, we will explain how each component is important for the things you normally do everyday. Two people can go through the stations together, so if you do it with a friend, you will have even more fun! Refreshments will be served.

After your classes end, with your permission, we would like to call you and arrange another appointment for you to return to this centre to reassess your balance, flexibility, strength, sleep patterns and so on to determine the extent to which these have improved following your exercise participation.

(please turn over)

Rest assured, your participation in this project is **completely voluntary**. Your decision to participate or not to participate will in no way impact on your relationship with the recreation center. You can decide not to complete any of the surveys or physical assessments (each will be fully explained and demonstrated beforehand) during either the first or second assessment periods.

The results of the physical assessment and surveys will be kept **totally confidential**. No individual will ever be identified in any publication or presentation resulting from this study. The information collected will be summarized across participants from Hamilton, Burlington, and K-W to provide a general description of the people taking part in various types of recreational programs. Information will be kept secured at all times. Once the data has been analyzed and published, it will be shredded.

This project is fully supported by the director of your centre and your program instructor. The study has been reviewed by and received ethics clearance through the Office of Research Ethics at the University of Waterloo. If you have any concerns resulting from your participation in this study, please contact Dr. Sykes at the Office of Research Ethics at the University of Waterloo at (519) 888-4567 ext. 6005.

Thank you for considering our request. We believe you will find this study to be an enjoyable and interesting experience. Please keep this letter of information and feel free to call me at my home number (905) 679-3985 if you have any questions or comments.

Sincerely,

Trisha Gavin
Ph.D. Candidate
Department of Health Studies and Gerontology
University of Waterloo

Participant Consent Form

I feel that the purpose of this project has been explained to my satisfaction. I understand that I will be asked to complete a physical assessment of my balance, strength, and flexibility as well as complete surveys regarding my basic background information, balance confidence, vitality, and current level of participation in recreational activities. The researcher will be by my side during the assessments for safety and I know that I can refuse to perform any measurement that I may feel uncomfortable with. My participation in this project or refusal to complete any assessment will not affect my relationship with the centre.

I understand that any information that I provide will be kept totally confidential. I have had the opportunity to ask questions and, if so, have received acceptable answers. By signing below, I am agree to have the information from my physical assessment and survey analyzed and reported in the study in summary form, together with the results from other people in other classes.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I understand that if I have any questions or concerns resulting from my participation in this study, I may contact Trisha Gavin at (905) 679-3985 or Dr. Sykes, the Director at the Office of Research Ethics at (519) 888-4567 ext. 6005. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study

Participant's name (please print):________________________________

Signature:__________________________ **Date:** __________________

Appendix S:

Information Letter and Consent Forms for Non-exercise Participants

Information Letter and Consent Form for Non-exercise Participants

Dear Participant:

My name is Trisha Gavin and I am a certified fitness instructor, currently working on my Ph.D. with Dr. Myers in the department of Health Studies and Gerontology at the University of Waterloo. My thesis is looking at the benefits of participating in various types of recreational programs offered at seniors' centres.

For this study, I am looking for volunteers, aged 55 and over, who are not enrolled in a formal exercise program.

We are asking volunteers for an hour of their time at the beginning, as well as at the end of the current session. If you volunteer, you will be asked to complete a few short questionnaires which will be used to gather background information (such as gender and reasons for joining the program) as well balance confidence, energy level and sleep patterns. These will take no more than 15 minutes and can be completed either here or at home.

We would also like to schedule an appointment with each volunteer to return to this centre over the next week. Stations will be set up to assess your balance, strength and flexibility, which will take about 45 minutes in total. For example, we will assess the flexibility and strength of your upper and lower body and your balancing abilities (such as the distance you can step and reach). All assessments will be conducted by myself and my assistant. One-on-one supervision will be provided to ensure your safety. As you go through each assessment, we will explain how each component is important for the things you normally do everyday. Two people can go through the stations together, so if you do it with a friend, you will have even more fun! Refreshments will be served.

After your classes end, with your permission, we would like to call you and arrange another appointment for you to return to this centre to reassess your balance, flexibility, strength, sleep patterns and so on to determine the extent to which these have improved following your participation in your recreational program.

(please turn over)

Rest assured, your participation in this project is **completely voluntary**. Your decision to participate or not to participate will in no way impact on your relationship with the recreation center. You can decide not to complete any of the surveys or physical assessments (each will be fully explained and demonstrated beforehand) during either the first or second assessment periods.

The results of the physical assessment and surveys will be kept **totally confidential**. No individual will ever be identified in any publication or presentation resulting from this study. The information collected will be summarized across participants from Hamilton, Burlington, and K-W to provide a general description of the people taking part in various types of recreational programs. Information will be kept secured at all times. Once the data has been analyzed and published, it will be shredded.

This project is fully supported by the director of your centre and your program instructor. The study has been reviewed by and received ethics clearance through the Office of Research Ethics at the University of Waterloo. If you have any concerns resulting from your participation in this study, please contact Dr. Sykes at the Office of Research Ethics at the University of Waterloo at (519) 888-4567 ext. 6005.

Thank you for considering our request. We believe you will find this study to be an enjoyable and interesting experience. Please keep this letter of information and feel free to call me at my home number (905) 679-3985 if you have any questions or comments.

Sincerely,

Trisha Gavin
Ph.D. Candidate
Department of Health Studies and Gerontology
University of Waterloo

Participant Consent Form

I feel that the purpose of this project has been explained to my satisfaction. I understand that I will be asked to complete a physical assessment of my balance, strength, and flexibility as well as complete surveys regarding my basic background information, balance confidence, vitality, and current level of participation in recreational activities. The researcher will be by my side during the assessments for safety and I know that I can refuse to perform any measurement that I may feel uncomfortable with. My participation in this project or refusal to complete any assessment will not affect my relationship with the centre.

I understand that any information that I provide will be kept totally confidential. I have had the opportunity to ask questions and, if so, have received acceptable answers. By signing below, I am agree to have the information from my physical assessment and survey analyzed and reported in the study in summary form, together with the results from other people in other classes.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I understand that if I have any questions or concerns resulting from my participation in this study, I may contact Trisha Gavin at (905) 679-3985 or Dr. Sykes, the Director at the Office of Research Ethics at (519) 888-4567 ext. 6005. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study

Participant's name (please print):________________________________

Signature:_________________________ **Date:** _________________

Appendix T:

Consent For Follow-up Contact

Consent for Follow-up Contact

If Trisha Gavin is unable to reach me during the last class of Fall session to arrange for a follow-up assessment, I give my permission for her to contact me by phone to arrange for this second assessment. This assessment will be identical to the first assessment, with the exception of the background survey and the inclusion of a follow-up questionnaire. If a convenient time cannot be arranged, or should I decide at that time not to take part for any reason, no further contact will be attempted.

I understand that personal contact information (name and phone number) will only be used for this study. My name and phone number will be kept totally secured by the researcher and will not be given to any other parties.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I understand that if I have any questions or concerns resulting from my participation in this study, I may contact Trisha Gavin at (905) 679-3985 or Dr. Sykes, the Director at the Office of Research Ethics at (519) 888-4567 ext. 6005. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study

Participant's name (please print):________________________________

Signature:__________________________ **Date:** ________________

Phone number:____________________________

Please indicate the most convenient times to call (3 check the boxes).

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Morning							
Afternoon							
Early evening							

Appendix U:

Information Letter and Consent Forms for Participants at the Taoist Tai Chi Society

Information Letter and Consent Form for Taoist Tai Chi Society Participants

Dear Participant:

My name is Trisha Gavin and I am a certified fitness instructor, currently working on my Ph.D. with Dr. Myers in the department of Health Studies and Gerontology at the University of Waterloo. My thesis is looking at the benefits of participating in Tai Chi and line dancing classes—which are fairly new types of exercise, but becoming increasingly popular in seniors' and recreational centres in Canada.

For this study, I am looking for experienced Tai Chi volunteers, aged 55 and over who are enrolled in the transition or continuing classes at the Taoist Tai Chi Society.

We are asking volunteers for an hour of their time in the next few days. If you volunteer, you will be asked to complete a few short questionnaires which will be used to gather background information (such as gender and reasons for joining the program) as well balance confidence, energy level and sleep patterns. These will take no more than 15 minutes and can be completed either here or at home.

We would also like to schedule an appointment with each volunteer to return to this centre over the next week. Stations will be set up to assess your balance, strength, and flexibility, which will take about 45 minutes in total. For example, we will assess the flexibility and strength of your upper and lower body and your balancing abilities (such as the distance you can step and reach). All assessments will be conducted by myself and my assistant. One-on-one supervision will be provided to ensure your safety. As you go through each assessment, we will explain how each component is important for the things you normally do everyday. Two people can go through the stations together, so if you do it with a friend, you will have even more fun! Refreshments will be served.

