TAI CHI FOR OLDER ADULTS:

IMPROVING PHYSICAL AND PSYCHOLOGICAL HEALTH THROUGH A COMMUNITY-BASED TAI CHI PROGRAM AND IDENTIFYING BARRIERS TO PARTICIPATION

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ABSTRACT

Older adults face aging challenges that occur naturally or are precipitated early in the aging cycle by physical inactivity. Using three prospective cohorts of ethnically diverse low-income older adults, this dissertation aimed to: i) assess the promoters and barriers of low-income older adults in terms of their enrollment in a locally-offered TC program, ii) examine the TC intervention effects in terms of physiological outcomes, iii), examine the TC intervention effects in terms of psychological outcomes, and, iv) assess the promoters and barriers of low-income older adults in terms of their adherence in a locally-offered TC program, with special sensitivity to ethno-cultural based issues. Results of the first objective uncovered six categories relating to enrollment with no clear barriers or promoters that related to gender and specific cultural limitations. Categories included physical and mental health, time of day, socialization, program pairing, accessibility and appropriate leadership/teacher. Results of the second objective showed significant improvements in both upper and lower body strength, low back flexibility, and the Short-Form Health Survey (SF 36) physical health scores ($p < 0.05$). Based on multiple linear regression analyses, no common health determinants explained a significant portion of the variation in percent changes of the musculoskeletal fitness and SF 36 measures. Results of the third objective did not find significant improvements when looking at SF 36 summary mental health scale, subjective happiness scale and the expectations regarding aging summary measure; however, there were significant improvements in two sub scales of the SF 36 of vitality (VT) and mental health (MH) in the combined cohorts and expectations regarding aging in the third of three cohorts ($p < 0.05$). Finally in the last objective there were ten categories found relating to adherence with no clear barriers or promoters that

related to specific cultural limitations. Categories included common barriers/promoters that embraced biological, psychological, social and environmental influences. Overall, the results demonstrated that TC has the ability to be used as a good health-related PA program in a multi-ethnic, low-income, older adult population with possible potential for psychological health improvement and with key categories to help enrollment and maintain attendance.

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List of Acronyms

SES – Socioeconomic Status

MET – Metabolic Equivalent

PA – Physical Activity

TC – Tai Chi

TCH – Toronto Community Housing

WHO – World Health Organization

CPAFLA – Canadian Physical Activity and Fitness Lifestyle Approach

INTRODUCTION

Older adults in Canada

As the Canadian population ages and with the baby boomer populace beginning to turn 65 years of age in 2011, an increased priority in research has occurred to better manage older adults' mental and physical health (Statistics Canada: A Portrait of Seniors 2007). As these baby boomers age and turn 65 the number of older adults will increase from 4.3 million to 8.0 million between 2006 and 2026 (Statistics Canada 2007). Older adults have been traditionally defined as 65 years of age, or older, however in this dissertation older adults will be defined as 50 years of age and older based on the definition of the World Health Organization (WHO 2014). Since many chronic conditions increase with age, it can be projected that as the older adult population grows so will a rise in the proportion of these chronic diseases (Denton & Spencer, 2010). In 2004 Epping-Jordan, Pruitt, Bengoa, and Wagner stated that chronic conditions are increasingly the primary concern of healthcare systems throughout the world and it seems that history is validating this statement. It stands to reason that all aspects of older adult health and wellness should be explored to not only find the best scenarios for prevention and management but the best pathways for financial sustainability. However, it is important to note that within the older adult population landscape in Canada there are groups that are more vulnerable for poorer health outcomes relating to low income and ethnicity. Lower socioeconomic status (SES) populations as well as racial/ethnic minority older adults, specifically, can experience increased health risk challenges because they are more likely to live in neighborhoods with poorer social environments (Fong & Gulia, 1999). While it is important to look at the inventory for improving and sustaining older adults' mental and physical health, the older adult multi-ethnic population may need specific tools to help improve their health outcomes.

Prevalence of Physical Activity in Older Adults

Participation in regular physical activity (PA) can provide numerous physiological, cognitive, and psychological health benefits in the aging population (Smith et al., 2012) and evidence has demonstrated that habitual PA, including exercise, minimizes the physiological effects of an otherwise sedentary lifestyle and increases active life expectancy (Chodzko-Zaijko et al., 2009). In 2010, Paterson and Warburton conducted a systematic review that underscored the strong relationship between PA and functional independence as well as cognitive function. The authors also reported that PA would translate to a greater than 30% decrease in the relative risk of morbidity and mortality with upwards of 60% reduction in risks with greater PA and physical fitness gains. Most physiological functions improve from birth to late teenage years and then level out in the mid-20s (Stewart, 2005), and from that point on regular PA increases in importance to maintain healthy physiological outcomes. Adding to this, physical inactivity has been shown to speed up the aging process in many people whereas an increase in PA has demonstrated a slowing down of the aging process (Stewart, 2005). It is in light of this, and other research that reinforces the importance of both appropriate and accessible community-based PA programs for the older adult populations in Canada, with a specific priority on the needs of the low-income ethnically diverse older adults within this population.

In 2013, 55.2% of Canadians aged 12 or older reported they were at least moderately active during their leisure time when controlling for work, transportation and housework. However, this figure drops to 43.7% for adults age 65 and older (Statistics Canada, 2014). The biggest leisure-time activity was walking (72.4%) but other activities such as gardening, home exercise, jogging or running, swimming and bicycling were also popular (Statistics Canada, 2014). According to the Canadian Health Measures Survey from 2007 to 2009 only 5% of Canadian adults are reaching the 150-minutes-per-week recommendation for PA (Garriguet et

al., 2011) with 69% of waking hours of middle-age and older adults spent on sedentary activities (Dogra & Stathokostas, 2012).

PA and physical fitness intensity categories can be defined in terms of relative or absolute intensity. Absolute intensity can be looked at as a general measure and can be quantified using a metabolic equivalent where 1 MET is the amount of energy any human uses in a resting state (Warren et al., 2010). Relative intensity is specific to a person's level of health-related fitness and can be quantified by a percentage of an individual's maximum heart rate or maximum oxygen uptake (Warren et al., 2010). Although these variables are interrelated and can be similar in a homogeneous sample (i.e. age, gender and fitness), the challenge increases in a heterogeneous sample when determining the best health-related fitness outcome based on a relative intensity of a given volume such as absolute intensity in a certain amount of time (Shephard, 2010). Research continues to explore what the "optimal" intensity of health-related PA actually is and it appears that a single relative or absolute intensity will not meet the objectives of improving health outcomes in multiple morbidly (2 or more chronic conditions) challenged individuals (Haskell, 1994). Classification categories have been developed and are constantly under review as we understand better the differences in sub groups within the population be it relating to age, gender or a specific chronic condition. Examples of these intensity categories are very light, light, moderate, hard (vigorous), very hard and maximal that are employed in the American College of Sports Medicine publications (Garber et al., 2011). The extent to which "light" intensity activities contribute to health-related fitness is less well known but is important to research since light-intensity activities are important for older adults since they tend to spend a greater portion of their day in this category more than any other age group (Westerterp, 2008). However, a review by Paterson and Warburton (2010) on PA and functional limitations in older adults demonstrated that PA at an intensity of moderate to

moderately vigorous aerobic activity with a total weekly volume of 150-180 min/wk is recommended for older adults and that there may be additional benefits when adding in a twice per week "resistance" exercise component (Paterson & Warburton, 2010).

What does "Adherence" really mean?

One of the goals in PA is to participate on a regular basis so that optimal health-related benefits can be achieved. Successful adherence is achieved when a person can self-regulate their behaviour by replacing an established response (i.e. sedentary behaviour) with a more desirable response (i.e. physical activity) (Baumeister & Vohs, 2003). Challenges with PA adherence can be seen in a clearer light when compared to dietary and pharmacological adherence (Chao et al., 2000). Comparatively speaking, PA takes more time and effort than other preventative behaviours. PA also needs to be done by the individual to be effective, whereas things like healthy meals can be prepared by others and medicines can be supplied by caregivers/immediate family members. As well PA usually involves some learning curve compared to a medicinal regimen.

Understanding factors that motivate people to adhere to PA is important to achieve success on a population level. Theory-based PA interventions help illuminate these factors and allow for better program design. Strategies that have shown success include goal setting, self-monitoring, implementing decision-making models, modifying cognitive thoughts during activity, and increasing social support (Knapp, 1988). The challenges with adherence research is to understand what adherence actually means relative to PA. Some research has defined adherence as a fulfillment of a predetermined goal, while other studies use exercising a certain number of times per week (Robison et al., 1992; Stoffelmayr et al., 1992) or numbers of sessions attended (Klonoff et al., 1994). It is also important to connect PA interventions with theoretical concepts for behaviour change to increase the understanding of how to apply them operationally

(Rejeski et al., 2000). To get a better picture of adherence and PA it is important to look at participant characteristics and their PA context and ultimately what aspects of programming could potentially help their adherence (King et al., 1995).

The PA guideline in Canada for older adults is:

> **Guidelines for Older Adults (65 years and older):** To achieve health benefits and improve functional abilities, adults aged 65 years and older should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic PA per week, in bouts of 10 minutes or more. It is also beneficial to add muscle and bone strengthening activities using major muscle groups, at least 2 days per week. Those with poor mobility should perform physical activities to enhance balance and prevent falls. More daily PA provides greater health benefits. (Canadian Society for Exercise Physiology, 2014).

Since life expectancy has increased in Canada (Human Mortality Database 2013) and larger cohorts are reaching older age (Ibbott et al., 2006), the older adult segment of Canadian society is receiving increased attention with respect to health-related fitness. As can be seen in the PA guidelines the goals for participating goes beyond basic physiological health and also emphasizes functional abilities (ability to do activities of daily living) as well as to enhance balance and to prevent falls. To this end the PA needs of older adults take on a higher priority for enhanced daily living and practical outcomes.

Barriers and Promoters of Physical Activity in Older Adults

As is well known, the investigation into how to increase PA to improve population health is an ongoing challenge. Although there is continued support to increase PA levels in the population (Pratt et al., 2012; Hallal et al., 2012), there is still a challenge to increase effect sizes, be it through a more active population numbers and increases in population health overall, as

well as to create more opportunities for the general population to be active (Bauman et al., 2012). It is therefore important to understand PA behaviour and to better understand behavioural theories and models that can help improve PA outcomes through research and public health initiatives. Although there have been great strides in data collection around barriers and promoters to PA, the information that comes from heterogeneous age research is not necessarily representative to specific age groupings like older adults (Cohen-Mansfield et al., 2003). Early general population research showed perceived barriers such as lack of time, health reasons, and lack of energy, motivation or need (Yoshida et al, 1987), with lack of time being the most common perceived barrier. Other research has shown barriers such as lack of money, facilities, exercise boredom and lack of interest (Johnson et al., 1990). However, it is important to note, that older adults are a distinct population group with their own unique barriers and promoters to PA (O'Neil & Reid, 1991). O'Neil and Reid, in research conducted in the early 90s, showed that older adults' most common motivator and barrier to exercise related to health challenges relating to the fact that as health begins to decline it potentially acts as a motivator however when the decline becomes too substantial it then potentially becomes a barrier. Combined with this finding were additional barriers relating to lack of knowledge and psychological and environmental barriers.

Health challenges as a barrier to activity represents a multi-level challenge. On the surface it is apparent that a health challenge can be a clear physical barrier. However, with many chronic conditions, it is not the physical limitation that is the issue, but the lack of appropriate knowledge on how PA can help improve the condition(s) that becomes the barrier. Although older adults can look to healthcare providers for guidance, there can be issues when general instructions to be more physically active are given without specific guidelines relating to an older adults' chronic, and often, multiple conditions (Schutzer et al., 2004). Environment also

represents a challenge to PA adherence in olders adult both from a recreational and an active transport perspective (Schutzer et al., 2004) as well as from a safety one (Centers for Disease Control and Prevention, 1999). Another strong barrier in older adults is lack of knowledge with respect to the relationship between moderate PA and health, especially if they feel they receive adequate amounts of physical movement in their activities of daily living (O'Neil & Reid, 1991). Some research has also shown that childhood exercise could also play a role in older adults PA patterns. When a child/adolescence has a negative relationship with PA and exercise evidence has shown that this may lead to reduced activity levels as an adult (Tayler et al., 1999). However the picture is not all bleak and there exists evidence showing multiple motivators for PA in the older adult community. Since behavioural outcomes are associated with a large number of variables that have complex interactions, many barriers to PA can also be motivators (Cohen-Mansfield et al., 2003). Even though health decline can be seen as a barrier to regular activity it can also act as motivator as well; in addition, health care providers can also be motivators when proper and appropriate direction is given to their patients. However an important determinant of PA behaviour is the concept of self-efficacy (Schutzer et al., 204). This can be defined as the ability to successfully perform a specific behaviour and plays a central role in social cognitive theory (Bandura, 1977). With the exception of health factors, self-efficacy has been consistently shown to have a powerful influence on PA behaviour of older adults (Brassington et al., 2002).

Tai Chi

Tai Chi (TC) was developed in China in the 17th century (China Sports, 1983) and is a slow, supple movement activity that has been found to be beneficial to cardiorespiratory function, strength, balance, flexibility, microcirculation and psychological health (Lan et al., 2002). Research shows that TC may be helpful for both health-related fitness and multiple chronic conditions, and is therefore appropriate for the aging population (Lan et al., 2013). From

a perspective of exercise prescription, TC is an ideal PA modality that fulfills the recommendations of the American College of Sports Medicine when looking at exercise to develop/maintain cardiorespiratory function, musculoskeletal fitness, neuromotor agility, and flexibility (Garber et al., 2011). In Western society the most popular form of TC is the 24 form Yang style (Zhu et al., 2010) Alongside TC, and often used for a warm up for TC, Qigong is a traditional Chinese energy exercise/therapy that involves a series of gentle movements and postures focused on meditation and breath control (Chan et al., 2012). Due to its low-tech nature (i.e. no expensive equipment, minimal space needed, single instructor/leader), TC is an ideal community-based intervention that is also fiscally sustainable.

Mechanisms of Effect of Tai Chi on Physiological Outcomes

Even though it is inevitable that physical strength will decline with age (Goodpaster et al., 2006), a major influence in this decline relates to the decreasing use of the musculoskeletal system and negative changes in lifestyle (Hubert et al., 2002). Although the origins of TC are martial arts based, it has many physical therapeutic qualities that make it ideal for the older adult population, which has both declining strength and declining PA habits (Jancewicz, 2001). The emphasis while performing the movements in this PA modality is not on exertion or strength, but on concentration, balance and relaxation, which makes it ideal for an aging body. Three basic principles that are universal in all TC styles are the relaxation and extension of the body with an awareness on trunk extension, knees being kept bent and movement achieved through weight shifting from leg to leg and sequencing movements from the waist and upper hips while maintaining a half squat position (Jancewicz, 2001). Since older adults are at high risk for falls (one out of three older adults fall each year) it is important to find interventions to help with this physical challenge (Tromp et al., 2001; Stevens et al., 2012). TC is recommended as a treatment for improving balance and reducing falls and has been shown to be successful in single studies as

well as through systematic and meta-analytical reviews (Leung et al., 2011). Mechanisms of action in balance improvement with respect to TC can be related to the fact that the slow movements of TC require whole body coordination (Woollacott & Tang, 1997). TC has also been shown through systematic reviews to be beneficial in multiple musculoskeletal conditions (Wang et al., 2004) and between 2012 and 2013 research has shown positive effects on as many as 15 health conditions (Harmer, 2014). Such conditions that have shown evidence-based improvement are strength loss, decreased range of motion, rheumatologic conditions, multiple sclerosis, Parkinson's disease, hypertension, fibromyalgia and even cardiovascular and respiratory system conditions (Wang et al., 2004; Harmer, 2014). Mechanisms relating to improved musculoskeletal function have been attributed to positive muscle adaptation, such as increases in enzymes for aerobic respiration, enhanced contraction ability and increased muscle mass and strength (Lan-yuen et al., 2014). Cardiovascular improvements can be attributed to peripheral strength increases in the lower body, and when the cardiovascular fitness of older adults drops below a certain threshold, the training effect of TC has the ability to improve and/or maintain their capacity (Taylor-Piliae, 2008). Since TC has applications in the older adult population for both general health and specific conditions, it is an ideal physiological tool for overall health promotion (Li, Hong & Chan, 2001).

Mechanisms of Effect of Tai Chi on Psychological Outcomes

As is well known, PA is associated with many health benefits such as primary and secondary prevention for a multitude of chronic conditions (Warburton et al., 2006). Combined with this knowledge is the evidence that regular exercise/PA is also associated with positive mental well-being (Tseng et al., 2011) and lower psychophysiological reactivity to mental stress (Rosenfeldt et al., 2011). As PA modalities go, TC has arisen in the research community as a particularly powerful tool for both physical and mental health in the older adult population (Chi

et al., 2013; Chou et al., 2012). TC is of particular interest since it is designated as a strong mind-body exercise modality (Tsang et al., 2014) that combines body movements with mental focus. The psychological effects of TC are attributed to the influence of the practice to induce calm and mental tranquility and has been classified as a form of "moving meditation" reinforcing its reputation as a true mind-body practice (Wang et al., 2009). The research that involves TC and psychological health has been labeled as confusing (Spirduso, Francis & MacRae, 2006) since different researchers classify the psychological variables in a multitude of ways using terms such as quality of life, well-being and perceived mental health or defining mood through depression, anxiety or stress. That being said, there is no reason to assume that the physiological and psychological mechanisms in TC are not the same (or even more powerful) as other forms of light to moderate PA.

When it comes to psychological benefits and TC, timelines associated with a positive outcome average at about 13 weeks with 2-3 sessions per week for 1 hour; however some research has shown benefits after as little as 5 weeks (Faber et al., 2006). To be able to compare results, standardization is needed for the duration and frequency of practice (Wang et al., 2010). Of particular interest in TC research and psychological benefits, post standardization, are interventions of longer duration to examine the degree of temporal exposure and psychological effects (Greenspan et al., 2007). However before a dose response relationship can truly be researched it would be valuable to better understand the mechanisms involved in the TC and psychological health interaction. Such mechanisms have possible explanations through associations between the effects of relaxation and diaphragmatic respiratory exercise with mental meditation (Yau & Packer, 2002), self-fulfilling prophecy syndrome (Dechamps et al., 2009) and teacher charisma effects (Dechamps et al., 2009). Other mechanisms that may be mediated more physiologically are changes in hormonal levels, such as cortisol and catecholamines (Wang et al.,

2010), as well as influences on vascularisation of the brain and increased oxygen transportation (Brown et al., 1989), and the stimulated secretion of endogenous opioids (endorphins) that produce a state of euphoria (Pert & Bowie, 1979). In the end, TC is a strong and appropriate PA modality for psychological health in all population levels. However, it is especially well suited for the older adult population with respect to positive psychological outcomes since it is non-pharmacologic and non-invasive in its influence in an older adult population that can be susceptible to adverse effects from too many pharmacologic therapies (Abott et al., 2013).

The goal of any community-based PA program is affordability and adherence; however, because of the Canadian population's unique blend of a multitude of ethnicities, it is a challenge to find a suitable program for as many participants as possible. Fink and Houston in 2013 demonstrated an evidence-based TC program in a multicultural setting with success based on: 1) the adoption of the local community organizations, 2) it was accessed by the older adult population with good participation rates, 3) it was delivered in a real world setting by regular community members and, 4) there were both perceived and actual benefits to the 12-week program from the participants. It is this kind of evidence that reinforces the potential for TC to be a suitable PA modality for the aging Canadian population. Although there is growing research around TC, and its potential for multiple health outcomes, there is a lack of research with respect to the aging population and specifically within the multi-ethnic low-income population in Canada. This dissertation represents a small glimpse into the role that TC could have within an under-studied, high health risk population.

DISSERTATION GUIDING THEORY

Several theories have been put forth to help in the explanation of physical activity (PA) behaviour, such as the theory of reasoned action and the theory of planned behaviour (Dzewaltowskiet al., 1990) however social cognitive theory will be used as the guiding model for

this dissertation. Social cognitive theory states that behaviour is influenced by three self-regulatory mechanisms that work together: perceived self-efficacy for outcome attainment, outcome expectations, and personal goal setting (Bandura, 1986). However social cognitive theory has the potential to be one of strongest theories in PA behaviour since self-efficacy has consistently been identified as a correlate of PA behaviour in a variety of populations (McAuley et al., 2000). Efficacy expectations relate to a person's perception or judgement of their ability to organize and carry out their skills and resources to perform an action that will lead to a goal outcome (Bandura, 1977, 1986). Previous evidence has shown that Tai Chi participant's changes in efficacy were associated with higher levels of program attendance (Li et al., 2001; Taylor-Piliae & Froelicher, 2004). These findings potentially suggest that self-efficacy can be enhanced through TC practice and this enhancement will likely improve exercise adherence. A potential mechanism involved with Tai Chi and self-efficacy could be in a relatively short-term Tai Chi exercise can significantly enhance perceptions of task-specific personal efficacy in older adults (Li et al., 2001). However there could potentially be multiple sources from which efficacy can be increased that go beyond task-specific and could related to social persuasion, social modeling and the interpretation of physiological and affective responses (Bandura, 1997) .

OBJECTIVES

The population for this research focused on older adults of multiple ethnic backgrounds (both culturally related and not related to TC) and of low economic status. The specific objectives of the dissertation were to:

1) Assess the barriers and promoters of enrollment in a 16-week Tai Chi program.
2) Examine the effects of a 16-week TC program in terms of physiological outcomes.
3) Examine the effects of a 16-week TC program in terms of psychological outcomes.
4) Assess the barriers and promoters of adherence in a 16-week Tai Chi program.

In this dissertation a mixed methods approach was used. One of the goals of mixed methods research is that multiple viewpoints when looking at the same phenomenon could potentially give greater accuracy to research results. Johnson and Onwegbuzie (2004) state that mixed methodology is not intended to replace quantitative or qualitative research but to draw from the strengths and minimize the weaknesses of both in single research studies as well as across studies. When looking at quantitative research alone, significant findings can be defined as statistical significance, practical significance, clinical significance and economic significance whereas when looking at qualitative significant findings these can be placed in the categories of meaning or representation (Leech & Onwegbuzie 2004).

The following section is a chronological timeline of the of the overall study methodology from spring of 2009 until spring of 2012. Following the methodology section the next four chapters of the dissertation will address each objective separately in a journal style article. The results of the second objective have been published at BMC Geriatrics. The following is the citation for manuscript 2.

Manson, J., Rotondi, M., Jamnik, V., Ardern, C., & Tamim, H. (2013). Effect of tai chi on musculoskeletal health-related fitness and self-reported physical health changes in low income, multiple ethnicity mid-to-older adults. *BMC geriatrics*,*13*, (1), 114.

OVERALL STUDY METHODOLOGY

Cohort 1

Pre focus group preparation

In the spring of 2009 plans were formulated to schedule two focus groups during the summer. These two focus groups would consist of one male and one female so that the researchers could explore questions regarding the future facilitation of a Tai Chi (TC) program and whether they should be gender based or mixed. The project coordinator plus four research assistants explored the Jane-Finch area looking for locations that would be appropriate to discuss with community members their interest in both a TC program and to attending focus groups to discuss details of the potential program. A local shopping mall and a Toronto Community Housing (TCH) building were found that provided adequate participants for both the male and female focus groups. The inclusion criterion were any members of the community that were not culturally related to TC, were 50 years of age or older (based on WHO criterion for older adults), and were living in the Jane-Finch community. The potential participants gave their names and telephone numbers, so as to confirm attendance, and were told that they would be attending an hour long meeting to discuss how best to initiate a TC program in their community. The potential attendees were also told that a meal would be provided. It was decided that a female focus group would be done in May 2009 and a male focus group would be done in June 2009. Initial discussions with the potential participants informed the research team that early evening during the week was the best time for these focus groups and the potential participants were told that they would be contacted in May (female participants) and June (male participants) about a week before the focus groups were to be held.

Focus Groups

On the day of the female focus group in late spring of 2009 and the male focus group in early summer of 2009 transportation was arranged to bring the participants to York University, near the Jane-Finch community in Toronto. The female focus group was attended by 21 participants and the male focus group was attended by 18 participants. They were a mixture of community living residents as well as TCH members. The focus group was facilitated by one of the principals on the research project and questions were explored around enrollment promoters and barriers to the TC program. Socio-demographic information was collected and the focus groups were recorded using two digital voice recorders. The focus group was about 45 minutes to an hour and before the participants were to leave they were each provided a meal and a ten dollar gift certificate for a local grocery store. Transportation was arranged to take them home.

Pre TC program testing

From the information obtained from the focus groups it was decided that the TC program would take place in an auditorium that was located on the top floor of the TCH building in the Jane-Finch community. The program would be mixed gender and the classes would be held throughout the week both in the morning and the afternoon with seven classes in total. Using this information the project coordinator plus six research assistances went into the Jane-Finch community and placed posters and flyers throughout the community at shopping malls, community centers, bus shelters and housing/apartment complexes. The TCH building had flyers placed at every unit with information on TC class times and a phone number to call and register for the program. As participants enrolled they were told that pre testing would be done at the end of summer 2009 with the TC program itself starting immediately after pre testing. The certified TC master facilitating the classes was then informed of his schedule for the next 16 weeks. The majority of the testing was done on two days at the end of the summer 2009 which

consisted of both physical tests (CPAFLA and Senior Fitness Test) plus facilitated questionnaires using research assistants from York University. A Spanish translator was provided for the participants, 45 in total, that did not speak English.

TC program

The TC program was seven classes throughout the week starting at the end of August and going until the beginning of December 2009. The classes were 60 minutes long with the first 15 minutes being Qi Gong (as a warm up) and then 45 minutes of TC. About a month into the schedule it was discovered that the Monday class was consistently very low in attendance and so that class was cancelled. Each class was attended by a research assistant and each participant had a name badge so that attendance could be taken. Initially a Spanish translator worked with the Spanish speaking participants, 45 in total, until one month into the TC program where at that point they had learned enough movements that they were comfortable working with the TC instructor without the translator. Attendance numbers were then uploaded to an online calendar so that attendance could be monitored. At the half way point (8 weeks) two physical tests (chair stand test in 30 seconds and the arm curl test in 30 seconds) and one questionnaire (SF 12) was administered to chart the progress of the participants.

As can be seen in the Cohort 1 Table that, of the 78 participants, 57 completed the program and 21 did not complete the program. For those that did not complete the program 11 withdrew due to health reasons, 2 left the country to visit family, 1 had surgery and 7 withdrew for unknown reasons. There were minimal differences between those that completed the program and those that did not. Gender, ethnicity of origin, education, smoking/drinking, marital status, income, all chronic conditions, weekly physical activity, previous TC participation and social support all were statistically not significant. The only variable that was found to be

significant ($p < 0.05$) was age with non-completed program participants having a younger mean age (68.7 ± 8.1) versus the completed program participants mean age (72.3 ± 5.9).

