THE EFFICACY OF ONLINE VINYASA YOGA AND TAIJIFIT™ ON PHYSICAL HEALTH OUTCOME MEASURES AND QUALITY OF LIFE OF ADULT INFORMAL CAREGIVERS

A Thesis

Submitted to the Faculty of Graduate Studies and Research

In Partial Fulfilment of the Requirements

For the Degree of

Doctor of Philosophy

in

Kinesiology and Health Studies

University of Regina

By

Andi Céline Martin

Regina, Saskatchewan

March 2018

UNIVERSITY OF REGINA

FACULTY OF GRADUATE STUDIES AND RESEARCH

SUPERVISORY AND EXAMINING COMMITTEE

Andi Celine Martin, candidate for the degree of Doctor of Philosophy in Kinesiolgy & Health Studies**,** has presented a thesis titled, ***The Efficacy of Online Vinyasa Yoga and Taijifit™ on Physical Health Outcome Measures and Quality of Life of Adult Informal Caregivers,*** in an oral examination held on March 19, 2018. The following committee members have found the thesis acceptable in form and content, and that the candidate demonstrated satisfactory knowledge of the subject material.

External Examiner:	*Dr. Nicole Culos-Reed, University of Calgary
Supervisor:	Dr. Darren Candow, Faculty of Kinesiology & Health Studies
Committee Member:	Dr. Paul Bruno, Faculty of Kinesiology & Health Studies
Committee Member:	Dr. Nuelle Novik, Faculty of Social Work
Committee Member:	Dr. Rebecca Genoe, Faculty of Kinesiology & Health Studies
Chair of Defense:	Dr. Karen Meagher, Faculty of Graduate Studies & Research

*via ZOOM

Abstract

Too often, informal caregivers suffer from physical pain, musculoskeletal injuries, aggravation of chronic illnesses, and other negative physical health consequences. Part of the negative impact on caregiver health may be a result of the reduced likelihood that informal caregivers engage in regular physical activity. Since nearly every Canadian will at some point in time be in the position of having to provide care for a loved one, reducing negative outcomes associated with informal caregiving represents a very large health concern. The purpose of this thesis was to investigate the effects of online Vinyasa Yoga (VY) and Taijifit™ practice and cessation on muscle strength and endurance, balance, walking speed, flexibility, and quality of life (QOL) in adult informal caregivers (≥ 18 years of age). This thesis involved two studies. Study I investigated the physical changes and QOL effects from 12 consecutive weeks of VY and Taijifit™ practice (150 minutes/week) in adult informal caregivers. Study II investigated the physical changes and QOL effects after six weeks of cessation from VY and Taijifit™ in these caregivers. For Study I, participants were randomized to one of two groups: VY (n = 16, 11 females, 5 males) or Taijifit™ (n = 13, 7 females, 6 males). Twenty-six participants who completed Study I were part of for Study II (VY: n = 14, 9 females, 5 males; Taijifit™: n = 12, 6 females, 6 males). Prior to and following the 12-week intervention (Study I) and six-week cessation period (Study II), assessments were made for muscle strength (1-RM leg press, chest press, hand-grip), muscle endurance (leg press and chest press; maximal number of repetitions performed to fatigue at 80 and 70% baseline 1-RM respectively), abdominal endurance (maximum number of consecutive curl-ups to fatigue), tasks of functionality (dynamic balance and walking speed), flexibility (sit and reach), and QOL.

Results from Study I showed that 12 consecutive weeks of VY and Taijifit™ increased muscle strength and endurance, indices of functionality, and flexibility ($p < 0.05$), with greater gains in chest press endurance ($p = 0.019$) and abdominal curl-up performance ($p = 0.034$) in the VY group compared to Taijifit™ group. Furthermore, 12 consecutive weeks of VY and Taijifit™ increased all eight QOL health domains and overall physical and mental health ($p < 0.05$), with Taijifit™ leading to greater gains in three QOL health domains – bodily pain ($p = 0.021$), general health ($p = 0.005$), and vitality ($p = 0.018$) – and overall physical health ($p = 0.026$) compared to VY. Results from Study II showed that all but two physical outcome measures (1-RM chest press strength, $p = 0.038$; chest press endurance, $p = 0.024$) were maintained six consecutive weeks post-exercise, with no differences between groups. Furthermore, overall physical and mental health and all but one QOL health domain (physical functioning, $p = 0.029$) were maintained six consecutive weeks post-exercise, with no differences between groups.

These studies provide evidence that VY and Taijifit™ are effective for improving muscle strength and endurance, functionality, flexibility, and QOL in adult informal caregivers. VY led to greater gains in chest press endurance and abdominal curl-ups compared to Taijifit™, while Taijifit™ led to greater gains in overall physical health, bodily pain, and general health compared to VY. Further, the vast majority of physical and QOL improvements were maintained after six weeks of cessation from VY and Taijifit™.

Keywords: Yoga, Tai Chi, Informal Caregiving, Strength, Endurance, Functionality, Flexibility, Quality of Life

Acknowledgements

Dr. Darren Candow: I cannot thank you enough for going on this journey with me. We molded this experience into something truly special. Your sense of humour, curiosity, open-mindedness, and desire to grow as a person has made this journey an inspiring and splendid one. In addition to your dedication, knowledge, and patience, you are an extraordinarily humble and content person: an uncommon blend. For the countless times I've left the potent smell of McDonald's fries in your office during/after our meetings, I apologize. For my fry addiction, however, I cannot apologize.

Thank you to my wonderful committee: Dr. Paul Bruno, Dr. Rebecca Genoe, and Dr. Nuelle Novik. Your varied backgrounds, personalities, and points of view were the perfect complement to this research - helping shape it *just so*, which made all the difference. Thank you to Dr. Nicole Culos-Reed, the external examiner, for the constructive criticisms and general statements that greatly enhanced the final product. Thank you to the Faculty of Graduate Studies and Research for the financial support for these research studies, which allowed for the activation and reality of my dreams.

Gundy and Pa: this is really your journey more than mine, since your journey included children and as such, I was given the opportunity to live this beautiful life and decide, without apology, to follow my curiosities. When I think of the life you've created with and for me, I realize and savour the excellence that you carry around; I do not overlook your masterpieces.

Finally, I am so grateful to my wonderful participants – *those who care*; your compassion, selflessness, and courage is the best motivation and inspiration. Notably, this is for Helen and Leslie: the two greatest champions of this research.

Dedication

Basil: since this journey has been an exceptional one and without you, everything would be different, this is for you. I know how easily life could have tipped us on some other course where our lives unfold in parallel. Yet we did meet in a keyframe[1], as we really are, and we didn't even need to introduce ourselves.

It seems we've both learned to live life – we've learned its rhythm. Obstacles do not block the journey – they are the journey. We know, feelingly, that there is nothing to fear and we should dare to fail as much as possible – to make interesting, amazing, glorious, and fantastic mistakes; dreams must not stay dormant in our heads and life must always remain in the foreground. We were given the opportunity to live this beautiful life and decide, without apology, to commit to a journey and not an outcome; to not wait for the world to hold still but feel comfortable moving on in this world, which is always stuck on play. We know the moments will get away – we don't try to live them all over again or covet morii[2], because we know 'you had to be there' anyway. We don't try to capture and convert it into something it's not –we don't need it to fit into any frame.

Only you understand what it is to do what we love in the service of people who love what we do. That although we've explored 50 countries and completed over 20 years of post-secondary education together, we haven't learned or experienced anything yet; except that we have wanderlust[3], sonder[4], monachopsis[5], rückkehrunruhe[6], onism[7], and dès vu[8]. Schmaime.

---

[1] a moment that seemed innocuous at the time but ended up marking a diversion into a strange new era of our lives
[2] the desire to capture a fleeting experience
[3] the strong desire for, or impule to, wander or travel and explore the world
[4] the realization that each passer-by has a life as vivid and complex as our own
[5] the subtle but persistent feeling of being out of place
[6] the feeling of returning home after an immersive trip only to find it fading rapidly from our awareness
[7] the awareness of how little of the world we'll experience
[8] the awareness that this will become a memory

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ADL	Activities of Daily Living
ANOVA	Analysis of Variance
CIHI	Canadian Institutes for Health Information
CIHR	Canadian Institutes of Health Research
cm	Centimeter
CMA	Census Metropolitan Area
e.g.	Exempli gratia (for example)
hrs	Hours
IADL	Instrumental Activities of Daily Living
i.e.	Id est (that is)
kg	Kilogram
lbs	Pounds
MBM	Mind-Body Medicine
MCS	Mental Component Score
min	Minute
N	Number
$\eta 2$	Partial eta squared
NASW	National Association of Social Workers
NCCAM	National Center for Complementary and Alternative Medicine
NIH	National Institutes of Health
PA	Physical Activity
PARMED-X	Physical Activity Readiness Medical Examination

PAR-Q+	Physical Activity Readiness Questionnaire
PCS	Physical Component Score
QOL	Quality of Life
RCT	Randomized Controlled Trial
RM	Repetition Maximum
SD	Standard Deviation
sec	Second
SF36v2	Medical Outcomes Study 36-Item Short-Form Health Survey version 2
TMD	Total Mood Disturbance
VY	Vinyasa Yoga
WHO	World Health Organization
wk	Week

Definition of Yoga and Tai Chi Terms

Yoga

Asanas

The physical postures (standing, sitting, forward bending, twisting, inverting, balancing, reclining, and back bending) of Yoga – the third limb of *Ashtanga* – designed to increase flexibility, strengthen the body, and detoxify/purify the tissues (Fraser, 2007; Satchidananda, 2009).

Ashtanga

Yoga is characterized as a science of self-study and awareness via *Ashtanga*, which translates to *eight limbs.* By studying and following these *eight limbs* (ethical and personal observations, physical postures, breathing exercises, sense control, concentration, meditation, and union), a Yoga practitioner can aspire to achieve optimal physical health and spiritual enlightenment (Fraser, 2007; Satchidananda, 2009).

Bhakti Yoga

Yoga of devotion; one of six branches of Yoga philosophy (Carrico, 2007).

Chakras

Chakra translates from Sanskrit to English as *spinning wheel* and *wheels of light.* Chakras are energy centers through which subtle energy (*chi/qi)* flows. The body has seven main chakras all positioned along the spine (in front and behind), from the perineum to the crown of the head (Judith, 2015; Mercier, 2007; Yogeesh, 2014).

Chi/Qi

Chi/qi is the Chinese word for *life energy*. *Chi/qi* is the vital life force/animating power that flows through all living things (Chitty, 2013; Cohen, 1997).

Dharana

Concentration/inner perceptual awareness; the sixth limb of *Ashtanga* (Satchidananda, 2009).

Dhyana

Meditation; the seventh limb of *Ashtanga* (Satchidananda, 2009).

Hatha Yoga

Yoga of postures; one of six branches of Yoga philosophy. *Hatha* Yoga is characterized as a science of self-study and awareness via *Ashtanga* (eight limbs). The word *Hatha* itself translates from Sanskrit to *Ha* – sun and *Tha* – moon; opposites that represent the spectrum of actuality that life presents to all human beings. Notably, all Yoga styles in the West involving physical postures (*asanas*) fall under the umbrella of *Hatha* Yoga since *Hatha* Yoga is the *Yoga of postures* (Swatmarama, 2013).

Jnana Yoga

Yoga of the mind; one of six branches of Yoga philosophy (Carrico, 2007).

Karma Yoga

Yoga of service; one of six branches of Yoga philosophy (Carrico, 2007).

Meridians

Channels or networks throughout the body through which *chi/qi* flows. The body has 12 major meridians, 10 of which are associated with major organs (urinary bladder, kidney, stomach, spleen, heart, lung, small and large intestine, liver, and gall bladder) and two of which are associated with the pericardium and san jiao (a conjectural structure for metabolism in the body; Grilley, 2002, 2012; Mercier, 2007).

Mīmāṃsā

One of six branches of orthodox Indian philosophy (alongside Yoga) emphasizing the nature of *dharma* (duties, rights, laws, conduct, virtues, cosmic law, and order; Nayyar, 2002; Satishchandra & Dhirendramohan, 2012).

Niyamas

Personal observances; the second limb of *Ashtanga* (Satchidananda, 2009).

Nyāya

One of six branches of orthodox Indian philosophy (alongside Yoga) exploring sources of knowledge (Nayyar, 2002; Satishchandra & Dhirendramohan, 2012).

Pranayama

Breath control/breathing exercises; the fourth limb of *Ashtanga.* Notably, during certain styles of *Hatha* Yoga (e.g., VY), the Yoga practitioner utilizes *Ujjayi* breath to help establish a natural rhythm, reduce distractions, create heat, and increase lung capacity (Beeken, 2004; Iyengar, 2013; Nayak & Shankar, 2004; Satchidananda, 2009).

Pratyahara

Sense withdrawal/control; the fifth limb of *Ashtanga* (Satchidananda, 2009).

Raja Yoga

Yoga of self-control; one of six branches of Yoga philosophy (Carrico, 2007).

Samadhi

Peace of mind; the eighth and final limb of *Ashtanga.* Here, the practitioner merges with his or her point of focus and transcends the Self altogether – realizing a profound connection to the Universe and an interconnectedness with all living things, experiencing peace of mind (Satchidananda, 2009).

Sāmkhya

One of six branches of orthodox Indian philosophy (alongside Yoga) characterized by the dualist theoretical exposition of consciousness and matter (Nayyar, 2002; Satishchandra & Dhirendramohan, 2012).

Tantra Yoga

Yoga of rituals; one of six branches of Yoga philosophy (Carrico, 2007).

Ujjayi breath

Victorious breath; the form of breath control (*pranayama*) utilized during VY to help establish a natural rhythm of the breath and reduce distractions (keeping the practitioner present in their practice), while creating heat and increasing lung capacity. *Ujjayi* breath is sometimes also called *Ocean* breath because the sound created mimics the sound of the ocean (Fraser, 2007).

Vaiśesika

One of six branches of orthodox Indian philosophy (alongside Yoga) emphasizing atomism, a form of natural philosophy (Nayyar, 2002; Satishchandra & Dhirendramohan, 2012).

Vedānta

One of six branches of orthodox Indian philosophy (alongside Yoga) signifying all philosophical traditions interpreting the three canonical texts (Upanishads, Brahma Sutras, and Bhagavad Gita; Nayyar, 2002; Satishchandra & Dhirendramohan, 2012).

Vinyasa Yoga

Vinyasa stems from its roots, *vi*, meaning *in a special way*, and *nyasa*, meaning *to place*. Therefore, *Vinyasa* roughly translates to placing the body in a special way and/or

arranging the *asanas* (poses) in a special way. The fundamental characteristic of *yang* Yoga is rhythmic, repetitive movements. VY is a moderate to fast-paced style of Yoga during which each *Yogasana* (Yoga posture) is linked to the next one in a continuous flow via a series of particular transitional movements; *asanas* are only held for a short period of time (1 to 3 minutes) before transitioning to the next pose (Fraser, 2007).

Yamas

Ethical observations; the first limb of *Ashtanga* (Satchidananda, 2009).

Yang energy

Yang energy is very active, energetic, and expanding. In the body, yang energy moves upwards, against gravity, and thus, is very forceful. Some common properties of yang energy include: heat (solar), brightness (light), and speed (fast; Chitty, 2013; Cohen, 1997; Palmer, 1997).

Yin energy

Yin energy is very passive, lethargic, and constricting. In the body, yin energy moves downwards with gravity and without any effort. Thus, it is very weak. Some common properties of yin energy include: coldness (lunar), dullness (dark), and speed (slow; Chitty, 2013; Cohen, 1997; Palmer, 1997).

Yoga

One of the six branches of orthodox Indian philosophy (alongside *Samkhya, Nyāya*, *Vaiśesika, Mīmāṃsā*, and *Vedānta*) emphasizing meditation, contemplation, and liberation. The Yoga branch of orthodox philosophy is further divided into six branches of Yoga, namely: *Bhakti, Raja, Jnana, Karma, Tantra,* and *Hatha*. In the West, the most commonly practiced branch of Yoga is the non-secular discipline of *Hatha* Yoga, which

translates to *Yoga of postures* (Satchidananda, 2009).

Yogasana

Yoga posture. Each *Yogasana* (Yoga posture) is linked to the next one via a series of particular transitional movements with synchronized and controlled use of the breath (Satchidananda, 2009).

Yoking

Yoga translates from Sanskrit to English as *yoke* and *union.* Thus, uniting the mind and body occurs by *yoking* oneself to a particular way of life – namely, *Ashtanga.* Accordingly, the *union* (Yoga) of mind and body takes place with the breath (*pranayama*) acting as the bind (Satchidananda, 2009).

Tai Chi

Chakras

Chakra translates from Sanskrit to English as *spinning wheel* and *wheels of light.* Chakras are energy centers through which subtle energy (*chi/qi)* flows. The body has seven main chakras all positioned along the spine (in front and behind), from the perineum to the crown of the head (Judith, 2015; Mercier, 2007; Yogeesh, 2014).

Chi/Qi

Chi/qi is the Chinese word for *life energy*. *Chi/qi* is the vital life force/animating power that flows through all living things (Chitty, 2013; Cohen, 1997).

Flow

Flow is a state of complete immersion in an activity. Inducing and maintaining flow is of utmost importance in Tai Chi. When Tai Chi practitioners are *flowing*, they are

completely involved in an activity for its own sake – the ego falls away and time flies. Importantly, in Tai Chi, flow is considered to be a sixth component of fitness (in addition to muscular strength and endurance, flexibility, body composition, and cardiovascular endurance; Ross, 2013).

Forms

Moving postures; a series of predetermined postures/movements that are combined in order to be practiced as one linear set of movements. Notably, Tai Chi practitioners flow synergistically from one form to another (Ross, 2013; Wong, 2002; Yang, 2010).

Meridians

Channels or networks throughout the body through which *chi/qi* flow. The body has 12 major meridians, 10 of which are associated with major organs (urinary bladder, kidney, stomach, spleen, heart, lung, small and large intestine, liver, and gall bladder) and two of which are associated with the pericardium and san jiao (a conjectural structure for metabolism in the body; Grilley, 2002, 2012; Mercier, 2007).

Qigong

A system to enrich and balance life energy (*chi/qi*). *Qigong* aligns breath, awareness, and movement and encompasses rhythmic breathing coordinated with slow repetition of fluid movements, a mindful state, and visualization and sensation of *qi/chi* (vital life force, energy) throughout the body. *Qigong* involves working with the life energy, learning how to control the flow and distribution of *chi/qi* to improve overall health and harmony of the mind and body (Cohen, 1997).

Tai Chi Chuan

Tai Chi's full name, Tai Chi Chuan, is taken from Taoism and can be translated as *supreme ultimate fist* (Galante, 1981).

Taijifit™

Taijifit™ is a popular *Yang*-style of Tai Chi developed expressly for westerners, combining the elements of fitness, meditation, and martial arts. Taijifit™ was developed by eight-time US national champion, world silver medalist, and two-time world bronze medalist in Tai Chi, David-Dorian Ross. Taijifit™ translates to *Tai Chi for exercise* and is about balancing strength with beauty, power with peace, and endurance with flow (*yin* and *yang*; Ross 2013).

Tao

The word Tao translates from Chinese to *way* or *path (of life)*. Tai Chi's philosophy follows *Taoism* – a philosophical tradition that emphasizes living in harmony with the *Tao* (Feng, English, & Lippe, 2011; Rones & Silver, 2007).

Taoism

Taoism is a philosophical tradition whose keystone work of literature is the *Tao Te Ching.* Notably, the *Tao Te Ching* draws its cosmological foundations from the concepts and philosophy of *yin* and *yang*, which form the basis of Tai Chi. Tai Chi's full name, Tai Chi Chuan, is taken from Taoism (Feng, English, & Lippe, 2011)

Yang energy

Yang energy is very active, energetic, and expanding. In the body, yang energy moves upwards, against gravity, and thus, is very forceful. Some common properties of

yang energy include: heat (solar), brightness (light), and speed (fast; Chitty, 2013; Cohen, 1997; Palmer, 1997).

Yang-style Tai Chi

Most modern styles of Tai Chi trace their development to one of five traditional schools (Chen, Yang, Wu/Hao, Wu/Woo, Sun). Currently, the most popular style of Tai Chi is the *Yang*-style (school of) Tai Chi. Moreover, Taijifit™ is a *Yang*-style Tai Chi (Wong, 2002; Yang, 2010).

Yin energy

Yin energy is very passive, lethargic, and constricting. In the body, yin energy moves downwards, with gravity and without any effort. Thus, it is very weak. Some common properties of yin energy include: coldness (lunar), dullness (dark), and speed (slow; Chitty, 2013; Cohen, 1997; Palmer, 1997).

1 Introduction

The term *informal caregiver* describes those who do not receive financial compensation for helping others with deficiencies related to disability, disease/illness, old age, or a mental disorder (Carers Canada, 2016; Keefe, 2011). Although informal caregiving may be fulfilling and rewarding in various fashions, the literature has highlighted several deleterious effects associated with this role. Too often informal caregivers suffer from physical pain, musculoskeletal injuries, aggravation of chronic illnesses, and other negative physical health consequences (Ohio State University Center for Clinical & Translational Science, 2014; Pinquart & Sörensen, 2007). Since nearly every Canadian will at some point in time be in the position of having to provide care for a loved one, reducing negative outcomes associated with informal caregiving represents a substantial health concern (Carers Canada, 2016; Ross, Sundaramurthi, & Bevans, 2013). Innovative and integrated programs, services, and policies are needed to support informal caregivers in their role (Bauer & Sousa-Poza, 2015; Lopez-Hartmann, Wens, Verhoeven, & Remmen, 2012). Delivering safe and effective physical activity (PA) interventions in this population is especially vital in Saskatchewan, where the prevalence of informal caregiving is not only above the national average (28%), but is the highest in Canada at 34%. The city of Regina ranks third in terms of informal caregiving prevalence (38%) across 27 Canadian Census Metropolitan Areas (CMAs; Statistics Canada, 2013a).

In recent years, research on the physical health of informal caregivers has grown, highlighting numerous physical impacts and the neglect of health promoting behaviours (Bauer & Sousa-Poza, 2015). This negative impact on caregiver health may be the result of the reduced likelihood that informal caregivers engage in regular PA (Castro, Wilcox,

O'Sullivan, Baumann, & King, 2002; Lim & Taylor, 2005; Vitaliano et al., 2002). Specifically, PA is defined as any bodily movement produced by skeletal muscles, which results in energy expenditure (e.g., walking, cycling, participating in sports, or occupational and household activities; Caspersen, Powell, & Christenson, 1985; World Health Organization [WHO], 2016). Despite the potential benefits of regular PA and the desire of informal caregivers to take part in such programs (Swartz & Keir, 2007), currently there is a lack of interventions designed to explicitly address the needs of this population through systematic (methodical or based on a system) and supervised (includes monitoring, guidance, and/or a designed curriculum) PA.

Recently, novel forms of PA such as mind-body medicines (MBMs) have gained popularity due to their objective of equitably utilizing the pillars of health-related fitness (i.e., cardiovascular fitness, muscle strength and endurance, flexibility, balance). Furthermore, MBMs fuse these components with breath work, bringing a meditative quality to a physical practice (Raub, 2002). Two of the most widely used PAs categorized as MBMs are Yoga and Tai Chi. Although few Yoga or Tai Chi interventions have targeted informal caregivers, the potential beneficial effects of Yoga and Tai Chi have consistently been recognized in the literature (Taylor-Piliae, Haskell, Stotts, & Froelicher, 2006; Tsai et al., 2003; Van Puymbroeck et al., 2007; Vedamurthachar et al., 2006; Yachoui & Kolasinski, 2012). Some of Yoga's benefits include improvements in flexibility, muscular strength and endurance (Bosch, Traustadottir, Howard, & Matt, 2009; Brown, Koziol, & Lotz, 2008; Chen et al., 2008; Cohen, Warneke, Fouladi, Rodriguez, & Chaoul-Reich, 2004; Desikachar, Bragdon, & Bossart, 2005; McCall, 2007), balance, and energy status (Chen et al., 2009; Manjunath & Tells, 2005). In the

West, Vinyasa Yoga (VY) is the most popular and commonly practiced style of Yoga (Hunsberger, 2017; Walsh, 2016). Similarly to Yoga, some of Tai Chi's benefits include improvements in balance, muscle strength, cardiovascular fitness, and flexibility (National Center for Complementary and Alternative Medicine [NCCAM] at the National Institutes of Health [NIH], 2016a; Wang, Collet, & Lau, 2004). A commonly practiced style of Tai Chi in North America is Taijifit™. Taijifit™, which translates to *Tai Chi for exercise*, is a popular style of Tai Chi developed expressly for Westerners, combining the elements of fitness, meditation, and martial arts (Ross, 2013).

Relatively few studies have examined the impact of these modalities in the informal caregiver population. Moreover, the majority of existing studies have significant methodological limitations, such as small and/or non-randomized samples, short intervention durations, wide variability in PA frequency and options, and lack of at-home practice monitoring and follow-up. To date, no study has investigated the effects of VY and Taijifit™ on physical health outcome measures and quality of life (QOL) in the adult informal caregiver population. Determining whether VY and Taijifit™ lead to improvements in physical outcome measures and QOL would add to the empirical literature and answer the question of whether these practices can lead to positive changes in this population's overall health.

While benefits have been reported with regard to PA interventions and informal caregivers, putting theory into practice can be especially challenging for this population. Using Internet-based interventions to improve the health of adult informal caregivers may offer an efficient and accessible alternative to traditional face-to-face interventions. To date no study has investigated the effects of online Yoga and Tai Chi in adult informal

caregivers. The consequences of physical inactivity in this population could ultimately lead to more demands on the formal health system, either directly (caregiver illness/mortality) or indirectly (employment absenteeism; Lysne, 2004). Thus, there is a need for more applicable and current interventions, to reach and engage adult informal caregivers in PA. This thesis examined the potential beneficial effects of online VY and Taijifit™ in adult informal caregivers. Online delivery was chosen to potentially reduce some of the purported barriers to PA in informal caregivers (e.g., transportation, time constraints, arranging alternative care).

The objective of this thesis was to investigate the effects of online VY and Taijifit™ practice and VY and Taijifit™ cessation on muscle strength and endurance, balance, walking speed, flexibility, and QOL in adult informal caregivers. To achieve this objective, two studies were performed. In the first study, the primary objective was to investigate the effects of online VY and Taijifit™ (150 minutes/week for 12 consecutive weeks) on muscle strength (1-repetition maximum [1-RM] leg press, chest press, hand-grip), muscle endurance (leg press and chest press; maximal number of repetitions performed to fatigue at 80 and 70% baseline 1-RM respectively), abdominal endurance (maximum number of consecutive curl-ups to volitional fatigue), tasks of functionality (dynamic balance and walking speed), and flexibility (sit and reach). A secondary objective was to determine whether these interventions improve QOL over time and to shed light on any perceived intervention benefits, the importance of and barriers to PA, the intervention delivery method (online), and overall program satisfaction.

In the second study, the primary purpose was to investigate the effects of VY and Taijifit™ cessation (6 consecutive weeks post-exercise) on muscle strength (1-RM

leg press, chest press, hand-grip), muscle endurance (leg press and chest press; maximal number of repetitions performed to fatigue at 80 and 70% baseline 1-RM respectively), abdominal endurance (maximum number of consecutive curl-ups to volitional fatigue), tasks of functionality (dynamic balance and walking speed), and flexibility (sit and reach). A secondary purpose was to investigate the effects of VY and Taijifit™ cessation on QOL and to shed light on participants' experiences throughout the six-week cessation period.

2 Literature Review

2.1 Informal Caregiving: An Overview

Informal caregiving has been the customary way to protect people of poor health since primordial times (Lebel et al., 2001). Generally, informal caregiving is grounded in the belief that human beings have an inborn right to function at their highest level of physical and mental capacity. Bridges (1995) concluded the purpose of caregiving is to encourage autonomy; that an informal caregiver's principal mission is to promote independence by maintaining a care recipient's functional state – physically, intellectually, emotionally, and spiritually.

The term informal caregiver is used to describe those helping others with deficiencies related to disability, disease/illness, old age, or a mental disorder. Accordingly, an informal caregiver is someone who provides physical, emotional, spiritual, financial, social, and/or personal care/support without financial compensation (Blum & Sherman, 2010; Carers Canada, 2016; Vitaliano, Zhang, & Scanlan, 2003;

Yabroff & Kim, 2009). Supports and services are provided voluntarily and differ from contractual or professional services (i.e., social work or home care services) provided for a fee to the public (Government of Canada, 2016a; National Association of Social Workers [NASW], 2010; Regina Qu'Appelle Health Region, 2017). For some people, informal caregiving occurs gradually over time; for others, it can happen overnight (Family Caregiver Alliance, 2016). Furthermore, informal caregiving can occur on a full-time, part-time, or intermittent basis and can include support provided from a distance or in proximity to the care recipient (Battams, 2016; NASW, 2010). Informal caregivers deliver an array of services, from simple grocery shopping to complex medical procedures. Markedly, friends, neighbours, and families are providing a growing portion of the healthcare in Canada, without pay (Carstairs & Keon, 2009; Hollander, Liu, and Chappell, 2009). In this thesis, the terms *informal caregiver* and *caregiver* are used to describe those who provide supports and services voluntarily to promote independence in those with deficiencies.

2.1.1 Distinction Between Caregiving and Caring. It is often difficult to distinguish between providing support and care for someone and being an informal caregiver. Baines, Evan, and Neysmith (1999) define informal caregiving as the efforts, whether mental, emotional, and/or physical, involved in supporting and looking after others. Thus, caregiving goes beyond caring and refers more to the doing of the caring work (e.g., the type of support provided). Throughout the caregiving literature, the types of tasks performed – the intensity, duration, and frequency of the tasks – and the relationship between the informal caregiver and care recipient are all ways in which informal caregiving has been evaluated (Keefe, 2011).

2.1.2 Family Caregiving. In informal caregiving literature, the term family caregiver goes beyond the family of origin and includes extended family, domestic partners, friends, and other individuals who support a care recipient (Family Caregiver Alliance, 2014). Such as informal caregivers, family caregivers support their loved ones without financial compensation. Although some family members may receive compensation or reimbursement for their services through government programs, family caregiving does not include individuals whose relationship with the care recipient is based on a financial or professional agreement. Often, different individuals within a family assume responsibility for diverse caregiving tasks. For example, an adult daughter may provide transportation to appointments, a neighbour may help with housework, a friend may help with grocery shopping, a spouse may assist with health care decisions, and a son may help with activities of daily living (Family Caregiver Alliance, 2011; NASW, 2010; Statistics Canada, 2013b).

2.1.3 Identifying Informal Caregivers. The term informal caregiver is not restricted to individuals who self-identify as informal caregivers. This label may not resonate with some caregivers even though they care for one or more loved ones in the ways outlined above (Lee, Peterson, Hahn, Atri, & Madison, 2016; NASW, 2010). Informal caregivers themselves often do not recognize their essential role or perceive that they are caregivers. Statistics Canada (2008) reports that spousal caregivers often do not categorize themselves as informal caregivers. Goodhead and McDonald (2007) note that informal caregiving may blend into normal relationship reciprocity and because it does not involve any formal agreements. Often, spouses do not view tasks as caregiving actions, but rather as an extension of their spousal responsibilities (Statistics Canada,

2013a). Thus, it is important to note that informal caregivers in Canada may be under-represented, particularly amongst spousal caregivers as a result of under-reporting (Statistics Canada, 2008). Consequently, in comparison to paid employment, informal caregiving tends to be invisible. It is only by self-identifying that informal caregivers are able to obtain information and receive services or help by professionals. Self-identifying and recognizing oneself as an informal caregiver has been shown to make a positive difference not only in caregivers themselves, but also in the lives of their care recipient(s), family members, and other loved ones (Centers for Disease Control and Prevention and the Kimberly-Clark Corporation, 2008).

2.2 Informal Caregiving in Canada

As in numerous countries around the world, informal caregiving plays a unique and valuable role in Canadian society (see Figure 1 on page 18 for a portrait of informal caregivers in Canada). The Commonwealth Fund 2014 International Policy Survey of Older Adults (55+) shows that Canadians generally spend more time as informal caregivers than people in other countries (Canadian Institute for Health Information [CIHI], 2015). In fact, the majority of Canadians inevitably will become informal caregivers at some point over the course of their lives (Battams, 2016; Carers Canada, 2016). Carers Canada (2016) notes that it is not *if*, but *when* every Canadian will be an informal caregiver. The 2012 General Social Survey reported that 46% (13 million) of Canadians aged 15 will, at some point, provide some type of care to a family member or friend with a long-term health condition, disability, or aging need (Statistics Canada, 2013a, 2013b). Within the 12 months preceding the survey, 28% (8.1 million) of Canadians aged 15 and over provided care to a chronically ill, disabled, or aging family

member or friend. While the majority of caregivers (57%) reported providing care to one person during the past 12 months, assisting more than one person was also prevalent. Specifically, 27% of informal caregivers reported caring for two and 15% for three or more family members or friends with a long-term illness, disability, or aging need (Statistics Canada, 2013a).

Altogether, most informal care comes from unpaid family, friends, and neighbours (Human Resources and Skills Development Canada, 2006). A recipient's main source of health and social support is typically a spouse or co-habitant (Grunfeld, Glossop, McDowell, & Danbrook, 1997; Keefe, Légaré, Charbonneau, & Décarie, 2012). As such, it is likely that the prevalence of informal caregiving is actually greater since spousal caregiving may not be reported, as it can be perceived as typical support delivered to family members (Hoover & Rotermann, 2009).

Saskatchewan has the highest prevalence of informal caregivers in Canada at 34% (Statistics Canada, 2013a). Moreover, Saskatchewan is one of only four provinces to rate above the national average (28%) of informal caregiving prevalence (Ontario: 29%, Nova Scotia: 31%, Manitoba: 33%). Regina has the third highest prevalence rate (38%) of informal caregivers across 27 Canadian CMAs (Statistics Canada, 2013a).

2.2.1 Reasons for Caregiving. Age-related needs were identified in a 2012 survey as the single most common problem requiring help from informal caregivers (28%). This was followed by cancer (11%), cardiovascular disease (9%), mental illness (7%), Alzheimer's disease and dementia (6%), neurological diseases (6%), injury from an accident (5%), arthritis (4.5%), diabetes (4%), and back problems, developmental disability/disorders, respiratory problems, and mobility of physical disability (3%).

Notably, cancer was the leading reason for spousal caregiving (17%; Statistics Canada, 2013a).

Caring for an older relative was the most common caregiving relationship in the 2012 survey, with about half (48%) of informal caregivers reporting caring for their parents or parents in-law over the past year (Statistics Canada, 2013a). Specifically, 38% of informal caregivers were caring for their mother or father and 10% were caring for their mother or father-in law. Adult children were almost four times more likely to report caring for a parent than a parent-in-law, and two and a half times more likely to report caring for their own mother than father. Statistics Canada (2013a) describes that the higher occurrence of caring for one's own mother reflects the fact that females often outlive their spouses and then rely on their children for support with aging needs or other health problems.

Older adults account for a growing percentage of the Canadian population – shifting the historical balance between young and old (Carstairs & Keon, 2009). While the Canadian population is relatively young compared to other developed countries, it still has a high proportion of older adults (Kembhavi, 2012). In Canada, much of what constitutes an older adult comes from what is considered retirement age – the age at which Old Age Security Pension is available – which is typically accessible at 65 years of age (Government of Canada, 2016b). Likewise, in most developed countries, the qualifying age for older adults is generally 65 years (Kembhavi, 2012).

By 2031, it is projected that the proportion of older adults (≥ 65 years of age) in Canada will rise to 24.5% compared to 14.8% in 2012. By 2051, approximately one in four Canadians are expected to be ≥ 65 years of age. For the first time ever, there are now

more people in Canada ≥ 65 years of age compared to those ≤ 14 years of age (Statistics Canada, 2015). In 2011, Saskatchewan had the seventh highest percentage (14.6 %) of older adults in Canada. Moreover, it is projected that by the year 2036, almost one-quarter (23.3%) of Saskatchewan's population will be ≥ 65 years of age (Statistics Canada, 2010). Accordingly, informal caregivers are fundamental to enabling those with age-related needs to remain in their homes and communities. Nonetheless, informal caregiving is not limited to just helping parents or parents-in-law. The second most common caregiving relationship in Canada is caring for close friends, colleagues, or neighbours (16%). Informal caregivers also care for grandparents (13%), siblings and other extended family members (10%), and spouses (8%; Statistics Canada, 2013a). Although the high prevalence of informal caregiving across Saskatchewan (34%) is ascribed to aging needs, the prevalence of informal caregiving in Regina (38%) is attributed to caring for a family member or friend suffering from a chronic health issue or disability, as opposed to problems related to aging.

2.2.2 Caregiver Age. The majority (87%) of informal caregivers are between 15-64 years of age, while the remaining 13% are ≥ 65 years of age (Statistics Canada, 2013a). Informal caregivers are predominantly ≥ 45 years of age (57%). Drawing from the General Social Surveys of 2007 and 2012, Statistics Canada (2013a) examined the changes in the number of informal caregivers ≥ 45 years of age. The number of informal caregivers ≥ 45 years of age increased by 760,000 to 4.5 million, representing a 20% increase over the five years. Of note, however, are two methodological differences between survey cycles: first, the age of caregivers included in the surveys varied from ≥ 45 years of age in 2007 to ≥ 15 years of age in 2012. Consequently, trend analysis must

be limited to caregivers ≥ 45 year of age. Second, the wording of the questions on caregiving was modified between the two cycles, which may have impacted the number of people identifying themselves as caregivers (Statistics Canada, 2013a).

Although informal caregivers are predominantly ≥ 45 years of age (57%), informal caregiving is widespread across all age groups. Specifically, 15% of all informal caregivers are 15-24 years of age, 14% are 25-34 and 35- 44 years of age, 24% are 45-54 years of age, and 20% are 55-64 years of age. While Statistics Canada (2013a) reports the number of informal caregivers across all age groups, it may not accurately represent the informal caregiving population at any given time, since informal caregiving can occur on an intermittent basis and this label may not resonate with some caregivers. Along these lines, Statistics Canada (2013b), using the 2012 General Social Survey, reported the percentage of males and females who provided help or care to a relative or friend with a chronic health problem. The results revealed that between 13-39% of males and females across all age groups provided help or care. Specifically, 25% of males and 30% of females aged 15-24, 20% of males and 28% of females aged 25-34, 22% of males and 27% of females aged 35-44, 36% of males and 38% of females aged 45-54, 38% of males and 39% of females aged 55-64, 24% of males and 25% of females aged 65-74, and 14% of males and 13% of females ≥ 75 years of age had provided help or care to a relative or friend with a chronic health problem.

2.2.3 Gender Differences in Informal Caregiving. Historically, informal caregivers have been primarily female (Statistics Canada, 2008). Health Canada (2002) reported that the majority of informal caregivers were female (77%) – typically the spouse or daughter of the care recipient. In 2007 and 2012, 54-57% of Canadian

caregivers were female (Statistics Canada, 2013a). Although informal caregivers are predominantly female, the percentage of female caregivers decreased from 2002 to 2012, with demographic trends suggesting that males increasingly become informal caregivers (Sanders, 2007).

Statistics Canada (2013a) reports that the median number of caregiving hours in 2012 was similar between males and females. However, females were more likely to spend 20 or more hours per week on caregiving tasks (17% versus 11%) and males were more likely to spend less than one hour per week providing care (29% versus 23%). The higher frequency of caregiving among females might be partly due to the type of tasks performed. Specifically, females tend to provide care for activities that must be completed on a regular or set schedule. For example, females were twice as likely as males to provide personal care such as bathing and dressing (29% versus 13%). Females were also considerably more likely to assist with medical treatments (27% versus 18%) and meal preparation (59% versus 41%). On the other hand, males were more likely to perform tasks that do not need to be completed on a set schedule, such as house maintenance and outdoor work (56% versus 35%; Statistics Canada, 2013a).

2.2.4 Hours. The support provided by informal caregivers can range from a few hours a week to continuous 24-hour care (Carstairs & Keon, 2009). In 2012, informal caregivers spent a median of three hours a week caring for an ill or disabled family member or friend. This support climbed to a median of 14 hours for those providing care to an ill spouse. Most often, informal caregivers spent under 10 hours a week on caregiving duties; 26% of caregivers reported spending ≤ one hour per week, 32% reported spending two to four hours per week, and 16% reported spending five to nine

hours per week caring for a family member or friend (Statistics Canada, 2013a). The lowest number of weekly caregiving hours involved those caring for grandparents and friends at 2 hours per week. Across all informal caregiving relationships (spouse/partner, parents, parents-in-law, other family members, grandparents, friends, neighbours, and colleagues), caregivers spent an average of 4.7 hours a week caregiving in 2012 (Statistics Canada, 2013a).

For some, caregiving is equal to a full-time job. Approximately 10% of informal caregivers were spending ≥ 30 hours a week providing some form of assistance to an ill family member or friend in 2012 (Statistics Canada, 2013a). These caregivers were most often caring for an ill spouse (31%). While relatively rare, 6% of spousal and 2% of overall caregivers reported providing care 24 hours a day, seven days a week. Certain health conditions require more hours of care, as in the case for care recipients with accident-related injuries (43%) and cancer (36%), where caregivers were spending at least 10 hours a week providing help (Statistics Canada, 2013a).

Although older adults were the least common group of informal caregivers, they were most likely to spend the longest hours providing care. Specifically, 23% of older caregivers (≥ 65 years of age) provided ≥ 20 hours of care per week, compared to 10% of those aged 15-24, 13% of those aged 45-54, and 17% of those aged 55-64. The longest hours of care among older caregivers may be partly explained by the likelihood of caring for a spouse (Statistics Canada, 2013a). In addition, the actual time spent performing tasks is often combined with the time needed to travel to provide care. Approximately three-quarters (73%) of informal caregivers indicated that they did not live in the same household or building as their recipient and often had to travel to provide care. Just over

half (52%), however, reported having to travel less than 30 minutes by car, while approximately 12% of caregivers provided help to someone who lived at least one hour away by car (Statistics Canada, 2013a). Lastly, Statistics Canada (2013a) examined changes in the amount of time informal caregivers ≥ 45 years of age devoted to their caregiving responsibilities from 2007 to 2012 and reported no change over the five-year period. Informal caregivers spent a median of three hours per week providing care for their family member or friend. As previously noted, however, these results warrant caution as a result of methodological differences between the 2007 and 2012 General Social Survey cycles (Statistics Canada, 2013a).

2.2.5 Length of Time. Caring for an ill or disabled family member or friend can span days, weeks, months, or even years. For the vast majority of informal caregivers (89%), caregiving activities last at least one year or more, with half reporting they had been caring for a loved one for at least four years (Statistics Canada, 2013a). Likewise, the Deloitte Canadian Health Consumer Survey (2009) illustrates that the average informal caregiver spent four and a half years caregiving, while 38% were providing continuous care for at least two years. Notably, longer-term caregivers (≥ 4 years) differ from shorter-term caregivers (< 1 year), in terms of who they provided care to. Longer-term informal caregivers were more likely caring for an aging friend or family member, while shorter-term caregivers were most commonly providing help to a cancer patient (Statistics Canada, 2013a).

2.2.6 Tasks. Informal caregiving can include a wide array of activities that vary in intensity and degree of physical demand on the caregiver. Informal caregivers provide vital help with activities of daily living (ADL) and instrumental activities of daily

living (IADL; Canadian Institutes of Health Research [CIHR], 2010). ADL refers to daily activities of self-care essential for fundamental functioning that take place within an individual's place of residence and/or within outdoor environments (Krapp, 2002). Examples of ADL that informal caregivers perform include help with personal hygiene, eating, toileting, and ambulation (Baumgarten et al., 1992; CIHR, 2010). IADL is a term used to refer to activities that are not necessary for fundamental functioning, but permit individuals to live independently in a community (Bookman, Harrington, Pass, & Reisner, 2007). Examples of IADL performed by informal caregivers include housework, medication management, shopping, transportation, and meal preparation (Baumgarten et al., 1992; CIHR, 2010). In addition to ADL and IADL, informal caregivers also provide a broad range of services and supports, including help with managing finances, attending appointments, assisting with decision making related to health care and lifespan planning, providing emotional and spiritual support, and arranging and participating in social events (CIHI, 2011; CIHR, 2010; Gilmour & Park, 2005; Statistics Canada, 2013a; Statistics Canada, 2007; Swartz & Keir, 2007).

Using the 2012 General Social Survey, Statistics Canada (2013a) illustrated that over 12 months the most frequently administered type of care – transportation – was provided by 73% of informal caregivers. Also, 52% of caregivers reported that they performed IADL in the last 12 months, such as cleaning, laundry, and preparing meals. Finally, 45% reported providing assistance with house maintenance or outdoor work. The most common types of care were not always the ones most likely to be executed on a regular basis (i.e., at least once a week). Despite the fact that personal care and providing medical assistance were the least common forms of care, when they were performed,

these tasks were most likely to be done regularly. Two-thirds of informal caregivers providing personal care did so at least once a week, as did 63% of caregivers helping with medical treatments. Furthermore, these tasks were often done on a daily basis, with nearly 33% of caregivers providing daily personal or medical care. In comparison, 50% of caregivers helping with house maintenance and outdoor work reported doing these tasks on a weekly basis, with only 12% performing them daily. Most informal caregivers do not merely complete one specific task or activity. In 2012, 71% of informal caregivers providing regular assistance helped with two or more tasks (Statistics Canada, 2013a).

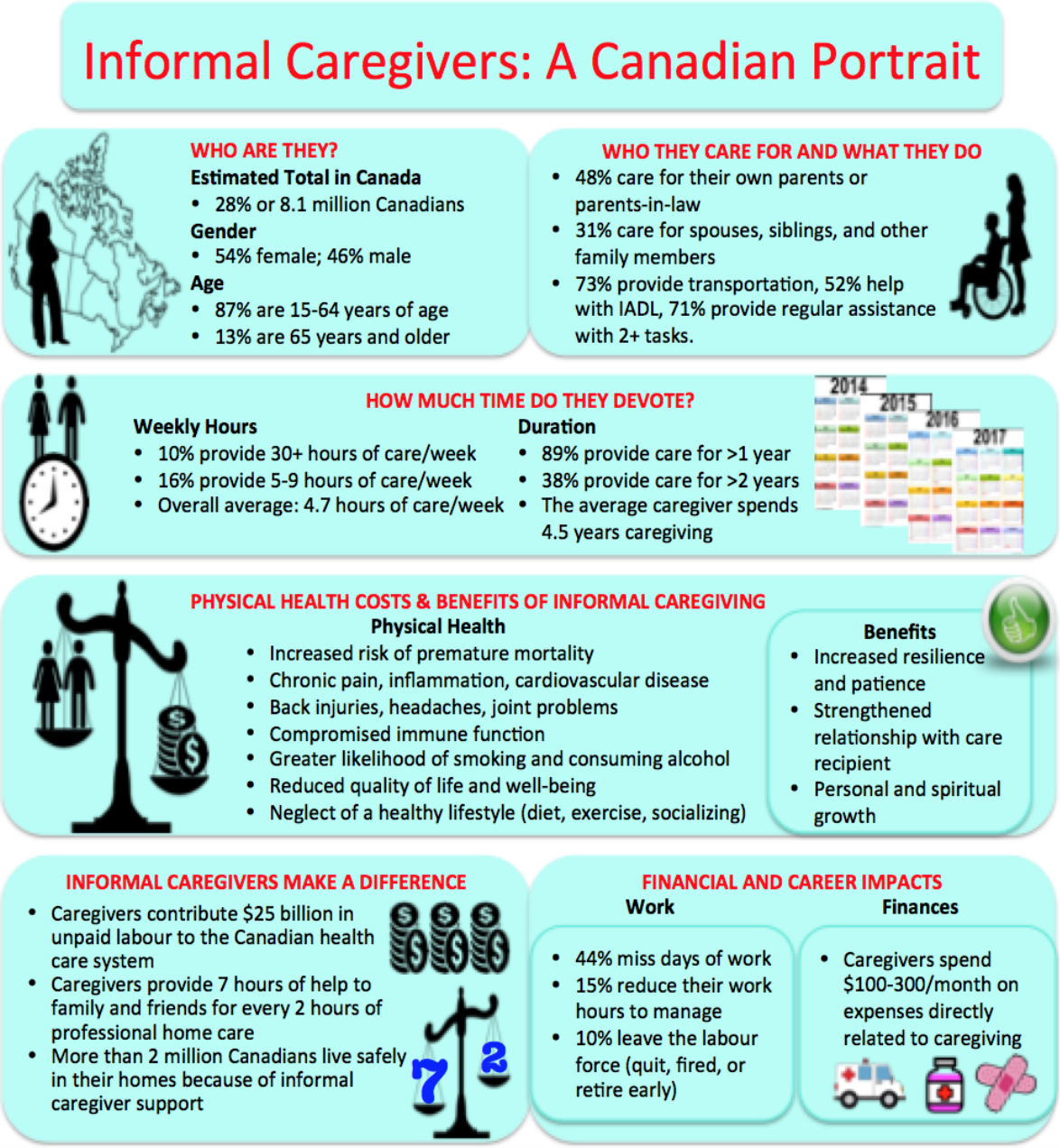


Figure 1 A portrait of informal caregivers in Canada

2.3 Impacts of Informal Caregiving

Many informal caregivers who provide care do so gladly and feel positively about their role. Caregivers report personal and spiritual growth and enjoyment in spending time with a loved one and making new memories. Other reported benefits include

feelings of increased resilience, greater patience, and stronger relationships with their care recipient and others (Cohen, Colantonio, & Vernich 2002; Kramer, 1997; Netto, Jenny, & Phillip, 2009; Sanders, 2005). Rajnovich, Keefe, and Fast (2005) reported that more than 70% of both male and female caregivers stated that informal caregiving had strengthened the relationship with their care recipient. The Family Caregiver Alliance (2006) reports that informal caregivers may find personal fulfillment and satisfaction from helping to relieve another's suffering. Specifically, informal caregivers may feel rewarded by delivering care that they initially did not think they would be capable of providing (Netto et al., 2009; Sanders, 2005).

Chappell and Dujela (2008) and Andren and Elhmstahl (2005) state that informal caregivers can be both burdened and experience acceptable or elevated levels of wellbeing at the same time. Moreover, Pearlin, Mullan, Semple, and Skaff (1990) noted that informal caregivers could find inner enrichment and growth even as they contend with mounting burdens. Along these lines, Schultz, Visintainer, and Williamson (1990) reported that even as informal caregivers experienced high levels of distress and depression, they expressed that caregiving gave meaning to their lives, enabled them to learn new skills, and made them feel good about themselves.

2.3.1 Negative Impacts. Although informal caregiving may be rewarding, the literature has highlighted several deleterious effects associated with this role. Informal caregivers are sometimes referred to as *secondary patients* because their caregiving demands place them at high risk for injury, reduced health, and adverse events (Reinhard, Given, Petlick, & Bemis, 2008). In some cases, such as the case of informal caregivers of cancer patients/survivors, caregivers are further defined as second order patients

(Lederberg, 1998) or secondary survivors (Aziz, 2002; Aziz & Rowland, 2003). These definitions highlight the fact that the health care system should see informal caregivers as both a care provider and potential patient who needs and deserves protection and guidance (Reinhard et al., 2008). It should not be assumed that informal caregivers are able to provide care without negative consequences to themselves or their care recipient.