Rest assured, your participation in this project is **completely voluntary**. Your decision to participate or not to participate will in no way impact on your relationship with the Taoist Tai Chi Society. You can decide not to complete any of the surveys or physical assessments (each will be fully explained and demonstrated beforehand) during the assessment period.

(please turn over)

The results of the physical assessment and surveys will be kept **totally confidential**. No individual will ever be identified in any publication or presentation resulting from this study. The information collected will be summarized across participants from Hamilton, Burlington, and K-W to provide a general description of the people taking part in various types of recreational programs. Information will be kept secured at all times. Once the data has been analyzed and published, it will be shredded.

This project is fully supported by the medical advisor, Dr. Jess Goodman, of the Taoist Tai Chi Society. The study has been reviewed by and received ethics clearance through the Office of Research Ethics at the University of Waterloo. If you have any concerns resulting from your participation in this study, please contact Dr. Sykes at the Office of Research Ethics at the University of Waterloo at (519) 888-4567 ext. 6005.

Thank you for considering our request. We believe you will find this study to be an enjoyable and interesting experience. Please keep this letter of information and feel free to call me at my home number (905) 679-3985 if you have any questions or comments.

Sincerely,

Trisha Gavin
Ph.D. Candidate
Department of Health Studies and Gerontology
University of Waterloo

Participant Consent Form

I feel that the purpose of this project has been explained to my satisfaction. I understand that I will be asked to complete a physical assessment of my balance, strength, and flexibility as well as complete surveys regarding my basic background information, balance confidence, vitality, and current level of participation in recreational activities. The researcher will be by my side during the assessments for safety and I know that I can refuse to perform any measurement that I may feel uncomfortable with. My participation in this project or refusal to complete any assessment will not affect my relationship with the centre.

I understand that any information that I provide will be kept totally confidential. I have had the opportunity to ask questions and, if so, have received acceptable answers. By signing below, I am agree to have the information from my physical assessment and survey analyzed and reported in the study in summary form, together with the results from other people in other classes.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I understand that if I have any questions or concerns resulting from my participation in this study, I may contact Trisha Gavin at (905) 679-3985 or Dr. Sykes, the Director at the Office of Research Ethics at (519) 888-4567 ext. 6005. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision. With full knowledge of all foregoing, I agree, of my own free will, to participate in this study

Participant's name (please print):____________________________________

Signature:______________________________ **Date:** ____________________

Consent to Arrange an Assessment Appointment

I am interested in possibly participating in this project but am unable to schedule an assessment appointment at this time. By signing below, I am giving Trisha Gavin permission to contact me by telephone, within the next few days, to arrange a convenient time. If a time cannot be arranged, or should I decide at that time not to take part for any reason, no further contact will be attempted.

I understand that personal contact information (name and phone number) will only be used for this study. My name and phone number will be kept totally secured by the researcher and will not be given to any other parties.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I understand that if I have any questions or concerns resulting from my participation in this study, I may contact Trisha Gavin at (905) 679-3985 or Dr. Sykes, the Director at the Office of Research Ethics at (519) 888-4567 ext. 6005. I am aware that I may withdraw from the study without penalty at any time by advising the researchers of this decision.

Participant's name (please print):____________________________________

Signature:____________________________ **Date:** ___________________

Phone number:________________________________

Please indicate the most convenient time for an appointment (3 check the boxes).

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
Morning							
Afternoon							
Early evening							

Appendix V:

Appointment Slip

Appointment Slip

For: Tai Chi Participants

You are scheduled for the physical assessment on:

Date:

Start Time: End Time:

Place:

Please arrive a few minutes early and wait in the entrance area until you are called. See you then!!

For Line Dancing Participants

You are scheduled for the physical assessment on:

Date:

Start Time: End Time:

Place:

Please arrive a few minutes early and wait in the entrance area until you are called. See you then!!

Appendix W:

Practice Log

TAI CHI PRACTICE LOG

Please mark with an **X (did attend)** or **O (did not attend)** the days of your scheduled Tai Chi class <u>each week.</u> Put a 4 in the box for each day you practiced at home and the approximate number of minutes that you practiced.

	Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
Week 1 (Sept.17)							
Week 2 (Sept.24)							
Week 3 (Oct. 1)							
Week 4 (Oct. 8)							
Week 5 (Oct. 15)							
Week 6 (Oct. 22)							
Week 7 (Oct. 29)							
Week 8 (Nov. 5)							
Week 9 (Nov.12)							
Week 10 (Nov.19)							

Appendix X:

Letter of Appreciation

Dear Participant

I would like to take this opportunity to thank you for your involvement in this study. I hope you enjoyed the experience and had the opportunity to learn about the components of fitness and how they contribute to daily living.

The information that you have provided will allow us to develop a profile of the participants enrolled in classes at community recreational facilities and address the benefits that may be gained from participation. As well, the results of this study will contribute to the scholarly literature in the exercise field and may assist planners in marketing and promoting such programs.

If you are interested, I will be leaving a summary of the results at the information desk at your centre within the next few months. Please check with them and I know they would be happy to show you the report.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. If you have any questions or concerns resulting from your participation in this study, please contact Trisha Gavin at (905) 679-3985 or Dr. Sykes, the Director at the Office of Research Ethics at (519) 888-4567 ext. 6005.

Once again, thank you for your participation. This study could not have been completed without your help!!

Sincerely,

Trisha Gavin
Ph.D. Candidate
Department of Health Studies and Gerontology
University of Waterloo

Appendix Y:

Background Survey for Taoist Tai Chi Participants
– Study 2: Outcome Evaluation -

Background Survey for Tai Chi Participants

Instructions: The purpose of this survey is to learn more about who is interested in certain forms of exercise such as Tai Chi, and why. Simply check 4 the box or write in a brief response. We would like people to answer all of the questions if they feel comfortable doing so. Feel free to make any additional comments in the margins.

Section A: First, A Few Questions About This Class

2) How or from whom did you **hear about** this Tai Chi class?

____

2) Do you **know anyone** in this class? ☐ No ☐ Yes

If yes, what is your **relationship** to this person(s) (example, spouse, friend, etc.)

____

____

5) How do you **normally travel** to this center?

☐ Car ☐ Drive myself

☐ Taxi ☐ Ride with a family member or friend

☐ Bus ☐ Other: ____________________

6) How **long** does it take you, on average, to get from your home to this center?

__________ minutes

5) What are **your reasons for joining** (or continuing with) the Taoist Tai Chi Society?

____

6) a) When did you **first join** the Taoist Tai Chi Society? __________ date

________ number of years ago; ________ number of months ago

b) When did you **move from the beginner class to the transition** (middle) class?

________ number of years ago; ________ number of months ago

7) **Since September** (not counting holiday breaks) approximately **what proportion** of the classes, offered twice a week, have you attended?

__________ give a percentage

For example: If you attended two classes a week since September – 100%
If you attended about once class a week since September – 50%
If you attended once class every second week since September – 25%

8) a) **Since September**, approximately how often did you **practice at home**?

________ daily

________ number of times per week

________ never

b) If you did practice at home, **how long were your average practice sessions**?

__________ number of minutes.

B: Tell Us About Other Physical Activities You Are Involved In.

1) Are you **currently enrolled** in any other physical activity **classes** or **groups**?

   ☐ No

   ☐ Yes
   If yes, what type(s)? ______________________________

   Number of times per week? ____________________

   Where? ______________________________

2) Do you **currently** do any **other types** of physical activity, at least once a week, for example: walking, swimming, biking, tennis, curling?

   ☐ No

   ☐ Yes
   If yes, what are the activities? ____________________________

   Number of times per week? ______________________________

3) How many **days in an average week** do you accumulate at least 30 minutes or more of moderate intensity physical activity (equivalent to a brisk walk)? (Note: the 30 minutes can be done as a single bout or several shorter bouts.)

   _____ days a week

4) Would you describe yourself as a person who has **always** been involved in **exercise and/or sports?**

☐ Yes, all of my life   ☐ Off and on   ☐ Not at all

5) Are there any daily activities that you **would like to do** but **are not** currently doing?

☐ No

☐ Yes. If yes, what are the activities? ___________________________

Section C: Tell Us About Your Health

1) In **general**, how would you describe your **current, overall state of health**?