Cohort 1 Table: Baseline Socio-Demographic & Physical Characteristics of Program Participants: Completed and Non-Completed

	Total N (%)	Completed N (%)	Non Completed N (%)	P
Totals	**78 (100.0)**	**57 (100.0)**	**21 (100.0)**	
Sex				
Male	17 (21.8)	11 (19.3)	6 (28.6)	.379
Female	61 (78.2)	46 (80.7)	15 (71.4)	
Age groups				
50-64 years	12 (15.4)	5 (8.8)	7 (33.3)	
65-74 years	41 (52.6)	32 (56.1)	9 (42.9)	.028
75+ years	78 (32.1)	20 (35.1)	5 (23.8)	
Mean (SD)	*71.3 (6.74)*	72.3 (5.97)	*68.7 (8.1)*	.034
Ethnicity of Origin				
Chinese	0 (0.0)	0 (0.0)	0 (0.0)	
South American	45 (60.8)	34 (60.7)	11 (61.1)	
Caribbean	9 (12.2)	8 (14.0)	1 (5.6)	.830
European	7 (9.5)	5 (8.9)	2 (11.1)	
South Asian	10 (13.5)	7 (12.5)	3 (16.7)	
Canadian	1 (1.4)	1 (1.8)	0 (9.9)	
Other	2 (2.6)	1 (1.8)	1 (5.6)	
Education:				
< High School	47 (61.0)	37 (66.1)	10 (47.7)	.458
High School	25 (32.5)	16 (28.6)	9 (42.9)	
> High School	5 (6.5)	3 (5.4)	2 (9.5)	
Smoking Status-Yes	2 (2.6)	1 (1.8)	1 (4.8)	.456
Drinking Status-Yes	17 (21.8)	14 (24.6)	3 (14.3)	.330
Marital Status				
Single	59 (76.6)	46 (80.7)	13 (65.0)	.153
Married	18 (21.8)	11 (19.3)	7 (35.0)	
Income				
<$14,000 per year	66 (90.4)	51 (91.1)	15 (88.3)	.657
$14,000-$30,000	5 (6.8)	4 (7.1)	1 (5.9)	
>$30,000	2 (2.7)	1 (1.8)	1 (5.9)	
Chronic Conditions				
Hypertension	52 (33.3)	38 (66.7)	14 (66.7)	.611
Arthritis	38 (48.7)	29 (50.9)	9 (42.9)	.530
Diabetes Mellitus	28 (35.9)	19 (33.3)	9 (42.9)	.437
Sleep Disturbance	20 (25.6)	12 (21.1)	8 (38.1)	.126
Depression	14 (17.9)	10 (17.5)	4 (19.0)	.878
Hearing Impairment	9 (11.5)	6 (10.5)	3 (14.3)	.645
Disorientation	9 (12.2)	5 (9.3)	4 (20.0)	.209
Heart Disease	8 (10.3)	5 (8.8)	3 (14.3)	.476
[a]COPD	4 (5.1)	4 (7.0)	0 (0.0)	.213
Tumour	1 (1.3)	1 (1.9)	0 (0.0)	.542
[b]Multi-Morbidity	56 (71.8)	42 (73.7)	14 (66.7)	.541
Walking Assistance	13 (16.7)	10 (17.5)	3 (14.3)	.911
[c]Weekly Physical Activity				
Needs improvement/fair	14 (18.0)	9 (16.4)	5 (23.8)	
Good	8 (10.3)	5 (9.1)	3 (14.3)	.749
Very good/excellent	54 (69.3)	41 (74.6)	13 (62.9)	
Mean (SD)	*6.4 (2.9)*	6.5 (2.8)	*6.0 (3.3)*	.549
[d]Previous Tai Chi	0 (0.0)	0 (0.0)	0 (0.0)	
[e]Social Support				
Mean (SD)	*4.5 (2.3)*	*4.3 (2.2)*	*4.9 (2.3)*	.351

[a]COPD: chronic obstructive lung disease, [b]Multi-morbidity: two or more chronic conditions
[c]Physical Activity: based on the Healthy Physical Activity Participation Questionnaire
[d]Previous Tai Chi: Previous Tai Chi participation more than one year, [e]Social Support based on 9 possible support sources
Note: Totals may vary due to missing responses

Post TC program testing

The final day of testing was arranged for the middle of December 2009 and was communicated to the participants and told that it was also going to be a holiday celebration to help facilitate attendance. The project coordinator plus 20-25 research assistants assisted with both the physical testing and the questionnaires from early morning to early evening. Each participant that came for the final testing was offered food and a holiday gift.

Post TC focus groups

The third week of December 2009 was designated for the post focus group data collection and was attended by 13 TC program participants that included 6 mid-to-high attenders and 7 low attenders. The potential focus group participants were contacted 2-3 days prior and transportation to York University was arranged. The participants were placed in two groups based on their attendance category. The project coordinator plus one research assistant facilitated the focus groups and the attendees were asked questions around barriers and promoters relating to adherence to the TC program. The focus groups lasted for 25 to 36 minutes and were recorded using digital recorders. All participants for these focus groups spoke English so no translators were required. At the end of the focus groups the participants were thanked and given ten dollar gift certificates for a local grocery store in appreciation of their time.

Cohort 1 lessons learned

Many lessons were learned throughout the first cohort that not only helped the first cohort but the subsequent cohorts as well. The initial focus groups were attended by too many people that made information gathering difficult and verbatim transcriptions very challenging as well as not being in line with standard focus group methodology. Going forward each focus group would be more streamlined. It was also decided that the project coordinator would facilitate the

focus groups since he was more familiar with both the participants and the research questions. Although York University was fine for hosting the focus groups it was decided that having the focus groups based in the community would be easier for the participants to not only attend but be in surroundings they were more comfortable so as to better facilitate open dialogue.

Holding the TC program in a TCH building was very appropriate and convenient for the first cohort but shortly after the first cohort TCH went through some changes that made it not appropriate for subsequent cohorts. Keeping the TC program at community centers going forward was more feasible. As well having data gathering all scheduled on one day was difficult for both the testers and participants to get to and to facilitate. It was decided that a rolling intake and post assessment would be better. As well the initial testing was done on a beautiful summer's day with the final testing done on a cold, stormy winter's day so there were some concerns around the impact that this might have on the psychological health questionnaires. This was another reason why a rolling intake and post assessment would be more appropriate. During the first cohort there were flu concerns that had a negative impact on attendance, phone calls were made to increase attendance but it was decided to watch attendance closely in the next two cohorts to help catch this before it happened. To also help positively influence attendance social luncheons were done at the half way point to help keep excitement for participation up for the final 8 weeks of the program as well as to capture half way point data. It was also discovered that there was too much physical testing and too many questionnaires placing too heavy a burden on participants and potentially negatively influencing the data as well. Through the testing of the first cohort it was discovered that some of the physical tests and questionnaires were not appropriate and the data collected from these was not useful. These extraneous tests were removed to streamline the testing process both pre and post. Cohort 1 can be seen in Figure 1 Flowchart showing recruited, lost to follow up and completed study.

Cohort 2

Pre focus group preparation

In the fall of 2010, similar to spring 2009, plans were formulated to schedule two focus groups for later fall and early winter. The goal for this cohort was to have it take place in the Dundas-Spadina area to look at participants that were culturally affiliated with TC practice. Several potential locations were identified one being a TCH building and another location being a community center. Since the TCH building had only a small auditorium so there were discussions around having two locations, one based at the TCH building and one at the community center. Unfortunately the TCH building turned out not to be a viable location so the community center became the main focus. The Alexandra Park Community Center upon further investigation turned out to be an ideal location since it was in the heart of the Dundas-Spadina region and had a fairly high East Asian usage with multiple programs already in place to draw and support older adults. Again the goal was on having two focus groups with one being male and another being female. Adding to this was a TC master that was affiliated with the community center that was open to facilitating the TC program and was able to speak multiple languages such as Mandarin, Cantonese, Fujian and English. At the community center was an administrator that worked part time, that was available to assist, and that spoke Mandarin, Cantonese, Fujian and English. This administrator was well educated and was also open and able to facilitate the focus groups under the direction of the project coordinator.

The project coordinator with five research assistants that were of East Asian descent and spoke Mandarin and Cantonese among them worked with the community center administrator to create two focus groups, one male and one female. The inclusion criterion was any member of the community that were culturally related to TC, were 50 years of age or older (based on WHO criterion for older adults), were living in the Dundas-Spadina community. The potential

participants gave their names and telephone numbers and were told that they would be attending an hour long meeting to discuss how best to initiate a TC program in their community.

Pre Focus Groups

The female focus group was conducted in mid fall of 2010 and the male focus group was conducted in early winter 2011 and both focus groups were done at the Alexandra Park Community Center that was within a 15-20 minute walk for the attendees. These focus groups were based on both males and females that were already attending other programs at the community center such as grandchildren programs, lunch programs, ballroom dancing and an already small TC program. Both focus groups were conducted by the project coordinator, with the assistance of the administrator to do translations, and questions were explored around enrollment promotion and enrollment barriers to the TC program. Socio-demographic information was collected and the focus groups were recorded using two digital voice recorders. These focus groups were specifically smaller than the first focus groups based on the methodology of proper focus group facilitation. These focus groups lasted from 30 to 45 minutes and when participants were finished they were given a 10 dollar gift certificate for a local grocery store.

Pre TC program testing

From the information obtained from the focus groups it was decided that the TC program would take place at the Alexandra Park Community Center that was located within a block of the Dundas-Spadina intersection. The program would be mixed gender and the classes would be held throughout the week and on Saturday both in the morning and the afternoon with seven classes in total. Using this information from the focus groups the project coordinator plus five research assistances went into the Jane-Finch community and placed posters and flyers

throughout the community at shopping malls, community and religious centers, bus shelters and housing and apartment complexes as well as older adult service providers. Based on the lessons learned from the first cohort it was decided that a rolling intake would be done and as potential participants were tested and enrolled they could immediately start the TC program which was initiated in February of 2011. The TC master was informed of the schedule with agreement that the program could potentially last more than 16 weeks due to the rolling intake methodology. Testing was done on a ongoing basis until April of 2011 so that the end date of all participants would potentially be August 2011. The testing consisted of both physical tests (CPAFLA and Senior Fitness Test) plus facilitated questionnaires using research assistants from York University and the Alexandra Park Community Center. All testing was done in either Mandarin, Cantonese, Fujian and/or English based on the specific language needs of the participant.

TC program

The TC program was seven classes throughout the week starting in the spring of 2011 and going until late summer of 2011. Since the testing was done on a rolling intake basis each participant was tracked exactly when they did their testing so that at exactly the sixteen week mark they would be scheduled to do their post testing. The classes were 60 minutes long with the first 15 minutes being Qi Gong (as a warm up) and then 45 minutes of TC. During the focus groups and the recruitment process there was a strong desire for a Saturday morning class so in the seven classes one included a Saturday morning. To facilitate attendance and participation classes during the week were scheduled such that when the grandparents brought their grandchildren to their programs at the community center the grandparents were able to do TC at the same time. Each class was attended by a research assistant however the attendance was done by the TC master since he spoke multi languages and either knew, or got to know, all the participants. Attendance numbers were then uploaded to an online calendar so that attendance

could be monitored. At the half way point two physical tests (chair stand test in 30 seconds and the arm curl test in 30 seconds) and two questionnaires (SF 12 and The Sense of Coherence) were administered to chart progress of the participants which was done in the form of a social get together where food and beverages were provided. As can be seen in the Cohort 2 Table, of the 80 participants, 60 completed the program and 20 did not complete the program. For those that did not complete the program 2 relocated back to China, 2 were traveling, 5 had health reasons not related to TC, 3 were busy and 8 withdrew for unknown reasons. There were minimal differences between those that completed the program and those that did not. Gender, age, ethnicity of origin, education, smoking status, marital status, income, all but one chronic condition, weekly physical activity, and social support all were statistically non-significant. The only variables that were found to be significant ($p < 0.05$) were smoking status, arthritis and previous TC experience.

Cohort 2 Table: Baseline Socio-Demographic & Physical Characteristics of Program Participants: Completed and Non-Completed

	Total N (%)	Completed N (%)	Non Completed N (%)	P
Totals	**80 (100.0)**	**60 (100.0)**	**20 (100.0)**	
Sex				
Male	16 (20.0)	11 (18.3)	5 (25.0)	.519
Female	64 (80.0)	49 (81.7)	15 (75.0)	
Age groups				
50-64 years	46 (57.5)	36 (60.0)	10 (50.0)	
65-74 years	28 (35.0)	20 (33.3)	8 (40.0)	.714
75+ years	6 (7.5)	4 (6.7)	2 (10.0)	
Mean (SD)	*63.8 (7.68)*	63.9 (7.55)	*63.4 (8.24)*	.809
Ethnicity of Origin				
Chinese	73 (91.3)	56 (93.3)	17 (85.0)	
South American	2 (2.5)	1 (1.7)	1 (5.0)	
Caribbean	1 (1.3)	0 (0.0)	1 (5.0)	.276
European	2 (2.5)	2 (3.3)	0 (0.0)	
South Asian	0 (0.0)	0 (0.0)	0 (0.0)	
Canadian	0 (0.0)	0 (0.0)	0 (0.0)	
Other	2 (2.5)	1 (1.7)	1 (5.0)	
Education:				
< High School	33 (43.4)	24 (42.8)	9 (45.0)	.848
High School	34 (44.7)	26 (35.3)	8 (40.0)	
> High School	9 (11.8)	6 (10.7)	3 (15.0)	
Smoking Status-Yes	1 (1.3)	1 (1.7)	0 (0.0)	.561
Drinking Status-Yes	9 (11.3)	4 (6.7)	5 (25.0)	.025
Marital Status				
Single	27 (35.1)	21 (36.8)	6 (30.0)	.581
Married	50 (64.9)	36 (63.3)	14 (70.0)	
Income				
<$14,000 per year	52 (70.3)	36 (65.5)	16 (84.2)	.251
$14,000-$30,000	12 (16.2)	11 (20.0)	1 (5.3)	
>$30,000	10 (13.5)	8 (14.5)	2 (10.5)	
Chronic Conditions				
Hypertension	39 (48.8)	19 (68.3)	8 (60.0)	.495
Arthritis	39 (48.8)	34 (56.7)	5 (25.0)	.014
Diabetes Mellitus	9 (11.3)	6 (10.0)	3 (15.0)	.540
Sleep Disturbance	21 (26.3)	16 (26.7)	5 (25.0)	.883
Depression	5 (6.3)	5 (8.3)	0 (0.0)	.182
Hearing Impairment	9 (11.3)	8 (13.3)	1 (5.0)	.307
Disorientation	4 (5.4)	4 (7.1)	0 (0.0)	.244
Heart Disease	3 (3.8)	2 (3.3)	1 (5.0)	.701
[a]COPD	2 (2.5)	1 (1.7)	0 (0.0)	.408
Tumour	0 (0.0)	0 (0.0)	0 (0.0)	
[b]Multi-Morbidity	41 (51.3)	32 (53.3)	9 (45.0)	.518
Walking Assistance	0 (0.0)	0 (0.0)	0 (0.0)	
[c]Weekly Physical Activity				
Needs improvement/fair	15 (20.0)	14 (25.0)	1 (5.3)	
Good	4 (5.3)	2 (3.6)	2 (10.5)	.183
Very good/excellent	56 (74.7)	40 (71.4)	16 (47.4)	
Mean (SD)	*6.7 (3.13)*	6.4 (3.28)	*7.5 (2.52)*	.161
[d]Previous Tai Chi	32 (40.0)	29 (48.3)	3 (15.0)	.008
[e]Social Support				
Mean (SD)	*5.4 (2.13)*	*5.4 (2.11)*	*5.5 (2.26)*	.787

[a]COPD: chronic obstructive lung disease
[b]Multi-morbidity: two or more chronic conditions
[c]Physical Activity: based on the Healthy Physical Activity Participation Questionnaire
[d]Previous Tai Chi: Previous Tai Chi participation more than one year
[e]Social Support based on 9 possible support sources
Note: Totals may vary due to missing responses

Post TC program testing

Post testing commenced based on the first participants to enrol initially, and testing was carried out throughout the summer on participants that had reached the sixteen week mark. The project coordinator plus 2-3 research assistants facilitated both physical testing and questionnaires as was needed during this time period. Each participant that came for the final testing was given a 10 dollar gift certificate for a local grocery store and was allowed to continue participating in the TC program since classes were still ongoing. Because intake was done on a rolling basis and so post testing was done on a rolling basis detailed time records were kept to guarantee that each participant was tested at exactly the sixteen week mark so as to keep the TC participation timeline the same as the first cohort.

Post TC focus groups

The end of the summer 2011 was designated for the post focus group data collection and once again TC program participants that were both mid-to-high attenders and low attenders were asked to attend. The potential focus group participants were contacted 2-3 days prior and scheduled to meet at the Alexandra Park Community Center. There were 13 participants and they were placed in two groups based on their attendance category. The project coordinator assisted the community center administrator and one research assistant that both spoke Mandarin, Cantonese, Fujian and/or English to facilitate the focus groups and the attendees were asked questions around variables relating to adherence to the TC program. The focus group lasted 25 to 36 minutes and was recorded using digital recorders. At the end of the focus groups the participants were thanked and given a ten dollar gift certificate for a local grocery store.

Cohort 2 lessons learned

Lessons continued to be learned throughout the second cohort that were carried into the third cohort as well. Although the translators were incredibly valuable and the second cohort could not be done without them there needed to be attention given to make sure that all measures, especially questionnaires, were done as identical as possible. Of particular note were Likert scales that were designed to be reversed in any given questionnaire.

The rolling intake was highly beneficial for both facilitating the possibility to increase participation but it also cut down labour expenses at each testing point. It was therefore important to keep accurate and detailed records on a master document. The only down side was that the project coordinator and several research assistants had to dedicate more time to be available to lead and facilitate testing over a longer period.

The Alexandra Park Community Center was a small and minimally funded community center and during the TC program there were challenges to be consistent with TC classes when extra or seasonal programs were added to the community center schedule. Several times the auditorium had to be shared and at one point the TC classes were done outside when the auditorium was taken over by a summer children's program. It was noted that special attention would need to be given to the third cohort to hopefully avoid this situation in other community centers. The TC master was a great teacher and taught exactly the same Qi Gong warm up and TC movements of the first TC master but it was acknowledged that this could be an area of future concern, if not variance, and so the program for the third cohort would need to be equally duplicated similar to cohort 1 and 2. Cohort 2 can be seen in Figure 1 Flowchart showing recruited, lost to follow up and completed study.

Cohort 3

Pre focus group preparation

Almost directly after the conclusion of the second cohort plans were made to move into initiating the final and 3rd cohort. The goal for this final cohort was to have it take place back in the Jane-Finch area to look at all participants that wanted to attend the program. Several potential locations were identified one being the Driftwood Community Center and another location being the John Booth Memorial Arena. Both were ideal locations since they were both attended by older adults in the area and there was one administrator that was overseeing both buildings. This administrator was very open and excited about the TC program being brought into her facilities and because all costs of the program were being covered by the research project she graciously allowed the use of both locations free of charge. A TC master had contacted the project coordinator months before discussions were held for the third cohort and so this person was contacted, since the other two TC masters were unable to do the third cohort, and he agreed to lead the TC classes for the third cohort.

The project coordinator with three research assistants worked with the community center administrator to create two focus groups, one occurring at the Driftwood Community Center and one occurring at the John Booth Memorial Arena. The inclusion criterion were any members of the community that were 50 years of age or older (based on WHO criterion for older adults), were living in the Jane-Finch community and were both male and female. The potential participants gave their names and telephone numbers and were told that they would be attending an hour long meeting to discuss how best to initiate a TC program in their community.

Pre Focus Groups

Both the Driftwood Community Center focus group and the John Booth Memorial Area focus group was conducted October 2011 and were done at each location. Attendees of the focus groups lived within a 15-20 minute walk, bus or car ride. These focus groups were based on both males and females that were already attending other programs at the community center such as older adult programs, lunch and food distribution programs, Bingo programs and various social groups plus grandparents who were waiting for their grandchildren. Both focus groups (male and female) were conducted by the project coordinator with the help of three research assistants and questions were explored around enrollment promotion and enrollment barriers to the TC program. Socio-demographic information was collected and the focus groups were recorded using two digital voice recorders. These focus groups were bigger in size (32 participants, 9 male and 23 female) to the second focus groups (16 participants, 7 male and 9 female) but smaller than the first focus groups (39 participants, 18 male and 21 female) and were within the methodology of proper focus group numbers. These focus groups lasted from 30 to 45 minutes and when participants were finished they were given a 10 dollar gift certificate for a local grocery store.

Pre TC program testing

From the information obtained from the focus groups it was decided that the TC program would take place at both the Driftwood Community Center and John Booth Memorial Arena and participants could go to both/either location. The program would be mixed gender and the classes would be held throughout the week in the morning and the afternoon with seven classes in total. Using this information from the focus groups the project coordinator plus three research assistances went into the Jane-Finch community and placed posters and flyers throughout the community at shopping malls, community and religious centers, bus shelters and housing and

apartment complexes and older adult service providers. Based on the lessons learned from the first cohort and with the success from the second cohort it was decided that a rolling intake would be done and as potential participants were tested and enrolled they could start the TC program which was initiated in late fall of 2011. Since both community centers had a number of people interested in participating it was decided to start the TC program right away but still do a rolling intake. The TC master was informed of the schedule with agreement that the program could potentially last more than 16 weeks due to the rolling intake methodology. Testing was done on this rolling intake methodology until January of 2012 so that the end date of all participants would potentially be early spring 2012. The testing consisted of both physical tests (CPAFLA and Senior Fitness Test) plus facilitated questionnaires using research assistants from York University. All testing was done in English and no translators were needed for this cohort.

TC program

The TC program was seven classes throughout the week starting in late fall 2012 and going until early spring 2012. Since the testing was done on a rolling intake basis each participant was tracked exactly when they did their testing so that at exactly the sixteen week mark they would be scheduled to do their post testing. The classes were 60 minutes long with the first 15 minutes being Qi Gong (as a warm up) and then 45 minutes of TC. Special attention was paid to scheduling the classes during the week such that they were either before or after other programs to not only facilitate attendance but to reduce multiple trips for the participants to the community centers. Each class was attended by a research assistant however the attendance was done by the TC master since he voiced a desire to get to know the participants and this was one of the ways he could accomplish this. Attendance numbers were then uploaded to an online calendar so that attendance could be monitored. At the half way point two physical tests and two questionnaires were administered to chart progress of the participants which was done in the

form of a social get together where food and beverages were provided. As can be seen in the Cohort 3 Table that, of the 51 participants, 37 completed the program and 14 did not complete the program. For those that did not complete the program 1 had an accident at work, 1 hurt her shoulder (not TC related), 1 had a spouse that had a heart attack, 4 were too busy, 1 felt she was too old to complete the program and 6 for unknown reasons. Age, ethnicity of origin, education, smoking/drinking status, marital status, income, all but one chronic condition, weekly physical activity, and social support all were statistically non-significant. The only variables that were found to be significant ($p < 0.05$) were gender, hearing impairment and previous TC experience.

Cohort 3 Table: Baseline Socio-Demographic & Physical Characteristics of Program Participants: Completed and Non-Completed

	Total N (%)	Completed N (%)	Non Completed N (%)	P
Totals	**51 (100.0)**	**37 (100.0)**	**14 (100.0)**	
Sex				
Male	9 (17.6)	9 (24.3)	0 (0.0)	.042
Female	42 (82.4)	28 (75.7)	14 (100.0)	
Age groups				
50-64 years	15 (30.6)	10 (27.8)	5 (38.5)	
65-74 years	17 (34.7)	15 (41.7)	2 (15.4)	.231
75+ years	17 (34.7)	11 (30.6)	6 (46.2)	
Mean (SD)	*70.3 (9.81)*	70.1 (9.14)	*70.8 (11.87)*	.832
Ethnicity of Origin				
Chinese	1 (2.0)	1 (2.7)	0 (0.0)	
South American	7 (13.7)	6 (16.2)	1 (7.1)	
Caribbean	3 (5.9)	3 (8.1)	0 (0.0)	.384
European	24 (47.1)	14 (37.8)	10 (71.4)	
South Asian	0 (0.0)	0 (0.0)	0 (0.0)	
Canadian	12 (23.5)	10 (27.0)	2 (14.3)	
Other	4 (27.7)	3 (8.1)	1 (7.1)	
Education:				
< High School	14 (28.6)	8 (23.5)	6 (40.0)	.498
High School	20 (40.8)	15 (44.1)	5 (33.3)	
> High School	15 (30.6)	11 (32.4)	4 (26.7)	
Smoking Status-Yes	1 (1.9)	0 (0.0)	1 (6.7)	.113
Drinking Status-Yes	19 (36.5)	16 (43.2)	3 (20.0)	.115
Marital Status				
Single	26 (52.0)	17 (48.6)	9 (60.0)	.549
Married	24 (48.0)	18 (51.4)	6 (40.0)	
Income				
<$14,000 per year	17 (40.5)	11 (36.7)	6 (50.0)	.693
$14,000-$30,000	18 (42.9)	14 (46.7)	4 (33.3)	
>$30,000	7 (16.7)	5 (16.7)	2 (16.7)	
Chronic Conditions				
Hypertension	26 (50.0)	19 (48.6)	7 (46.7)	.760
Arthritis	25 (48.1)	16 (43.2)	9 (60.0)	.273
Diabetes Mellitus	8 (15.4)	5 (13.5)	3 (20.0)	.557
Sleep Disturbance	13 (25.0)	10 (27.0)	3 (20.0)	.596
Depression	12 (23.1)	10 (27.0)	2 (13.3)	.288
Hearing Impairment	8 (15.4)	8 (21.6)	0 (0.0)	.050
Disorientation	1 (2.0)	0 (0.0)	1 (7.1)	.126
Heart Disease	1 (2.0)	1 (2.9)	0 (0.0)	.523
[a]COPD	4 (7.7)	3 (8.1)	1 (6.7)	.860
Tumour	4 (7.7)	2 (5.4)	2 (13.3)	.331
[b]Multi-Morbidity	36 (69.2)	27 (73.0)	9 (60.0)	.358
Walking Assistance	5 (9.6)	3 (8.1)	2 (13.3)	.563
[c]Weekly Physical Activity				
Needs improvement/fair	6 (12.5)	4 (11.5)	2 (15.4)	
Good	4 (8.3)	2 (5.7)	2 (15.4)	.079
Very good/excellent	38 (79.2)	29 (82.8)	9 (69.2)	
Mean (SD)	*7.4 (3.13)*	7.9 (3.13)	*6.0 (2.77)*	.059
[d]Previous Tai Chi	6 (11.5)	4 (10.8)	2 (13.3)	.008
[e]Social Support				
Mean (SD)	*5.1 (2.10)*	*5.0 (2.21)*	*5.2 (1.89)*	.760

[a]COPD: chronic obstructive lung disease
[b]Multi-morbidity: two or more chronic conditions
[c]Physical Activity: based on the Healthy Physical Activity Participation Questionnaire
[d]Previous Tai Chi: Previous Tai Chi participation more than one year
[e]Social Support based on 9 possible support sources
Note: Totals may vary due to missing responses

Post TC program testing:

In winter 2012 post testing commenced based on the first participants to enrol initially and testing was carried out on participants that subsequently reached the sixteen week mark. The project coordinator plus 2-3 research assistants facilitated both physical testing and questionnaires as was needed during this time period. Each participant that came for the final testing was given a 10 dollar gift certificate for a local grocery store and was allowed to continue participating in the TC program since classes were still ongoing. Because intake was done on a rolling basis and so post testing was done on a rolling basis detailed time records were kept to guarantee that each participant was tested at exactly the sixteen week mark so as to keep the TC participation timeline the same as the first and second cohort.