Recently, Carers Canada, the Canadian Cancer Action Network, and the Canadian Home Care Association (2017) collaborated through the Mobilizing Action: Family Caregivers in Canada project to unite pan-Canadian efforts to enhance the well-being of informal caregivers (Henningsen & Morrison, 2017). The collaboration identified five universal priorities required to effectively support informal caregivers. These priorities were incorporated into *A Canadian Carer Strategy*, launched in 2008 and updated in 2014 following consultations across Canada to ensure accurate representation of caregiver needs. The elements identified were safeguarding the health and well-being of informal caregivers, minimizing excessive financial burden, improving access to caregiver support services and patient care resources, creating supportive workplaces and educational environments that respect caregiving obligations, and investing in research as a foundation for evidence-informed decision making (Henningsen & Morrison, 2017).

Many negative outcomes may result from informal caregiving that could be prevented, addressed, mitigated, and/or improved. Throughout the informal caregiving journey, caregivers may experience physical and mental health problems (Brodaty & Green, 2000; Schulz & Paula, 2008), social isolation (Brodaty, Green, & Koschera, 2003; Ranmuthugala, Nepal, Brown & Percival, 2009), poor physical health compared to non-caregivers (Schulz, Vistainer, & Williamson, 1990), and direct (e.g., medications) and

indirect (e.g., loss of earnings from relinquishing paid work) financial costs and problems (Brodaty et al., 2003). Loss of life perspectives, emotional isolation, sleep disorders, burnout of personal relationships, abuse of psychotropic substances, and negative impacts on QOL and well-being have also been reported (Caswell et al., 2003; McCurry, Gibbons, Logsdon, Vitiello, & Teri, 2009; McCurry, Logsdon, Teri, & Vitiello, 2007; Pitceathly & Maguire, 2003; Stenberg, Ruland, & Miaskowski, 2010; Tremont, 2011).

Informal caregiving can come at the cost of physical health. Shaw et al. (1997) suggested that the poor physical health of informal caregivers may be due to factors such as negative changes in health-related activities (e.g., diet and PA), consequences of physical exertion (e.g., skeletal injuries or aggravating chronic illnesses), changes in sympathetic arousal and cardiovascular reactivity (e.g., increasing the risk for hypertension and cardiovascular disease), and physiological effects of psychological distress (e.g., depression and anxiety, which increase vulnerability to infections). Since informal caregiving often involves physical efforts such as lifting people and doing physical chores, these efforts can lead to physical pain and poor self-assessed health (Do, Norton, Stearns, & Van Houtven, 2015). Along these lines, Pinquart and Sörensen (2007) report that negative physical health outcomes in the informal caregiving population can be linked to physically demanding work over a long duration, which might cause musculoskeletal injuries, aggravation of arthritis and other chronic illnesses, and the neglect of a healthy lifestyle (e.g., diet and exercise). In recent years, research on the physical health of informal caregivers has grown, highlighting numerous physical impacts and the neglect of health promoting behaviours (Bauer & Sousa-Poza, 2015).

2.3.2 Physical Impacts. Informal caregiving research has noted an assortment of detrimental physical conditions, including back injuries, headaches, and joint problems (Public Health Agency of Canada, 2012; Sawatzky & Fowler-Kerry, 2003); increased mortality and higher use of psychoactive medications (Kiecolt-Glaser & Glaser, 2001; Schulz & Beach, 1999; Schulz, O'Brien, Bookwala, & Fleissner, 1995; Vitaliano et al., 2003); compromised immune function and vulnerability to physical illness (Chenoweth & Spencer, 1986; Kiecolt-Glaser & Glaser, 1989; Shaw et al., 1997); sleep problems (Oyebode, 2003), severe fatigue (Jensen & Given, 1991), and crying episodes (Hawranik & Strain, 2002); and respiratory infections, hypertension, eating disorders, and poor health habits (Capistrant, Moon, Berkman, & Glymour, 2012; Carter & Chang, 2000; Chentsova-Dutton et al., 2000). Informal caregivers often experience heightened levels of chronic pain (Morris, 2004), biological markers of inflammation (Wu et al., 1999), arthritis, blood pressure, gastric ulcers (Sawatzky & Fowler-Kerry, 2003), and cardiovascular disease (Lee, Colditz, Berkman, & Kawachi, 2003). The combination of the physical demands of caregiving, prolonged distress, and biological vulnerability may compromise an informal caregiver's physiological functioning and increase their risk for physical health problems, potentially also leading to increased mortality (Schulz & Beach, 1999). Likewise, other studies have shown high risks for premature mortality among informal caregivers, in addition to adverse physical health and institutionalization (Christakis & Allison, 2006; Family Caregiver Alliance, 2006; Navaie-Waliser et al., 2002; Pinquart & Sörensen, 2003; Shaw et al., 1997).

2.3.3 Subjective Physical Health. Caregivers self-report poor physical health associated with their caregiving (Kiecolt-Glaser & Glaser, 2001; Schulz & Beach,

1999; Schulz et al., 1995). Most recently, Darragh et al. (2015) conducted a study to shed light on the musculoskeletal discomfort of 46 informal caregivers (41 female, 5 male) of adults with physical disabilities. The authors reported that 37% (n = 17) of informal caregivers reported high or very high physical strain associated with caregiving, while 94% (n = 43) reported musculoskeletal discomfort in at least one body part during the previous four weeks. Furthermore, 82% (n = 37) of informal caregivers experienced musculoskeletal discomfort in multiple parts of the body. Markedly, 78% (n = 33) of those reporting musculoskeletal discomfort believed that caregiving either caused or contributed to their symptoms, which interfered with their ability to provide care, work, and participate in other life activities.

In another larger study, 17% of informal caregivers (*N* = 1307) reported their health as fair or poor, compared to 13% of the general adult population that described their health as fair or poor. For informal caregivers providing care for five years or more, this percentage jumped to 23%. Moreover, 17% of informal caregivers believed that their health had deteriorated as a result of providing care (National Alliance for Caregiving & American Association of Retired Persons, 2009). Brown and Mulley (1997) reported that 76% (n = 31) of informal caregivers in their study had suffered an injury whilst lifting or handling; 20% (n = 8) were temporarily unable to continue caring as a result of these injuries. These findings are supported by previous research indicating that informal caregivers perceive their health to decline as a result of their caregiving role and duties (Neundorfer, 1991; Snyder & Keefe, 1985). Statistics Canada (2013a) reported that 28% of informal caregivers found providing care somewhat or very stressful and 19% indicated that their physical health suffered in the last 12 months as a result of their

caregiving responsibilities. Remarkably, the Evercare and National Alliance for Caregiving (2006) illustrated that over half (53%) of the American caregivers in their study (N = 528) indicated that the decline in their physical health compromised their ability to provide care for their recipients. Finally, the Administration on Aging (2004) reported that although one-third of informal caregivers expressed having poor to fair health themselves, they are likely the care recipient's sole caregiver.

2.3.4 Caregivers Versus Non-Caregivers. Berglund, Lytsy, and Westerling (2015) compared informal caregivers' self-rated health and number of recent days with poor health with that of non-caregivers in the general Swedish population. Approximately 11% (9343/90845) of respondents were informal caregivers (45.5% male, 54.5% female). Although the majority of respondents reported good or very good general self-reported health (65.5% caregivers, 71.7% non-caregivers), there was a statistically significant difference between caregivers and non-caregivers reporting less than good self-reported health (34.6% caregivers, 28.3% non-caregivers). Furthermore, caregivers had, on average, significantly ($p < 0.001$) more days with poor physical health in the past month than non-caregivers, reporting an average of 7.4 ± 9.89 days, while non-caregivers reported an average of 6.4 ± 9.43 days (Berglund et al., 2015). These results are consistent with other studies reporting that informal caregiving is associated with poorer physical health and lower self-reported health than non-caregivers or the general population (Chan, Malhotra, Malhotra, Rush, & Ostbye, 2013; Do et al., 2015; Sjolander, Rolander, Jarhult, Martensson, & Ahlstrom, 2012). Along these lines, results from a 2007 Los Angeles County Health Survey showed that a higher percentage of informal caregivers (53.1%) had one or more of the following chronic conditions than non-

caregivers (48.6%): hypertension, high cholesterol, diabetes, and heart disease. The survey also indicated that informal caregivers reported more unhealthy days in the past month (6.3) compared to non-caregivers (5.2; Los Angeles County Department of Public Health, 2010).

2.3.5 Potential Mediating Variables. Navaie-Waliser et al. (2002) found that informal caregivers reporting fair to poor health or a serious health condition were more likely to be ≥ 65 years of age. Likewise, the biological vulnerabilities of aging caregivers, in combination with the prolonged distress and physical demands of caregiving, may compromise their physiological functioning and increase their risk for health problems (Kiecolt-Glaser, Glaser, Gravenstein, Malarke, & Sheridan, 1996; Vitaliano, 1997). Pinquart and Sörensen (2007) indicated that spousal caregivers might report reduced physical health compared to adult children, possibly due to age-related physical decline. The authors further identify older male dementia caregivers as having the most severe physical impairments. Dementia caregiving itself, however, has been associated with an overall downturn in health (Schoenmakers, Buntinx, & Delepeleire, 2010). In contrast to these reports regarding caregiver age, Harwood, Barker, Ownby, and Duara (2000) found no substantial age differences in informal caregiver physical health. To date, the literature is inconsistent with regard to age differences in this population. In terms of gender, Keefe (2011) paints a different picture than Pinquart and Sörensen (2007), reporting that when asked about overall health, over twice as many females (18%) as males (8%) expressed that caregiving had affected their physical health. Cuthbert, King-Shier, Tapp, Ruether, and Culos-Reed (2017) examined the self-reported physical health of older caregivers and reported that gender had a minimal effect on

physical health. Currently, the literature presents conflicting information regarding caregiver gender and physical health.

The negative physical consequences of informal caregiving may be mitigated and/or aggravated by the number of hours per week spent providing care (Legg, Weir, Langhorne, Smith, & Stott, 2013; Ugreninov, 2013). Capistrant et al. (2012) estimated a 31% increase in risk of cardiovascular disease among spousal caregivers overall and near double the risk of cardiovascular diseases among spousal caregivers providing ≥ 14 hours per week of care. Likewise, Statistics Canada (2013a) reported that the reduced physical health experienced by informal caregivers is magnified by the number of hours per week they provide care. Specifically, the highest percentage of caregivers (38%) reported that their health suffered as a result of caregiving responsibilities when they spent ≥ 20 hours per week caregiving. Similarly, Ohio State University illustrated that informal caregivers who spent ≥ 21 hours per week caring for a loved one experienced musculoskeletal discomfort that impacted their everyday lives (Ohio State University Center for Clinical and Translational Science, 2014). Finally, informal caregivers who provided ≥ 40 hours of care per week were much more likely to report fair or poor self-perceived health (29.7%) than caregivers who provided ≤ 10 hours of care per week (15.3%; Los Angeles County Department of Public Health, 2010).

Markedly, Coe and Van Houtven (2009) drew attention to the fact that informal caregiving may not only affect health status during the caregiving period. Rather, informal caregiving may be related to subsequent downturns in immune function after the caregiving role has been relinquished. Specifically, Coe and Van Houtven (2009) demonstrated occurrences of lower self-assessed health and high blood pressure two to

four years post-caregiving. The authors also reported that at four years post-caregiving, married female caregivers had a statistically significant reduction in the probability of being in at least very good health compared to married female non-caregivers. Along these lines, Gräsel (2002) demonstrated that although caregivers in his study experienced no health decrease during the caregiving period, caregivers experienced uplifts in health post-caregiving. These informal caregivers, however, experienced approximately twice as many doctor visits post caregiving, which the author interpreted as an increased awareness of their own health that may have been neglected while caregiving. Finally, Beach et al. (2005) illustrated that when informal caregivers reported more physical symptoms, their care recipients were more likely to state that their caregivers screamed and yelled at them, used a harsh tone of voice, insulted them, called them names, or swore at them.

2.3.6 Impacts on Health-Promoting Behaviours. Regrettably, an informal caregiver's health may deteriorate since they are less likely to engage in preventive health measures (Bevans & Sternberg, 2012; Collins & Swartz, 2011; Hill, Smith, Fearn, Rydberg, & Oliphant, 2007; Schoenmakers, Buntinx, Delepeleire, 2009; Schulz & Beach, 1999; Schulz et al., 1997). Important health-promoting behaviours often neglected by informal caregivers include getting adequate sleep and physical exercise, neglecting preventive health care, poor eating habits, failure to stay in bed when ill, social isolation, postponement or failure to make medical appointments for themselves, and a greater likelihood of smoking and drinking alcohol (Alzheimer's Association, 2007; Baumgarten et al., 1992; Haley, Levine, Brown, Berry, & Hughes, 1987; Keefe, 2011; Pruchno & Potashnik, 1989; Schulz & Williamson, 1997; Segerstrom, Schipper, & Greenberg, 2008;

Vedhara et al., 1999; Vedhara et al., 2003; Vitaliano et al., 2003). While fulfilling the caregiver role, social activities and leisure time are often abandoned in order to provide care (Keating, Fast, Frederick, Cranswick, & Perrier, 1999). Informal caregivers often lack social contact and support, experience feelings of social isolation (Brodaty & Hadzi-Pavlovic, 1990; LoGiudice et al., 1999), sacrifice their hobbies, and restrict time with friends and family (Brodaty & Donkin, 2009). Frequently, informal caregivers have difficulty maintaining social networks either because they do not have the time or energy to maintain them or because friends stop visiting (Statistics Canada, 2008). The social isolation and lack of downtime that may occur as a result of informal caregiving responsibilities can lead to poorer physical health for caregivers (Song, Biegel, & Milligan, 1997). Having leisure time for resting or doing PA has been specified as a prospective important strategy to reduce mortality rates among informal caregivers (Schulz & Beach, 1999).

2.3.7 Informal Caregivers and PA Participation. It has been hypothesized that part of the negative impact on informal caregiver health may be reduced PA participation (Castro et al., 2002; Lim & Taylor, 2005; Vitaliano et al., 2002). The American Heart Association (2014) recently highlighted PA as one of its three recommendations (alongside avoiding tobacco and ensuring proper nutrition) for improving caregiver health. Yet, research is equivocal regarding how much PA caregivers perform. Hiel et al. (2015) note that informal caregivers have less time to exercise and will therefore not benefit as much from the advantageous effects of PA. Encouragingly, however, McKibbin, Walsh, Rinki, Koin, and Gallagher-Thompson (1999) reported that approximately half of all informal caregivers participate in regular

PA. Other studies are less optimistic, with self-report evidence demonstrating that physical inactivity is widespread among informal caregivers and is a principal risk factor that requires attention (King & Brassington, 1997; Vitaliano et al., 2002). In line with Vitaliano et al. (2002), Etkin, Prohaska, Connell, Edelman, and Hughes (2008) state that the majority (60%) of informal caregivers do not engage in consistent, regular PA, and less than a quarter meet or exceed PA recommendations.

2.3.8 PA Recommendations and Preferences. The general aerobic prescription for individuals ≥ 18 years of age to achieve health benefits, as outlined by the Canadian Society for Exercise Physiology's Canadian Physical Activity Guidelines (2011a, 2011b), is to accumulate at least 150 minutes of moderate-to-vigorous-intensity aerobic PA per week, in bouts of 10 minutes or more. It is also important to add muscle and bone strengthening activities that use the major muscle groups at least twice a week. Notably, Lysne (2004) indicates that maintaining cardiovascular health, flexibility, strength, endurance, and balance are all essential to healthy aging.

Although PA has consistently been shown to have positive effects on overall physical health (Lee, 2003; Loprinzi & Brosky, 2014; Myers et al., 2004; Perales, Del Pozo-Cruz, Del-Pozo-Cruz, De Pozo-Cruz, 2014; Warburton, Gledhill, & Quinney, 2001a, 2001b), attempts to employ PA interventions or assess preferences and interests in PA has rarely been explored in informal caregivers. In one of the few studies concerning informal caregivers and PA preferences, Swartz and Keir (2007) examined the stress-reduction preferences of informal caregivers of brain tumour patients (N = 60). Of the 11 programs presented to the participants (i.e., exercise [cardiovascular and muscular], coping skills training, massage, Yoga, progressive muscle relaxation, deep soft-belly

breathing, meditation, guided imagery, biofeedback, Tai Chi, and qi gong), the most frequently chosen (73%) modality was exercise. Male caregivers ranked exercise (70%), massage (70%), meditation (55%), and soft-belly breathing (55%) as their most preferred stress reduction programs. Female caregivers ranked exercise (75%), massage (65%), coping skills (58%), and progressive muscle relaxation (50%) as their most preferred stress reduction programs. Interestingly, four of the six (67%) most preferred stress-reduction programs chosen by males and females delineate novel forms of PA, such as Yoga and Tai Chi (i.e., exercise, meditation, soft-belly breathing, and progressive muscle relaxation). Moreover, 42% of the informal caregivers in Swartz and Keir's (2007) study chose Yoga as their most preferred stress reduction program.

Markedly, both Yoga and Tai Chi incorporate the pillars of health-related fitness (i.e., cardiovascular fitness, muscle strength and endurance, flexibility, balance) and have been shown to improve cardiovascular health, flexibility, strength, endurance, and balance (Bosch et al., 2009; Brown, 2010; Brown et al., 2008; Chen et al., 2008; Cohen et al., 2004; Desikachar et al., 2005; McCall, 2007; NCCAM at the NIH, 2016a; Pullen et al., 2008; Rones & Silver, 2007; Wang et al., 2004; Zheng et al., 2015). Similar to Swartz and Keir (2007), King and Brassington (1997) reported that PA was also rated as more desirable than stress management or other types of health promotion programs (e.g., nutrition, weight control).

Novel forms of PA are becoming increasingly popular among healthy and chronically ill populations (Crew et al., 2007; Gimbel, 1998; Mustian, Katula, & Zhao, 2006; Speed-Andrews, Stevinson, Belanger, Mirus, & Courneya, 2010; Tacon & McComb, 2009). An exciting current trend in fitness is to utilize MBM-based PAs, which

are becoming increasingly popular due to their fusion of breath work with the pillars of health-related fitness, bringing a meditative quality to a physical practice. PAs categorized as MBMs are also gaining recognition as a result of mindfulness in mainstream culture (which denotes the foundation of MBMs). The current zeitgeist embraces mindfulness and other contemplative practices as a path to wellness, where awareness of and focus on the interactions of the brain, mind, body, and behavior is fundamental to one's physical functioning and training (Elkins, Fisher & Johnson, 2010). Markedly, such as PA, mindfulness alone can benefit one's health. Though research is still in the early stages, several studies have reported benefits associated with mindfulness, such as: reducing stress, pain, anxiety, depression, blood pressure, and cortisol levels and increasing energy, sleep quality, immune function, awareness, clarity, calmness, and happiness (Carlson, Speca, Faris, & Patel, 2007; Feuille & Pargament, 2015; Hofmann, Sawyer, & Witt, 2010; Jazaieri et al., 2014; Khoury et al., 2013; Kuyken et al., 2008; Kvillemo & Bränström, 2011; Ma & Teasdale, 2004; Tan & Goleman, 2014; Walsh & Shapiro, 2006; Witek-Janusek et al., 2008; Young, 1997). Presently, two of the most widely used MBM-based PAs are the ancient Eastern (Indian) discipline of Yoga and the ancient Eastern (Chinese) martial art of Tai Chi (Rosenbaum et al., 2004; Wolsko, Eisenberg, & Davis, 2004).

3 Yoga

Yoga is one of six unique orthodox philosophies stemming from India (alongside *Samkhya, Nyaya, Vaiśesika, Mīmāṃsā*, and *Vedānta*) that emphasizes meditation,

contemplation, and liberation (Radhakrishnan & Moore, 1967). The goal of Yoga is to cultivate the ability to still the mind, control the senses, and be absorbed by the universe, thus achieving fulfillment or enlightenment (Cope, 2006; Fraser, 2007; Gimbel, 1998). Through the practice of various styles of Yoga, the practitioner cultivates the faculties to maintain focus on the present moment, as opposed to continuously being arrested by thoughts and cogitation (Grossman, Niemann, Schmidt, & Walach, 2004). The philosophy of Yoga is further sub-divided into six branches, namely: *Bhakti, Raja, Jnana, Karma, Tantra,* and *Hatha*. In the West, the most commonly practiced branch of Yoga is the non-secular discipline of *Hatha* Yoga, which translates to *Yoga of postures*.

3.1 Hatha Yoga

Hatha Yoga – the Yoga of postures – is characterized as a science of self-study and awareness via *Ashtanga* (eight limbs), namely: 1) *yamas* (ethical observations), 2) *niyamas* (personal observances), 3) *asanas* (physical postures), 4) *pranayama* (breath work/breathing exercises), 5) *pratyahara* (sense withdrawal/control), 6) *dharana* (concentration/inner perceptual awareness), 7) *dhyana* (meditation), and 8) *samadhi* (union/absorption). In the West, the most commonly practiced aspects of *Hatha* Yoga are the third, fourth, and seventh limbs, namely: *asanas* (physical postures), *pranayama* (breath work/breathing exercises), and *dyana* (meditation; Collins, 1998; Nayak & Shankar, 2004). In *Hatha* Yoga, *asanas* (standing, sitting, forward bending, twisting, inverting, balancing, reclining, and back bending poses) generally make up the majority of a Yoga session, strengthening, lengthening, and opening the body, while detoxifying the tissues (Coulter, 2001; Desikachar, 1999; McCall, 2007). *Pranayama* (breath work) and *dhyana* (meditation) usually make up the remainder of *Hatha* Yoga sessions and are

utilized to calm and focus the mind and develop greater awareness (Riley, 2004). The *pranayama* (breathing exercise) of *Hatha* Yoga (*Ujjayi* breath) helps establish a natural rhythm of the breath and increase lung capacity (Beeken, 2004; Iyengar, 2013; Nayak & Shankar, 2004).

The word *Hatha* itself translates from Sanskrit to *Ha* – sun and *Tha* – moon, opposites that represent the spectrum of actuality that life presents to all human beings (Feuerstein, 2001). According to Yoga philosophy, everything in the universe is comprised of *chi/qi* (a vital life force [energy] that circulates throughout one's body and everything in existence; Clark, 2007; Grilley, 2002, 2012). Furthermore, the two components of *chi/qi* are *yin* and *yang.* Thus, everything in existence (our bodies, plants, animals) is comprised of vital *yin* and *yang* energy. Specifically, *yin* energy is lunar, cool, feminine, dark, and slow, while *yang* energy is solar, hot, masculine, bright, and fast.

Although *yin* and *yang* are opposites (lunar vs. solar, cold vs. hot, light vs. dark), they are interdependent – one cannot exist without the other (there is no cold without hot, no light without darkness). What is more, since the relative levels of *yin* and *yang* are constantly changing (something that is predominantly *yin* in one circumstance – ice [cold], can be predominantly *yang* in another – steam [hot]); what is *yin* is also *yang*, and vice-versa (Clark, 2007). Therefore, nothing is truly *yin* OR *yang;* everything is *yin* AND *yang*. For example, just as a state of total *yin* is reached (full moon, dead of night), *yang* begins to grow – that is, the sun (*yang*) begins to emerge. Thus, *yin* contains a seed of *yang* and vise versa. Accordingly, the purpose of *Hatha* Yoga is to unite and balance these *yin* and *yang* energies in our bodies. It is by unifying the physical body, breath, and mind whilst performing specific postures and movements that blockages in the energy

centers (chakras) and channels (meridians) of the body can be cleared and *yin* and *yang* may become more balanced (Woodyard, 2011). Notably, all Yoga styles in the West involving physical postures (*asanas*) fall under the umbrella of *Hatha* Yoga since *Hatha* Yoga is the *Yoga of postures*. Recently, Cramer, Lauche, Langhorst, and Dobos (2016) conducted a systematic review of randomized Yoga trials, which revealed that the majority of randomized trials conducted up to 2014 were *Hatha*-based Yoga styles. Markedly, there are hundreds of different styles of Yoga stemming from the *Hatha* Yoga branch, however, the most popular, widespread, and frequently practiced *Hatha* Yoga style in the West is VY (Hunsberger, 2017; Walsh, 2016).

3.2 Vinyasa Yoga

The Sanskrit word *Vinyasa* stems from its roots, *vi*, meaning *in a special way*, and *nyasa*, meaning *to place*. Therefore, *Vinyasa* roughly translates to placing the body in a special way and/or arranging the *asanas* (poses) in a special way (Rea, 2012). The body and *asanas* (standing, sitting, forward bending, twisting, inverting, balancing, reclining, and back bending poses) are continually altered in order for the practitioner to achieve maximum benefits (Ramaswami, 2005). VY poses are designed to mostly stress the muscles, with the goal of increasing muscular strength and endurance (Fraser, 2007; Kaminoff, 2007; Ramaswami, 2005). VY is a moderate to fast-paced style of Yoga during which each *Yogasana* (Yoga posture) is linked to the next one in a continuous flow via a series of particular transitional movements; the majority of *asanas* are only held for a short period of time (1 to 3 minutes) before transitioning to the next pose (Fraser, 2007; Ramaswami, 2005; Stephens, 2012). Each *asana* is linked with synchronized and controlled use of the breath (Ramaswami, 2005). Specifically, the mind

and body closely follow the measured, velvety, and deliberately loud *Ujjayi* (victorious) breath. *Ujjayi* breath helps establish a natural rhythm of the breath, while increasing lung capacity by focusing on the conscious prolongation of inhalation, breath retention, and exhalation (Nayak & Shankar, 2004). This form of *pranayama* involves forcefully exhaling the breath so it is felt in the throat while exiting the nostrils. The breath is meant to swirl at the back of the throat and feel as though it is being forced out through the throat, all while maintaining a closed mouth. Notably, *Ujjayi* breath is often called *Ocean Breath* because the sound created mimics the sound of the ocean (Brown & Gerbarg, 2005; see Appendix A for a comprehensive description of *Ujjayi* breath).

3.3 Yoga in the West

Yoga is now regarded in the Western world as a holistic approach to health and is classified by the NIH as a MBM (NCCAM at the NIH, 2016b). Yoga is presently experiencing a noticeable increase in popularity in the West, primarily in wellness centers and health clubs, as a form of exercise and relaxation (Yachoui & Kolasinski, 2012). Trapper (2013) estimates that the number of global Yoga practitioners to be as high as 250 million. A recent survey illustrated that 5.5% of Canadian adults (approximately 1.4 million people) practiced Yoga in 2005, a 15% increase from 2004 and a 45% increase from 2003 (Namasta, 2005). Moreover, 2.1 million Canadians (one in 12 people) said they anticipated trying Yoga within the next 12 months. As a measure of Yoga's popularity in Canada, Tapper (2013) reports there are 669 Yoga studios in the greater Toronto area alone. Yoga has also become popular in the United States and is one of the ten most commonly practiced forms of complementary healthcare (Barnes, Powell-Griner, McFann, & Nahin, 2004).

Markedly, the most recent Yoga Journal and Yoga Alliance *Yoga in America* study (N = 3700) revealed that 36.7 million Americans (10.3 million males [28%] and 26.4 million females [72%]) practiced Yoga in 2016. Comparatively, the same study reported that in 2012, 20.4 million Americans practiced Yoga. In just four years, there has been an 80% increase of Yoga practitioners, in addition to another 80 million Americans who stated that they were likely to try Yoga in 2016 (Yoga Journal 2016). Americans believe Yoga enhances athletic performance, relieves stress, and increases strength and flexibility. Along these lines, the 2012 'Yoga in America' study reported that the top five reasons for starting Yoga were: flexibility training (78.3%), general conditioning (62.2%), stress relief (59.6%), and improvements in overall health (58.5%) and physical fitness (55.1%). In 2016, Yoga was most commonly practiced in the home, followed by gyms/health clubs, Yoga studios, community centers, and parks (Yoga Journal, 2016). Finally, practitioners spent $16.8 billion dollars on Yoga classes and products in 2016, an increase of $6.1 billion (57%) from 2012 (Yoga Journal, 2016, 2012).

3.4 Physical Benefits of Yoga

While practicing Yoga, joints are taken through a full range of motion, increasing nutrient, oxygen, and blood delivery to skeletal muscle (McCall, 2007). Yoga benefits posture, sleep (quality and duration), balance, energy, and resiliency (Chen et al., 2009; Manjunath & Tells, 2005). Yoga can build muscle mass and/or maintain muscle strength (Bosch et al., 2009; Brown, Koziol, & Lotz, 2008; Chen et al., 2008; Cohen et al., 2004; Desikachar et al., 2005), lower blood pressure, strengthen bones, improve immune function, improve cardiovascular conditioning, decrease markers of inflammation (C-

reactive protein and inflammatory cytokines; Blumenthal et al., 1989; Innes, Bourguignon, & Taylor, 2005; Lox, Ginis, & Petruzzello, 2006; Pilkington, Kirkwood, Rampes, & Richardson, 2005; Tran, Holly, Lashbrook, & Amsterdam, 2001; Van Puymbroeck et al., 2007; Vedamurthachar et al., 2006; Woolery, Myers, Stemliebm, & Zeltzer, 2004; Yogendra et al., 2004), and reduce minute ventilation, diastolic and systolic blood pressure, heart rate, and mean arterial pressure (Blumenthal et al., 1989, 1991; Cohen et al., 2004; Harinath et al., 2004; Sivasankaran et al., 2006; Yogendra et al., 2004). Furthermore, Yoga has been shown to improve homeostatic control and autonomic balance (Woodyard, 2011) and decrease levels of salivary cortisol (Michalsen et al., 2005; West, Otte, Geher, Johnson, & Mohr, 2004) and 24-hour urine norepinephrine and epinephrine levels (Selvamurthy et al., 1998).

Recent discoveries from well-designed randomized controlled trials (RCTs) utilizing Yoga as a clinical intervention report promising results. For example, Yoga has been shown to improve management of Type II diabetes mellitus (Innes & Vincent, 2006), decrease chronic low back pain (Sherman, Cherkin, Erro, Miglioretti, & Deyo, 2005), decrease gastrointestinal symptoms in irritable bowel syndrome (Kuttner et al., 2006), and advance the physical capabilities of healthy older adults (Oken et al., 2006). Yoga has also been shown to be an effective and safe intervention for people with asthma (Agarwal, 2013; Manocha, Marks, Kenchington, Peter, & Salome, 2002), cardiovascular disease, headaches, hypertension, coronary heart disease (Baer, 2003; Bijlani et al., 2005; Dash & Telles 2001; Kolasinski et al., 2005; Manchanda et al., 2000; Manocha, 2003; Manocha et al., 2002; McCall, 2013; Raub, 2002; Yang 2007; Yogendra et al., 2004), osteoarthritis (Garfinkel, Schumacher, Husain, Levy, & Resheta, 1994; Kolasinski et al.,

2005), multiple sclerosis (Oken et al., 2004), and cancer (Banerjee et al., 2007; Culos-Reed, Carlson, Daroux, & Hately-Aldous, 2006; Danhauer et al., 2009; Mackenzie, Carlson, Ekkekakis, Paskevich, & Culos-Reed, 2013; Mackenzie, Wurz, Yamauchi, Pires, & Culos-Reed, 2016; McCall, 2007; Moadel et al., 2007; Speed-Andrews et al., 2010; Ulger & Yagli, 2010; Wolsko et al., 2004; Wurz, Chamorro-Vina, Guilcher, Schulte, & Culos-Reed, 2014). Various Yoga trials have also reported improvements in physical outcomes such as walking (Chen et al., 2008; DiBenedetto et al., 2005; Iyengar, 2004), timed 1-leg stand (Oken et al., 2006; Pullen et al., 2008), lower body flexibility and endurance, shoulder and hip range of motion (Chen et al., 2008), number of chair stands in 30 seconds and arm curls performed, and hand-grip strength (Telles & Singh, 2012). Furthermore, Bosch et al. (2009) studied the effects of a 10-week Yoga intervention (three 75-minute sessions/week) in nine females (mean age 56.3) with rheumatoid arthritis as compared to seven controls with rheumatoid arthritis (mean age 66.7). The authors found improvements in balance, disability index, pain, and symptoms of depression in the Yoga, but not the control group. Furthermore, the authors reported that participants in the Yoga group also experienced decreases in disease activity, perceptions of pain, and depression as well as enhanced balance. Yoga may elicit favourable changes in risk factors for chronic disease such as body weight, cholesterol, blood glucose levels, blood pressure (Bijlani et al. 2005; Gokal & Shillito, 2007; Khatri, Mathur, Gahlot, Jain, & Agrawal, 2007; Manchanda et al., 2000; Okonta, 2012; Schmidt, Wijga, Vin Zur Muhlen, Brabant, & Wagner, 1997; Yang, 2007; Yogendra et al., 2004), and autoimmune and immune conditions (McCall, 2013; Sathyaprabha et al., 2008). Lastly, Yoga has been shown to be effective in relieving symptoms associated with pregnancy (Chuntharapat,

Petpicketchian, & Hatthakit, 2008; Narendran, Nagarathna, Narendran, Gunasheela, & Nagendra, 2005) and menopause (Booth-LaForce, Thurston, & Taylor, 2007; Chattha, Nagarathna, Venkatram, & Hongasandra, 2008), appearing to increase maternal comfort, shorten labour time, and decrease the number of hot flashes.

Yoga is one of the most widely used MBM-based PAs. In the West, VY is the most popular style of Yoga (Hunsberger, 2017; Walsh, 2016). Though few Yoga interventions have targeted informal caregivers, Yoga has been shown to benefit several aspects of physical health and functioning in healthy and chronically ill populations (Bosch et al., 2009; Brown, Koziol, & Lotz, 2008; Chen et al., 2008, 2009; Cohen et al., 2004; Desikachar et al., 2005; Innes & Vincent, 2006; Manjunath & Tells, 2005; McCall, 2007; Oken et al., 2006). This PA should be considered as a support service to help informal caregivers maintain physical well-being and continue in their caregiving role (Hill et al., 2007). Currently, there is a lack of Yoga interventions designed to explicitly address the needs of this population through systematic (methodical or based on a system) and supervised (includes monitoring, guidance, and/or a designed curriculum) exercise. Martin and Candow (2016) report that structured PA, particularly a MBM such as Yoga, may be an effective intervention for improving physical health outcome measures in informal caregivers. VY – the most popular and widely available style of *Hatha* Yoga in the West – was the style of Yoga used for the purposes of this thesis.

4 Tai Chi

Another popular and growing form of MBM is Tai Chi. Tai Chi is an ancient Chinese philosophy/martial art that dates back at least 5,000 years (Yang, 2010). Tai Chi's full name, Tai Chi Chuan, is taken from Taoism and can be translated as the *supreme ultimate fist* (Galante, 1981). Taoism is a philosophy stemming from China that emphasizes living in harmony with the *Tao* (way/path [of life]). The keystone work of literature in Taoism is the *Tao Te Ching*, a book that draws its cosmological foundations from the concepts and philosophy of *yin* and *yang* (Feng, English, & Lippe, 2011). *Lao Tzu*, a contemporary of the Chinese philosopher *Confucius*, wrote and taught the *Tao Te Ching* in the 6th century BCE, which forms the basis of Tai Chi (Rones & Silver, 2007). Notably, the Tai Chi emblem is a symbol of the eternal *Tao*; it is composed of a circle containing one *yin* and one *yang* harmoniously interconnected (see Appendix B for a picture and description of the Tai Chi emblem). This *yin/yang* symbol represents everything that is manifested and the duality that is contained in all of creation (Galante, 1981). *Yin/yang* theory is based on the idea that everything created in the universe is constantly changing due to the interaction, balance, and imbalance of *yin* and *yang* (Wayne & Fuerst, 2013). When *yin* and *yang* come together, they create inner movement – moving the *chi/qi* (life force/energy), blood, and sinews in the body, purportedly improving health imbalances (Brown, 2010). Such as with *Hatha* Yoga, the purpose of Tai Chi is to unite and balance the *yin* and *yang* energies in our bodies. It is by unifying the physical body, breath, and mind whilst performing specific forms and movements that blockages in the energy centers (chakras) and channels (meridians) of the body can be cleared and *yin* and *yang* may become more balanced (Woodyard, 2011).

Practicing Tai Chi trains the mind and body while stimulating *chi/qi* (*yin* and *yang* energies) at the same time. *Training the mind* refers to calming and concentrating the mind, which is intended to quiet the central nervous system. *Training the body* refers to gentle flowing movements, which improve the strength and elasticity of muscles and connective tissues (Mansky et al., 2006). The primary goal of Tai Chi practice is to induce, cultivate, and sustain *flow*; ensuring the practitioner's sequence of Tai Chi forms is continuous, harmonious, and synergistic (Ross, 2013).

Tai Chi evolved from martial art, a means of self-defense, and breathing exercises such as *qigong*, progressing into a unique practice by the end of the Ming Dynasty (1368-1644 CE). The development of all modern forms of Tai Chi can be traced back to one of five traditional school of Tai Chi, namely the *Chen, Yang, Wu (Hao), Wu (Woo),* or *Sun* schools. Moreover, the development of the *Yang, Wu (Hao), Wu (Woo),* and *Sun* schools can all be traced back to the *Chen* school, which was passed down as a family secret for generations (Wong, 2002). Though little is known of him, a Taoist priest named Zhang San Feng (c1247-1447, believed to have been immortal) is widely regarded as the creator of Tai Chi. The most popular account of Tai Chi's origins relays how Zhang was inspired to develop Tai Chi after witnessing a fight between a snake and a crane. Impressed by the snake's defensive tactics, Zhang observed the snake remain still and alert in the face the crane's onslaught until it made only one lunge, fatally biting the bird (Wong, 2002). Zhang transmitted the art to his successor, who in turn, continued to spread his knowledge of Tai Chi to his disciples until it reached the Chen family. Though legend has the development of Tai Chi stemming from Zhang, the Chen family maintains

the art was developed in the 17th century by a 9th generation ancestor, General Chen Wang Ting (Wong, 2002).

The *Chen*-style Tai Chi is reputed to stem from the Chenjiagou Village of the Henan Province of China approximately 400 years ago (Wong, 2002). Following a decorated military career, General Chen (c1600-1680) retired and began formulating the martial art. In the early 19th century, Chen family member Grandmaster Chen Chang Xing taught the art to Yang Lu Chan, the first person outside the Chen family to learn the practice. Wanting to make the complex, rigorous, and militaristic practice more accessible to the masses, Yang Lu Chan refined the art by internalizing the energy work and focusing on skill over application. Yang then travelled the country, breaking the tradition of restricting *Chen*-style Tai Chi to Chen family members; spreading and expounding his *Yang*-style Tai Chi (Wong, 2002). It is from the dissemination of the *Yang*-style Tai Chi that the three remaining traditional schools of Tai Chi (*Wu [Hao]*, *Wu [Woo]*, and *Sun*) ensued. Currently, there are dozens of new styles, hybrid styles, and spin-offs of the traditional styles, but the international community recognizes only the *Chen*, *Yang*, *Wu (Hao)*, *Wu (Woo)*, and *Sun*-styles as being orthodox. The *Yang*-style Tai Chi is the most popular and widely practiced style in the world (Wong, 2002).

4.1 Yang-Style Tai Chi

Tai Chi itself has been evolving for over seven hundred years, the contents of which have varied from one generation to the next (Yang, 2010). The content may also vary from one teacher to another, making it difficult to state exactly what makes up each style. All *Yang*-styles of Tai Chi can include large, medium, and/or small forms: the practice can include high, medium, or low stances; and all forms involve either extended,

opened, and/or relaxed postures. Therefore, there are many variations within the style and practice (Yang, 2010).

Generally, *Yang*-style Tai Chi involves the coordination of breath with forms linked together in a continuous flow. It is said that with correct breath coordination (upwards movements linked with inhales, downwards movements linked with exhales), the practitioner can relax more deeply, allowing the mind to enter a more perceptive state (Yang, 2010). In addition to coordinating the breath with Tai Chi forms, *qigong* is generally incorporated into *Yang*-style Tai Chi training. *Qigong* aligns breath, awareness, and movement, and encompasses rhythmic breathing coordinated with slow repetition of fluid movements, a mindful state, and visualization and sensation of *qi/chi* (vital life force, energy) throughout the body. *Qigong* involves working with the life energy, learning how to control the flow and distribution of *chi/qi* to improve overall health and harmony of the mind and body. *Qigong* is practiced as a method of controlling the flow and distribution of *chi/qi*, supporting the practitioner's subsequent Tai Chi practice (Cohen, 1997; Yang, 2010). Specifically, *qigong* includes healing postures, movements, self-massage, breathing techniques, and meditation (see Appendix C for a comprehensive description of *qigong*). Although *Yang*-styles of Tai Chi may differ in approaches to training (stance, form, postures, and speed), the underlying theory and components (coordination of breath, continuous flow, and *qigong*) remains consistent. Notably, a commonly practiced *Yang*-style of Tai Chi in North America is Taijifit™.

4.2 Taijifit™

Taijifit™ is a popular *Yang*-style of Tai Chi developed expressly for Westerners, combining the best elements of fitness, meditation, and martial arts. Taijifit™, which

translates to *Tai Chi for exercise*, was developed by eight-time US national champion, world silver medalist, and two-time world bronze medalist in Tai Chi, David-Dorian Ross. Ross developed Taijifit™ in response to the challenges of teaching the difficult, precise, and unfamiliar movements of Tai Chi to westerners, which left them frustrated and bored (Ross, 2013). Such as with all styles of Tai Chi, Taijifit™ is about balancing *yin* and *yang* – strength with beauty, power with peace, and endurance with flow (Ross, 2013). Akin to Yoga and other *Yang*-styles of Tai Chi, Taijifit™ is varied and well-rounded (i.e., includes cardiovascular, muscle/resistance, flexibility, and balance training), and the intensity of the practice is continually altered in order to achieve maximum benefits and challenge the body.

Taijifit™ is a moderately paced style of Tai Chi where practitioners flow through multiple Tai Chi forms, creating one continuous sequence. Taijifit™ forms are designed to stress both muscular and connective tissues (tendons, ligaments, fascia). In addition to the goal of inducing *flow*, Taijifit™ seeks to increase range of motion, balance, and flexibility, while also promoting muscular strength and endurance. The breath is not controlled during Taijifit™, however, practitioners are guided to link their breath with particular movements (i.e., inhale the arms up, exhale sink into a squat). Taijifit™ sessions may begin with or include *qigong*, preparing practitioners to control the flow and distribution of *chi/qi* in their body during a Tai Chi sequence.

4.3 Tai Chi in the West

Currently, Tai Chi has great appeal throughout China and is gaining recognition throughout North America as it is not harnessed to any particular faith or religion and is seen as a technique of personal and mental development. Over time, Tai Chi has evolved

into its current form, which combines distinct and identifiable movements designed to promote physical and psychological well-being (NCCAM at the NIH, 2016a). As a result of the growing evidence suggesting that Tai Chi may have many health benefits, this MBM is becoming increasingly popular in the West as a form of exercise and relaxation, and is often referred to as a moving meditation (NCCAM at the NIH, 2016a).

The total number of worldwide Tai Chi practitioners has been reported to be approximately 250 million people (Liang 2016; Scutti 2013). An estimated 2.3 million American adults had used Tai Chi during the previous 12 months (NCCAM at the NIH, 2016a). Harvard Health Publications (2016) recently listed Tai Chi as one of the five best exercises a person could ever do (alongside swimming, strength training, walking, and kegel exercises). The article further details how Tai Chi is good for both the body and mind and is accessible and valuable to people of all ages and physical fitness/ability levels. Finally, Brown (2010) highlighted Tai Chi's combination of flexibility, balance, and strength training with aerobic exercise and complex motor sequences as uniquely beneficial for both the brain (e.g., attentional focus) and body (e.g., brain structure, exercise capacity).

Today, many people mainly identify Tai Chi with *qigong*, the breathing technique utilized in conjunction with Tai Chi practice. Q*igong*, however, is merely one of the various tools used for healing; inducing and maintaining *flow* with the help of the three main Tai Chi tools (*qigong*, forms, and focus) is of utmost importance (Ross, 2013). Any of these three tools can be used separately, however, it is the integration and balance of all three that enables proper *flow*, which in turn, can lead to physical and mental benefits. Ross (2013) defines *flow* as a state of complete immersion in an activity. When

Tai Chi practitioners are *flowing*, they are completely involved in an activity for its own sake – the ego falls away and time flies. Importantly, in Tai Chi, *flow* is considered to be a sixth component of fitness (in addition to muscular strength and endurance, flexibility, body composition, and cardiovascular endurance; Ross, 2013).

4.4 Physical Benefits of Tai Chi

As Tai Chi has gained acceptance in the West, it has become the focus of increased attention by scientific investigators and health care professionals (Zhang, Layne, Lowder, & Liu, 2012). Tai Chi teaches balance between strength and flexibility and involves all soft tissues areas in the body: muscles, tendons, ligaments, fascia, and skin (Rones & Silver, 2007). Tai Chi may improve sleep, balance, muscle strength, coordination, cardiovascular fitness, and flexibility, and may decrease the risk of falls and injuries (Brown, 2010; NCCAM at the NIH, 2016a; Wang et al., 2004). Tai Chi has also been shown to lower systolic and diastolic blood pressure, facilitate nutrient uptake and waste removal, and improve circulation (Channer, Barrow, Barrow, Osborne, & Ives, 1996). Taylor-Piliae and Froelicher (2004) demonstrated that Tai Chi practitioners achieve better cardiopulmonary functional status compared to aerobic exercise of equal intensity, which may be a result of Tai Chi's principles of integrating breathing techniques and meditation with PA.

In the past two decades, the potential therapeutic benefits of Tai Chi for chronic conditions have been recognized in the literature (Yachoui & Kolasinski, 2012). Wang et al. (2004) systematically reviewed studies assessing the effects of Tai Chi on health outcomes in patients with chronic conditions. Their review included 47 studies; nine were RCTs, 23 were non-RCTs, and 15 were observational studies. Several Tai Chi studies

showed significant benefits for balance, falls reduction, musculoskeletal conditions, hypertension, cardiovascular health, immune and endocrine system function, and self-efficacy. These benefits have also been reported across a range of populations including healthy young and old adults, elderly populations, and other patient populations such as those with cardiovascular disease, musculoskeletal conditions, and cancer (Zhang et al., 2012).

Recently, Webster, Luo, Krägeloh, Moir, and Henning (2016) systematically reviewed evidence regarding Tai Chi's potential for improving the health of students in higher education. The review included 76 Tai Chi studies published before 2013 in Chinese and English. Tai Chi possesses aerobic, physical, and psychological benefits with few or no side effects and may have an advantage over activities that enhance only physical aspects of health. Tai Chi increased flexibility, balance, lung capacity, run time (800/1000m), and quality of sleep. Previous studies have also demonstrated that Tai Chi may have significant benefits and promote aerobic capacity, muscular strength, and balance capability (Jahnke, Larkey, Rogers, Etnier, & Lin, 2010; Lan, Chen, Lai, & Wong, 2013). Although benefits to aerobic capacity have previously been noted, Webster et al. (2016) report that Tai Chi may be less effective in improving anaerobic fitness, as evidence by a lack of benefit in sprinting (50/100m) and long jumping.

Zheng et al. (2015) conducted a RCT on the effectiveness of 12 weeks of Tai Chi on the physical and psychological health of college students. There was a statistically significant improvement in sit-and-reach flexibility and two parameters of balance ability (open and closed eyes parameters) after 12 weeks of Tai Chi exercise (n = 95) compared with usual exercise controls (n = 103). Furthermore, a statistically significant benefit for

closed eyes parameter was observed over the additional 12-week follow-up period, indicating a possible long-term benefit to practicing Tai Chi. No significant changes in other physical and mental outcomes (lower limb proprioceptive function, cardio-pulmonary function, self-reported psychological symptoms, stress, self-esteem, mood, mindfulness, sleep, and QOL) were found between the two groups. Such as in Webster et al.'s (2016) study, the authors noted no adverse events related to Tai Chi exercise were reported during the intervention period, suggesting that Tai Chi is safe.

RCTs have also examined the potential physical benefits of Tai Chi on symptomatic osteoarthritis (Brismee, Paige, Chyu, 2007; Fransen, Nairn, Winstanley, 2007; Hartman et al., 2000; Song et al., 2007; Wang et al., 2009), cancer (Mustian et al., 2006), fall prevention (Chen, Fu, Chan, & Tsang, 2012; Tousignant, et al., 2013; Quigley et al., 2014), bone health (Chyu et al., 2010; Song, Roberts, Less, Lam, & Bae, 2010), healthy aging (Irwin & Olmstead, 2012), exercise capacity, and QOL (Black et al., 2014; Dechamps et al., 2010; Yeh et al., 2004). Hartman et al. (2000) randomly assigned community-dwelling patients with osteoarthritis to a *Yang*-style Tai Chi intervention (n = 18; two 1-hour classes per week for 12 weeks) or a control group (n = 15) receiving routine care. Participants in the Tai Chi group experienced statistically significant improvements in arthritis self-efficacy, level of tension, satisfaction with general health status, and arthritis symptoms. Similarly, Song et al. (2007) reported that among participants with osteoarthritis, those performing *Sun*-style Tai Chi (n = 22) over 12 weeks perceived significantly less pain and stiffness ($p = 0.03$) than those receiving routine care (n = 21). In another study, Brismee et al. (2007) examined the effects of participating in six weeks of group and six weeks of home Tai Chi practice (n = 18) on

osteoarthritis. There were significant improvements in knee pain and physical function as compared to a control group (n = 13). Yeh et al. (2004) examined the effects of twice-weekly one-hour Tai Chi classes on exercise capacity and QOL in chronic heart failure patients (mean age, 64 years). Thirty participants were randomly assigned to receive either standard care (n = 15) or 12 weeks of Tai Chi training (n = 15) in addition to the standard care. Results showed a statistically significant improvement in QOL and an increase in distance walked in six minutes as compared to patients in the control group. Furthermore, participants in the Tai Chi group presented a trend towards improvement in peak oxygen uptake. Finally, Mustian et al. (2006) assessed the efficacy of Tai Chi and psychosocial therapy for improving functional capacity among 21 breast cancer survivors. Participants were randomized to receive Tai Chi (n = 11) or psychosocial therapy (n = 10) three times a week for 12 weeks. The authors reported improvements in aerobic capacity, muscular strength, and flexibility in the Tai Chi group, whereas the psychosocial group showed statistically significant improvements in flexibility only.

Tai Chi is one of the most widely used MBM-based PAs. Though no Tai Chi interventions have targeted informal caregivers, Tai Chi has been shown to benefit several aspects of physical health and functioning in healthy and chronically ill populations (Hartman et al., 2000; Lan, Lai, Chen, & Wong, 1998; NCCAM at the NIH, 2016a; Rones & Silver, 2007; Wang et al., 2004; Yachoui & Kolasinski, 2012). This PA should be considered as a support service to help informal caregivers maintain physical well-being and continue in their caregiving role (Hill et al., 2007). Currently, there is a lack of Tai Chi interventions designed to explicitly address the needs of informal caregivers through systematic (methodical or based on a system) and supervised

(includes monitoring, guidance, and/or a designed curriculum) exercise. Martin and Candow (2017) report that structured PA, particularly a MBM such as Tai Chi, may be an effective intervention for improving health outcome measures of informal caregivers. Taijifit™ – the most popular and widely available *Yang*-style Tai Chi in the West – was the style of Tai Chi used for the purposes of this thesis.