- ☐ Excellent
- ☐ Good
- ☐ Fair
- ☐ Poor

2) As **diagnosed by a health professional** do you currently have any of the following? (Check all that apply)

- ☐ Heart trouble
- ☐ Chronic asthma, emphysema, or bronchitis
- ☐ Diabetes
- ☐ Osteoporosis
- ☐ Arthritis
- ☐ High blood pressure
- ☐ Back problems
- ☐ Foot problems
- ☐ Hearing disorder
- ☐ Cataracts or other vision disorder
- ☐ Other health problems (Please specify: ____________________________)

3) Are you **currently limited** in the type or amount of physical activity (work or leisure) you can do because of an illness, injury, or disability?

☐ No

☐ Yes, because of a **temporary** illness or injury (example: flu, fracture)

Please specify ____

☐ Yes, because of a **long-term** illness, injury, or disability (example: diabetes, arthritis, chronic foot, back or joint problems, heart disease)

Please specify ____________________________________

Section D: Finally, Tell Us A Little About Yourself

1) Are you? ☐ **Female** ☐ **Male**

2) What is your **age**? _______

3) What is your **current marital status**?

☐ Single ☐ Separated or divorced

☐ Married ☐ Widowed ☐ other _______________

7) What is your **ethnic/cultural** heritage? ____________________

8) What is the **highest level of education** you have **completed**?

☐ Elementary school
☐ Some high school
☐ High school diploma
☐ Some post-secondary school
☐ College or university diploma
☐ Graduate or Professional Degree

9) Are you **currently retired**?

☐ Yes, fully retired
4) Semi-retired
5) No

If yes, do you consider yourself to be a **busy** person?

☐ Very much so
☐ Somewhat
☐ Not at all

Thank you for completing this survey. If you found any questions unclear, please call Trish at (905) 679-3985, or write comments in the margin beside the questions. **Please return this survey to your instructor in the envelope, along with your signed consent form, at the next class if possible.**

Appendix Z:

CHAMPS Physical Activity Questionnaire for Older Adults

1. Which of the following statements best describes how active you have been during the past 4 weeks, that is, had hobbies, work, social activities, or other activities that kept you busy? (Circle one)

Not at all active	1
A little active	2
Fairly active	3
Quite active	4
Very active	5
Extremely active	6

2. Which of the following statements best describes how physically active you have been during the past 4 weeks, that is, done activities such as brisk walking, swimming, dancing, general conditioning, or recreational sports? (Circle one)

Not at all active	1
A little active	2
Fairly active	3
Quite active	4
Very active	5
Extremely active	6

3. During the past 4 weeks, about how many flights of stairs did you climb during a typical day? (one flight = 12-15 steps, equivalent to going from one floor to another)(Circle one)

None	1
Less than one	2
1-2 flights	3
3-4 flights	4
5 or more flights	5

Instructions: read carefully

4. Think about the past 4 weeks. The next few pages list various activities you might have done. Before you begin, please review the following steps and examples:

Step #1: Number of times each week

- For each activity, write on the line provided how many times each week, on average, you did that activity. If you did an activity less than once a week or not at all, please write a zero "0" on the line provided.

For example, if you did not do the activity at all or did it less than once a week during the past 4 weeks:

Example A — **Step #1**

Activities:	**Number of times a week** (If none, write "0")	Less than 1 hour a week	1-2 1/2 hours a week	3-4 1/2 hours a week	5-6 1/2 hours a week	7-8 1/2 hours a week	9 or more hours a week
		***When "Times a week" is "0", skip this part**					
Mow lawn	Times a week ____* ⇐	a	b	c	d	e	f

Step #2: Total time, on average, each week

- If you did the activity at least once a week, circle one letter representing how much total time, on average, you spent doing it each week (**see *Example B***).

For example, if you did the activity on average 3 times a week for a total of 1 ½ hours each week:

Example B — **Step #1** — ← **Step #2** →

Activities:	**Number of times a week** (If none, write "0")	Less than 1 hour a week	1-2 1/2 hours a week	3-4 1/2 hours a week	5-6 1/2 hours a week	7-8 1/2 hours a week	9 or more hours a week
Go to the senior center...	Times a week _____ ⇐	a	b	c	d	e	f

Think about the past 4 weeks. For each activity, please write **HOW MANY TIMES** each week, on average, you did it. Next, please circle one letter representing how much **TOTAL TIME**, on average, you spent doing that activity each week.

Social Activities:	**Number of times a week** (If none, write "0")	Less than 1 hour a week	1-21/2 hours a week	3-41/2 hours a week	5-61/2 hours a week	7-81/2 hours a week	9 or more hours a week
a. Visit with friends or family (other than those you live with)	Times a week _____ ⇐	a	b	c	d	e	f
b. Go to the senior center.............	Times a week _____ ⇐	a	b	c	d	e	f
c. Do volunteer work....................	Times a week _____ ⇐	a	b	c	d	e	f
d. Attend church or take part in church activities	Times a week _____ ⇐	a	b	c	d	e	f
e. Attend other club or group meetings	Times a week _____ ⇐	a	b	c	d	e	f
Recreation and Hobbies:							
f. Use a computer........................	Times a week _____ ⇐	a	b	c	d	e	f
g. Dance (such as square, folk, line, ballroom) (do not count aerobic dance here)	Times a week _____ ⇐	a	b	c	d	e	f

Think about the past 4 weeks. For each activity, please write **HOW MANY TIMES** each week, on average, you did it. Next, please circle one letter representing how much **TOTAL TIME**, on average, you spent doing that activity each week.

	Number of times a week (If none, write "0")	Less than 1 hour a week	1-21/2 hours a week	3-41/2 hours a week	5-61/2 hours a week	7-81/2 hours a week	9 or more hours a week
h. Do woodworking, needlework, drawing, or other arts or crafts..	Times a week _____ ⇐	a	b	c	d	e	f
i. Play golf, riding a cart (count walking time only)	Times a week _____ ⇐	a	b	c	d	e	f
j. Play golf, carrying or pulling your equipment (count walking time only)	Times a week _____ ⇐	a	b	c	d	e	f
k. Attend a concert, movie, lecture, or sport event	Times a week _____ ⇐	a	b	c	d	e	f
l. Play cards, bingo, or board games with other people	Times a week _____ ⇐	a	b	c	d	e	f
m. Shoot pool or billiards	Times a week _____ ⇐	a	b	c	d	e	f
n. Play singles tennis (do not count doubles)	Times a week _____ ⇐	a	b	c	d	e	f
o. Play doubles tennis (do not count singles)	Times a week _____ ⇐	a	b	c	d	e	f

Think about the past 4 weeks. For each activity, please write **HOW MANY TIMES** each week, on average, you did it. Next, please circle one letter representing how much **TOTAL TIME**, on average, you spent doing that activity each week.

	Number of times a week (If none, write "0")	Less than 1 hour a week	1-21/2 hours a week	3-41/2 hours a week	5-61/2 hours a week	7-81/2 hours a week	9 or more hours a week
p. Skate (ice, roller, in-line)	Times a week _____ ⇐	a	b	c	d	e	f
q. Play a musical instrument.........	Times a week _____ ⇐	a	b	c	d	e	f
r, Read	Times a week _____ ⇐	a	b	c	d	e	f

Work Around the House:

s. Do heavy work around the house (such as washing windows, cleaning gutters).......	Times a week _____ ⇐	a	b	c	d	e	f
t. Do light work around the house (such as sweeping or vacuuming)	Times a ⇐ week _____	a	b	c	d	e	f
u. Do heavy gardening (such as spading, raking).......................	Times a week _____ ⇐	a	b	c	d	e	f
v. Do light gardening (such as watering plants).......................	Times a week _____ ⇐	a	b	c	d	e	f

Think about the past 4 weeks. For each activity, please write **HOW MANY TIMES** each week, on average, you did it. Next, please circle one letter representing how much **TOTAL TIME**, on average, you spent doing that activity each week.

	Number of times a week (If none, write "0")	Less than 1 hour a week	1-21/2 hours a week	3-41/2 hours a week	5-61/2 hours a week	7-81/2 hours a week	9 or more hours a week
w. Work on your car, truck, lawn mower, or other machinery.......	Times a week _____ ⇐	a	b	c	d	e	f
Walking and Jogging, *Including Treadmill*:							
x. Walk uphill or hike uphill (count only uphill part)............	Times a week _____ ⇐	a	b	c	d	e	f
y. Walk leisurely for exercise or pleasure	Times a week _____ ⇐	a	b	c	d	e	f
z. Walk to do errands (such as to/from a store or to take children to school (count walk time only)	Times a week _____ ⇐	a	b	c	d	e	f
aa. Walk fast or briskly for exercise (do not count walking leisurely or uphill)	Times a week _____ ⇐	a	b	c	d	e	f
bb. Jog or run	Times a week _____ ⇐	a	b	c	d	e	f

Think about the past 4 weeks. For each activity, please write **HOW MANY TIMES** each week, on average, you did it. Next, please circle one letter representing how much **TOTAL TIME**, on average, you spent doing that activity each week.