Post TC focus groups

Early spring 2012 was designated for the post focus group data collection and TC program participants that were both mid-to-high attenders and low attenders were asked to attend. The potential focus group participants were contacted 2-3 days prior and scheduled to meet at the Driftwood Community Center. There were 15 participants who attended and they were placed in two groups based on their attendance category. The project coordinator facilitated one of the focus groups and a senior research assistant facilitated the other focus group, the attendees were asked questions around variables relating to adherence to the TC program. The focus groups lasted 25 to 36 minutes and were recorded using digital recorders. At the end of the focus groups the participants were thanked and given a ten dollar gift certificate for a local grocery store.

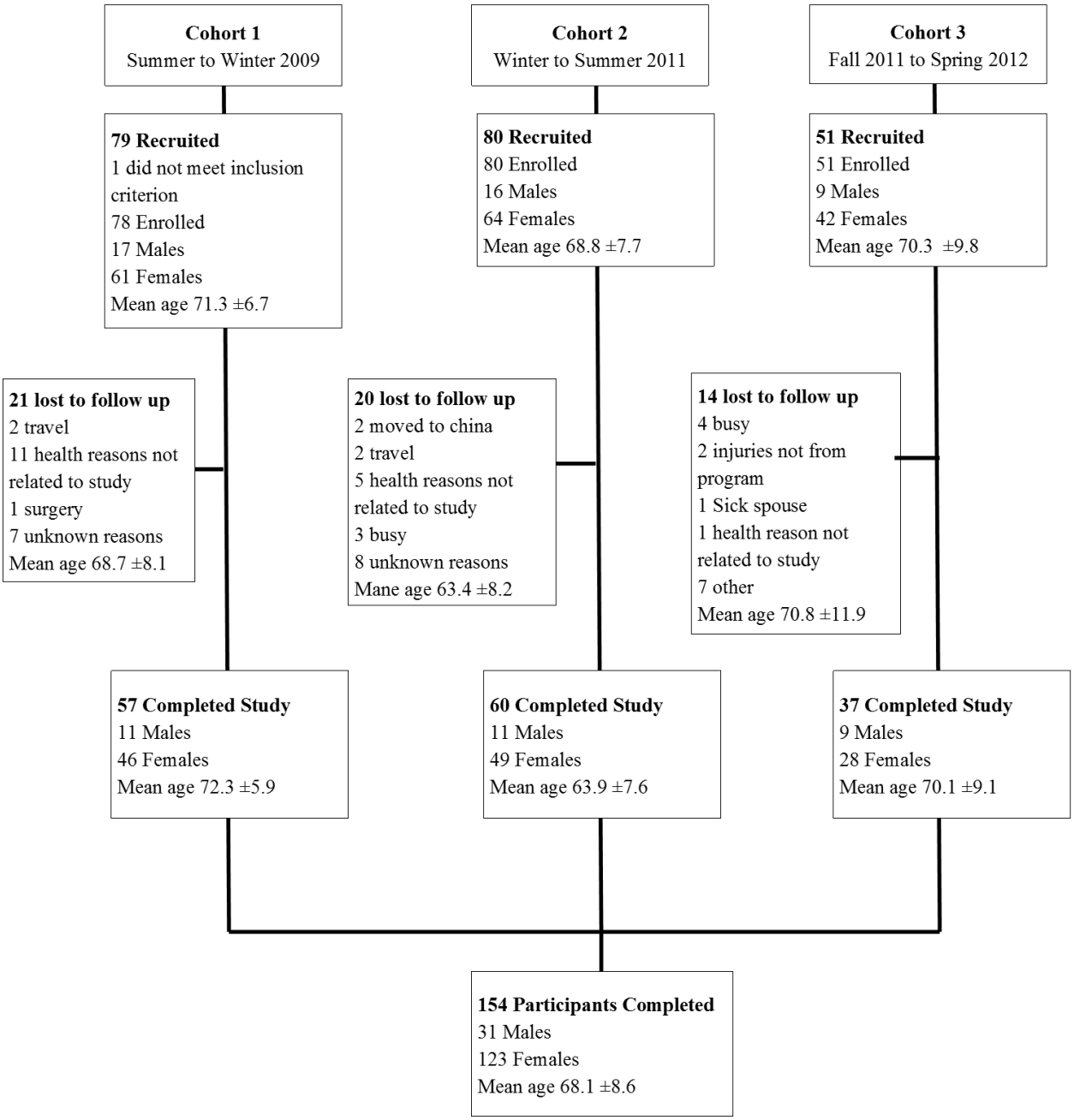
Cohort 3 lessons learned

Lessons continued to be learnt throughout the third cohort that were, for the most part, similar to the first two. Although the research assistants were highly skilled, patient and knowledgeable a few older adult participants voiced their preference that the age disparity between them and the research assistants ideally should not be that big.

The rolling intake was highly beneficial for both facilitating the possibility to increase participation but it also cut down labour expenses on any given testing point. It was therefore important to keep accurate and detailed records on a master document. The only down side was that the project coordinator and several research assistants had to dedicate more time to be available to lead and facilitate testing over a longer period.

Both the Driftwood Community Center and the John Booth Memorial Arena were great facilities and space and room availability was never an issue. However this third cohort did take place during the winter and there were some participants that were either taking public transit or being given a ride and when the weather was not good attendance was down. Luckily overall the winter of 2012 was mild and was on record as having one of the lowest snow falls. The TC master was a great teacher and taught exactly the same Qi Gong warm up and TC movements of the first two TC masters, because of his desire to get to the know the participants and vice versa, after the research project was over he volunteered to keep doing one class a week at Driftwood Community Center. Cohort 3 can be seen in Figure 1 Flowchart showing recruited, lost to follow up and completed study.

Figure 1 Flowchart of Study



Overall Lessons Learned

As was mentioned earlier, research in the community can be a challenge due to multiple variables that are a challenge to control. These variables can be the variety and needs of the participants themselves as well as the environment, the general population health and the built

environment that the research programs take place within. The first cohort taught very strong lesson around pre and post testing and even with the best organization and research assistant labour force there can be challenges with weather that can have a mitigating effect on pre and post results. The rolling intake and similar post collection was a major solution for this and did, in fact, cut down on labour and the challenge of scheduling everything on one day. However it did increase the length of the program and put more pressure and labour demands on the project coordinator and research assistants.

As well, since there are a variety of participants with individual needs and motivators it is important to have enough classes to attempt to accommodate as many as possible. In this research project we were able to afford to offer seven classes a week for sixteen weeks but, unfortunately, in the reality of regular community based programming this would potentially not be achievable. As much as society thinks that older adults have time on their hands they do have obligations such as multiple health appointments and family responsibilities and commitments and so in our research program we attempted to be sensitive to this and schedule accordingly.

When doing research in the community there needs to be an understanding that the subjects are not always available, open to or even enjoy participating in lengthy pre and post focus groups or time consuming questionnaires and physical tests pre and post research program testing. It is important to understand and be sensitive to the needs, education, language and attention spans of the participants and to program accordingly. Connected to this are also the use of translators and making sure that all questions that are asked in different languages are capturing data consistently.

During the third cohort we discovered that the TC instructor had to be away for several classes, as it turned out he was able to supply a substitute teacher however, in retrospect, this could have been a problem for not only this cohort but the other cohorts if a substitute had not been arranged

earlier. Having one or more substitute back up instructors throughout the study, in hindsight, would have been well advised to potentially prepare for situations like this and to assure that the research was not interrupted.

In the end we were very lucky that we were able to locate three TC instructors that were able to deliver very similar TC programs at all locations. However we acknowledge that one TC instructor would probably not been able to do all three cohorts. The second cohort in the heart of Dundas-Spadina was uniquely suited to facilitate that cohort by nature of his positively known reputation in the community and that he spoke Mandarin, Cantonese, Fijian and English.

MANUSCRIPT 1

Barriers and Promoters for Enrollment to a Community based Tai Chi Program for Older, Low-Income, and Ethnically Diverse Adults

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Abstract

Background: Low-income, ethnically diverse, older adults may be at greater health risk owing to their lower activity levels and potential cultural barriers to physical activity (PA) programs. To explore the specific barriers and promoters to enrollment in a 16-week Tai Chi (TC) program we interviewed 87 lower socioeconomic older adults age 50 years and older from multiple ethnic backgrounds before the initiation of a TC program.

Methods: Semi-structured qualitative focus group interviews were conducted with questions focused on themes of barriers and promoters to enrollment that might or might not be culturally or gender related.

Results and Conclusion: Important issues emerged that covered six categories and with no clear barriers or promoters that related to gender or specific cultural limitations. Categories included physical and mental health, time of day, socialization, program pairing, accessibility and appropriate leadership/teacher. This information may have value for tailoring future PA programming in the community that could lead to improved health outcomes through better enrollment and subsequent increased participation in PA and exercise.

Introduction

Currently, physical activity (PA) is the only intervention that consistently demonstrates the slowing of age-related declines in physical function (Buford et al., 2014). Habitual PA has multiple health risk reducing dimensions that include positive influences on obesity, stroke, high blood pressure, and type 2 diabetes (Australian Institute of Health and Welfare, 2010; Gillespie et al., 2009). In Canada the major multiple health risks are heart disease, cancer, stroke, respiratory disease and diabetes, and are the leading causes of death in the general population (Health Canada, 2008). In a report by Statistics Canada in 2012, Canadian adults aged 50 or older rarely made positive changes in lifestyle behaviours after being diagnosed with these and other chronic conditions with only modest changes in behaviour relating to diabetes alone (Newson et al., 2012). Not only does the aging population suffer from increased chronic conditions but they also have increased functional limitations brought on either by these chronic conditions or from the negative influences of physical inactivity, or a combination of both (Wrosch et al., 2007). Regular PA can be used as a treatment or management strategy for chronic conditions as well as increasing an older adult's independence (Cress et al., 2005). Unfortunately consistent evidence has shown that older adults are the least physically active groups in the Canadian and U.S. populations (Craig et al., 2004; Hallal et al., 2012).

Although the importance of PA programs are acknowledged, health promoters are challenged to recruit older adults into PA programs (Hildebrand & Neufeld, 2009). This highlights the need for research on recruitment and enrollment of community-dwelling older adults into PA programs. Previous research has examined approaches that looked at recruitment strategies for two American older adult activity programs (Active Living Every Day program (ALED)) (Dunn et al., 1999) and the naturally occurring retirement community (NORC) (Callahan & Lanspery, 1997)). To understand what worked and did not work, with respect to

recruitment, data was collected using semi-structured interviews to examine the successful elements of recruitment (Hildebrand and Neufeld, 2009). Since it is apparent that there exist means and opportunities for Canadians and specifically older adults to become more physically active, the question becomes how to best get these "at risk or vulnerable" populations into activity programs. As shown in the Hildebrand and Neufeld study one potential pathway is by collecting and analyzing information directly from older adults themselves by examining barriers and promoters to enrollment in PA programs through semi-structured focus groups. The researchers classified the influential factors that could affect enrollment into the following three categories; person-based variables, environmental factors, and intervention factors (King et al., 1992). Person-based variables included individual characteristics such as age, lifestyle, physical and mental health, and attitudes and beliefs (Mills et al., 1996). Environmental factors included the setting in which the program occurs, as well as interpersonal factors, such as the support and encouragement of family, friends, and physicians (Dishman, Sallies, & Ornstein, 1985). Intervention factors included program components (targeted behaviours, program aims and length of program), recruitment strategies (content, credibility, and means of conveying recruitment message) and exclusion criteria (Mills et al., 1996).

Tai Chi (TC) has been shown to be a successful PA tool for reduction in falls and improvements in health-related cardiovascular and musculoskeletal fitness, arthritis and psychosocial behavior (Taylor-Piliae, 2004). In TC, the body is comfortably moved and relaxed, the mind is focused on the moment, and body movements are slow, smooth, and well-coordinated as the various forms are undertaken (Hong & Xian, 2009). TC exercise has the ability to produce balanced movements between natural physical and metabolic processes in the body in a slow, meditative, and relaxed way. These sequential graceful movements emphasize the smooth integration of trunk rotation, weight shifting, and coordination, along with a

progressive narrowing of one's stance or base of support. As powerful as TC is, it is important to emphasize the social benefits as part of the PA participation structure that helps keep the mind engaged, as well as evidence that being physically active with people of similar age, ability and outlook highly influences the social rewards that are a significant influence on adherence to long-term practice (Chen et al. 2001). Physically, TC is highly appropriate for an aging population since it can be practiced by participants with one or more chronic conditions due to its appropriate intensity, steady rhythm and low physical and mental demands. Moreover, it specifically influences balance and motor control, variables that might reduce falls in this more vulnerable population (Li et al. 2007). To date, there has been no research around promoters and barriers to enrollment to TC programs in Canada.

The goal of the present study was to examine the barriers to, and promoters of, enrollment to a community-based TC program in older ethnically diverse low-income adults. The findings from this research have the potential to elucidate the facilitators and challenges this vulnerable population has with respect to enrolling in PA programs within their community. This knowledge could be used to better design community-based PA programs to help facilitate stronger registration and compliance/participation rates.

Methods

Participants

Eligible participants were 50 years or older and were community members of various ethnicities in two locations in the Greater Toronto Area of Ontario, Canada, Jane-Finch as well as Dundas-Spadina area. These two locations were chosen for their multiple ethnic groups and their low socioeconomic status (SES) with both the Dundas-Spadina and Jane-Finch areas having a population average income of about $26,771.00 (Social Planning Toronto 2009) with low

income defined through low income cut-offs (LICOs) where a family has to spend 20 percent or more of its income on food, shelter and clothing than the average family (Statistics Canada 2010). Dundas and Spadina was specifically targeted since it is an area that is particularly dense in adults of Chinese origin (a purposeful decision to explore influences of ethnic origin affiliations with TC) as well as being socio-economically similar to the Jane-Finch community (Profile of Low Income in the City of Toronto 2010). The research goal was to have three cohorts for the TC program from 2010 to 2012 with two focus groups (one male and one female) facilitated two to three months before each TC program. Participants were recruited from community hubs such as grocery stores, shopping malls, community groups, living complexes and through word of mouth. These recruited older adults were asked to participate in the previously mentioned timeline before the TC program was to initiate with two focus groups per cohort, one male and one female. In total 87 participants took part in six focus groups (61.0% female: N=53) and ranged in age from 50 to 84 years.

Materials and Measures

Participants were briefed on the study and were informed that they would be asked a series of questions that they could answer freely and honestly based on their likes and dislikes with respect to enrolling in the TC program. The questions explored were:

1. What are some of the key promoters that you see for enrolling in a TC program?
    a. Possible probes used were physical and mental activity, improvement of physical and mental status, social networking, enjoyment, current knowledge of TC.
2. What are some of the key challenges that you see for enrolling in a TC program?

a. Possible probes used were day/time of session, number of sessions per week, location of program, language, gender, age range, transportation, lack of knowledge of TC or past history with TC, current health status and weather conditions.

A digital voice recorder was used to record each focus group and these recordings were subsequently transcribed verbatim. The experimental protocol conformed to the standards set by the Declaration of Helsinki and is approved by the Research Ethics Board at York University.

Focus Groups

Six focus groups were conducted and each group was made up of 7 or more participants with the goal of equal numbers between males and females (Table 1). Participants were contacted by phone or in person and asked to participate 3 days prior to the scheduled focus group session.

The first author worked with three research assistants to facilitate the focus groups. Attendees seated themselves around two digital voice recorders, which were stationary on a table or chair. Participants were read each question, with probes when needed, and were allowed to answer freely as well as discuss their perceptions among themselves. The duration of each focus group session was 45 minutes to 60 minutes. Focus groups were conducted at or close to the locations of the proposed TC program. Focus group participants were provided snacks and beverages after focus group participation and were given a ten dollar gift card for a local grocery store as a thank you for participating. The focus groups held at the Spadina and Dundas location were provided with a translator that spoke both Mandarin and Cantonese for any participants who did not speak English. Discussions ended with the opportunity for participants to make final comments before the recorders were switched off.

Analysis

All focus group data was transcribed and participants were designated with unique gender identifiers (i.e. F-1 for female 1, M-1 for male 1, etc.). Transcripts were analysed based on multiple readings of the focus groups; broad themes/categories were established for the responses using Microsoft excel software. In accordance with hierarchical content analysis outlined by Côté and colleagues (Côté, Salmela, Baria & Russell, 1993; Côté, Salmela & Russell, 1995), "meaning units" were identified from comments and quotes. From these meaning units, similarities were identified and grouped into "categories" of similar meaning units with common features such as repetitive words and phrases (Côté et al., 1993; Tesch, 1990). Six different documents were created (3 female and 3 male) from which categories with similar meaning units were grouped together. This approach to qualitative analysis is often referred to as the constant comparative method (Glaser & Strauss, 1967), and uses a technique of contrasting the data until saturation is achieved. Saturation refers to the process of defining encompassing categories at a level that demonstrates no new concepts from the data.

The data was analysed via the use of guidelines that, although systematic, are endowed with maximum flexibility. In the first stage quotes from the transcripts were initially coded into thematic clusters. Table 2 demonstrates the themes identified which were promoters and barriers to enrollment, relating to the specific categories and subcategories. All categories identified at all three stages of analysis were checked by a second coder to ensure they were grounded in the data.

Trustworthiness

Interpreter reliability was established through the categorization of a random sample of participants' response (approximately 10% of meaning units) by an individual familiar with this method of qualitative analysis. There was complete agreement in the categorization of the data.

Results and Discussion

Baseline socio-demographic characteristics of the pre-study focus group participants can be seen in Table 1. The majority of the participants were female (53) with almost 80% of focus group members being 65 years of age or older and of mixed ethnicity that is not culturally connected to TC. Most of the participants had a high school education or less, were single and had an income of 14,000 dollars or less. Within the two broad themes (Promoters and Barriers to Enrollment to a TC program), six categories of clustered meaning unites emerged (Table 2). There were minimal differences found between males and females in these themes and no differences between cohort groups with no perceived ethno-cultural barriers to enrollment. These categories and themes are described in further detail with quotations from participants.

Promoters to Enrollment

Health Improvement: Although a health focus priority is pervasive throughout society, it becomes an even higher priority in populations that can see a personal decline in their health status, such as older adults. Older adults embrace physical, functional, psychological and social health in their definition of successful aging (Phelan et al., 2004). In our focus groups several participants mentioned multiple times that, even though they had minimal knowledge of TC, they perceived TC as good PA to improve their health and, as such, it was a draw for enrollment. Many statements reflected this such as, "….we know it is good for health, seniors become more flexible" (M-19), and "to strengthen the body, to help regulate it….health" (F-22), as well as,

"good for seniors health condition because the actions/practices are slow" (M-20). However the focus was not just on physical health improvement but on mental/emotional health improvement as well. This was shown by such phrases as, "we will be more optimistic and open-minded [from participating]" (F-23), and "health mentally is maintained [with exercise]" (M-15). Research has shown that health status was consistently a significant individual facilitator to PA participation since people understand the need to exercise to improve health (or not exercise because health was too poor) (Boehm et al., 2013). It is therefore important to not only have PA programs that demonstrate evidence-based health improvement but health improvement when participants are already dealing with chronic conditions. This information then needs to be clearly presented to potential PA program participants to facilitate enrollment. In a 2004 study, older adult participants frequently mentioned both health and social benefits as motivating factors for being physically active (Belza et al., 2004). Several times during the focus groups participants mentioned that they had heard that TC was appropriate for older adults and thus they were motivated to enrol. This can be seen in such statements as, "[TC] is used in retirement and good for health" (M-23) and "have heard Tai Chi is good for [seniors] blood pressure" (M-25).

Time of Day: Of equal importance to health, in our focus groups, was time of day. When exploring this area many focus group participants were not shy in voicing what time worked for them. Some research has shown that PA programs can be inaccessible due to older adults' schedules around self-care, volunteer work and family obligations (Hildebrand and Neufeld, 2009). There were multiple motivators around time of day and possible enrollment with respect to our focus group participants reflected in such statements as, "afternoons good, can come with wife" (M24), and, "do not want noon, time to eat" (F-21). There were also time of day motivators specifically relating to older adults, "a lot of older people don't sleep very well, so not too early" (F-31) and since many older adults take public transit they need to factor

this into their schedule reflected by the statement, "……and then the subway then another bus to get here….." (F-34). As well many participants in our focus groups acted as support systems for their children and grandchildren so their decisions around times were influenced by their family commitments. Such commitments and time choices were reflected in the statements, "not as good in morning since grandkids sleeping" (F-25), and "[if in same building as kids program]….when the kids settled, then they can do it [Tai Chi]. (F-28). So with multiple desire for times and various reasons for timing this potentially demonstrates the importance, where possible, for older adult programs to be offered throughout the week at different times. Paralleling our results, previous research in older adult activity patterns has shown that PA was strongest during the day, especially mid to late morning, with much less activity in the evenings (Davis and Fox 2007).

Socializing/Networking: Although we found minimal differences between males and females in our categories, the socializing/networking category had a slightly higher female focus compared to males. Current research knowledge has shown that the social environment is one of the elements that influences the "determinants of health" (WHO 2014). Research has shown that social participation for older adults is part of a productive and healthy aging paradigm and social support system facilitated through friends and family, and therefore has a strong protective effect on healthy aging (BC Ministry of Health, 2014). Multiple participants in our focus groups mentioned the draw to participate through social interaction. Even though many mentioned the social aspects there were different motivators for them socially, with one participant stating simply, "OK to do classes with the men" (F-22), while another woman stated, "I would like the men to participate, to get these men out and exercising" (F-10). Some participants just liked the basic social aspect stated as, "also to socialize as well" (F-26) and "group activity can be a great draw especially if alone" (M-30). However it was interesting to note that many participants felt

the desire to enroll to have people support them as seen in such statements as, "people looking out for you and asking where you were" (M-31) and "just knowing people will miss you" (F-28) and some participants were motivated by potential follow up if they missed class in such statements as, "checking in on you, to make sure you are OK" (F-32) and "things like get well cards, or missed you cards [when they are absent]" (F-31). Making programs highly interactive has been shown to be a strong variable for recruitment and retention for PA interventions and shows the strong force that social needs can have on enrollment (Robinson et al., 2003; Beech et al., 2003). Although social motivation has long been recognized as a draw to participation from our focus groups, there could be multiple levels at work within this social arena. Some research has focused on different levels of social support, be it from family and friends all the way to program leadership (Bunn et al., 2008), and so it is important, when looking at proven enrollment variables, to leverage as many of these variables as possible.

Other Program Pairing: As seen in the promoter influence around "time of day", older adults sometimes are limited due to schedules around self-care, volunteer work and family obligations (Hildebrand and Neufeld, 2009). These multiple scheduling variables influence older adults to desire more efficiency with their scheduling by looking at enrolling in programs that are paired with other programs. Our focus groups uncovered different pairings that related to the different needs and obligations that some older adults have. Some participants wanted to pair activities relating to their grandchildren as can be seen in the statements, "Because our [children's] program starts at 1…So we think 1:30 [for Tai Chi] when we settle the kids, then we can do it." (F-22). Also, "if you want to leave them [children] alone, you have to have the kids program on" (F-23). Other potential participants had other programs at locations where the TC program could potentially take place. They articulated how it would be easier for them to attend for multiple programs demonstrated by, "Monday mornings good because right after is another

program, bingo" (F-29) and "we can also have another class Friday right after another function" (F-30) also, "[we] are already here so good time for another [TC] class" (F-31). Evidence shows that one important variable, among several, is convenience (Gavin & Myers, 2003) demonstrating the need for easier pathways for activity accessibility. Older adults living independently have been shown to be successfully recruited to PA programs through partnerships with neighborhood organizations, that although are not exactly pairing, demonstrate that other programs (participator or informative) are facilitators to enrollment (Hildebrand & Neufeld, 2009). When examining research focused around enrollment/recruitment there can be seen a pattern of partnerships that have been associated with successful campaigns showing the importance of pairing, be it programs within participator centers or through community partnerships (Carroll et al., 2011).

Barriers to Enrollment

Accessibility (Travel and Weather): Although older adults may have challenges around having enough PA programs to address their needs, it is important to address access to these programs. Many of the participants in our focus groups articulated their desire to attend but were faced with the realities of big city living combined with Canadian weather patterns. Weather challenges were shown in statements such as, "Will come in bad weather, but too much snow though cannot walk" (F-23) and direct statements such as, "storms can be a barrier" (F-25) and "heavy snow a barrier, we cannot come here" (F-26). Even when highly motivated the reality of the weather was always there in this statement, "Weather not a problem when living close, although the very cold weather can be difficult" (M-22) and "summer, spring and fall more accessible" (M-28). Canadian research has shown that walking challenges due to the environment can be a barrier to both active transport and PA participation (Locket et al., 2005). However, our focus groups also uncovered barriers to enrollment through transportation

limitations relating to time and walking versus public transportation. One potential participant stated, “A 30 minute walk is [my] limit” (F-22) and, “[I can come if I] do not have to make another trip” (M-27) and echoing the 30 minute limitation was, “[can come if] locations not too far” (F-29). Neighbourhoods that have shown limitations to active transport have demonstrated poorer older adult health outcomes, be it through the loss of active transport health effects or walking limitations to programs (King et al., 2011).