5 Yoga and Tai Chi Interventions in Informal Caregivers

Although the potential benefits of both Yoga and Tai Chi have been recognized in the literature (Taylor-Piliae et al., 2006; Tsai et al., 2003; Van Puymbroeck et al., 2007; Vedamurthachar et al., 2006; Yachoui & Kolasinski, 2012), few studies have utilized these MBMs in the informal caregiver population. To the best of our knowledge, only six studies have used Yoga as an intervention option for informal caregivers (Danucalov et al., 2013; Jagannathan, et al., 2012; Mackenzie et al., 2016; Martin & Keats, 2014; Van Puymbroeck et al., 2007; Waelde, Thompson, & Gallagher-Thompson, 2004); with the exception of a study by Hill et al. (2007) that utilized both Yoga and Tai Chi as PA options for informal caregivers, no studies utilizing Tai Chi in this population have been published.

5.1 Tai Chi

To date, no studies utilizing Tai Chi interventions for informal caregivers have been published. One research center, however – the University of California Los Angeles Longevity Center – is currently examining the effects of Tai Chi. Specifically, the Centre is seeking to help both Alzheimer's patients and their informal caregivers by utilizing Tai

Chi as part of a memory program (Gorman, 2014). The program's intention is to strengthen memory and brain functioning in Alzheimer patients; it does not focus specifically on informal caregivers. Nonetheless, informal caregivers participate in Tai Chi alongside their care recipient and gather separately for an informal support group. Markedly, informal caregivers participating in the program have highlighted the importance of meeting other caregivers and one caregiver expressed that the program had probably helped her more than it has helped her care recipient (Gorman, 2014).

Secondly, two RCTs (Chan et al., 2016; Nyman, 2017) are currently recruiting caregiver-care recipient dyads to investigate the efficacy and feasibility of Tai Chi. Chan et al. (2016) are investigating the efficacy of eight one-hour at-home sitting Tai Chi sessions over 12 weeks on informal caregiver stress, QOL, cognitive function, and personality and care recipient depressive and neuropsychiatric symptoms, functional abilities, and performance of ADLs. Similarly, Nyman (2017) is investigating the effectiveness of 50 hours of in-class and at-home Tai Chi practice alongside usual care as compared to usual care alone over six months on informal caregiver balance, QOL, and burden and care recipient balance, fear of falling, cognitive functioning, falls, and QOL.

5.2 Yoga

Jagannathan et al. (2012) studied the effects of one hour of Yoga a day for seven days on the burden levels of informal caregivers of schizophrenia patients (N = 5; mean age 49.6 years) in Bangalore, India. Importantly, this study is one of the only studies to use an inductive enquiry model for the development of a needs-based Yoga program and possess face and content validity, reliability, and generalizability of the program. After the seventh and final Yoga session, four of five participants (80%) assigned a score of

four or five on a five-point Likert scale for the overall usefulness of the program, handouts, and trainer (five being extremely useful). Qualitative feedback from the informal caregivers provided further endorsement of the feasibility and usefulness of the Yoga program, with participants expressing that the entire program was good, that it taught them the importance of taking care of their own health, that it reduced physical problems, and that it provided relief and fostered a relaxed feeling. Although positive, the results of this study must be interpreted with caution as no control group was included, the sample size was small (N = 5), the intervention was short (seven days), and no long-term follow-up was included. Although the average stay of an in-patient and his or her informal caregiver(s) is usually less than one week, a seven-day program is likely too short to establish whether a Yoga program is beneficial for this population.

Waelde et al. (2004) and Martin and Keats (2014) pilot tested the effectiveness of a six-week Yoga intervention on the health of informal caregivers. In Waelde et al.'s (2004) study, the authors assessed the potential benefits of six weekly psychotherapeutic Yoga and meditation sessions (five 90-minute sessions plus one 3-hour session) on reductions in depression, anxiety, and subjective caregiver burden as well as improving self-efficacy for controlling distressing caregiving-related thoughts. The informal caregivers (N = 12; mean age 56 years) were also asked to practice these techniques for at least 30 minutes per day, six days per week, and were provided with a Yoga and meditation manual and audiocassette for home use. Pre/post comparisons revealed statistically significant reductions in depression and anxiety and improvements in perceived self-efficacy. The majority of informal caregivers found the intervention useful and reported subjective improvements in physical and emotional functioning (Waelde et

al., 2004). Contrary to expectations, however, no pre/post difference was observed in subjective and objective caregiving burden. Lastly, the authors reported increases in practice time over the course of the intervention by the caregivers and indicated this may signify that participants found Yoga to be acceptable and feasible even in the context of demanding caregiving responsibilities (Waelde et al., 2004).

Martin and Keats (2014) tested the effectiveness of a single-group, six-week, pre- and post-test VY intervention. The authors assessed the potential benefits of VY (two 75-minute sessions/week) on cancer caregivers' (N = 12; mean age 41 years) overall QOL and psychological distress. QOL was measured using the Medical Outcomes Study 36-Item Short-Form Health Survey version 2, which yields two summary scales: an overall physical and overall mental health component score. Psychological distress was measured using the Profile of Mood States, which yields a total mood disturbance (TMD) score. Additionally, program satisfaction was measured with open-ended survey questions post-intervention.

Pre and post comparisons revealed a statistically significant difference and large effect in TMD ($n^2 = 0.61$; $p = 0.002$) and in overall mental health ($n^2 = 0.41$; $p = 0.018$). Contrary to expectations, no statistically significant difference was found in overall physical health from baseline to post-intervention ($p = 0.133$). Despite the lack of statistically significant improvements in physical health, most participants (n = 11, 92%) reported that they experienced improvements in physical fitness. Moreover, all of the participants (N = 12) noted perceived improvements in their mental or physical well-being, reporting improvements in flexibility (n = 5), strength (n = 4), and physical fitness (n = 2). When asked what physical or mental skills they learned over the course of the

intervention, participants most often reported breathing techniques and the use of breath for relaxation (n = 7). Perceived improvements in mindfulness, relaxation, and focus (n = 2) as well as increased energy (n = 1) were also noted, while seven (58%) participants noted that the program made a difference in how they felt day-to-day.

These findings are consistent with other researchers who found increases in QOL and reductions in psychological distress or depression in healthy and chronically ill populations with the use of Yoga interventions (Oken et al., 2006; Pilkington et al., 2005; Sareen, Kumari, Gajebasia, & Gajebasia, 2007; Woolery et al., 2004). Although positive, the results of Martin and Keats' (2014) study must be interpreted with caution, as no control group was included, which makes it difficult to determine whether improvements in overall mental health-related QOL (MCS) and reductions in overall psychological distress (TMD) were from VY or other confounding variables. Furthermore, the study's small sample size precluded the use of more powerful statistics and the p-value was not adjusted for multiple testing.

Danucalov et al. (2013) and Van Puymbroeck et al.'s (2007) studies utilized experimental designs. Danucalov et al. (2013) piloted a study investigating whether a two-month (three 75-minute sessions/week) stress reduction program of in-person Hatha Yoga and compassion meditation might alter the stress, anxiety, depression, and salivary cortisol levels of Alzheimer's caregivers (n = 25; mean age 55.5 years) as compared to a control group (n = 21; mean age 53.4 years). Participants were also instructed to perform two weekly sessions (16 sessions) at home with the aid of a Hatha Yoga DVD. Among the most relevant findings were the statistically significant changes in the stress indices as shown on the Lipp Stress Symptoms Inventory for Adults, which categorizes stress

according to a four-phase model: alertness, resistance, quasi-exhaustion, and exhaustion. Statistically significant improvements were found among all four stress indices. Additionally, the Yoga group demonstrated a 51.2% reduction in depression whereas the control group exhibited an increase of 9.5% after the intervention. Moreover, the Yoga group showed a 49.4% reduction in their anxiety whereas the control group presented an increase of 10% at the same time point. No differences were found between the groups in salivary cortisol.

Similarly, the aim of Van Puymbroeck et al.'s (2007) study was to determine the effects of an eight-week Yoga program (two 75-minute sessions per week) on the physiological well-being and coping of informal caregivers as compared to a control group. Yoga participants (n = 6; mean age 55.2 years) were also provided with workbooks and encouraged to practice Yoga at home. Adherence to home Yoga practice, however, was not monitored between classes. Subjects in the control group (n = 7; mean age 62.7 years) were asked to maintain their regular activities and not initiate any new PAs for the duration of the study. The Yoga group did not differ significantly from the control group in terms of body mass index, lower body strength, lower body flexibility, upper body flexibility, and sense of coherence pre-intervention. No significant differences between the Yoga and control groups in terms of upper body strength, aerobic endurance, and balance were found.

The results of the study showed a statistically significant increase in lower body strength and non-significant increase in lower body flexibility after eight weeks of Hatha Yoga (Van Puymbroeck et al., 2007). These findings are consistent with other researchers who found increases in upper and lower body strength and endurance in young healthy

adults (ages 18-27) with the use of Hatha Yoga (Tran et al., 2001). These discoveries also support Kolasinski et al. (2005) who reported increased flexibility and strength after an eight-week Iyengar Yoga program for individuals over 50 with osteoarthritis. Additional benefits for Van Puymbroeck et al.'s (2007) study included subjective perception of improved posture, flexibility, and balance. Equally noteworthy is that participants in the Yoga group displayed trends towards improvements in coping, lower and upper body strength, upper body flexibility, balance, and agility, while caregivers in the control group showed trends towards decreased ability. Importantly, the authors reported that the informal caregivers who participated in Yoga chose to pursue additional Yoga instruction, likely indicative of their satisfaction with Yoga as an intervention and PA option.

Lastly, Mackenzie et al. (2016) conducted a qualitative study that explored the experiences of cancer survivors and their caregivers following their participation in a seven-week Hatha Yoga program (weekly 75-minute sessions). Twenty-five participants took part in a series of semi-structured focus groups post-intervention (7 weeks) and at three- and six-month follow-up. While participants were predominantly cancer survivors ($n = 20$), both cancer survivors and caregivers ($n = 5$; mean age 71.73 ± 18.88) expressed the importance of the Yoga program for respite and for taking back control during and following cancer treatment. Further, the focus groups revealed a multitude of benefits, including stress reduction, relaxation, physical health promotion, social-emotional regulation, and improved QOL. The interviews also revealed that cancer survivors and their caregivers perceived that certain Yoga mechanisms, such as the mind-body connection, the ability to regulate breath, and enhanced confidence, underscored the benefits they accrued. Mackenzie et al.'s (2016) qualitative research provided a unique

and in-depth insight into Yoga and generated meaningful knowledge about the role Yoga may play in the lives of cancer survivors/caregivers.

Despite the significance of these qualitative findings, this study is associated with several limitations that should be considered. Most notably, the study included a small number (n = 5) of caregivers who participated in a Yoga program designed for their care recipients (cancer survivors). Furthermore, the average participant had participated in the Yoga program 3.35 ± 3.66 times and attended approximately 1.64 ± 0.70 of three possible focus groups. Thus, the benefits described might not be achievable in those new to Yoga and cannot be generalized beyond these participants, who were unique in their diagnoses, backgrounds, and caregiver-care recipient dyads.

5.3 Tai Chi and Yoga

Hill et al.'s (2007) study evaluated the health benefits of a six-month supported PA program for older informal caregivers (N = 116; mean age, 64.4 years). In this study, informal caregivers had the option to chose one of four PAs: strength training, Hatha Yoga, Tai Chi for arthritis, and circuit training. In total, there were two Yoga groups (n = 16 participants), eight strength-training groups (n = 95 participants), and one Tai Chi group (n = 5 participants). Seven of the groups (64%) ran two one-hour sessions per week (six strength-training groups and one Yoga group), while the remaining four groups (36%; one Yoga group, two strength-training groups, and one Tai Chi group) ran once weekly for one hour.

Eighty-eight of the 116 participants (76%) completed the six-month program and the follow-up assessment, attending a median of 75% of available sessions (Hill et al., 2007). Although the Yoga and strength-training protocols both had weekly and twice-

weekly sessions, statistically significant improvement in gait endurance (six-minute walk test) and balance performance (step test) was only found in those attending Yoga and strength-training classes that ran twice a week over the six-month period. Across all groups (weekly and twice-weekly), other statistically significant health benefits included improved leg strength and self-rated physical health and reduced depression. Most participants reported other positive benefits, including that the program was enjoyable, that it gave them a break from the caregiving role, and that it gave them time to look after their own needs. Specifically, the item with the smallest range of responses (7–10) and the highest median score (10/10), "I enjoyed the social atmosphere of the program", highlighted the importance of the social support provided by this type of program. Notably, Lopez-Hartmann et al. (2012) recently noted the potential of group interventions for this population, reporting that it may help participants recognize that other informal caregivers may experience similar difficulties. Finally, most of the participants in Hill et al.'s (2007) study expressed that the program *recharged their batteries* and that participating in the program did not upset their care recipients. Encouragingly, after completing the program, many participants expressed a desire for the groups to continue.

Although there were improvements in both physical and psychological outcomes**,** there was no statistically significant change in the level of caregiver burden as assessed by the Zarit Carer Burden Interview or overall QOL as assessed by the SF-36 (Hill et al., 2007). Additionally, the study possessed limitations such as a lack of control group and a wide variability in the PA options and frequency, which did not allow for comparison between groups. Although offering only one PA option would have resulted in a higher-powered single intervention study, the authors felt that allowing participants to choose

the type of PA was a central factor in increasing uptake of the activity in this study.

6 Comparing and Contrasting Yoga and Tai Chi

Although Yoga and Tai Chi are both MBMs focusing on subtle energy with the intention to ease the mind and advance overall physical health, they do have differences. Yoga, stemming from India, is practiced to cultivate the faculties to maintain focus on the present moment (Grossman et al., 2004). Tai Chi, originating in China, seeks to induce, cultivate, and sustain *flow* (Ross, 2013). Tai Chi is a martial art that was originally used in combat but has evolved into a moderately paced, dance-like moving meditation. Yoga also has a meditative component but involves stationary periods of meditation during each Yoga session. Although both Yoga and Tai Chi can be used to improve a person's flexibility and strength, the approach and anatomical focus differs between the two practices.

In terms of flexibility, Yoga tends to use more static and extreme stretches, while Tai Chi emphasizes stretching through dynamic, fluid, and cautious motions (Coulter, 2001; Feuerstein, 2001; Fraser, 2007; Ross, 2013; Wayne & Fuerst, 2013; Wong, 2002). Specifically, VY requires practitioners to hold poses for a specific length of time (1 to 3 minutes) before continuing through a series of transitional/counteractive movements to hold the next pose. Conversely, no forms are held in Taijift™ for any length of time – the entire sequence of forms is linked together and performed as one linear set of movements (Grilley, 2012; Liang & Wen-Ching, 2014; Ramaswami, 2005; Zhuang, 2015). Moreover, while both practices seek to increase muscular strength and endurance, balance, and

flexibility, VY's predominant focus is muscular strength and endurance, while Taijift™ predominantly focuses on balance and flexibility. Additionally, the strength gained from VY tends to predominantly be in the upper body, while any strength gained from Taijift™ tends to mainly be in the lower body. Specifically, VY focuses on using the arms and core to hold one's body weight and provide the necessary support, while Taijift™ focuses on developing and using the muscles in the legs for support (Liang & Wen-Ching, 2014; Stephens, 2012; Ramaswami, 2005; Zhuang, 2015). What is more, during VY breathing techniques are utilized with the goal of improving respiratory stamina, while the breath is natural with the intention of circulating *chi*/*qi* (life force, energy) throughout the body during Taijift™ (Bryant & James, 2004; Cohen, 1997; Coulter, 2001; Feuerstein, 2001; Fraser, 2007; Yang, 2010; Ross, 2013; Wong, 2002).

Finally, while all styles of Yoga and Tai Chi emphasize and prioritize the cultivation and balance of *chi/qi* (*yin* and *yang* energies), Yoga tends to be *yin* OR *yang*, while Tai Chi is *yin* AND *yang*. Tai Chi seeks to balance and work *yin* and *yang* energies and tissues simultaneously during practice. In contrast, Yoga tends to balance and work *yin* and *yang* energies and tissues separately, one practice at a time (Clark, 2007; Green, 2013; Grilley, 2002, 2012; Wong, 2002; Yang, 2010). All Tai Chi forms involve an aspect of *yin* AND *yang*; the Tai Chi practitioner is taught to equalize *yin* and *yang* energies in every movement (opposing a squat by proportionally raising the arms; contracting the muscles while expanding the connective tissues; Liao, 1990). Contrastingly, every Yoga *asana* (pose) involves an aspect of *yin* OR *yang;* Yoga styles and sequences are designed to predominantly affect *yin* or *yang* energies and tissues separately (contracting the muscles throughout a Yoga pose/sequence – not focusing on

the connective tissues, or, releasing the muscles to expand the connective tissues while performing a Yoga pose/sequence; Grilley, 2012).

Although Yoga and Tai Chi differ from one another, both of these forms of PA are categorized as MBMs. As such, it is important to examine and compare these mind-body based PAs, shedding light on which practice may be most beneficial, feasible, and agreeable for this population. While both practices seek to increase muscular strength and endurance, balance, and flexibility, it is unknown whether informal caregivers benefit from the stated focus of each practice. Moreover, it is unknown which practice may yield the greatest overall benefits in this population.

7 Challenges to PA Interventions

Although several benefits have been identified with regard to PA interventions and informal caregivers, putting theory into practice can be especially challenging for this population. Informal caregivers trying to schedule regular PA into their busy calendars face a number of potential barriers, including finding time and energy for regular PA, locating an exercise program that is appealing, appropriate, and accessible, and arranging alternative care and transportation (Canadian Association for Community Care, 2002). Hill et al. (2007) reported similar barriers to those noted above regarding their PA intervention for informal caregivers. In their study, a small proportion of participants noted obstacles in their ability to participate, such as: difficulty in accessing the program, health problems of the care recipients, health problems of the informal caregivers, and issues with their caregiving role (e.g., not having appropriate respite available).

Furthermore, Martin and Keats (2014) reported, regarding their VY intervention for cancer caregivers, barriers to participation such as sickness or physical pain, having to work or attend school, caregiving responsibilities, and transportation.

The intense nature of the caregiving role often leaves caregivers feeling physically and emotionally fatigued; a common barrier to leisure and PA involvement expressed by caregivers (Bedini & Guinan, 1996; Dunn & Strain, 2001). As in Martin and Keats' (2014) study, other studies have reported that informal caregivers have found that participating in programs interferes with their caregiving and other responsibilities and they worry about being away from their care recipient (Farran et al., 2008; Hill et al., 2007; King & Brassington, 1997). Lewis and Meredith (1988) noted that female caregivers reported feeling constantly responsible for the welfare of the care recipient. This constant worry and uncertainty can make it hard for informal caregivers to plan for activities since they cannot predict the future health status of their care recipient (Abel, 1991). In addition, caregivers often feel guilty about taking time away from their care recipient and caregiving responsibilities (Aronson, 1992; Parker, 1990). Finally, as previously noted, lack of time due to caregiving responsibilities is one of the most frequently acknowledged barriers to leisure and/or PA participation (Bedini & Guinan, 1996; Dunn & Strain, 2001; Martin & Keats, 2014). Along these lines, Van Puymbroeck et al. (2007) reported that the informal caregivers (who were predominantly female) who dropped out of their study cited time commitments as the reason. Positively, however, Swartz and Keir (2007) reported that the majority of informal caregivers in their study indicated they could participate in stress-reduction interventions daily (n = 15, 25%) or weekly (n = 18, 30%), for at least 30 minutes (42%), and would travel 15 minutes (n = 29,

48%) to attend.

Irrespective of the potential barriers to leisure and PA participation in this population, PA should be considered as a support service to help informal caregivers maintain their physical well-being and continue in their caregiving role (Hill et al., 2007). Recently, Darragh et al. (2015) expressed a necessity for interventions that target informal caregiver activity performance, as these may reduce the physical demands of caregiving. Likewise, Martin and Candow (2016, 2017) report that structured PA may be an effective intervention for improving health outcome measures of informal caregivers. Using Internet-based interventions to support informal caregivers may offer an efficient and accessible alternative to traditional face-to-face interventions. Specifically, delivering interventions in the home via the Internet may help reduce previously noted barriers in informal caregiver recruitment, adherence, and retention (Martin & Keats, 2014), as well as help reduce difficulties with participation, such as transportation or problems accessing the program (Canadian Association for Community Care, 2002; Hill et al., 2007; Martin & Keats, 2014), having to arrange alternative care (Canadian Association for Community Care, 2002; Farran et al., 2008; Hill et al., 2007; King & Brassington, 1997), and time constraints (Bedini & Guinan, 1996; Dunn & Strain, 2001; Martin & Keats, 2014). Utilizing the Internet to support informal caregivers can also help provide flexibility in the days and times of intervention delivery, an important intervention characteristic for this population (Hill et al., 2007). Interventions delivered in the home via the Internet may reach a greater majority of informal caregivers, particularly those who face additional barriers to accessing in-person support, such as remote or rural caregivers (WHO, 2015). Finally, from a methodological standpoint, an at-home online design may

also help reduce the possibility that any potential benefits are due to the effects of the intervention facilitator rather than the program itself. The researcher is the only certified Taijifit™ instructor in Saskatchewan. Providing informal caregivers with at-home online programs eliminates the potential confounding factor that the facilitator's knowledge of the study's hypotheses may influence the study's outcomes. Likewise, Woolf et al. (2006) note the importance of investigating strategies that promote intervention delivery in real-life settings, without the effect of researcher contact. In recent years, there has been a rise in technologically- and Internet-based interventions focused on improving outcomes for informal caregivers.

8 Technologically- or Internet-based Interventions for Informal Caregivers

Parra-Vidales et al. (2017) systematically reviewed Internet interventions aimed at improving QOL and reducing the incidence of diseases in dementia caregivers. Seven studies that had taken place between 2010-2015 were included in the review, four of which included a control group. Intervention length ranged from eight to 12 weeks and included 11-150 participants. The Internet interventions varied and included Websites providing support, care delivery strategies, and chat or video communication. One study in the review also included seven weekly face-to-face sessions with a social worker or nurse. Though designs, number of participants, length of participation, and characteristics of the interventions differed, all seven studies reported statistically significant improvements after the intervention. Specifically, caregivers' wellbeing, self-efficacy, anxiety, and depression improved, as well as their knowledge of the disease, acquired

competences, and functional autonomy. Additionally, the systematic review reports statistically significant reductions in stress and perceptions of the threats and risks to their health. Though the review is not without limitations and further trials are needed, Parra-Vidales et al. (2017) report that Internet-based interventions are a promising strategy for dementia caregivers.

In 2015, the WHO developed and assessed an online program for dementia caregivers, which consisted of a total of nine lessons aimed at relieving burdens and improving self-efficacy and mental health. A RCT of this intervention found that it decreased symptoms of depression and anxiety among caregivers. Although positive, more than half (55.7%) of all participants did not complete all lessons, indicating room for improvement. Given the promise of this approach, however, the WHO (2015) is presently field-testing and developing another comprehensive online support tool (iSupport).

Chi and Demiris (2015) conducted a systematic review of 65 studies (19 [29%] RCTs; 33 [51%] non- RCTs; 11 [17%] evaluation studies; one [2%] case study; and one [2%] secondary analysis) utilizing telehealth interventions (i.e., a variety of technologies and strategies to deliver virtual health, medical, and education services) to improve various outcomes in informal caregivers. The technologies included Internet-based, telephone-based, video, and remote monitoring. Sixty-two articles (95%) reported that caregivers had significant improvements in outcomes, including enhanced psychological health (44%) and QOL (12%); higher satisfaction, confidence, preference, and comfort with telehealth (38%); improved caregiving knowledge, skills, and patient management (20%); more social support/function and met needs (14%); improved coping/problem

solving skills and goal attainment/decision-making (8%); better communication with providers (5%); greater cost savings (5%); and enhanced physical health (2%) and productivity (2%). Three studies (5%) did not show significant differences in outcomes or satisfaction; yet, the effect of telehealth was similar to conventional face-to-face care. Overall, more than 80% of the studies delivered interventions for informal caregivers in their homes, 23% of which were delivered to caregivers living in remote or rural areas. Chi and Demiris (2015) state that telehealth can provide efficient care and save travel costs for informal caregivers.

Similarly, McKechnie, Barker, and Stott (2014) systematically reviewed the effectiveness of computer-mediated interventions for dementia caregivers across various outcomes (e.g., mood and mental health, physical health and health behaviours, stress and burden, social support, self-efficacy, and the positive aspects of informal caregiving). The most commonly measured variables were burden/stress and depression. The authors reviewed 16 papers describing 14 studies and reported that all studies found some positive effects of the intervention evaluated, supporting the use of computer-mediated interventions in this population. The authors cautioned, however, that a lack of statistical power and the use of non-standardized measures in some studies complicated comparisons. Blom, Zarit, Groot Zwaaftink, Cuijpers, and Pot, (2015) also evaluated the effects of an Internet-based intervention for dementia caregivers (N = 245) on symptoms of depression and anxiety. Participants, who ranged in age from 26 to 87 years, were randomly assigned to an experimental group (n = 149) that received text material and videos modeling positive caregiving strategies via the Internet, or a control group (n = 96) receiving e-bulletins. The results of this RCT indicated that caregivers in the

experimental group showed significantly lower symptoms of depression ($p = 0.034$) and anxiety ($p = 0.007$) post-intervention. Overall, effect sizes were moderate for symptoms of anxiety ($d = 0.48$) and small for depressive symptoms ($d = 0.26$). Blom et al.'s (2015) study provides further evidence for the development of Internet-based interventions for dementia caregivers, particularly since these interventions show promise for keeping support for caregivers accessible and affordable. The authors further indicate that these findings are even more promising for future generations of caregivers as they will likely be more familiar with the Internet. Encouragingly, Blom et al. (2015) found that even among an older age group of caregivers (≥ 65 years of age) who had not grown up with the Internet, participation in the Internet course was feasible. That being said, the study's dropout rate was high, with a total of seventy caregivers (28.6%) dropping out before the end of the intervention period. Of these seventy caregivers, 59 (40%) were from the experimental group and 11 (11%) from the e-bulletin group. The authors indicate that a coach may be a beneficial tool for Internet interventions, helping those who are struggling to remain on track, encouraging them to focus and continue. The literature, however, reports mixed results regarding the role of a coach: some studies have shown that guided self-help was more effective than self-help without guidance in Internet-based interventions (Kelders, Kok, Ossebaard, & van Gemert-Pijnen, 2012), while one study revealed that an Internet support program without contact with a coach was beneficial for caregiver depression, anxiety, and stress (Beauchamp, Irvine, Seeley, & Johnson, 2005).

Two other systematic reviews have recently evaluated the feasibility of Internet-based interventions in the informal caregiver population (Hu, Kung, Rummans, Clark, & Lapid, 2015; Kaltenbaugh et al., 2015). Kaltenbaugh et al. (2015) systematically

reviewed six articles examining the physical, social, psychological, financial, usability, and feasibility outcomes of Internet-based interventions on cancer caregivers. All six studies administered an intervention over the Internet, however, study approaches ranged from single to multicomponent modalities. Overall, the authors concluded that Internet-based interventions can be beneficial in offering information and support and may positively influence social and psychological outcomes in this population. Of the six studies, only one (17%) assessed physical outcomes (physical preparedness and burden), which produced no statistically significant difference at six and 12 months. Importantly, the authors noted that the range of effect sizes for Internet-based interventions were comparable to those of traditional interventions in cancer caregivers (Northouse et al., 2010; Sorensen et al., 2002).

Lastly, Hu et al. (2015) systematically reviewed studies assessing the effectiveness of Internet-based interventions aimed at improving QOL or reducing stress or burden in caregivers of someone with a chronic health condition (including cancer, traumatic injuries, and cardiac, neurodegenerative, and mental health conditions). Of the eight open-label trials and 16 RCTs included, some compared Internet-based interventions with standard care, unguided computer use, or with providing information. Overall, the authors identified that nine trials (37.5%) were positive (3 open-label studies and 6 RCTs), nine (37.5%) were partially positive (4 open-label studies and 5 RCTs), and six (25%) were negative (1 open-label study and 5 RCTs). The authors noted that the negative studies tended to be studies with earlier publication years, which may be related to older Internet technology and less general comfort with Internet use. The authors reported that no clear patterns as to the variables (e.g., study duration, complexity of the

intervention) associated with better outcomes could be identified.

Though more research is needed to ensure that Internet-based interventions are maximally effective, examinations regarding the use of Internet-based interventions in this population show promising results. As home computer use and mobile devices become increasingly widespread, the feasibility of computer and Internet-based interventions increases, decreasing the cost to service providers as an increasing number of informal caregivers already have the necessary instruments. Thus, Internet-based interventions may be beneficial not only to informal caregivers, but also to service providers, helping them to reach more caregivers for an equivalent or lower cost (McKechnie et al., 2014). Recently, the WHO and Alzheimer's Disease International (2012) stressed the importance of accessible and cost-effective informal caregiver support. While the prevalence, societal acceptance, and use of technology and the Internet continue to increase, no Internet-based interventions have focused on increasing PA and improving physical outcome measures in this population. Recent meta-analyses and RCTs, however, report exciting results regarding the effectiveness of Internet-based PA interventions.

9 Technologically- or Internet-based PA Interventions

9.1 Yoga

To date, one study has evaluated the effects of Yoga classes delivered via the Internet to participants in their homes. Selman, McDermott, Donesky, Citron, and Howie-Esquivel (2015) conducted an eight week controlled, non-randomized telehealth Yoga

pilot study in people (N = 15) with heart failure and chronic obstructive pulmonary disease. The first seven volunteers were allocated to bi-weekly one-hour teleheath Yoga classes, while the next eight were allocated to an educational control. Telehealth Yoga classes were offered via multipoint videoconferencing, which connected participants' televisions to live classes over the Internet. Participants in the control group received education materials via the mail once a week and the research nurse called weekly to discuss the information. Following the study, semi-structured qualitative interviews were conducted to explore reasons for and experiences of participating, including views of study outcome measures and physiological tests conducted (spirometry, weight, biceps, quadriceps, balance, and endurance). Interviews were analyzed using thematic content analysis.

Twelve participants (mean age 71.2 ± 10.09 years) were interviewed; six in the Yoga (4 females, 2 males) and six in the control group (5 females, 1 male). Several themes emerged from the qualitative interviews, including: acceptability and appropriateness of the intervention, potential active ingredients of the intervention, acceptability and appropriateness of the control, participation in the research, and acceptability of the testing procedures. The Yoga group reported enjoying Yoga and valuing the home-based aspect and the control group participants found the educational information acceptable and appropriate. Yoga participants described several benefits they perceived as resulting from taking part in the telehealth intervention, such as increased flexibility and strength, improved motivation and ability to exercise, improved ability to cope with shortness of breath, improved sleep, and a greater ability to cope with anxiety or stress.

Selman et al.'s (2015) findings support further exploration and evaluation of home-based, telehealth Yoga interventions. However, a limitation of the study is the small sample size in each group and that the control group was not matched to the Yoga group in terms of time commitment and attention (2 hours a week for the Yoga group vs. ≤ 1 hour a week for the control). Further, the quantitative data, which were not reported in this publication, is required to confirm or refute these findings. Additionally, the physiological tests were not investigated individually in this report, but rather asked about as a group with the intention of assessing the acceptability of home physiological testing. Positively, the control group did not report any benefits hypothesized to explain the effectiveness of Yoga, such as fitness, mindfulness, relaxation, or breath.

9.2 Other PAs

Recently, Joseph, Durant, Benitex, and Pekmezi (2014) conducted a comprehensive review of 72 Internet-based PA interventions targeting adult populations published prior to 2012. The studies ranged from two weeks to 13 months and included 46 RCTs, 21 randomized trials without a control, two non–RCTs, and three single-group designs. Thirty-seven studies targeted PA as the sole outcome of the intervention, while the remaining 35 studies targeted several outcomes, including PA, weight loss, improvement in diet/nutritional intake, weight control, and self-management of cardiovascular risk factors, type 2 diabetes, or arthritis. Study participants were predominantly Caucasian, middle-aged (mean age = 43.3 years), and female (65.9%).

Of the 72 studies included in Joseph et al.'s (2014) review, the majority (n = 48) employed a Website-based approach for the primary intervention delivery method. Several studies (n = 20) evaluated combined Website- and email-based approaches, while

six studies were email-only and one utilized a combined approach consisting of a Website, emails, and text messages. Furthermore, several studies included in-person (n = 5) and telephone contact (n = 1) to complement their Internet-based PA promotion interventions. Fifty-six studies reported PA outcomes using only self-report measures, seven used only objective measures, and nine used both self-report and objective measures.

Joseph et al.'s (2014) comprehensive review suggests that Internet-based PA studies are effective in promoting and increasing PA, which is consistent with previous reviews (Marcus, Ciccolo, & Sciamanna, 2009; Vandelanotte, Spathonis, Eakin, & Owen, 2007; van den Berg, Schoones, & Vliet Vlieland, 2007) and meta-analyses (Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012; Jenkins, Christensen, Walker, & Dear, 2009). Another promising finding of this review was that longer-term interventions (> 6 months) appeared to be as successful in promoting increased PA as shorter-term interventions. Fewer longer-term interventions were identified, with only 20 studies with intervention periods of > 6 months. Furthermore, only 16 studies incorporated delayed follow-up assessments to evaluate the longer-term impacts of the PA promotion efforts. Encouragingly, 60% of studies reporting statistically significant improvements in PA at the end of the intervention also reported sustained improvements in PA at delayed follow-up assessment, which ranged from one to nine months. Finally, the authors noted improvements in Internet-based PA intervention designs, highlighting the increased prevalence of RCTs for Internet-based PA interventions since previous reviews (Davies et al., 2012; Vandelanotte, Spathonis, Eakin, & Owen, 2007). These reviews identified 10 RCTs (Vandelanotte et al., 2007) and 14 RCTs (Davies et al., 2012) respectively,

whereas Joseph et al. (2014) identified 46 RCTs, 33 of which were published after 2007.

Although encouraging, several methodological issues exist among the reviewed studies, including a predominantly Caucasian population (only one study was predominantly comprised of a minority population), a primarily female population (66% across all studies), the assessment of PA outcomes using self-report measures only (only 16 studies reported using an objective measure to assess PA), and high attrition rates (22% across all studies).

Similar to Joseph et al. (2014), Müller and Khoo's (2014) systematic review sought to determine the extent to which non face-to-face PA interventions can lead to PA adoption, increase, and/or maintenance in healthy, community dwelling adults aged 50 years or older. The authors identified 16 studies (11 RCT and 5 studies employing different designs) implementing a non-face-to-face (Website, phone calls, or written material) PA, exercise, and/or walking intervention utilizing quantitative data to report the effectiveness of interventions. Sample sizes varied from 31 to 2503 participants and included a predominantly female population (13 studies reported more than 60% female participants).

Of the 16 studies, 14 reported statistically significant improvements in PA over the study periods (1 week - 24 months), suggesting that the respective interventions were effective in enhancing PA participation. Further, nine studies conducted post-intervention follow-up analysis (which ranged from 1 - 18 months), of which eight studies found that PA was maintained over time. Two studies presented contradictory results. One study observed no changes in PA after a 12-month print and phone intervention. Another study reported a non-statistically significant decrease of PA in terms of daily calorie

expenditure and time spent in moderate or greater PA over the previous week even though participants' perceptions of barriers decreased and PA self-efficacy increased (Greaney et al., 2008; Hageman, Walker, & Pullen, 2005).

Müller and Khoo's (2014) systematic review is the first to report on PA interventions targeting older adults (≥ 50 years of age) that were conducted with no or limited face-to-face contact. Although the authors report exciting results that may serve as a basis for future research, their review should be interpreted with caution as most studies included a predominantly female population, a wide variety in size and delivery method, and exclusively self-assessed PA levels.

Finally, Davies et al. (2012) evaluated the effectiveness of 34 Internet-delivered interventions measuring and targeting PA as an outcome variable in an adult population. All studies included a comparison group that did not receive Internet-delivered materials and PA was the primary behaviour targeted in 25 (74%) studies. Results of their meta-analysis supported the delivery of Internet-based interventions in producing positive changes in PA. The magnitude of the overall mean effect size, however, was small ($d = 0.14$), indicating that Internet-delivered programs have a small but positive effect on PA. Importantly, the effect size in Davies et al.'s (2012) meta-analysis was similar to findings from a meta-analysis investigating the effect of PA interventions for healthy adults across all modes of delivery (Conn, Hafdahl, & Mehr, 2011). This finding is also consistent with previous narrative reviews suggesting that Internet-delivered interventions produce modest effects on PA (Vandelanotte et al., 2007; Webb, Joseph, Yardley, & Michie, 2010). The overall mean effect size, however, was smaller than face-to-face interventions ($d = 0.29$; Conn et al., 2011). In conclusion, Davies et al. (2012) reported that Internet-

delivered interventions are effective in producing small but significant increases in PA.

10 Technologically- or Internet-based vs. Face-to-Face PA Interventions

10.1 Tai Chi and Yoga

To date, only one Tai Chi study has evaluated and compared the effectiveness of face-to-face and telehealth modes of delivery. Wu et al. (2010) compared the adherence to and effectiveness of a live, interactive, telehealth Tai Chi program with that of a community-based and home video-based Tai Chi program among community-dwelling adults (≥ 65 years of age) who were at risk for falls. To ensure balance among all three groups, the randomization of 64 participants was stratified by sex, age (65-74 vs. 75+), and expected missed days during the study period (1 week vs. 1-2 weeks). Subjects in all three groups had an identical Tai Chi instruction curriculum delivered by the same instructor in terms of content, frequency, and duration. All groups were asked to complete three one-hour Tai Chi sessions per week for 15 weeks.

Participants in the telehealth (n = 22) group exercised in their homes while connected to the instructor via video conferencing. Participants in the community-based (n = 20) group exercised at the local YMCA, on the same days as the telehealth classes. Thus, Tai Chi for these two groups was live and supervised in real time. Finally, participants in the home video-based (n = 22) group received a custom-made DVD containing 45 one-hour Tai Chi sessions that were identical to the telehealth and community-based classes. Wu et al. (2010) examined exercise compliance, number of falls, fear of falling, QOL, single leg stance, timed-up and go (the amount of time a

person needs to complete a well-defined task), and body sway during quiet stance across all three groups. Compared with the home video-based group, the telehealth and community-based groups showed a significantly higher exercise compliance rate, a higher reduction in falls, and larger improvements in most of the balance and health measures. Although the home-based Tai Chi group was shown to be the least effective of the three groups, it still led to a positive outcome on several measures, including number of falls, fear of falling, single leg stance, and timed-up and go. The study provides valuable insights into the advantages of telehealth and community-based Tai Chi, with similar limitations to previous research in terms of a relatively low power as a result of small sample sizes and a high drop-out rate in the home-based Tai Chi group.

Schulz-Heik et al. (2017) evaluated the feasibility, acceptability, effectiveness, and outcome differences of an in-person and telehealth Yoga program at a Veterans Affairs Medical Center in Palo Alto. The Yoga program offers 13 classes per week – eight of which are open drop-in outpatient classes (including three classes that are simultaneously provided as telehealth Yoga) and five of which are restricted to patients in a specific setting (e.g. an inpatient psychiatric unit or residential trauma treatment program and not simultaneously offered via telehealth). It should be noted that American Veterans receiving telehealth were at outpatient community centers, not at home. Veterans who attended a Yoga class at the Medical Center were invited to complete an anonymous program evaluation survey.

Sixty-four Veterans completed the survey, reporting high satisfaction with the classes and the instructors. When reported, a similar number of Veterans attended classes in-person (n = 29) and via telehealth (n = 30). Of the 64 Veterans who completed the

survey, almost three-quarters were male (n = 47). Though age was not recorded, nearly half of the Veterans (n=29) reported serving in the military during the Vietnam War era [1965-1973], while approximately one-fifth (n = 11) served during the recent Iraq War [2003-present] and Afghanistan War [2001-present]. The number of Yoga classes attended by Veterans ranged widely, with 40% of participants having attended five or fewer classes, and 29% having attended 21 or more classes. Gender, era of military service, and number of Yoga classes completed did not differ significantly between face-to-face and telehealth groups.

Participants were asked to rate their overall satisfaction with the Yoga sessions, equipment, classroom, and instructor in addition to reporting subjective symptom changes across 16 problem areas (back pain, other pain, headaches, upset stomach, constipation or diarrhea, trouble falling asleep, trouble staying asleep, energy level, feeling irritable, angry outburst, difficulty concentrating, depression, anxiety, feeling jumpy or easily startled, repeated, disturbing memories, and other). Most variables were consistently rated highly across groups and 80% of participants who endorsed a problem with pain, energy level, depression, or anxiety reported improvement in these symptoms. Those who participated via telehealth did not differ from those who participated in-person in any measure of satisfaction, overall improvement, or improvement in any of 16 specific health problems.

The Veteran's responses provide preliminary support for the delivery of Yoga via telehealth, as it appears to be acceptable, feasible, and effective, such as an in-person delivery. No control group was used, however, and as a result, it cannot be concluded that any improvements were due to the Yoga program. Further, participants were not

randomly assigned to face-to-face or telehealth settings. Finally, all telehealth classes were chair-based Yoga, while face-to-face classes were not, which may have served as a potential confounding variable.

10.2 Other PAs

Wantland, Portillo, Holzemer, Slaughter, and McGhee (2004) conducted a meta-analysis comparing any potential effect size differences between Internet-based and non-Internet-based interventions (traditional face-to-face interactions and paper and pencil assessments) on several behaviour change outcomes, including exercise time, 18-month weight loss maintenance, improved body shape perception, and increased participation in healthcare, among others. Aggregation of participant data across 22 studies revealed a total of 11,754 participants (mean age = 41.5 years). Interventions ranged from three to 78 weeks (mean = 27 weeks) with attrition rates for both the intervention (Internet-based) and control (non-Internet-based) groups averaging 21%. The authors reported substantial evidence that the use of Internet-based interventions improve behavioural change outcomes such as exercise time and 18-month weight loss maintenance, among others. The broad variability of the outcomes, however, precluded the calculation of an overall effect size for the compared outcome variables in the Internet-based as compared to the non-Internet-based interventions (Wantland et al., 2004).

Steele, Mummery, and Dwyer (2009) examined statistical equivalency on targeted determinants of PA (self-efficacy, social support, and motivational readiness) and perceived health status after participation in a 12 week PA behaviour change program, which included weekly modules to facilitate participant engagement and adoption of behavioural and self-management strategies. Participants (N =192) were

randomized to face-to-face (n = 65), Internet-only (n = 62), and combined face-to-face and Internet (n = 65) groups and assessed at baseline, post intervention, and two and five months post intervention.

Participants allocated to the face-to-face group received 12 weekly one-hour in-person contact sessions with a facilitator to work through the weekly activities and the relevant behavioural and self-management strategies. The combined face-to-face and Internet group received the same content delivered via an interactive Website as well as two one-hour in-person sessions with the same facilitator as the face-to-face group. The Internet-only group received access to the same Website as the combined face-to-face and Internet group. Additionally, all participants received a pedometer, though a step-count prescription was not provided, as the intervention was self-paced and targeted incremental week-by-week increases in PA. By the end of the intervention, the aim was to achieve 30 minutes of moderate-intensity PA per day.

One important finding of this study was that each intervention delivery method was not significantly different to the other and was statistically equivalent. The face-to-face and Internet groups showed changes in social support, however, there were no statistically significant differences between groups at each time point and all groups were equivalent. There were also no changes or statistically significant differences between groups at each time point in self-efficacy and all groups were equivalent. Further, there were no changes in perceived physical health, with tests of statistical equivalency showing that the groups were not significantly different and were equivalent at 12 weeks and two and five months post-intervention. Finally, motivational readiness for PA and perceived mental health increased across three intervention groups.

While this is the only study to compare traditional face-to-face delivery with Internet-only and combined face-to-face and Internet delivery of a theoretically driven PA intervention, some limitations should be noted. Specifically, the authors acknowledged that the program attracted predominately professional/white collar (77.6%) females (83%) with a mean age of 38.7 ± 12 years and did not include a *true* control group. Though the aim of the study was to evaluate the equivalency of intervention delivery methods, without a *true* control group it cannot be assumed that any intervention effects were the result of the content delivered face-to-face or via the Internet.

Other studies have also compared Internet-based versus face-to-face (Nguyen et al., 2008; Pellegrini et al., 2012; Touger-Decker, Denmark, Bruno, O'Sullivan-Maillet, & Lasser, 2010) or print-based (Cook, Billings, Hersch, Back, & Hendrickson, 2007; Marcus et al., 2007; Marshall, Leslie, Bauman, Marcus, & Owen, 2003) delivery of the same PA intervention material and yielded the same PA outcomes regardless of the delivery method. Thus, if Internet-based programs can be shown to be as effective as face-to-face, they may in turn be a more efficient and cost-effective delivery method since program costs and geographical barriers may be reduced/removed, potentially increasing accessibility (Steele et al., 2009). This being said, one potential limitation regarding the comparison of face-to-face or Internet-based interventions is publication bias (Richards et al., 2013). Potentially, only studies with positive results may have been submitted or accepted for publication, which is common in health research (Hopewell, Loudon, Clarke, Oxman, & Dickersin, 2009). A systematic Cochrane review supported this view and suggested that positive findings were more likely to be published than trials

with negative or null findings (Hopewell et al., 2009). Although the body of literature is in its early phase of development and may not include both positive and negative or null results, previous research supports the use of Internet-based interventions in the informal caregiver population.

To date, however, no studies have utilized the Internet as a means of delivering PA-based interventions to informal caregivers. Yet, it is estimated that there are more than 1.5 billion Internet users worldwide (Miniwatts International Marketing Group, 2009) and that a large portion of these users access the Internet specifically for health- and lifestyle-related information (Rice, 2006). In the general population, interest in fitness has found new life through technology (Kelly, 2014). Presently, an emerging trend in the fitness world involves the continual increase of online fitness programs and classes. According to the 2014 Nielsen Global Consumer Exercise Trends Survey, which surveyed 4610 people across 13 countries (USA, Australia, Brazil, and 10 countries in Europe), 82% of overall gym members and 45% of high frequency gym members surveyed exercised at home, either with a DVD, a pre-recorded workout, or on their own (O'Rourke, 2014). Moreover, 52% of all gym members also utilized a DVD, gaming, and/or online workout program – a number that rose to 70% for high frequency gym attendees. Finally, the 2014 Nielsen Global Consumer Exercise Trends Survey reports that 37% of the market (those who exercise regularly or would like to) utilizes either a DVD, gaming, and/or online workout program at home (O'Rourke, 2014). Along these lines, Flurry Insights reports that health and fitness tracking apps are growing 87% faster than any other app category, while apps themselves are growing at an astounding rate (Khalaf, 2014). For the most part, online fitness programs and classes are becoming more

and more popular because technology supports a high-quality delivery (Lucyk, 2015).

11 Online Yoga and Tai Chi Classes and Programs

11.1 Yoga

In 2007, YogaGlo founder Derik Mills came up with the idea for online Yoga classes after sitting in his car, frustrated and late for his favourite Yoga class. At that moment, Mills wished there was a camera at the back of the studio so he could beam himself into his favourite class whenever he wanted. From there, he pondered the idea of streaming a spectrum of accessible, non-dogmatic Yoga practices directly into his living room – a concept that did not exist (Intent Blog, 2011). Subsequently, Mills created YogaGlo for people restrained by time, much like him, offering an essential solution and a sense of community accessible to all.

Since 2007, YogaGlo.com has been part of an ongoing dialogue about health, wellness, and mindfulness, and has drawn the attention of several renowned media outlets, including The New York Times, Oprah.com, Time, The Washington Post, and Forbes. Specifically, Oprah.com celebrated YogaGlo's wide variety of classes and flexible schedule, allowing members to practice 24 hours a day, seven days a week (Pikul, 2014). The Wall Street Journal (online) appreciated YogaGlo's ability to help practitioners start or advance their Yoga practice at home without traveling and parking to attend a busy in-person class or practicing at home with the monotony of a DVD (Moser, 2013). Finally, The New York Times (online) noted the potential benefits of online Yoga sites such as

YogaGlo to reach those who live in Yoga-free zones, as well as the variability of Yoga instructors, styles, and levels (Alvarez, 2010).

YogaGlo.com has quickly become one of the most popular online Yoga studios, offering more than 4000 different Yoga, mindfulness, and meditation classes, with more added each week. With a patent on their filming, YogaGlo.com is the only online Yoga studio shooting their Yoga sessions to make the viewer/practitioner feel as though they are part of the class. The site makes it easy to find classes suited to one's desires at any given moment – practitioners can filter classes by skill level, length (5 to 120 minutes), style, or specific body parts (Moser, 2013; YogaGlo, 2016). Notably, YogaGlo.com offers a plethora of VY classes, all of which can be filtered by skill level (i.e., beginner, intermediate, advanced) and length (10-120 minutes). Finally, one of the biggest draws is the excellent roster of teachers, which includes several of the most influential Yoga teachers, such as Seane Corn, Elena Brower, Kathryn Budig, and Noah Mazé, among many others (Sonima, 2016; YogaGlo, 2016).

11.2 Tai Chi

David-Dorian Ross, the creator of Taijifit™, has been successfully utilizing multimedia to educate people about Tai Chi, qigong, and fitness for over 13 years (Trainerly, 2015). Ross is an International Tai Chi master and champion, holding the US and world record in Tai Chi forms competition as well as winning eight US Gold medals, one World Silver medal, and two World Bronze medals in Tai Chi; the only American and non-Asian in the world with this record (Ross, 2017a). Ross is an expert in using media to teach martial arts, having produced award-winning videos for Tai Chi instruction and received the 12th World Congress on Qigong and Traditional Chinese

Medicine Media Award in 2010, among others (Li, 2013). What's more, Ross's Tai Chi DVDs have sold more than 1 million copies worldwide and his *Tai Chi Beginning Practice* DVD is the best-selling Tai Chi DVD of all time. Finally, Ross's Website, Taijifit.net, is the world's first fully live (synchronous) online Tai Chi academy and wellness studio, which also houses a plethora of Tai Chi and qigong training, practice, and philosophy videos (Li, 2013; Ross, 2017b).

Currently, Taijifit.net is the only Website offering online Taijifit™ instruction and practice. This site offers a bank of Taijifit™ classes in addition to several free and paid live-streaming Tai Chi classes; new classes occur and are added daily. Taijifit.net makes it easy to find classes suited to one's desires at any given moment – practitioners can search for classes by skill level, length (15-60 minutes or more), or focus (qigong, Tai Chi, breath; Ross, 2017b). Finally, the biggest draw is Ross himself – American's *Chi-vangelis*t and the creator of Taijifit™ – who Kung-fu Magazine called *the man who brought T'ai Chi mainstream* and who martial arts action star Jet Li called *the American Idol of Tai Chi* (Ross, 2017a; Qi Squared, 2017). His highly interactive and how-to oriented teaching style, which includes metaphors, examples, stories, and humour, engages the audience in the physical application of movement, making a complex martial art accessible, joyful, and stress-free (Ross, 2017b). Such as Yoga classes on Yogaglo.com, all Taijifit™ sessions are shot to make the viewer/practitioner feel as though they are part of the class.