Other Types of Exercise:	**Number of times a week** (If none, write "0")	Less than 1 hour a week	1-21/2 hours a week	3-41/2 hours a week	5-61/2 hours a week	7-81/2 hours a week	9 or more hours a week
cc. Ride a bicycle or stationary cycle using legs only	Times a week _____ ⇐	a	b	c	d	e	f
dd. Do aerobic machines involving arms and legs (such as rowing or cross-country ski machines).	Times a week _____ ⇐	a	b	c	d	e	f
ee. Do stair or step machine	Times a week _____ ⇐	a	b	c	d	e	f
ff. Swim gently	Times a week _____ ⇐	a	b	c	d	e	f
gg. Swim moderately or fast...........	Times a week _____ ⇐	a	b	c	d	e	f
hh. Do water exercises (do not count other swimming)............	Times a week _____ ⇐	a	b	c	d	e	f
ii. Do stretching or flexibility exercises (do not count yoga or Tai-chi)	Times a ⇐ week _____	a	b	c	d	e	f
jj. Do yoga or Tai-chi	Times a week _____ ⇐	a	b	c	d	e	f

Think about the past 4 weeks. For each activity, please write **HOW MANY TIMES** each week, on average, you did it. Next, please circle one letter representing how much **TOTAL TIME**, on average, you spent doing that activity each week.

	Number of Times a week (If none, write "0")	Less than 1 hour a week	1-21/2 hours a week	3-41/2 hours a week	5-61/2 hours a week	7-81/2 hours a week	9 or more hours a week
kk. Do aerobics or aerobic dancing	Times a week _____ ⇐	a	b	c	d	e	f
ll. Do moderate to heavy strength training (such as hand-held weights of more than 5 lbs., weight machines, or push-ups).	Times a week _____ ⇐	a	b	c	d	e	f
mm. Do light strength training (such as hand-held weights of 5 lbs. or less or elastic bands)	Times a week _____ ⇐	a	b	c	d	e	f
nn. Do general conditioning exercises, such as light calisthenics or chair exercises (do not count strength training)	Times a week _____ ⇐	a	b	c	d	e	f
oo. Play basketball, soccer, or racquetball (do not count time on sidelines)	Times a week _____ ⇐	a	b	c	d	e	f
pp. Do other types of physical activity not previously mentioned (please specify) ______________________	Times a week _____ ⇐	a	b	c	d	e	f

Thank you!

Appendix AA:

Activity Specific Balance Confidence Scale

Activity-specific Balance Confidence (ABC) Scale

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

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

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

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

Administering the ABC: The ABC can be self-administered or administered via personal or telephone interview. Use a larger typeset font for self-administration, while an enlarged version of the rating scale on an index card will facilitate in-person interviews. Instruct respondents, "If you **do not currently do** the activity in question, try to imagine how confident you would be if you had to do the activity. If you normally use a walking aid or hold onto someone, rate your confidence as if you were using these supports. If you have any questions, please ask."

Instructions for Scoring: Total the ratings (possible range = 0 to 1,600) and divide by 16 (or the number of items completed) to get each person's ABC. If a person qualifies her response to items 2, 9, 11, 14, or 15, solicit separate ratings and use the lowest confidence of the two (as this will limit the entire activity, e.g., likelihood of using stairs). Total scores can be computed if at least 12 of the 16 items are answered and alpha does not decrease appreciably.

Note: from Powell and Myers (1995), Myers et al. (1996), and Myers et al. (1998)

Appendix BB:

Vitality Plus Scale

Vitality Plus Scale (VPS)

This scale looks at how you are currently feeling. For each statement, circle a number from 1 to 5 that best describes you. For instance, if you usually fall asleep quickly then you want to circle 5. Otherwise, circle a number from 1 to 4, depending on the extent to which you usually have difficulty falling asleep.

a) Take a long time to fall asleep	1	2	3	4	5	Fall asleep quickly
b) Sleep poorly or restlessly	1	2	3	4	5	Sleep well
c) Tried or drowsy during the day	1	2	3	4	5	Feel rested
d) Rarely hungry	1	2	3	4	5	Excellent appetite
e) Often constipated	1	2	3	4	5	Do not get constipated
f) Often have pains aches and pains	1	2	3	4	5	Have no aches and pains
g) Low energy level	1	2	3	4	5	Full of pep and energy
h) Often stiff in the morning	1	2	3	4	5	Not stiff in the morning
i) Often restless and agitated	1	2	3	4	5	Feel relaxed
j) Often do not feel good	1	2	3	4	5	Feel good

Instructions for scoring: Each item is scored from 1 to 5 based on the respondent's rating. Calculate a total Vitality Plus Score by summarizing the item scores. Total scores can range from 10 to 50 with higher scores indicating greater well-being. Do not compute total scores unless an individual has answered at least 7 items. Substitute the mean (total divided by number of items answered) for the missing values to compute a total score.

Note: from "Measuring accumulated health-related benefits of exercise participation by older adults: The Vitality Plus Scale" by Myers (1999).

Appendix CC:

Follow Up Survey

Follow-up Survey for Tai Chi Participants

Instructions: The purpose of this survey is to learn about any changes in your activity patterns and health status since you began the program. Please take a few moments to complete a few short surveys. Simply check 4 the box or write in a brief response. We would like people to answer all of the questions if they feel comfortable doing so. Feel free to make any additional comments in the margins.

1) How **physically exerting** did you find this Tai Chi class? (Circle a number).

1	2	3	4	5
Not at all Exerting		Moderately Exerting		Extremely Exerting

2) How did you **usually feel** right after the class? (circle a number)

1	2	3	4	5
Not at all Tired		Pleasantly Tired		Unpleasantly Tried

3) What have you **personally gained from this class**; what kept you coming back?

____

____

____

4) Is there anything you would like to see changed about the class?

☐ No

☐ Yes,

If yes, what would you like to see changed? ______________________________

____

5) Since joining this class, **have you started any other physical activities** (classes, or exercising on your own) **outside the class?**

☐ No

☐ Yes

If yes, please complete the following chart.

Type of activity	**How often per week**	**Where?** (e.g. home, seniors' centre, pool)
1.		
2.		
3.		
4.		

6) How many **days in an average week** do you accumulate at least 30 minutes or more of moderate intensity physical activity (equivalent to a brisk walk)? (Note: the 30 minutes can be done as a single bout or several shorter bouts)

_____ days a week

10) Since you joined this class, have any events **caused a major disruption in your normal patterns of activity** (such as an illness or injury to yourself or someone close to you, etc.

☐ No

☐ Yes

If yes, please specify ____

____

11) Have you **noticed any change** in how you feel health-wise as a result of taking this class?

☐ No

☐ Yes

If yes, what changes have you noticed? ______________________________

____

12) a) Have you **noticed any change** in your physical abilities as a result of taking this class?

☐ No

☐ Yes

If yes, what changes have you noticed? ______________________________

____

b) If you feel your physical abilities have improved, is there anything that you now attempt that may have been too physically challenging for you before?

☐ No

☐ Yes

If yes, what changes have you noticed? ______________________________

____

Thank you for completing this survey. If you found any questions unclear, please call Trish at (905) 679-3985, or write comments in the margin beside the questions.
Please return this survey to Trish at your physical assessment appointment

Appendix DD:

Testing Protocols

Testing Protocol

BASIC PHYSICAL ASSESSMENT

Height

For height, the participant was asked to stand erect (feet together) without footwear against the wall, with their back against a vertical measuring tape and to look straight ahead. A setsquare was placed on the participant's head. Participants were instructed to take a deep breath upon which a mark was made on the lower border of the setsquare on the wall. The measurement was taken to the nearest 0.5 cm.

Weight

Weight was measured on a scale to the nearest 0.1 kg. Participants were asked to stand erect, wearing light clothing and without shoes, until a reading was made.

BALANCE MEASURES

1) Single Leg Stance Time (SLST)

During the SLST assessment, the participant was asked to choose a leg to stand on (whichever they felt the most comfortable with), and balance on one leg for as long as possible or to a maximum of 60 seconds. The length of time the participant was able to stand was recorded.

2) Tandem Walk

Participants were asked to stand heel to toe with his/her preferred foot position for placement of the front and back foot. Persons were asked to walk heel to toe along a 10 foot line (approximately 15 steps can be completed in this distance) as quickly as they could and without a misstep. A misstep occurs when the participant fails to walk along the line or to follow a heel-to-toe pattern. The number of missteps and walk time were recorded and averaged over three trials.