Teacher/Leadership Appropriateness: Since the proposed TC program was aimed at community-dwelling older adults, there was a higher percentage of focus group attendees that had historically attended other PA programs. Through this experience some of the focus group participants understood exactly what they liked in a teacher or PA group leader. They knew what qualities would make it more attractive to enroll and those qualities that they felt were a barrier for enrollment. Such basic statements as, “also hard to find a [good] teacher” (F-24) and “communicate clearly with participants important” (M-22) to more precise statements as “the [Tai Chi] masters have to be very organized because the students may not follow it [Tai Chi] (M-23) and “[Tai Chi] needs to be accessible both through facility and through teacher” (M-25). However there were also qualities that participants mentioned that were not directly related to teaching such as, “good connection with leader of the group [important]” (F-28) and one participant stated that they need to “like the instructor” as well. Relating to older adults was also a strong focus that could be a potential barrier to enrollment reflected in statements like, “instructors need to relate and vice versa” (F-29) and “sometimes young [age of instructor] is a barrier” (F-30). One participant was very clear in her desire to have an instructor that knows “what it feels like to be in an aging body” and also made the observation of a past instructor that “was injured and older, in pain, and participants knew that the instructor could relate to them” (F-28). Evidence reinforces the fact that it is important to have well-trained, matched and

tailored leadership specifically around recruitment as well as retention (Carroll et al., 2011). In a study done by Hildebrand and Neufeld (2009) participants articulated that one of the variables that made enrollment more attractive was trust in both the program organizations and the staff running those programs. This same study concluded the importance in enrolling and retaining participants by not running a "one-size-fits-all" recruitment approach and it was important to understand variables that have proven to work for adults under 50 years of age that might not work for older adults (Hildebrand and Neufeld, 2009).

Conclusion

In our focus group investigations we discovered six categories and no specific barriers or promoters that related to gender and specific cultural limitations. Categories included physical and mental health, time of day, socialization, program pairing, accessibility and appropriate leadership/teacher. The strengths of this study are anchored in the fact that there was a large number of participants that allowed issues to be examined in detail and depth. The focus groups had semi structured interview questions that were not restricted to yes or no responses or Likert scales and the participants had the freedom to elaborate on their answers and statements. As well the categories that were examined in this study were based on data of the participants' own meanings. Limitations with this study were also present and although the focus group facilitators took every precaution not to influence the participants some biases from the facilitators could have had an influential effect. The results from this study may also may have some limitations to generalizability to other subjects and settings.

Although it is important for PA programs to focus on optimal methodology and adherence, it is equally important to focus on enrollment. In this period of increasing costs and lower funding it is important to attract and enrol optimal numbers of participants to community PA programs. The target population for any study is a source of great knowledge with respect to

key variables that can facilitate an optimal enrollment process. The study focus groups in this paper were highly beneficial with respect to informing and advising the important variables to focus on so as to achieve the highest enrollment numbers possible. These focus groups illuminated four categories around enrollment promotion and two categories around barriers to enrollment. Health improvement, time of day, opportunities for social engagement/networking and program pairing were the promoters to enrollment and accessibility relating to weather and travel and appropriate leader/teacher were the barriers to enrollment. These should be taken into consideration when designing PA groups for older adults.

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Table 1: Baseline Socio-Demographic Characteristics of Pre Study Focus Group Participants

	Overall Focus Groups N (%)	Focus Group 1 N (%)	Focus Group 2 N (%)	Focus Group 3 N (%)
Totals	**87 (100.0)**	**39 (44.8)**	**16 (18.4)**	**32 (36.8)**
Sex				
Male	34 (39.1)	18 (46.1)	7 (43.8)	9 (17.6)
Female	53 (60.9)	21 (53.8)	9 (56.2)	23 (82.4)
Age groups				
50-64 years	18 (20.7)	13 (33.4)	0 (00.0)	5 (15.6)
65-74 years	35 (40.2)	19 (48.7)	2 (12.5)	14 (43.7)
75+ years	34 (39.1)	7 (17.9)	14 (87.5)	13 (40.7)
Ethnicity of Origin				
Chinese	16 (18.4)	0 (0.0)	16 (100.0)	0 (0.0)
South American	37 (42.5)	31 (79.5)	0 (0.0)	6 (18.8)
Caribbean	3 (3.5)	0 (0.0)	0 (0.0)	3 (9.3)
European	22 (25.3)	0 (0.0)	0 (0.0)	22 (68.8)
South Asian	8 (9.2)	8 (20.5)	0 (0.0)	0 (0.0)
Other	1 (1.1)	0 (0.0)	0 (0.0)	1 (3.1)
Education:				
< High School	40 (45.9)	24 (61.6)	7 (43.7)	9 (28.1)
High School	32 (36.8)	12 (30.8)	7 (43.7)	13 (40.6)
> High School	15 (17.3)	3 (7.6)	2 (12.6)	10 (31.3)
Marital Status				
Single	51 (58.6)	30 (76.9)	5 (31.3)	16 (50.0)
Married	36 (41.4)	9 (23.1)	11 (68.7)	16 (50.0)
Income				
<$14,000 per year	59 (67.9)	35 (89.7)	11 (68.8)	13 (40.6)
$14,000-$30,000	20 (22.9)	3 (7.7)	3 (18.8)	14 (43.8)
>$30,000	8 (9.2)	1 (2.6)	2 (12.4)	5 (15.6)

Table 2. Themes, Categories, and Subcategories to Enrollment resulting from the qualitative analysis

Themes	Categories	Subcategories
Promoters to Enrollment	Health Improvement	Heart disease/health issues (16), TC Good physical activity (92), TC good for older adults (2), TC benefits: fitness (12), mental health (14)
	Time of Day	Time of day important (92)
	Socializing and Networking	Outreach (7), Communication (5), Socializing and Networking (22)
	Other Program Pairing	Pairing with other programs (11)
Barriers to Enrollment	Accessibility: Travel, Weather & Facility	Accessibility (24), weather issues (19)
	Teacher Appropriateness	Learn fundamentals (2), Teacher importance (7), Teacher issue (9)

MANUSCRIPT 2:

Effect of Tai Chi on Musculoskeletal Health-Related Fitness and Self-Reported Physical Health Changes in Low-Income, Multiple Ethnicity, Mid-to-Older Adults

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Abstract

Background: Tai Chi (TC) has proven to be effective at improving musculoskeletal fitness by increasing upper and lower body strength, low back flexibility and overall physical health. The objectives of this study were to examine changes in musculoskeletal health-related fitness and self-reported physical health after a 16-week TC program in a low-income, multiple ethnicity mid-to-older adult population.

Methods: Two hundred and nine ethnically diverse mid-to-older community-dwelling Canadian adults residing in low-income neighbourhoods were enrolled in a 16-week Yang style TC program. Body Mass Index and select musculoskeletal fitness measures including upper and lower body strength, low back flexibility and self-reported physical health measured by SF 36 were collected pre and post the TC program. Determinants of health such as age, sex, marital status, education, income, ethnicity of origin, multi-morbidity conditions, weekly physical activity, previous TC experience as well as program adherence were examined as possible musculoskeletal health-related fitness change predictors.

Results: Using paired sample t-tests significant improvements were found in both upper and lower body strength, low back flexibility, and the SF 36 physical health scores ($p < 0.05$). Based on multiple linear regression analyses, no common health determinants explained a significant portion of the variation in percent changes of the musculoskeletal fitness and SF 36 measures.

Conclusion: These results reveal that TC has the potential of having a beneficial influence on musculoskeletal health-related fitness and self-reported physical health in a mid-to-older low socioeconomic, ethnically diverse sample.

Background

As the Canadian population both ages and increases in number musculoskeletal health-related fitness maintenance concerns become a higher priority. Physical activity (PA) has been shown to be effective in the prevention and management of cardiovascular disease, stroke, hypertension, breast cancer, colon cancer, type 2 diabetes and osteoporosis (Warburton et al., 2010). Since many older adults must deal with multiple chronic health conditions that may place them close to important thresholds of physical ability that straddles the line between independence and dependence (Paterson & Warburton, 2010), it is important to research and implement appropriate community-based activity programs. Adding further layers to this challenge are health-related fitness concerns that are unique to specific populations. Data has consistently shown low socioeconomic status (SES), ethnic minorities and new immigrants have lower activity levels than White or non-immigrant groups (Dawson, Sundquist & Johannson, 2005), as well as living in poorer social environments that add to the barriers of activity overall (Marshall et al., 2007).

Tai Chi (TC) has been shown to be a successful program for reduction in falls, health-related cardiovascular and musculoskeletal fitness, arthritis and psychosocial behavior (Taylor-Piliae, 2004). In TC, the body is comfortably moved and relaxed, the mind is focused on the moment, and body movements are slow, smooth, and well-coordinated as the various forms are undertaken (Hong, 2007). TC exercise has the ability to produce balanced movements between natural physical and metabolic processes in the body in a slow, meditative, and relaxed way. These sequential graceful movements emphasize the smooth integration of trunk rotation, weight shifting, and coordination, along with a progressive narrowing of one's stance or base of support. The intensity of TC is moderate and approximately equivalent to a walking speed of 3.7 mph

(Zhou 1984). As powerful as TC is as a good, low-intensity exercise, it is important to emphasize the social benefits as part of the participation structure that helps keep the mind engaged. Combined with this, evidence has demonstrated that being active with people of similar age, ability and outlook highly influences the social rewards that are a significant factor for adherence to long-term practice (Chen, Synder & Krichbaum 2001). Physically TC is highly appropriate for an aging population since it can be practiced by participants with one or more chronic conditions due to its low intensity, steady rhythm and low physical and mental demands but it can also specifically influence balance and motor control to reduce falls in this at risk aging population group (Li, Cheri & Oteghen 2007).

Although several studies to date have reported musculoskeletal health-related fitness benefits for mid-to-older adults who practice TC (community living and institutionalized) (Lin et al., 2006), they have not specifically focused on low socioeconomic status (SES) and ethnically diverse aging populations who could also benefit substantially from an inexpensive, low-impact PA program such as TC. Factors such as age, sex, marital status, among others, may individually or collectively influence these health-related musculoskeletal fitness outcomes (Konopack et al., 2008). The above notwithstanding, the goal with any PA modality is to improve overall health-related fitness. In this sense, the maintenance of adequate musculoskeletal fitness allows older adults to perform normal daily activities in a safe and independent fashion without undue fatigue or pain (Rikli & Jones, 1997).

The primary objective of the current study was to examine the effect of a 16-week TC program on musculoskeletal health-related fitness and self-reported physical health changes in a sample of low SES, ethnically-diverse mid-to-older community dwelling Canadian adults. As a secondary objective we aimed to identify factors related to overall changes in musculoskeletal health-related fitness and SF 36 physical health improvement.

Methods

The study targeted community-dwelling mid-to-older adults of various ethnicities of origin in two locations in the Greater Toronto Area of Ontario, Canada-Jane and Finch as well as Dundas and Spadina. These two locations were chosen for their diversity of ethnic groups represented and their low SES. The city of Toronto has specific areas that have a significant proportion of socially and economically vulnerable population groups, the two areas chosen for this study were almost identical in low income rates (Profile of Low Income in the City of Toronto 2010). The Dundas and Spadina and Jane and Finch area have a population average income of about $26,771.00 (Social Planning Toronto 2009). Ethnic or visible minorities in Canada are defined as persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in color (Canadian Census 2001). The Jane-Finch community is ethnically diverse and has approximately 86,000 immigrants where 63% of the total population is a visible minority (Statistics Canada 2006). Poverty and various forms of discrimination, including racism, have been identified as negatively affecting the quality of life of the community's families, and as significant risk factors for poor physical and mental health (United Way Toronto 2011). Moreover, the SES of the Jane-Finch population is modest compared to many other areas of Toronto and Ontario as a whole (Profile of Low Income in the City of Toronto 2010). Dundas and Spadina was a logical choice since it is an area that is particularly dense in adults of Chinese origin (a purposeful decision to explore research questions of ethnic origin affiliations with TC) as well as being socio-economically similar to the Jane-Finch community (Profile of Low Income in the City of Toronto 2010). Almost 50% of Chinese Canadians live in Ontario, and the Dundas-Spadina area of Toronto, is identified as the center of one of the largest Chinese communities in North America (Statistics Canada 2007).

Eligibility for participation was limited to those individuals who were 50 years of age and older (male/female), residing in the target community, and who had the medical capability to be involved in a PA program. This capability was measured by Physical Activity Readiness Questionnaire (PAR-Q) which is a self-screening tool that if any participant answers yes to one of the seven health questions must be cleared by their doctor via the Physical Activity Readiness Medical Examination (PAR-Med-X) (Gledhill & Jamnik 2003).

To facilitate enrollment and to increase access to the TC programs, two focus groups (male/female) were conducted for each cohort to identify barriers and promoters to participation in a community-based TC program. The focus group attendees were recruited from the local community and key contacts from community housing agencies in the geographical area. Information attained from participants of these focus groups helped identify information dissemination strategies (and areas) in the Jane-Finch and Dundas-Spadina neighborhood for targeted recruitment. In addition to these strategies, further recruitment of study participants was achieved through networking and invitations from focus group participants. Three cohorts of participants were followed; cohorts 1 and 3 were recruited from the Jane and Finch area and were followed from August through December 2009, and from October 2011 through April 2012 respectively. Participants for cohort 2 were recruited from the Dundas and Spadina area and were followed from February through August 2011. For cohort 1, participant recruitment was completed prior to commencement of the TC program whereas for cohorts 2 and 3, participants were enrolled on an ongoing basis, which accounts for the 6-month duration. All participants were exposed to 16 consecutive weeks of TC.

Program

For each of the three cohorts, a TC program was offered free of charge to the participants. The TC program consisted of 6-7 classes given throughout the week where participants were advised

to attend two classes per week for 16 consecutive weeks. Classes for cohort 1 took place at a Toronto Community Housing building whereas classes for cohorts 2 and 3 took place at local community centers in their respective area. A professional TC master facilitated the classes. Each class was 60 minutes long and consisted of 15 minutes of a Qigong warm up followed by 45 minutes of Yang style TC. A research assistant monitored participation in the TC classes so that exact attendance could be recorded.

Study variables

Socio-demographics and physical health-related fitness characteristics were collected at baseline and included information on sex, age, education, smoking/drinking status, marital status, income and chronic conditions. Weekly PA, based on the CPAFLA Healthy Physical Activity Participation that examines frequency, intensity and perceived fitness, and previous lifetime TC participation of more than one year, were also recorded (Gledhill & Jamnik 2003). Pre- and post-TC program musculoskeletal health-related fitness characteristic testing was conducted by qualified exercise personnel and were assessed pre- and post-TC program by employing a combination of the Canadian Physical Activity Fitness and Lifestyle Approach and the Senior Fitness Test (Rikli & Jones 1997; Gledhill & Jamnik 2003). These measures included anthropometrics (height and weight which was used to calculate body mass index), upper body (overall grip strength, arm curl test in 30 seconds), lower body (chair stand test in 30 seconds, timed 8-foot Up and Go test) and lower back flexibility measure (sit and reach). Height was measured using a wall mounted tape measure without footwear, standing erect, arms hanging by the sides with feet together, the heels and back in contact with the wall using a set square the measure was made to the nearest 0.5 cm. Weight was measured using a calibrated scale on a wooden surface with the participant wearing light clothing, the weight in kilograms was measured to the nearest 0.1 kg. Grip strength was taken using a dynamometer using each

individual hand allowing for two trials with the maximum of each combined together. The arm curl test in 30 seconds was done with the participant sitting on a chair with back straight and feet flat on the floor and the dominant side of the body close to the edge of the seat. For men the weight was 3.63 kg pounds and for women the weight was 2.27 kg and was held in the dominant hand, perpendicular to the floor with a handshake grip. Participants were allowed two repetitions without the weight to ensure proper form before the test of as many curls as possible in 30 seconds. The chair stand test in 30 seconds involved the participant siting in the middle of the chair with back straight, feet flat on the floor, arms crossed at the wrist and held against the chest. On the signal "go" the participant rose to a full stand, then returned to a fully seated position, the participant was allowed two stands to ensure proper form. The timed 8-foot Up and Go test had the participant sitting in a chair that was placed against a wall and facing a cone marker exactly 8 feet away, on the signal "go" the participant got up from the chair, walked as quickly as possible around either side of the cone and sat back down in the chair. The participant was allowed one test practice and then two test trials. The sit and reach test involved a small warm up of a modified hurdle stretch held for 20 seconds for each leg before they placed their feet, without shoes, against the flexometer. The participants were coached to reach forward along the flexometer ruler while breathing out and extending their arms, palms down to a comfortable limit that was held for two seconds. This test was repeated twice. The SF 36 scales of physical functioning, role-physical, bodily pain and general health were assessed pre- and post-TC program were used to provide an overall summary measure of self-reported physical health (Brazier et al., 1992).

Statistical analysis

Differences in baseline socio-demographic, physical health related characteristics, musculoskeletal health and SF 36 physical scales among participants by cohort was performed

using chi square tests and a one-way ANOVA. To compare the health-related musculoskeletal fitness measures and SF 36 physical scales for the pre versus post TC program values pair samples t-tests were performed for both the individual cohorts and the combined cohorts, effect size was determined using a Cohen's D calculation. To examine the determinants of health predictors of changes for these outcomes, a multivariate linear regression model was performed for each of the health-related musculoskeletal fitness dependent variables and the overall summary measure of the SF 36 scales. For each of the regression models the dependent variable was the percent change (calculated as the post minus the pre score divided by the pre score and multiplied by 100) and the independent variables included age, sex, marital status, education, income, ethnicity of origin (defined by Chinese versus non-Chinese origin), attendance, previous TC experience, weekly PA and multi-morbidity influences. Standardized beta coefficients and R^2 were reported. Significance was set at an alpha of 0.05. The study was approved by the human participants' ethics review committee of York University.

Results

A total of 209 participants were recruited for this study (78, 80, and 51 for cohorts 1, 2, and 3 respectively). Figure 1 shows the study flow, recruitment, enrollment and loss to follow-up. Of the 209 overall sample recruited, 56 (26.7%) did not complete the study and were lost to follow-up. Reasons for loss to follow-up included health reasons not related to the TC program, travel, busy or inaccessible for post TC program data collection and unknown reasons.

Table 1 and 2 summarize the socio-demographic characteristics, physical characteristics, health-related musculoskeletal fitness characteristics and SF 36 physical scales of the 209 study participants. There were initially 79.9% female and 20.1% male participants and the overall mean age of the participants at enrollment was 68.1 years (range 50-87 years). The ethnicity of

origin of participants included China (36.1%), South America (26.3%), Caribbean (6.3%), Europe (16.1%), South Asia (4.9%), Canada (6.2%) and other (3.9%).

Several differences existed between cohorts notably with cohort 2 having a lower mean age of 63.8 years of age. Cohort 3 also had a higher prevalence of (greater than high school) education (30.4%), whereas cohort 2 had a higher percentage of married participants (64.9%). Finally, cohort 1 had the greatest proportion of lower income status (less than $14,000) participants (90.4%).

Baseline musculoskeletal fitness characteristics for the overall cohort can be seen in Table 2. Differences between musculoskeletal fitness characteristics between cohorts were also observed, cohort 1 having a lower upper body strength (overall grip strength 46.8 ±16.8 kg and arm curl test in 30 seconds 11.9 ±4.0). Cohort 1 also was below the other cohorts in lower body musculoskeletal strength (chair stand test in 30 seconds 10.0 ±3.1 and timed 8-foot Up and Go 8.8 ±4.2). As well in the SF 36 physical summary measure cohort 1 had a lower mean score of 46.9 ±8.8.

For the overall sample, mean attendance was 1.1 ±0.94 sessions per week with 0.9 ±0.72, 0.9 ±1.44, and 1.3 ±0.86 for cohorts 1, 2 and 3 respectively.

Table 3 summarizes the differences in effect size using Cohen's D for all outcomes. Participation in the 16-week TC program showed no significant change in body mass index measures, role physical and bodily pain. However, significant improvements were observed in musculoskeletal health measures of overall grip strength, arm curl in 30 seconds, chair stand in 30 seconds, 8-foot Up and Go test and sit and reach as well as physical functioning, general health, and the aggregate summary measure of physical health in the SF 36 ($p < 0.05$).

Table 4 shows results of the multivariate linear regression models. Overall, no common health determinants explained a significant portion of the variation in percent changes of the musculoskeletal health-related fitness and SF 36 physical health measure. Percent change in body mass index, overall grip strength, arm curl in 30 seconds, chair stand in 30 seconds and the 8-foot Up and Go test all showed a significant linear association ($p < 0.05$) with a limited number of predictors. The sit and reach test and the physical health summary measure showed no significant linear associations.

Discussion

This study examined the effect of a 16-week TC program on musculoskeletal health-related fitness changes and self-reported physical health in a community-based program with low income, mid-to-older adults from multiple ethnicities of origin. This study is the first TC study in Canada to look at a community-based program in this specific population. Results showed that a 16-week program aimed at 2 sessions per week participation has the potential for being beneficial on improving health-related musculoskeletal fitness and SF 36 measures where results could not be explained by traditional determinants of health. These benefits may be particularly valuable given that many participants' attendance averaged less than 2 sessions a week, yet still showed improvements in health-related musculoskeletal measures and self-perceived physical health.

Research in community based settings often deal with complexities of health challenges (as well as environmental challenges) that can influence the research goals and program practices (Minkler 2005). Factors such as geography, time of year, population density, population demographics plus cultural influences combine to create different and unique cohort influences. In this study multiple characteristics differed at baseline. Cohort 1 was based in a Toronto

Community Housing building with an onsite auditorium while cohort 2 and 3 were both based in community centers that needed some participants to use some form of transportation to attend. Cohort 2 in the Chinese community had a wider age range of participants that used the community center and were motivated to partake in multiple social programs throughout the day. Toronto can have a variety of weather that can also influence attendance to any community program. Cohort 1 occurred summer into fall, whereas cohort 2 took place between spring into summer and cohort 3 occurred fall into winter. However despite these influences, the TC program showed consistent improvements across all cohorts in both health-related musculoskeletal fitness and SF 36 summary physical health measures.

The ability of aging adults to maintain quality of life through activities of daily living is important in a country that has an ever increasing maturing population (Day, 2005). To enhance health and empower self-management in this area accessible PA is an important factor for creating and sustaining well-being at all ages and especially so in aging adults (Physical activity and older adults. World Health Organization, 2011). The basic body functions, such as strength, endurance, balance and flexibility in upper and lower extremities, are all important to maintain physical independence in older age (Langhammer & Stangehelle, 2011). Overall grip strength has been found to be a reliable tool for the predictor of mortality, disability, health complications and length of hospital stay (Bohannon 2008). Multiple TC studies have found an increase in overall hand-grip strength (Kim, So & Song, 2010) as did this present study. Similarly, evidence continues to build on the beneficial effects of musculoskeletal fitness in the prevention of chronic diseases and in combination with performance of activities of daily living (Wolf, 2006). Upper and lower body musculoskeletal fitness is important in executing many normal everyday activities such as household chores, carrying groceries, lifting objects and picking up grandchildren (Langhammer & Stangehelle, 2011) as well as performance variables such as gait,

stair climbing, rising from a chair, and balance (Fukagawa et al., 1995). Multiple TC studies have also shown upper and lower body strength improvements in older adults in line with our findings (Taylor-Piliae et al., 2006, Li, Xub & Hong, 2009). In Canada the fall-related injury rate is nine times greater among seniors than among those less than 65 years of age (Manitoba Health, 2005) thus the importance to prioritize programs that improve balance, mobility and strength. The timed 8-foot Up and Go test was specifically designed to test motor agility and dynamic balance for older adults (Langhammer & Stangehelle, 2011). In our study there was a significant improvement for the timed 8-foot Up and Go test similar to recent TC studies (Lovecchio et al., 2012). As older adults age their range of motion decreases and insufficient hamstring flexibility is associated with low back pain, increased susceptibility to injury and increased risk of falling (Langhammer & Stangehelle, 2011). Once again in our study there was a significant change in flexibility similar to other findings in the TC literature (Yu & Yang, 2012). Finally when looking at the psychometric based physical scales from the SF 36 and the pre post differences in our study we found that physical function (PF), general health (GH) and the overall physical health summary measure (PCS) were significant. Our findings were similar to other TC studies that also showed significant changes in the physical scales of the SF 36 (Chen, Synder & Krichbaum, 2002).

Even though this present study was a unique combination of low SES with multiple ethnicities, there have been some TC studies that have used low SES populations. One study was done in a community center based in the United States with a lower income Chinese ethnicity of origin population (Taylor-Piliae et al., 2006). This group of 39 mixed gender older adults were enrolled in a 12-week Yang style TC program and demonstrated significant results in muscular strength similar to our study (Taylor-Piliae et al., 2006). Another group of low-income Caucasian seniors living in the United States were enrolled in a 6-month TC study that focused

on physical functioning as the primary outcome (Fuzhon et al., 2006). This study also showed significant improvements in all aspects of physical functioning (Fuzhon et al., 2006).

Since this was a preliminary analysis targeting multiple ethnicities of origin and a low SES population, our goal was to explore potential relationships while attempting to control for known confounders. In this present study we found that no overall independent variables were strong predictors of health-related musculoskeletal fitness and SF 36 changes, however there were select individual variables that had predictive influences. It is also important to note that despite select significant variables, R^2 values in the multivariate linear regression models were consistently small throughout all models. However since the duration of the program was only 4 months, this was possibly too short a time to fully discover potential mediators. Future studies should be designed specifically to explore these mediators further. The few predictors that showed some potentially small influential effects such as initial PA levels, marital status, multi-morbidity and age are worth some consideration. As community PA programs continue to grow, all populations, especially older adults, can increase their health benefits when participating in these programs even with small changes in BMI regardless of their initial PA levels (Bean, Ariann & Walter, 2004). Although research has explored marital status and longevity (Kaplan & Kronick, 2006), the relationship between marital status and grip strength would be interesting to explore in futures studies. Grip strength has become a powerful tool for predicting frailty and increased risk for early morbidity and mortality and even despite increases in chronic conditions, as seen in our sample population, strength can be improved (Bohannon, 2008). Finally, as the population ages it is important to understand that this increase in years does not mean that strength, agility and power cannot be positively modified by PA programs like TC and that increased age also highlights the importance of PA programs as an anti-aging intervention (Castillo, Ortega & Ruiz, 2005). In our analysis no predictors were associated with the sit and

reach test and the summary measure of physical health in the SF 36. Despite the absence of strong predictors this could potentially point in the direction of the broad adaptability of TC on the musculoskeletal system. Since TC is a complex, multicomponent intervention that integrates effects on multiple systems (Wayne & Kaptchuk, 2008), being unable to narrow outcomes to specific predictors could simply be reinforcing its strong multivariate influence.

Unlike a randomized controlled study, the current study design has known limitations related to internal validity of results. These limitations include uncontrolled program induced changes in daily physical activities, seasonal variations in health status and mood, lifestyle factors and self-reporting bias. However it should be noted the strength of this study are the real world outcomes demonstrated in a high at risk population that is under-researched and over-exposed to stressors from both aging and lower income.