YogaGlo.com and Taijifit.net are among the most reputable and well-known Websites/brands in their respective sectors. Their Website designs are streamlined and appealing, their content is high quality, and their teachers are widely recognized as being

among the world's elite. Both YogaGlo.com and Taijifit.net were early industry leaders who continue to grow their online presence many years of operation later. Both sites offer professionally shot classes filmed and streamed in high-definition quality that is compatible on all computers, including Apple and Android devices. Their classes can also be viewed on smart TVs, phones, tablets, and streaming devices such as Roku. To view and partake in these online Yoga and Tai Chi sessions, no additional hardware or software installation is required as they seamlessly integrate with any Web browser. Although MBMs such as Yoga and Tai Chi are becoming more and more mainstream in the West (Liang 2016; Namasta, 2005; NCCAM at the NIH, 2016a, 2016b; Scutti 2013; Yoga Alliance, 2016), many are still intimidated by these practices. Numerous myths still surround these practices, such as: that one must already be flexible or in shape before starting and that all poses and forms must be done perfectly (Alternative Medicine Zone, 2015; Cap, 2015; Coldman, 2008; Shape, 2016). Consequently, an at-home Internet-based delivery method may also help to engage those overwhelmed by the prospect of entering a Yoga or Tai Chi studio.

12 Summary

Though being an informal caregiver is associated with many negative physical consequences, few programs exist to specifically maintain or improve the health of this population. Thus, there is a need for more applicable and current interventions, which both reach and engage informal caregivers in health promoting behaviours, especially PA. The consequences of physical inactivity in this population could ultimately lead to more

demands on the formal health system (Lysne, 2004). Ross et al. (2013) express that implementing interventions that target health behaviours may improve morbidity and mortality outcomes.

Despite the desire of informal caregivers to participate in PA programs, there is currently a lack of interventions designed to explicitly address the needs of informal caregivers through systematic and supervised exercise programs. Yoga and Tai Chi have gained popularity due to their ability to improve cardiovascular fitness, muscle strength and endurance, flexibility, and balance (Lee & Choi, 2010; Mansky et al., 2006; Mustian, et al., 2006; Van Puymbroeck et al., 2007; Vedamurthachar et al., 2006; Yachoui & Kolasinski, 2012).

Incorporating Yoga and Tai Chi into an informal caregiver's routine may help to address not only the physical health consequences that could present themselves, but also help address the healthcare system's need for this population's continued efforts. Importantly, beyond the standard health benefits that informal caregivers stand to gain from participating in MBM-based PAs such as Yoga and Tai Chi, they may also be in a better position to meet the physical challenges of caregiving – perhaps also delaying hospitalization or institutionalization of the care recipient (Chodzko-Zajko et al., 2009). Though the most popular and/or prominent styles of Yoga and Tai Chi, no studies have examined and compared the benefits of VY and Taijifit™ in this population. Thus, it is necessary to investigate the merits of these MBM-based PA options for this population. Further, it is particularly important to deliver Yoga and Tai Chi interventions to informal caregivers in Saskatchewan, where the prevalence of informal caregiving is the highest across Canada at 34%. Moreover, at 38%, the city of Regina rates third in terms of

informal caregiver prevalence across 27 Canadian CMAs (Statistics Canada, 2013a).

Without fundamental changes in research and program delivery, Canadian families and the Canadian health care system may become overwhelmed, leaving informal caregivers vulnerable. Informal caregivers are not seeking to relinquish their caregiver role, however, caregiver demands may become overwhelming, putting them at risk of their own health deteriorating, and consequently, potentially putting the care recipient at risk through lack of proper care (Bernier, 2014). While in many instances prevention is crucial early in the informal caregiving trajectory, action taken later can also serve to maintain health, delay the onset of negative consequences, or lessen the severity of existing health concerns (Public Health Agency of Canada, 2010).

13 Rationale for the Studies

Research into the effects of Yoga and Tai Chi on the physical health of informal caregivers is in its early stages. Though preliminary results have been encouraging, much of the existing research has suffered significant methodological limitations, such as small sample sizes, short intervention duration, lack of long-term follow-up, and lack of home practice monitoring, making interpretation of the findings difficult. To date, few studies have targeted adult informal caregivers that help a variety of care recipients (e.g., relationship to care recipient and reasons for caregiving). Instead, a number of Canadian studies have focused predominantly on informal caregivers who are 45 years of age and over and providing care to aging parents. In 2012, however, 43% of informal caregivers were under 45 years of age and only 28% of informal caregivers cared for someone with age-related needs (Statistics Canada, 2013a). What’s more, much of the Internet-based

research to date has focused predominantly on dementia caregivers and research in general targets caregivers caring for individuals with specific health conditions, making generalizability of the results to the informal population as a whole difficult. The Canadian Ministry of Health and Long-term Care (2017) notes that many caregivers have the same issues and needs and therefore, it is important to improve access to generic programming.

To date, several studies have reported a range of potential barriers (e.g., transportation, time constraints, arranging alternative care) associated with conducting face-to-face interventions in this population and most have failed to use popular and widely available or accessible Yoga or Tai Chi programs, making attempts at replication impossible. Using Internet-based interventions to support informal caregivers may offer an efficient and accessible alternative to traditional face-to-face interventions. Moreover, according to the 2016 Yoga in America study, the most prominent place to practice Yoga is in the home (Yoga Journal, 2016). Along these lines, three of the six (50%) face-to-face Yoga interventions conducted in this population provided participants with materials (manuals, audiocassettes, DVDs, and workbooks) to perform Yoga at home two or six times a week (Danucalov et al., 2013; Waelde et al., 2004) or whenever possible (Van Puymbroeck, 2007). Only one (33%) study, however, monitored and reported adherence to at-home practice (Waelde et al., 2004).

Equally noteworthy are the potential benefits of utilizing a coach when delivering Internet-based interventions and utilizing qualitative research alongside quantitative data collection. A coach may be a beneficial tool for Internet interventions, helping those who are struggling to remain on track, encouraging them to focus and

continue (Blom et al., 2015; Brouwer et al., 2011). Finally, qualitative research can provide valuable insights into the intervention needs of informal caregivers, going beyond outcome measurements and tapping into factors that are of great importance to informal caregivers (McKechnie et al., 2014). An advantage of qualitative methods is the use of open-ended questions and probing, which, with informal caregivers in particular, could enable the more complex aspects of their vital role to be studied, understood, and considered (Mack, Woodsong, MacQueen, Guest, & Namey, 2005). Moreover, using qualitative research alongside quantitative methods can help to interpret and better understand the implications of quantitative data. Lopez-Hartmann et al. (2012) encourage the use of mixed-methods (including qualitative approaches) to evaluate the effectiveness of informal caregiver interventions. Likewise, Martin and Candow (2016, 2017) highlight the importance of qualitative research in this population, particularly with regard to assessing why or why not informal caregivers partake in health-promoting behaviours such as PA. Markedly, all six (100%) intervention studies involving the use of Yoga and Tai Chi in informal caregivers included post-program qualitative evaluation (Danucalov et al., 2013; Hill et al., 2007; Jagannathan, et al., 2012; Martin & Keats, 2014; Van Puymbroeck et al., 2007; Waelde et al., 2004).

This thesis addressed methodological limitations, expanded on existing research, and assessed the feasibility of online VY and Taijfit™ in this population. We conducted a priory power analysis to ensure adequate sample size, used objective physical health outcome measures, utilized widely-available and popular styles of Yoga and Tai Chi (replicability), utilized telehealth to reach and engage informal caregivers and reduce barriers to PA participation, and assessed the effects of cessation from VY and Taijifit™

participation. Study I is the first to deliver an online VY and Taijifit™ intervention in this population, while also utilizing a certified VY and Taijifit™ instructor to help support and encourage participants to remain on track. Study II is the first study to investigate the effects of VY and Taijifit™ cessation (6 consecutive weeks post-exercise) on physical outcome measures and QOL; shedding light on the potential long-term effects of VY and Taijifit™ practice. The caregiving journey can present numerous significant and unique challenges, including an unpredictable trajectory. As such, it is important to assess whether any potential benefits persist during irregular and intense caregiving periods when PA is unlikely.

Study I also administered a 10-item open-ended questionnaire at the 12-week post-intervention testing session to shed light on any perceived benefits, the importance of and barriers to PA, the delivery method (online), and overall program satisfaction (how to improve the intervention), for which limited literature exits. Similarly, Study II administered an open-ended questionnaire at the six-week cessation testing session to shed light on participants' experiences throughout the six-week cessation period. This qualitative information offered an important supplement to quantitative outcome measures and allowed the more complex aspects of their vital role to be studied, understood, and considered.

14 Research Purpose and Hypotheses

The primary purpose of Study I was to investigate the effects of online VY and Taijifit™ (150 minutes/week for 12 consecutive weeks) on muscle strength (1-RM leg

press, chest press, hand-grip), muscle endurance (leg press and chest press; maximal number of repetitions performed to fatigue at 80 and 70% baseline 1-RM respectively), abdominal endurance (maximum number of consecutive curl-ups to volitional fatigue), tasks of functionality (dynamic balance, walking speed), and flexibility (sit and reach) in adult informal caregivers (≥ 18 years of age). A second purpose was to determine whether these interventions improve QOL over time. Thirdly, a 10-item open-ended questionnaire was administered post-intervention to provide insight from participants on their perceived benefits, the importance of and barriers to PA, the intervention delivery method (online), and overall program satisfaction. Based on the purported benefits of VY and *Yang*-style Tai Chi (Taijifit™), it was hypothesized that VY would lead to greater improvements in upper body and abdominal strength and endurance, while Taijifit™ would lead to greater improvements in lower body strength and endurance and tasks of functionality.

The primary purpose of Study II was to investigate the effects of VY and Taijifit™ cessation (6 weeks post-exercise) on muscle strength (1-RM leg press, chest press, hand-grip), muscle endurance (leg press and chest press; maximal number of repetitions performed to fatigue at 80% and 70% baseline 1-RM respectively), abdominal endurance (maximum number of consecutive curl-ups to volitional fatigue), tasks of functionality (dynamic balance, walking speed), and flexibility (sit and reach) to determine whether any potential benefits of regular VY and Taijfit™ participation (Study I) may persist during irregular and intense caregiving periods when physical activity is unlikely. No previous study has examined the rate of change in each dependent variable post-exercise, which may help in the development of optimal cycling strategies regarding

VY and Taijifit™ intervention and cessation duration. A secondary purpose was to investigate the effects of VY and Taijifit™ on QOL. Thirdly, a three-item open-ended questionnaire was administered to shed light on participants' experiences throughout the six-week follow-up period.

15 Methods

15.1 Participants

Inclusion criteria included informal caregivers who predominantly provided help with ADL and IADL (i.e., daily activities of self-care essential for fundamental functioning and activities that permit individuals to live independently in a community), were ≥ 18 years of age, and provided care to a variety of recipients (e.g., parents, siblings, spouses, neighbours, friends). Participants who identified themselves as informal caregivers and who were not participating in Yoga or Tai Chi for ≥ 6 weeks prior to the start of the study were enrolled. Both males and females were included to increase the impact of the study findings to the general informal caregiver population.

Participants were recruited by posting posters throughout the city of Regina (specifically in and around medical clinics, care homes, non-profit organizations, and informal caregiver support groups), by way of online advertisements (CBC Radio/Canada, Facebook), and via the radio and television (*Talk of the Town* with Lisa Peters [television], *The Morning Edition* with Sheila Coles [radio], and CBC/Radio Canada's *Pour Faire un Monde* with Doris Labrie [radio]).

Participants were required to fill out a leisure time exercise questionnaire

(Appendix D) at the start of the study, which indicated the average number of times they performed strenuous (i.e. heart beats rapidly), moderate (i.e. not exhausting), and mild exercise (i.e. minimal effort) per week (Godin & Shephard, 1985). Participants also filled out a Physical Activity Readiness Questionnaire (PAR-Q+), which assessed their readiness for participation in exercise programs (Appendix E). This questionnaire included questions related to heart conditions, angina at rest or during physical exercise, balance, and bone or joint problems that may affect exercise performance. If participants indicated that they had any of the above conditions, they were provided with a Physical Activity Readiness Medical Examination (PARMED-X) form to be filled out by their family physician (Appendix F). The PARMED-X gave their physician the option of assessing resting ECG or performing an exercise stress test before recommending whether or not it was safe for them to participate in the study. The PAR-Q+ and PARMED-X were designed by the Canadian Society for Exercise Physiology and are endorsed by Health Canada.

Participants were instructed not to change their diet or engage in any additional PA that was not part of their normal daily routine. The Research Ethics Board at the University of Regina approved the study (Appendix G) and participants were informed of the risks and purposes of the study before their written informed consent was obtained (Appendix H).

15.2 Research Design

A priori power analysis (G*Power v. 3.1.9.2) revealed that a total of 28 participants were required (14 per group). This calculation was based on a moderate effect size (Cohen's d = 0.25), an alpha level of 0.05, and a ß-value of 0.8 for a repeated

measures, within-between interactions, analysis of variance (ANOVA) approach (Faul, Erdfelder, Lang, & Buchner, 2007) for the four primary physical outcomes (muscular strength and endurance, walking speed, balance, and flexibility).

Prior to the start of Study I, participants were properly shown how to use the resistance training equipment and perform muscle strength, muscle endurance, tasks of functionality, and flexibility assessments (familiarization phase). The protocols used for familiarization muscular strength, muscular endurance, functionality, and flexibility testing (see sections 15.3.1 - 15.3.3) were also used for the determination of baseline and post-intervention strength, endurance, functionality, and flexibility (Study I) as well as cessation strength, endurance, functionality, and flexibility (Study II). Studies I and II were directly supervised by the researcher and all testing (familiarization, Study I, and Study II testing) was conducted by the same researcher. During the cessation period (Study II), participants were instructed not to change their diet or engage in any additional PA that was not part of their normal daily routine and access to the VY and Taijifit™ interventions was terminated.

15.3 Primary Dependent Variables

15.3.1 Muscular Strength and Endurance. Muscle strength was assessed using the leg press, chest press, and hand-grip exercise, whereas muscle endurance was assessed using the leg press and chest press exercise in the Aging Muscle and Bone Health Laboratory at the University of Regina. Machine-based resistance training equipment was chosen because it is considered safer and easier to use than free-weights, especially for individuals with minimal training experience (Ratamess et al., 2009).

Familiarization 1-RM testing was performed for each exercise. Following a 5-

minute warm-up on a stationary cycle ergometer at a light intensity and a demonstration, participants were positioned in a bilateral, leg press machine so that a 90^0 angle at the knee was achieved and feet were shoulder width apart. Participants then pushed the weight away from their body to full extension without locking the knees before returning to the starting position. Participants were then positioned in a bilateral, chest press machine with both feet on the floor following another demonstration. Participants were positioned in the chest press machine so that the adjacent bars line up mid-chest level. Participants were instructed to grasp the bars (overhand grip) approximately shoulder width apart and push the weight away from the body until full extension and then lower the weight back to the starting position, without lifting their buttocks off the bench or arching their back during the lift. Seat position and settings were recorded for each participant to ensure consistency.

For both leg and chest press 1-RM, participants performed 1 set of 5 repetitions using a load that was comfortable. Two-minutes after the warm-up set, the load was progressively increased for each subsequent 1-RM attempt. Participants rested (passively) between 1-RM attempts. All participants reached their 1-RM in six sets or less.

Leg press and chest press muscular endurance was determined as the maximum number of repetitions that could be performed for one set using 70% baseline 1-RM for chest press and 80% baseline 1-RM for leg press. The different percentages of 1-RM used for the muscular endurance tests reflect observations that for a given percentage of 1-RM, more repetitions can be performed during lower body exercises than during upper body exercises (Chilibeck, Calder, Sale, & Webber, 1998; Chrusch, Chilibeck, Chad, Davison, & Burke, 2001). Total body strength was determined by summing 1-RM leg

and chest press values and total body endurance was determined by summing the maximum number of leg and chest press repetitions.

Abdominal endurance was determined as the maximum number of consecutive curl-ups performed using the Canadian Society for Exercise Physiology's partial curl-up protocol. The partial curl-up test concluded when a participant failed two consecutive repetitions as a result of any of the following reasons: palms or feet broke contact with the mat/floor, knees broke 90° angle, fingers did not reach the 10cm mark, shoulders/head did not make contact with the mat/floor, unable to maintain proper cadence, or visible straining/undue comfort.

Hand-grip strength was assessed using a hand-grip dynamometer (Jamar® Hydraulic Hand Dynamometer by Sammons Preston Rolyan). The test was conducted in an upright standing position and the arm to be tested was abducted from the body at a 45° angle, with the elbow by the side of the body. Grip width was adjusted to the participants' hand size and recorded to ensure consistency. Participants were instructed to squeeze the dynamometer with maximal isometric effort for three seconds. Participants performed two test trials for each hand with one minute of rest between trials. For both hands, the average strength was used for hand-grip strength.

Muscle strength and endurance was assessed on the same day and in the following order: (1) leg press strength, (2) chest press strength, (3), leg press endurance, (4) chest press endurance, (5) abdominal curl-ups, and (6) hand-grip strength. Five minutes of passive rest separated each strength or endurance assessment for a particular muscle group. The same strength and endurance testing procedures were used for both Study I and Study II.

15.3.2 Tests of Functionality. Walking speed and dynamic balance were assessed by recording the time it took participants to perform backward tandem walking (i.e. toe to heel) over a distance of 6m on a 10cm wide board that was raised about 4cm off the ground. The number of errors (i.e. number of times the participant stepped off the walking board) during the test was recorded. Participants performed one practice trial, followed by two test trials with a one-minute break between trials, for which the time and errors were recorded and averaged.

15.3.3 Flexibility. Hamstring flexibility was assessed using a sit-and-reach flexometer. Participants sat on the floor with their legs fully extended and soles of the feet flat against the flexometer six inches apart. With palms facing downwards and one hand on top of the other, participants exhaled and reached forward along the measuring line, holding the stretch for two seconds while the distance was recorded. Participants performed one practice trial followed by two test trials with a one-minute break between trials, for which the scores were recorded to the nearest 0.5cm and averaged.

Functionality and flexibility was assessed on the same day, following muscular strength and endurance testing, in the following order: (1) walking speed and dynamic balance and (2) flexibility. Five minutes of passive rest separated functionality and flexibility testing. The same functionality and flexibility testing procedures were used for both Study I and Study II.

15.4 Secondary Dependent Variables

15.4.1 QOL. The Medical Outcomes Study 36-Item Short-Form Health Survey version 2 (SF36v2) was used to measure overall QOL in informal caregivers (Ware, Kosinski, & Dewey, 2000). Participants completed the SF36v2 prior to

completing muscular strength, muscular endurance, and functionality testing in Studies I and II. The SF36v2 is a multi-purpose, 36-item health survey yielding a profile of two health component summary measures (Physical Component Score [PCS] and Mental Component Score [MCS]), each of which is predominantly comprised of four subscales (see figure 2). The four predominant PCS subdomain scales include: (1) *physical functioning* (lower scores indicate greater limitations in performing everyday physical activities, whereas higher scores indicate better physical functioning without limitations due to health), (2) *role-physical* (lower scores reflect problems with work or daily roles due to physical health problems, whereas higher scores indicate better role-physical functioning), (3) *bodily pain* (lower scores reflect very severe and extremely limiting pain whereas higher scores indicate a lack of bodily pain and no limitations due to pain), and (4) *general health* (lower scores indicate that personal health is judged to be poor and deteriorating, whereas higher scores indicate that general health perceptions are excellent). The four predominant MCS subdomain scales include: (1) *vitality* (lower vitality scores indicate that participants feel tired and worn out, whereas higher scores indicate more vitality; that participants feel energetic), (2) *social functioning* (lower scores reflect frequent interference with social activities due to emotional or physical health problems, whereas higher scores indicate better to excellent social functioning; no problems with social activities due to physical or emotional problems), (3) *role-emotional* (lower scores reflect issues or problems with day to day activities as a result of emotional problems, whereas higher scores indicate better to excellent role-emotional functioning – no issues or problems with day to day activities due to emotional problems), and (4) *mental health* (lower scores reflect feelings of depression or unease most/all of the time,

whereas higher scores indicate excellent mental health; feelings of happiness and calm most/all of the time; Ware, 1994). The SF36v2 contains 36 positive and negative questions/statements, which are scored on six different 5-point Likert scales (excellent *to* poor; much better *to* much worse; all of the time *to* none of the time; not at all *to* extremely; none *to* very severe; and definitely true *to* definitely false) and one 3-point Likert scale (yes, limited a lot *to* no, not limited at all).

The two health component summary measures (PCS, MCS) and eight subdomain scales are yielded using the QualityMetric Health Outcomes™ Scoring Software 5.0 to ensure that all SF-36v2 data are scored in accordance with the standards set by the developers of the survey (Maruish, 2011). This software is designed to provide two approaches when calculating scores: a norm-based approach that adjusts raw scores to have a mean of 50 and standard deviation of 10 and a normal, additive approach that produces 0-100 scores (McDowell, 2006), where higher scores indicate better physical and mental functioning/health (Ware et al., 2007). The most recent SF-36v2 Health Survey (3rd ed.) user's manual highlights several advantages for using standardized *T*-scores (M = 50, SD = 10; Maruish, 2011). Notably, the PCS and MCS measures take into account the correlations amongst the eight health domain scales and the results for the PCS and MCS measures have always been transformed to *T*-scores. Thus, utilizing *T*-scores enables a direct comparison with results for the eight health domain scales. Additionally, the use of *T*-scores makes it possible for the results from the two SF-36 versions to be directly compared, allowing users to take advantage of the advances achieved with the SF-36v2 while retaining the option of comparing results with SF-36 results. Accordingly, in the current study, standardized *T*-scores for the eight subscales

and two health component summary scores were yielded using the QualityMetric Health Outcomes™ Scoring Software 5.0.

Further post-hoc analyses included calculating and examining the change scores for the eight subscales and two summary measures using descriptive statistics to determine if any minimally important difference values were significant. The following mean group minimally important difference values for the summary measures (PCS, MCS) and eight subscales are proposed to be: PCS, 2 *T*-score points; MCS, 3 *T*-score points; *physical functioning*, 3 *T*-score points; *role-physical*, 3 *T*-score points; *bodily pain*, 3 *T*-score points; *general health*, 2 *T*-score points; *vitality*, 2 *T*-score points; *social functioning*, 3 *T*-score points; *role-emotional*, 4 *T*-score points; and *mental health*, 3 *T*-score points (Ware et al., 2007). These suggested values signify the best estimates based on current evidence (Maruish, 2011).

The SF36v2 is used internationally and evaluated for reliability, validity, and sensitivity in healthy persons. Like its predecessor (the SF36), the SF-36v2 has proven useful in surveys of general and specific populations, has been translated for use in more than 70 countries, takes approximately five to 15 minutes to complete, and is a highly recommended self-administered measure with advanced psychometric properties (McDowell, 2006; Ware et al., 2007). The two summary scales have been shown to be factorially valid across clinical and general populations from various countries (Ware et al., 2000). Moreover, previous research has provided evidence of construct, criterion, content, concurrent, and predictive validity of the SF-36v2 (Ware et al., 2000). Specifically, the SF36v2 has been found to possess adequate discriminatory power, good correlation with other measures, good construct validity, and adequate criterion validity

(McDowell, 2006; Ware, 1994). The reliability of the eight scales and two health component summary measures has been estimated using both internal consistency and test-retest methods (Ware, 1994). Standard errors of measurement, 95% confidence intervals for individual scores, and responsiveness (specifically adequate sensitivity to change) have been reported (Ware et al., 2007). Finally, the SF36v2 was judged to be the most widely evaluated generic health outcome measure in a bibliographic study on the development of QOL measures (Garratt, Schmidt, Mackintosh, & Fitzpatrick, 2002).

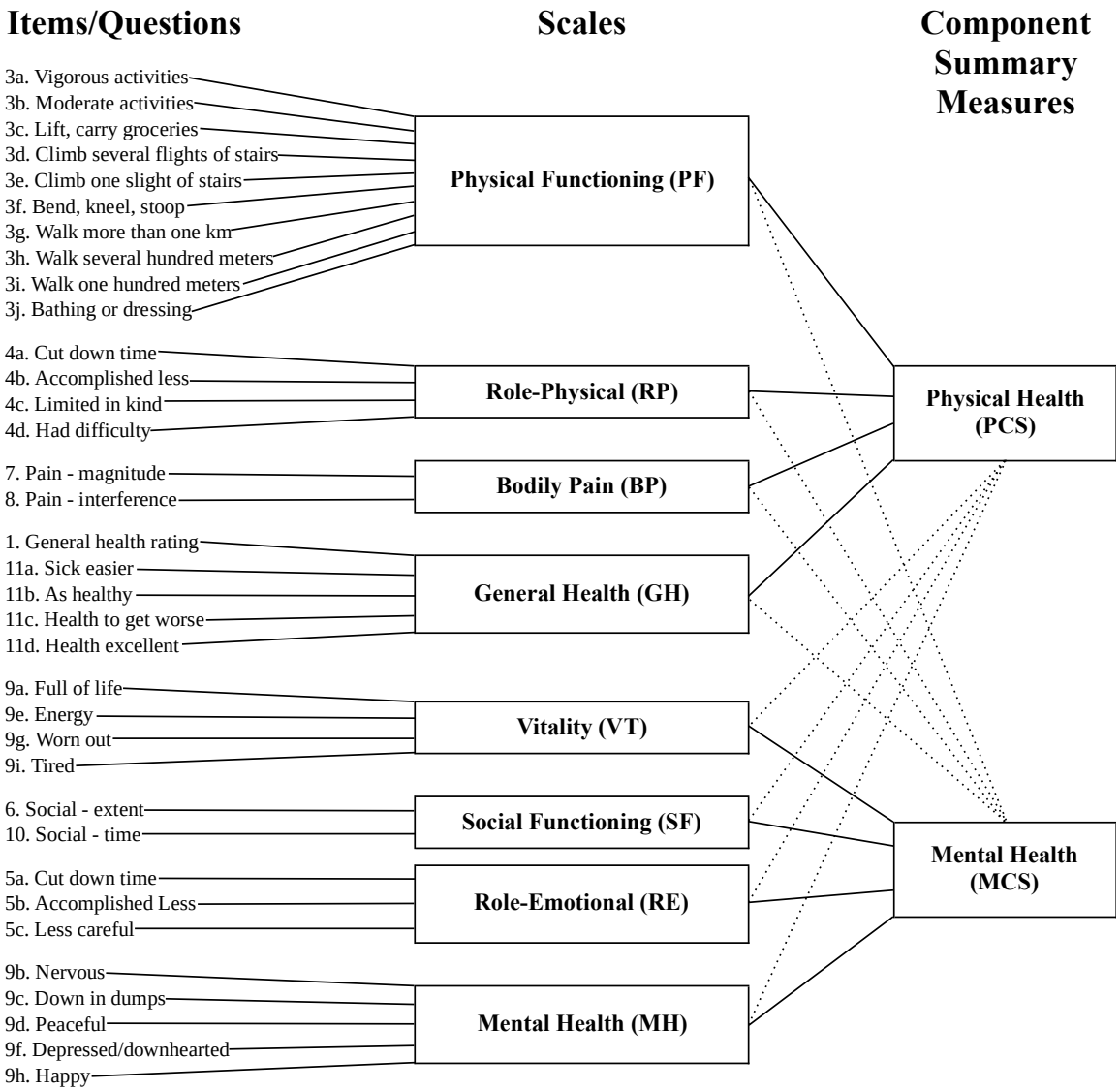


Figure 2 SF-36v2 Measurement Model

Note: All health domain scales contribute to the scoring of both the physical and mental component Summary measures (PCS, MCS). Scales contributing most to the scoring of the summary measures are indicated by a connecting solid line (——). Scales contributing to the scoring of the summary measures to a lesser degree are indicated by a dotted line (·····).

Note: All but one of the survey's 36 items (question 2) are used to score the eight health domain scales and two summary measures.

15.5 Yoga and Tai Chi Protocols

After completing baseline testing, a Yoga (Yogaglo.com) or Tai Chi (Taijifit.net) profile and account was created and provided free of charge to each

participant. The researcher showed the participants how to navigate the online Yoga or Tai Chi Websites until participants were comfortable with the sites and could navigate them on their own (30 – 60 minutes). Participants were also emailed directions on how to navigate their respective sites, which included screenshots of each step, parameters of use, and their user name and password. Participants were required to perform 150 minutes of VY or Taijifit™ per week, in accordance with the Canadian Society for Exercise Physiology's Canadian Physical Activity Guidelines for individuals aged 18 years and older (Canadian Physical Activity Guidelines, 2011a, 2011b). Participants were instructed to fill out training logs to assess adherence to the VY and Taijifit™ programs (Appendix I). Participants were also instructed to log their hours of informal caregiving throughout the 12-week intervention period (Appendix I) and six-week cessation period (Appendix J). Throughout the duration of the 12-week VY and Taijifit™ intervention (Study I) and six-week cessation period (Study II), the researcher (a certified VY and Taijifit™ instructor) acted as a coach, monitoring, supporting, and guiding participants. The researcher emailed every participant on weeks 1, 2, 4, 6, 8, 10, 11, and 12 to check-in and ensure they felt comfortable and confident navigating their respective Websites and performing their respective MBMs. Participants could also contact the researcher via phone, email, or text message at any time should they have any questions/concerns or require demonstrations/clarifications.

15.5.1 VY. VY (a form of *Hatha* Yoga) was chosen as the style of Yoga for the study based on its popularity and prominence in the West and the prevalence of *Hatha*-based Yoga interventions in the literature (Cramer et al., 2016; Danucalov et al., 2013; Hill et al., 2007; Martin & Keats, 2014; Oken et al., 2004, 2006; Sareen, Kumari,

Gajebasia, & Gajebasia, 2007; Tran et al., 2001; Van Puymbroeck et al., 2007; Waelde et al., 2004). All VY sessions were taught by certified instructors through the online Yoga community, YogaGlo.com. Participants were required to filter VY classes by level (*beginner*) for the first two weeks of the intervention and by session length (≥ *15 minutes*) for the duration of the intervention. After the first two weeks, participants could participate in *intermediate* classes in consultation with the researcher/coach. Participants were free to choose any instructors they preferred.

Every VY session was taught within the prescribed parameters of *Hatha* Yoga, namely: *Ashtanga* (the eight limbs of Yoga). VY sessions included *savasana* (corpse pose) – a pose that helps to calm down the mind, promote relaxation, and relieve stress and pressure off of the body (Coulter, 2001; Kaminoff, 2007; Fraser, 2007); guided meditation; *Ujjayi* breath cultivation and maintenance; and *asanas* (standing, sitting, forward bending, twisting, inverting, balancing, reclining, and back bending poses), which are personally altered in order for the practitioner to achieve maximum benefits.

15.5.2 Taijifit™. Taijifit™ was chosen as the style of Tai Chi for the study based on its popularity in North America and its modern combination of fitness elements, meditation, and martial arts. Taijifit™ is the first and only program endorsed by the Physical Education and Sports authority of China (Evergreen Fitness, 2017). Taijifit™ still maintains its authenticity when it comes to the guiding principles of Tai Chi, namely: ensuring the practitioner's sequence of Tai Chi forms is continuous, harmonious, and synergistic, thus inducing, developing, and improving *flow* (Ross, 2013).

All Taijifit™ sessions were moderately paced, guiding practitioners through multiple Tai Chi forms, *flowing* through one continuous sequence. The breath was not

controlled during Taijifit™, however, practitioners were guided to link their breath with particular movements (i.e., inhale the arms up, exhale sink into a squat). Such as with all styles of Tai Chi, Taijifit™ is about balancing *yin* and *yang* – strength with beauty, power with peace, and endurance with flow and the intensity of the practice is personally altered in order to achieve maximum benefits and challenge the body (Ross, 2013). Lastly, Taijifit™ sessions began with or included *qigong,* preparing practitioners to control the flow and distribution of *chi/qi* in their body during a Tai Chi sequence. Taijifit.net is the only Website offering Taijifit™ classes. Taijifit.net offers synchronous, but not asynchronous Taijifit™ classes, while Yogaglo.com offers exclusively asynchronous Yoga classes. As a result, the researcher and David-Dorian Ross developed a specific webpage on the Taijifit.net Website, which offered synchronous Taijifit™ classes that closely resembled those offered on Yogaglo.com. The synchronous Taijifit™ classes resembled the synchronous VY classes in terms of HD quality, streaming capacity, morning and evening focused classes, classes with music or silence, class length options, and classes with a focus on the instructor, modifications, or the whole studio/class. All Tai Chi sessions were taught by certified instructors through the online Tai Chi community, Taijifit.net. Participants were required to filter Taijifit™ classes by level (*beginner*) for the first two weeks of the intervention and by session length (≥ *15 minutes*) for the duration of the intervention. After the first two weeks, participants could participate in *intermediate* classes in consultation with the researcher/coach. Participants were free to choose any instructors they preferred.

15.6 Evaluation of the Intervention

A 10-item open-ended questionnaire was administered post-intervention (Study I) and a three-item open-ended questionnaire was administered after the six-week cessation period (Study II). Open-ended survey questions were administered in Study I to provide insight from participants on any perceived benefits, the importance of and barriers to PA, the intervention delivery method (online), and overall program satisfaction. In Study II, open-ended survey questions were administered to shed light on participants' experiences throughout the six-week cessation period.

15.7 Adverse Event Assessment

In the case of an adverse event, participants were asked to complete an adverse event form (Appendix K) in order to provide details on the type of adverse event, the severity (i.e. mild, moderate, severe, or life threatening), the frequency, and the relationship to the intervention (i.e. not related, unlikely, possible, probable, or definite).

15.8 Statistical Analyses

For Study I, a 2 (group: VY vs. Taijifit™) x 2 (time: baseline vs. week 12) repeated measures ANOVA was conducted to determine differences between groups over time for total leisure activity and self- and Internet-reported PA, the primary dependent variables of muscle strength, muscle endurance, abdominal endurance, balance, walking speed, flexibility, and the secondary dependent variable of QOL. If statistically significant main effects or interactions were found, descriptive data, profile plots, and file splitting were used to confirm the main effects and interactions. An ANOVA was used to to assess differences in baseline characteristics. ANCOVA was used to analyze flexibility and overall physical health (PCS), with baseline measurements as a covariate because

differences were observed at baseline in these measures between groups. A one-way ANOVA was conducted to compare reported training volume (self-report PA logs vs. Internet PA logs) between groups (VY vs. Taijifit™). Dependent samples *t*-tests were conducted to determine differences in reported training volume (self-report PA logs vs. Internet PA logs) for the VY and Taijifit™ groups. The QOL mean group respondent change score values were interpreted based in the suggested minimally important difference values as outlined in the SF-36v2 Manual (Maruish, 2011). Content analysis (Hsieh & Shannon, 2005) was conducted with the intent of identifying any major themes emerging from the answers to the 10 open-ended survey questions.

For Study II, a 2 (group: VY vs. Taijifit™) x 2 (time: baseline vs. week 6) repeated measures ANOVA was conducted to determine differences between groups over time for total leisure activity and self- and Internet-reported PA, the primary dependent variables of muscle strength, muscle endurance, abdominal endurance, balance, walking speed, and flexibility, and the secondary dependent variable of QOL. Week 12 (post-intervention) data from Study I was used as the baseline data for Study II. If statistically significant main effects or interactions were found, descriptive data, profile plots, and file splitting were used to confirm the main effects and interactions. An ANOVA was used to to assess differences in baseline characteristics. ANCOVA was used to analyze chest press endurance, abdominal endurance, and flexibility with baseline measurements as a covariate because differences were observed at baseline in these measures between groups. Content analysis (Hsieh & Shannon, 2005) was conducted with the intent of identifying any major themes emerging from the answers to the three open-ended survey questions.

For both studies, significance was set at an alpha level < 0.05 and all results are expressed as means ± standard deviation. Since Studies I and II were feasibility studies, the *p* value was not adjusted for multiple testing for the following reasons: Bonferroni adjustments cannot decrease Type I errors without inflating Type II errors and Type II errors are no less false than Type I errors; Bonferroni adjustments imply that the interpretation of a finding depends on the number of other tests performed; Bonferroni adjustments do not take into account tests that have been performed, but not published, or tests published in other papers based on the same study; the same tests were not repeated in subsamples of the population, such as by age group or sex; and generally, simply describing what tests of significance have been performed, and why, is the best way of dealing with multiple comparisons (Perneger, 1998). Exact *p* values are presented for all findings > 0.001, along with the magnitude of the difference between significant means, as determined by partial eta squared (n^2) effect size. This is a measure of the effect size and therefore of the proportion of the total variance that can be explained by the effects of the treatment. A n^2 value of ≥ 0.15 represents large differences, 0.06-0.14 represents medium differences, and 0.01-0.05 represents small differences. Statistical analyses were performed using IBM® SPSS® Statistics, v. 21.

16 Results

16.1 Subjects

From September to December 2016, 66 participants volunteered for the study (23 males and 43 females). However, of the 66 participants who volunteered, 27

participants (5 males, 22 females) did not meet inclusion criteria (13 cared for their own child ≤ 18 years of age, 10 did not perform any ADL or IADL, three had a current Yoga/Tai Chi practice, and one wanted to initiate a new PA during the intervention period), one participant (female) did not want her physician to complete the PARMED-X, and two participants (females) were worried about the timing of the intervention (Christmas and New Years). Thirty-six participants (11 males, 25 females) started the familiarization phase with one participant (female) withdrawing because she did not enjoy the testing exercises. Thus, thirty-five participants were randomized to either VY or Taijifit™ and completed baseline testing. Six female participants (3 VY, 3 Taijifit™) withdrew before Study I was finished. One participant in the VY group withdrew at week 3 for a family emergency, another participant in the VY group withdrew at week 7 because her care recipient was hospitalized, and the last VY group participant withdrew at week 11 because her care recipient passed away. From the Taijifit™ group, one participant withdrew at week 4 because her care recipient passed away, another participant withdrew at week 7 when she slipped on ice and broke her ankle, and the last participant withdrew at week 8 when a pre-existing chronic condition flared up as a result of her occupation. Twenty-nine participants (VY = 16 [11 females, 5 males], Taijifit™ = 13 [7 females, 6 males]) completed Study I and 26 participants (VY = 14 [9 females, 5 males], Taijifit™ = 12 [6 females, 6 males]) completed Study II. Three female participants (2 VY, 1 Taijifit™) did not complete Study II (cessation testing) as they were out of the country (see Figure 3 for a summary of recruitment, allocation, and analysis).

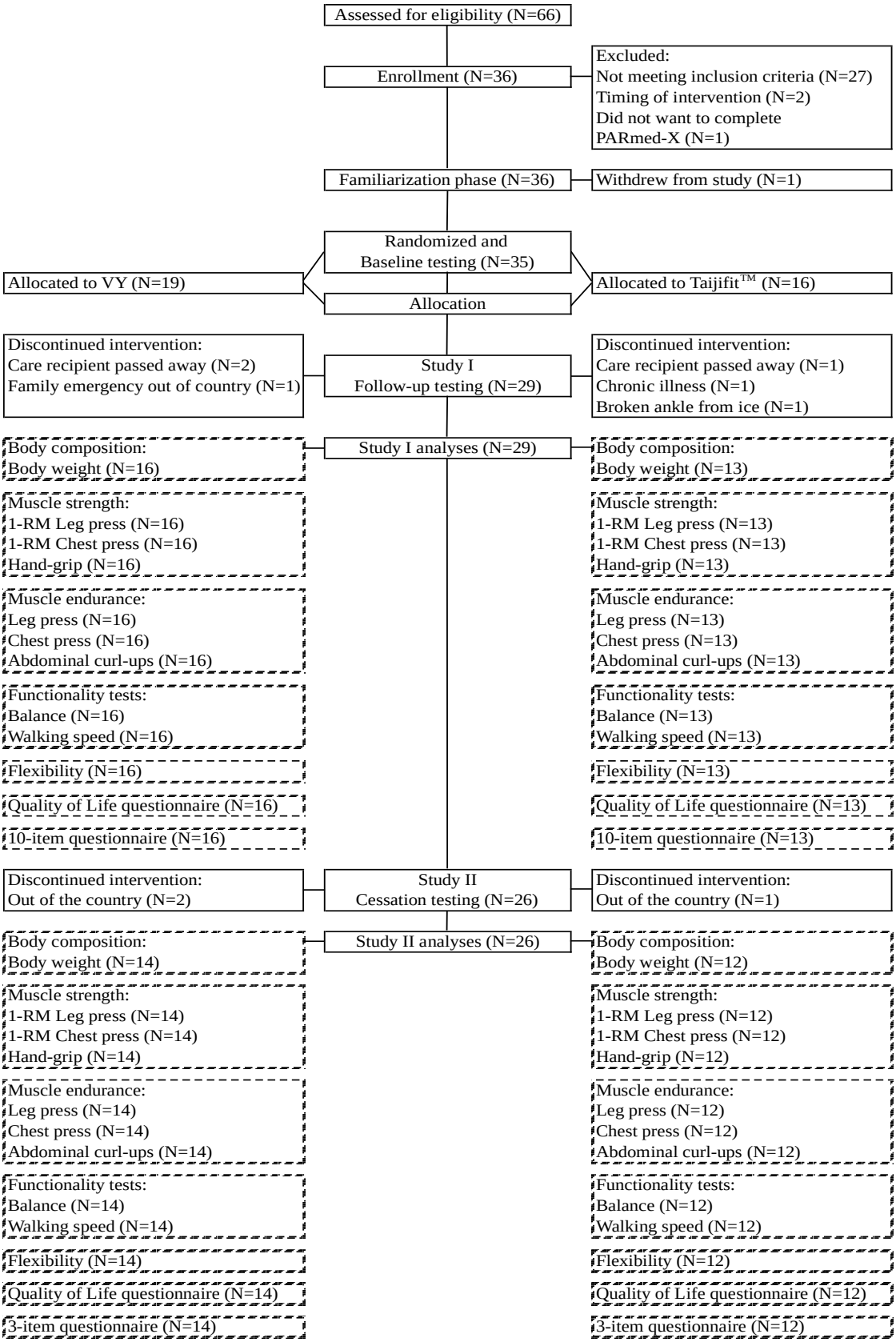


Figure 3 Summary of recruitment, allocation, and analyses

16.2 Study I

16.2.1 Participants. Twenty-nine participants (11 males, 18 females) completed the study. All participants completed baseline testing within 4.62 ± 2.74 days of familiarization testing (VY group = 4.13 ± 1.2 days; Taijifit^{TM} group = 5.23 ± 3.21 days). Following the 12 week intervention, all follow-up testing was conducted within 2.24 ± 3.21 days (VY group = 1.94 ± 2.49 days; Taijifit^{TM} group = 2.62 ± 4.01 days) of each participant's last VY or Taijifit^{TM} session. Detailed demographic and caregiving characteristics are reported in Table 1 (VY participants) and Table 2 (Taijifit^{TM} participants).

Prior to participating in the study, participants were asked: *In what ways has informal caregiving positively or negatively impacted your overall health? Please explain.* Twenty-six participants (14 VY, 12 Taijifit^{TM}) responded and provided positive and/or negative health impacts. Several positive health impacts were reported, including: increased resilience (1 Taijifit^{TM}), well-being (1 Taijifit^{TM}), mood (1 Taijifit^{TM}), PA participation (1 VY), and activity engagement with their care recipient (1 VY), as well as a deepened relationship with their care recipient (1 Taijifit^{TM}) and greater awareness of self-care (1 Taijifit^{TM}). Several participants also noted that informal caregiving had increased their stress (4 VY, 5 Taijifit^{TM}), anxiety/worry (5 VY, 4 Taijifit^{TM}), and physical (7 VY, 3 Taijifit^{TM}) and emotional fatigue/exhaustion (2 VY, 1 Taijifit^{TM}); caused them to be more impatient, (1 Taijifit^{TM}), gain weight (1 VY), and have sleep (1 Taijifit^{TM}) and musculoskeletal (1 VY) problems; and decreased their physical fitness (1 VY, 1 Taijifit^{TM}), ability to socialize and/or workout (1 VY, 3 Taijifit^{TM}), and time for themselves (2 VY). Furthermore, three participants reported that their care recipient was

constantly on their mind (3 Taijifit™), while others noted negative feelings towards their informal caregiving obligations (1 VY), feelings of depression (1 Taijifit™), and adverse education and career progression impacts (1 Taijifit™).

Participants were also asked: *What are your top three motivations for participating in this research study?* Twenty-eight participants (15 VY, 13 Taijifit™) responded, noting the following motivations: to maintain or improve physical fitness/endurance (15 VY, 8 Taijifit™), to support research/future informal caregivers (7 VY, 5 Taijifit™), to be motivated/committed to exercise (6 VY, 2 Taijifit™), to feel and be healthier (1 VY, 5 Taijifit™), to improve mental and/or emotional well-being (5 VY, 1 Taijifit™), to try a new form of PA (1 VY, 4 Taijifit™), to provide better informal care (1 VY, 4 Taijifit™), to decrease or manage stress (2 VY, 2 Taijifit™), to lose weight (3 Taijifit™), to expand coping skills (1 VY, 1 Taijifit™), to receive a free exercise program (2 VY), to improve sleep (2 Taijifit™), to increase energy (1 Taijifit™) or self-care (1 Taijifit™), to better deal with anxiety (1 Taijifit™) or guilt (1 VY), to see the quantifiable benefits of VY/ Taijifit™ (1 VY), and because they were recommended by a friend (1 VY).

Table 1

Demographic Characteristics of VY Group (N = 16)

Variable	***N***	**%**
Demographic profile		
Age		
23-40	2	(12.50%)
41-60	5	(31.25%)
61-68	9	(56.25%)
Gender		
Female	11	(68.75%)
Male	5	(31.25%)
Highest level of education completed		
Some university/college	2	(12.50%)
Completed university/college	9	(56.25%)
Some technical school	1	(6.25%)
Completed technical school	1	(6.25%)
Some graduate school	1	(6.25%)
Master's or law degree	2	(12.50%)
Marital status		
Single/never married	1	(6.25%)
Married/living with partner	14	(87.50%)
Divorced/separated	1	(6.25%)
Annual household income		
$25,000-$34,999	1	(6.25%)
$50,000-$74,999	2	(12.50%)
$75,000-$99,999	4	(25%)
$100,000-$149,999	4	(25%)
$150,000-$199,999	3	(18.75%)
$200,000 or more	1	(6.25%)
Did not wish to respond	1	(6.25%)
Current employment status		
Paid work full time (>35 hrs/wk)	4	(25%)
Self-employed full time (>35 hrs/wk)	1	(6.25%)
Paid work part time (<35 hrs/wk)	2	(12.50%)
Unable to work due to sickness or disability	1	(6.25%)
Retired	8	(50%)
Number of children		
0	3	(18.75%)

1	2 (12.50%)
2	3 (18.75%)
3	7 (43.75%)
4	1 (6.25%)
Race/ethnicity	
Caucasian	13 (81.25%)
Asian	1 (6.25%)
Métis	2 (12.50%)
Religion	
Christianity	13 (81.25%)
Islam	1 (6.25%)
No religious affiliation	2 (12.50%)
Number of care recipients	
1	9 (56.25%)
2	6 (37.50%)
4	1 (6.25%)
Hours of informal caregiving per week	
2.5-5	6 (37.50%)
6-10	3 (18.75%)
11-15	1 (6.25%)
20-30	4 (25%)
31-40	1 (6.25%)
90+	1 (6.25%)
Months of caregiving[a]	
1-6	1 (5.88%)
12-24	2 (11.76%)
49-60	3 (17.65%)
61-72	1 (5.88%)
73-84	3 (17.65%)
85-96	1 (5.88%)
109-120	2 (11.76%)
121+	4 (23.53%)
Relationship to care recipient[b]	
Daughter/son	8 (32%)
Spouse/partner	9 (36%)
Daughter/son-in-law	1 (4%)
Sibling	4 (16%)
Friend	3 (12%)
Distance to care recipient[c]	
Live in same dwelling	9 (36%)
Less than 15 minutes by car	7 (28%)
Less than 30 minutes by car	3 (12%)
Between 1-2 hours by car	5 (20%)

Over 3 hours by car	1 (4%)
Main reason(s) for informal caregiving[d]	
Old age/aging needs	9 (36%)
Disease/illness	7 (28%)
Disability	2 (8%)
Mental disorder	1 (4%)
Accident/injury	1 (4%)
Other	5 (20%)
Care recipient requires more care than able to provide[e]	
Yes	13 (52%)
No	12 (48%)
Informal caregiving tasks/responsibilities performed	
Errands/shopping	15 (93.75%)
Emotional and spiritual support	15 (93.75%)
Transportation	13 (81.25%)
Attending appointments	12 (75%)
Visits/phone calls to check in	12 (75%)
Finances (banking, bills)	12 (75%)
Meal preparation, cleaning, dishes	10 (62.50%)
House cleaning/maintenance	10 (62.50%)
Arranging and participating in social events	9 (56.25%)
Medication management	5 (31.25%)
Eating	5 (31.25%)
Ambulation	3 (18.75%)
Toileting/personal hygiene	2 (12.50%)
Other	2 (12.50%)
Number of tasks/responsibilities performed	
4	1 (6.25%)
5	2 (12.50%)
6	1 (6.25%)
7	2 (12.50%)
8	5 (31.25%)
9	1 (6.25%)
10	2 (12.50%)
11	2 (12.50%)
Anticipated continued months of informal caregiving[f]	
1-3 months	1 (4%)
For the remainder of care recipient's life	13 (52%)
For the unforeseeable future	11 (44%)
Care recipient age[g]	
5-20	4 (16%)
36-50	3 (12%)
51-65	4 (16%)

66-75	6 (24%)
76-85	2 (8%)
86-92	6 (24%)
Change in physical activity since informal caregiving	
It has not changed	6 (37.50%)
I do less physical activity	7 (43.75%)
I do more physical activity	3 (18.75%)
Sustained injuries as a result of informal caregiving	
Yes	0 (0%)
No	16 (100%)
Yoga participation in previous 12 months	
0 classes	4 (25%)
1-3 classes	1 (6.25%)
7-10 classes	1 (6.25%)
11-14 classes	1 (6.25%)
20+ classes	3 (18.75%)
Never practiced Yoga before	6 (37.50%)

Note: 16 VY participants reported caring for 25 care recipients.