3) Multi-Directional Reach Test (MDRT)

The protocol for the MDRT required an apparatus to be constructed – a yardstick, mounted on a tripod at shoulder height. Assessments of forward reach, backward lean, reach to the sides and reach upward were completed. The protocol for each of these measures (Fall-Prevention-Project, 1998; Newton, 1998) is provided, followed by a picture of the apparatus to be used in the assessment.

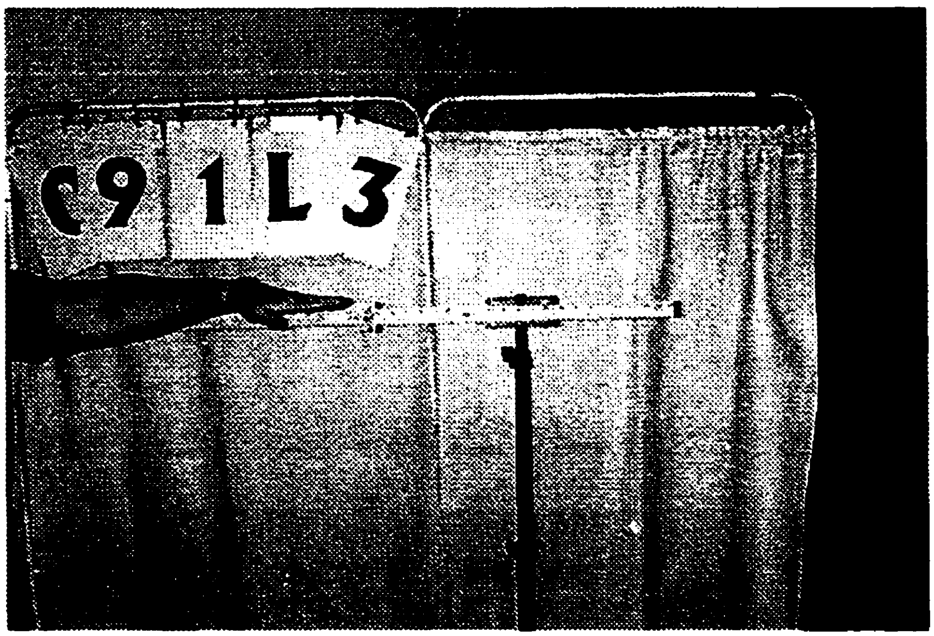
Forward reach

The participant was asked to stand next to the tripod structure. The participant raised their arm horizontally to shoulder height, hand extended and palm facing medially. The location of the middle finger on the yardstick was recorded. The participant was asked to lean forward as far as possible without lifting their heels or bending their knees. The location of the middle finger at maximal lean was recorded. The end point was subtracted from the starting point to obtain the number of inches reached.

Backward lean
This assessment involved the same set up as the forward reach; participant stood comfortably close to the yardstick with their arm extended horizontally in front of them. The participant was instructed to lean back as far as possible without lifting any part of their foot or bending their knees. The participant may rotate or extend the trunk and retract the shoulder. The distance of maximal backward lean was recorded and subtracted from the start position to obtain the inches reached.

Sideways reach to the right and left
This assessment required the same set up as the forward reach and the backward lean however, the participant stood perpendicular to the yardstick. The participant was instructed to lean to the left as far as possible. The distance of the maximal sideways lean to the left was recorded and subtracted from the starting position. The protocol was repeated for sideways lean to the right.

Upward Reach.
Participants were asked to stand next to the yardstick, which was adjusted to the vertical position. Participants were asked to comfortably raise their arm above their head, as close to the yardstick as possible. Using the same scoring protocol, participants were instructed to reach their arm upwards as far as possible while keeping their feet on the ground.

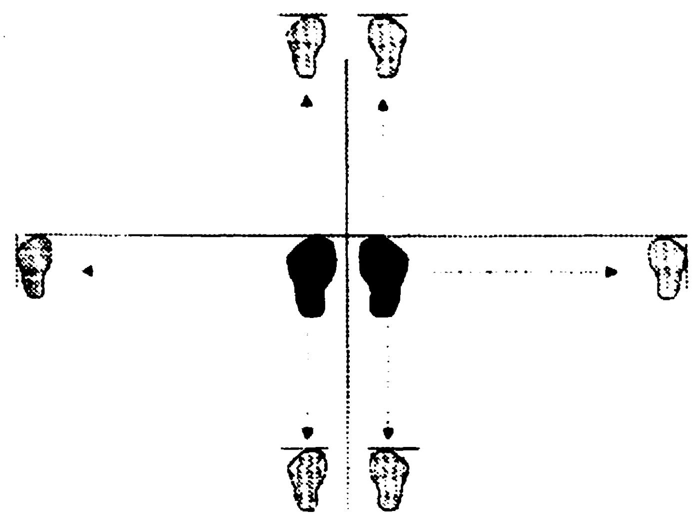


Picture of Multi-Directional Reach Apparatus Used in Outcome Study

4) Maximal and Rapid Stepping Response
The maximal and rapid stepping response consists of two measures; maximal step length (MSL) and the rapid step test (RST). The MSL was used in this project. A description of the RST is provided under Appendix FF: Pilot Protocols. The protocol for the MSL (Medell and Alexandar, submitted for publication) is provided. A diagram of the stepping response is available below.

a) Maximal Step Length Protocol
Participants were asked to cross their arms over their chest (placing their hands on opposite shoulders), to step maximally, and return to the starting position in one step while keeping the other leg on the floor. Participants were allowed to practice their steps until he/she felt comfortable. The maximal step length of each participant was performed in the front, side, and back directions. As suggested by the developers Medell and Alexander (2000) each of the step directions was tested five times and measured in inches.

Maximum Step Length Diagram
This is a diagram of the maximum step length. The large feet in the center represent the initial starting position. Each smaller foot in the front, side and back positions (both on the right and on the left) represent the maximum step length in each of those directions.



Source: Medell - Protocol for Testing

FLEXIBILITY MEASURES

a) Sit and Reach

The participant was instructed to sit on the floor, without shoes, legs extended, and feet approximately ten centimeters (cm) apart. A yardstick with a permanent crossbar at the 26-cm mark was placed between the participants extended legs with the heels flush against the crossbar. Keeping the knees fully extended, arms evenly stretched, and palms down, participants were instructed to bend and reach forward, without jerking, as far as possible. The maximum flexion must be held for approximately two seconds. Participants were advised that lowering the head would maximize the distance reached. If the knees flexed than the trial was not be counted.

b) Extension and Flexion of the Shoulder

To determine the range of motion of shoulder flexion, a Flexometer was strapped to lateral side of the upper arm. The participant was asked to stand with their arms at their sides at the projecting corner of a wall. Their back, shoulder blades, buttocks, and heels touched the wall. Their arm began in the vertical position, elbow locked, and the palm facing the lateral side of the leg. The elbow remained extended and the wrist maintained its starting position as the arm moved forward and upward as far as possible. The pointer was locked and the reading was recorded. The assessment of shoulder extension was identical to shoulder flexion, except the arm is moved backward and upward as far as possible.

c) Ankle flexion (dorsi-flexion)

The Flexometer was strapped to the medial side, at the medial arch, of the foot being measured. The participant was asked to sit on a bench, one foot resting on the floor and one-foot projecting over the end of the bench. With the knee being kept as straight as possible and the calf pressed against the bench, the foot was turned up and toward the knee as far as possible. The Flexometer was locked and a reading taken. The assessment of ankle extension (plantar-flexion) was identical to flexion except the foot was turned down toward the floor as far as possible. The knee was kept straight and the calf pressed against the bench (Canadian Society for Exercise Physiology, 1995).