These findings suggest that a community-based TC program with low income, mid-to-older adult participants consisting of multiple ethnicities has the potential to be beneficial in improving health-related musculoskeletal fitness changes through strength, flexibility improvements and SF 36 physical scales. This program was effective with a wide range of participants with multiple chronic conditions ranging from metabolic to orthopedic that influenced a large range of functional abilities. It is important to note that a community program such as this can be offered at a minimal cost making it an accessible and sustainable approach to maintaining and/or enhancing health-related fitness in a wide variety of participants.

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Table 1: Baseline Socio-Demographic & Physical Characteristics of Program Participants

	Total N (%)	Cohort 1 N (%)	Cohort 2 N (%)	Cohort 3 N (%)	P
Totals	**209 (100.0)**	**78 (37.3)**	**80 (38.2)**	**51 (24.4)**	
Sex					
Male	42 (20.1)	17 (21.8)	16 (20.0)	9 (17.6)	.847
Female	167 (79.9)	61 (78.2)	64 (80.0)	42 (82.4)	
Age groups					
50-64 years	73 (35.3)	12 (15.4)	46 (57.5)	15 (30.6)	
65-74 years	86 (41.5)	41 (52.6)	28 (35.0)	17 (34.7)	<0.001
75+ years	48 (23.2)	25 (32.1)	6 (7.5)	17 (34.7)	
Mean (SD)	*68.1 (8.62)*	*71.3 (6.7)*	*63.8 (7.7)*	*70 (9.8)*	<0.001
Ethnicity of Origin					
Chinese	74 (36.1)	0 (0)	73 (91.3)	1 (2.0)	
South American	54 (26.3)	45 (60.8)	2 (2.5)	7 (13.7)	
Caribbean	13 (6.3)	9 (12.2)	1 (1.3)	3 (5.0)	<0.001
European	33 (16.1)	7 (9.5)	2 (2.5)	24 (47.1)	
South Asian	10 (4.9)	10 (13.5)	0 (0)	0 (0)	
Canadian	13 (6.3)	1 (1.4)	0 (0)	12 (23.5)	
Other	8 (3.9)	2 (2.6)	2 (2.5)	4 (7.8)	
Education:					
< High School	94 (46.5)	47 (61.0)	33 (41.2)	14 (28.6)	<0.001
High School	79 (39.1)	25 (32.5)	34 (44.7)	20 (40.8)	
> High School	29 (14.3)	5 (6.5)	9 (11.8)	15 (30.4)	
Smoking Status-Yes	4 (1.9)	2 (2.6)	1 (1.3)	1 (1.9)	.833
Drinking Status-Yes	45 (21.4)	17 (21.8)	9 (11.3)	19 (36.5)	.003
Marital Status					
Single	112 (54.9)	59 (75.6)	27 (35.1)	26 (52.0)	<0.001
Married	90 (44.1)	18 (23.1)	50 (64.9)	23 (48.0)	
Income					
<$14,000 per year	135 (71.4)	66 (90.4)	52 (70.3)	17 (40.5)	<0.001
$14,000-$30,000	35 (18.5)	5 (6.8)	12 (16.2)	18 (42.9)	
>$30,000	19 (10.1)	2 (2.7)	10 (13.5)	7 (16.7)	
Chronic Conditions					
Hypertension	105 (50.0)	52 (49.4)	27 (33.8)	26 (50.0)	<0.001
Arthritis	102 (48.6)	38 (51.3)	39 (48.8)	25 (48.1)	.997
Diabetes Mellitus	45 (21.4)	28 (19.5)	9 (11.3)	8 (15.4)	<0.001
Sleep Disturbance	54 (25.7)	20 (25.6)	21 (26.3)	13 (25.0)	.987
Depression	31 (14.8)	14 (17.9)	5 (6.3)	12 (23.1)	.017
Hearing Impairment	26 (12.4)	9 (11.5)	9 (11.3)	8 (15.4)	.749
Disorientation	14 (7.2)	9 (11.5)	4 (5.0)	1 (1.9)	.090
Heart Disease	12 (5.7)	8 (10.3)	3 (3.8)	1 (1.9)	.097
[a]COPD	10 (4.8)	4 (5.1)	2 (2.5)	4 (7.7)	.385
Tumour	5 (2.4)	1 (1.3)	0 (0.0)	4 (7.7)	.013
[b]Multi-Morbidity	133 (63.3)	56 (71.8)	41 (51.2)	36 (69.2)	.016
Walking Assistance	18 (8.6)	13 (16.7)	0 (0.0)	5 (9.6)	.001
[c]Weekly Physical Activity					
Needs improvement/fair	35 (23.3)	14 (18.4)	15 (20.0)	6 (12.5)	
Good	16 (7.9)	8 (10.5)	4 (5.3)	4 (8.3)	.606
Very good/excellent	150 (74.6)	56 (71.0)	56 (74.7)	38 (79.6)	
Mean (SD)	*6.7 (3.1)*	*6.4 (2.9)*	*6.6 (3.1)*	*7.4 (3.1)*	*.196*
[d]Previous Tai Chi	38 (18.1)	0 (0.0)	32 (40.0)	6 (11.8)	<0.001

[a]COPD: chronic obstructive lung disease
[b]Multi-morbidity: two or more chronic conditions
[c]Physical Activity: based on the Healthy Physical Activity Participation Questionnaire
[d]Previous Tai Chi: Previous Tai Chi participation more than one year
Note: Totals may vary due to missing responses

Table 2: Baseline Health-Related Musculoskeletal Fitness Characteristics and SF 36 Physical Scales and Physical Summary Measure of Study Participants

	Combined Cohorts Mean (SD)	Cohort 1 Mean (SD)	Cohort 2 Mean (SD)	Cohort 3 Mean (SD)	P
Anthropometric Measures					
Body Mass Index (kg/m²)	26.7 (4.8)	28.3 (4.8)	24.3 (3.7)	28.2 (5.2)	<0.001
Upper Body Musculoskeletal Measures					
Overall Grip Strength (kg)	54.3 (17.7)	46.8 (16.8)	59.8 (16.5)	57.7 (16.8)	<0.001
Arm Curl Test in 30 Seconds (#)	15.5 (5.4)	11.9 (4.0)	17.9 (4.4)	17.6 (5.9)	<0.001
Lower Body Musculoskeletal Measures					
Chair Stand Test in 30 Seconds (#)	12.2 (4.1)	10.0 (3.1)	13.9 (4.1)	13.2 (3.8)	<0.001
Timed 8-Foot Up and Go (secs)	7.6 (3.2)	8.8 (4.2)	6.4 (1.7)	7.8 (2.2)	<0.001
Low Back Flexibility Measures					
Sit and Reach (cm)	26.4 (9.1)	25.3 (8.2)	26.2 (9.6)	28.7 (9.1)	.141
SF 36 Physical Scales					
Physical Functioning (PF)	75.0 (21.6)	67.2 (23.8)	80.9 (16.4)	78.0 (22.1)	<0.001
Role-Physical (RP)	80.9 (25.6)	74.4 (29.5)	87.0 (21.1)	81.8 (23.1)	.009
Bodily Pain (BP)	68.7 (24.8)	62.8 (27.2)	74.1 (22.7)	69.4 (22.2)	.017
General Health (GH)	64.8 (20.5)	64.9 (21.1)	60.5 (20.2)	71.7 (18.3)	.012
SF 36 Physical Summary Measure					
Physical Health (PCS)	49.2 (7.9)	46.9 (8.8)	50.7 (5.9)	50.3 (8.6)	.009

Table 3: Mean Difference of Health-Related Musculoskeletal Fitness Measures, SF 36 Physical Scales and Summary Measure

	Combined Cohorts [a]Mean (SD)	P	Cohort 1 [a]Mean (SD)	P	Cohort 2 [a]Mean (SD)	P	Cohort 3 [a]Mean (SD)	P
Anthropometric Measures								
Body Mass Index (kg/m²)	-0.1 (2.1)	.450	0.3 (3.0)	.906	-0.3 (1.1)	.004	-0.7 (0.9)	.002
Upper Body Musculoskeletal Measures								
Overall Grip Strength (kg)	2.4 (7.7)	<0.001	3.4 (8.1)	.002	1.3 (6.9)	.262	2.5 (8.4)	.133
Arm Curl Test in 30 Seconds (#)	3.3 (4.9)	<0.001	3.4 (3.8)	<0.001	3.9 (5.9)	<0.001	1.9 (4.7)	.034
Lower Body Musculoskeletal Measures								
Chair Stand Test in 30 Seconds (#)	3.3 (4.6)	<0.001	2.2 (2.3)	<0.001	4.9 (6.2)	<0.001	2.5 (3.7)	.001
Timed 8-Foot Up & Go Test (secs)	-0.6 (2.0)	.001	-0.6 (2.8)	.321	-0.8 (1.5)	<0.001	-0.3 (1.3)	.047
Low Back Flexibility Measures								
Sit & Reach (cm)	1.9 (7.1)	.004	0.9 (5.8)	.315	1.5 (8.0)	.167	4.2 (7.3)	.009
SF 36 Physical Scales								
Physical Functioning (PF)	6.0 (18.4)	<0.001	7.5 (21.1)	.006	5.7 (17.5)	.004	4.2 (15.2)	.180
Role Physical (RP)	0.9 (24.3)	.663	-1.8 (26.0)	.696	0.1 (24.8)	.918	7.1 (19.3)	.046
Bodily Pain (BP)	1.1 (23.6)	.587	-2.2 (25.3)	.557	1.2 (23.5)	.655	6.2 (20.7)	.069
General Health (GH)	3.8 (15.8)	.005	3.4 (13.5)	<0.001	3.6 (17.2)	<0.001	4.8 (16.9)	<0.001
SF 36 Physical Summary Measure								
Physical Health (PCS)	1.13 (5.9)	.033	0.4 (6.0)	.582	1.4 (6.7)	.025	1.9 (3.9)	.055

[a]Mean difference calculated as post measure minus pre measure

Table 4: Multivariate Linear Regression for Relationship between Musculoskeletal Health, SF 36 Physical Summary Measure and Determinates of Health

	Body Mass Index (kg/m²)		Overall Grip Strength (kg)		Arm Curl Test in 30 Seconds (#)		Chair Stand Test in 30 Seconds (#)		Time 8-Foot Up and Go Test (secs)		Sit and Reach (cm)		SF 36 Physical Health	
	Beta (SE)	P	Beta (SE)	P	Beta (SE)	P	Beta (SE)	P	Beta (SE)	P	Beta (SE)	P	Beta (SE)	P
Age	-0.0 (0.1)	.836	0.1 (0.3)	.607	3.7 (1.7)	.033	1.2 (0.6)	.033	-0.5 (0.3)	.052	-2.4 (1.0)	.025	0.2 (0.2)	.248
[a]Gender	1.8 (2.4)	.460	3.5 (4.7)	.456	34.5 (28.6)	.231	2.1 (9.6)	.826	-0.7 (4.8)	.890	-7.6 (18.3)	.680	3.1 (3.1)	.317
[b]Marital Status	2.8 (2.2)	.199	-10.1 (4.3)	.022	17.0 (26.9)	.528	5.1 (8.9)	.569	0.9 (4.5)	.836	-20.6 (16.5)	.214	2.2 (2.9)	.440
Education:	-2.6		-3.7		52.2		9.9 (7.9)		-8.9 (4.1)		-22.1		4.9	
[c]High School	(2.0)	.200	(3.9)	.344	(24.2)	.033	19.2	.217	-10.6	.030	(14.9)	.142	(2.7)	.069
[c]> High School	-3.8 (3.1)	.222	-0.92 (6.1	.883	49.3 (37.9)	.197	(12.0)	.130	(6.4)	.102	-31.5 (22.9)	.174	2.7 (4.2)	.527
[d]Cohorts	4.0		0.6		20.9		-17.4				-2.3		-1.7	
One	(2.5)	.119	(4.9)	.893.831	(31.1)	.503	(10.2)	.090	10.3 (5.3)	.051	(10.0)	.900	(3.2)	.599
Three	-0.3 (2.9)	.914	1.2 (5.6)		-38.4 (35.1)	.276	-27.4 (11.4)	.020	11.5 (5.9)	.052	40.0 (20.8)	.057	-1.4 (3.9)	.717
[e]TC Attended	0.0 (0.1)	.657	-0.1 (0.1)	.428	0.1 (0.8)	.950	0.2 (0.2)	.332	-0.1 (0.1)	.452	-0.1 (0.46)	.970	-0.1 (0.1)	.189
[d]Physical Activity	-0.8 (0.3)	.012	-0.1 (0.6)	.919	-4.2 (3.8)	.274	0.1 (1.3)	.969	0.4 (0.6)	.486	-0.8 (2.4)	.745	0.2 (0.4)	.615
[g]Multi-Morbidity	1.9 (2.1)	.345	-0.4 (3.9)	.914	24.7 (24.7)	.646	8.0 (8.0)	.821	3.4 (4.2)	.414	-10.5 (15.0)	.485	0.4 (2.7)	.866
R^2	.166		.032		.036		.022		.059		.004		.064	

[a] Reference group male
[b] Reference group single
[c] Reference group < High School

[d] Reference group Cohort Two
[e] Based on Overall Attendance
[f] Based on Average Weekly Physical Activity
[g] Reference group 1 or none chronic diseases

MANUSCRIPT 3

Effect of Tai Chi on Psychological Health, Subjective Happiness, and Expectations Regarding Aging in Low-Income, Multiple Ethnicity, Mid-to-Older Adults

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Abstract

Background: Tai Chi (TC) has proven to be effective at improving musculoskeletal fitness but less is known regarding its ability to improve psychological health. The objective of this study was to examine the effects of a 16-week TC intervention on psychological health, subjective happiness, and expectations regarding aging in low socioeconomic, ethnically diverse mid-to-older community-dwelling Canadian adults.

Methods: Two hundred and nine ethnically diverse mid-to-older community-dwelling Canadian adults residing in low-income neighbourhoods were enrolled in a 16-week Yang style TC program. Self-reported psycological health measures were collected using the SF 36, Subjective Happiness Scale (SHS), and Expectations Regarding Aging (ERA) survey pre and post the TC program.

Results: Using paired sample t-tests significant improvements were not found when looking at SF 36, subjective happiness scale, and the expectations regarding aging summary measure; however, there were significant improvements in two sub scales of the SF 36 of vitality (VT) and mental health (MH) in the combined cohorts and expectations regarding aging in the third of three cohorts ($p < 0.05$).

Conclusion: Results provided evidence that the 16-week program aimed at 2 sessions per week participation was effective at improving two of the four subscales of the SF 36 in the categories of VT and MH. The study did not show significant improvement in SHS and the results were inconsistent for improvements for the ERA scale.

Background

In Canada over the last several decades many health care service providers have focused on prioritizing adequate support to the aging population's physical needs. However, 'successful aging' goes beyond physical health and encompasses positive states of health in psychological domains as well (Depp et al., 2010). The challenge then becomes how to influence psychological health in a progressive manner. Numerous studies have shown a positive relationship between physical activity (PA) and psychological health in the mainstream population for both men (Asztalos et al., 2010) and women (Vallance et al., 2010) and specifically in the aging population and their unique needs relating to psychological health, depression and neurodegenerative disease (Rovio et al., 2005). When looking at psychological health and those factors that lead to subjective well-being, evidence has underscored that better health and longevity are tied closely to higher levels of subjective well-being (Diener & Chan, 2011).

Even though strong evidence has demonstrated that PA, even in advanced age, is a powerful influence on psychological or mental well-being (McAuley, et al., 2007), multiple variables can impact healthy outcomes positively. One such variable is the ability to utilize PA opportunities relating to the individual's expectations regarding the aging process, which can be linked to healthy behaviors, such as consistent PA (Meisner, Weir, & Baker, 2013), which, in turn, affects the ability to experience higher levels of subjective well-being (Steverink, et al., 2001). Expectations regarding aging (ERA) is linked to the idea that if negative perceptions of health issues are seen as an expected part of aging, older adults may be less willing to partake in health-promoting behaviors (Sarkisian et al., 2002). It is therefore important to understand ERA in the population to increase the effectiveness of health care-related interventions.

Tai Chi (TC) is a form of Chinese low impact mind-body PA that has been used for centuries as a health and fitness tool in the East (Wang et al., 2010). Although many of the physical aspects of TC have been studied such as balance, strength, flexibility, cardiovascular improvement and respiratory function, pain reduction and overall quality of life enhancement (Verhagen et al., 2004; Taylor-Pilaie & Froelicher, 2004), there is emerging evidence that mood and psychological or mental wellbeing may be improved (Wang et al., 2004; Wang et al., 2010; Wang et al., 2013; Li et al., 2001). On a psychological level, TC has been associated with the capacity to influence states of great calm and mental tranquility, and has been classified as a form of "moving meditation" that connects mind and body (Taylor-Piliae et al., 2006). Although research results are mixed with respect to using TC as an intervention with depression (Sharma & Haider, 2013; Chi et al., 2013), there has been stronger evidence showing that TC practice can positively influence negative emotional states such as sadness, confusion, anger, tension and fear (Gemmell & Leathem, 2006). The majority of TC research has looked at psychological profiles of stress, anxiety, depression, mood and self-esteem (Wang et al., 2010, Chow et al., 2012), however, evidence is lacking on how TC influences subjective happiness and expectations regarding aging. To this end, the objective of the current study was to examine the effect of a 16-week TC intervention on measures of psychological health, subjective happiness and aging expectations in a sample of low socioeconomic, mid-to-older community-dwelling multi-ethnic Canadian adults.

Methodology

Two regions in the Greater Toronto Area of Ontario were involved in this research project. They were specifically targeted to focus on community-dwelling mid-to-older adults of various ethnicities. These locations were the Jane and Finch area in the Northern part of Toronto

as well as the Dundas and Spadina area in the downtown core of Toronto. Both of these areas are ethnically varied and have a low socioeconomic status (SES). The Jane-Finch area has 22.4% of its population from recent immigration (i.e., last ten years) and 78.1% of the total population is a visible minority (Toronto Community Health Profiles, 2008). There are multiple nationalities/ethnic populations with 39% designated as low-income economic families (Prescod 2008) with low-income defined through low income cut-offs (LICOs) where a family has to spend 20 percent or more of its income on food, shelter and clothing than the average family (Statistics Canada, 2010). Since the Dundas and Spadina area is heavily populated by adults of Chinese origin this area was also targeted to explore the relationship of this culturally affiliated group to TC. The Dundas-Spadina area is socio-economically similar to the Jane-Finch community making it an ideal population partner (Profile of Low Income in the City of Toronto, 2010). The Dundas-Spadina area is known to be one of the largest Chinese communities in North America making it a unique and accessible population (Statistics Canada 2007).

Participation in this project was limited to males and females who were 50 years of age or older based on the World Health Organization definition (WHO, 2014). Moreover, participants needed to live in either the Jane-Finch or Dundas-Spadina area and had to be medically able to participate in a PA-based intervention. This capability was measured by Physical Activity Readiness Questionnaire (PAR-Q) and Physical Activity Readiness Medical Examination (PAR-Med-X) (Gledhill & Jamnik, 2003).

Multiple focus groups were conducted to improve enrollment and to introduce the project to the two communities. Two gender-specific (male/female) focus groups were facilitated before each cohort to examine barriers and promoters to understand both the participation and accessibility to attending a community-based TC program. Three cohorts were followed for this

study with cohort 1 and 3 based in the Jane and Finch area (August to December 2009 and October 2011 to April 2012). Cohort 2 from the Dundas and Spadina area were followed from February to August of 2011. In cohort 1, recruitment was done prior to the launch of the TC program and in cohort 2 and 3 enrollment was based on an ongoing basis to help facilitate participation. Due to the ongoing intake of participants, cohorts 2 and 3 were longer in duration but each participant was only exposed to 16 consecutive weeks of TC.

Program

A TC program was offered free of charge to the participants for each of the three cohorts. The TC program consisted of 6-7 classes given Monday through Friday where participants were asked to attend two classes per week for 16 consecutive weeks. Classes for cohort 1 took place at a Toronto Community Housing building whereas classes for cohorts 2 and 3 took place at local community centers in their respective areas. A professional TC master facilitated the classes. Each class was 60 minutes long and consisted of 15 minutes of Qigong followed by 45 minutes of Yang style TC. A research assistant monitored participation in the TC classes so that attendance could be recorded.

Study variables

Socio-demographics and psychological health-related characteristics were collected at baseline and included information on sex, age, ethnicity of origin, education, marital status, income, multi-morbidity and TC program attendance. Psychological health-related variables were collected pre- and post-intervention by qualified research assistants. These outcome measures included the ERA survey, the SHS and the SF 36 multipurpose health survey instrument. The ERA survey measures expectations regarding aging among older adults and

looks at the relationship between perceptions of aging, health behaviours and outcomes and the survey has been shown to have acceptable reliability and validity to estimate ERA (Sarkisian et al., 2005). The SHS is an assessment of happiness survey using a 4-item measure of global subjective happiness and has been shown to have a good to excellent reliability and construct validation to measure happiness (Lyubomirsky & Lepper, 1999). The SF 36 is a health status survey used in both clinical practice and research that includes one multi-item scale that assesses eight health concepts, four of which were used in this study (Ware et al., 1992). Those four scales were general mental health (MH), emotional health (RE), vitality (VT) and social functioning (SF) (Ware et al., 1992). Reliability estimates for physical and mental summary scores usually exceed 0.90 (Ware et al., 1994) and studies of validity generally support the intended meaning of high and low SF 36 scores as documented in the original user's manuals (Ware et al., 1993; Ware et al., 1994).

Statistical analysis

Differences in baseline socio-demographic, physical and psychological health-related characteristics and SF 36 mental health scales among participants by cohort was examined using chi square tests and a one-way ANOVA. To compare the psychological health measures and SF 36 mental health scales for the pre versus post TC program, paired t-tests were performed for both the individual cohorts and the combined cohorts. The experimental protocol conformed to the standards set by the Declaration of Helsinki and is approved by the Research Ethics Board at York University and all participants provided written informed consent.

Results

A total of 209 participants were recruited for this study (78, 80, and 51 for cohorts 1, 2, and 3 respectively). Table 1 summarizes the socio-demographic characteristics, physical and

psychological and the SF 36 mental health scales, ERA survey and the SHS of the study participants. At baseline, participants were 79.9% female and 20.1% male and the overall mean age of the participants at enrollment was 68.1 years (range 50-87 years). The ethnicity of origin of participants included Chinese (35.4%) and Non-Chinese (64.6%). The majority had less than a high school education (46.5%) and had an annual income less than $14,000 (71.4%). Participants who were married or living with a spouse constituted 44.1% of the sample. At baseline, the majority of participants reported having multiple morbidities (63.3%). For the overall sample, mean attendance was 1.05 ±0.94 sessions per week with 0.9 ±0.72, 0.9 ±1.44, and 1.3 ±0.86 for cohorts 1, 2 and 3 respectively. Several differences existed between cohorts notably with cohort 2 having a lower mean age (63.8 years) and a higher Chinese ethnicity of origin (91.3%). Cohort 3 also had a higher prevalence of (greater than high school) education (30.4%), whereas cohort 2 had a higher percentage of married participants (64.9%). Cohort 1 had the greatest proportion of lower income status (less than $14,000) participants (90.4%) as well as the highest percentage of participants with multi-morbidity (2 or more chronic conditions) (71.8%). Finally, cohort 3 had the highest mean program attendance (1.3 ±0.86). Baseline psychological health-related variables for the overall cohort in Table 1 included social support (4.9 ±2.2), expectations regarding aging (33.9 ±21.5) and the subjective happiness scale (20.5 ±4.6) and the SF 36 overall mental health summary measure (52.0 ±8.9). Differences between psychological health related variables between cohorts were also observed with cohort 1 having lower social support (4.4 ±2.3) and cohort 3 having higher expectations regarding aging (46.5 ±17.5).

Of the 209 overall sample recruited, 56 (26.7%) did not complete the study and were lost to follow-up. Reasons for loss to follow-up included health reasons not related to the TC

program, out of country family visits, not being available or being inaccessible for post TC program data collection, and unknown reasons.

Table 2 summarizes the pre post results for all outcomes. In the combined group, participation in the 16-week TC program showed no significant change in ERA, SHS or the SF 36 scales of social functioning, role-emotional and mental health summary measure. However, significant improvements were observed in the SF 36 scales of vitality and mental health ($p < 0.05$). When looking at the individual cohorts, there were significant improvements in ERA scores and the SF 36 scales of vitality in cohort 3 as well as in the SF 36 mental health scale in cohort 1 ($p < 0.05$).

Discussion

This study examined the effect of a 16-week TC intervention in terms of psychological health changes, SHS and ERA in a community-based program with low income and ethnically diverse mid-to-older community-dwelling Canadian adults. This is the first TC study in Canada to look at a community-based program and psychological health (particularly around SHS and ERA) in this specific population. Results provided evidence that the 16-week program aimed at 2 sessions per week participation was effective at improving two of the four subscales of the SF 36 in the categories of VT and MH. The study did not show significant improvement in SHS and the results were inconsistent for improvements for the ERA scale.

Research in community-based settings often deals with many complexities that can influence the research goals and the program practices (Minkler, 2005). In this study multiple characteristics differed at baseline that could have been potential influencers of attendance and thus overall exposure to the TC dose. Cohort 1 was based in a Toronto Community Housing building with an onsite auditorium while cohort 2 and 3 were both based in community centers.

Cohort 2 in the Chinese community had a wider age range of participants who used the community center and were motivated to partake in multiple social programs throughout the day. Toronto can have considerable range in weather, which could have influenced attendance to any community program. Cohort 1 occurred summer into fall, whereas cohort 2 took place between spring into summer and cohort 3 occurred fall into winter. Although changing weather patterns can be somewhat of a challenge to most Canadians, older adults are faced with more challenges from weather complexities, which can influence program accessibility as well as psychological perceptions of subjective well-being. Every effort was also taken to expose all participants to the same Yang style TC, however, each cohort did have a different TC Master that may have had subtle teaching differences that may have influenced subtle outcome variances (i.e. teaching methods, language differences, physical/psychological progression differences, etc.) especially around psychological health.

In this study we did not find significance with respect to ERA overall but did find significance for ERA in cohort 3. Challenges with adherence have been shown to have a moderating effect on outcomes in PA research (Nyman and Victor, 2011) and to date research has demonstrated that older persons, in general, have expectations that they will maintain low physical and psychological health and cognitive functioning as they age (Sarkisian et al., 2005), which might present challenges with adherence. However, it should be noted that the data around adherence in this present study has informative potential for future research. The fact that there were challenges with adherence is in line with a non-significant difference in ERA pre and post program, and it is therefore valuable to observe that cohort 3 had the highest attendance, an initially higher ERA score, and significance in the ERA measure pre and post (Kim, 2009). Little is known about the relationships between expectations with respect to aging, health-

promoting behaviors and health status in culturally different groups (Kim, 2009), like the ones in the present study. At the very least, these results emphasize that more research is needed to explore ERA in multi-cultural, low socioeconomic populations.