[a] N=17; one participant cared for 2 care recipients, starting at different times
[b] N=25; 16 participants cared for a total of 25 care recipients
[c] N=25; 16 participants reported on the distance to 25 care recipients
[d] N=25; 7 participants reported caring for more than one care recipient
[e] N=25; 16 participants reported on the needs of 25 care recipients
[f] N=25; 16 participants reported on the anticipated months of caring for 25 care recipients
[g] N=25; age reported for 25 care recipients

Table 2

Demographic Characteristics of Taijifit™ Group (N = 13)

Variable	***N***	**%**
Demographic profile		
Age		
32-45	3	(23.08%)
46-55	3	(23.08%)
56-65	5	(38.46%)
66-77	2	(15.38%)
Gender		
Female	7	(53.85%)
Male	6	(46.15%)
Highest level of education completed		
Some university/college	2	(15.38%)
Completed university/college	4	(30.77%)
Completed technical school	3	(23.08%)
Master's or law degree	3	(23.08%)
PhD or medical degree	1	(7.69%)
Marital status		
Single/never married	2	(15.38%)
Married/living with partner	11	(84.62%)
Annual household income		
$25,000-$34,999	1	(7.69%)
$75,000-$99,999	4	(30.77%)
$100,000-$149,999	2	(15.38%)
$150,000-$199,999	2	(15.38%)
$200,000 or more	1	(7.69%)
Did not wish to respond	3	(23.08%)
Current employment status		
Paid work full time (>35 hrs/wk)	3	(23.08%)
Self-employed full time (>35 hrs/wk)	1	(7.69%)
Paid work part time (<35 hrs/wk)	2	(15.38%)
Self-employed part time (<35 hrs/wk)	2	(15.38%)
Retired	5	(38.46%)
Number of children		
0	5	(38.46%)
2	3	(23.08%)
3	3	(23.08%)
4	2	(15.38%)

Race/ethnicity	
Caucasian	12 (92.31%)
Asian	1 (7.69%)
Religion	
Christianity	6 (46.15%)
No religious affiliation	7 (53.85%)
Number of care recipients	
1	12 (92.31%)
4	1 (7.69%)
Hours of informal caregiving per week	
3.5-5	3 (23.08%)
11-15	3 (23.08%)
20-30	2 (15.38%)
31-40	2 (15.38%)
50-60	1 (7.69%)
70-80	2 (15.38%)
Months of caregiving[a]	
1-6	1 (6.25%)
12-24	2 (12.50%)
25-36	2 (12.50%)
37-48	1 (6.25%)
49-60	4 (25%)
85-96	4 (25%)
97-108	1 (6.25%)
121+	1 (6.25%)
Relationship to care recipient[b]	
Daughter/son	6 (37.50%)
Spouse/partner	6 (37.50%)
Uncle/aunt	3 (18.75%)
Parent	1 (6.25%)
Distance to care recipient[c]	
Live in same dwelling	8 (50%)
Less than 15 minutes by car	2 (12.50%)
Less than 30 minutes by car	2 (12.50%)
Between 30 and 60 minutes by car	1 (6.25%)
Over 3 hours by car	3 (18.75%)
Main reason(s) for informal caregiving[d]	
Old age/aging needs	5 (22.73%)
Disease/illness	9 (40.91%)
Disability	2 (9.09%)
Mental disorder	2 (9.09%)
Accident/injury	1 (4.54%)
Other	3 (13.64%)

Care recipient requires more care than able to provide[e]	
Yes	8 (50%)
No	8 (50%)
Informal caregiving tasks/responsibilities performed	
Attending appointments	13 (100%)
Transportation	11 (84.61%)
Meal preparation, cleaning, dishes	11 (84.61%)
Emotional and spiritual support	10 (76.92%)
House cleaning/maintenance	10 (76.92%)
Visits/phone calls to check in	8 (61.53%)
Errands/shopping	8 (61.53%)
Arranging and participating in social events	8 (61.53%)
Finances (banking, bills)	7 (53.84%)
Medication management	6 (46.15%)
Ambulation	4 (30.76%)
Eating	2 (15.38%)
Toileting/personal hygiene	2 (15.38%)
Other	2 (15.38%)
Number of tasks/responsibilities performed	
3	1 (7.69%)
4	1 (7.69%)
5	1 (7.69%)
6	2 (15.38%)
7	1 (7.69%)
9	3 (23.08%)
10	3 (23.08%)
14	1 (7.69%)
Anticipated continued informal caregiving[f]	
For the remainder of care recipient's life	10 (62.50%)
For the unforeseeable future	6 (37.50%)
Care recipient age[g]	
21-35	5 (31.25%)
51-65	4 (25%)
66-75	2 (12.50%)
76-85	2 (12.50%)
86-92	3 (18.75%)
Change in physical activity since informal caregiving	
It has not changed	5 (38.46%)
I do less physical activity	6 (46.15%)
I do more physical activity	2 (15.38%)
Sustained injuries as a result of informal caregiving	
Yes	1 (7.69%)
No	12 (92.31%)

Tai Chi participation in previous 12 months	
Never practiced Tai Chi before	13 (100%)

Note: 13 Taijifit™ participants reported caring for 16 care recipients.

[a] N=16; one participant cared for 4 care recipients, starting at different times
[b] N=16; 13 participants cared for a total of 16 care recipients
[c] N=16; 13 participants reported on the distance to 16 care recipients
[d] N=22; 4 care recipients had co-morbidities and 1 participant had 4 care recipients, one of which had co-morbidities
[e] N=16; 13 participants reported on the needs of 16 care recipients
[f] N=16; 13 participants reported on the anticipated months of caring for 16 care recipients
[g] N=16; age reported for 16 care recipients

Baseline characteristics of the participants who completed Study I are shown in Table 3. There were no significant differences between the VY (N = 16) and Taijifit™ (N = 13) groups with respect to age ($p = 0.865$), body weight ($p = 0.268$), height ($p = 0.906$), and total leisure activity ($p = 0.665$). There was no change over time between groups in total leisure activity ($F [1, 27] = 2.47$, $p = 0.128$, $\eta 2 = 0.084$) or weight ($F [1, 27] = 2.47$, $p = 0.324$, $\eta 2 = 0.036$).

Table 3. *Participant characteristics at baseline for the VY group and Taijifit™ group*

Group	**Age** (years)	**Weight** (lbs)	**Height** (cm)	**Total Leisure Activity**
VY (N = 16)	55.87 ± 12.31	172.90 ± 31.90	167.57 ± 8.71	26.68 ± 15.39
Taijifit™ (N = 13)	55.07 ± 12.65	187.80 ± 39.07	167.92 ± 6.48	30.46 ± 30.07

Values are means ± standard deviation.

16.2.2 Self-report PA, Internet PA, and Informal Caregiving Logs. Self-report training logs assessed adherence to the VY and Taijifit™ programs throughout the 12-week intervention. All twenty-nine participants (16 VY, 13 Taijifit™) completed their logs and recorded an average of 1626.07 ± 224.05 minutes of VY or Taijifit™ over the 12 week period out of the required 1800 minutes, averaging 135.51 ± 7.72 minutes of PA per week (see Table 4 for the 12-week total and weekly average of self-report VY and Taijifit™ participation). Twenty-seven participants (14 VY, 13 Taijifit™) recorded the duration of each VY or Taijifit™ session in their training log, which revealed that the majority (45.64%) of all VY and Taijifit™ sessions ranged from 16-30 minutes, followed by ≤ 15 minutes (36.26%), 31-45 minutes (10.56%), 45-60 minutes (6.11%), and 61-75 minutes (1.42%). Overall, 81.9% of all VY and Taijifit™ was performed in sessions of 30 minutes or less. Specifically, the majority (52.61%) of VY sessions were between 16 and 30 minutes in length, followed by ≤ 15 minutes (19.03%), 31-45 minutes (14.42%), 45-60 minutes (11.15%), and 61-75 minutes (2.79%). Overall, 71.64% of all VY was performed in sessions of 30 minutes or less. Similarly, 91.74% of all Taijifit™ was performed in sessions of 30 minutes or less. Unlike the majority of VY sessions, which were 16 to 30 minutes in length, the majority (52.79%) of Taijifit™ sessions were ≤ 15 minutes in length, followed 16-30 minutes (38.95%), 31-45 minutes (6.86%), 45-60 minutes (1.28%), and 61-75 minutes (0.12%).

Internet PA logs were retrieved and recorded for all twenty-nine participants (16 VY, 13 Taijifit™). According to the online activity tracking system, VY (N = 16) and Taijifit™ participants (N = 13) performed an average of 1738.79 ± 308.01 minutes of VY or Taijifit™ over the 12-week period, averaging 144.90 ± 10.62 minutes of VY or

Taijifit™ per week (see Table 4 for the 12-week total and weekly average of Internet VY and Taijifit™ participation).

There was a statistically significant difference with respect to recorded training volume (self-report PA logs vs. Internet PA logs) between groups (VY vs. Taijifit™). The VY group performed more self-report PA (1712.93 ± 190.2 minutes; $F [1,27] = 6.40$, $p = 0.018$) compared to the Taijifit™ group (1519.15 ± 222.5 minutes). Internet PA was also higher in the VY group (1858.43 ± 326.48 minutes; $F [1, 27] = 6.43$, $p = 0.017$) compared to the Taijifit™ group (1591.54 ± 213.45 minutes). There was a statistically significant difference with respect to the self-reported and Internet PA logs (training volume) for both the VY ($t (15) = 2.209$; $p = 0.043$) and Taijifit™ ($t (12) = 5.417$; $p = 0.001$) groups, with Internet PA logs showing a higher training volume than self-reported PA logs for both groups.

Caregiving logs assessed hours of informal caregiving throughout the 12-week intervention. Twenty-seven participants (14 VY, 13 Taijifit™) submitted their informal caregiving logs. Altogether, VY and Taijifit™ participants reported an average of 273.11 ± 325.02 hours of informal caregiving over the 12-week intervention, averaging 22.76 ± 12.03 hours per week (see Table 4 for the 12-week total and weekly average of self-report informal caregiving by group).

Table 4. *Self-report PA, Internet PA, and informal caregiving logs for the duration of the 12-week VY and Taijifit™ intervention*

Group	**Self-report PA log** (mins)	**Internet log** (mins)	**Informal caregiving log** (hours)
VY (N=16)			
12-week total	1712.93 ± 190.20	1858.43 ± 326.48	168.79 ± 260.56
Weekly average	142.74 ± 11.88	154.87 ± 20.40	14.07 ± 18.61
Taijifit™ (N=13)			
12-week total	1519.15 ± 222.50	1591.54 ± 213.45	385.47 ± 359.10
Weekly average	126.60 ± 17.12	132.63 ± 16.42	32.12 ± 27.62

Values are means ± standard deviation.

16.2.3 Muscle Strength and Endurance. There were no statistically significant differences between groups at baseline for strength (1-RM leg press: $p = 0.924$, 1-RM chest press: $p = 0.714$, total body strength: $p = 0.992$, right hand-grip: $p = 0.812$, left hand-grip: $p = 0.935$, total hand-grip: $p = 0.871$) and endurance (leg press: $p = 0.749$, chest press: $p = 0.085$, abdominal curl up: $p = 0.082$, total body endurance: $p = 0.750$).

There was a time main effect for 1-RM leg press strength ($F [1, 27] = 41.89$, $p < 0.001$, $\eta2 = 0.608$), 1-RM chest press strength ($F [1, 27] = 32.37$, $p < 0.001$, $\eta2 = 0.545$), total body strength (leg press and chest press combined; $F [1, 27] = 52.28$, $p < 0.001$, $\eta2 = 0.659$), leg press endurance ($F [1, 27] = 29.31$, $p < 0.001$, $\eta2 = 0.521$), total body endurance (leg press and chest press combined; $F [1, 27] = 42.34$, $p < 0.001$, $\eta2 = 0.611$), right hand-grip strength ($F [1, 27] = 49.41$, $p < 0.001$, $\eta2 = 0.647$), left hand-grip strength ($F [1, 27] = 28.64$, $p < 0.001$, $\eta2 = 0.515$), and total hand-grip strength (both hands combined; $F [1, 27] = 45.94$, $p < 0.001$, $\eta2 = 0.630$), with no differences between groups over time (see Table 5).

There was a time main effect ($F [1, 27] = 107.37$, $p < 0.001$, $\eta 2 = 0.799$) and a group x time interaction for chest press endurance ($F [1, 27] = 6.26$, $p = 0.019$, $\eta 2 = 0.188$). Both the VY and Taijifit™ groups increased chest press endurance over time but the change was greater in the VY group compared to the Taijifit™ group. Similar to chest press endurance, there was a time main effect ($F [1, 27] = 28.38$, $p < 0.001$, $\eta 2 = 0.513$) and a group x time interaction ($F [1, 27] = 4.96$, $p = 0.034$, $\eta 2 = 0.155$) for abdominal curl-up. Both the VY and Taijifit™ groups increased abdominal curl-ups over time but the change was greater in the VY group compared to the Taijifit™ group (see Table 5).

Table 5. *Muscle strength and endurance for leg press, chest press, abdominal curl-up, and hand-grip before and after 12 weeks of VY and Taijifit™*

Strength	**VY**		**Taijifit™**			
Exercise	**Pre**	**Post**	**Pre**	**Post**	**p-value**	**η2**
1-RM Leg Press (lbs)	344.06 ± 142.17	402.81 ± 131.88*	339.15 ± 130.30	390.30 ± 122.33*	<0.001	0.608
1-RM Chest Press (lbs)	94.06 ± 41.23	103.59 ± 49.29*	99.61 ± 38.91	107.69 ± 42.30*	<0.001	0.545
1-RM Total Strength (lbs)	438.12 ± 168.64	506.40 ± 164.75*	438.76 ± 155.12	498.00 ± 149.67*	<0.001	0.659
Right Hand-Grip (kg)	26.28 ± 13.43	29.81 ± 12.10*	27.26 ± 6.96	29.92 ± 8.94*	<0.001	0.647
Left Hand-Grip (kg)	24.43 ± 12.67	27.71 ± 12.29*	24.76 ± 7.59	27.46 ± 8.27*	<0.001	0.515
Total Hand-Grip (kg)	50.71 ± 25.98	57.53 ± 24.18*	52.03 ± 14.02	57.38 ± 16.79*	<0.001	0.630
Endurance (number of repetitions)						
Exercise						
Leg Press	27.37 ± 11.35	56.93 ± 34.81*	29.00 ± 15.67	50.23 ± 25.57*	<0.001	0.521
Chest Press	19.25 ± 5.90	28.06 ± 7.60**	15.69 ± 4.49	21.07 ± 5.85*	0.019	0.799
Abdominal Curl-Ups	37.12 ± 31.26	68.43 ± 55.07**	19.23 ± 19.00	32.07 ± 20.87*	0.034	0.513
Total Endurance	46.62 ± 14.62	85.00 ± 38.49*	44.69 ± 17.77	71.30 ± 28.22*	<0.001	0.611

Values are mean ± standard deviation.
* Indicates a significant change over time ($p < 0.05$).
** Indicates VY group had greater improvements compared to the Taijifit™ group ($p < 0.05$).

16.2.4 Functionality and Flexibility. There were no statistically significant differences between groups at baseline for tasks of functionality (balance: $p = 0.451$, walking speed: $p = 0.889$). There was a statistically significant difference with respect to baseline flexibility ($p = 0.002$); the VY group had greater flexibility (32.0 ± 7.0) at baseline compared to the Taijifit™ group (21.6 ± 8.8).

There was a time main effect for balance ($F [1, 27] = 16.58$, $p < 0.001$, $\eta 2 = 0.381$), walking speed ($F [1, 27] = 29.35$, $p < 0.001$, $\eta 2 = 0.521$), and flexibility ($F [1, 27] = 26.53$, $p < 0.001$, $\eta 2 = 0.496$), with no differences between groups over time (see Table 6).

Table 6. *Functionality tests (balance, walking speed) and flexibility before and after 12 weeks of VY and Taijifit™*

Tests	**VY**		**Taijifit™**			
Functionality	**Pre**	**Post**	**Pre**	**Post**	**p-value**	**η2**
Balance (step-offs)	3.34 ± 5.61	1.53 ± 2.67*	4.92 ± 5.42	2.11 ± 2.74*	<0.001	0.381
Walking Speed (sec)	43.42 ± 21.25	30.31 ± 14.74*	42.24 ± 23.64	28.35 ± 15.78*	<0.001	0.521
Flexibility						
Flexometer (cm)	32.04 ± 7.08	36.04 ± 6.04*	21.67 ± 8.89	28.79 ± 9.63*	<0.001	0.496

Values are mean ± standard deviation.
* Indicates a significant change over time ($p < 0.05$).

16.2.5 Quality of Life. There were no statistically significant differences between groups at baseline for overall mental health (MCS: $p = 0.244$) or the physical functioning ($p = 0.148$), social functioning ($p = 0.096$), role-emotional ($p = 0.155$), and mental health ($p = 0.361$) subscales. There was a statistically significant difference at baseline for overall physical health (PCS: $p = 0.008$) and the role-physical ($p = 0. 023$), bodily pain ($p = 0.002$), general health ($p = 0.043$), and vitality ($p = 0.036$) subscales, with the VY group reporting greater values compared to the Taijifit™ group.

There was a time main effect for the physical functioning ($F [1, 27] = 21.93$, $p < 0.001$, $\eta2 = 0.448$), role-physical ($F [1, 27] = 26.38$, $p < 0.001$, $\eta2 = 0.494$), social functioning ($F [1, 27] = 17.39$, $p < 0.001$, $\eta2 = 0.392$), role-emotional ($F [1, 27] = 44.05$, $p < 0.001$, $\eta2 = 0.620$), and mental health ($F [1, 27] = 12.17$, $p = 0.002$, $\eta2 = 0.311$) subscales, as well as a time main effect for the MCS ($F [1, 27] = 39.38$, $p < 0.001$, $\eta2 = 0.593$), with no differences between groups over time (see Table 7).

Regarding bodily pain, there was a time main effect ($F [1, 27] = 29.05$, $p < 0.001$, $\eta2 = 0.518$) and a group x time interaction ($F [1, 27] = 6.04$, $p = 0.021$, $\eta2 = 0.183$). Both groups experienced a decrease in bodily pain over time (a higher score indicates a lack of bodily pain and no limitations due to pain), but the change was greater in the Taijifit™ group compared to the VY group. Similar to bodily pain, there was a time main effect ($F [1, 27] = 26.13$, $p < 0.001$, $\eta2 = 0.492$) and a group x time interaction ($F [1, 27] = 9.16$, $p = 0.005$, $\eta2 = 0.253$) for general health. Both groups' general health scores increased over time, but the change was greater in the Taijifit™ group compared to the VY group. There was also a time main effect ($F [1, 27] = 57.33$, $p < 0.001$, $\eta2 = 0.680$) and a group x time interaction for vitality ($F [1, 27] = 6.37$, $p = 0.018$, $\eta2 = 0.191$). Both groups increased

vitality over time, but the change was greater in the Taijifit™ group compared to the VY group. Regarding the PCS, there was a time main effect ($F [1, 27] = 32.02$, $p < 0.001$, $\eta 2 = 0.543$) and a group x time interaction ($F [1, 27] = 5.56$, $p = 0.026$, $\eta 2 = 0.171$). Both the VY and Taijifit™ groups' PCS increased over time, but the change was greater in the Taijifit™ group compared to the VY group (see Table 7).

Mean group change scores in both the VY and Taijifit™ groups exceeded the threshold for minimally important difference values in the PCS (VY: +2.92 *T* score points, Taijifit™: +7.1 *T* score points) and MCS (VY: +5.7 *T* score points, Taijifit™: +10.69 *T* score points) and role-physical (VY: +4.78 *T* score points, Taijifit™: +6.91 *T* score points), bodily pain (VY: +3.73 *T* score points, Taijifit™: +9.98 *T* score points), general health (VY: +2.94 *T* score points, Taijifit™: +11.48 *T* score points), vitality (VY: +7.43 *T* score points, Taijifit™: +14.85 *T* score points), social functioning (VY: +5.64 *T* score points, Taijifit™: +7.72 *T* score points), and role-emotional (VY: +6.32 *T* score points, Taijifit™: +9.37 *T* score points) subscales. The Taijifit™ group exceeded the threshold for minimally important difference values in the physical functioning (+4.57 *T* score points) and mental health (+8.46 *T* score points) subscales.

Table 7. *Quality of Life before and after 12 weeks of VY and Taijifit™*

	VY		Taijifit™			
Subscales	**Pre**	**Post**	**Pre**	**Post**	**p-value**	**η2**
Physical functioning	52.63 ± 5.67	54.78 ± 3.49*	48.70 ± 8.50	53.27 ± 5.80*	<0.001	0.448
Role-physical	50.13 ± 6.90	54.91 ± 4.56*	42.30 ± 10.51	49.21 ± 8.53*	<0.001	0.494
Bodily pain	50.23 ± 7.01	53.96 ± 6.63*	41.00 ± 7.40	50.98 ± 8.36**	0.021	0.518
General health	52.29 ± 9.88	55.23 ± 8.93*	43.93 ± 11.31	55.41 ± 7.06**	0.005	0.492
Vitality	47.58 ± 10.10	55.01 ± 7.53*	39.80 ± 8.61	54.65 ± 8.86**	0.018	0.680
Social functioning	48.25 ± 10.06	53.89 ± 7.02*	40.75 ± 13.32	48.47 ± 8.72*	<0.001	0.392
Role-emotional	45.93 ± 8.66	52.25 ± 6.71*	40.63 ± 10.88	50.00 ± 7.80*	<0.001	0.620
Mental health	49.06 ± 10.45	51.52 ± 9.33*	45.62 ± 9.18	54.08 ± 6.85*	0.002	0.311
Health Component Summary Measures						
PCS	52.74 ± 5.91	55.66 ± 4.87*	44.91 ± 8.80	52.01 ± 6.80**	0.026	0.543
MCS	46.06 ± 11.86	51.76 ± 8.99*	41.14 ± 9.98	51.83 ± 6.70*	<0.001	0.593

Values are mean ± standard deviation.
* Indicates a significant change over time ($p < 0.05$).
** Indicates Taijifit™ group had greater improvements compared to the VY group ($p < 0.05$).

16.2.6 Evaluation of the Program. The following themes emerged from the 10 open-ended survey questions:

Question 1: *Have you noticed any positive or negative changes in your physical and/or mental health since participating in the Yoga/Tai Chi program? Please explain.* All twenty-nine participants (16 VY, 13 Taijifit™) reported that they noticed positive changes in their physical and/or mental health. Physically, participants reported perceived improvements to flexibility (8 VY, 4 Taijifit™), strength (6 VY, 2 Taijifit™), sleep (5 Taijifit™), balance (4 Taijifit™), energy (2 VY, 2 Taijifit™), endurance (2 VY, 1 Taijifit™), coordination (2 Taijifit™), posture (1 VY), and overall well-being (1 Taijifit™) as well as reductions in aches and pains (4 VY, 2 Taijifit™), heart rate (1 Taijifit™), weight (1 VY), and prescription medication use (1 VY). Participants also reported the following changes: increased relaxation/calm (9 Taijifit™), mental strength/focus (7 VY, 1 Taijifit™), productivity/motivation (4 Taijifit™), positive outlook/mood (2 VY, 5 Taijifit™), ability to cope with stress (1 VY), and mindfulness/awareness (1 VY, 1 Taijifit™). Finally, two participants (1 VY, 1 Taijifit™) reported a reduction in anxiety/worry and one VY participant reported having quit smoking during the intervention.

Question 2a: *Has participating in the program changed your outlook and/or expectations regarding your current or future health (e.g., mental, physical, emotional, spiritual, and/or social health)? Please explain.* Twenty-six participants (14 VY, 12 Taijifit™) answered “yes”, two participants (1 VY, 1 Taijifit™) answered “no”, and one VY participant did not respond. Only those who answered “yes” provided further clarification. The most noted changes as a result of participating in the program included

the realization of agency in one's future health and fitness (8 VY, 5 Taijifit™), the importance of self-care (4 VY, 3 Taijifit™), and the importance of balancing caregiving vs. self-care for health (2 VY, 4 Taijifit™). Other emerging themes included: discovering that 150 minutes of exercise per week can lead to positive improvements (1 VY, 3 Taijifit™), greater physical and mental well-being (2 VY, 1 Taijifit™), feeling more energized/refreshed (1 VY, 2 Taijifit™), recognizing the value of being more present with people and activities (3 Taijifit™), realizing the importance of a calm and stable demeanour (2 VY, 1 Taijifit™), and understanding the value of stretching (2 VY, 1 Taijifit™). Finally, participants also noted the program's influence on healthier life choices (2 Taijifit™), the value of feeling spiritually connected (2 VY), and an increase in self-worth (1 VY).

Question 2b: *Has participating in the program changed your outlook on the importance and/or benefits of being physically active? Please explain.* Twenty-six participants (13 VY, 13 Taijifit™) answered, "yes", while three VY participants reported that they had the same outlook as before the intervention. The most noted change in outlook reported by nine participants (4 VY, 5 Taijifit™) was that little bouts of exercise add up to improve health. Several other themes emerged regarding the importance of being physically active, including: that exercise motivates continued exercise (2 VY, 1 Taijifit™) and that participants realized they needed to exercise more (3 Taijifit™); that exercise helps reduce aches and pains (3 VY), promotes calm (2 VY, 1 Taijifit™), and increases energy (1 VY, 2 Taijifit™); that stretching and flexibility are vital aspects of overall health (2 VY, 1 Taijifit™); and that exercising at home could be effective (1 Taijifit™). Participants also reported benefits to sleep (1 VY), informal caregiving (1

VY), and self-esteem (1 Taijifit™) as well as the value of trying new forms of PA (1 Taijifit™) and exercising the whole body (1 Taijifit™).

Question 3: *How did participation in the Yoga/Tai Chi program impact your informal caregiving role? Please explain.* Twenty-seven participants (15 VY, 12 Taijifit™) reported positive impacts to their informal caregiving role, one Taijifit™ participant reported that the program did not impact informal caregiving, and one VY participant did not respond. Of those that responded, the most predominant themes that emerged were feeling more calm/patient while caregiving (5 VY, 4 Taijifit™) and feeling energized/less fatigued for their role (4 VY, 3 Taijifit™). These were followed by a greater ability to cope with informal caregiving (2 VY, 3 Taijifit™), generally feeling happier and healthier (4 VY, 1 Taijifit™), being more mindful and open-minded (2 VY, 2 Taijifit™), and appreciating some much needed "me time" (2 VY, 2 Taijifit™). Participants also reported feeling more positive (1 VY, 2 Taijifit™) and less stressed before, during, and after caregiving (2 Taijifit™), improved sleep (2 Taijifit™), going with the "flow" while caregiving (1 Taijifit™), greater motivation as a caregiver (1 Taijifit™) and empathy towards their care recipient (1 Taijifit™), a strengthened relationship with their care recipient (1 VY), and re-evaluating their time spent caregiving vs. self-care (1 Taijifit™).

Question 4a: *What did you like most about the program being delivered at-home (convenience, video quality/variability, instructors, etc.)?* Twenty-three participants (12 VY, 11 Taijifit™) reported most enjoying the flexibility/convenience of the program as well as the quality of the instructors (9 VY, 8 Taijifit™). Thirteen participants (7 VY, 6 Taijifit™) also noted enjoying the quantity and variety of videos/classes available, while

others appreciated the video (HD) quality (3 VY, 5 Taijifit^{TM}), the privacy/ability to exercise at home (4 VY, 4 Taijifit^{TM}), and the simplicity of use (1 VY, 2 Taijifit^{TM}).

Question 4b: *What did you like least?* Twenty-five participants (12 VY, 13 Taijifit^{TM}) responded, eight of which (4 VY, 4 Taijifit^{TM}) answered that there was nothing they did not like. Three Taijifit^{TM} participants noted that the fast pace was difficult, while two Taijifit^{TM} participants did not enjoy the slow pace of the practice. Three participants (1 VY, 2 Taijifit^{TM}) did not like failing to perform 150 minutes/week and two VY participants did not like their slow Internet connection. Participants also reported that the program was difficult to set-up at first (1 Taijifit^{TM}), there were too many video options (1 VY), there was no interaction with others (1 Taijifit^{TM}), that they wished the program was longer (1 Taijifit^{TM}), that instructors didn't value precision of poses (1 Taijifit^{TM}), and that they were unsure if poses were being done correctly (1 VY). Finally, one VY participant found it difficult to see the screen and practice and to self-motivate to practice, while one participant did not enjoy the restriction in VY style and another did not enjoy the tone of some VY instructors.

Question 5: *What, if anything, did you find useful and/or valuable about having access to a certified Yoga/Tai Chi instructor throughout the duration of the program? Please explain.* Participants reported on the value of the certified instructor's knowledge of VY/Taijifit^{TM} (2 VY, 4 Taijifit^{TM}), support/encouragement (1 VY, 4 Taijifit^{TM}), demonstration of proper technique (3 VY, 1 Taijifit^{TM}), modification of poses (1 VY, 1 Taijifit^{TM}), optimism/enthusiasm (1 Taijifit^{TM}), calmness/mindfulness (1 Taijifit^{TM}), friendliness (1 VY), and insight into anatomy/physiology (1 Taijifit^{TM}). Additionally, four participants (1 VY, 3 Taijifit^{TM}) reported that having access to a certified

VY/Taijifit™ instructor helped with their confidence, while two VY participants expressed that simply knowing the instructor was available was important.

Question 6a: *In general, what are the barriers that may impact your ability to participate in physical activity? Please explain.* Informal caregivers identified the following barriers to PA: time (5 VY, 7 Taijifit™), laziness/motivation (2 VY, 7 Taijifit™), energy (4 VY, 1 Taijifit™), physical issues (4 VY, 1 Taijifit™), accessibility (3 Taijifit™), cost (1 VY, 1 Taijifit™), weather (1 VY, 1 Taijifit™), and caregiving responsibilities (2 Taijifit™). Six participants (4 VY, 2 Taijifit™) reported no barriers to PA participation.

Question 6b: *Did you encounter any barriers to participating in the Yoga/Tai Chi program? Please explain.* The following barriers were encountered by informal caregivers participating in the VY/Taijifit™ interventions: time/time management (4 VY, 1 Taijifit™), physical ailments (2 VY, 1 Taijifit™), caregiving responsibilities (2 Taijifit™), self-motivation (1 VY), and travel (1 VY). Fourteen participants (7 VY, 7 Taijifit™) reported no barriers to participating in the VY/Taijifit™ program.

Question 6c: *What can be done, if anything, to make it easier for informal caregivers to participate in a program such as this in the future? Further, is there anything we could have done to make <u>your</u> participation easier? Please explain.* Seventeen participants (7 VY, 10 Taijifit™) reported that nothing more could be done and it was easy to participate, while five participants (3 VY, 2 Taijifit™) did not respond and 1 VY participant was unsure. Participants also provided the following suggestions: offering more online exercises (1 Taijifit™), providing a DVD supplement (1 VY),

flexibility on achieving 150 minutes/week (1 VY), less video choice (1 VY), access to a quiet space and props (1 VY), and continued access to the program (1 VY).

Question 6d: *Would you recommend this program to other informal caregivers? Yes/No.* All 29 participants (16 VY, 13 Taijifit™) reported "yes"; they would recommend this program to other informal caregivers.

Question 7: *Did you find it manageable to achieve the goal of doing 150 minutes of Yoga/Tai Chi per week? Please explain.* Twenty-one participants (11 VY, 10 Taijifit™) answered "yes", five participants (3 VY, 2 Taijifit™) answered "no", and three participants (2 VY, 1 Taijifit™) answered that it was "challenging". The five participants who answered "no" further elaborated: two participants (2 Taijifit™) noted it was not achievable as a result of their personal motivation/laziness, one VY participant noted personal circumstances, one VY participant noted time constraints, and another VY participant noted a hectic travel schedule.

Question 8: *Do you have an interest in continuing your Yoga/Tai Chi practice? Yes/No.* All 29 participants (16 VY, 13 Taijifit™) reported "yes"; they would like to continue their VY/Taijifit™ practice.

Question 9: *Would you have been able to achieve 150 minutes of Yoga/Tai Chi per week had the program been delivered at a studio on specific days and times? Yes/No.* Twenty-six participants (13 VY, 13 Taijifit™) reported "no"; they would not have been able to achieve 150 minutes of VY/Taijifit™ per week had the intervention not been delivered in the home. Three VY participants reported "yes"; they could have achieved 150 minutes of VY per week outside the home.

Question 10: *Other than this program, have you been offered access to any*

physical activity programs because of your status as an informal caregiver? Yes/No. All 29 participants (16 VY, 13 Taijifit™) reported "no"; they have not been offered access to any PA programs as a result of being an informal caregiver.

Please share any thoughts or comments you may have that were not covered by the questionnaire. Eleven participants (4 VY, 7 Taijifit™) expressed gratitude for the program and seven participants (3 VY, 4 Taijifit™) expressed gratitude for the researcher. Six participants (4 VY, 2 Taijifit™) noted their intentions to continue their VY or Taijifit™ practice, while five participants (4 VY, 1 Taijifit™) reiterated their perceived physical and mental benefits. Three participants (1VY, 2 Taijifit™) expressed a continued need for this program for informal caregivers and three participants (1 VY, 2 Taijifit™) noted the importance of at-home PA options. Finally, individual participants also expressed the value of doing something for themselves (VY), their love of the whole program design (Taijifit™), their appreciation that the intervention was free of charge (Taijifit™), that they learned important tools for the future (VY), that they were inspired to quit smoking after 30+ years (VY), and that they had significantly reduced their smoking and intended on quitting (VY).

16.2.7 Adverse Events. There were no reported injuries or adverse events related to the VY or Taijifit™ programs.

16.3 Study II

16.3.1 Participants. Twenty-six participants (11 males, 15 females) who completed Study I were used for Study II. All testing was conducted within 2.15 ± 4.32 days (VY group = 2.64 ± 5.16 days; Taijifit™ group = 1.58 ± 3.20 days) of the six week cessation period. Three participants (2 VY, 1 Taijifit™) from Study I did not complete

cessation testing (Study II) as they were out of the country. Briefly, the two VY participants that did not complete follow-up cessation testing were: 1) a 68 year old married female who spent 28 hours per week caring for her 69 year old spouse for the previous 120 months as a result of a disease/illness and 2) a 68 year old married female who spent 6 hours per week caring for her 91 year old mother and 69 year old spouse for the previous 72 (mother) and 12 (spouse) months as a result of old age/aging needs (mother) and a disease/illness (spouse). Lastly, the Taijifit™ participant that did not complete follow-up cessation testing was a 77 year old married female who spent 40 hours per week caring for her 83 year old spouse for the previous 36 months as a result of a disease/illness.

There were no statistically significant differences between the VY (N = 14) and Taijifit™ (N = 12) groups with respect to age ($p = 0.849$), body weight ($p = 0.223$), height ($p = 0.903$), and total leisure activity ($p = 0.599$) and there was no change over time between groups for total leisure activity ($F [1, 27] = 2.64$, $p = 0.117$, $\eta 2 = 0.099$) or weight ($F [1, 27] = 0.452$, $p = 0.508$, $\eta 2 = 0.018$).

Table 8. *Participant characteristics at baseline for the VY group and Taijifit™ group*

Group	**Age** (years)	**Weight** (lbs)	**Height** (cm)	**Total Leisure Activity**
VY (N = 14)	176.95 ± 32.73	176.95 ± 32.73	168.65 ± 8.75	20.85 ± 11.07
Taijifit™ (N = 12)	191.80 ± 35.00	191.8 ± 35.00	169.00 ± 5.40	32.50 ± 32.10

Values are means ± standard deviation.

16.3.2 Informal Caregiving Logs. Caregiving logs assessed hours of informal caregiving throughout the six week cessation period. Twenty-five participants (13 VY, 12 Taijifit™) submitted their informal caregiving logs. Altogether, VY and Taijifit™ participants reported an average of 151.53 ± 197.05 hours of informal caregiving over the six week cessation period, averaging 25.25 ± 7.57 hours per week. VY participants (N = 13) reported an average of 117.67 ± 203.40 hours of informal caregiving over the cessation period, averaging 19.61 ± 15.64 hours per week. Taijifit™ participants (N = 12) reported an average of 200.85 ± 188.84 hours of informal caregiving over the cessation period, averaging 33.47 ± 15.73 hours per week.

16.3.3 Muscle Strength and Endurance. There were no statistically significant differences between groups at baseline for strength (1-RM leg press: $p = 0.807$, 1-RM chest press: $p = 0.837$; total body strength: $p = 0.762$, hand-grip right: $p = 0.918$, hand-grip left: $p = 0.842$, total hand-grip: $p = 0.878$) and endurance (leg press: $p = 0.681$, total body $p = 0.396$). There was a statistically significant difference at baseline for chest press endurance ($p = 0.020$) and abdominal endurance ($p = 0.039$); the VY group had greater chest press endurance (28.4 ± 7.6) and abdominal endurance (72.7 ± 57.8) at baseline compared to the Taijifit™ group (chest press endurance: 21.8 ± 8.8, abdominal endurance: 34.2 ± 20.2).

There was no significant change over time for 1-RM leg press strength ($F [1, 24] = .221$, $p = 0.642$, $\eta2 = 0.009$), total body strength ($F [1, 24] = 0.420$, $p = 0.524$, $\eta2 = 0.019$), leg press endurance ($F [1, 24] = 0.851$, $p = 0.365$, $\eta2 = 0.034$), total body endurance ($F [1, 24] = 0.228$, $p = 0.637$, $\eta2 = 0.009$), abdominal curl-ups ($F [1, 24] = 0.013$, $p = 0.910$, $\eta2 = 0.001$), right hand-grip strength ($F [1, 24] = 2.35$, $p = 0.138$, $\eta2 =$

0.089), left hand-grip strength ($F [1, 24] = 0.128$, $p = 0.724$, $\eta 2 = 0.005$), or total hand-grip strength ($F [1, 24] = 1.46$, $p = 0.238$, $\eta 2 = 0.058$). There was a decrease over time for 1-RM chest press strength ($F [1, 24] = 4.80$, $p = 0.038$, $\eta 2 = 0.167$) and chest press endurance ($F [1, 24] = 5.76$, $p = 0.024$, $\eta 2 = 0.194$), with no differences between groups (see Table 9).

Table 9. *Muscle strength and endurance for leg press, chest press, abdominal curl-up, and hand-grip before and after 6 weeks of cessation from VY and Taijifit™.*

Strength	**VY**		**Taijifit™**			
Exercise	**Pre**	**Post**	**Pre**	**Post**	**p-value**	**η2**
1-RM Leg Press (lbs)	418.57 ± 132.31	404.57 ± 117.62	406.58 ± 112.11	412.41 ± 111.47	0.642	0.009
1-RM Chest Press (lbs)	109.64 ± 49.86	109.28 ± 48.51*	113.33 ± 38.74	110.41 ± 39.28*	0.038	0.167
1-RM Total Strength (lbs)	503.15 ± 139.89	487.69 ± 125.89	497.72 ± 113.54	500.90 ± 114.97	0.524	0.019
Right Hand-Grip (kg)	31.39 ± 12.13	31.32 ± 12.92	30.95 ± 8.48	29.87 ± 6.95	0.138	0.089
Left Hand-Grip (kg)	29.17 ± 12.45	29.42 ± 12.54	28.33 ± 7.98	27.83 ± 6.86	0.724	0.005
Total Hand-Grip (kg)	60.57 ± 24.35	60.75 ± 25.30	59.29 ± 16.00	57.70 ± 13.59	0.238	0.058
Endurance (number of repetitions)						
Exercise						
Leg Press	58.00 ± 36.94	62.35 ± 52.16	52.75 ± 24.96	55.91 ± 25.06	0.365	0.034
Chest Press	28.42 ± 7.68	26.92 ± 7.95*	21.83 ± 5.40	19.83 ± 4.54*	0.024	0.194
Abdominal Curl-Ups	72.71 ± 57.81	70.42 ± 57.55	34.25 ± 20.20	37.00 ± 22.35	0.910	0.001
Total Endurance	86.42 ± 40.45	89.28 ± 53.03	74.58 ± 26.77	75.75 ± 27.40	0.637	0.009

Values are mean ± standard deviation.
* Indicates a significant change over time ($p < 0.05$).

16.3.4 Functionality and Flexibility. There were no significant differences between groups at baseline for tasks of functionality (balance: $p = 0.503$, walking speed: $p = 0.488$). There was a significant difference at baseline for flexibility ($p = 0.023$); the VY group had greater flexibility (36.6 ± 5.3) at baseline compared to the Taijifit™ group (flexibility: 29.2 ± 9.9).

There was no significant change over time for balance ($F [1, 24] = 0.529$, $p = 0.474$, $\eta 2 = 0.022$), walking speed ($F [1, 24] = 0.012$, $p = 0.913$, $\eta 2 = 0.001$), or flexibility ($F [1, 24] = 2.82$, $p = 0.106$, $\eta 2 = 0.105$; see Table 10).

Table 10. *Functionality tests (balance, walking speed) and flexibility before and after 6 weeks of cessation from VY and Taijifit™*

Tests	**VY**		**Taijifit™**			
Functionality	**Pre**	**Post**	**Pre**	**Post**	**p-value**	**η2**
Balance (step-offs)	1.50 ± 2.78	1.42 ± 2.04	2.25 ± 2.82	2.58 ± 2.98	0.474	0.022
Walking Speed (sec)	30.04 ± 15.75	30.83 ± 19.14	25.76 ± 14.11	24.69 ± 11.46	0.913	0.001
Flexibility						
Flexometer (cm)	36.66 ± 5.33	35.67 ± 6.27	29.23 ± 9.92	28.87 ± 9.43	0.106	0.105

Values are mean ± standard deviation.

16.3.5 Quality of Life. There were no statistically significant differences between groups at baseline for all eight QOL subscales (physical functioning: $p = 0.688$; role-physical: $p = 0.055$; social functioning: $p = 0.118$; role-emotional: $p = 0.658$; bodily pain: $p = 0.457$; vitality: $p = 0.958$; mental health: $p = 0.533$; and general health: $p = 0.875$) and overall physical (PCS: $p = 0.219$) and mental (MCS: $p = 0.949$) health.

There was no significant change over time between groups for both health component summary measures (PCS, MCS) and seven of the eight subscales: PCS ($F [1, 24] = 4.15$, $p = 0.053$, $\eta 2 = 0.148$), MCS ($F [1, 24] = 1.27$, $p = 0.271$, $\eta 2 = 0.050$), role-physical ($F [1, 24] = 0.329$, $p = 0.571$, $\eta 2 = 0.014$), bodily pain ($F [1, 24] = 1.216$, $p = 0.281$, $\eta 2 = 0.048$), general health ($F [1, 24] = 3.56$, $p = 0.071$, $\eta 2 = 0.129$), vitality ($F [1, 24] = 1.61$, $p = 0.215$, $\eta 2 = 0.063$), social functioning ($F [1, 24] = 0.129$, $p = 0.723$, $\eta 2 = 0.005$), role-emotional ($F [1, 24] = 1.98$, $p = 0.171$, $\eta 2 = 0.077$), and mental health ($F [1, 24] = 0.275$, $p = 0.605$, $\eta 2 = 0.011$), however, there was a time main effect for physical functioning ($F [1, 24] = 5.43$, $p = 0.029$, $\eta 2 = 0.185$, with no differences between groups (see Table 11).

Table 11. *Quality of Life before and after 6 weeks of cessation from VY and Taijifit™*

	VY		Taijifit™			
Subscales	**Pre**	**Post**	**Pre**	**Post**	**p-value**	**η2**
Physical functioning	54.66 ± 3.65	53.85 ± 4.65*	53.87 ± 5.62	52.43 ± 7.31*	0.029	0.185
Role-physical	55.23 ± 4.48	55.07 ± 2.40	50.04 ± 8.33	49.29 ± 7.56	0.329	0.571
Bodily pain	53.90 ± 6.46	53.01 ± 6.71	51.71 ± 8.29	50.27 ± 9.41	0.281	0.048
General health	54.68 ± 9.16	53.59 ± 9.36	55.20 ± 7.33	52.94 ± 8.01	0.071	0.129
Vitality	55.14 ± 7.89	54.08 ± 8.38	55.32 ± 8.90	53.09 ± 10.81	0.215	0.063
Social functioning	54.11 ± 7.25	53.04 ± 9.40	48.98 ± 8.90	48.99 ± 9.38	0.723	0.005
Role-emotional	52.43 ± 6.89	51.41 ± 7.25	51.23 ± 6.71	49.78 ± 7.83	0.171	0.077
Mental health	51.99 ± 9.72	53.10 ± 9.56	54.13 ± 7.15	51.30 ± 8.77	0.605	0.011
Health Component Summary Measures						
PCS	55.43 ± 4.92	54.11 ± 5.68	52.51 ± 6.85	51.44 ± 6.91	0.053	0.148
MCS	52.17 ± 9.35	51.73 ± 11.95	52.38 ± 6.70	50.44 ± 8.58	0.271	0.050

Values are mean ± standard deviation.
* Indicates a significant change over time ($p < 0.05$).

16.3.6 Evaluation of the Program. The following themes emerged from the three open-ended survey questions:

Question 1: *Did you learn/experience anything throughout the 12-week Yoga/Tai Chi program that you found to be helpful/beneficial during the 6-week cessation period? Please explain.* All 26 participants (14 VY, 12 Taijifit™) responded "yes"; they had learned something from the program that was beneficial to them during the cessation period. Of those that elaborated, participants found that what they had learned/experienced with regard to stretching (2 VY, 2 Taijifit™), breath work (3 Taijifit™), finding balance throughout their day (3 Taijifit™), being present (1 VY, 1 Taijifit™), having patience (1 VY), and prioritizing self-care (2 VY) was most helpful during the cessation period. Other emerging themes included: realizing they missed practicing VY (4 VY), having a more positive relationship with exercise (1 VY), realizing their need for a program with set goals (1 VY, 1 Taijifit™), recognizing their ability to make time for exercise (1 VY, 1 Taijifit™) and their greater likelihood to exercise at home (2 VY), increased inner strength (1 VY), and perceived sustained physical and mental stamina (2 VY).

Question 2: *Have you noticed any sustained benefits/gains since completing the 12-week Yoga/Tai Chi program (over the last 6 weeks)? Please explain.* Several participants perceived sustained benefits/gains to flexibility (4 VY, 5 Taijifit™), balance (2 VY, 5 Taijifit™), strength (4 VY, 2 Taijifit™), and calmness (2 VY, 4 Taijifit™). A handful of participants also perceived experiencing sustained gains in stamina/endurance (3 VY, 2 Taijifit™), awareness/mindfulness (3 VY, 2 Taijifit™), overall health and wellness (2 VY, 3 Taijifit™), energy (1 VY, 2 Taijifit™), coordination (1 Taijifit™), and

sleep (1 Taijifit™), as well as sustained reductions in joint pain (2 VY, 3 Taijifit™) and stress (2 Taijifit™).

Question 3: *Since completing the 12-week Yoga/Tai Chi program, have you experienced any downsides or drawbacks (over the last 6 weeks)? Please explain.* Seven participants reported no drawbacks (1 VY, 6 Taijifit™) throughout the cessation period, while seven participants reported that the cessation period reinforced their commitment to PA (6 VY, 1 Taijifit™). Several other perceived drawbacks from VY or Taijifit™ cessation were noted, including: increased bodily pain/aches (2 VY, 1 Taijifit™), poorer sleep (2 Taijifit™), feeling less centered and balanced (1 Taijifit™), reductions in energy (1 Taijifit™) and flexibility (1 VY), and poorer overall health (1 VY).

Please share any thoughts or comments you may have about the 6-week cessation period, the program as a whole, or anything else that was not covered by the questionnaire. Nine participants (6 VY, 3 Taijifit™) expressed gratitude for the program and four participants (1 VY, 3 Taijifit™) expressed gratitude for the researcher. Eight participants (2 VY, 6 Taijifit™) noted their intentions to continue with VY or Taijifit™, while six participants (1 VY, 5 Taijifit™) expressed missing VY or Taijifit™ during the cessation period. Additionally, three participants (1 VY, 2 Taijifit™) reiterated their perceived physical and mental benefits, three participants (1 VY, 2 Taijifit™) realized their need for self-care, three Taijifit™ participants expressed the necessity of this program for informal caregivers, and two Taijifit™ participants expressed the potential of this program for the community as a whole. Finally, participants also expressed a renewed interesting in PA (1 VY, 1 Taijifit™), that 150 minutes of PA/week is achievable at home (1 Taijifit™), that they learned a lot about themselves (1 VY), and

that the structure of a program is necessary for committed to PA (1 Taijifit™).

16.3.7 Adverse Events. There were no reported injuries or adverse events during the six-week cessation period.

17 Discussion and Future Directions

The purpose of these studies was to evaluate the efficacy, feasibility, and cessation effects of online VY and Taijifit™ in adult informal caregivers (≥ 18 years of age). These are the first studies to investigate the effects of 12 consecutive weeks of online VY and Taijifit™ practice (150 minutes/week) and six consecutive weeks of VY and Taijifit™ cessation (post-intervention) on muscle strength and endurance, balance, walking speed, flexibility, and QOL in adult informal caregivers. These studies also collected qualitative data to provide insight on any perceived benefits, the importance of and barriers to PA, the intervention delivery method (online), overall program satisfaction, and experiences with VY and Taijifit™ cessation. Twenty-nine participants (11 males, 18 females) completed Study I and twenty-six participants (11 males, 15 females) who completed Study I were used for Study II.

The main findings were: (1) VY and Taijifit™ increased muscle strength and endurance, indices of functionality, and flexibility, (2) VY produced greater gains in chest press endurance and abdominal curl-ups, (3) VY and Taijifit™ increased all eight QOL health domains, as well as overall physical (PCS) and mental (MCS) health, (4) Taijifit™ produced greater gains in three QOL health domains (bodily, general health, vitality) and overall physical health (PCS), (5) All but two physical outcome measures (1-

RM chest press strength and chest press endurance) were maintained six consecutive weeks post-exercise, and (6) All but one QOL health domain (physical functioning), as well as overall physical (PCS) and mental (MCS) health were maintained six consecutive weeks post-exercise.

These studies also provide evidence that an online delivery method of VY and Taijifit™ is safe, effective, and feasible for informal caregivers (no reported injuries or adverse events related to the program). The potential for successful implementation of an online VY and Taijifit™ intervention in the informal caregiver population is evidenced by: the studies' ability to reach and engage this population, 29 (Study I) and 26 (Study II) participants completing the studies, the high VY and Taijifit™ adherence rates (both self- and Internet-reported PA), the low drop-out rate (17.14%), and the overall satisfaction with the interventions (as revealed in the qualitative data). The feasibility of these studies may help to build the foundation for future planned online intervention studies and RCTs in this population and with these MBM-based PAs. Results of the present studies are also meaningful in that the participation and cessation effects of two MBMs were compared. Unfortunately, there was no control group, which limits our ability to conclude that improvements and maintenance in muscle strength and endurance, balance, walking speed, flexibility, and QOL were from VY and Taijifit™ and not other confounding variables. However, previous RCTs of both Yoga and Tai Chi have reported these benefits in Yoga and Tai Chi groups, but not control groups (Van Puymbroeck et al., 2007; Yeh et al., 2004; Zheng et al., 2015).

These results have application for the design of effective and optimal lifestyle interventions in the informal caregiver population. From a health promotion and

knowledge translation perspective, these results are important as the consequences of physical inactivity in this population could ultimately lead to more demands on the formal health system, either directly or indirectly. Further, since nearly every Canadian will at some point in time be in the position of having to provide care for a loved one, reducing negative outcomes associated with informal caregiving represents a large health concern.

17.1 Participants

In both the VY and Taijifit™ groups, informal caregivers varied in age, gender, caregiving relationship, total months of caregiving, hours of caregiving per week, reason(s) for caregiving, and caregiving tasks. Representative of the Canadian caregiver population, participants were predominantly over 45 years of age, averaging 55.52 ± 12.25 years of age. Moreover, informal caregiving was widespread across all age groups, such as is typical in Canada, with participants ranging from 23 - 77 years of age. Interestingly, demographic information revealed a higher proportion (27.59%) of informal caregivers ≥ 65 years of age as compared to the Canadian average of 13%. The VY and Taijifit™ groups were similar in age, averaging 55.88 ± 12.31 years in the VY and 55.08 ± 12.65 years in the Taijifit™ group. Study I included 11 (37.93%) males and 18 (62.07%) females and Study II included 11 (42.31%) males and 15 (57.69%) females; a slightly higher proportion of females than the general Canadian caregiving population (54% in 2012 and 57% in 2007; Statistics Canada, 2008; Statistics Canada, 2013a). Consistent with Statistics Canada's (2013a) report detailing that assisting more than one person is prevalent, demographic information revealed that six (21%) of the 29 participants in Study I cared for two and two (7%) participants cared for four care

recipients. Notably, the 29 participants in Study I cared for 41 care recipients.