STRENGTH MEASURES

Knee extension and ankle dorsi flexion were assessed. A six-second maximal voluntary contraction was completed using the 'belt-resisted' method. A practice trial was provided prior to the testing session to ensure a correct and comfortable muscle contraction. Three trials of each test were performed with 60 seconds of rest between each contraction.

a) Knee extension

Participants were asked to sit on a chair, with their feet flat on the floor, and their knee joint at an angle of 40°, the dynamometer was placed on the anterior aspect of the ankle (Desrosiers et al., 1998a). The nylon belt was secured around a wooden board, slated for the purpose of this test, and positioned around the dynamometer. The participant was asked to try to straighten the knee and push as hard as they could for approximately six seconds. Three trials were completed with the average score being used in the analysis.

b) Ankle dorsifexion

Participants were asked to sit on a chair with their ankle foot resting comfortably on the floor and their knee joint at 90° (positioned with a goniometer). The dynamometer was aligned with the third toe and placed on the dorsal surface of the foot (Desrosiers et al., 1998a). The belt was secured around the dynamometer and the slated board. Participants were asked to raise their foot, while keeping their heel on the ground.

c) Back strength (trunk extension)

Participants were asked to lie on their stomach (prone position), legs stabilized, and hands positioned under the shoulders and pointing forward (similar as if they were doing a push up). The participant was asked to extend their elbows to raise the trunk (lift their chest off the floor) and extend the thoracolumbar spine. A tape measure was used to measure the distance (in inches) between the sternal notch and the floor. This value provides the range of motion required for assessing the grade of strength

Assessment of Grade 3 Strength: In prone lying, with the legs stabilized and arms by the side of the body, participants were asked to raise their chest off the floor. The distance from the sternal notch and the floor was measured. If the distance was less than the first test than the test was complete and the grade of strength determined by use of the Conventional Strength Grading System (see Appendix F-1). If the participant reached their full range of motion, grade 4 level of strength was to be assessed. No none reached their full range of motion so the grade 4 level was not needed.

Obtained from: Clarkson and Gilewich (1989)

Appendix EE:

Conventional Strength Grading System

Conventional Strength Grading System

Numerals	Letters	Description
Against gravity tests		The patient is able to actively move through:
5	N (normal)	The full available ROM against gravity and against maximal resistance
4	G (good)	The full available ROM against gravity and against moderate resistance
4-	G-	Greater than ½ the available ROM against gravity and against moderate resistance
3+	F+	Less than ½ the available ROM against gravity and against moderate resistance
3	F (fair)	The full available ROM against gravity
3-	F-	Greater than ½ the available ROM against gravity
2+	P+	Less than ½ the available ROM against gravity
Gravity-eliminated tests		The patient is able to actively move through:
2	P (poor)	The full available ROM gravity-eliminated
2-	P-	Greater than ½ the available ROM gravity-eliminated
1+	T+	Less than ½ the available ROM gravity-eliminated
1	T (trace)	None of the available ROM gravity-eliminated and there is a palpable or observable flicker of a muscle contraction
0	0 (zero)	None of the available ROM gravity-eliminated and there is no palpable or observable muscle contraction

Source: Clarkson & Gilewich (1989) and Clarkson (2000)

Appendix FF:

Pilot Protocols

Balance Measures

a) Rapid Step Time Protocol

The RST requires participants to step at least 80% of their maximal step length as fast as possible and return to the starting position. Therefore, for the RST, 80% and 100% of the MSL for each of the directions will be calculated and marked on the floor with colored tape. At the time of testing, the evaluator will verbally instruct each participant on the leg and direction for which they should step. Participants will be asked to step as fast as possible and return to their starting position. A total of 24 random repetitions, four steps in each leg-direction (e.g. left-front, right-back, left-side etc.) will be completed three times.

b) Clinical Test of Sensory Interaction in Balance (CTSIB) or the 'Foam and Dome'

The Foam and Dome examines the influence of sensory interaction on postural stability while in the standing position. This test requires participants to maintain standing balance for 30 seconds under six different sensory conditions that eliminate input or produce inaccurate visual and surface orientation inputs. Visual conditions include a blindfold for eliminating visual input and a visual conflict dome hat for producing inaccurate visual information. Surface conditions involve a firm flat surface to ensure accurate orientation information from the somatosensory system and a firm compliant section of medium density foam that reduces the accuracy of the orientation information (Shumway-Cook & Horak, 1986).

Participants will be assessed while maintaining a normal, and a one-foot stance throughout the testing conditions. The six testing conditions included in the 'Foam and Dome' are:

1) standing on a firm surface;
2) standing on a firm surface while wearing a blindfold;
3) standing on a firm surface and wearing the dome hat;
4) standing on the foam
5) standing on the foam while wearing a blindfold; and
6) standing on the foam while wearing the dome hat.

Two techniques for quantifying the level of sway will be used. These consist of:

a) Using condition 1 as the baseline reference, the amount of change and the direction of sway will be observed over the 5 subsequent sessions. A ranking system including: 1 = minimal sway, 2 = mild sway, 3 = moderate sway, 4 = fall will be used.

b) The amount of time that balance is maintained (subject stands erect) to a maximum of 30 seconds will be recorded (Shumway-Cook & Horak, 1986)

6) Dynamic Gait Index

The Dynamic Gait Index evaluates a participant's ability to modify gait in response to changing task demands and has been reported as an effective measure in predicting the likelihood of falls in older adults. The test consists of 8 tasks. Through visual observation, the scorer grades the participant on their performance and places them into one of 4 categories -- normal, mild impairment, moderate impairment, or severe impairment for each task. The tasks are:

1. Assessment of Gait on a level surface.
- Walk at a normal speed from here to the next mark (20').

2. Change in Gait Speed
- Begin walking at normal pace (for 5') when I tell you go, walk as fast as you can (for 5'). When I tell you slow, walk as slowly as you can (for 5').

3. Gait with horizontal head turns
- Begin walking at your normal pace. When I tell you to look right, keep walking straight but turn your head to the right. Keep looking right until I tell you look left, then keep walking straight and turn your head to the left. Keep your head to the left until I tell you to look straight, then keep walking straight but return your head to the centre.

4. Gait with vertical head turns

- Begin walking at your normal pace. When I tell you to look up, keep walking straight, but tip your head and look up. Keep looking up until I tell you, look down. Then keep walking straight and turn your head down. Keep looking down until I tell you, look straight, then keep walking straight, but return your head to the centre.

5. Gait with pivot turn
- Begin walking at your normal pace. When I tell you turn and stop turn as quickly as you can to face the opposite direction and stop.

6. Step over obstacle
- Begin walking at your normal speed. When you come to the shoe box, step over it, not around it, and keep walking.

7. Step around obstacles
- Begin walking at your normal speed. When you come to the first cone (about 6'away), walk around the right side of it. When you come to the second cone (6' past first cone) walk around it to the left.

8. Steps
- Walk up these stairs as you would at home (using rail if necessary). At the top, turn around and walk down.

STRENGTH MEASURES

a) Hip extension and flexion

Participants were instructed to lie on their side with the hip in the neutral position. The dynamometer was placed on the anterior (flexion) or posterior (extension) sides at the distal end of the femur just proximal to the femoral condyles (Lazowski et al., 1999)

b) Hip abduction and abduction

Participants were asked to lie on their back (supine position) with their hip in the neutral position. For abduction, the dynamometer was placed on the lateral side of the distal end of the femur, just proximal to the knee joint. For adduction, the dynamometer was placed on the medial side (Lazowski et al., 1999).

Appendix GG:

Pre and Posttest Scores for All Outcome Variables

Pre and Post Test Scores for the Outcome Study

Measure	Tai Chi			Line Dancing			Non Exercise			Experienced Taoist Tai Chi	
	n	Pre	Post	n	Pre	Post	n	Pre	Post	n	Score
ABC	18	89.55± 15.82 81.69-97.42	91.03± 11.76 85.18-96.88	18	84.34±14.86 76.95-91.73	85.51±10.94 80.06-90.95	14	72.51±20.65 61.58-85.44	73.88±15.99 64.63-83.11	19	94.46±13.11 88.325-100
VPS	18	35.86± 9.14 31.32-40.41	36.83± 9.17 32.01-41.66	18	36.56±3.94 34.59-38.52	35.67±4.63 33.37-37.97	14	37.23±8.18 32.50-41.95	38.29±6.28 34.66-41.91	19	39.79±4.85 37.45-42.16
CHAMPS Calories in all activities	18	3553.91±2915.1 2104.3- 5003.6	2717.9±1902.3 1771.9-3663.9	18	2022.5±1676.8 1188.6-2856.4	1756.5±989.1 1264.6-2248.3	14	2621.4±1295.9 1873.1-3369.7	1548.4±895.7 1031.3-2065.6	19	2773.3±1613.8 1995.8-3551.1
Frequency/wk	17	17.75±8.08 13.45-22.05	16.69±8.86 11.97-21.41		12.78±7.27 9.16-16.39	12.67±7.45 8.96-16.37		19.57±7.27 15.37-23.77	14.79±7.55 10.43-19.14		18.28±9.98 13.31-23.24
Calories in moderate activities	18	1763.5±1960.0 788.79-2738.20	1135±1169.9 553.9-1717.6		1048.2±1230.4 436.33-1660.0	1026.6±739.0 659.1-1394.1		1113.9±906.79 590.41-1637.5	375.8±291.2 207.7-543.9		975.34±978.23 503.84-1446.8
Frequency/wk	17	4.69±4.81 2.12-7.25	3.69±4.85 1.10-6.27		3.11±3.70 1.26-4.96	3.00±1.75 2.13-3.87		5.86±3.48 3.84-7.86	3.50±2.68 1.95-5.05		5.56±6.71 2.21-8.89
Height (cm)	20	168.89±9.70 164.35-173.42	168.89±9.70 164.35-173.42	18	158.42±6.53 155.17-161.67	158.42±6.53 155.17-161.67	14	161.96±7.71 157.50-166.41	162.07±7.57 157.71-166.45	20	163.44±7.75 159.81-167.07
Weight (kg)	20	75.23±11.52 69.84-80.62	75.64±11.27 70.35-80.92	18	64.74±18.40 55.59-73.89	64.90±17.61 56.14-73.66	14	68.11±17.11 58.23-78.00	69.06±16.37 59.60-78.51	20	71.85±15.48 64.60-79.09
BMI	20	26.39±3.12 24.91-27.84	26.58±3.31 25.02-28.14	18	25.48±5.73 22.63-28.33	25.57±5.37 22.90-28.24	14	25.93±5.85 22.54-29.31	26.25±5.76 22.93-29.58	20	26.88±5.40 24.35-29.42