Subjective well-being as influenced by PA is becoming increasingly important on both health and social public policy (Pawloski et al., 2012). The beneficial effects of PA on psychological well-being have been convincingly documented even for people of advanced age (McAuley & Rudolph, 1995; Netz, Wu, Becker, & Tenenbaum, 2005; Ransford & Palisi, 1996). However, subjective happiness can be influenced more specifically through practiced optimism (King, 2001) and expressed gratitude (Emmons & McCullogh, 2003). In this study we did not find significant changes with respect to the subjective happiness scale. Evidence has shown that in advanced age, people tend to focus more strongly on maintenance or loss-avoidance (Stevernik et al.,, 2001; Heckhausen, 1997) and these avoidance orientations merely result in a more quieted state if a feared loss can be prevented (Shah & Higgins, 2001; Ebner et al., 2006). This avoidance orientation could then mean instead of a positive focus, such as happiness, the focus is on avoiding a negative state such as sadness. Potentially in our study the dose of TC, either relating to the low weekly attendance or to the 16-week program length being too short, was not a strong enough influence to affect significant change in the subjective happiness scale. This dose challenge should be considered in future studies.

However, we found evidence that VT from the SF 36 mental health scales improved in pre post differences, which is in line with multiple TC studies showing similar results in this scale (Husted et al., 1999; Wang et al., 2004; Ko et al., 2006). Evidence points to the ability of TC participants' improvement in coping with physical limitations which are then associated with improvements in vitality (Husted et al., 1999). Other TC research has shown a reduction in pain

which participants also associate with an increase in vitality (Lee et al., 2007). Our results also revealed a significant improvement in MH from the SF 36 from the pre- and post-tests, which is in line with numerous TC study results (Ko et al., 2006; Irwin et al., 2007; Li et al., 2004). In this area evidence suggests that the combination of exercise, relaxation and meditation is instrumental to the improvement of mental health as captured by the SF 36 (Irwin et al., 2007) whereas other evidence suggests improved focus or concentration positively influences mental health (Kutner et al., 1997). Again, several variables could have influenced attainment of greater significance; as stated earlier, adherence was a potentially modifying factor as well as the fact that cohort 2 had 40% of its participants with previous TC experience and may have had less impact from the current TC exposure.

It is important to note that unlike a randomized controlled study, the current study design has known limitations related to internal validity of results. Some of these challenges related to uncontrolled program-induced changes in daily physical activities, seasonal variations in health status and mood, lifestyle factors and self-reporting bias. It is, however, important to note that the strength of this study relates to the meaningful use of a PA program that has been shown in research to produce both positive physical and mental health outcomes. In addition, this study looked at a vulnerable, under-researched population that can be exposed to higher than usual physical and mental stressors relating to both lower income and aging.

This study provided evidence that the 16-week program aimed at 2 sessions per week participation was effective at improving two of the four subscales of the SF 36 in the categories of VT and MH. The study did not show significant improvement in SHS and the results were inconsistent for improvements for the ERA scale. Since psychological health is a multi-faceted paradigm this study demonstrates the need for further research to better understand the

relationship between PA interventions such as TC and psychological health, subjective happiness and expectations regarding aging.

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Table 1: Baseline Socio-Demographic, Psychological Health Related Characteristics and SF 36 Scales and Summary Measure of Study Participants

	Combined Cohorts N (%)	Cohort 1 N (%)	Cohort 2 N (%)	Cohort 3 N (%)	P
Totals	**209 (100.0)**	**78 (37.3)**	**80 (38.2)**	**51 (24.4)**	
Socio-Demographic Characteristics					
Sex					
Male	42 (20.1)	17 (21.8)	16 (20.0)	9 (17.6)	.847
Female	167 (79.9)	61 (78.2)	64 (80.0)	42 (82.4)	
Age groups					
50-64 years	73 (35.3)	12 (15.4)	46 (57.5)	15 (30.6)	
65-74 years	86 (41.5)	41 (52.6)	28 (35.0)	17 (34.7)	<0.001
75-87 years	48 (23.2)	25 (32.1)	6 (7.5)	17 (34.7)	
Mean (SD)	*68.1 (8.62)*	*71.3 (6.7)*	*63.8 (7.7)*	*70 (9.8)*	<0.001
Ethnicity of Origin					
Chinese	74 (35.4)	0 (0)	73 (91.3)	1 (2.0)	<0.001
Non-Chinese	135 (64.6)	78 (100)	7 (8.7)	50 (98.0)	
Education:					
< High School	94 (46.5)	47 (61.0)	33 (41.2)	14 (28.6)	<0.001
High School	79 (39.1)	25 (32.5)	34 (44.7)	20 (40.8)	
> High School	29 (14.3)	5 (6.5)	9 (11.8)	15 (30.4)	
Marital Status:					
Single/Widowed	112 (54.9)	59 (75.6)	27 (35.1)	26 (52.0)	<0.001
Married/Partnered	90 (44.1)	18 (23.1)	50 (64.9)	23 (48.0)	
Income:					
<$14,000 per year	135 (71.4)	66 (90.4)	52 (70.3)	17 (40.5)	<0.001
$14,000-$30,000	35 (18.5)	5 (6.8)	12 (16.2)	18 (42.9)	
>$30,000	19 (10.1)	2 (2.7)	10 (13.5)	7 (16.7)	
[a]Multi-Morbidity	133 (63.3)	56 (71.8)	41 (51.2)	36 (69.2)	.001
[b]Program Attendance (SD)	1.05 (0.94)	0.92 (0.72)	0.99 (1.14)	1.3 (0.86)	.036
Psychological Health Related Variables					
[c]Social Support					
Mean (SD)	*4.9 (2.2)*	*4.4 (2.3)*	*5.4 (2.1)*	*5.1 (2.1)*	.019
Expectations Regarding Aging	33.9 (21.5)	34.7 (20.8)	25.8 (20.8)	46.5 (17.5)	<0.001
Subjective Happiness Scale	20.5 (4.6)	20.9 (5.4)	19.8 (3.9)	21.1 (3.9)	.207
SF 36 Mental Health Summary	52.0 (8.9)	50.2 (9.9)	52.5 (8.4)	54.0 (7.6)	.074

[a]Multi-morbidity: two or more chronic conditions
[b]Previous Tai Chi: participation greater than one year
[c]Average sessions attended per week
P values base on chi square and ANOVA

Table 2: Pre and Post Mean Difference of Expectations Regarding Aging Survey, Subjective Happiness Scale and SF 36 Mental Health Scales and Summary Measure

	Combined Cohorts Pre/Post		P	Cohort 1 Pre/Post		P	Cohort 2 Pre/Post		P	Cohort 3 [b]Mean Pre/Post		P
	Pre	**Post**		**Pre**	**Post**		**Pre**	**Post**		**Pre**	**Post**	
Expectations Regarding Aging Summary Measure	33.9 (21.4)	35.7 (21.7)	.113	34.7 (20.8)	33.3 (21.4)	.610	25.8 (20.8)	28.0 (17.3)	.413	46.5 (17.5)	54.3 (19.4)	<0.001
Subjective Happiness Scale	20.5 (4.6)	21.0 (5.1)	.480	20.9 (5.4)	21.8 (5.3)	.726	19.8 (3.9)	19.3 (4.9)	.887	21.1 (3.9)	22.6 (4.7)	.203
SF 36 Mental Health Scales												
Vitality (VT)	64.2 (20.1)	68.4 (21.3)	.007	60.8 (21.1)	66.0 (21.8)	.229	66.1 (19.3)	66.6 (22.2)		66.5 (19.4)	75.4 (17.9)	.004
Social Functioning (SF)	86.5 (20.0)	84.3 (22.8)	.235	81.2 (22.2)	79.9 (25.0)	.349	91.1 (18.3)	86.9 (20.6)		87.5 (17.1)	86.8 (22.9)	.633
Role-Emotional (RE)	83.5 (24.3)	85.5 (22.3)	.409	79.6 (26.2)	82.5 (26.2)	.574	86.6 (20.9)	85.6 (20.0)	.899	84.9 (26.2)	90.0 (19.4)	.461
Mental Health (MH)	75.0 (17.3)	78.5 (18.0)	.012	72.0 (19.3)	78.0 (18.1)	.008	76.5 (15.7)	75.3 (17.9)	.747	77.4 (15.9)	84.6 (17.0)	.061
Summary Measure Mental Health (MCS)	52.0 (8.9)	52.4 (9.2)	.480	50.2 (9.9)	52.0 (9.2)	.281	52.5 (8.4)	51.4 (9.1)	.877	54.0 (7.6)	55.6 (9.4)	.473

[a]Paired Samples t test
Mean difference is post minus pre measures

MANUSCRIPT 4

Barriers and Promoters for Adherence to a Community-based Tai Chi Program for Older, Low-Income and Ethnically Diverse Adults

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Abstract

Background: The growing older adult landscape in Canada potentially indicates an increased risk for chronic conditions associated with physical inactivity. Low-income, ethnically diverse, older adults may be more vulnerable owing to their lower physical activity (PA) levels and potential cultural barriers to PA participation. To explore the specific barriers and promoters to adherence to a 16-week Tai Chi (TC) program we interviewed 41 low-income, ethnically diverse older adults age 50 years and older after completion of a TC program.

Methods: Semi-structured qualitative focus group interviews were conducted with questions focused on themes of barriers and promoters to attendance adherence. Important issues emerged that covered ten categories and with no clear barriers or promoters that related to specific cultural limitations.

Results and Conclusion: Categories included common barriers/promoters that embraced biological, psychological, social and environmental influences. This information may have value for optimally-tailored PA programming that could lead to improved health outcomes through increased participation in PA and exercise specifically in ethnically diverse, low-income groups.

Introduction

Although physical inactivity has been shown to be a health risk throughout the population, older adults have particularly low physical activity (PA) levels (Bouchard et al., 1994, US Department of Health 1995, ACSM 1996). Physical inactivity combined with the aging process can increase the risk of chronic diseases creating functional limitations impacting both physical and mental health (Wrosch, Schulz, & Heckhausen, 2002; Wrosch, Schulz, Miller, Lupien, & Dunne, 2007). Evidence continues to accumulate showing that moderate-intensity aerobic activity for at least 30 minutes five days per week along with strength training for at least two days per week has a positive effect on healthy aging (Nelson et al., 2007). However, implementation of this knowledge is often the biggest challenge. It is equally important to undertake research that explores variables associated with positive PA behaviors to tailor interventions that will facilitate increased PA participation (Bauman et al., 2002). Within this behaviour prediction research it is also a priority to examine older adult ethnic minorities within the Canadian population to explore the positive and negative behavioural triggers that may be unique to them as a group. Since 2011, the size of the aging population has been increasing with projections showing that over the next three decades the number of seniors in Canada will go from 4.2 million to 9.8 million (Employment and Social Development). Of the current senior population, 28% consists of ethnicities not born in Canada (www.elections.ca, 2012) which places special emphasis on understanding their unique behavioural needs with respect to PA. It has been shown that ethnic minority groups have lower PA levels than White or non-immigrant groups (Bryan et al., 2006) and this combined with aging effects puts older ethnic minorities at an increased risk of ill health and chronic disease.

Successful adherence to a behaviour requires someone to change an established response (e.g. sitting and watching TV) and replace it with a less common but more desirable response (e.g. going for a brisk walk) (McAuley, et al., 2011). Therefore, it is important to understand the influences involved with creating a more "desirable" outlook in participants to increase the likelihood to adherence. Research has demonstrated that certain variables such as personal characteristics, program or regimen-based factors, and environmental factors are strong influences on PA participation in older adults (King et al., 1992).

Tai Chi (TC) research has demonstrated that fall reduction programs can be designed around this PA practice as well as TC having a positive influence on health-related cardiovascular and musculoskeletal fitness, arthritis and psychosocial behavior (Taylor-Piliae, 2004; Manson et al., 2013). TC can result in healthy physiological outcomes and the TC user-friendly graceful movements emphasize the smooth integration of body rotation, weight-shifting, balance and coordination. The intensity of TC can be from low-intensity up to moderate-intensity and can be approximately equivalent to a walking speed of 3.7 mph when practiced at the moderate-intensity level (Zhou et al., 1984). There is also a strong social aspect to TC and evidence has demonstrated that being active with people of a similar age, ability and outlook highly influences the social rewards that are a significant factor for adherence to long-term practice (Chen et al., 2001). Physically, TC is highly appropriate for an older adult population since it can be practiced by participants with multiple chronic conditions due to its low to moderate-intensity level, steady rhythm and lower physical and mental demands. Moreover, it specifically influences balance and motor control, variables that might reduce falls in a maturing population (Li et al., 2007).

The goal of the present study was to use semi-structured focus group interviews to examine the barriers to, and promoters of, adherence to a community-based TC program in older, ethnically-diverse adults. The findings from this research have the potential to elucidate the program participants' successful, or not successful, experiences with TC as older adults of mixed ethnicity when using TC as a PA program in their community. This knowledge could be used to better design community-based activity programs to help facilitate stronger participation rates that could therefore lead to better health outcomes.

Methods

Participants

Eligible participants were 50 years or older and were community dwellers of various ethnicities in two locations, Jane-Finch and Dundas-Spadina, in the Greater Toronto Area of Ontario, Canada who participated in a 16-week TC program. The two locations were chosen for their diversity of ethnic groups and their low socioeconomic status (SES) with both the Dundas-Spadina and Jane-Finch area having a population average income of about $26,771.00 (Social Planning Toronto, 2009). Dundas-Spadina was specifically targeted since it is an area that is particularly dense in adults of Chinese origin (a purposeful decision to explore influences of ethnic origin affiliations with TC) as well as being socio-economically similar to the Jane-Finch community (Profile of Low Income in the City of Toronto, 2010). Three cohorts of participants participated in the TC program; cohorts 1 and 3 were followed from August through December 2009, and from October 2011 through April 2012 respectively. Participants for cohort 2 were followed from February through August 2011. In total 41 participants took part in six focus groups (90.2% female: N=37) and ranged in age from 50 to 84 years (Table 1). Participants were

a convenience sample chosen after completion of the TC program from all three cohorts and included mid-to-high attenders (25.1% attendance or above n=22) and low attenders (25% attendance or lower n=19).

Materials and Measures

Participants were briefed on the study and were informed that they would be asked a series of questions that they could answer freely and honestly based on their experience in the TC program. The questions for the focus groups were informed by previous research and relevant evidence from personal experience. The questions covered were:

1. What did they like and not like about the TC program overall?
2. Did the time of day, class length, and class intensity influence their attendance or did they have issues with any of these variables?
3. Did they find the movements easy, moderate or hard to learn and what their feelings/perceptions of the TC instruction and did either influence their adherence to the program?
4. Did they like the building and space and time of year of the program and how did this influence their attendance? What were their thoughts on TC being offered all year round, as well as their thoughts on doing TC indoors or outdoors with respect to their continued participation?
5. Was their health an issue for participation and did they feel their mental and/or physical health improved during the TC program?

6. Were their expectations met during the program and what elements did they enjoy most (e.g. physical, social, etc.) and how did this influence their attendance?

7. Did they like the group setting for TC and did this directly affect their attendance? Did they participate in TC on their own and if they did, how did it influence their attendance?

8. Did they feel that since TC was from another culture that this was a barrier to participation?

A digital voice recorder was used to record each focus group and these recordings were subsequently transcribed verbatim. The experimental protocol conformed to the standards set by the Declaration of Helsinki and is approved by the Research Ethics Board at York University and all participants provided informed consent.

Focus Groups

Participants were recruited from attendees from all three TC cohorts, and two focus groups, one consisting of low attendance participants and one consisting of mid-to-high attendance participants, were done for each of the three cohorts. In all, six focus groups were conducted. A sample of 5-7 participants from each focus group was counterbalanced among mid-to-high attenders and low attenders. Participants were not informed that they were divided into groups based on their attendance so as to make sure that all participants felt equally valid. Participants were contacted by phone and asked to participate in the focus groups 2-3 days after the TC program had ended.

The first author worked with three research assistants to facilitate the focus groups. All focus groups were done at the locations where the TC programs took place. Study participants

seated themselves around two digital voice recorders, which were stationary on a table or chair. Participants were read each question and were allowed to answer freely as well as discuss their perceptions among themselves. Each focus group lasted 25 minutes to 36 minutes. Focus groups for cohort 1 and 3 were facilitated in English and focus groups for cohort 2 were facilitated by a translator that spoke both Mandarin and Cantonese. Discussions ended with the opportunity for participants to make final comments before the recorders were switched off. Participants were asked if they had any final questions or concerns, and thanked for their time and received a ten dollar grocery gift card.

Analysis

All focus group data were transcribed and participants were designated with unique identifiers (i.e. F-1 for female 1, M-1 for male 1, etc.). Transcripts were analysed based on multiple readings of the focus groups; broad themes/categories were established for the responses. In accordance with hierarchical content analysis outlined by Côté and colleagues (Côté, Salmela, Baria & Russell, 1993; Côté, Salmela & Russell, 1995) "meaning units" were identified from comments and quotes. From these meaning units, similarities were identified and grouped into "categories" of similar meaning units with common features such as receptive words and phrases (Côté et al., 1993; Tesch, 1990). Six different documents were created (3 high attender and 3 low attender documents) from which categories with similar meaning units were grouped together. This approach to qualitative analysis is often referred to as the constant comparative method (Glaser & Strauss, 1967), and uses a technique of contrasting the data until saturation is achieved. Saturation refers to the process of defining encompassing categories at a level that demonstrates no new concepts from the data.

The data were analysed via the use of guidelines that, although systematic, are endowed with maximum flexibility. In the first stage, the transcripts were coded into thematic clusters. Table 1 demonstrates the themes identified, promoters and barriers to attendance, relating to the specific categories and subcategories. All categories identified at all three stages of analysis were checked by a second coder to ensure they were grounded in the data. Microsoft Excel software was used in the coding process.

Trustworthiness

Interpreter reliability was established through the categorization of a random sample of participant responses (approximately 10% of meaning units) by an individual familiar with this method of qualitative analysis. There was complete agreement in the categorization of the data.

Results and Discussion

Baseline socio-demographic characteristics of the post study focus group participants can be seen in Table 1. The majority of the participants were female, 65 years of age or older, with high school or less education, single, of various ethnicities and had an income of less than $14,000. Within the two broad themes (Promoters and Barriers to Adherence to TC attendance), ten categories of clustered meaning unites emerged (Table 2). There were no differences found between cohorts. As well there were no perceived cultural barriers to adherence and low and high attenders reinforced similar categories and themes. These categories and themes are described in further detail with quotations from participants.

Promoters to Adherence

Enjoyment*:* In community-based programs the physical health benefits of being active are constantly reinforced both by the research itself and the media messages that come from this research. However, the powerful influence from enjoyment of the activity to program adherence is often understated or overlooked. Multiple participants in the TC program commented on the reinforcing effect enjoyment had on strengthening their desire to continue/maintain their attendance. Statements from the participants reflected this enjoyment such as, "I like whatever we are doing. We do different stuff. I like….we do not get into everything at the same time but we….try and it feels good." (F-1). Another statement of enjoyment reinforced this, "Basically, (we enjoyed) that we are active." (F-21). Enjoyment information around the teaching was also shared, "(What helped make it enjoyable for us is that) He also has the most important thing a teacher has to have which is patience." (F-11). At the end of this statement patience was said in unison by several participants at once demonstrating the powerful influence of enjoyment from the teacher.

It is important to note that PA participants in the population tend to acknowledge the beneficial/therapeutic effects of exercise but are reluctant to engage often citing "lack of time", and, relevant to our examination, "lack of enjoyment", as influential factors (Leslie et al., 1999; Stutts, 2002; Trost, Owen, Bauman, Sallis, & Brown, 2002). Other researchers have noted enjoyment as a positive predictor of adherence to PA (Withall et al., 2012).

Physical and Mental Health Influence: There were two levels of health categories that emerged from the focus groups in the promotion of attendance theme physical health influence and mental health influence. Research has shown that sources of information on PA benefits can

come from doctors and other health professionals (Booth et al., 2007; Chao et al., 2000). One participant described the support they obtained that influenced their adherence as, "Yes! It encouraged me [the support]. Tai Chi helps. I told my doctor that I do it and he said 'you should go and do it because it is good for your body'. When I told my daughter that I do it, she said 'go do it mom'". Since older adults can be exposed to more health care providers on a regular basis, reinforcement of both the physical and mental benefits may have a strong influence on participants' adherence to activities. There were specific phrases that were used in relation to these benefits. Statements such as, "It enhances mobility and balance" (M-4), and, "I can walk from the bottom to the ninth floor now" (F-8). As well as direct health statements such as, "We like that it is good for health." (F-16).

Participants also observed mental health benefits and TC research has shown improved mood and psychological wellbeing as one of its benefits (Wang et al., 2004). In the current study, several participants articulated this during the focus groups. One participant smiled and said, "It is relaxing and soothes our emotions/mood." (F-12). Another noted, "It helped me to relax and to think about before you do anything, to think about it and it gives me such a relaxation and you go home so changed, so peaceful." (M-3).

It is important to acknowledge that individuals' goals regarding PA change with age (Chao et al., 2000). Older adults may be more motivated to consistently engage in PA to maintain health, while younger adults may be more motivated by appearance (Chao et al., 2000). Because statements of health benefits were strongly consistent throughout each of the high attender focus groups, the impact of health benefits on adherence is strong in this group. Some of the participants were surprised, and potentially more motivated, by the fact that although the TC program was physically-based exercise it was easy to execute. Statements reflecting this surprise

were, “I was surprised that it doesn’t seem like exercise, but you still the next day you can feel it.” (F-9). While another said, “How the time went by so fast.” (M-4). Ease of execution was also shown in the statement: “The movements were very simple for me and I enjoyed doing it.” (F-11).

This ease of execution (either real or perceived) as a pathway to health benefits once again seems to act as a powerful predictor of adherence in this group of older individuals. Since older adults have a higher risk of injury associated with exercise and are unable to achieve levels of PA compared to younger individuals (Hui et al., 2006), programs that demonstrate health improvement with low physical risk are particularly valuable.

Facilitated both Indoors and Outdoors: The TC program for this study was done indoors in a controlled environment but TC research has shown that it can be performed both indoors and outdoors (Nguyen & Kruse, 2012). We found that consistently throughout all three cohorts there was an openness and comfort level with the idea of doing TC outdoors. One participant stated, “I would like it to be outdoors. Just to be with the environment and with nature.” (F-25). While another said, “If all students took up the space we can pick another park with enough space for us” (F-17). One participant enthusiastically stated, “Outside for me. Weather permitting.” (M-3).

Although all cohorts were open to the idea of doing TC outdoors there were also practical concerns with practicing outside with respect to weather, flat ground and time of year. These concerns were reflected in a statement with distractions such as children, “You’d have to have it at some time when the kids weren’t around. Cause you wouldn’t want to be doing TC when you know, lunch time and they’re all playing.” (F-8). One of the positive aspects to TC, which is often cited in the literature, is the low cost (Logghe et al., 2010); when TC is performed outdoors

the cost lowers even more. This low cost aspect could potentially be an important variable in low income communities with a need for PA interventions. Although some evidence has shown the positive physiological effects of participating in PA outdoors, such as improved mental wellbeing (Thompson Coon et al., 2011), results are mixed on whether indoors or outdoors PA is best. In the context of weather permitting one participant said, "In the park…that would be the best. You get fresh air and all." (M-1), while another said similarly, "Because you get fresh air outside" (F-5). Multiple studies have shown that contact with natural environments offers a relatively effective way of obtaining restoration from stress and mental fatigue (Health Council of The Netherlands, 2004). This openness to the practice of TC outdoors has the potential for downstream health effects over and above the physical benefits of TC since evidence demonstrates exposure to green space in one's environment has a positive association with perceived general health (Health Council of The Netherlands, 2004).

Health Issues not a Barrier: As the population ages, being physically active can be a challenge when chronic conditions limit a person's abilities both physically and psychologically. A final category that emerged from our focus groups under the promoter theme was that participants felt having health issues was not a barrier to participating in TC. This is reflected in the statement, "My health issues did not stop me from coming and they didn't interfere with the way I worked." (F-16). Adding to this another said, "So I don't have no problems [sic] with my ankles, that they use to be all every couple months, the problem." (F-9). One participant proudly stated, "I know I used to have a lot of pain. When I do it [TC], it loosened up my shoulders." (F-12).

These statements are particularly salient since major limitations to PA participation are related to many chronic conditions (Lan, 2012). Previous research has demonstrated that TC is

not only safe but also beneficial to cardiovascular function, muscular strength, microcirculation and various cardiovascular risk factors (Lan et al., 2008). Not only were physical challenges found not to limit TC participation but mental challenges seemed non-limiting as well. One participant stated, "I have a lot of stress in my life. I am always stressed and doing Tai Chi helps relieve my stresses" (F-26). Another participant made a strong statement of, "As I said, I go home peaceful, and I think about it whenever I am in a bad mood or upset and now has improved my spiritual self." (M-5). Yet another participant made an important statement reflecting 21st century influences and TC, "Yes, you have to slow down and become aware of more of your surroundings and it was really nice slowing down." (F-8). Research has shown that TC appears to be associated with improvements in psychological well-being that facilitate a reduction in stress, anxiety, depression and mood disturbance (Wang et al., 2010) which all have been associated with barriers to consistent PA.

Barriers to Attendance

Initial Physical/Mental Challenge: Although many participants felt that TC was very accessible and easy to participate in, a category emerged of the initial physical and mental challenges to participation. Several statements reflected this in our focus groups, "Yes, they were challenging, (TC movements)" (F-8), while similarly another participant stated, "You need to have a lot of patience because you cannot expect us to come a few weeks and know all the moves." (M-2).

An important aspect to understand in the context of this study was that the participants were made up of older adults from various ethnicities, levels of education and levels of motivation. When looking at programs aimed at increasing PA participation it is important to understand the specific barriers faced by older adults of mixed ethnicities and to look at any

cultural barriers that could exist (Horne et al., 2013). Limitations to PA adherence are not solely influenced by physical challenges but by mental challenges as well. Some of these mental challenges can take the form of simple concentration and memory. Although TC is an accessible PA modality, it is based on a series of forms or poses that move from one to another (Liu & Frank, 2010). Some participants initially found that remembering the moves could be a challenge, one participant stated, "I found with me that it was memory" however they also followed up with the statement, "And of course this was what I was looking for as a challenge so, there you are". (F-8). Not all participants are at an equal level in any PA program and this could relate to age and cultural barriers as well as to prior experience. For instance M-5 indicated, "You're forced to concentrate and focus all of your attention, and for some people that was really, really hard." Some researchers have seen this initial physical and mental challenge as an issue and have designed unique TC programs that focus on limited forms or movements (Hao et al., 2013). Sometimes these modified programs were associated with limitations due to the use of assistive devices and required modification of the program goal to improve participant adherence (Hao et al., 2013).