In 2012, caring for an older close relative was the most common caregiving relationship, with 38% of informal caregivers caring for their mother or father (Statistics Canada, 2013a). Comparably, the 29 participants in Study I most commonly cared for a parent (41.46%). In 2012, age-related needs were identified as the single most common problem requiring help from Canadian informal caregivers (28%), followed by diseases/illnesses such as cancer, cardio-vascular disease, mental illness, Alzheimer's disease and dementia, and neurological diseases (39%; Statistics Canada, 2013a). In Study I, the informal caregivers' care recipients were similar to the Canadian population, with 29.79% requiring help as a result of old age/aging needs and 40.43% requiring help as a result of a disease/illness (including cancer, mental illness, Alzheimer's disease and dementia, and neurological diseases). Participants' main reason(s) for informal caregiving were also consistent with the high prevalence of informal caregiving across Saskatchewan (34%), which is ascribed to aging needs, as well as the prevalence of informal caregiving in Regina (38%), which is attributed to chronic health issues or disability, as opposed to problems related to aging (Statistics Canada, 2013a).

Previous research suggests that informal caregivers perceive their health to decline as a result of their caregiving role and duties (Neundorfer, 1991; Snyder & Keefe, 1985). One study revealed that informal caregivers reporting musculoskeletal discomfort predominantly (78%) believed that caregiving either caused or contributed to their symptoms, which interfered with their ability to provide care, work, and participate in other life activities (Darragh et al., 2015). Similarly, the participants in Study I reported several negative impacts to their overall health as a result of informal caregiving, such as

increased stress (4 VY, 5 Taijifit^{TM}), anxiety/worry (5 VY, 4 Taijifit^{TM}), physical (7 VY, 3 Taijifit^{TM}) and emotional fatigue/exhaustion (2 VY, 1 Taijifit^{TM}), impatience (1 Taijifit^{TM}), feelings of depression (1 Taijifit^{TM}), weight gain (1 VY), and sleep (1 Taijifit^{TM}) and musculoskeletal (1 VY) problems, as well as negative impacts to their physical fitness (1 VY, 1 Taijifit^{TM}), ability to socialize and/or workout (1 VY, 3 Taijifit^{TM}), and education/career progression (1 Taijifit^{TM}).

Generally, caregiving activities last at least one year or more for the vast majority (89%) of informal caregivers in Canada, with half of the population caring for a loved one for at least four years (Statistics Canada, 2013a). Moreover, the Deloitte Canadian Health Consumer Survey (2009) reported that on average, informal caregivers spend four and a half years caregiving. Comparably, 93.94% of the informal caregivers in Study I had provided care for at least one year or more, while the majority (62.5%) of caregivers in the Taijifit^{TM} group and the majority (82.35%) of caregivers in the VY group had provided care for at least four years.

Demographic information also revealed that participants spent more hours informal caregiving per week than the Canadian average of 4.7 hours (Statistics Canada, 2013a); the majority (62.5%) of caregivers in the VY group spent at least six hours per week caregiving and the majority (76.92%) of caregivers in the Taijifit^{TM} group spent at least 11 hours per week caregiving. Altogether, participants (N = 29) spent an average of 22.62 hours caregiving per week, with eight (27.59%) participants spending over 30 hours per week caregiving. Notably, the participants in this study were predominantly high frequency caregivers, since typically only 10% of Canadian informal caregivers generally spend 30 or more hours a week informal caregiving (Statistics Canada, 2013a).

Such as is typical in the literature, the female participants in this study were more likely than their male counterparts to spend 20 or more hours per week caregiving (31.03% vs. 10.34%).

The high frequency of informal caregiving reported by participants in Study I is important since previous research has shown that the negative physical consequences of informal caregiving may be mitigated and/or aggravated by the number of hours per week spent providing care (Legg, Weir, Langhorne, Smith, & Stott, 2013; Ugreninov, 2013). Statistics Canada (2013a) also reported that the reduced physical health experienced by informal caregivers is magnified by the number of hours per week they provide care. Further, Beach et al. (2005) illustrated that when informal caregivers reported more physical symptoms, their care recipients were more likely to state that their caregivers screamed and yelled at them, used a harsh tone of voice, insulted them, called them names, or swore at them. Since participants in Study I were predominantly high frequency caregivers, it was encouraging to discover that several participants felt that the VY or Taijifit™ program had positively impacted their informal caregiving role. Following the 12 week intervention, participants reported feeling more calm/patient while caregiving (5 VY, 4 Taijifit™), a greater ability to cope with their role (2 VY, 3 Taijifit™), generally feeling happier and healthier (4 VY, 1 Taijifit™), feeling more positive (1 VY, 2 Taijifit™), feeling less stressed before, during, and after caregiving (2 Taijifit™), going with the "flow" while caregiving (1 Taijifit™), greater motivation as a caregiver (1 Taijifit™), and greater empathy towards and a strengthened relationship with their care recipient (1 VY, 1 Taijifit™). Accordingly, VY and Taijifit™ programs that reach and engage informal caregivers, particularly high frequency caregivers, may also

benefit care recipients.

It was no surprise to discover that the participants, being such high frequency caregivers, were performing multiple tasks as part of their role. In 2012, Statistics Canada (2013a) reported that 71% of informal caregivers helped with two or more tasks, such as transportation (provided by 73% of caregivers) and IADL such as preparing meals, cleaning, and doing laundry (provided by 52% of caregivers). Demographic information revealed that every VY participant in Study I (N = 16) performed at least four tasks, the majority (12; 75%) of whom performed seven or more. Similarly, every Taijifit™ participant in Study I (N = 13) performed at least three tasks, the majority (10; 76.92%) of whom performed six or more. Across all participants in Study I (N = 29), the majority (20; 68.97%) performed seven or more tasks, which primarily consisted of: transportation, attending appointments, visits/phone calls to check in, meal preparation (including dishes), house cleaning/maintenance, errands/shopping, and emotional and spiritual support. Markedly, informal caregivers in both the VY and Taijifit™ groups revealed that they believed that over 50% of their care recipients required more help than they were able to provide. Encouragingly, although these informal caregivers felt as though they were not able to provide all of the care required by their care recipient(s), they still had a desire to participate in a structured and supervised PA intervention.

17.2 PA

Despite the stated desire of informal caregivers to be able to take part in PA programs, attempts to employ PA interventions or assess preferences and interests in PA has rarely been explored in informal caregivers. Along these lines, when asked if they had been offered access to any PA programs as a result of being an informal caregiver,

responses to the demographic questionnaire revealed that all 29 participants (16 VY, 13 Taijifit™) reported *no*. Subsequently, when asked their top three motivations for participating in this research study, the most frequently noted motivation was maintaining or improving their physical fitness/endurance, which was reported by 23 (82.14%) of the 28 respondents (15 VY, 8 Taijifit™). Furthermore, eight participants (28.57%; 6 VY, 2 Taijifit™) reported that the motivation/commitment to exercise was one of their three main reasons for participating in the study. This qualitative data aligns itself with previous research (Swartz & Keir, 2007) demonstrating that informal caregivers are able and willing to take part in PA programs. Research, however, is equivocal regarding how much PA caregivers perform.

Some authors have demonstrated that physical inactivity is widespread among informal caregivers and is a principal risk factor that requires attention (King & Brassington, 1997; Vitaliano et al., 2002), while other studies are more optimistic, stating that approximately half of all informal caregivers participate in regular PA (McKibbin, Walsh, Rinki, Koin, & Gallagher-Thompson, 1999). Notably, Etkin et al. (2008) reported that the majority (60%) of informal caregivers do not engage in consistent, regular PA, and less than a quarter meet or exceed PA recommendations.

In line with Etkin et al.'s (2008) research, only eight participants (27.59%) in Study I met the program's goal of achieving 150 minutes of VY or Taijifit™/week. Self-report logs revealed that Taijifit™ participants averaged 126.60 minutes of Tai Chi per week and VY participants averaged 142.74 minutes of Yoga per week. Qualitative questionnaires revealed that eight participants (5 VY, 3 Taijifit™) found it challenging or unmanageable to achieve the goal of doing 150 minutes of VY/Taijifit™ per week.

Interestingly, almost half (13; 44.83%) of all participants (N = 29) in Study I said they participated in less PA since becoming an informal caregiver, while the remaining participants noted that their PA had not changed (11; 37.93%) or that they did more PA (5; 17.24%). When asked whether participating in the intervention had changed their outlook on the importance and/or benefits of being physically active, twenty-six participants (13 VY, 13 Taijifit™) answered, *yes*. The most noted change in outlook reported by nine participants (4 VY, 5 Taijifit™) was that little bouts of exercise add up to improve health. This belief was supported by quantitative data, which revealed that 81.9% of all VY and Taijifit™ sessions were ≤ 30 minutes in length. Specifically, 45.64% of all VY and Taijifit™ sessions were performed for 16-30 minutes and 36.36% were performed for ≤ 15 minutes.

17.3 Barriers to PA Participation

Informal caregivers trying to schedule regular PA into their busy calendars face a number of potential barriers, including: finding time and energy for regular PA; locating an exercise program that is appealing, appropriate, and accessible; and arranging alternative care and transportation (Canadian Association for Community Care, 2002). Significantly, lack of time due to caregiving responsibilities is one of the most frequently acknowledged barriers to leisure and/or PA participation (Bedini & Guinan, 1996; Dunn & Strain, 2001; Martin & Keats, 2014). The informal caregivers in Study I were asked to list the barriers that may generally impact their ability participate in PA. In line with the literature, participants most frequently identified time (5 VY, 7 Taijifit™) as a barrier to PA participation, followed by laziness/motivation (2 VY, 7 Taijifit™), energy (4 VY, 1 Taijifit™), physical issues (4 VY, 1 Taijifit™), accessibility (3 Taijifit™), cost (1 VY, 1

Taijifit™), weather (1 VY, 1 Taijifit™), and caregiving responsibilities (2 Taijifit™). Such as with PA in general, participants most frequently identified time/time management (4 VY, 1 Taijifit™) as a barrier to participating in Study I. Other barriers to participating in Study I included: physical ailments (2 VY, 1 Taijifit™), caregiving responsibilities (2 Taijifit™), self-motivation (1 VY), and travel (1 VY), while 14 participants (7 VY, 7 Taijifit™) noted no barriers to participating in the study. Participants were also asked how participation in Study I could have been made easier. Seventeen participants (7 VY, 10 Taijifit™) reported that nothing more could be done and it was easy to participate in the study, while other participants provided the following suggestions: offering more online exercises (1 Taijifit™), providing a DVD supplement (1 VY), flexibility on achieving 150 minutes/week (1 VY), less video choice (1 VY), and access to a quiet space (1 VY) and props (1 VY). These important suggestions can help with the tailoring of future PA interventions to reduce barriers to participation and increase adherence and retention. Despite the majority (23; 79.31%) of participants in Study I caregiving for more hours per week then the Canadian average, both the VY and Taijifit™ groups achieved a high percentage (95.16% and 84.40%) of the 150 minutes/week PA goal. Though informal caregivers want to engage in PA and participate in research, intervention designs that do not consider and address the specific needs and barriers of this population may increase difficulties with informal caregiver recruitment, participation, adherence, and retention.

Banks-Wallace and Conn (2002) report that PA interventions typically experience moderate attrition rates, ranging from 3% to 41%. Waldron et al. (2012) reported, in their systematic review of RCTs for cancer caregivers, an average retention

rate of 72.9%. Moreover, previous studies utilizing Yoga or targeting informal caregivers have reported attrition rates ranging from 16% to 50% (Jacobs et al., 2004; Mant, Carter, Wade, & Winner, 2000; Northouse et al., 2006). In Study I, six participants (17.14%) withdrew before completing the 12-week intervention; three (15.79%) from the VY and three (18.75%) from the Taijifit™ group. These participants primarily noted caregiving responsibilities and/or care recipient death as well as physical ailments as their reasons for dropping out of the study. Positively, 82.86% of the participants completed the 12-week intervention and post-testing (Study I) and 89.66% of the participants from Study I completed cessation testing (Study II). The three participants that did not complete Study II (cessation testing) did so because they were out of the country during the testing window. These high retention rates may be indicative of the feasibility of the delivery method (online) and the suitability of MBM-based PA for this population. Thus, using Internet-based interventions to support informal caregivers may offer an efficient and accessible alternative to traditional face-to-face interventions.

17.4 Intervention Delivery Method

While several studies have systematically reviewed and delivered interventions to informal caregivers via the Internet (Chi & Demiris, 2015; Hu, Kung, Rummans, Clark, & Lapid, 2015; Kaltenbaugh et al., 2015; McKechnie, Barker, & Stott, 2014; Parra-Vidales et al., 2017; WHO, 2015), no Internet-based interventions have sought to increase PA or improve physical outcome measures in this population. To date, Study I is the only study to have delivered a VY and Taijifit™ intervention at home via the Internet in this population, yet, Tai Chi has been effectively delivered online for 13 years via Taijifit.net and the Yoga Journal (2016) recently revealed that Yoga was most commonly

practiced in the home.

When participants in Study I were asked what they liked most about the program being delivered in their home, the most frequent responses were the flexibility/convenience of the program (12 VY, 11 Taijifit™) and the quality of the instructors (9 VY, 8 Taijifit™). Additionally, 13 participants (7 VY, 6 Taijifit™) noted enjoying the quantity and variety of videos/classes available, while others appreciated the video (HD) quality (3 VY, 5 Taijifit™), the privacy/ability to exercise at home (4 VY, 4 Taijifit™), and the simplicity of use (1 VY, 2 Taijifit™). Only three of the 29 participants (10.34%) believed that they could have achieved 150 minutes of VY/Taijifit™ per week had the program been delivered outside of the home on specific days and times. In Study I, the at-home Internet delivery method provided flexibility in the length of each VY or Taijifit™ session and the days and time of practice; an important intervention characteristic for this population (Hill et al., 2007). Moreover, the PA logs revealed that over the course of the 12-week intervention (Study I), the session length and days on which participants practiced VY or Taijifit™ varied week to week. This flexibility may appeal to informal caregivers who face one or more of the barriers to PA participation previously noted. Due to the evident nature of this study, however, participating caregivers may have included a specifically selected group of individuals who were interested in participating since it was being delivered at home and may have excluded those willing/desiring to practice Yoga or Tai Chi in person.

While several participants noted positive aspects of the at-home Internet-based intervention, some participants also reported unfavourable aspects and provided suggestions for future research. Specifically, one VY participant was unsure if the poses

were being performed correctly, one VY participant found it difficult to see the screen and practice, and one Taijifit™ participant would have liked to have had some interaction with other informal caregivers. Previous research has highlighted the importance of meeting other caregivers, which helps caregivers acknowledge their informal caregiving status and recognize that other caregivers may experience similar difficulties (Gorman, 2014; Lopez-Hartmann et al., 2012). Significantly, self-identifying and recognizing oneself as an informal caregiver has been shown to make a positive difference not only in caregivers themselves, but also in the lives of their care recipient(s), family members, and other loved ones (Centers for Disease Control and Prevention and the Kimberly-Clark Corporation, 2008). Along these lines, recruitment for these studies proved most useful through organizations (e.g., Alzheimer Society of Saskatchewan, MS Society of Canada, Parkinson Canada) or physicians that educated family members and friends of their informal caregiver status.

Positively, in line with Müller and Khoo's (2014) systematic review of non face-to-face PA adoption and/or maintenance studies, participation in Study I was feasible for the 22 (75.86%) participants ≥ 50 years of age. Further, such as in Blom et al.'s (2015) Internet-based intervention for dementia caregivers, participation was feasible for the eight (27.59%) participants ≥ 65 years of age whom had not grown up with the Internet. This is an important discovery since projections indicate that by 2031, the proportion of older adults in Canada will rise to about 24.5% as compared to 14.8% in 2012. It is also projected that by 2036, almost one quarter (23.3%) of Saskatchewan's population will be over 65 years of age (Statistics Canada, 2010). Markedly, Statistics Canada (2013a) revealed that aging caregivers (≥ 65 years) were most likely to spend the longest hours

providing care, while Navaie-Waliser et al. (2002) reported poor physical health among aging caregivers.

Utilizing a coach when delivering Internet-based interventions may be important. Though the literature reports mixed results regarding the role of a coach, authors have indicated that a coach may be beneficial to participants who are struggling to remain on track, encouraging them to focus and continue (Blom et al., 2015; Brouwer et al., 2011). Throughout Study I, the researcher acted as a coach and emailed participants on weeks 1, 2, 4, 6, 8, 10, 11, and 12 to offer guidance and support in their practice. Participants could also contact the researcher via phone, email, or text message at any time throughout the 12-week intervention (Study I) and the six-week cessation period (Study II) should they have any questions/concerns. Qualitative questionnaires revealed that several participants appreciated the use of a coach, noting that the researcher's knowledge of VY/Taijifit™ (2 VY, 4 Taijifit™), demonstration of proper technique and modifications (4 VY, 2 Taijifit™), and support/encouragement (1 VY, 4 Taijifit™) were important. Participants also noted that the researcher's optimism/enthusiasm (1 Taijifit™), calmness/mindfulness (1 Taijifit™), friendliness (1 VY), and insight into anatomy/physiology (1 Taijifit™) was helpful to them throughout the intervention. Further, four participants (1 VY, 3 Taijifit™) reported that having access to a certified VY/Taijifit™ instructor (the researcher/coach) helped with their confidence and two VY participants expressed that simply knowing the researcher was available was important. In Study I, the use of a coach was an important tool to help participants personalize and navigate their own journey with VY or Taijifit™ and remain committed, which supports previous research suggesting that increased contact with participants (via email, telephone, or text message) and utilizing a coach are

effective ways to individualize interventions and maintain engagement in Internet-based interventions (Joseph et al., 2014; Wantland et al., 2004). The utilization of a coach and the continued contact with participants may have contributed to the high VY and Taijifit™ participation rates and the overall satisfaction with the intervention; all 29 participants (16 VY, 13 Taijifit™) reported that they would like to continue their VY/Taijifit™ practice and that they would recommend this program to other informal caregivers.

17.5 Study I

17.5.1 Primary Outcome Measures. Both the VY and Taijifit™ groups experienced statistically significant increases in muscle strength (1-RM leg press, 1-RM chest press, total body strength, hand-grip right, hand-grip left, total hand-grip), muscle endurance (leg press, chest press, abdominal curl-up, total body), indices of functionality (walking speed, balance), and flexibility. These results are consistent with previous research demonstrating that Yoga and Tai Chi can improve strength, endurance, balance, and flexibility (Bosch et al., 2009; Brown, 2010; Brown et al., 2008; Chen et al., 2008; Cohen et al., 2004; Desikachar et al., 2005; Jahnke et al., 2010; Lan et al., 2013; McCall, 2007; Mustian et al., 2006; Pullen et al., 2008; Rones & Silver, 2007; Song et al., 2007; Wang et al., 2004; Webster et al., 2016; Zheng et al., 2015) as well as studies demonstrating Yoga's benefits to walking (Chen et al., 2008; DiBenedetto et al., 2005; Iyengar, 2004), lower body flexibility and endurance, and hand-grip strength (Telles & Singh, 2012) and Tai Chi's benefits to run time (800/1000m; Webster et al., 2016), sit-and-reach flexibility (Zheng et al., 2015), and abdominal muscle strength (Song et al., 2007). Moreover, qualitative questionnaires revealed that all twenty-nine participants (16

VY, 13 Taijifit™) perceived physical and/or mental benefits as a result of the 12-week intervention. Specifically, participants listed the following physical benefits: improved flexibility (8 VY, 4 Taijifit™), strength (6 VY, 2 Taijifit™), sleep (5 Taijifit™), balance (4 Taijifit™), energy (2 VY, 2 Taijifit™), endurance (2 VY, 1 Taijifit™), coordination (2 Taijifit™), posture (1 VY), and overall well-being (1 Taijifit™) as well as reductions in aches and pains (4 VY, 2 Taijifit™), heart rate (1 Taijifit™), and weight (1 VY). These qualitative findings align themselves with previous Yoga and Taijifit™ research demonstrating improvements in sleep, coordination, posture, and energy, and reductions in stiffness and pain (Brown, 2010; Chen et al., 2009; Manjunath & Tells, 2005; NCCAM at the NIH, 2016a; Van Puymbroeck et al., 2007; Wang et al., 2004; Webster et al., 2016). Lastly, two VY participants revealed the participating in the intervention inspired them to quit/reduce their smoking; one participant quit smoking after 30+ years, while another participant significantly reduced his smoking and was working towards cessation.

Both the VY and Taijifit™ groups increased upper body and abdominal endurance and strength over time, but there was only a group x time interaction for chest press and abdominal endurance. The change in upper body and abdominal endurance was greater in the VY group compared to the Taijifit™ group. Since Yoga focuses on using the arms and core to hold one's body weight and provide the necessary support, while Tai Chi focuses on developing and using the muscles in the legs for support (Liang & Wen-Ching, 2014; Stephens, 2012; Ramaswami, 2005; Zhuang, 2015), it was hypothesized that VY would lead to greater improvements in upper body (chest press) and abdominal strength and endurance. This hypothesis was only partially supported since there was no group x time interaction for chest press strength.

The greater increase in chest press and abdominal endurance over time in the VY group compared to the Taijifit™ group may be a result of the training volumes of both groups. While there were no baseline differences and no change over time between the VY and Taijifit™ groups with respect to total leisure activity, there was a statistically significant difference with respect to the recorded training volumes between groups. Notably, participants' total leisure activity scores do not include activities performed from the VY/Taijifit™ programs as instructed on the leisure time exercise questionnaire. Therefore, there were no differences in activities performed outside of the VY/Taijifit™ programs. According to both self-report and Internet PA logs, however, the VY group performed significantly more PA compared to the Taijifit™ group. As a result, the VY group adhered more closely to the 150 minutes/week protocol, averaging 142.74 minutes/week (95.16%) of VY compared to the Taijifit™ group, which averaged 126.60 minutes/week (84.40%) of Taijifit™. What's more, the majority (52.61%) of the VY sessions lasted 16-30 minutes, while the majority (52.79%) of the Taijifit™ sessions lasted ≤ 15 minutes, which may have contributed to the greater improvements in upper body and abdominal endurance – but not upper body strength – in the VY group. Lastly, the weekly average of informal caregiving hours was more then double in the Taijifit™ group (32.12 hours/week) as compared to the VY group (14.07 hours/week), which may have contributed to the Taijifit™ group only achieving 84.40% of the recommended 150 minutes/week. Along these lines, the only two participants to list caregiving responsibilities as a barrier to participating in this study were from the Taijifit™ group.

The results also did not fully support the second hypothesis, that Taijifit™ would lead to greater improvements in lower body strength and endurance and tasks of

functionality. Although Tai Chi focuses on developing and using the muscles in the legs for support whereas Yoga utilizes the arms and core (Liang & Wen-Ching, 2014; Stephens, 2012; Ramaswami, 2005; Zhuang, 2015), both groups improved equally over time. There were no differences between groups over time in 1-RM leg press, leg press endurance, balance, or walking speed. While several studies have confirmed the ability of both Yoga and Tai Chi to improve lower body strength and endurance, balance, and walking speed, no studies have compared these two MBM-based PAs across these physical outcome measures. Moreover, no studies have examined and compared the potential benefits of Vinyasa-style Yoga and Taijifit™-style Tai Chi.

17.5.2 Secondary Outcome Measure (QOL). VY and Taijifit™ increased all eight QOL health domains (physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health) as well as overall physical (PCS) and mental (MSC) health. The discoveries are consistent with the results of researchers who found increases in QOL in healthy and chronically ill populations with the use of Yoga (Ben-Josef et al., 2017; Hägglund, Hagerman, Dencker, & Strömberg, 2017; Hewetta, Pumpa, Smith, Fahey, & Cheema, 2017; Lau, Yu, & Woo, 2015; Oken, 2006; Patel, Newstead, & Ferrer, 2012; Rao et al., 2017; Sareen, Kumari et al., 2007; Woodyard, 2011) and Tai Chi (Husted, Pham, Hekking, & Niederman, 1999; Huston & McFarlane, 2016; Kim, Kim, & Lee, 2015; Ko, Tsang, & Chan, 2016; Liu, Miller, Burton, Chang, & Brown, 2013; Sun, Buys, & Javasinghe, 2014; Wang, Shan, Li, Yang, & Shan, 2017) interventions. Specifically, Yoga has previously been shown to benefit the vigor/activity (Michalsen, 2011; Campbell et al., 2007), social functioning (Ben-Josef et al., 2017; Lau et al., 2015), fatigue-inertia (Oken et al., 2004; Michalsen,

2011), bodily pain (McCall, 2007; Desikachar, Bragdon, & Bossart, 2005; Williams, Steinberg, & Petronis, 2003), role-emotional (Ben-Josef et al., 2017), role-physical (Ben-Josef et al., 2017; Lau et al., 2015), and general health (Birkel & Edgren, 2000; Hewetta, Pumpa, Smith, Fahey, & Cheema, 2017; Lau et al., 2015; Oken et al., 2006) QOL subscales, while research has shown Tai Chi to benefit the vitality (Hewetta, et al., 2017; Husted et al., 1999; Kim et al., 2015; Ko et al., 2016; Liu et al., 2013; Wang et al., 2017), physical functioning (Husted et al., 1999; Kim et al., 2015; Liu et al., 2013), bodily pain (Kim et al., 2015; Liu et al., 2013; Sun et al., 2014; Wang et al., 2017), general health (Kim et al., 2015; Sun et al., 2014; Wang et al., 2017), mental health (Husted et al., 1999; Kim et al., 2015; Wang et al., 2017), role physical (Liu et al., 2013; Sun et al., 2014), social functioning (Husted et al., 1999; Sun et al., 2014), and role-emotional (Husted et al., 1999) QOL subscales. Markedly, the majority of these Yoga and Tai Chi studies assessing QOL used the SF36 – the same QOL tool utilized in this study.

To the best of our knowledge, only six studies have used Yoga as an intervention option for informal caregivers (Danucalov et al., 2013; Jagannathan, et al., 2012; Mackenzie et al., 2016; Martin & Keats, 2014; Van Puymbroeck et al., 2007; Waelde, Thompson, & Gallagher-Thompson, 2004) and with the exception of one study (Hill et al., 2007) that utilized both Yoga and Tai Chi as PA options for informal caregivers, no studies utilizing Tai Chi in this population have been published. Positively, two RCTs (Chan et al., 2016; Nyman, 2017) are currently recruiting caregiver-care recipient dyads to investigate the efficacy and feasibility of Tai Chi on QOL. Of the six Yoga interventions in this population, only two (Hill et al., 2007; Martin & Keats, 2014) assessed Yoga's effect on QOL. Comparable to the current study, Martin and Keats

(2014) investigated the potential benefits of six weeks of VY on cancer caregivers' overall QOL as measured using the SF36v2. Pre/post comparisons revealed a statistically significant change in overall mental health (MCS) as well as the role-emotional and mental health subscales. Hill et al. (2007) found no statistically significant change in caregiver QOL after six months of weekly Yoga or Tai Chi. To date, this is the only study examining any style of Yoga or Tai Chi to report improvements in all QOL subscales and overall physical (PCS) and mental (MCS) health in this population.

Qualitative questionnaires revealed that several participants reported benefits such as improved relaxation/calm (9 Taijifit™), mental strength/focus (7 VY, 1 Taijifit™), productivity/motivation (4 Taijifit™), outlook/mood (2 VY, 5 Taijifit™), ability to cope with stress (1 VY), and mindfulness/awareness (1 VY, 1 Taijifit™), as well as reduced anxiety/worry (1 VY, 1 Taijifit™). Notably, these qualitative discoveries report outcomes assessed by several QOL subscales, such as mental health (which assesses nervousness and peacefulness), role-emotional (which assesses motivation and mood), general health (which assesses a general outlook on health), and vitality (which assesses feelings of motivation/productivity and the energy to accomplish tasks).

Interestingly, though both groups increased across all aspects of QOL, Taijifit™ lead to greater gains in three QOL health domains (bodily pain, general health, vitality) and overall physical health (PCS). Notably, the Taijifit™ group reported a greater general outlook on heath (general health domain) at baseline as compared to the VY group and while both groups' general health scores increased over time, the change was greater in the Taijifit™ group compared to the VY group. The greater improvement across several QOL subscales and overall physical health (PCS) in the Taijifit™ group may be a result

of Tai Chi's emphasis on *flow*. Distinctly, the primary goal of Tai Chi (including Taijifit™) is to induce, cultivate, and sustain *flow*; ensuring the practitioner's sequence of Tai Chi forms is continuous, harmonious, and synergistic (Ross, 2013). Ross (2013) defines *flow* as a state of complete immersion in an activity; when Tai Chi practitioners are *flowing*, they are completely involved in an activity for its own sake – the ego falls away and time flies. Mihaly Csikszentmihalyi, a Hungarian psychologist who first recognised and named the concept of *flow*, is widely considered the authority on *flow* and describes *flow* as a state of mind where consciousness is harmoniously ordered and people are pursuing whatever they are doing for its own sake (Csikszentmihalyi, 1991). When a person's relevant skills are needed to cope with the challenges of a situation, the person's attention is completely absorbed by the activity; there is no excess energy left to process anything other than what the activity offers. As a result, people become so involved in what they are doing that the activity becomes almost automatic; they stop being aware of themselves as separate from the actions they are performing. *Flow* pushes the person to a higher level of performance, transforming the self by making it more complex (Csikszentmihalyi, 1991).

Although the *flow* experience may appear to be effortless, Csikszentmihalyi (1991) states that it is far from being so and often requires strenuous physical exertion and the application of skilled performance; the muscles and brain must be equally involved. Markedly, Csikszentmihalyi (1991) highlights that when a person is able to organize his or her consciousness to experience *flow* as often as possible, QOL inevitably improves; *flow* affects the quality of the experience and therefore affects QOL.

What makes Tai Chi most conducive to *flow* is that it is designed to make *flow* easier to achieve. Likewise, Taijifit™ facilitates concentration and involvement by making the activity as distinct as possible from the paramount reality of everyday existence. Taijifit™, as a *flow* activity, has its primary function as the provision of inducing, cultivating, and sustaining *flow*. Though it is not unreasonable to regard Yoga as a strong *flow*-producing practice as a result of its doctrines, this is not how Yoga is taught, especially in the West. Yoga has lost its connection to *flow* – which was never as strong as Tai Chi's – and Yoga does not involve *flow* or *flow*-cueing (Csikszentmihalyi, 1991). Thus, during a Yoga session, there are countless opportunities for mind wandering and disconnection from the present moment (*flow*), whereas during Tai Chi (including Taijifit™), the cultivation and maintenance of *flow*, with the use of *flow*-cueing techniques, is constantly achieved (Ross, 2013). Finally, *flow* attempts to fortify the self, yet the goal of Yoga is to abolish it – where one must maintain control over consciousness and try to merge with the universal energy (Csikszentmihalyi, 1991).

The greater improvement in QOL in the Taijifit™ group may also be explained by the fact that the Taijifit™ group was a higher frequency caregiving group (32.12 hours/week vs. 14.07 hours/week) and the time spent on self-care may have lead to greater perceived benefits. When asked if participating in the program had changed their outlook and/or expectations regarding their current or future health, a greater proportion of Taijifit™ participants highlighted the importance of balancing caregiving with self-care (33.33% vs. 13.33%) and reported feeling more energized/refreshed (16.67% vs. 6.67%). Additionally, when asked if the intervention had impacted their informal caregiving role, a greater proportion of Taijifit™ participants reported that they had a

greater ability to cope with informal caregiving (25% vs. 13.33%) and reported "going with the flow" while caregiving (8.33% vs. 0%). Therefore, while VY and Taijifit™ may both be effective PA modalities to improve overall QOL, Taijifit™ may be more effective at reducing limitations due to pain, improving general health perceptions, reducing fatigue and increasing energy (bodily pain, general health, and vitality subscales) as well as increasing perceptions of overall physical health (PCS).

Lastly, it is important to consider not only statistical significance, but also clinical significance or minimally important differences. While minimally important difference values in mean group change was not the primary outcome of Study I, these scores represent a clinical perspective and have significance for the participants, their care recipients, and the Canadian healthcare system. Minimally important difference values supplement the understanding of participant outcomes and responses to VY and Taijifit™, beyond traditional significance measures. In this Study, the mean group change scores in both the VY and Taijifit™ groups exceeded the threshold for clinically meaningful differences in the two summary measures (PCS, MCS) and in six of the eight subscales (role-physical, bodily pain, general health, vitality, social functioning, role-emotional). Further, the Taijifit™ group exceeded the threshold for clinically meaningful differences in the remaining two subscales (physical functioning, mental health).

These minimally important difference scores represent a change in participants' evaluations of their health (e.g., functional health, well-being, or other health status constructs), forecast substantial changes in health-related events, and are associated with noteworthy differences in clinical markers (Maruish, 2011). While these minimally important difference suggestions represent the best estimates based on currently available

evidence, it should be noted that minimally important differences are the focus of many current research projects, the data from which might necessitate the modification of these guidelines in the future (Maruish, 2011).

17.6 Study II

17.6.1 Primary and Secondary Outcome Measures. At six consecutive weeks post-exercise, muscle strength (1-RM leg press, total body, hand-grip right, hand-grip left, total hand-grip), muscle endurance (leg press, abdominal curl-up, total body), indices of functionality (walking speed, balance), and flexibility were maintained in both groups. Only chest press strength and endurance decreased six consecutive weeks post-exercise in both the VY and Taijifit™ groups. Further, overall physical (PCS) and mental (MCS) health and seven QOL health domains (role-physical, bodily pain, general health, vitality, social functioning, role-emotional, mental health) were maintained six consecutive weeks post-exercise. Both groups, however, experienced a decrease in physical functioning, with no differences between groups over time. Thus, participants perceived greater limitations to performing everyday PA (physical functioning subscale of QOL) after six consecutive weeks of VY or Taijifit™ cessation. Significantly, the maintenance of all but two physical outcome measures (1-RM chest press strength and chest press endurance) and all but one QOL health domain (physical functioning) highlights not only the long-term benefits of VY and Taijifit™, but also the long-term impacts of Internet-based PA. These cessation results may relate to greater lower limb use throughout the day as well as the novelty of continuous upper body use while performing these MBM-based PAs.

The qualitative questionnaires substantiated several quantitative discoveries,

revealing that participants perceived sustained benefits/gains to flexibility (4 VY, 5 Taijifit^{TM}), balance (2 VY, 5 Taijifit^{TM}), strength (4 VY, 2 Taijifit^{TM}), calmness (2 VY, 4 Taijifit^{TM}), stamina/endurance (3 VY, 2 Taijifit^{TM}), overall health and wellness (2 VY, 3 Taijifit^{TM}), awareness/mindfulness (3 VY, 2 Taijifit^{TM}), energy (1 VY, 2 Taijifit^{TM}), stress (2 Taijifit^{TM}), coordination (1 Taijifit^{TM}), inner strength (1 VY), and sleep (1 Taijifit^{TM}), as well as sustained reductions in joint pain (2 VY, 3 Taijifit^{TM}) throughout the six week cessation period. Further, all 26 participants (14 VY, 12 Taijifit^{TM}) noted that they had learned something from the program that was beneficial to them during the cessation period, such as stretching (2 VY, 2 Taijifit^{TM}), breath work (3 Taijifit^{TM}), finding balance throughout their day (3 Taijifit^{TM}), being present (1 VY, 1 Taijifit^{TM}), having patience (1 VY), and prioritizing self-care (2 VY). These results provide preliminary evidence that the benefits of VY and Taijifit^{TM} may persist during irregular and intense caregiving periods when PA is unlikely. Markedly, the caregiving journey can present numerous significant and unique challenges, including an unpredictable trajectory. Furthermore, informal caregiving may not only affect health status during the caregiving period, but may also be related to subsequent downturns in immune function after the caregiving role has been relinquished, even two to four years post-caregiving (Coe & Van Houtven, 2009). Thus, results revealed from examining the rate of change of VY and Taijifit^{TM} benefits may be used in developing optimal VY and Taijifit^{TM} cycling strategies for informal caregivers.

To date, no studies have investigated the cessation effects of any style of Yoga and Tai Chi on physical or QOL outcomes in the informal caregiver population. Only six studies have utilized a Yoga or Tai Chi intervention in this population, none of which

have included follow-up testing. Few studies have assessed the long-term benefits of these MBMs, even though several authors have noted that studies should incorporate follow-up testing to determine whether or not the benefits persist over time (Jagannathan et al., 2012; Solloway et al., 2016; Thind et al., 2017).

As such, there is no follow-up research targeting this population upon which to expound these results. However, a handful of studies utilizing Tai Chi in healthy or diseased young and aging populations have found sustained benefits in balance at 12-week (Zheng et al., 2015) and six-month (Li, Harmer, Fisher, & McAuley, 2005; Murphy & Singh, 2008) follow-up testing as well as functional strength and mobility at 12-month follow-up testing (Murphy & Singh, 2008). Another study reported that Yoga might produce a sustained positive effect on health-related QOL at one-year follow-up (Kinser, Elswick, & Kornstein, 2014). The authors posit that simple exposure to a Yoga intervention may provide sustained benefits, though generalizability of the study's results is limited as a consequence of a small follow-up sample size (N = 7). Such as most follow-up research with Yoga and Tai Chi, however, most studies do not report on continued Yoga or Tai Chi practice and/or frequency or whether participants were asked to refrain from Yoga or Tai Chi until follow-up assessments.

In the current study, participants were asked to refrain from VY or Taijfit™ for six consecutive weeks and participants no longer had access to the online VY (Yogaglo.com) and Taijifit™ (Taijifit.net) programs. There were no baseline differences and no change over time between the VY and Taijifit™ groups with respect to total leisure activity. Additionally, qualitative questionnaires revealed that 10 participants (5 VY, 5 Taijifit™) expressed missing VY or Taijifit™ during the cessation period, seven

participants (6 VY, 1 Taijifit™) reported that the cessation period had reinforced their commitment to PA, and two participants expressed their need for a program with set goals (1 VY, 1 Taijifit™). Moreover, a handful of participants reported experiencing downsides or drawbacks to VY and Taijifit™ cessation, such as increased bodily pain/aches (2 VY, 1 Taijifit™), poorer sleep (2 Taijifit™), feeling less centered and balanced (1 Taijifit™), reductions in energy (1 Taijifit™) and flexibility (1 VY), and poorer overall health (1 VY); likely indicative that participants did in fact cease to practice VY or Taijifit™. Finally, when asked if they had any final thoughts/comments, eight participants (2 VY, 6 Taijifit™) noted their intentions to resume VY or Taijifit™, while three Taijifit™ participants expressed a necessity for more programs such as this for informal caregivers and two Taijifit™ participants expressed the potential of this program for the community as a whole.

17.7 Future Directions

These studies provide evidence that VY and Taijifit™ are effective forms of PA that may improve muscle strength and endurance, functionality, flexibility, and QOL in informal caregivers with no side effects. Moreover, these studies demonstrate that the vast majority of physical and QOL improvements may be maintained after six weeks of cessation from VY and Taijifit™. Further, the suitability of the online delivery method highlights the importance of continuing to develop, implement, and evaluate Internet-based interventions in this population. The discoveries generated from these studies have the potential to serve as the basis for future research and significantly contribute to the establishment of a new paradigm for conventional healthcare practices. Still, numerous questions remain unanswered.

Due to the small number of studies having been conducted with PA or MBMs and informal caregivers as well as the limitations of the current studies, these results should be regarded as preliminary. There is a need for the participation and cessation effects of these two MBMs to be tested utilizing a RCT to be able to determine whether any physical or QOL benefits stem from VY and Taijifit™ or other pontetial confounding variables. Additionally, future research is required to examine treatment effects of VY and Taijifit™ in comparison to other forms of Yoga or Tai Chi, as well as according to the amount of Yoga or Tai Chi practiced. Currently, there is no evidence to suggest the optimal volume, frequency, duration, style, or length of Yoga/Tai Chi program for improving informal caregiver health. For example, Yoga and Tai Chi intervention studies have ranged in duration from seven days to six months, with 60 to 90 minute sessions once or twice a week, with or without home-based sessions. Consequently, future trials assessing the response to specific amounts of Yoga/Tai Chi and specific Yoga/Tai Chi style(s) are required. Since there are so many different styles of Yoga/Tai Chi, one area that may be helpful not only with recruitment but in making Yoga/Tai Chi more appealing to informal caregivers of all ages and PA levels, would be to clearly describe the style of the Yoga/Tai Chi in the intervention. These descriptions may help avoid misconceptions and attract informal caregivers looking for a certain level of PA or a stress-reduction technique from an intervention; perhaps leading to greater program recruitment, adherence, and retention. Positively, informal caregivers in the current studies noted their satisfaction with VY and Taijifit™, their desire to continue their practice, and that they would recommend these MBMs to other caregivers.

Additionally, while the online delivery method was found to be feasible, further investigations are necessary to investigate how technological advances may enhance delivery and improve informal caregiver health and outcomes. A strength of Study I was the flexibility to choose when and where to undertake the VY/Taijifit™ sessions, which may have led to greater participation and adherence. While several benefits exist in delivering interventions face-to-face to informal caregivers (e.g., socializing, meeting other caregivers), previous research has noted difficultly in retaining informal caregivers in face-to-face interventions (Jacobs et al., 2004; Mant, Carter, Wade, & Winner, 2000; Northouse et al., 2006; Waldron et al., 2012); mostly noting time constraints as a main reason why caregivers drop out. Therefore, home- or Internet-based PA programs may help to reach those who are unable to access in-person classes and may have the added benefit of enabling participants to participate at their own rate. That being said, participants in Study I noted some unfavourable aspects of the online delivery, including the lack of interaction with other informal caregivers. Therefore, future technology-based PA studies may want to consider offering its participants the opportunity to participate in an online community (such as discussion boards, groups, and forums), in-person PA classes, and social/group activities (e.g., coffee, focus, or discussion groups) throughout the duration of the home- or Internet-based intervention.

Significantly, the use of telehealth in this population provides important information not only for future research, but also for practitioners and organizations working with informal caregivers. For example, social workers, nurses, and physicians may help informal caregivers remain physically and mentally healthy (or recover from lowered functioning) by promoting participation in VY or Taijifit™ and referring them to

VY and Taijifit™ Websites. The utilization of well-established Websites can significantly reduce the cost and burden of participation; one month of unlimited online VY or Taijifit™ costs less than one face-to-face class. Also, Joseph et al. (2014) suggest that Internet-based PA studies should include follow-up assessments to evaluate the longer-term impacts of non face-to-face PA promotion efforts. To date, few Internet-based studies have included long-term follow-up and few studies have assessed the long-term benefits of these MBMs, even though several authors have noted that Yoga and Tai Chi studies should incorporate follow-up testing to determine whether or not the benefits persist over time (Jagannathan et al., 2012; Solloway et al., 2016; Thind et al., 2017). Importantly, those working with this population could inform informal caregivers of their ability to participate in Yoga or Tai Chi and the potential benefits of participation to their overall physical functioning and QOL. Notably, in Campbell et al.'s (2007) study, the recruitment of caregivers mostly occurred (55%) from physicians. Therefore, physicians may be particularly helpful in identifying coping strategies and promoting healthy behaviours such as PA.

Along those lines, interpretation of clinical research outcomes should not be based solely on the presence or absence of statistically significant differences. Clinical research data is often analyzed with traditional statistical probability (p-values), which may not provide enough information to make clinical decisions. Statistically significant differences or outcomes simply address whether to accept or reject a null or directional hypothesis, without providing information on the magnitude or direction of the treatment effect (Page, 2014). There is a need for future research to assess indices that speak to a given study's clinical significance, a metric relevant to patients, researchers, and

clinicians (Culos-Reed, Mackenzie, Sohl, Jesse, Zahavich, & Danhauer, 2012). Identifying the clinical significance in studies of Yoga and Tai Chi for informal caregivers adds further description to the existing literature and highlights the promising benefits of these MBM-based PAs. Future research is required to examine and present clinical significance data in order to ensure that *significant* findings are truly meaningful to people, impacting various health outcomes and behaviours that are important to them (Culos-Reed et al., 2012).

As the literature has developed on informal caregivers, further predictor variables for health problems have been identified, such as caregiver age, sex, relationship to the care recipient (Kozachik et al., 2001; Navaie-Waliser et al., 2002; Sörensen, Pinquart, & Duberstein, 2002), ethnicity (Pinquart & Sörensen, 2005), social isolation (Cameron, Franche, Cheung, & Stewart, 2002; Goldstein et al., 2004), and weekly hours of informal caregiving (Legg, Weir, Langhorne, Smith, & Stott, 2013; Ugreninov, 2013). Future research may want to examine the effectiveness, feasibility, and likeability of MBMs and telehealth PA programs across these variables.

An advantage of the current studies was the use of qualitative questionnaires, which provided valuable insights regarding perceived benefits, the importance of and barriers to PA, the intervention delivery method (online), overall program satisfaction, experiences with VY and Taijifit™ cessation, and how informal caregivers view and experience their role. Further, these qualitative data helped to interpret and better understand the implications of quantitative data as well as substantiate some of the quantitative results. Future research should seek to conduct more qualitative research with this population, particularly with the use of in-depth interviews and focus groups,

which can provide a flexible and participatory method that contextualizes users' perceptions and experiences (Adams & Cox, 2008). Participants are more likely to release sensitive data when they have formed some rapport with the researcher, which may help in tailoring intervention delivery methods (face-to-face vs. non-face-to-face), understanding why or why not informal caregivers partake in PA, and shedding light on the potential underlying mechanisms of VY and Taijifit™.

Finally, the use of a theoretical framework can offer a foundation upon which to build evidence-based interventions. Theory plays a key role in the development and implementation of best practices and theoretical models can help explain how health behaviours such as PA can be shaped (Keats & Culos-Reed, 2009). Though some models have been applied more frequently than others, the four most prominent theories utilized within a PA context are the Social Cognitive Theory, the Theory of Planned Behaviour, the Self-Determination Theory, and the Transtheoretical Model (Nigg, Borrelli, Maddock, & Dishman, 2008). Notably, the Theory of Planned Behaviour (Ajzen, 1991) has guided most of the theoretical research on PA (Keats & Culos-Reed, 2009) and several reviews have shown the Theory of Planned Behavior's constructs to be important predictors for explaining exercise behaviour across various populations, including healthy, obese, elderly, and chronically ill (e.g., Ameneh Motalebi, Amirzadeh, Abdollahi, & Kong Lim, 2014; Blanchard, Courneya, Rodgers, & Murnaghan, 2002; Boudreau, & Godin, 2007; Courneya & Friedenreich, 1999; Courneya, Friedenreich, Arthur, & Bobick, 1999; Keats, Culos-Reed, Courneya, & McBride, 2007; Symons Downs & Hausenblas, 2005). As such, both qualitative and theory-based research can help to tackle current inactivity levels, shed light on who will likely engage in and/or maintain PA, help to best tailor

interventions to meet specific needs, and generate further understanding of the complexities involved in PA and informal caregiving behaviour.

18 Limitations

There were several limitations to this study that have to be considered when interpreting the results.

(1) The studies did not include a control or comparison group, which makes it difficult to determine whether results are from VY and Taijifit™ or other confounding variables.

(2) The researcher performed all testing and acted as a coach throughout the intervention, which may have increased bias.

(3) The *p* value was not adjusted for multiple testing, which may have lead to a Type 1 error.

(4) Results only apply to a population that has the same characteristics as the participants that were recruited for this study (e.g., age range, informal caregiving status, health status). Further, because of the evident nature of these studies, the informal caregivers who volunteered may have recognized the importance of PA and may have had an interest in Yoga and Tai Chi.

(5) Although the estimated sample size for both Study I and Study II was 28 subjects, only 26 participants completed Study II. This could have reduced statistical power and increased the likelihood of Type I error.

(6) Subjects' motivation, well-being, and current physical condition may have influenced the primary measurements of the study.

(7) During testing, participants were instructed to perform repetitions to volitional fatigue. Although this was emphasized throughout the testing, some participants may have stopped before they reached muscular fatigue.

(8) Participants were instructed to not change their PA patterns. Changes in these parameters could have influenced the results of the studies. Leisure activity status questionnaires were administered to control for this variable. There was no change over time between groups in total leisure activity in Study I ($F [1, 27] = 2.47$, $p = 0.128$, $\eta 2 = 0.084$) and Study II ($F [1, 27] = 2.64$, $p = 0.117$, $\eta 2 = 0.099$).

(9) Eight participants (4 VY, 4 Taijifit™) reported being sick with the flu for one to two weeks throughout the 12-week intervention period (Study I) and one VY participant suffered a burn. One Taijifit™ participant reported being sick for three of the six weeks of cessation (Study II). This may have affected test results for Studies I and II.

(10) Participants were instructed to not perform any VY or Taijifit™ at least 48 hours before testing. Noncompliance may have influenced the results.

(11) In some cases, the maximal load on the leg press machine was not sufficient for the 1-RM strength tests. Therefore, 1-RM strength was predicted when ≤ 10 repetitions were performed (Baechle & Earle, 2008).

(12) The gender ratio was different across both groups and in both studies. Study I included five males and 11 females in the VY group and six males and seven females in the Taijifit™ group. Study II included five males and nine females in the VY group and six males and six females in the Taijifit™ group. Consequently, any interaction that may have occurred due to gender remains undetermined and a confounding effect of gender on the outcome variables cannot be ruled out. Further, the use of Yoga and

Tai Chi may have contributed to the disproportionately low number of males. Other studies involving Yoga and informal caregivers have also recruited a disproportionate number of females (from 69% to 100% of study participants). Moreover, Swartz and Keir (2007) reported that although exercise was the most preferred form of intervention and stress reduction technique for males and females, only 30% of males (as compared to 48% of females) chose Yoga as one of their stress-reduction or intervention preferences.

(13) In the aim of attracting as many informal caregivers are possible, various caregiver populations were recruited (caregiver-recipient dyads, care recipient health status, caregiving frequency), which may have affected the generalizability of the results beyond this population.

(14) The data obtained from the qualitative questionnaires is limited to the questions asked and is subject to misinterpreting questions.

(15) The online delivery presented drawbacks and potential confounding variables, such as a variety of VY and Taijifit™ instructors and adherence to the parameters of the programs.

19 Conclusion

Too often, informal caregivers suffer from physical pain, musculoskeletal injuries, aggravation of chronic illnesses, and other negative physical health consequences as a result of physically demanding tasks such as lifting people, shopping, meal preparation, personal hygiene, ambulation, and household/outdoor maintenance. Such negative

outcomes must be considered part of the cost of informal care; otherwise, informal (unpaid) caregiving comes at the cost of those who provide it (Bernier, 2014). Relying on informal caregivers who are left on their own is not a sustainable solution and is likely to have serious consequences for Canada in the future (Bernier, 2014). This lack of support can have negative impacts on the physical health of informal caregivers as well as the quality of care that they provide.