Pre and Post Test Scores for the Outcome Study (continued)

Measure	Tai Chi			Line Dancing			Non Exercise			Experienced Taoist Tai Chi	
	n	Pre	Post	n	Pre	Post	n	Pre	Post	n	Score
Single Leg Stance	20	40.07±20.08 30.67-49.78	39.10±21.68 29.03-49.32	18	28.64±18.26 19.56-37.72	43.06±16.64 34.78-51.34	14	23.50±13.51 15.71-31.31	20.31±10.19 14.44-26.21	20	42.11±22.90 31.39-52.83
Tandem Walk	18	11.45±3.05 10.09-13.12	10.27±1.02 9.76-10.78	18	14.08±4.06 12.06-16.11	11.97±3.21 10.37-13.57	14	12.86±4.10 10.51-15.25	15.93±5.58 12.70-19.15	19	11.07±2.99 9.12-12.71
Forward Reach	20	14.37±2.34 13.27-15.47	15.34±2.38 14.23-16.44	18	15.41±3.11 13.86-16.96	15.67±2.97 14.19-17.14	14	11.02±2.15 9.78-12.26	10.66±2.70 9.10-12.22	20	14.64±1.96 13.72-15.56
Backward Lean	20	8.23±1.22 7.66-8.81	8.51±0.98 8.03-8.96	18	10.03±2.69 8.69-11.37	8.12±2.74 6.67-9.49	14	7.30±1.44 6.47-8.14	7.62±1.59 6.70-8.54	20	8.65±2.47 7.49-9.81
Right Reach	20	12.21±3.79 10.44-13.99	12.27±4.63 10.10-14.44	18	11.34±2.67 10.00-12.66	10.78±3.06 9.26-12.31	14	10.19±3.50 8.17-12.22	9.78±2.56 8.29-11.26	20	12.72±2.67 11.46-13.97
Left Reach	20	11.89±3.59 10.20-13.56	12.27±4.72 10.06-14.49	18	11.76±3.05 10.23-13.27	11.87±2.61 10.57-13.17	14	9.80±3.06 8.04-11.57	9.21±2.72 7.63-10.78	20	12.11±3.87 10.30-13.93
Upwards Reach	20	2.27±0.89 1.85-2.68	2.15±0.81 1.76-2.53	18	2.56±1.08 2.03-3.10	2.54±1.02 2.03-3.05	14	2.00±0.64 1.63-2.36	1.63±0.34 1.43-1.82	20	1.58±0.58 1.31-1.85
MDRT Total	20	49.08±9.02 44.60-53.57	50.54±10.41 44.19-57.18	18	51.12±10.17 46.05-56.17	49.00±9.82 44.11-53.88	14	40.33±8.25 35.57-45.10	38.91±7.82 34.39-43.43	20	50.38±9.05 46.02-56.75
Right Forward Step	20	28.50±4.70 26.31-30.70	30.63±4.01 28.75-32.51	18	23.74±6.22 20.64-26.83	27.56±5.10 25.01±30.09	14	24.12±3.76 22.03-26.39	24.57±3.46 22.57-26.58	20	30.65±4.35 28.61-32.68
Left Forward Step	20	27.78±5.04 25.42-30.13	30.76±4.37 28.71-32.81	18	25.00±6.52 21.75-28.24	27.96±5.04 25.46-30.47	14	23.96±6.44 20.24-27.68	24.37±4.95 21.51-27.23	20	31.94±4.48 29.78-34.11
Right Back Step	20	28.54±4.33 26.51-30.57	28.04±4.23 26.06-30.02	18	30.12±5.43 27.42-32.83	29.48±4.94 27.02-31.94	14	25.48±4.05 23.15-27.83	25.00±3.67 22.88-27.11	20	31.09±5.75 28.39-33.78
Left Back Step	20	27.16±5.17 24.74-29.57	28.47±4.24 26.48-30.45	18	27.63±6.15 24.57-30.69	28.78±5.27 26.15-31.40	14	23.92±3.80 21.73-26.12	24.82±4.53 22.20-43.70	20	30.02±4.90 27.72-32.32
Right Side Step	20	32.68±5.72 29.99-35.35	34.14±5.12 31.74-36.54	18	35.24±4.56 32.97-37.51	32.32±4.52 30.07-34.57	14	27.02±6.18 23.45-30.59	29.07±5.81 25.17-32.43	20	34.38±4.00 32.51-36.26
Left Side Step	20	32.40±6.27 29.46-35.34	33.77±5.43 31.23-36.31	18	34.50±3.94 32.54-36.46	32.28±3.80 30.39-34.17	14	27.48±6.21 23.89-31.06	28.71±5.66 25.44-31.98	20	34.23±4.64 32.05-36.40
MSL Total	20	177.06±28.44 163.75-190.38	185.82±24.70 163.41-196.96	18	176.25±27.42 162.61-189.89	178.39±27.22 164.85-191.93	14	152.09±29.06 135.31-168.88	156.56±26.80 141.08-172.04	20	191.46±26.97 178.46-204.46

Pre and Post Test Scores for the Outcome Study (continued)

Measure	Tai Chi			Line Dancing			Non Exercise			Experienced Taoist Tai Chi	
	n	Pre	Post	n	Pre	Post	n	Pre	Post	n	Score
Knee Extension	20	175.30±64.87 144.94-205.66	177.84±56.93 151.20-204.49	18	166.70±47.00 143.33-190.08	163.72±43.17 142.25-185.19	14	159.17±48.64 131.07-187.25	157.67±38.52 135.42-179.91	20	177.41±69.75 144.77-210.06
Ankle Dorsiflexion	20	138.57±41.93 118.94-158.19	137.93±25.80 125.85-150.00	18	122.26±41.33 101.70-142.81	117.78±31.05 101.84-132.72	14	115.71±35.90 94.96-136.44	113.52±27.60 97.59-129.46	20	126.58±45.86 105.11-148.05
Total Strength	20	313.86±100.77 266.70-361.03	215.77±80.50 267.04-388.06	18	288.96±72.04 253.13-324.79	281.00±71.13 245.62-316.37	14	274.88±79.38 229.05-320.71	268.33±60.63 233.32-303.34	20	315.77±80.50 267.04-388.06
Back Strength† **Baseline**	15	13.67±3.32 (12.12-15.80)	15.61±1.95 (14.44-16.79)	16	15.62±2.52 (14.27-16.97)	16.67±3.61 (15.46-17.87)	10	14.40±1.96 (13.00-15.80)	14.42±1.96 (12.61-16.24)	16	15.65±2.27 (14.44-16.87)
Grade 3 assessment		7.76±1.85 (6.74-8.79)	9.00±0.97 (8.40-9.59)		6.94±2.56 (5.57-8.30)	8.67±3.55 (6.41-10.92)		7.40±1.07 (6.63-8.17)	7.28±1.25 (6.12-8.44)		7.56±2.26 (6.16-8.96)
Grade of Strength (categorical)		2+ (n=4) 3- (n=11)	2+ (n=4) 3- (n=11)		2+ (n=8) 3- (n=8)	2+ (n=8) 2+ (n=8)		2+ (n=4) 3- (n=6)	2+ (n=4) 3- (n=6)		2+ (n=9) 3- (n=7)
Sit and Reach	13	27.91±10.89 20.99-34.83	27.25±10.24 20.74-33.75	17	23.06±8.43 18.56-27.55	24.06±9.17 19.18-28.94	11	20.59±9.75 14.03-27.14	21.72±9.55 15.31-28.14	20	22.13±10.21 17.35-26.90
Shoulder Extension	20	46.30±9.58 41.81-50.79	48.35±8.94 44.16-52.53	18	51.00±5.20 48.41-53.58	48.00±5.70 45.16-50.83	14	49.00±12.31 41.89-56.11	49.85±9.71 44.24-55.46	20	45.35±8.26 41.48-49.21
Shoulder Flexion	20	141.15±13.08 135.03-147.27	142.70±11.57 137.28-148.12	18	151.61±10.63 146.32-156.90	146.32±6.44 147.29-153.71	14	144.71±7.82 140.20-149.23	144.14±8.73 139.09-149.19	20	153.55±11.42 148.20-158.90
Ankle Dorsi flexion	20	14.35±4.58 12.21-16.49	17.55±5.54 14.95-20.14	18	15.11±3.92 13.16-17.06	16.78±4.77 14.40-19.15	14	12.57±4.89 9.74-15.40	14.07±4.14 11.68-16.46	20	16.15±7.24 12.76-19.54
Ankle Plantar flexion	20	47.35±10.51 42.43-52.27	51.30±8.60 47.27-55.32	18	50.89±9.79 46.01-55.75	54.11±12.57 47.86-60.34	14	46.63±4.68 44.13-49.12	45.00±5.01 42.11-47.89	20	54.15±8.54 50.15-58.14
Total Flexibility	20	249.30±24.13 238.00-260.59	260.15±21.49 237.61-264.60	18	268.61±11.63 262.82-274.39	269.39±18.72 260.08-278.70	14	252.42±16.64 243.97-260.88	253.07±10.95 246.74-259.40	20	269.20±20.63 259.52±288.16