Number of Classes for Accessibility: The fact that TC only involves a single instructor to lead the sessions and a space big enough to hold the participants made it easier for there to be multiple classes offered per week. Thus offering numerous classes was optimal since this limited barriers to accessibility. Both the high attenders and the low attenders agreed regarding the importance of access and having enough classes for accessibility and thus it became a category in our analysis. A participant reflected this with the statement, "If we only had the one choice we might have not been able to make it all the time." (F-7), another participant added, "I would come to the community centre. It is more boring at home. Here we have the teacher and

we have other people." (M-3). Multiple participants liked the varied choice of times and one said, "Um, I ah preferred that, like 10:30, so you can go and after that you can go for other things, because the 2:30 it between up the day, it not really good." (F-15) with M-5 simply saying, "I liked 2:30."

One participant was very specific about why the number of classes was appropriate, "I found the fact that people had choices, they had 2 choices of location. They had lots of choice in terms of time, because this age group, this demographic that you're dealing with, people are extremely busy." (F-2).

Good Teacher Influence: Gyurcsik et al. (2004), found that effective leadership in PA groups for older adults involved leaders who the participants felt were properly qualified, created personal bonds with participants and were able to use their knowledge and the group to demonstrate collective accomplishments. Based on feedback from the focus groups all of these qualities seemed present in each of the TC instructors. One participant said, "I think that his instructions were very good." (F-7). Common statements were articulated by several participants such as, "He was very good teacher. Tony is an excellent teacher. I like our teacher Tony." (F-12), with F-14 stating, "His way is good. Yes, we understood him".

Although once again in this study the teaching/leadership was positive and successful, this category emerged under the barriers theme mainly because the participants recognized how integral the teacher was to either their specific adherence or to adherence in general. Research has shown that older adults have a strong attraction to group-based physical activities and this underscores the importance of not only qualified group leaders but those with an understanding of what leadership qualities benefit adherence (Beauchamp et al., 2007). One participant was very passionate when she stated, "I see David have [sic] a lots of patience. He can do something

over and over and over... And (he) encourages you..." (F-31). Potentially the leadership role of the TC instructor is to perhaps facilitate self-efficacy in the participants so that they feel good about the activity and are motivated to return and continue to participate. These results emphasize the importance of self-efficacy in older adults' sustained participation in group-based PAprograms (McAuley et al., 2011).

Proper Facilities: Van Dyck et al. (2011), looked at Belgium, Australia and the USA with respect to neighborhood environmental attributes and their association with adults' leisure-time PA, showing higher PA in "recreational walking-friendliness" and "leisure-time activity friendliness" neighbourhoods (pg. 59). Although this research was not focused on group-based exercise programs, it does underscore the importance of the physical environment to adherence and sustainability. Many participants in our study reflected on the accessibility of facilities as a strong determinate for adherence and, conversely, the harder the facility was to get to the worse their attendance would be. One participant stated, "It has to do with accessibility in terms of location. It needs to be close to where they (we) live." (F-3), and reinforcing that statement another participant said, "It's clear to be a problem right away if it's far away and if there is a cost." (M-5). Participant M-2 declared a similar sentiment, "I liked how it is in the building. If it was any other place I would not go." Several participants said, "Yes. In the building was really convenient."

However, within this category were other factors, such as the physical layout of the space itself that had real or potential effects on the participants. A participant observed, "When (we) move (we have to) make sure we do not hit other people around us" (F-14), while another participant stated, "(If there are) More people it is too squishy" (M-4). Once again these

elements can be seen in research in older adults showing that dissatisfaction with facilities was significantly associated with a greater risk of inactivity (Trost et al., 2002).

Challenge on Own: One category that emerged as a clear barrier among the participants was attempting to do TC on their own. They articulated the challenge/limitation of doing TC at home on their own in statements like, "I do a little bit but sometimes when I go home, I do not remember everything."(F-14). They also articulated the preference for group when asked about doing TC on their own. A participant somewhat philosophically said, "You feel good. Especially….you built a relationship with all those friends. Whether you are Christian, Hindu or Muslim, we all come together and do it together." (F-25). Another participant simply said, "The interaction was great for me. We get to make friends." (F-11), and "We were building relationships." (F-11).

Some participants just stated their preference for group settings without articulating reasons why, "I like it in a group", or "Better as a group." However many participants knew why they preferred the group situation. M-3 said, "I tried to do it from my apartment but it is hard. I tried to find the space to do it in the apartment." Adding to this another participant stated, "Yes, group classes are better. You can look at other people and we can help each other. I like to watch someone doing it so then I can try to do it [laughing]. I would watch how someone is doing it…." (F-25).

In many ways this category could be tied directly into the first promoter category (i.e., enjoyment). It appeared, by the statements from the participants, that a motivating factor to adherence was the enjoyment of the group setting from helping to facilitate learning to simple social interactions. In this TC study there was negative association of both losing the group

benefit and the challenge of remembering the TC poses on their own, as reflected in the statement, "Yes. If we do it on our own we will forget easily." (F-14).

Conclusion

Participants in this study had different levels of adherence and yet demonstrated similar views on promoters and barriers to adherence in the TC program. Although this study consisted of multiple older adults from various ethnicities, there seemed to be no promoters or barriers to attendance based on their overt cultural exposures. What was similar in this study were the common biological, psychological, social and environmental factors noted, which were similar to those noted by Belza et al., (2004) when looking at PA perspectives from multiple cultures. These factors could then potentially be combined with behaviours and habits that influence back into the physical environment. Despite all the variables that interact and influence PA behaviour, similar themes and categories emerged to further our understanding of PA and exercise adherence and to help make future program choices more successful.

The strength of this study is the data and information collected was not restricted to just specific questions and the participants were allowed to talk in depth and elaborate on any areas in the discussion. The data collected was based on real human experiences within their own community setting that allowed a clearer exploration of the barriers and promoters to adherence. Since this information is grounded in the participants experience there was a greater ability to explore subtleties and complexities around the research questions. Limitations also exist and could relate to the individual skills of the interviewer/focus group facilitators since the nature of this study called on several interviewers to be used. As well rigor is more difficult to maintain, assess and demonstrate in the reality of semi-structured interview scenarios.

Interestingly, in the present study health limitations worked as a promoter to activity and highlighted the need to provide the right modality (i.e. TC) to address health limitations. Similar to other studies (Dergeance et al., 2003; Walcott-McQuigg & Prohaska, 2001), our participants identified both physical and mental health benefits from being physically active through TC. Common barriers to adherence in our study, also found in the literature, related to both built environment and accessibility through transportation (King et al., 2006). Without proper facilities, even basic ones, many PA programs cannot be consistently facilitated year round in Canada due to the changing environmental weather conditions. This seemed to be an especially strong influence for the older adults in this study. By listening to the voices of older adult participants in our TC program the promoters and barriers to adherence were explored which, in turn, could potentially lead to better PA programs tailored to the needs of similar populations. With more appropriately designed PA programs there is a greater chance of better physical and mental health outcomes and at the same time facilitating a better investment in these community-based programs.

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Table 1: Baseline Socio-Demographic Characteristics of Post Study Focus Group Participants

	Overall Focus Groups N (%)	Focus Group 1 N (%)	Focus Group 2 N (%)	Focus Group 3 N (%)
Totals	**41 (100.0)**	**13 (31.7)**	**13 (31.7)**	**15 (36.6)**
Sex				
Male	4 (9.8)	1 (7.7)	1 (7.7)	2 (13.3)
Female	37 (90.2)	12 (92.3)	12 (92.3)	13 (86.7)
Age groups				
50-64 years	8 (19.5)	2 (15.4)	3 (23.1)	3 (20.0)
65-74 years	17 (41.5)	8 (62.5)	2 (15.4)	7 (46.7)
75+ years	16 (39.0)	3 (23.1)	8 (61.5)	5 (33.3)
Ethnicity of Origin				
Chinese	13 (31.8)	0 (0.0)	13 (100.0)	0 (0.0)
South American	9 (21.9)	6 (46.1)	0 (0.0)	3 (20.0)
Caribbean	2 (4.9)	1 (7.7)	0 (0.0)	1 (6.7)
European	10 (24.4)	2 (15.4)	0 (0.0)	8 (53.3)
South Asian	6 (14.6)	4 (30.8)	0 (0.0)	2 (13.3)
Other	1 (2.4)	0 (0.0)	0 (0.0)	1 (6.7)
Education:				
< High School	20 (48.8)	8 (61.5)	6 (46.2)	6 (40.0)
High School	15 (36.7)	4 (30.8)	6 (46.1)	5 (33.3)
> High School	6 (14.5)	1 (7.7)	1 (7.7)	4 (26.7)
Marital Status				
Single	24 (58.5)	10 (76.9)	3 (23.1)	11 (73.3)
Married	17 (41.5)	3 (23.1)	10 (76.9)	4 (26.7)
Income (per year)				
<$14,000	28 (68.3)	11 (84.6)	10 (76.9)	7 (46.6)
$14,000-$30,000	9 (21.9)	2 (15.4)	3 (23.1)	4 (26.7)
>$30,000	4 (9.8)	0 (0.0)	0 (0.0)	4 (26.7)

Table 2. Themes, categories, and subcategories to adherence resulting from the qualitative analysis

Themes	Categories	Subcategories
Promoters to Adherence	Enjoyment	General enjoyment(2), teacher enjoyment (8)
	Physical health influence	Balance better(2), overall health(7), improvement(9)
	Mental health influence	Relax(3), sooth(2), outlook better(1), improvement(9)
	Facilitated both indoors and outdoors	Length good(4), Intensity good(4), Movements good(5), Outdoors/indoors good(5)
	Health issues not a barrier	No barrier when issues with back(2), breathing(1), arms(3), legs(4), colds(2)
Barriers to Adherence	Initial Physically and mental challenge	Challenge/at beginning(5), struggle(1), hard at beginning(1), concentration challenge(1), memory challenge(2)
	Number of classes for accessibility	One class limiting(1),
	Good teacher importance	Patience needed(1), hard to follow(1), bad teacher a barrier(1)
	Right space	Too hot/cold issue(2), weather issues(1), transportation issues, space size issue(2)
	Challenge on own	Motivation, memory challenge(2)

CONCLUSION

MAIN FINDINGS

The goal of this dissertation was to look at the effects of a 16-week Tai Chi (TC) intervention on physiological and psychological health as well as to examine the barriers and promoters of enrollment and adherence in a low income multi-ethnic older adult population. It is unique in being one of the first studies in Canada to look at a community-based physical activity (PA) intervention using TC with low-income participants from cultures not associated with TC practice. It is also unique in that it explored a PA modality that combines both physiological health influences and psychological health influences in an older adult, low-income, multiple-ethnic population using both quantitative and qualitative research techniques.

The first research question addressed potential barriers and promoters to enrollment through multiple focus groups. Through our large focus group sample of 87 we uncovered promoters such as health improvement, optimal time of day, socializing/networking and program pairing. What was not motivational for our focus group participants was accessibility when limited by transportation (distance and/or transit) and appropriate leadership and/or teacher. The first three promoters were understandable and found throughout the literature but what was novel with our participants was the focus on program pairing. In a low-income older adult population the need to cut down on travel time, to be more efficient with the time they have and to incorporate multiple programs into their lives has the potential to be a powerful motivator to enrollment.

With respect to TC and physiological outcomes, or health-related physical fitness outcomes which was the focus in the second study, having participants attend even one session

per week showed a beneficial physical effect. As is known from PA research in Canada (Paterson & Warburton, 2010) improved attendance will increase physical fitness gains and reduce risks. When looking at specific health-related physical fitness benefits in this older adult, multiple-ethnic group, TC was shown in the second study to not only strengthen the lower body but the upper body as well, demonstrating the ability of a "no equipment" based intervention to affect whole body health-related fitness outcomes.

When exploring TC and psychological health outcomes in the third study, the picture was not as clear as the physiological outcomes, but improvements were seen in certain areas of psychological health such as vitality and mental health. Other studies examining the effects of TC, and using a comparable instrument to the SF 36, showed similar psychological health improvements to ours (Wang et al., 2004; Ko et al., 2006; Lee et al., 2007) but, like our research, psychological outcomes were not as robust as the physiological outcomes. Our study was unique in that we looked at Expectations Regarding Aging (ERA) and observed that the 3rd cohort had both a higher ERA improvement and a higher attendance which would be valuable to explore further in future research.

When looking at barriers and promoters to sustained attendance, in the fourth manuscript, multiple categories emerged that could prove valuable for future TC programming but also for general PA programming in the community. Highlighting the enjoyment, physical and mental health benefits, accessibility (indoor/outdoor) and health issues not being a barrier to the practice of TC could help with sustained attendance and therefore potentially increase health benefits for participants. Helping participants with the initial learning curve, not overcrowding the classes, having the right space and having an engaging TC master would also help remove barriers to the

practice of and adherence to TC. It was also clear from both the enrollment and the adherence focus groups that ethnicity was not a limiting factor with the embracing of TC as a PA modality.

STRENGTHS AND LIMITATIONS

Due to the fact that the second and third manuscripts were not based on randomized control trials there may be limitations relating to internal validity of results. Potential limitations could include uncontrolled program-induced changes in daily physical activities, seasonal influences on health status and mood, lifestyle factors and self-reporting bias. With respect to the focus groups there can be limitations with facilitating the exact same focus group scenario for all participants, having a few participants dominate the group, and having too much involvement by the facilitator. Strengths of this study are the real world outcomes with the potential for present day applications in a high risk population that is under-researched and over-exposed to stressors from aging, low income and lack of activity. The use of mixed methods research techniques was not only unique for TC research but increased the informative outcomes. The participants' direct input into both the recruiting and initiating of the program with feedback on optimal design was very powerful. This participation not only facilitated enrollment and adherence but empowered community members to "own" the program, which may have contributed to improved motivation to have a stake in its continuation after the research study was done. This was evidenced in both the 2nd and 3rd cohorts that continued TC practice months after the end of the study.

Mixed Methods

One of the main strengths of the study was the use of mixed methods which has the potential to combine multiple findings of "significance" to create a more complete picture and, therefore, minimize misleading interpretations of research data.

When looking at the results of the research from this dissertation, the statistical significance can be seen quantitatively with regard to the success of the health-related physical outcomes with some limited statistical significance in the psychological outcomes. Practical significance can be seen in the value of how to create more TC programs in lower-income communities based on the educational lessons learned through this dissertation. Potential clinical significance can be seen with a substantial number of participants that moved from the lower health-related fitness levels to higher levels. Finally, in the area of economic significance the results of this dissertation have the potential to show that an open space and an effective TC master/leader can facilitate multiple positive health outcomes at relatively low cost. The research data from the quantitative information is then added to the qualitative outcomes from the categories of facilitated enrollment such as health improvement, time of day, socializing/networking and program pairing and facilitated adherence categories such as enjoyment, physical/mental health influences, facilitation indoors/outdoors and health issues being non limiting. When these results are considered as a whole, a more complete picture can be formed to potentially inform future research and/or community programming with TC.

STUDY IMPLICATIONS AND FUTURE DIRECTIONS

This research could potentially be used, in combination with other studies, to look at appropriate TC program design in both physiological influences and psychological influences.

This dissertation is also important since it illuminates an accessible and effective PA program that not only has proven evidence-based outcomes, but also has the potential for being financially sustainable. While previous studies have indeed shown that minority groups tend to be more inactive when compared with non-minority groups (Marshall et al., 2007; Marquez & McAuley, 2006; He & Baker, 2004; Crespo et al., 2000), this problem is exacerbated by insufficient research about PA promotion and adoption in the minority elderly in Canada. Through the findings in this dissertation one more piece can be added to the picture of positively influencing low-income, ethnic older adults to become more active in a potentially sustainable manner. However there were some limitations to this research. Unfortunately unstructured PA or an assessment of change in PA during the study was not captured that could have been an influential variable on the outcomes.

The dissertation examined the physiological and psychological outcomes as well as the barriers and promoters to enrollment and adherence to a 16-week older adult, multi-ethnic, low-income population. Future research could potentially build on follow-ups beyond 16 weeks to examine the health outcomes around longer exposure times such as six months to several years. These longer timelines could be potentially illuminating around psychological health outcomes since the majority of studies in TC are based around 12 to 16 weeks. As well, increasing stake holder involvement when creating and sustaining PA program research could potentially create greater enrollment and adherence. Although this is one of the first studies in Canada to look at this specific population and TC, the results point in the direction that this PA modality has community-based health care potentials that could be deployed on a larger scale.

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Appendices

Appendix A-Focus Group Informed Consent

Informed Consent Form (Focus Groups)

Date: 09/30/2011

Study Name:
Tai Chi (TC) for older adults: "improving physical and psychological health and identifying and overcoming cultural/ethnic barriers to participation".

Researchers:
Hala Tamim PhD, Patricia Lynn Weir PhD, Chris Ardern PhD, Joseph Baker PhD, Paul Ritvo PhD

Sponsors:
Social Sciences and Humanities Research Counsel of Canada (SSHRC).

Purpose of the Research:
The purpose of this study is to better understand the factors influencing older adults in terms of enrolment and consistent participation in a locally-offered Tai Chi program.

What You Will Be Asked to Do in the Research:
You will be asked, through focus group discussions, about the factors that will influence older adults' participation in a Tai Chi program and will assess factors that influence sustained and unsustained participation in such a program. Being able to speak English will not be a necessary prerequisite for participation. Translators will be available for focus group sessions. Using the information obtained from focus group discussions, the research team and TC Master will design two TC programs (one for males and one for females) tailored to reflect the interests and concerns of each of the ethnic groups.

Risks and Discomforts:
No know significant risks associated with the quantitative and qualitative measurements.

Benefits of the Research and Benefits to You:
Studies have shown that Tai Chi have beneficial effects on cardio-respiratory function, health-related fitness, musculoskeletal function, balance and flexibility, posture control capacity, and functional status. Using the information obtained from focus group discussions, the research team and TC Master will design two TC programs (one for males and one for females) tailored to reflect the interests and concerns of each of the ethnic groups.

Voluntary Participation:
Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the nature of the ongoing relationship you may have with the researchers or study staff either now, or in the future.

Withdrawal from the Study:
You can stop participating in the study at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, York University, or any other group associated with this project.

Confidentiality:

Your identity will be kept confidential to the full extent possible by law. In addition, neither your name nor any other personal identifier will be used in any reports or publications arising from this project. The data collected from you will be entered into a database used to store data from all study participants. This database will be located in a computer that is password protected and no one but study investigators will have access to it. The computer itself will located in a locked, secure office at York University. Your data will be identified only with a number, so there will be no way for anything you say to be connected with your name, or any personally identifying information. The data base will only be maintained and used for the time period required to complete study analyses, then securely stored for a period of two years after the project. After that, all information will be erased.

Questions About the Research?

If you have questions about the research in general or about your role in the study, please feel free to contact James Manson either by telephone at (647) 226-3488, or by e-mail (jmanson@yorku.ca). This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 309 York Lanes, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Signatures:

I_____, consent to participate in the FOCUS GROUP and the TAI CHI PROGRAM pertaining to the "Tai Chi study for older adults: improving physical and psychological health and identifying and overcoming cultural/ethnic barriers to participation" conducted by Dr. Hala Tamim. I have understood the nature of this project and wish to participate in the focus group. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

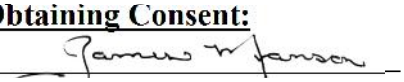
Participant

Signature _____

Date

Name (please print)_____

Person Obtaining Consent:

Signature 

Date

Name (please print) James Manson

Consent to be photographed:

I _____, consent to be photographed during this FOCUS GROUP. The photos may be presented at scientific conferences. Names will never be disclosed with photos.

Signature_____

Date

Consent to be contacted for future studies:

I _____, consent to be contacted by the principal investigator for future studies that are related to the current study.

Signature_____

Date

Appendix A-Enrollment Focus Group Questions and Probes

Enrollment

Tai Chi (TC) for older adults: improving physical and psychological health and identifying and overcoming cultural/ethnic barriers to participation

Narrative around Tai Chi and their culture, personal and objective. Initial discussion unsolicited.

Collect demographics from group, age, gender, years in Canada, original area from when last practiced TC, for how long, why stopped.

Focus Group Questions to answer objective 1:

What are some of the key challenges that you see for enrolling in a Tai Chi program?

Possible probes:

a. Day / time of session—12 & 3 (Monday to Thursday)
b. Number of sessions they could attend (suggest if 2 is reasonable)
c. Language
d. Sex of participants
e. Age range of participants
f. Transportation to place where tai chi program would take place
g. Not knowing enough about tai chi
h. Overall health of older adult
i. Weather conditions
j. Place where Tai Chi would take place (indoors versus outdoors)
k. If done Tai Chi in the past what has been barrier for continuing/starting again?

What are some of the key promoting factors that you see for enrolling in Tai Chi program?

Possible probes:

a. To be physically active
b. Improvement in physical fitness
c. Improvement in psychological wellbeing
d. Fill the day
e. Social networking

Suggested methods for recruiting participants in tai chi opportunities

Possible probes:

a. Advertisements
b. Through young individuals
c. Temple and other religious centers
d. Hubs for cultural interaction
e. word of mouth/friends and family participating"
f. Within Alexandra Community center

Informed Consent Form (enrolling in Tai Chi program)

Date: 14/5/2009

Study Name:
Tai Chi (TC) for older adults: improving physical and psychological health and identifying and overcoming cultural/ethnic barriers to participation"

Researchers:
Hala Tamim PhD, Patricia Lynn Weir PhD, Chris Ardern PhD, Joseph Baker PhD, Paul Ritvo PhD

Sponsors:
Social Sciences and Humanities Research Council of Canada (SSHRC).

Purpose of the Research:
The purpose of this study is to assess effectiveness of a locally-offered Tai Chi exercise program on improving physical and psychological health.

What You Will Be Asked to Do in the Research:
You will also be asked to fill out several questionnaires prior and after the tai chi program. These are designed to evaluate socio-demographic, behavioral, physical and mental health, social support, ability and confidence in performing different tasks, falls, fear of falling and expectations to aging. In conjunction with these questionnaires, measurements by Certified Exercise Physiologists will be performed at beginning of the tai chi program, at 8 weeks after start-up and at the end of the study to fully assess an individual's musculoskeletal fitness, balance, resting heart rate, resting blood pressure, height, weight, BMI and waist circumference.

Risks and Discomforts:
There are no known significant risks associated with the quantiviative and qualitative measurements. Although we do not foresee major risks or discomfort from your participation in the research, the risks associated with this study are those associated with regular physical activity i.e. episodes of transient light headiness, loss of consciousness, abnormal blood pressure, chest discomfort, leg cramps, and nausea, and you must assume willfully those risks. Your obligation is to immediately inform the Tai Chi Master of any pain, discomfort, fatigue, or any other symptoms that you may suffer during and immediately after the Tai Chi sessions. Care will be taken to ensure these risks are minimized by insuring proper supervision/instruction by a qualified professional (who as a minimum is trained to administer CPR at Heart Saver Level) during the exercise sessions.

Benefits of the Research and Benefits to You:
Studies have shown that Tai Chi have beneficial effects on cardio-respiratory function, health-related fitness, musculoskeletal function, balance and flexibility, posture control capacity, and functional status. This study has been designed to have a potential benefit

of reducing the risk of falling and the number of falls participants may have by improving balance. Participants may encounter psychological benefits such as improvements in mental strength, self-esteem, and confidence. There may also be some benefits derived from participating in a group setting with individuals of similar age such as improving one's motivation and enthusiasm towards participating.

Voluntary Participation:
Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the nature of the ongoing relationship you may have with the researchers or study staff either now, or in the future.

Withdrawal from the Study:
You can stop participating in the study at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the researchers, York University, or any other group associated with this project.

Confidentiality:
Your identity will be kept confidential to the full extent possible by law. In addition, neither your name nor any other personal identifier will be used in any reports or publications arising from this project. The data collected from you will be entered into a database used to store data from all study participants. This database will be located in a computer that is password protected and no-one but study investigators will have access to it. The computer itself will be located in a locked, secure office at York University. Your data will be identified only with a number, so there will be no way for anything you say to be connected with your name, or any personally identifying information. The data base will only be maintained and used for the time period required to complete study analyses, then securely stored for a period of two years after the project. After that, all information will be erased.

Questions About the Research?
If you have questions about the research in general or about your role in the study, please feel free to contact Dr. Hala Tamim either by telephone at (416) 736-2100, extension 33338 or by e-mail (htamim@yorku.ca). This research has been reviewed and approved by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 309 York Lanes, York University (telephone 416-736-5914 or e-mail ore@yorku.ca).

Legal Rights and Signatures:

I _____, consent to participate in the study entitled "Tai Chi (Tai Chi) for older adults: improving physical and psychological health and identifying and overcoming cultural/ethnic barriers to participation" conducted by Dr. Hala Tamim. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Participant:	**Person obtaining consent:**
Signature_____	Signature _____
Date_____	Date_____
Name (please print _____	Name (please print) James Manson

Consent to be photographed during Tai Chi sessions:

I _____, consent to be photographed during the tai chi sessions. The photos may be presented at scientific conferences. Names will never be disclosed with photos.

Signature_____

Date_____

Consent to be photographed during assessments session:

I _____, consent to be photographed during the tai chi assessments session. The photos may be presented at scientific conferences. Names will never be disclosed with photos.

Signature_____

Date_____

PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

Regular physical activity is fun and healthy, and more people should become more physically active every day of the week. Being more physically active is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

SECTION 1 - GENERAL HEALTH

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	YES	NO
1) Has your doctor ever said that you have a heart condition **OR** high blood pressure?	☐	☐
2) Do you feel pain in your chest at rest, during your daily activities of living, **OR** when you do physical activity?	☐	☐
3) Do you lose balance because of dizziness **OR** have you lost consciousness in the last 12 months? Please answer **NO** if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)?	☐	☐
5) Are you currently taking prescribed medications for a chronic medical condition?	☐	☐
6) Do you have a bone or joint problem that could be made worse by becoming more physically active? Please answer **NO** if you had a joint problem in the past, but it does not limit your current ability to be physically active. For example, knee, ankle, shoulder or other.	☐	☐
7) Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

☑ **If you answered NO to all of the questions above, you are cleared for physical activity. Go to Section 3 to sign the form. You do not need to complete Section 2.**

- Start becoming much more physically active – start slowly and build up gradually.
- Follow Canada's Physical Activity Guidelines for your age (www.csep.ca/guidelines).
- You may take part in a health and fitness appraisal.
- If you have any further questions, contact a qualified exercise professional such as a CSEP Certified Exercise Physiologist® (CSEP-CEP) or a CSEP Certified Personal Trainer® (CSEP-CPT).
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous physical activity, please consult a qualified exercise professional (CSEP-CEP) before engaging in maximal effort exercise.

If you answered YES to one or more of the questions above, please GO TO SECTION 2.