Along these lines, Canada's leading cancer, mental health, and caregiver groups stated that a failure to recognize and support caregivers heightens their risk of becoming *collateral casualties*, compromises their health, reduces the efficacy of the help they can provide, and increases costs to the health and social service systems (Canadian Cancer Action Network, 2013). While informal caregivers are not seeking to relinquish their caregiver role, caregiver demands may become overwhelming, putting them at risk of their own health deteriorating, and potentially putting the care recipient at risk through lack of proper care (Bernier, 2014). Since nearly every family will at some point in time be in the position of having to provide care for an ill loved one, reducing negative outcomes associated with informal caregiving represents a large and real public health concern (Ross et al., 2013). Thus, innovative and integrated programs, services, and policies are required to support informal caregivers with providing care (Bauer & Sousa-Poza, 2015; Lopez-Hartmann et al., 2012). Notably, it has been hypothesized that part of the negative impact on caregiver health may be a result of the reduced likelihood that informal caregivers engage in regular PA (Castro, Wilcox, O'Sullivan, Baumann, & King, 2002; Lim & Taylor, 2005; Vitaliano et al., 2002).

Despite the potential benefits of regular PA and the desire of informal caregivers to take part in such programs (Swartz & Keir, 2007), there is currently a lack of interventions designed to explicitly address the needs of this population through systematic and supervised exercise. Further, intervention studies for informal caregivers have mainly concentrated on the care recipient (Gorman, 2014; Waldron, Janke, Bechtel, Ramirez, & Cohen, 2012); less attention has been paid to the informal caregivers themselves (Beesley, Price, & Webb, 2010; Cochrane & Lewis, 2005). Yet, the increasing rates of mortality, chronic illness, and stress-related conditions in this population display that the boundaries of healing need to stretch further. Carr, Higginson, and Robinson (2003) express that ideally, the health care system would equip informal caregivers with lifestyle modalities, stress management skills, and important health-promoting strategies to help them improve and/or maintain their own health and wellbeing.

Recently, novel forms of PA, such as MBMs, have gained popularity due to their objective of equitably utilizing the pillars of health-related fitness (i.e., cardiovascular fitness, muscle strength and endurance, flexibility, and balance). Furthermore, MBMs fuse these components with breath work, bringing a meditative quality to a physical practice (Raub, 2002). Currently, two of the most widely used PAs categorized as MBMs are Yoga and Tai Chi. Along these lines, Epstein-Lubow, McBee, Darling, Armey, and Miller (2011) state that teaching skills that foster mindfulness (as do MBMs such as Yoga and Tai Chi) may offer promise as methods to reduce symptoms associated with the chronic stress of caregiving. Having a healthy sense of mindfulness and acceptance of one’s present moment experiences (emphasized in MBMs) may be especially important

when caring for a loved one with substantial, diverse, and intense needs (Reinhard et al., 2008). Appropriately, Dr. Patricia Boham, PhD, recently offered an online webinar entitled *Mindfulness practices for caregivers* through The Caregiver Network (The Caregiver Network, 2017). Mind-body interventions are also generally easy to practice and maintain, have low attrition rates, and are inexpensive (Li & Goldsmith, 2012). Other researchers have also indicated that Yoga and Tai Chi can be safely and effectively modified to fit the needs and PA levels of informal caregivers, potentially improving overall physical health outcomes with few or no negative side-effects (Brown, 2010; Cassileth & Deng, 2004; Elkins et al., 2010; Martin & Candow, 2016, 2017). Accordingly, implementing PA interventions that go beyond basic cardiovascular fitness or strength training exercise and utilize all aspects of the mind and body while also teaching tools that can be used in every day stressful situations is important for this population (Martin & Candow, 2016, 2017).

While that the demand for a wide-range of MBMs such as Yoga and Tai Chi will continue to exist in the foreseeable future (Cassileth & Deng, 2004), relatively few studies have examined the impact of these MBMs in the informal caregiver population. These are the first studies to examine the effects of VY and Taijifit™ on physical health outcome measures and QOL in informal caregivers. Additionally, these studies are the first to deliver VY and Taijifit™ via the Internet as well as examine cessation effects. The Internet is expanding the way society receives and retrieves information and offers an alternative to traditional face-to-face methods. Internet-based interventions may reduce numerous barriers to PA participation in this population while also offering additional advantages, such as greater access, convenience, flexibility, and novelty

(Fotheringham, Owies, Leslie, & Owen, 2000). Since Internet-based interventions have the potential to reach a greater number of people at a lower cost, they represent a cost-effective method in which to promote PA (Joseph et al., 2014). Thus, if Internet-based programs can be shown to be as effective as face-to-face, they may in turn be a more efficient and cost-effective delivery method since program costs and geographical barriers may be reduced/removed, potentially increasing accessibility (Steele, et al., 2009). Therefore, given the potential breadth of delivery, producing small changes in PA across a population has the potential for large public health impacts (Rose, 2001). Further, Woolf et al. (2006) highlight the importance of investigating strategies that promote intervention delivery in real-life settings, without the effect of researcher contact. Thus, utilizing popular and widely available PA Websites is not only practical and logistically sustainable, but also replicable – essential elements for informal caregivers to develop the ability to meet their own needs and for researchers to validate or refute previous investigations.

To date, much of the informal caregiving research utilizing the Internet has focused predominantly on dementia caregivers. In fact, research in general tends to target caregivers caring for individuals with specific health conditions. This makes generalizability of the results to the informal caregiver population as a whole difficult. While targeting specific types of caregivers is important, the Canadian Ministry of Health and Long-term Care (2017) notes that many caregivers have the same issues and needs and therefore it is important to improve access to generic programming. Thus, the literature supports interventions aimed at promoting positive health outcomes in informal caregivers irrespective of the care recipient's disease entity since caregiver well-being is

related to more aspects than simply the care recipient's health status (Lopez-Hartmann et al., 2012).

As the proportion of aging Canadians continues to increase, so does the number of informal caregivers. The foundation for improving the lives of caregivers exists; translating that foundation into widespread practice, however, still remains to be done. Caregivers need to be encouraged and supported to take care of their own health and participate in regular PA. Further, learning skills that apply to various aspects of the informal caregiving journey, such as those offered by MBMs, may be beneficial to caregivers and care recipients alike in both the short- and long-term. Ultimately, the objective is to reach more informal caregivers with effective evidence-based programs. Meeting this challenge is critical, and Yoga and Tai Chi have the ability to reach a large number of informal caregivers of all ages, PA levels, and MBM experience with just one instructor using minimal equipment (face-to-face delivery) or via well-established Websites such as Yogaglo.com and Taijifit.net (Internet-based delivery) for minimal costs. Though more research is needed to ensure that Internet-based interventions and VY and Taijifit™ are maximally effective, examinations regarding the use of this delivery method and these MBMs show promising results. These findings can help to tailor programs and interventions that will address the needs of this population, as well as contribute to the advancement of health care practices.

20 References

Abel, E., (1991). Who cares for the elderly? Public policy and the experiences of adult daughters. Philadelphia: Temple University Press. Retrieved from http://books.google.ca/books?id=zkyvkYgkrwkC&printsec=frontcover&dq=Who+cares+for+the+elderly%3F+Public+policy+and+the+experiences+of+adult+daughters&hl=en&sa=X&ei=y8FCVMf2AsuCigLPmoG4BQ&redir_esc=y#v=onepage&q=Who%20cares%20for%20the%20elderly%3F%20Public%20policy%20and%20the%20experiences%20of%20adult%20daughters&f=false

Adams, A., & Cox, A. L. (2008). Questionnaires, in-depth interviews and focus groups. In: Cairns, P., & Cox, A. L. (Eds), *Research Methods for Human Computer Interaction.* Cambridge, UK: Cambridge University Press, 17-34.

Administration on Aging. (2004). National family caregiver support program complete resource guide. Washington, DC: US Department of Health and Human Services; 2004.

Agarwal, S. K. (2013). Evidence based medical benefits of Yoga. *Indian Journal of Science, 2*(3), 1-4.

Alternative Medicine Zone. (2015, June 29). Myths about Tai Chi. Retrieved from http://www.altmedicinezone.com/tai-chi/myths-about-tai-chi/

Alvarez, L. (2010, April 10). How to get to Yoga class, without moving a muscle. *The New York Times.* Retrieved from http://www.nytimes.com/2010/04/11/nyregion/11stretch.html?_r=0

Ameneh Motalebi, S., & Amirzadeh, J., Abdollahi, A., & Kong Lim, W. (2014). Applying of theory of planned behavior to promote physical activity and exercise behavior among older adults. *Physical Education and Sport, 4*, 562-568. doi:10.7752/jpes.2014.04087

Andren, S., & Elmstahl, S. (2005). Family caregivers' subjective experiences of satisfaction in dementia care: Aspects of burden, subjective health and sense of coherence. *Scandinavian Journal of Caring Sciences, 19*(2), 157-168.

American Heart Association. (2015). What is caregiver burnout. Retrieved from https://www.google.ca/search?q=American+Heart+Association.+%282014%2C+December+18%29.+Signs+of+caregiver+burnout&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&dcr=0&ei=UFdFWutWo9TyB-TMq9gH

Aronson, J. (1992). Women's sense of responsibility for the care of old people: But who else is going to do it? *Gender and Society, 6*(1), 8-29.

Aziz, N. M. (2002). Cancer survivorship research: Challenge and opportunity. *The Journal of Nutrition, 132*, Supplement 11, 3493S-3503S.

Aziz, N. M., & Rowland, J. H. (2003). Trends and advances in cancer survivorship research: Challenge and opportunity. *Seminars in Radiation Oncology, 13*(3), 248-266.

Baechle, T. R., & Earle, R. W. (2008). *Essentials of strength training and conditioning*. *National Strength Conditioning Association (3rd ed.)*. Champaign, Ill.: Human Kinetics.

Baer, R. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*, 125-143.

Baines, C., Evans, P., & Neysmith, S. (1999). *Women's caring: Feminist perspectives on social welfare* (2nd ed.). Toronto: McClelland and Stewart.

Banerjee, B., Vadiraj, H. S., Ram, A., Rao, R., Jayapal, M., Gopinath, K. S., … Hande, M. P. (2007). Effects of an integrated Yoga program in modulating psychological stress and radiation-induced genotoxic stress in breast cancer patients undergoing radiotherapy. *Integral Cancer Therapy, 6*(3), 242-250. doi:10.1177/1534735407306214

Barnes, P. M., Powell-Griner, E., McFann, K., & Nahin, R. L. (2004). Complementary and alternative medicine use among adults: United States, 2002. *Seminars in Integrative Medicine, 2*(2), 54-71.

Battams, N. (2016). Family Caregiving in Canada: A Fact of Life and a Human Right. *The Vanier Institute of the Family*, 1-8.

Bauer, J. M., & Sousa-Poza, A. (2015). Impacts of informal caregiving on caregiver employment, health, and family. Institute for the Study of Labor. IZA Discussion Paper No. 8851.

Baumgarten, M., Battista, R. N., Infante-Rivard, C., Hanley, J. A., Becker, R., & Gauthier, S. (1992). The psychological and physical health of family members caring for an elderly person with dementia. *Journal of Clinical Epidemiology, 24*(1), 61-70.

Beach, S. R., Schulz, R., Williamson, G. M., Miller, L. S., Weiner, M. F., & Lance, C. E. (2005). Risk factors for potentially harmful informal caregiver behavior. *Journal of the American Geriatrics Society, 53*, 255-261.

Beauchamp, N., Irvine, A. B., Seeley, J., & Johnson, B. (2005). Worksite-based Internet multimedia program for family caregivers of persons with dementia. *The Gerontologist, 45*(6), 793-801.

Bedini, L. A., & Guinan, D. M. (1996). The leisure of caregivers of older adults: Implications for CTRS's in non-traditional settings. *Therapeutic Recreational Journal, 30*, 274-288.

Beeken, J. (2004). *Don't hold your breath: A guide to good breathing*. Great Britain: Cambridge University Press.

Beesley, V. L., Price, M. A., & Webb, P. M. (2010). Loss of lifestyle: Health behaviour and weight changes after becoming a caregiver of a family member diagnosed with ovarian cancer. *Support Care Cancer, 19*(12), 1949-1956. doi:10.1007/s00520-010-1035-2

Ben-Josef, A. M., Chen, J., Wileyto, P., Doucette, A., Bekelman, J., Christodouleas, J., … Vapiwala, N. (2017). Effect of Eischens Yoga during radiation therapy on prostate cancer patient symptoms and quality of life: A randomized phase II trial. *International Journal of Radiation Oncology Biology Physics*, *98*(5), 1036-1044.

Berglund, E., Lytsy, P., & Westerling, R. (2015). Health and wellbeing in informal caregivers and non-caregivers: a comparative cross-sectional study of the Swedish a general population. *Health and Quality of Life Outcomes, 13*, 109-119. doi:10.1186/s12955-015-0309-2

Bernier, N. (2014, October 2). Why Canada's reliance on unpaid care is not sustainable. *The Globe and Mail*. Retrieved from http://www.theglobeandmail.com/opinion/why-canadas-reliance-on-unpaid-care-is-not-sustainable/article20888991/

Bevans, M. F., & Sternbergm, E. M. (2012). Caregiving burden, stress, and health effects among family caregivers of adult cancer patients. *Journal of the American Medical Association, 307*(4), 398-403.

Bijlani, R. L., Vempati, R. P., Yadav, R. K., Ray, R. B., Gupta, V., Sharma, R., Mehta, N., & Mehapatra, S. C. (2005). A brief but comprehensive lifestyle education program based on Yoga reduces risk factors for cardiovascular disease and diabetes mellitus. *Journal of Alternative and Complementary Medicine, 11*, 267-274.

Black, D. S., Irwin, M. R., Olmstead, R., Ji, E., Crabb Breen, E., & Motivala, S. J. (2014). Tai chi meditation effects on nuclear factor-κB signaling in lonely older adults: A randomized controlled trial. *Psychotherapy and Psychosomatics, 83*(5), 315-317. doi:10.1159/000359956

Blanchard, C. M., Courneya, K. S., Rodgers, W. M., & Murnaghan, D. M. (2002). Determinants of exercise intention and behavior in survivors of breast and prostate cancer: An application of the theory of planned behavior. *Cancer Nursing, 25*(2), 88-95.

Blom, M. M., Zarit, S. H., Groot Zwaaftink, R. B. M., Cuijpers, P., & Pot, A. M. (2015). Effectiveness of an Internet Intervention for Family Caregivers of People with Dementia: Results of a Randomized Controlled Trial. *PLoS ONE, 10*(2), e0116622. doi:10.1371/journal.pone.0116622

Blum, K., & Sherman, D. W. (2010). Understanding the experience of caregivers: A focus on transitions. *Seminars in Oncology Nursing, 26*(4), 243-258.

Blumenthal, J. A., Emery, C. F., Madden, D. J., George, L. K., Coleman, R. E., Riddle, M. W., McKee, D. C., … Williams, R. S. (1989). Cardiovascular and behavioral effects of aerobic exercise training in healthy older men and women. *The Journals of Gerontology, 44*(5), M147–M157.

Bookman, A., Harrington, M., Pass, L., & Reisner, E. (2007). *Family caregiver handbook: Finding elder care resources in Massachusetts*. Cambridge, MA: Massachusetts Institute of Technology. Retrieved from http://web.mit.edu/workplacecenter/hndbk/

Booth-LaForce, C., Thurston, R. C., & Taylor, M. R. (2007). A pilot study of Hatha Yoga treatment for menopausal symptoms. *Maturitas, 57*(3), 286-295.

Bosch, P. R., Traustadottir T., Howard P., & Matt, K. S. (2009). Functional and physiological effects of Yoga in women with rheumatoid arthritis: A pilot study. *Alternative Therapies in Health and Medicine, 15*(4), 24-31.

Boudreau, F., & Godin, G. (2007). Using the theory of planned behaviour to predict exercise intention in obese adults. *Canadian Journal of Nursing Research, 39*(2), 112-125.

Bridges, B. J. (1995). *Therapeutic caregiving: A practical guide for caregivers of persons with Alzheimer's and other dementia-causing diseases*. Washington, DC, USA: BJB Publishing.

Brismee, J. M., Paige, R. L., & Chyu, M. C. (2007). Group and home-based Tai Chi in elderly subjects with knee osteoarthritis: A randomized controlled trial. *Clinical Rehabilitation, 21*(2), 99-111.

Brodaty, H., & Donkin, M. (2009). Family caregivers of people with dementia. *Dialogues in Clinical Neuroscience, 11*(2), 217-228.

Brodaty, H., & Green, A. (2000). Family caregivers for people with dementia. In: O'Brien J., Ames, D., & Burns, A. (Eds.), *Dementia* (2nd ed.). London: Arnold, 193-205.

Brodaty, H., Green, A. B., & Koschera, A. (2003). Meta-analysis of psychosocial interventions for caregivers of people with dementia. *Journal of the American Geriatrics Society, 51*(5), 657-64.

Brodaty, H., & Hadzi-Pavlovic, D. (1990). Psychosocial effects on carers of living with persons with dementia. *Australian and New Zealand Journal of Psychiatry, 24*(3), 351-361.

Brouwer, W., Kroeze, W., Crutzen, R., De Nooijer, J., De Vries, N., Brug, J., & Oenema, A. (2011). Which intervention characteristics are related to more exposure to Internet-delivered healthy lifestyle promotion interventions? A systematic review. *Journal of Medical Internet Research, 13*(1), e2. doi:10.2196/jmir.1639

Brown, N. P. (2010, January-February). Easing ills through Tai Chi. Researchers study the benefits of this mind-body exercise. *Harvard Magazine.* Retrieved from http://harvardmagazine.com/2010/01/researchers-study-tai-chi-benefits

Brown, R. P., & Gerbarg, P. L. (2005). Sudarshan Kriya Yogic breathing in the treatment of stress, anxiety, and depression. Part II--clinical applications and guidelines. *Journal of Alternative and Complementary Medicine, 11*(4), 711-717.

Brown, K. D., Koziol, J. A., & Lotz, M. (2008). A Yoga-based exercise program to reduce the risk of falls in seniors: A pilot and feasibility study. *Journal of Alternative and Complementary Medicine, 14*(5), 454-457.

Brown, A. R., & Mulley, G. R. (1997). Injuries sustained by caregivers of disabled elderly people. *Age and Aging, 26*(1), 21-23.

Bryant, G. & James, L. (2004). *Simply Tai Chi*. Victoria, Australia: Hinkler Books Pty Ltd.

Cameron, J. I., Franche, R. L., Cheung, A. M., & Stewart, D. E. (2002). Lifestyle interference and emotional distress in family caregivers of advanced cancer patients. *Cancer, 94,* 521-527.

Campbell, L. C., Keefe, F. J., Scipio, C., McKee, D. C., Edwards, C. L., Herman, S. H., … Donatucci, C. (2007). Facilitating research participation and improving quality of life for African American prostate cancer survivors and their intimate partners. A pilot study of telephone-based coping skills training. *CANCER Supplement, 109*(2), 414-424.

Canadian Association for Community Care. (2002). *Give me a break!: Helping family caregivers of seniors overcome barriers to respite*. Ottawa, Canada: Canadian Association for Community Care, 2002.

Canadian Cancer Action Network. (2013). Canada, a caring society: Action table on family caregivers - Informed dialogue leading to concrete action for all Canadians. Ottawa, Canada. Retrieved from https://www.google.ca/search?q=Canada,+a+Caring+Society:+Action+Table+on+Family+Caregivers++Informed+Dialogue+Leading+to+Concrete+Action+for+all+Canadians&ie=utf-8&oe=utf8&gws_rd =cr&ei=9QhVV6uXBcfWyALez7voAw

Canadian Institute for Health Information. (2011). National health expenditure trends, 1975 to 2011. Ottawa, Canada: CIHI, 2011.

Canadian Institute for Health Information. (2015). Commonwealth Fund Survey 2014: Informal Caregiving Infographic. Informal caregiving. Retrieved from https://www.cihi.ca/en/commonwealth-fund-survey-2014-informal-caregiving-infographic

Canadian Institutes of Health Research. (2010). Supporting Informal Caregivers - The Heart of Home Care. Analysis in Brief, 1-22. Retrieved from https://www.google.ca/search?q=Canadian+Institutes+of+Health+Research,+(2010).+Supporting+Informal+Caregivers%E2%80%94+The+Heart+of+Home+Care.+Health+Systems+Performance.+Analysis+in+Brief.+1-22&ie=utf-8&oe=utf-8&gws_rd=cr&ei=ozueWYayM8LVjwSThb2wCw

Canadian Physical Activity Guidelines. (2011a). Canadian physical activity guidelines for adults 18-64 years (2011). *Canadian Society for Exercise Physiology***.** Retrieved from http://www.csep.ca/view.asp?ccid=580

Canadian Physical Activity Guidelines. (2011b). Canadian Physical Activity Guidelines for Older Adults 65 years & older (2011). *Canadian Society for Exercise Physiology*. Retrieved from http://www.csep.ca/view.asp?ccid=580

Cap, L. (2015). 10 myths about Yoga. Retrieved from http://Yogatime.tv/blog/10-myths-about-Yoga/

Capistrant, B. D., Moon, J. R., Berkman, L. F., & Glymour, M. M. (2012). Current and long term spousal caregiving and onset of cardiovascular disease. *Journal of Epidemiology & Community Health, 66*(10), 951-956.

Carers Canada. (2016). Carer facts. *Carers Canada*. Retrieved from http://www.carerscanada.ca/carer-facts/

Carlson, L. E., Speca, M., Faris, P., & Patel, K. D. (2007). One year pre-post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatient. *Brain, Behavior, and Immunity 21*(8), 1038-1049.

Carr, A. J., Higginson, I. J., & Robinson, P. G. (2003). *Quality of life.* London, ENG: PMJ Publishing.

Carrico, M. (2007). The branches of the Yoga tree. *Yoga Journal.* Retrieved from https://www.yogajournal.com/practice/the-branches-of-yoga

Carstairs, S., & Keon, W. J. (2009). Canada's aging population: Seizing the opportunity. Ottawa, Canada: Special Senate Committee on Aging, 2009, 1-233. Retrieved from http://www.senate-senat.ca/age.asp

Carter, P. A., & Chang, B. L. (2000). Sleep and depression in cancer caregivers. *Cancer Nursing, 23*(6), 410-415.

Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Report, 110*(2), 126-131.

Cassileth, B. R., & Deng, G. (2004). Complementary and alternative therapies for cancer. *The Oncologist, 9*(1), 80-89.

Castro, C. M., Wilcox, S., O'Sullivan, P., Baumann, K., & King, A. C. (2002). An exercise program for women who are caring for relatives with dementia. *Psychosomatic Medicine, 64*(3), 458-68.

Caswell, L. W., Vitaliano, P. P., Croyle, K. L., Scanlan, J. M., Zhang, J., & Daruwala, A. (2003). Negative associations of chronic stress and cognitive performance in older adult spouse caregivers. *Experimental Aging Research, 29*(3), 303-318.

Centers for Disease Control and Prevention and the Kimberly-Clark Corporation. (2008). Assuring healthy caregivers, a public health approach to translating research into practice: The RE-AIM framework. Neenah, WI: Kimberly-Clark Corporation. Retrieved from www.cdc.gov/aging/ and www.kimberly-clark.com

Chan, W. C., Lautenschlager, N., Dow, B., Ma, S. L., Wong, C. S. M., & Lam, L. C. W. (2016). A home-based exercise intervention for caregivers of persons with dementia: Study protocol for a randomised controlled trial, *Trials, 17*(460), 1-8. doi:10.1186/s13063-016-1582-z

Chan, A., Malhotra, C., Malhotra, R., Rush, A. J., & Ostbye, T. (2013). Health impacts of caregiving for older adults with functional limitations: results from the Singapore survey on informal caregiving. *Journal of Aging and Health. 25*(6), 998-1012.

Channer, K. S., Barrow, D., Barrow, R., Osborne, M., & Ives, G. (1996). Changes in haemodynamic parameters following Tai Chi Chuan and aerobic exercise in patients recovering from acute myocardial infarction. *Postgraduate Medical Journal, 72*(848), 349-351.

Chappell, N. & Dujela, C. (2008). Caregiving: Predicting at-risk status. *Canadian Journal on Aging, 27*(2). doi:10.3138/cja.27.2.169

Chattha, R., Nagarathna, R., Venkatram, P., & Hongasandra, N. (2008). Treating the climacteric symptoms in Indian women with an integrated approach to Yoga therapy: A randomized control study. *Menopause, 15*(5), 862-870.

Chen, K. M., Chen, M. H., Chao, H. C., Hung, H. M., Lin, H. S., & Li, C. H. (2009). Sleep quality, depression state, and health status of older adults after silver Yoga exercises: Cluster randomized trial. *International Journal of Nursing Studies, 46*(2), 154-163.

Chen, K. M., Chen, M. H., Hong, S. M., Chao, H. C., Lin, H. S., & Li, C. H. (2008). Physical fitness of older adults in senior activity centres after 24-week silver Yoga exercises. *Journal of Clinical Nursing, 17*(19), 2634-2646.

Chen, E. W., Fu, A. S., Chan, K. M., & Tsang, W. W. (2012). The effects of Tai Chi on the balance control of elderly persons with visual impairment: A randomised clinical trial. *Age and Ageing*, 41(2), 254-259. doi:10.1093/ageing/afr146

Chenoweth, B., & Spencer, B. (1986). Dementia: The experience of family caregivers. *Gerontologist, 26*(3), 267-272.

Chentsova-Dutton, Y., Shuchter, S., Hutchin, S., Strause, L., Burns, K., & Zisook, S. (2000). The psychological and physical health of hospice caregivers. *Annals of Clinical Psychiatry, 12*(1), 19-27.

Chi, N. C., & Demiris, G. (2015). A systematic review of telehealth tools and interventions to support family caregivers. *Journal of Telemedicine and Telecare, 21*(1), 37-44. doi:10.1177/1357633X14562734

Chilibeck, P. D., Calder, A. W., Sale, D. G., & Webber, C. E. (1998). A comparison of strength and muscle mass increases during resistance training in young women. *European Journal of Applied Physiology and Occupational Physiology, 77*(1-2), 170-175.

Chitty, J. (2013). *Dancing with yin and yang. Ancient wisdom, modern psychotherapy and Randolph Stone's polarity therapy.* Boulder, CO: Polarity Press.

Chodzko-Zajko, W. J., Proctor, D. R., Fiatarone Singh, M. A., Minson, C. T., Nigg, C. R. Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. *American College of Sports Medicine position stand, 41*(7), 1510-1530.

Christakis, N. A., & Allison, P. D. (2006). Mortality after the hospitalization of a spouse. *New England Journal of Medicine, 354*(7), 719-730.

Chrusch, M. J., Chilibeck, P. D., Chad, K. E., Davison, K. S., & Burke, D. G. (2001). Creatine supplementation combined with resistance training in older men. *Medicine & Science in Sports & Exercise, 33*(12), 2111-2117.

Chuntharapat, S., Petpicketchian, W., & Hatthakit, U. (2008). Yoga during pregnancy: Effects on maternal comfort, labor pain, and birth outcomes. *Complementary Therapies in Clinical Practice, 14*(2), 105-115.

Chyu, M. C., James, C. R., Sawyer, S. F., Brismée, J. M., Xu, K. T., Poklikuha, G., … Shen, C. L. (2010). Effects of tai chi exercise on posturography, gait, physical function and quality of life in postmenopausal women with osteopaenia: A randomized clinical study. *Clinical Rehabilitation, 24*(12), 1080-1090. doi:10.1177/0269215510375902

Clark, B. (2007). YinSights. *A journey into the philosophy & practice of Yin Yoga*. Printed in Canada.

Cochrane, B., & Lewis, F. M. (2005). The partner's adjustment to breast cancer: a critical analysis of intervention studies. *Health Psychology, 24*(3), 327-332

Coe, N., & Van Houtven, C. (2009). Caring for Mom and neglecting yourself? The health effects of caring for an elderly parent. *Health Economics 18*(9), 991-1010.

Cohen, K. S. (1997). *The way of qigong. The art and science of Chinese energy healing*. New York, USA: Ballantine Books.

Cohen, C. A., Colantonio, A., & Vernich, L. (2002). Positive aspects of caregiving: Rounding out the caregiver experience. *International Journal of Geriatric Psychiatry, 17*(2), 184-188.

Cohen, L., Warneke, C., Fouladi, R. T., Rodriguez, M. A., & Chaoul-Reich, A. (2004). Psychological adjustment and sleep quality in a randomized trial of effects of a Tibetan Yoga intervention in patients with lymphoma. *Cancer, 100*(10), 2253-2260.

Coldman, R. (2008, October 13). Tai Chi myths exposed - 7 myths about Tai Chi that continue to confuse and mislead beginners. Retrieved from http://ezinearticles.com/?Tai-Chi-Myths-Exposed---7-Myths-About-Tai-Chi-That-Continue-to-Confuse-and-Mislead-Beginners&id=1578272

Collins, C. (1998). Yoga: intuition, preventive medicine, and treatment. *Journal of Obstetric, Genycologic, & Neonatal Nursing, 27*(5), 563-568.

Collins, L. G., & Swartz, K. (2011). Caregiver care. *American Family Physician, 83*(11), 1309-1317.

Conn, V. S., Hafdahl, A. R., & Mehr, D. R. (2011). Interventions to increase physical activity among healthy adults: meta-analysis of outcomes. *American Journal of Public Health, 101*(4), 751-758.

Cook, R. F., Billings, D. W., Hersch, R. K., Back, A. S., & Hendrickson, A. (2007). A field test of a web-based workplace health promotion program to improve dietary practices, reduce stress, and increase physical activity: Randomized controlled trial. *Journal of Medical Internet Research. 9*(2):e17.

Cope, S. (2006). *The wisdom of Yoga. A seeker's guide to extraordinary living*. New York, USA: Bantam Dell.

Coulter, H. D. (2001). *Anatomy of Hatha Yoga. A manual for students, teachers, and practitioners*. Vermont, USA: Body and Breath, Inc.

Courneya, K. S., & Friedenreich, C. M. (1999). Utility of the theory of planned behaviour for understanding exercise during breast cancer treatment. *Psycho-Oncology, 8*(2), 112-122.

Courneya, K. S., Friedenreich, C. M., Arthur, K., & Bobick, T. M. (1999). Understanding exercise motivation in colorectal cancer patients: A prospective study using the theory of planned behavior. *Rehabilitation Psychology, 44*, 68-84.

Cramer, H., Lauche, R., Langhorst, J., & Dobos, G. (2016). Is one yoga style better than another? A systematic review of associations of yoga style and conclusions in randomized yoga trials. *Complementary Therapies in Medicine, 25,* 178-187.

Crew, K. D., Capodice, J. L., Greenlee, H., Apollo, A., Jacobson, J. S., Raptis, G., … Hershman, D. L. (2007). Pilot study of acupuncture for the treatment of joint symptoms related to adjuvant aromatase inhibitor therapy in postmenopausal breast cancer patients. *Journal of Cancer Survivorship, 1*(4), 283-291.

Csikszentmihalyi, M. (1990). *Flow. The Psychology of optimal experience.* (1991). HarperCollins: New York, NY.

Culos-Reed, S. N., Carlson, L., Daroux, L., & Hately-Aldous, S. (2006). A pilot study of Yoga for breast cancer survivors: Physical and psychological benefits. *Psycho-Oncology, 15*(10), 891-897. doi:10.1002/pon.1021

Culos-Reed, S. N., Mackenzie, M. J., Sohl, S. J., Jesse, M. T., Zahavich, A. N. S., & Danhauer, S. C. (2012). Yoga & cancer interventions: A review of the clinical significance of patient reported outcomes for cancer survivors. *Evidence-Based Complementary and Alternative Medicine*, Article ID 642576, 17 pages. doi:10.1155/2012/642576

Cuthbert, C. A., King-Shier, K., Tapp, D. M., Ruether, D., & Culos-Reed, S. N. (2017). Exploring Gender Differences in Self-Reported Physical Activity and Health Among Older Caregivers. *Oncology Nursing Forum, 44*(4), 435-445. doi:10.1188/17.ONF.435-445

Danhauer, S., Mihalko, S., Russell, G., Campbell, C., Felder, L., Daley, K. & Levine, E. (2009). Restorative Yoga for women with breast cancer: Findings from a randomized pilot study. *Psycho-Oncology, 18*(4), 360-368. doi:10.1002/pon.1503

Danucalov, M. A. D., Kozasa, E. H., Ribas, K. T., Galduroz, J. C. F., Garcia, M. C., Verreschi, I. T. N., Oliveira, K. C., … Leitel, J. R. (2013). A Yoga and compassion meditation program reduces stress in familial caregivers of Alzheimer's disease patients. *Evidence-Based Complementary and Alternative Medicine*. Article ID 513149, 1-9. doi:10.1155/2013/513149

Darragh, A. R., Sommerich, C. M., Lavender, S. A., Tanner, K. J., Vogel, K., & Campo, M. (2015). Musculoskeletal discomfort, physical demand, and caregiving activities in informal caregivers. *Journal of Applied Gerontology, 34*(6), 734-760.

Dash, M., & Telles, S. (2001). Improvement in hand grip strength in normal volunteers and rheumatoid arthritis patients following Yoga training. *Indian Journal of Physiology and Pharmacology, 45*(3), 355-360.

Davies, C. A., Spence, J. C., Vandelanotte, C., Caperchione, C. M., & Mummery, W. K. (2012). Meta-analysis of internet-delivered interventions to increase physical activity levels. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 52-64.

Deloitte Canadian Health Consumer Survey. (2009). Treating patients as consumers. 2009 Canadian health care consumer survey report. Retrieved from http://kinwahlin.wordpress.com/2009/11/27/treating-patients-as-consumers-2009-canadian-health-care-consumer-survey-report-deloitte-6-november-2009/

Dechamps, A., Diolez, P., Thiaudière, E., Tulon, A., Onifade, C., Vuong, … Bourdel-Marchasson, I. (2010). Effects of exercise programs to prevent decline in health-related quality of life in highly deconditioned institutionalized elderly persons: A randomized controlled trial. *Archives of Internal Medicine, 170*(2), 162-169. doi:10.1001/archinternmed.2009.489

Desikachar, K. (1999). *The heart of Yoga: Developing a person practice*. Vermont, USA: Inner Traditions.

Desikachar, K., Bragdon, L., & Bossart, C. (2005). The Yoga of healing: Exploring Yoga's holistic model for health and well-being. *International Journal of Yoga, 15*(1), 17-39.

DiBenedetto, M., Innes, K. E., Taylor, A. G., Rodeheaver, P. F., Boxer, J. A., Wright, H. J., & Kerrigan, D. C. (2005). Effect of a gentle Iyengar Yoga program on gait in the elderly: An exploratory study. *Archives of Physical Medicine and Rehabilitation, 86*(9), 1830-1837.

Do, Y. K, Norton, E. C., Stearns, S. C., & Van Houtven, C. H. (2015). Informal care and caregiver’s health. *Health Economics, 24*(2), 224-237.

Dunn, N. J., & Strain, L. A. (2001). Caregivers at risk? Changes in leisure participation. *Journal of Leisure Research, 33*(1), 32-55.

Elkins, G., Fisher, W., & Johnson, A. (2010). Mind-body therapies in integrative oncology. *Current Treatment Options in Oncology, 11*(3-4), 128-140. doi:10.1007/s11864-010-0129-x

Epstein-Lubow, G., McBee, L., Darling, E., Armey, M., & Miller, I. (2011). A pilot investigation of mindfulness-based stress reduction for caregivers of frail elderly. *Mindfulness, 2*(2), 95-102.

Etkin, C. D., Prohaska, T. R., Connell, C. M., Edelman, P., & Hughes, S. L. (2008). Antecedents of physical activity among family caregivers. *Journal of Applied Gerontology, 27*(3), 350.

Evercare and National Alliance for Caregiving. (2006). Caregivers in decline: A close-up look at the health risks of caring for a love one. Retrieved from http://webcache.googleusercontent.com/search?q=cache:Aq4EbZ0N55cJ:www.caregiving.org/data/Caregivers%2520in%2520Decline%2520Study-FINAL-lowres.pdf+&cd=2&hl=en&ct=clnk&gl=ca

Evergreen Fitness. (2017). Why we love the Taijifit approach. Retrieved from http://evergreen-fitness.com/about/taichi-faqs/

Family Caregiver Alliance. (2006). Caregiver assessment: Voices and views from the field. Report from a National Consensus Development Conference (Vol. II). San Francisco: Author. Retrieved from https://www.google.ca/search?q=Caregiver+assessment:+Voices+and+views+from+the+%09field.+Report+from+a+National+Consensus+Development+Conference+&ie=utf-8&oe=utf-8&gws_rd= cr& ei=COTcVpqBDMydjwSt54mwDg

Family Caregiver Alliance. (2011). Caregiving with your siblings. Retrieved from https://www.caregiver.org/caregiving-with-your-siblings

Family Caregiver Alliance. (2014). Definitions. Retrieved from https://www.caregiver.org/definitions-0

Family Caregiver Alliance. (2016). New to caregiving. Retrieved from https://www.caregiver.org/new-to-caregiving

Farran, C. J., Staffileno, B. A., Grilley, D. W., McCann, J. J., Yan, L., Castro, C. M., & King, A. C. (2008). A lifestyle physical activity intervention for caregivers of persons with Alzheimer's disease. *American Journal of Alzheimer's Disease and Other Dementias, 23*(2), 132-142.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175-191.

Feng, G-F., English, J., & Lippe, T. (2011). *Tao te ching.* New York: Vintage Books.

Feuerstein, G. (2001). *The Yoga tradition. Its history, literature, philosophy and practice*. Phoenix, AZ, USA: Hohm Press.

Feuille, M., & Pargament, K. (2015). Pain, mindfulness, and spirituality: A randomized controlled trial comparing effects of mindfulness and relaxation on pain-related outcomes in migraineurs. *Journal of Health Psychology 20*(8), 1090-1106.

Fotheringham, M. J., Owies, D., Leslie, E., & Owen, N. (2000). Interactive health communication in preventive medicine: Internet-based strategies in teaching and research. *American Journal of Preventive Medicine, 19*(2), 113-120.

Fransen, M., Nairn, L., & Winstanley, J. (2007). Physical activity for osteoarthritis management: A randomized controlled clinical trial evaluating hydrotherapy or Tai Chi classes. *Arthritis & Rheumatology, 57*(3), 407-414.

Fraser, T. (2007). *Total Ashtanga*. New York, NY, USA: Duncan Baird.

Galante, L. (1981). *Tai Chi. The supreme ultimate*. Boston, MA, USA: Red Wheel/Weiser.

Garfinkel, M. S., Schumacher, H. R., Husain, A., Levy, M., & Resheta, R. A. (1994). Evaluation of a Yoga based regimen for treatment of osteoarthritis of the hands. *Journal of Rheumatology, 21*(12), 2341-2343.

Garratt, A., Schmidt, L., Mackintosh, A., & Fitzpatrick, R. (2002). Quality of life measurement: Bibliographic study of patient assessed health outcome measures. *British Medical Journal, 324*, 1417-1421.

Gilmour, H., & Park, J. (2005). Dependency, chronic conditions and pain in seniors. *Health Reports, 16* Suppl., 21-31.

Gimbel, M. A. (1998). Yoga, meditation, and imagery: clinical applications. *Nurse Practitioner Forum, 9*(4), 243-255.

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences, 10*(3), 141-146.

Gokal, R., & Shillito, L. (2007). Positive impact of Yoga and pranayam on obesity, hypertension, blood sugar, and cholesterol: A pilot assessment. *Journal of Alternative Complementary Medicine, 13*(10), 1056-1057.

Goldstein, N. E., Concato, J., Fried, T. R., Kasl, S. V., Johnson-Hurzeler, R., & Bradley, E. H. (2004). Factors associated with caregiver burden among caregivers of terminally ill patients with cancer. *Journal of Palliative Care, 20*, 38-43.

Goodhead, A., & McDonald, J. (2007). Informal caregivers literature review. A report prepared for the National Health Committee Health Services Research Centre, Victoria University of Wellington. Retrieved from https://www.google.ca/search?q=Goodhead,+A.,+%26+McDonald,+J.+%282007%29.+A+report+prepared+for+the+National+Health+Committee+Health+Services+Research+Centre,+Victoria+University+of+Wellington.+&ie=utf-8&oe=utf-8&gws_rd=cr&ei=RObcVpPBFcWljgTStJOACw

Gorman, A. (2014, March 12). UCLA memory programs offers ‘gym for your brain’. *Kaiser Health News* and *The Washington Post*. Retrieved from http://khn.org/news/ucla-memory-program-offers-gym-for-your-brain/

Government of Canada. (2013). Changes to the old age security program. Retrieved from http://www.servicecanada.gc.ca/eng/services/pensions/oas/changes/index.shtml

Government of Canada. (2016a). Home and community health care. Retrieved from https://www.canada.ca/en/health-canada/services/home-continuing-care/home-community-care.html

Government of Canada. (2016b). Old age security – Eligibility. Retrieved from https://www.canada.ca/en/services/benefits/publicpensions/cpp/old-age-security/eligibility.html

Gräsel, E. (2002). When home care ends – changes in the physical health of informal caregivers caring for dementia patients: A longitudinal study. *Journal of the American Geriatrics Society 50*(5), 843-849.

Greaney, M. L., Riebe, D., Garber, C. E., Rossi, J. S., Lees, F. D., Burbank, P. A., … & Clark, P. G. (2008). Long-term effects of a stage-based intervention for changing exercise intentions and behavior in older adults. *Gerontologist, 48*(3), 358-367.

Green, M. (2013). *The Tai Chi healing bible.* New York: Chartwell Books, Inc.

Grilley, P. (2002). *Yin Yoga. Outline of a quiet practice*. Oregon, USA: White Cloud Press.

Grilley, P. (2012). *Yin Yoga. Principles & practice*. Oregon, USA: White Cloud Press.

Grossman, P., Niemann, L., Schmidt, S., & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: a meta-analysis. *Journal of Psychosomatic Research, 57*(1), 35-43.

Grunfeld, E., Glossop, R., McDowell, I., & Danbrook, C. (1997). Caring for elderly people at home: The consequences to caregivers. *Canadian Medical Association Journal, 157*(8), 1101-1105.

Hageman, P. A., Walker, S. N., & Pullen, C. H. (2005). Tailored versus standard internet-delivered interventions to promote physical activity in older women. *Journal of Geriatric Physical Therapy, 28*(1), 28-33.

Hägglund, E., Hagerman, I., Dencker, K., & Strömberg, A. (2017). Effects of yoga versus hydrotherapy training on health-related quality of life and exercise capacity in patients with heart failure: A randomized controlled study. *European Journal of Cardiovascular Nursing, 16*(5), 381-389.

Haley, W. E., Levine, E. G., Brown, S. L., Berry, J. W., & Hughes, G. H. (1987). Psychological, social, and health consequences of caring for a relative with senile dementia. *Journal of the American Geriatric Society, 35*(5), 405-411.

Harinath, K., Malhotra, A. S., Pal, K., Prasad, R., Kumar, R., Kain, T. C., Rai, L., & Sawhney, R. C. (2004). Effects of hatha Yoga and omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. *Journal of Alternative and Complementary Medicine, 10*(2), 261-268.

Hartman, C. A., Manos, T. M., Winter, C., Hartman, D. M., Li, B., & Smith, J. C. (2000). Effects of T'ai Chi training on function and quality of life indicators in older adults with osteoarthritis. *Journal of the American Geriatrics Society, 48*(12), 1553-1559.

Harvard Health Publications. (2016, February). 5 of the best exercises you can ever do. *Harvard Health Publications, Harvard Medical School.* Retrieved from http://www.health.harvard.edu/ staying-healthy/5-of-the-best-exercises-you-can-ever-do

Harwood, D. G., Barker, W. W., Ownby, R. L., & Duara, R. (2000). Caregiver self-rated health in Alzheimer's disease. *Clinical Gerontologist, 21*(4), 19-33.

Hawranik, P., & Strain, L. A. (2002). Always on-call: The health of informal caregivers for seniors. *Research Bulletin of the Centres of Excellence for Women's Health, 3*(1), 8-10. Retrieved from http://www.cwhn.ca/en/node/22292

Health Canada. (2002). National Profile of Family Caregivers in Canada - Final Report. Retrieved from http://www.hc-sc.gc.ca/hcs-sss/pubs/home-domicile/2002-caregiv-interven/index-eng.php#a2_1

Henningsen, N., & Morrison, M. (2017). Advancing collective priorities. A Canadian carer strategy. Retrieved from http://www.ccanceraction.ca/advancing-collective-priorities-a-canadian-carer-strategy/

Hewett, Z. L., Pumpa, K. L., Smith, C. A., Fahey, P. P., & Cheema, B. S. (2017). Effect of a 16-week Bikram yoga program on perceived stress, self-efficacy and health-related quality of life in stressed and sedentary adults: A randomised controlled trial. *BMC Complementary and Alternative Medicine, 17*(1), 1-6.

Hiel, L., Beenackers, M. A., Renders, C. M., Robroek, S. J. W., Burdorf, A., & Croezen, S. (2015). Providing personal informal care to older European adults: Should we care about the caregivers' health? *Preventive Medicine 70*, 64-68.

Hill, K., Smith, R., Fearn, M., Rydberg, M., & Oliphant, R. (2007). Physical and psychological outcomes of a supported physical activity program for older carers. *Journal of Aging and Physical Activity, 15*(3), 257-271.

Hollander, M., Lui, G., & Chappelle, N. (2009). Who Cares and How Much? The imputed economic contribution to the Canadian healthcare system of middle-aged and older unpaid caregivers providing care to the elderly. *Healthcare Quarterly, 12*(2), 42-49.

Hopewell, S., Loudon, K., Clarke, M. J., Oxman, A. D., & Dickersin, K. (2009). Publication bias in clinical trials due to statistical significance or direction of trial results. *The Cochrane Database of Systematic Reviews, 1*, MR000006. doi:10.1002/14651858.MR000006.pub3

Hoover, M., & Rotermann, M. (2009). Seniors' use of and unmet needs for home care, 2009. Statistics Canada, Catalogue no. 82-003-XPE. *Health Reports, 23*(4). Retrieved from https://www.statcan.gc.ca/pub/82-003-x/2012004/article/11760-eng.htm

Houston, P., & McFarlane, B. (2016). Health benefits of Tai Chi. What is the evidence? *Canadian Family Physician, 62,* 881-890.

Hsieh, H-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277-1288. doi:10.1177/1049732305276687

Hu, C., Kung, S., Rummans, T. A., Clark, M. M., & Lapid, M. I. (2015). Reducing caregiver stress with internet-based interventions: A systematic review of open-label and randomized controlled trials. *Journal of the American Medical Informatics Association, 22*(e1), e194-e209. doi:10.1136/amiajnl-2014-002817

Human Resources and Skills Development Canada. (2006). Disability in Canada: A 2006 profile. Retrieved from http://publications.gc.ca/site/eng/ 9.693366/publication.html

Hunsberger, M. (2017). These are the most popular Yoga styles in the world. *Doyouyoga.* Retrieved from https://www.doyouyoga.com/these-are-the-most-popular-yoga-styles-in-the-world-55277/

Husted, C., Pham, L., Hekking, A., & Niederman, R. (1999). Improving quality of life for people with chronic conditions: The example of T'ai Chi and multiple sclerosis. *Alternative Therapies in Health and Medicine, 5*(5), 70-74.

Innes, K. E., Bourguignon, C., & Taylor, A. G. (2005). Risk indices associated with the insulin resistance syndrome, cardiovascular disease, and possible protection with Yoga: A systematic review. *Journal of the American Board of Family Practice, 18*(6), 491-519.

Innes, K. E., & Vincent, H. K. (2006). The influence of Yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: A systematic review. *Evidence-Based Complementary and Alternative Medicine, 4*(4), 469-486.

Intent Blog. (2011). Today's featured Yoga interview: Q&A with Derik Mills, founder of YogaGlo.com. Retrieved from http://intentblog.com/todays-featured-Yoga-interview-qa-derik-mills-founder-Yogaglocom/

Irwin, M.R., & Olmstead, R. (2012). Mitigating cellular inflammation in older adults: A randomized controlled trial of Tai Chi Chih. *American Journal of Geriatric Psychiatry*, 20(9):764-772. doi:10.1097/JGP.0b013e3182330fd3

Iyengar, B. K. S. (2004). *Light on Yoga - the classic guide to Yoga by the world's foremost authority*. New Delhi, Harper Collins.

Iyengar, B. K. S. (2013). *Light on pranayama. The definitive guide to the art of breathing*. London, Great Britain: Clays Ltd.

Jacobs, B. P., Mehling, W., Avins, A. L., Goldberg, H. A., Acree, M., Lasater, J. H., …Maurer, S. (2004). Feasibility of conducting a clinical trial on Hatha Yoga for chronic low back pain: methodological lessons. *Alternative Therapy in Health and Medicine, 10*(2), 80-83.

Jagannathan, A., Hamza, A., Thirthalli, J., Nagendra, H. R., Nagarathna, R., & Gangadhar, B. N. (2012). Development and feasibility of need-based Yoga program for family caregivers of inpatients with schizophrenia in India. *International Journal of Yoga, 5*(1), 42-47.

Jahnke, R., Larkey, L., Rogers, C., Etnier, J., & Lin, F. (2010). A comprehensive review of health benefits of qigong and Tai Chi. *American Journal of Health Promotion, 24*(6), 1-25.

Jazaieri, H., McGonigal, K., Jinpa, T., Doty, J. R., Gross, J. J., & Goldin, P. R. (2014). A randomized controlled trial of compassion cultivation training: Effects on mindfulness, affect, and emotion regulation. *Motivation and Emotion 38*(1), 23-35.

Jenkins, A., Christensen, H., Walker, J.G., & Dear, K. (2009). The effectiveness of distance interventions for increasing physical activity: A review. *American Journal of Health Promotion, 24*(2), 102–117.

Jensen, S., & Given, B. A. (1991). Fatigue affecting family caregivers of cancer patients. *Cancer Nursing, 14*(4), 181-187.

Joseph, R. P., Durant, N. H., Benitez, T. J., & Pekmezi, D. W. (2014). Internet-based physical activity interventions. *American Journal of Lifestyle Medicine. 8*(1). 42-68. doi:10.1177/1559827613498059

Judith, A. (2015). *Wheels of life.* Woodbury, MN, USA: Llewellyn Publications.

Kaltenbaugh, D. J., Klem, M. L., Hu, L., Turi, E., Haines, A. J., & Lingler, J. H. (2015). Using web-based interventions to support caregivers of patients with cancer: A systematic review. *Oncology Nursing Forum, 42*(2), 156-164.

Kaminoff, L. (2007). *Yoga anatomy.* Champaign, IL: Human Kinetics.

Keating, N., Fast, J., Frederick, J., Cranswick, K., & Perrier, C. (1999). Eldercare in Canada: Context, content and consequences. Ottawa: Statistics Canada.

Keats, M. R., Culos-Reed, S.N. (2009). A theory-driven approach to encourage physical activity in pediatric cancer survivors: A pilot study. *Journal of Sport and Exercise Psychology, 31*(2), 267-283.

Keats, M. R., Culos-Reed, S.N., Courneya, K. S., & McBride, M. (2007). Understanding physical activity in adolescent cancer survivors: An application of the theory of planned behavior. *Psycho-Oncology, 16*(5), 448-457.

Keefe, J. A. (2011). IRPP Study. *Supporting caregivers and caregiving in an aging Canada, 23*, 1-40. Retrieved from http://irpp.org/research-studies/study-no23/

Keefe, J. A., Légaré, J., Charbonneau, P., & Décarie, Y. (2012). The family, the market, or the state? Intergenerational support to older Canadians by their adult children: Implications for the future. *International Studies in Population, 100*, 141-158.