† Grade of strength was determined by subtracting the grade 3 assessment score from the baseline score and using the conventional method for assessing and grading muscle strength, as described by Clarkson and Gilewich (1989) and Clarkson (2000) to determine the grade of strength.

Appendix HH:

Sample Values in Comparison to Other Study Samples

Sample Values in Comparison to Other Study Samples

Measure	Sample Pretest Scores	Comparable Pretest Scores	Comparable Posttest Scores
ABC	TC=89.18 LD=87.68 NE=73.51 TA=94.46	36% - home/day care users; 64% - retirement home residents; 70% - craft class; 77% - wellness clinic; 82% - aquatics class; 90% - walking group; * (later three groups completed pre and posttest)	Posttest values not available – range & extent of improvement reported. - 40% of wellness clinic (walking, balance & strength training) improved by 5% or more (group was previously sedentary) - Aquatic and walking group did not change (groups were previously active)
VPS	TC=36.18 LD=38.25 NE=37.23 TA=39.79	36.1∀9 – craft class; 37.9∀7 – social groups** 39.0∀8 – exercise class; 40.3∀5– wellness clinic; 36.9∀7 – walking group; 36.8∀6 – aquatics class; (later three groups completed pre and posttest)	Posttest values not available – range & extent of improvement reported. - 61% of wellness clinic improved by 19% - approximately 40% of walking & aquatic groups improved by 10%
Single-leg Stance	TC=30.85 LD=32.74 NE=20.94 TA=42.11	1) Tai Chi group-right-46.1 sec.; left-48.2 sec.[†] Non Tai Chi – right-29.6 sec.; left-30.8 sec.[†] 2) Healthy non-institutionalized men (60 to 90 yrs) – right-20.7 sec; left-21.9[††] Healthy non-institutionalized women (60 to 86 yrs) – dominant leg-20.4[‡]	N/A
Tandem Walk **Walk Time (sec.)**	TC=10.98 LD=12.42 NE=10.83 TA=9.91	a) *Walk time*[‡‡] 8.5±1.6 Unimpaired older women (mean 69 yrs) 17.0±23.6 Impaired older women	N/A
Missteps	TC=1.44 LD=1.02 NE=2.62 TA=1.19	*b)* Number of missteps[‡‡] 0.5±0.5 Unimpaired older women 4.4±3.2 Impaired older women	
Tandem Walk (with penalty)		8.92 Unimpaired Older Women 24.48 Impaired Older Women	

Note: TC=Tai Chi, LD=Line Dance, NE=Non-exercise, TA=Experienced Taoist participants.
*Myers et al (1998); **Myers et al. (1999); [†]Tse & Bailey (1992); [††]Iverson et al. (1990); [‡]Briggs et al. (1989); [‡‡]Medell and Alexandar (2000).

Sample Values in Comparison to Other Study Samples (continued)

Measure	Sample Pretest Scores	Comparable Pretest Scores	Comparable Posttest Scores
MDRT **Forward**	TC=14.70 LD=15.18 NE=10.83 TA=14.64	1) Older adults at seniors centre (mean age 74.1)[´] *Forward* 8.9±3.4 *Back* 4.6±3.0 *Left* 6.2±3.0 *Right* 6.6±2.8	N/A
Backward	TC=7.84 LD=9.11 NE=7.26 TA=8.65		
Left Side	TC=11.94 LD=11.33 NE=9.62 TA=12.11	*Upwards* – never tested	
Right Side	TC=11.81 LD=11.35 NE=9.97 TA=12.72	2) Older adults with mild balance disorder (age 20 to 76 years)[´´] Duncan's functional reach (forward reach only) 11.69±4.15	After a 8 week Tai Chi class – 12.15±4.66
Upwards	TC=2.23 LD=2.51 NE=1.87 TA=1.58		
Maximal Step **Right Forward**	TC=27.45 LD=23.11 NE=23.65 TA=30.65	36-37 inches – Unimpaired older women[!!] 25-26 inches – Impaired older women[!!]	N/A
Left Forward	TC=27.20 LD=24.05 NE=23.44 TA=31.94	no difference in direction	
Right Back	TC=27.45 LD=23.11 NE=23.65 TA=31.09		
Left Back	TC=25.41 LD=28.38 NE=23.22 TA=30.02		
Right Side	TC=30.99 LD=33.02 NE=26.89 TA=34.38		
Left Side	TC=31.30 LD=32.33 NE=27.13 TA=34.23		

Note: TC=Tai Chi, LD=Line Dance, NE=Non-exercise, TA=Experienced Taoist participants, IS=Initially sedentary, SA=Somewhat active, AA=Already Active.
[!!] Medell and Alexandar (2000); [´]Newton (2001); [´´]Hain et al (1999)

Sample Values in Comparison to Other Study Samples (continued)

Measure	Sample Pretest Scores	Comparable Pretest Scores	Comparable Posttest Scores
Knee Extension	TC=167.4 LD=161.6 NE=156.9 TA=177.4	N/A	N/A
Ankle Dorsiflexion	TC=138.0 LD=109.2 NE=109.4 TA=126.5	*Healthy Older Community Dwelling Adults*[§] (age62-86 years) Right ankle – 193-197 Left ankle – 186-198	N/A
Sit and Reach	TC=21.16 LD=23.31 NE=21.42 TA=22.13	1) Adults (45-75 years) – 24.7±11.4 cm Men (mean age 57.8) – 20.7±10.7 cm Women (mean age 59.0) – 28.4±10.9 2) Adults involved in Tai Chi program - 13.3±5.3[ε] Control group 11.9±5.6 (age 50-75 years)	After 16 weeks of practice Tai Chi - 15.7±6.6; Control - 12.1±4.8
Shoulder Flexion and Extension	*Shoulder Flexion* TC=144.5 LD=150.2 NE=141.9 TA=151.5 *Shoulder Extension* TC=45.06 LD=46.07 NE=47.75 TA=45.3	*Shoulder Flexion* Long term care residents in fitness program[εε] – 129.0±27.4; ROM program - 122.8±28 *Young, nonathletic males -- 165 ±5*['] *Shoulder Extension* *Young, nonathletic males* -- 57 ±8[']	Shoulder Flexion Long term care residents 145.0±27.5 ROM program 127.1±34.1
Ankle Dorsi and Plantar Flexion	Ankle Dorsiflexion TC=14.0 LD=14.0 NE=12.0 TA=14.0 *Ankle Plantarflexion* TC=44.8 LD=54.3 NE=46.6 TA=45.0	*Ankle Dorsiflexion* *Young, Nonathletic, Males -- 12-25 ±1-4*['] *Ankle Plantarflexion* Young, Nonathletic, Males -- 56±6[']	N/A

Note: TC=Tai Chi, LD=Line Dance, NE=Non-exercise, TA=Experienced Taoist participants, IS=Initially sedentary, SA=Somewhat active, AA=Already Active.
[§]Desrosiers et al (1998a)]; [ε]Chen & Sun (1997); [εε] Lazowski et al (1999); [']Hubley-Kozey (1991).