⚠ **Delay becoming more active if:**

- You are not feeling well because of a temporary illness such as a cold or fever - wait until you feel better
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ before becoming more physically active OR
- Your health changes - please answer the questions on Section 2 of this document and/or talk to your doctor or qualified exercise professional (CSEP-CEP or CSEP-CPT) before continuing with any physical activity programme.

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PAR-Q+

SECTION 2 - CHRONIC MEDICAL CONDITIONS

1. Do you have Arthritis, Osteoporosis, or Back Problems?

YES ☐ If yes, answer questions 1a-1c **NO** ☐ If no, go to question 2

1a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
1b.	Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)?	YES ☐ NO ☐
1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	YES ☐ NO ☐

2. Do you have Cancer of any kind?

YES ☐ If yes, answer questions 2a-2b **NO** ☐ If no, go to question 3

2a.	Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and neck?	YES ☐ NO ☐
2b.	Are you currently receiving cancer therapy (such as chemotheraphy or radiotherapy)?	YES ☐ NO ☐

3. Do you have Heart Disease or Cardiovascular Disease? *This includes Coronary Artery Disease, High Blood Pressure, Heart Failure, Diagnosed Abnormality of Heart Rhythm*

YES ☐ If yes, answer questions 3a-3e **NO** ☐ If no, go to question 4

3a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
3b.	Do you have an irregular heart beat that requires medical management? (e.g., atrial fibrillation, premature ventricular contraction)	YES ☐ NO ☐
3c.	Do you have chronic heart failure?	YES ☐ NO ☐
3d.	Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer **YES** if you do not know your resting blood pressure)	YES ☐ NO ☐
3e.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?	YES ☐ NO ☐

4. Do you have any Metabolic Conditions? *This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes*

YES ☐ If yes, answer questions 4a-4c **NO** ☐ If no, go to question 5

4a.	Is your blood sugar often above 13.0 mmol/L? (Answer **YES** if you are not sure)	YES ☐ NO ☐
4b.	Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, and the sensation in your toes and feet?	YES ☐ NO ☐
4c.	Do you have other metabolic conditions (such as thyroid disorders, pregnancy-related diabetes, chronic kidney disease, liver problems)?	YES ☐ NO ☐

5. Do you have any Mental Health Problems or Learning Difficulties? *This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome)*

YES ☐ If yes, answer questions 5a-5b **NO** ☐ If no, go to question 6

5a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
5b.	Do you also have back problems affecting nerves or muscles?	YES ☐ NO ☐

PAR-Q+

6. Do you have a Respiratory Disease? *This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure*

YES ☐ If yes, answer questions 6a-6d **NO** ☐ If no, go to question 7

6a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
6b.	Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?	YES ☐ NO ☐
6c.	If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?	YES ☐ NO ☐
6d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?	YES ☐ NO ☐

7. Do you have a Spinal Cord Injury? *This includes Tetraplegia and Paraplegia*

YES ☐ If yes, answer questions 7a-7c **NO** ☐ If no, go to question 8

7a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
7b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?	YES ☐ NO ☐
7c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?	YES ☐ NO ☐

8. Have you had a Stroke? *This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event*

YES ☐ If yes, answer questions 8a-c **NO** ☐ If no, go to question 9

8a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
8b.	Do you have any impairment in walking or mobility?	YES ☐ NO ☐
8c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?	YES ☐ NO ☐

9. Do you have any other medical condition not listed above or do you live with two chronic conditions?

YES ☐ If yes, answer questions 9a-c **NO** ☐ If no, read the advice on page 4

9a.	Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months **OR** have you had a diagnosed concussion within the last 12 months?	YES ☐ NO ☐
9b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?	YES ☐ NO ☐
9c.	Do you currently live with two chronic conditions?	YES ☐ NO ☐

Please proceed to Page 4 for recommendations for your current medical condition and sign this document.

PAR-Q+

If you answered NO to all of the follow-up questions about your medical condition, you are ready to become more physically active:

- It is advised that you consult a qualified exercise professional (e.g., a CSEP-CEP or CSEP-CPT) to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually - 20-60 min of low to moderate intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate intensity physical activity per week.
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous physical activity, please consult a qualified exercise professional (CSEP-CEP) before engaging in maximal effort exercise.

If you answered **YES** to **one or more of the follow-up questions** about your medical condition:

You should seek further information before becoming more physically active or engaging in a fitness appraisal.
It is recommended strongly that you complete the specially designed online screening and exercise recommendations program (i.e., the ePARmed-X+; www.eparmedx.com) and/or visit a qualified exercise professional (CSEP-CEP) for further information.

Delay becoming more active if:

- You are not feeling well because of a temporary illness such as a cold or fever - wait until you feel better
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ before becoming more physically active OR
- Your health changes - please talk to your doctor or qualified exercise professional (CSEP-CEP) before continuing with any physical activity programme.

SECTION 3 - DECLARATION

- You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.
- The PAR-Q+ Collaboration, the Canadian Society for Exercise Physiology, and their agents assume no liability for persons who undertake physical activity. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.
- If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.
- Please read and sign the declaration below:

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that a Trustee (such as my employer, community/fitness centre, health care provider, or other designate) may retain a copy of this form for their records. In these instances, the Trustee will be required to adhere to local, national, and international guidelines regarding the storage of personal health information ensuring that they maintain the privacy of the information and do not misuse or wrongfully disclose such information.

NAME _____ DATE _____

SIGNATURE _____ WITNESS _____

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER _____

For more information, please contact

www.eparmedx.com or
Canadian Society for Exercise Physiology
www.csep.ca

Citation for PAR-Q+
Warburton DER, Jamnik VK, Bredin SSD, and Gledhill N on behalf of the PAR-Q+ Collaboration. The Physical Activity Readiness Questionnaire (PAR-Q+) and Electronic Physical Activity Readiness Medical Examination (ePARmed-X+). Health & Fitness Journal of Canada 4(2):3-23, 2011.

The PAR-Q+ was created using the evidence-based AGREE process (1) by the PAR-Q+ Collaboration chaired by Dr. Darren E. R. Warburton with Dr. Norman Gledhill, Dr. Veronica Jamnik, and Dr. Donald C. McKenzie (2). Production of this document has been made possible through financial contributions from the Public Health Agency of Canada and the BC Ministry of Health Services. The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada or BC Ministry of Health Services.

Key References
1. Jamnik VJ, Warburton DER, Makarski J, McKenzie DC, Shephard RJ, Stone J, and Gledhill N. Enhancing the effectiveness of clearance for physical activity participation; background and overall process. APNM 36(S1):S3-S13, 2011.
2. Warburton DER, Gledhill N, Jamnik VK, Bredin SSD, McKenzie DC, Stone J, Charlesworth S, and Shephard RJ. Evidence-based risk assessment and recommendations for physical activity clearance; Consensus Document. APNM 36(S1):S266-s298, 2011.

CSEP | SCPE
THE GOLD STANDARD IN EXERCISE SCIENCE AND PERSONAL TRAINING

Tai Chi Participation Study: Physical and Psychological Measures Booklet

Name of CSEP-CEP for Physical Measures _____

Name of Facilitator for Questionnaires _____

Please Place Name Sticker Here
(Includes name and registry number)

Physical Measures

1. Area is the heart rate and blood pressure section.

Resting Heart Rate _____ BPM, Blood Pressure (1) Systolic _____ Diastolic _____

(2) Systolic _____ Diastolic _____

Birth Date: (M/D/Y) _____Age: _____, Gender: ☐Male , ☐Female

Current Tai Chi class participation : ☐No , ☐Yes

How may years ago did you last participate in Tai Chi class of a duration for more then 1 month? _____

Lifetime Tai Chi Participating _____ yrs.

Ethnicity _____ Time in Canada: _____ yrs,

2. Area is height, weight, and waist circumference section.

Height: _____ cm, Weight: _____ kg, Waist Circumference _____ cm

3. Area is grip strength section.

Grip Strength:

Trial 1: Right _____ Kg, Left _____ Kg,

Trial 2: Right _____ Kg, Left _____ Kg,

4. Area is chair stand section.

Demonstrate and have participant perform 1 or 2 chair sits

# of chair sits/30 second number: _____

Please note any help or deviations:

5. Area is one arm curl section.

Demonstrate on how to execute the arm curl: women use 5 lb and men use 8 lb and dominant arm is used.

# of arm curls/30 second number: _____

Please note any help or deviations:

6. Area is up and go section.

Demonstrate: Timing 1: _____ seconds Timing 2: _____ seconds Please note any help or deviations:

7. Area is sit and reach section.

Demonstrate standard sit and reach. Participant removes shoes and start point is 26 cm. Measurement: Trial 1_____ , Trial 2_____, Trial 3_____ cm Please note any help or deviations:

8. Balance testing

Demonstrate Static Balance test: One Leg Stance Test. Stop after 45 seconds. Have participant pick the leg they are most comfortable with. Measurement: R or L (circle one) Trial 1 _____ , Trial 2 _____, time in seconds Demonstrate Dynamic Balance Test: 10 foot toe to heel walk Measurement: Trial 1 _____ , Trial 2_____, feet Please note any help or deviations:

9. Functional Reach Test

Demonstrate Functional Reach Test: Standing against wall, arms 90 degrees measure start position and then maximum reach position. Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. Examiner places a ruler at the end of fingertips when arm is at 90 degrees. Fingers should not touch the rule while reaching forward. The recorded measure is the distance forward that the fingers reach while the participant is in the most forward lean position. When possible, ask participant to use both arms when reaching to avoid rotation of the trunk.

Start point Measurement; _____, cm

Max Reach Trial 1 _____, Trial 2 _____,cm

Please note any help or deviations:

11. Determining the Health Benefits of your Physical Activity Participation……

#1. Frequency

Over a typical seven-day period (one week), how many times do you engage in physical activity that is sufficiently prolonged and intense to cause sweating and rapid heart beat?

☐At least three times ☐ Normally once or twice ☐ Rarely or never

#2(a). Intensity

When you engage in physical activity, do you have the impression that you:

☐Make an intense effort ☐ Make a moderate effort ☐ Make a light effort

#3. Perceived Fitness

In a general fashion, would you say that your current physical fitness is:

☐Very Good ☐ Good ☐ Average ☐ Poor ☐ Very Poor

12. **Please ask the current activities of the individual.** Circle number from 1 to 5 for level of enjoyment. Record number of times per week activity is done and generally the average time of each session in minutes. Check the box that indicates level of intensity. x

Activity	**Enjoy** **Do Not Enjoy(1) to Enjoy The Most(5)**	**Frequency** **per week**	**Duration** **in mins per session**	**Intensity**	**Notes**
Walking	1 2 3 4 5			☐ Low ☐Mod ☐High	
Stretching	1 2 3 4 5			☐Low ☐Mod ☐High	
Swimming	1 2 3 4 5			☐Low ☐Mod ☐High	
Other _____	1 2 3 4 5			☐Low ☐Mod ☐High	
Other _____	1 2 3 4 5			☐Low ☐Mod ☐High	
Other _____	1 2 3 4 5			☐Low ☐Mod ☐High	
Other _____	1 2 3 4 5			☐Low ☐Mod ☐High	

Demographic Information

Education				
	1.Illiterate	2.Primary	3.Junior high	4.Senior high
	5.University-Undergraduate	6.University-Graduate		
Marital Status				
	1.Unmarried	2.Married	3.Divorced	4.Widowed
	5.Other			
Annual Income				
	<$14,000	$14,000 to $30,000	>$30,000-50,0000	>50,
Cigarette smoking:				
	1.No	2.Yes		
	The number of cigarettes/week. _____			
Drinking (Alcohol)				
	1.No	2. Yes		
	The amount of alcohol drinking/day (glasses) _____			
Assistance provision				
	1.None	2.Zimmer frame, walker, or stick		
Notes:				

Information on Falls				
How many falls in the last year _____				
Falls (start with most recent)	Which Month	Severity Low (1) to High(5)	*Description of Fall (Cause)	Medical Attention
Fall 1		1 2 3 4 5		☐ Yes ☐ No
Fall 2		1 2 3 4 5		☐ Yes ☐ No
Fall 3		1 2 3 4 5		☐ Yes ☐ No
Fall 4		1 2 3 4 5		☐ Yes ☐ No
Fall 5		1 2 3 4 5		☐ Yes ☐ No
* Example: If got dizzy and tripped on a chair then fall would be from dizziness, not the chair.				

Do you have the following illness?	No	Yes	If "yes" how many years you have had it?	On Medication.	
Hypertension (high blood pressure)	1	2		No	Yes
Diabetes mellitus: Please circle type I or II	1	2		No	Yes
Cardiovascular disease (heart disease)	1	2		No	Yes
Arthritis: Please circle Rheumatoid or Osteo	1	2		No	Yes
Cerebral vascular accident	1	2		No	Yes
Vision impairments (Glasses)	1	2		No	Yes
Hearing impairments	1	2		No	Yes
Tumor	1	2		No	Yes
Sleep disturbances	1	2		No	Yes
Disorientation	1	2		No	Yes
Depression	1	2		No	Yes
Chronic obstructive pulmonary disease	1	2		No	Yes
Incontinence	1	2		No	Yes
Other illness _____	1	2		No	Yes
Total illness					

Do you take other tablets (drugs from doctor)?	No	Yes	Notes:
Tranquilizers	1	2	
Laxative/diuretic (bowel medicine/water tablets)	1	2	
Pain relief	1	2	
Other medication	1	2	

Who are the people that are in your life? How often do you interact with them?			
Social Support	No	Yes	The frequency of phoning, and/or visiting per month?
Brother	1	2	Monthly _____
Sister	1	2	Monthly _____
Son	1	2	Monthly _____
Daughter	1	2	Monthly _____
Spouse	1	2	Monthly _____
Friend	1	2	Monthly _____
Neighbour	1	2	Monthly _____
Religion Attendance	1	2	Monthly _____

Do you consider yourself to be a religious person.

1-I strongly disagree 2-I tend to disagree 3-I am not sure 4-I tend to agree 5-I strongly agree

Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.
Thank you for completing this survey!

For each of the following questions, please mark an ☒ in the one box that best describes your answer.

1. **In general, would you say your health is:**

Excellent	Very good	Good	Fair	Poor
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

2. **<u>Compared to one year ago</u>, how would you rate your health in general <u>now</u>?**

Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

3. The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?

		Yes, limited a lot	Yes, limited a little	No, not limited at all
a	<u>Vigorous activities</u>, such as running, lifting heavy objects, participating in strenuous sports	☐ 1	☐ 2	☐ 3
b	<u>Moderate activities</u>, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐ 1	☐ 2	☐ 3
c	Lifting or carrying groceries	☐ 1	☐ 2	☐ 3
d	Climbing <u>several</u> flights of stairs	☐ 1	☐ 2	☐ 3
e	Climbing <u>one</u> flight of stairs	☐ 1	☐ 2	☐ 3
f	Bending, kneeling, or stooping	☐ 1	☐ 2	☐ 3
g	Walking <u>more than a kilometre</u>	☐ 1	☐ 2	☐ 3
h	Walking <u>several hundred metres</u>	☐ 1	☐ 2	☐ 3
i	Walking <u>one hundred metres</u>	☐ 1	☐ 2	☐ 3
j	Bathing or dressing yourself	☐ 1	☐ 2	☐ 3

4. During the <u>past 4 weeks</u>, how much of the time have you had any of the following problems with your work or other regular daily activities <u>as a result of your physical health</u>?

		All of the time	Most of the time	Some of the time	A little of the time	None of the time
a	Cut down on the <u>amount of time</u> you spent on work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b	<u>Accomplished less</u> than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c	Were limited in the <u>kind</u> of work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d	Had <u>difficulty</u> performing the the work or other activities (for example, it took extra effort)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

5. During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Cut down on the amount of time you spent on work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c Did work or other activities less carefully than usual	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

Not at all	Slightly	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

7. How much bodily pain have you had during the past 4 weeks?

None	Very mild	Mild	Moderate	Severe	Very severe
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

8. **During the <u>past 4 weeks</u>, how much did <u>pain</u> interfere with your normal work (including both work outside the home and housework)?**

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

9. **These questions are about how you feel and how things have been with you <u>during the past 4 weeks</u>. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the <u>past 4 weeks</u>…**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a Did you feel full of life?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b Have you been very nervous?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c Have you felt so down in the dumps that nothing could cheer you up?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d Have you felt calm and peaceful?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
e Did you have a lot of energy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
f Have you felt downhearted and depressed?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
g Did you feel worn out?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
h Have you been happy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
i Did you feel tired?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

10. During the <u>past 4 weeks</u>, how much of the time has your <u>physical health or emotional problems</u> interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

11. How TRUE or FALSE is <u>each</u> of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
a. I seem to get sick a little easier than other people	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
b. I am as healthy as anybody I know	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
c. I expect my health to get worse	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
d. My health is excellent	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing these questions!

Appendix: 12-Item Expectations Regarding Aging Survey (ERA-12)

Including expectations regarding physical health, expectations regarding mental health, and expectations regarding cognitive function scales.

- This survey has questions about what you expect about aging.
- Please check the **ONE** box to the right of the statement that best corresponds with how you feel about the statement. If you are not sure, go ahead and check the box that you think **BEST** corresponds with your feelings.

	Definitely True ▼	Somewhat True ▼	Somewhat False ▼	Definitely False ▼
1. When people get older, they need to lower their expectations of how healthy they can be.	☐ 1	☐ 2	☐ 3	☐ 4
2. The human body is like a car: When it gets old, it gets worn out.	☐ 1	☐ 2	☐ 3	☐ 4
3. Having more aches and pains is an accepted part of aging.	☐ 1	☐ 2	☐ 3	☐ 4
4. Every year that people age, their energy levels go down a little more.	☐ 1	☐ 2	☐ 3	☐ 4
5. I expect that as I get older I will spend less time with friends and family.	☐ 1	☐ 2	☐ 3	☐ 4
6. Being lonely is just something that happens when people get old.	☐ 1	☐ 2	☐ 3	☐ 4
7. As people get older they worry more.	☐ 1	☐ 2	☐ 3	☐ 4
8. It's normal to be depressed when you are old.	☐ 1	☐ 2	☐ 3	☐ 4
9. I expect that as I get older I will become more forgetful.	☐ 1	☐ 2	☐ 3	☐ 4
10. It's an accepted part of aging to have trouble remembering names.	☐ 1	☐ 2	☐ 3	☐ 4
11. Forgetfulness is a natural occurrence just from growing old.	☐ 1	☐ 2	☐ 3	☐ 4
12. It is impossible to escape the mental slowness that happens with aging.	☐ 1	☐ 2	☐ 3	☐ 4

Subjective Happiness Scale (SHS)

By Sonja Lyubomirsky, Ph.D.

For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

1	2	3	4	5	6	7
not a very happy person						a very happy person

2. Compared to most of my peers, I consider myself:

1	2	3	4	5	6	7
less happy						more happy

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

1	2	3	4	5	6	7
not at all						a great deal

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?

1	2	3	4	5	6	7
not at all						a great deal

Note: Item #4 is reverse coded.

Perceived Stress Scale-14

INSTRUCTIONS:

The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, you will be asked to indicate your response by placing an "X" over the circle representing HOW OFTEN you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

	Never	Almost Never	Sometimes	Fairly Often	Very Often
	1	2	3	4	5
1. In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
2. In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
3. In the last month, how often have you felt nervous and "stressed"?	○	○	○	○	○
4. In the last month, how often have you dealt successfully with day to day problems and annoyances?	○	○	○	○	○
5. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?	○	○	○	○	○
6. In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
7. In the last month, how often have you felt that things were going your way?	○	○	○	○	○
8. In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
9. In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
10. In the last month, how often have you felt that you were on top of things?	○	○	○	○	○

PSS-14

	Never	Almost Never	Sometimes	Fairly Often	Very Often
	1	2	3	4	5
11. In the last month, how often have you been angered because of things that happened that were outside of your control?	○	○	○	○	○
12. In the last month, how often have you found yourself thinking about things that you have to accomplish?	○	○	○	○	○
13. In the last month, how often have you been able to control the way you spend your time?	○	○	○	○	○
14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

Appendix D-Adherence Focus Group Questions and Probes

Adherence

Tai Chi (TC) for older adults: improving physical and psychological health and identifying and overcoming cultural/ethnic barriers to participation

Narrative around Tai Chi and their culture, personal and objective. Initial discussion unsolicited.
Collect demographics from group, age, gender, years in Canada, original area from.

Focus Group Questions to answer objective 4:

1. What did they like and not like about the Tai Chi program overall?

2. Did the time of day, class length, and class intensity influence their attendance or did they have issues with any of these variables?

3. Did they find the movements easy, moderate or hard to learn and what their feelings/perceptions of the TC instruction and did either influence their adherence to the program?

4. Did they like the building and space and time of year of the program and how did this influence their attendance. What were their thoughts on Tai Chi being offered all year round, as well as their thoughts on doing Tai Chi indoors or outdoors with respect to their continued participation?

5. Was their health an issue for participation and did they feel their mental and/or physical health improved during the Tai Chi program?

6. Were their expectations met during the program and what elements did they enjoy most (e.g. physical, social, etc.) and how did this influence their attendance?

7. Did they like the group setting for Tai Chi and did this directly affect their attendance. Did they participate in Tai Chi on their own and if they did how did it influence their attendance?

8. Did they feel that since Tai Chi was from another culture that this was a barrier to participation?

ORIENTATION TO LIFE QUESTIONNAIRE

Here is a series of questions relating to various aspects of our lives. Each question has seven possible answers. Please mark the number which expresses your answer, with numbers 1 and 7 being the extreme answers. If the words under 1 are right for you, circle 1; if the words under 7 are right for you, circle 7. If you feel differently, circle the number which best expresses your feeling. Please give only one answer to each question.

1. Do you have the feeling that you don't really care about what goes on around you?

1	2	3	4	5	6	7
very seldom or never						very often

2. Has it happened in the past that you were surprised by the behavior of people whom you thought you knew well?

1	2	3	4	5	6	7
never happened						always happened

3. Has it happened that people whom you counted on disappointed you?

1	2	3	4	5	6	7
never happened						always happened

4. Until now your life has had:

1	2	3	4	5	6	7
no clear goals or purpose at all						very clear goals and purpose

5. Do you have the feeling that you're being treated unfairly?

1	2	3	4	5	6	7
very often						very seldom or never

6. Do you have the feeling that you are in an unfamiliar situation and don't know what to do?

1	2	3	4	5	6	7
very often						very seldom or never

7. Doing the things you do every day is:

1	2	3	4	5	6	7
a source of deep pleasure and satisfaction						a source of pain and boredom

8. Do you have very mixed-up feelings and ideas?

1	2	3	4	5	6	7
very often						very seldom or never

9. Does it happen that you have feelings inside you would rather not feel?

1	2	3	4	5	6	7
very often						very seldom or never

10. Many people - even those with a strong character - sometimes feel like sad sacks (losers) in certain situations. How often have you felt this way in the past?

1	2	3	4	5	6	7
never						very often

11. When something happened, have you generally found that:

1	2	3	4	5	6	7
you overestimated or underestimated its importance						you saw things in the right proportion

12. How often do you have the feeling that there's little meaning in the things you do in daily life?

1	2	3	4	5	6	7
very often						very seldom or never

13. How often do you have feelings that you're not sure you can keep under control?

1	2	3	4	5	6	7
very often						very seldom or never

Appendix F-SF-12 Questionnaire

SF-12® Participant Questionnaire

Participant Name: _____ **Registry Number:** _____

Data Intake Person: _____ **Date:** _____

SF-12®:
This information will help your do ctors keep track of how you feel and how well you are able to do your usual activities. Answer every question by placing a check mark on the line in front of the appropriate answer. It is not specific for arthritis. If you are unsure about how to answer a question, please give the best answer you can and make a written comment beside your answer.

1. In general, would you say your health is:
   _____ Excellent (1)
   _____ Very Good (2)
   _____ Good (3)
   _____ Fair (4)
   _____ Poor (5)

The following two questions are about activities you might do during a typical day. Does YOUR HEALTH NOW LIMIT YOU in these activities? If so, how much?

2. MODERATE ACTIVITIES, such as moving a table, pushing a vacuum cleaner, bowling, or p laying golf:
   _____ Yes, Limited A Lot (1)
   _____ Yes, Limited A Little (2)
   _____ No, Not Limited At All (3)

3. Climbing SEVERAL flights of stairs:
   _____ Yes, Limited A Lot (1)
   _____ Yes, Limited A Little (2)
   _____ No, Not Limited At All (3)

During the PAST 4 WEEKS have you had any of the following problems with your work or other regular activities AS A RESULT OF YOUR PHYSICAL HEALTH?

4. ACCOMPLISHED LESS than you would like:
   _____ Yes (1)
   _____ No (2)

5. Were limited in the KIND of work o r other activities:
   _____ Yes (1)
   _____ No (2)

Registry Number: _____

SF-12® Cont'd:

During the PAST 4 WEEKS, were you limited in the kind of work you do or other regular activities AS A RESULT OF ANY EMOTIONAL PROBLEMS (such as feeling depressed or anxious)?

6. ACCOMPLISHED LESS than you would like:
   _____ Yes (1)
   _____ No (2)

7. Didn't do work or other activities as CAREFULLY as usual:
   _____ Yes (1)
   _____ No (2)

8. During the PAST 4 WEEKS, how much did PAIN interfere with your normal work (including both work outside the home and housework)?
   _____ Not At All (1)
   _____ A Little Bit (2)
   _____ Moderately (3)
   _____ Quite A Bit (4)
   _____ Extremely (5)

The next three questions are about how you feel and how things have been DURING THE PAST 4 WEEKS. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the PAST 4 WEEKS –

9. Have you felt calm and peaceful?
   _____ All of the Time (1)
   _____ Most of the Time (2)
   _____ A Good Bit of the Time (3)
   _____ Some of the Time (4)
   _____ A Little of the Time (5)
   _____ None of the Time (6)

Registry Number: _____

SF-12® Cont'd:

10. Did you have a lot of energy?
    _____ All of the Time (1)
    _____ Most of the Time (2)
    _____ A Good Bit of the Time (3)
    _____ Some of the Time (4)
    _____ A Little of the Time (5)
    _____ None of the Time (6)

11. Have you felt downhearted and blue?
    _____ All of the Time (1)
    _____ Most of the Time (2)
    _____ A Good Bit of the Time (3)
    _____ Some of the Time (4)
    _____ A Little of the Time (5)
    _____ None of the Time (6)

12. During the PAST 4 WEEKS, how much of the time has your PHYSICAL HEALTH O R EMOTIONAL PROBLEMS interfered with your social activities (like visiting with friends, relatives, etc.)?
    _____ All of the Time (1)
    _____ Most of the Time (2)
    _____ A Good Bit of the Time (3)
    _____ Some of the Time (4)
    _____ A Little of the Time (5)
    _____ None of the Time (6)