Kelders, S. M., Kok, R. N., Ossebaard, H. C., & van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: a systematic review of adherence to web-based interventions. *Journal of Medical Internet Research, 14*(6), e152.doi:10.2196/jmir.2104

Kelly, S. M. (2014, June 20). Health and fitness apps are growing 87% faster than any other apps. *Mashable.* Retrieved from http://mashable.com/2014/06/20/health-fitness-apps-growth/#E2I5jhBQcaq3

Kembhavi, R. (2012). Canadian seniors: A demographic profile. *Elections Canada.* Retrieved from http://www.elections.ca/content.aspx?section=res&dir=rec/part/sen&document=index&lang=e

Khalaf, S. (2014, July 21). Health and fitness apps finally take off, fuelled by fitness fanatics. *Flurry Insights*. Retrieved from http://flurrymobile.tumblr.com/post/115192181465/health-and-fitness-apps-finally-take-off-fueled

Khatri, D., Mathur, K. C., Gahlot, S., Jain, S., & Agrawal, R. P. (2007). Effects of Yoga and meditation on clinical and biochemical parameters of metabolic syndrome. *Diabetes Research and Clinical Practice, 78*(3), e9-e10.

Khoury, B., Lecomte, R., Fortin, G., Masse, M., Therien, P., Bouchard, V., … & Hofmann, S. G. (2013). Mindfulness-based therapy: A comprehensive meta-analysis. *Clinical Psychology Review, 33*(6), 763-771.

Kiecolt-Glaser, J. K., & Glaser, R. (1989). Caregiving, mental health, and immune function. In E. Light, B. D. Lebowitz (Eds.), *Alzheimer's disease treatment and family stress: Directions for research*. Rockville, MD: U.S. Department of Health and Human Services, 245-266.

Kiecolt-Glaser, J. K. & Glaser, R. (2001). Stress and immunity: Age enhances the risks. *Current Directions in Psychological Science, 10*(1), 18-21.

Kiecolt-Glaser, J., Glaser, R., Gravenstein, S., Malarkey, W., & Sheridan, J. (1996). Chronic stress alters the immune response to influenza virus vaccine in older adults. *Proceedings of the National Academy of Sciences, 93*(7), 3043-3047.

Kim, H., Kim, Y. L., & Lee, S. M. (2015). Effects of therapeutic tai chi on balance, gait, and quality of life in chronic stroke patients. *International Journal of Rehabilitation Research, 38*(2), 156-161.

King, A. C., & Brassington, G. (1997). Enhancing physical and psychological functioning in older family caregivers: the role of regular physical activity. *Annals of Behavioral Medicine, 19*(2), 1-100.

Kinser, P. A., Elswick, R. K., & Kornstein, S. (2014). Potential long-term effects of a mind-body intervention for women with major depressive disorder: Sustained mental health improvements with a pilot yoga. *Archives of Psychiatric Nursing, 28*(6), 377-383. doi:10.1016/j.apnu.2014.08.014

Kolasinski, S. L., Garfinkel, M., Tsai, A. G., Matz, W., Van Dyke, A., & Schumacher, H. R. (2005). Iyengar Yoga for treating symptoms of osteoarthritis of the knees: a pilot study. *Journal of Alternative and Complementary Medicine, 11*(4), 689-693.

Kozachik, S. L., Given, C. W., Given, B. A., Pierce, S. J., Azzouz, F., Rawl, S. M., & Champion, V. L. (2001). Improving depressive symptoms among caregivers of patients with cancer: Results of a randomized clinical trial. *Oncology Nursing Forum, 28*, 1149-57.

Kramer, B. (1997). Gains in caregiving: Where are we? What next? *The Gerontologist, 37*(2), 218-232.

Krapp. K. (2002). *Activities of daily living evaluation*. Encyclopedia of Nursing & Allied Health: Gale Group, Inc.

Kuttner, L., Chambers, C. T., Hardial, J., Israel, D. M., Jacobson, K., & Evans, K. (2006). A randomized trial of Yoga for adolescents with irritable bowel syndrome. *Pain Research & Management, 11*(4), 217-223.

Kuyken, W., Byford, S., Taylor, R. S., Watkins, E., Holden, E., White, K., … & Teasdale, J. D. (2008). Mindfulness-based cognitive therapy to prevent relapse in recurrent depression. *Journal of Consulting and Clinical Psychology 76*(6), 966-978.

Kvillemo, P., & Bränström, R. (2011). Experiences of a mindfulness-based stress-reduction intervention among patients with cancer. *Cancer Nursing, 34*(1), 24-31.

Lan, C., Chen, S. Y., Lai, J. S., & Wong, A. M. (2013). Tai Chi Chuan in medicine and health promotion. *Evidence-Based Complementary and Alternative Medicine*, 502131, 1-17. doi:10.1155/2013/502131PMID:24159346

Lan, C., Lai, J. S., Chen, S. Y., & Wong, M. K. (1998). 12-Month Tai Chi training in the elderly: its effect on health fitness. *Medical & Science in Sports & Exercise, 30*(3), 345-351.

Lau C., Yu, R., & Woo, J. (2015) Effects of a 12-week Hatha Yoga intervention on metabolic risk and quality of life in Hong Kong Chinese adults with and without metabolic syndrome. *PLoS ONE 10*(6), e0130731. doi:10.1371/journal.pone.0130731

Lebel, S., Trinkaus, E., Faure, M., Fernandez, P., Guérin, C., Richter, D., … Wagner, G. A. (2001). Comparative morphology and paleobiology of Middle Pleistocene human remains from the Bau de l'Aubesier, Vaucluse, France. *Proceedings of the National Academy of Sciences, 98*(20), 11097-11102. doi:10.1073/pnas.181353998

Lederberg, M. (1998). The family of the cancer patient. In: Holland, J.C., Breibart, W., Jacobsen, P.B., Lederberg, M.S., Loscalzo, M.J. & McCorkle, R. (Eds.), *Psycho-Oncology* (2nd ed.). New York: Oxford University Press.

Lee, M. S., & Choi, T. (2010). Tai Chi for breast cancer patients: A systematic review. *Breast Cancer Research and Treatment, 120*(2), 309-316. doi:10.1007/s10549-010-0741-2

Lee, S., Colditz, G. A., Berkman, L. F., & Kawachi, I. (2003). Caregiving and risk of coronary heart disease in U.S. women: A prospective study. *American Journal of Preventive Medicine, 24*(2), 113-119.

Lee, A., Peterson, K., Hahn, H., Atri, A., & Madison, C. (2016). The challenge of identifying and engaging informal caregiver in the "integrated care initiative (ICI)': An education program for caregivers of people with dementia or cognitive impairment. *Alzheimer's & Dementia, 12*(7), Supplement, P1122. doi:http://dx.doi.org/10.1016/j.jalz.2016.06.2333

Legg, L., Weir, C. J., Langhorne, P., Smith, L. N., & Stott, D. J. (2013). Is informal care giving independently associated with poor health? A population-based study. *Journal of Epidemiology and Community Health 67*(1), 95-97.

Lewis, J., & Meredith, R. (1988). Daughters caring for mothers: The experience of caring and its implications for professional helpers. *Ageing and Society, 8*(1), 1-21.

Li, V. (2013, April 17). TaijiFit and TaijiZen march together to popularize Tai Chi worldwide. *Examiner.* Retrieved from https://www.google.ca/search?q=TaijiFit+and+TaijiZen+march+together+to+popularize+Tai+Chi+worldwide.+Examiner&ie=utf-8&oe=utf-8&client=firefoxb&gfe_rd=cr&dcr=0&ei=RNNGWpzBKsrM8genlZiABQ

Li, A. W., & Goldsmith, C. A. W. (2012). The effects of Yoga on anxiety and stress. *Alternative Medicine Review, 17*(1), 21-35.

Li, F., Harmer, P., Fisher, K. J., McAuley, E., Chaumeton, N., Eckstrom, E., & Wilson, N. L. (2005). Tai Chi and fall reductions in older adults: A randomized controlled trial. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 60*(2), 187-194.

Liang, H. (2016, February 1). Discover the Tai Chi 48 form. *Yang's Martial Arts Association.* Retrieved from https://ymaa.com/articles/2016/02/discover-the-tai-chi-48-form

Liang, S-H., & Wen-Ching, W. (2014). *Simplified Tai Chi chuan: 24 postures with applications & standard 48 postures*. Wolfeboro, NH: YMAA Publication Center.

Liao, W. (1990). *T'ai chi classics.* Boston, MA: Shambhala Classics.

Lim, K., & Taylor, L. (2005). Factors associated with physical activity among older people – a population-based study. *Preventive Medicine, 40*(1), 33-40.

Liu, X., Miller, Y. D., Burton, N. W., Chang, J. H., & Brown, W. J. (2013). The effect of Tai Chi on health-related quality of life in people with elevated blood glucose or diabetes: A randomized controlled trial. *Quality of Life Research, 22*(7), 1783-1786.

LoGiudice, D., Waltrowicz, W., Brown, K., Burrows, C., Ames, D., & Flicker, L. (1999). Do memory clinics improve the quality of life of carers? A randomized pilot trial. *International Journal of Geriatric Psychiatry, 14*(8), 626-632.

Lopez-Hartmann, M., Wens, J., Verhoeven, V., & Remmen, R. (2012). The effect of caregiver support interventions for informal caregivers of community-dwelling frail elderly: A systematic review. *International Journal of Integral Care, 12*, e133.

Loprinzi, P. D., & Brosky, J. A. (2014). Objectively-measured physical activity and balance among U.S. adults. *Journal of Strength and Conditioning Research, 28*(8), 2290-2296.

Los Angeles County Department of Public Health. (2010). Office of Health Assessment and Epidemiology, Informal Caregiving: Implications for Public Health, LA Health. Retrieved from https://www.google.ca/search?q=Office+of+%20Health%20+%20Assessment+and+Epidemiology,+Informal+Caregiving:+%20Implications+for+Public+Health,+LA+Health.&ie=utf8&oe=utf8&gws_%20rd=cr&ei=l1RXV42sF%20qWkjwT33%20ZjQCg

Lox, C. L., Ginis, K. A. M., & Petruzzello, S. J. (2006). *The psychology of exercise. Integrating theory and practice* (2nd ed.). Scottsdale, Arizona, USA: Holcomb Hathaway.

Lucyk, S. (2015). 2015 fitness industry trend report. *Zenplanner.* Retrieved from https://zenplanner.com/fitness-trends-2015/

Lysne, L. (2004). Using physical exercise to enhance the health of adults 65+ who are family caregivers. Canadian Association for Community Care. Executive Summary. Ottawa, Ontario: Retrieved from https://www.google.ca/search?q=Using+physical+exercise+to+enhance+the+health+of+adults+65%2B+who+are+family+caregivers.+Canadian+Association+for+Community+Care.+Executive+Summary.+Ottawa%2C+Ontario&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&dcr=0&ei=VtRGWpqFC8rM8genlZiABQ

Ma, S. H., & Teasdale, J. D. (2004). Mindfulness-based cognitive therapy for depression: Replication and exploration of differential relapse prevention effects. *Journal of Consulting and Clinical Psychology 72*(1), 31-40.

Mack, N., Woodsong, C., MacQueen, K. M., Guest, G., & Namey, E. (2005). *Qualitative research methods: A data collector's field guide.* North Carolina, USA: Family Health International. Retrieved from http://www.fhi360.org/resource/qualitative-research-methods-data-collectors-field-guide

Mackenzie, M. J., Carlson, L. E., Ekkekakis, P., Paskevich, D. M., & Culos-Reed, S. N. (2013). Affect and mindfulness as predictors of change in mood disturbance, stress symptoms, and quality of life in a community-based yoga program for cancer survivors. *Evidence-Based Complementary and Alternative Medicine,* Article 419496, 1-13. doi:10.1155/2013/419496

Mackenzie, M. J., Wurz, A. J., Yamauchi, Y., Pires, L. A., & Culos-Reed, S. N. (2016). Yoga helps put the pieces back together: A qualitative exploration of a community-based Yoga program for cancer survivors. *Evidence-Based Complementary and Alternative Medicine,* Article ID 1832515, 1-10. http://dx.doi.org/10.1155/2016/1832515

Manchanda, S. C., Narang, R., Reddy, K. S., Sachdeva, U., Prabhakaran, D., Dharmanand, S., … Bijlani, R. (2000). Retardation of coronary atherosclerosis with Yoga lifestyle intervention. *Journal of Association of Physicians of India, 48*(7), 687-694.

Manjunath, N. K., & Tells, S. (2005). Influence of Yoga and Ayurveda on self-rated sleep in a geriatric population. *Indian Journal of Medical Research, 121*(5), 683-690.

Manocha, R. (2003). Sahaja Yoga in asthma. *Thorax, 58*(9), 825-826. doi:10.1136/thorax.58.9.825-a

Manocha, R., Marks, G. B., Kenchington, P., Peters, D., & Salome, C. M. (2002). Sahaja Yoga in the management of moderate to severe asthma: A randomized controlled trial. *Thorax, 57*, 110-115.

Mansky, P., Sannes, T., Wallerstedt, D., Ge, A., Ryan, M., Johnson, L. L., … Gerber, L. (2006). Tai Chi chuan: mind-body practice or exercise intervention? Studying the benefit for cancer survivors. *Integrative Cancer Therapies, 5*(3), 192-201. doi:10.1177/1534735406291590

Mant, J., Carter, J., Wade, D. T., & Winner, S. (2000). Family support for stroke: A randomised controlled trial. *Lancet, 356*, 808-813.

Marcus, B. H., Ciccolo, J. T., & Sciamanna, C. N. (2009). Using electronic/computer interventions to promote physical activity. *British Journal of Sports Medicine, 43*(2), 102–105.

Marcus, B. H., Lewis, B. A., Williams, D. M., Dunsiger, S., Jakicic, J. M., Whiteley, J. A., … Parisi, A. F. (2007). A comparison of Internet and print-based physical activity interventions. *Archives of Internal Medicine, 167*(9), 944–949.

Marshall, A. L., Leslie, E. R., Bauman, A. E., Marcus, B. H., & Owen, N. (2003). Print versus website physical activity programs: A randomized trial. *American Journal of Preventative Medicine, 2*, 88-94.

Martin, A. C., & Candow, D. (2016). Potential of Yoga for improving health outcome measures in informal caregivers. *Journal of Sport and Health, 7*(1), 15-32.

Martin, A. C., & Candow, D. (2017). Tai Chi's potential for improving health outcome measures in informal caregivers. *Journal of Health, Wellness, and Society, 6*(4), 35-50.

Martin, A. C., & Keats, M. R. (2014). The impact of Yoga on quality of life and psychological distress in caregivers for patients with cancer. *Oncology Nursing Forum, 41*(3), 257-264.

Maruish, M. E. 2011. (Ed.). User's manual for the SF-36v2 Health Survey (3rd ed.). Lincoln, RI: QualityMetric Incorporated.

McCall, T. (2007). *Yoga as medicine. The yogic prescription for health and healing*. New York, NY, USA: Bantam Dell.

McCurry, M. S., Gibbons, L. E., Logsdon, R. G., Vitiello, M. V., & Teri, L. (2009). Insomnia in caregivers of persons with dementia: who is at risk and what can be done about it? *SleepMedicine Clinics, 4*(4), 519-526.

McCurry, S. M., Logsdon, R. G., Teri, L., & Vitiello, M. V. (2007). Sleep disturbances in caregivers of persons with dementia: contributing factors and treatment implications. *SleepMedicine Reviews, 11*(2), 143-153.

McDowell, I. (2006). *Measuring health. A guide to rating scales and questionnaires*. New York: Oxford University Press.

McKechnie, V., Barker C., & Stott, J. (2014). Effectiveness of computer-mediated interventions for informal carers of people with dementia - a systematic review. *International Psychogeriatrics, 26*(10), 1619-1637. doi:10.1017/S1041610214001045

McKibbin, C. L., Walsh, W., Rinki, M., Koin, D., & Gallagher-Thompson, D. (1999). Lifestyle and health behaviors among female family dementia caregivers: A comparison of wives and daughters. *Aging & Mental Health, 3*(2), 165-172.

Mercier, P. (2007). *The Chakra bible: The definitive guide to working with Chakras.* New York, NY, USA: Sterling.

Michalsen, A., Grossman, P., Acil, A., Langhorst, J., Ludtke, R., Esch, T., … Dobos, G. J. (2005). Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive Yoga program. *Medical Science Monitor, 11*(12), 555-561.

Ministry of Health and Long-term Care. (2017). Call for applications - Caregiver education and training. Home and Community Care Branch. Toronto, ON: Ministry of Health and Long-term Care, 1-8. Retrieved from https://www.google.ca/search?q=Call+for+Applications+Caregiver+Education+and+Training.+Home+and+Community+Care+Branch&ie=utf-8&oe=utf-8&gws_rd=cr&ei=vieaWcq9KqrWjwSH1Jb4BA

Miniwatts Marketing Group. (2009). Internet world stats. Retrieved from http://www.internetworldstats.com/index.html

Moadel, A., Shah, C., Wylie-Rosett, J., Harris, M., Patel, S., Hall, C., & Sparano, J. (2007). Randomized controlled trial of Yoga among a multiethnic sample of breast cancer patients: Effects of quality of life. *Journal of Clinical Oncology, 25*(28), 4387-4395. doi:10.1200/JCO.2006.06.6027

Morris, M. (2004). What research reveals about gender, home care and caregiving: Overview and the case for gender analysis. In P. Armstrong et al., (Eds.), *Caring for/caring about: Women, home care and unpaid caregiving* (pp. 91-113). Aurora: Garamond Press.

Moser, L. (2013). Online Yoga classes aid busy schedules. *The Wall Street Journal.* Retrieved from https://www.wsj.com/articles/SB10001424127887323394504578607782490993740

Müller, A. M., & Khoo, S. (2014). Non-face-to-face physical activity interventions in older adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 11*(35), 1-12.

Murphy, L., & Singh, B. B. (2008). Effects of 5-Form, Yang Style Tai Chi on older females who have or are at risk for developing osteoporosis. *Physiotherapy: Theory and Practice, 24*(5), 311-320.

Mustian, K. M., Katula, J. A., & Zhao, H. (2006). A pilot study to assess the influence of Tai Chi Chuan on functional capacity among breast cancer survivors. *Supportive Oncology, 4*(3), 139-145.

Myers, J., Kaykha, A., George, S., Abella, J., Zaheer, N., Lear, S., … Froelicher, V. (2004). Fitness versus physical activity patterns in predicting mortality in men. *American Journal of Medicine, 117*(2), 912-918.

Namasta. (2005). Canadian Yoga statistics. *Namasta: North American Studio Alliance Newsletter*. Retrieved from http://www.namasta.com/pressresources.php#7

National Alliance for Caregiving & American Association of Retired Persons. (2009). Caregiving in the U.S.: Executive summary. 2009. Retrieved from https://www.google.ca/search?q=Caregiving+in+the+U.S.:+executive+summary.+2009&ie=utf-8&oe=utf-8&gws_rd=cr&ei=GfncVtqiKeypjgSB7JmYBw

National Association of Social Workers. (2010). Family caregivers of older adults. Washington, DC. Retrieved from www.SocialWorkers.org

National Center for Complementary and Alternative Medicine at the National Institutes of Health. (2016a). Tai Chi: An introduction. Retrieved from https://nccih.nih.gov/health/taichi/introduction.htm

National Center for Complementary and Alternative Medicine at the National Institutes of Health. (2016b). Complementary, alternative, or integrative health: What's in a name? Retrieved from https://nccih.nih.gov/health/integrative-health

Navaie-Waliser, M., Feldman, P. H., Gould, D. A., Levine, C., Kuerbis, A. N., & Denelan, K. (2002). When the caregiver needs care: The plight of vulnerable caregivers. *American Journal of Public Health, 92*(3), 409-413.

Nayak, N. N., & Shankar, K. (2004). Yoga: A therapeutic approach. *Physical Medicine and Rehabilitation Clinics of North America, 15*(4), 783-798.

Nayyar, S. (2002). Six systems of Indian philosophy. Retrieved from http://www.esamskriti.com/essay-chapters/Six-Systems-of-Indian-Philosophy-1.aspx

Narendran, S., Nagarathna, R., Narendran, V., Gunasheela, S., & Nagendra, H. R. (2005). Efficacy of Yoga on pregnancy outcome. *Journal of Alternative and Complementary Medicine, 11*(2), 237-244.

Neighbours in Aging Quarterly. (2017). Collaborative for healthy aging and care. Spring 2017. Retrieved from http://www.nbcollab.ca/en/index.html

Netto, N. R., Jenny, G. Y. N., & Phillip, Y. L. K. (2009). Growing and gaining through caring for a loved one with dementia. *Dementia, 8*(2), 245-261. doi:10.1177/1471301209103269

Neundorfer, M. M. (1991). Family caregivers of the frail elderly: Impact of caregiving on their health and implications for interventions. *Family Community Health, 14*(2), 48-58.

Nguyen, H. Q., Donesky-Cuenco, D., Wolpin, S., Reinke, L. F., Benditt, J. O., Paul, S. M., & Carrieri-Kohlman, V. (2008). Randomized controlled trial of an internet-based versus face-to-face dyspnea self-management program for patients with chronic obstructive pulmonary disease: Pilot study. *Journal of Medical Internet Research, 10*(2):e9. doi:10.2196/jmir.990

Nigg, C. R., Borrelli, B., Maddock, J., & Dishman, R. K. (2008). A theory of physical activity maintenance. *Applied Psychology, 57*(4), 544-560.

Northouse, L. L., Katapodi, M. C., Song, L., Zhang, L., & Mood, D. W. (2010). Interventions with family caregivers of cancer patients: Meta-analysis of randomized trials. *CA: A Cancer Journal for Clinicians, 60*(5), 317-339.

Northouse, L. L., Rosset, T., Phillips, L., Mood, D., Schafenacker, A., & Kershaw, T. (2006). Research with families facing cancer: The challenges of accrual and retention. *Research in Nursing and Health*, *29*, 199-211.

Nyman, S. (2017). A randomised controlled trial comparing the effectiveness of Tai Chi alongside usual care with usual care alone on the postural balance of community-dwelling people with dementia. *ClinicalTrials.gov.* Retrieved from https://clinicaltrials.gov/ct2/show/study/NCT02864056

Ohio State University Center for Clinical and Translational Science. (2014). Millions of informal caregivers at risk for chronic pain, injury trying to help disabled family members. Retrieved from https://www.sciencedaily.com/releases/2014/07/140708091119.htm

Oken, B. S., Kishiyama, S., Zajdel, D., Bourdette, D., Carlsen, J., Haas, M., … Mass, M. (2004). Randomized controlled trial of Yoga and exercise in multiple sclerosis. *Neurology, 62*(11), 2058-2064.

Oken, B. S., Zajdel, D., Kishiyama, S., Flegal, K., Dehen, C., Haas, M., … Leyva, J. (2006). Randomized, controlled, six-month trial of Yoga in healthy seniors: Effects on cognition and quality of life. *Alternative Therapies in Health and Medicine, 12*(1), 40-47.

Okonta, N. R. (2012). Does Yoga therapy reduce blood pressure in patients with hypertension? An integrative review. *Holistic Nursing Practice, 26*(3), 137-141. doi:10.1097/HNP.0b013e31824ef647

O'Rourke, B. (2014, September 15). Nielsen global consumer exercise trends survey 2014. *SlideShare.* Retrieved from http://www.slideshare.net/Bryankorourke/nielsen-global-consumer-exercise-trends-survey-2014

Oyebode, J. (2003). Assessment of carers' psychological needs. *Advances in Psychiatric Treatment, 9*(1), 45-53.

Page, P. (2014). Beyond statistical significance: Clinical interpretations of rehabilitation research literature. *International Journal of Sports Physical Therapy, 9*(5), 726-736.

Palmer, M. (1997). *Yin & Yang. Understanding the Chinese philosophy of opposites and how to apply it to your everyday life.* London, UK: Judy Piaktus Ltd.

Parker, G. (1990). *With due care and attention: A review of research on informal care.* London: Family Policy Studies Centre.

Parra-Vidales, E., Soto-Pérez, F., Perea-Bartolomé, M.V., Franco-Martín, M.A., & Muñoz-Sánchez, J.L. (2017). Online interventions for caregivers of people with dementia: A systematic review. *Actas Espanolas De Psiquiatria, 45*(3), 116-126.

Patel, N. K., Newstead, A. G., & Ferrer, R. L. (2012). The effects of yoga on physical functioning and health related quality of life in older adults: a systematic review and meta-analysis. *Journal of Alternative and Complementary Medicine, 18*(10), 902-917. doi:10.1089/acm.2011.0473

Pearlin, L. I., Mullan, J. T., Semple, S. J., & Skaff, M. M. (1990). Caregiving and the stress process: An overview of concepts and their measures. *Gerontologist, 30*(5), 583-594.

Pellegrini, C. A., Verba, S. D., Otto, A. D., Helsel, D. L., Davis, K. K., & Jakicic, J. M. (2012). The comparison of a technology-based system and an in-person behavioral weight loss intervention. *Obesity (Silver Spring), 20*(2), 356-363.

Perales, F., Del Pozo-Cruz, J., Del Pozo-Cruz, J., & Del Pozo-Cruz, B. (2014). On the associations between physical activity and quality of life: findings from an Australian nationally representative panel survey. *Quality of Life Research, 23*(7), 1921-1933. doi:10.1007/s11136-014-0645-4

Perneger, T. V. (1998). What's wrong with Bonferroni adjustments. *BMJ, 316*, 1236-1238.

Pikul, C. (2014, September 23). 5 workouts your gym doesn't want you to know about. *Oprah.com*. Retrieved from http://www.oprah.com/health/home-workout-home-exercises-workout-videos#ixzz4AeHzPw4i

Pilkington, K., Kirkwood, G., Rampes, H., & Richardson, J. (2005). Yoga for depression: The research evidence. *Journal of Affective Disorders, 89*(1-3), 13-24.

Pinquart, M. & Sörensen, S. (2003). Differences between caregivers and noncaregivers in psychological health and physical health: A meta-analysis. *Psychology and Aging, 18*(2), 250-267.

Pinquart, M., & Sörensen, S. (2005). Ethnic differences in stressors, resources, and psychological outcomes of family caregiving for older adults: A meta-analysis. *The Gerontologist, 45*, 90-106.

Pinquart, M., & Sörensen, S. (2007). Correlates of physical health of informal caregivers: a meta-analysis. *The Journals of Gerontoloy. Series B, Psychological Sciences and Social Sciences, 62*(2), 126-137.

Pitceathly, C., & Maguie, P. (2003). The psychological impact of cancer on patients' partners and other key relatives: A review. *European Journal of Cancer, 39*(11), 1517-1524.

Pruchno, R. A., & Potashnik, S. L. (1989). Caregiving spouses: Physical and mental health in perspective. *Journal of American Geriatric Society, 37*(8), 697-705.

Public Health Agency of Canada. (2010). The chief public health officer's report on the state of public health in Canada 2010. Chapter 3: The health and well-being of Canadian seniors. Retrieved from http://www.phac-aspc.gc.ca/cphorsphc-respcacsp/2010/fr-rc/cphorsphc-respcacsp-06-eng.php

Public Health Agency of Canada. (2012). Seniors caring for seniors. Retrieved from http://www.phac-aspc.gc.ca/seniors-aines/scs-spaa-eng.php

Pullen, P. R., Nagamia, S. H., Mehta, P. K., Thompson, W. R., Benardot, D., Hammoud, R., … Khan, B. V. (2008). Effects of Yoga on inflammation and exercise capacity in patients with chronic heart failure. *Journal of Cardiac Failure, 14*(5), 407-413.

Qi Squared. (2017). About David-Dorian. Master instructor and world peace advocate. Retrieved from https://drtaichi.com/about-david-dorian/

Quigley, P.A., Bulat, T., Schulz, B., Friedman, Y., Hart-Hughes, S., Richardson, J.K., & Barnett, S. (2014). Exercise interventions, gait, and balance in older subjects with distal symmetric polyneuropathy: A three-group randomized clinical trial. *American Journal of Physical Medicine and Rehabilitation*, *93*(1), 1-12. doi:10.1097/PHM.0000000000000052

Radhakrishnan, S., & Moore, C. A. (1967). *A source book in Indian philosophy*. New Jersey, USA: Princeton University Press.

Rajnovich, B., Keefe, J., & Fast, J. (2005). Supporting caregivers of dependent adults in the 21st Century. *CRPN Background Paper*. Ottawa: Health Canada. Retrieved from https://www.google.ca/search?q= Supporting +Caregivers+of+ Dependent+ Adults+in+the+21st+Century&ie=utf-8&oe=utf-8&gws_rd=cr&ei =gQhVV4GJFs7myQLg9YngBA

Ramaswami, S. (2005). *The complete book of Vinyasa Yoga*. Philadelphia, PA, USA: Da Capo Press.

Ranmuthugala, G., Nepal, B., Brown, L., & Percival, R. (2009). Impact of home based long-term care on informal carers. *Australian Family Physician, 38*(8), 618-620.

Ratamess, N. A., Alvar, B. A., Evetoch, T. K., & Housh, T. J. (2009). American College of Sports Medicine position stand. Progression models in resistance training for healthy adults. *Medicine & Science in Sports & Exercise, 41*(3), 687-708.

Raub, J. A. (2002). Psychophysiologic effects of Hatha Yoga on musculoskeletal and cardiopulmonary function: A literature review. *Journal of Alternative and Complementary Medicine, 8*(6), 797-812.

Rea, S. (2012). Consciousness in motion: Vinyasa. *Yoga Journal*. Retrieved from http://www.Yogajournal.com/article/practice-section/consciousness-in-motion/

Regina Qu'Appelle Health Region. (2017). Home care services. Retrieved from http://www.rqhealth.ca/department/community-and-preventative-health/home-care-services

Reinhard, S., Given, B., Petlick, N. H., & Bemis, A. (2008). Supporting family caregivers in providing care. In R.G. Hughes (Ed.) *Patient safety and quality: An evidence-based handbook for nurses*. (pp. 347-410) Rockville, MD: AHRQ Publication No. 08-0043

Rice, R. E. (2006). Influences, usage, and outcomes of Internet health information searching: Multivariate results from the Pew surveys. *International Journal of Medical Informatics,75*(1), 8-28.

Richards, J., Thorogood, M., Hillsdon, M., & Foster, C. (2013). Face-to-face versus remote and web 2.0 interventions for promoting physical activity. *Cochrane Database of Systematic Reviews*, (9). 1-40. doi:10.1002/14651858.CD010393.pub2

Riley, D. (2004). Hatha Yoga and the treatment of illness. *Alternative Therapies in Health and Medicine, 10*(2), 20-21.

Rones, R., & Silver, D. (2007). *Sunrise Tai Chi. Simplified Tai Chi for health & longevity*. Boston, Massachusetts, USA: YMAA Publication Center.

Rose, G. (2001). Sick individuals and sick populations. *International Journal of Epidemiology, 30*(3), 427-432. doi:10.1093/ije/30.3.427

Rosenbaum, E., Gautier, H., Fobair, P., Neri, E., Festa, B., Hawn, M., … Spiegel, D. (2004). Cancer supportive care, improving the quality of life for cancer patients: a program evaluation report. *Supportive Care Cancer, 12*(5), 293-301. doi:10.1007/s00520-004-0599-0

Ross, D-D. (2013). *Taijifit flow*. Instructor Manual. David-Dorian Ross.

Ross, D-D. (2017a). Meet the founder – David-Dorian Ross. *Taijifit.net*. Retrieved from https://taijifit.net/about-2/

Ross, D-D. (2017b). Beginners start here. *Taijifit.net*. Retrieved from https://taijifit.net/about-2/

Ross, A., Sundaramurthi, T., & Bevans, T., (2013). A labor of love. The influence of cancer caregiving on health behaviors. *Cancer Nursing, 36*(6), 474-483.

Sanders, S. (2005). Is the glass half empty or half full? Reflections on strain and gain in caregivers of individuals with Alzheimer's disease. *Social Work in Health Care, 40*(3), 57-73.

Sanders, S. (2007). Experiences of rural male caregivers of older adults with their informal support networks. *Journal of Gerontological Social Work, 49*(4), 97-115.

Sareen, S., Kumari, V., Gajebasia, K. S., & Gajebasia, N. K. (2007). Yoga: A tool for improving the quality of life in chronic pancreatitis. *World Journal of Gastroenterology, 13*(3), 391-397.

Sathyaprabha, T. N., Satishchandra, P., Pradhan, C., Sinha, S., Kaveri, B., Thennarasu, K., … Raju, T. R. (2008). Modulation of cardiac autonomic balance with adjuvant Yoga therapy in patients with refractory epilepsy. *Epilepsy Behavior, 12*(2), 245-52.

Satishchandra, C., & Dhirendramohan, D. (2012). *An introduction to Indian philosophy*. Rupa Publications India.

Sawatzky, J. E., & Fowler-Kerry, S. (2003). Impact of caregiving: Listening to the voice of informal caregivers. *Journal of Psychiatric and Mental Health Nursing, 10*(3), 277-286.

Schmidt, T., Wijga, A., Vin Zur Muhlen, A., Brabant, G., & Wagner, T. O. (1997). Changes in cardiovascular risk factors and hormones during a comprehensive redidential three month kriya Yoga training and vegetarian nutrition. *Acta Physiologica Scandinavia, 640*, 158-162.

Schoenmakers, B., Buntinx, F., & Delepeleire, J. (2009). What is the role of the general practitioner towards the family caregiver of a community-dwelling demented relative? A systematic literature review. *Scandinavian Journal of Primary Health Care, 27*(1), 31-40.

Schoenmakers, B., Buntinx, F., & Delepeleire, J. (2010). Factors determining the impact of care-giving on caregivers of elderly patients with dementia. A systematic literature review. *Maturitas 66*(2), 191-200.

Schulz, R., & Beach, S. R. (1999). Caregiving as a risk factor for mortality: The caregiver health effects study. *The Journal of the American Medical Association, 282*(23), 2215-2219.

Schulz, R., Newsom, J., Mittelmark, M., Burton, L., Hirsch, C., & Jackson, S. (1997). Health effects of caregiving: The caregiver health effects study: An ancillary study of the cardiovascular health study. *Annals of Behavioral Medicine, 19*(2), 110-116.

Schulz, R., O'Brien, A. T., Bookwala, J., & Fleissner, K. (1995). Psychiatric and physical morbidity effects of dementia caregiving: prevalence, correlates, and causes. *The Gerontologist, 35*(6), 771-791.

Schulz, R. S., & Paula, R. (2008). Physical and mental health effects of family caregiving. *American Journal of Nursing, 108*(S9), 23-27.

Schulz, R., Visintainer, P., & Williamson, G. M. (1990). Psychiatric and physical morbidity effects of caregiving. *Journal of Gerontology, Psychological Sciences, 45(5)*, 181-191.

Schulz, R., & Williamson, G. M. (1997). The measurement of caregiver outcomes in Alzheimer disease research. *Alzheimer Disease Association Disorder Journal, 11*(6), 117-124.

Schulz-Heik, R. J., Meyer, H., Mahoney, L., Stanton, M. V., Cho, R. H., Moore-Downing, D. P., … Bayley, P. J. (2017). Results from a clinical Yoga program for veterans: Yoga via telehealth provides comparable satisfaction and health improvements to in-person Yoga. *BMC Complementary & Alternative Medicine*, *17*(1), 198-206. doi:10.1186/s12906-017-1705-4

Scutti, S. (2013, June 18). Tai Chi health benefits: 250 million people know what's good for them. *Medical Daily.* Retrieved from http://www.medicaldaily.com/tai-chi-health-benefits-250-million-people-know-whats-good-them-246916

Segerstrom, S. C., Schipper, L. J., & Greenberg, R. N. (2008). Caregiving, repetitive thought, and immune response to vaccination in older adults. *Brain Behavior Immunity Journal*, *22*(5), 744-752.

Selman, L., McDermott, K., Donesky, D., Citron, T., & Howie-Esquivel, J. (2015). Appropriateness and acceptability of a Tele-Yoga intervention for people with heart failure and chronic obstructive pulmonary disease: qualitative findings from a controlled pilot study. *BMC Complementary & Alternative Medicine*, *15*, 21-33. doi:10.1186/s12906-015-0540-8

Selvamurthy, W., Sridharan, K., Ray, U. S., Tiwary, R. S., Hegde, K. S., Radhakrishan, U., & Sinha, K. C. (1998). A new physiological approach to control essential hypertension. *Indian Journal of Physiology and Pharmacology*, *42*(2), 205-213.

Shape. (2016, February 19). 5 Yoga myths that just aren't true. *PureWow*. Retrieved from https://www.purewow.com/wellness/yoga-myths

Shaw, W. S., Patterson, T. L., Semple, S. J., Ho, S., Irwin, M. R., Hauger, R. L., & Grant, I. (1997). Longitudinal analysis of multiple indicators of health decline among spousal caregivers. *Annals of Behavioral Medicine*, *19*(2), 101-109.

Sherman, K. J., Cherkin, D.C., Erro, J., Miglioretti, D. L., & Deyo, R. A. (2005). Comparing Yoga, exercise, and a self-care book for chronic low back pain: a randomized, controlled trial. *Annals of Internal Medicine*, *143*(12), 849-856.

Sivasankaran, S., Pollard-Quintner, S., Sachdeva, R., Pugeda, J., Hoq, S. M., & Zarich, S. W. (2006). The effects of a six-week program of Yoga and meditation on brachial artery reactivity: Do psychosocial interventions affect vascular tone? *Clinical Cardiology, 29*(9), 393-398.

Sjolander, C., Rolander, B., Jarhult, J., Martensson, J., & Ahlstrom, G. (2012). Health related quality of life in family members of patients with an advanced cancer diagnosis: A 1-year prospective study. *Health and Quality of Life Outcomes, 10*, 89-101. doi:10.1186/1477-7525-10-89

Snyder, B., & Keefe, K. (1985). The unmet needs of family caregivers for frail and disabled adults. *Social Work in Health Care, 10*(3), 1-14.

Sobi-Wilderman, A. (2014). *Pranayama: Master the art of pranayama breathing and the Ujjayi breath*. Amazon Digital Services, LLC.

Solloway, M. R., Taylor, S. L., Shekelle, P. G., Miake-Lye, I. M., Beroes, J. M., Shanman, R. M., & Hempel, S. (2016). An evidence map of the effect of Tai Chi on health outcomes. *Systematic Reviews, **5(1)***, 126136. doi:10.1186/s13643-016-0300-y

Song, L., Biegel, D. E., & Milligan, S. E. (1997). Predictors of depressive symptomatology among lower social class caregivers of persons with chronic mental illness. *Community Mental Health Journal, 33*(4), 269-286.

Song, R., Lee, E. O., Lam, P., & Bae, S. C. (2007). Effects of a sun-style Tai Chi exercise on arthritic symptoms, motivation and the performance of health behaviors in women with osteoarthritis. *Taehan Kanho Hakhoe Chi, 37*(2), 249-256.

Song, R., Roberts, B.L., Lee, E.O., Lam, P., & Bae, S.C. (2010). A randomized study of the effects of t'ai chi on muscle strength, bone mineral density, and fear of falling in women with osteoarthritis. *Journal of Alternative and Complementary Medicine, 16*(3), 227-233. doi:10.1089/acm.2009.0165

Sonima. (2016, February 8). 100 most influential Yoga teachers in America. *Sonima*. Retrieved from http://www.sonima.com/Yoga/100-most-influential-Yoga-teachers-in-america-2016/#

Sörensen, S., Pinquart, M., & Duberstein, P. (2002). How effective are interventions with caregivers? An updated meta-analysis. *The Gerontologist, 42*(3), 356-372.

Speed-Andrews, A. E., Stevinson, C., Belanger, L. J., Mirus, J. J., & Courneya, K. S. (2010). Pilot evaluation of an Iyengar Yoga program for breast cancer survivors. *Cancer Nursing, 33*(5), 369-381. doi:10.1097/NCC.0b013e3181cfb55a

Statistics Canada. (2007). A portrait of seniors in Canada. Ottawa: Statistics Canada, 2007. Catalogue no. 89-519-XIE. ISBN 978-0-662-45047-4. Retrieved from http://www5.statcan.gc.ca/access_acces/alternative_alternatif.action?loc=http://www.statcan.gc.ca/pub/89-519-x/89-519x2006001eng.pdf&l=eng&teng=ARCHIVED+A+Portrait+of+Seniors+in+Canada%2C+2006&tfra=Un+portrait+des+a%C3%AEn%C3%A9s+au+Canada%2C+2006&archive=1

Statistics Canada. (2008). Eldercare: What we know today. Canadian Society Trends, 11-008-X, No. 86. Retrieved from https://www.statcan.gc.ca/pub/11-008-x/2008002/article/10689-eng.htm

Statistics Canada. (2010). Population projections for Canada, provinces and territories. Catalogue no. 91-520-X. Retrieved from https://www.google.ca/search?q=Statistics+Canada%2C+Population+Projections+for+Canada%2C+Provinces+and+Territories%3A+2009+to+2036+%28Ottawa%2C+Ont.%3A+Statistics+Canada%2C+2010&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&dcr=0&ei=T2VFWsv2Fq3U8gfSwaA4

Statistics Canada. (2013a). Portrait of caregivers, 2012. Spotlight on Canadians: Results from the General Social Survey. Catalogue no. 89-652-X-No. 001. ISBN 978-1-100-22502-9. Retrieved from http://www.statcan.gc.ca/pub/89-652-x/2013001/hl-fs-eng.htm

Statistics Canada. (2013b). Insights on Canadian society. Family caregiving: What are the consequences? Catalogue no. 75-006-X. ISSN 2291-0840 Retrieved from http://www5.statcan.gc.ca/olc-cel/olc.action?objId=75-006 X201300111858&objType= 47&lang=en&limit=0

Statistics Canada. (2015). Annual demographic estimates: Canada, provinces and territories. Catalogue no. 91-215-X. ISSN 1911-2408. Retrieved from https://www.google.ca/search?q=Annual+demographic+estimates%3A+Canada%2C+provinces+and+territories.+Catalogue+no.+91-215-X&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&dcr=0&ei=X9tGWqjTGMLM8geb0LFg

Steele, R. M, Mummery, W. K., & Dwyer, T. (2007). Using the Internet to promote physical activity: A randomized trial of intervention delivery modes. *Journal of Physical Activity and Health, 4*(3), 245–260.

Steele, R. M., Mummery, W. K., & Dwyer, T. (2009). A comparison of face-to-face or Internet-delivered physical activity intervention on targeted determinants. *Health Education & Behavior, 36*(6),1051-1064. doi:10.1177/1090198109335802

Stenberg, U., Ruland, C. M., & Miaskowski, C. (2010). Review of the literature on the effects of caring for a patient with cancer. *Psycho-Oncology, 19*(10), 1013-1025.

Stephens, M. (2012). *Yoga sequencing*. Berkeley, CA: North Atlantic Books.

Sun, J., Buys, N., & Jayasinghe, R. (2014). Effects of community-based meditative tai chi programme on improving quality of life, physical and mental health in chronic heart-failure participants. *Aging & Mental Health, 18*(3), 289-295.

Swartz, J. J., & Keir, S. T. (2007). Program preferences to reduce stress in caregivers of patients with brain tumors. *Clinical Journal of Oncology Nursing, 11*(5), 723-727.

Symons Downs, D., & Hausenblas, H. A. (2005). Applying the theories of reasoned action and planned behavior to exercise: A meta-analytic update. *Journal of Physical Activity and Health, 2*, 76-97.

Tacon, A. M., & McComb, J. (2009). Mindful exercise, quality of life, and survival: A mindfulness-based exercise program for women with breast cancer. *The Journal of Alternative and Complementary Medicine, 15*(1), 41-46. doi:10.1089/ acm.2008.0255

Tan, C.-M., & Goleman, D. (2014). *Search inside yourself: The unexpected path to achieving success, happiness (and world peace)*. New York, NY, USA: HarperOne.

Taylor-Piliae, R. E., & Froelicher, S. (2004). Effectiveness of Tai Chi exercise in improving aerobic capacity: A meta-analysis. *Journal of Cardiovascular Nursing, 19*(1), 48-57.

Taylor-Piliae, R. E., Haskell, W. L., Stotts, N. A., & Froelicher, E. S. (2006). Improvement in balance, strength, and flexibility after 12 weeks of Tai Chi exercise in ethnic Chinese adults with cardiovascular disease risk factors. *Alternative Therapies in Health and Medicine, 12*(2), 50-58.

Telles, S., & Singh, N. (2012). Is Yoga a suitable treatment for rheumatoid arthritis: Current opinion. *Open Access Journal of Sports Medicine, 3*, 81-87.

The Caregiver Network. (2017). Mindfulness practices for caregivers. Retrieved from https://thecaregivernetwork.ca/event/caregiver-mindfulness/

Thind, H., Lantini, R., Balletto, B. L., Donahue, M. L., Salmoirago-Blotcher, E., Bock, B. C., & Scott-Sheldon, L. A. J. (2017). The effects of yoga among adults with type 2 diabetes: A systematic review and meta-analysis. *Preventative Medicine, 105*, 116-126. doi:10.1016/j.ypmed.2017.08.017

Torjman, S. (2015). Policies in support of caregivers. Reviewing Canada's social architecture. Caledon Institute of Social Policy. ISBN 978-1927350-95-9. Retrieved from http://social-architecture.ca/policiesinsupportofcaregivers/

Touger-Decker, R., Denmark, R., Bruno, M., O'Sullivan-Maillet, J., & Lasser, N. (2010). Workplace weight loss program; comparing live and internet methods. *Journal of Occupational and Environmental Medicine, 52*(11), 1112-1118.

Tousignant, M., Corriveau, H., Roy, P. M., Desrosiers, J., Dubuc, N., & Hébert, R. (2013). Efficacy of supervised Tai Chi exercises versus conventional physical therapy exercises in fall prevention for frail older adults: A randomized controlled trial. *Disability and Rehabilitation, 35*(17), 1429-1435. doi:10.3109/09638288.2012.737084

Trainerly. (2015). 11+ years experience. *Trainerly*. Retrieved from http://www.trainer.ly/trainers/784/david-dorian-ross#.WkbdaYVcNSt

Tran, M. D., Holly, R. G., Lashbrook, J., & Amsterdam, E. A. (2001). Effects of Hatha Yoga practice on the health-related aspects of physical fitness. *Preventive Cardiology, 4*(4), 165-170.

Trapper, J. (2013, March 19). Yoga's evolution: From basement studios to big business. *TheStar.com*. Retrieved from https://www.thestar.com/life/health_wellness/fitness/2013/03/19/yogas_evolution_from_basement_studios_to_big_business.html

Tremont, G. (2011). Family caregiving in dementia. *Medicine and Health, Rhode Island, 94*(2), 36-38.

Tsai, J. C., Wang, W. H., Chan, P., Lin, L. J., Wang, C. H., Tomlinson, B., … Liu, J. C. (2003). The beneficial effects of Tai Chi chuan on blood pressure and lipid profile and anxiety status in a randomized controlled trial. *Journal of Alternative and Complementary Medicine, 9*(5), 747-754.

Ugreninov, E. (2013). Offspring in squeeze: Health and sick leave absence among middle-aged informal caregivers. *Journal of Population Ageing 6*(4), 323-338.

Ulger, O., & Yagli, N. V. (2010). Effects of Yoga on the quality of life in cancer patients. *Complementary Therapies in Clinical Practice, 16*(2), 60-63. doi:10.1016/j.ctcp.2009.10.007

van den Berg, M. H., Schoones, J. W., & Vliet Vlieland, T. P. (2007). Internet-based physical activity interventions: A systematic review of the literature. *Journal of Medical Internet Research, 9*(3), e26.

Vandelanotte, C., Spathonis, K. M., Eakin, E. G., & Owen, N. (2007). Website-delivered physical activity interventions: A review of the literature. *American Journal of Preventive Medicine, 33*(1), 54-64.

Van Puymbroeck, M., Payne, L. L., & Hsieh, P-C. (2007). A phase I feasibility study of Yoga on the physical health and coping of informal caregivers. *Evidence Based Complementary and Alternative Medicine, 4*(4), 519–529. doi:10.1093/ecam/nem075

Vedamurtharchar, A., Janakiramaiah, N., Hegde, J. M., Shetty, T. K., Subbakrishna, D. K., Sureshbabu, S. V., & Gangadhar, B. N. (2006). Antidepressant efficacy and hormonal effects of sudarshana kriya Yoga (SKY) in alcohol dependent individuals. *Journal of Affective Disorders, 94*(1-3), 249-53.

Vedhara, K., Bennett, P. D., Clark, S., Lightman, S. L., Shaw, S., Perks, P., … Shanks, N. M. (2003). Enhancement of antibody responses to influenza vaccination in the elderly following a cognitive behavioural stress management intervention. *Psychotherapy and Psychosomatics, 72*(5), 245-252.

Vedhara, K., Cox, N. K., Wilcock, G. K., Perks, P., Hunt, M., Anderson, S., … Shanks, N. M. (1999). Chronic stress in elderly carers of dementia patients and antibody response to influenza vaccination. *Lancet, 353*(9153), 627-631.

Vitaliano P. (1997). Physiological and physical concomitants of caregiving: Introduction to special issue. *Annals of Behavioral Medicine, 19*(2), 75-77.

Vitaliano, P. P., Scanlan, J. M., Zhang, J., Savage, M. V., Hirsch, I. B., & Siegler, I. C. (2002). A path model of chronic stress, the metabolic syndrome, and coronary heart disease. *Psychosomatic Medicine, 64*(3), 418-435.

Vitaliano, P. P., Zhang, J., & Scanlan, J. M. (2003). Is caregiving hazardous for one's physical health? A meta-analysis. *Psychological Bulletin, 129*(6), 946–972.

Waelde, L. C., Thompson, L., & Gallagher-Thompson, D. (2004). A pilot study of a Yoga and meditation intervention for dementia caregiver stress. *Journal of Clinical Psychology, 60*(6), 677-687.

Waldron, E. A., Janke, E. A., Bechtel, C. F., Ramirez, M., & Cohen, A. (2012). A systematic review of psychosocial interventions to improve cancer caregiver quality of life. *Psycho-Oncology, 22*(6), 1200-1207. doi:10.1002/pon.3118

Walsh, K. (2016). Find your fit: The 5 most popular Yoga styles. *Fitness*. Retrieved from http://www.fitnessmagazine.com/workout/Yoga/help/Yoga-class-styles/?page=3

Walsh, R., & Shapiro, S. L. (2006). The meeting of meditative disciplines and western psychology: A mutually enriching dialogue. *American Psychologist 61*(3), 227-239. doi:10.1037/0003-066X.61.3.227

Wang, C., Collet, J. P., & Lau, J. (2004). The effect of Tai Chi on health outcomes in patients with chronic conditions: A systematic review. *Archives of Internal Medicine, 164*(5), 493-501. doi:10.1001/archinte.164.5.493

Wang, C., Schmid, C. H., Hibberd, P. L., Kalish, R., Roubenoff, R., Rones, R., & McAlindon, R. (2009). Tai Chi is effective in treating knee osteoarthritis: a randomized controlled trial. *Arthritis & Rheumatology, 61*(11), 545-553. doi:10.1002/art.24832

Wang, Y., Shan, W., Li, Q., Yang, N., & Shan, W. (2017). Tai Chi exercise for the quality of life in a perimenopausal women organization: A systematic review. *Worldviews on Evidence-Based Nursing, 14*(4), 294-305.

Wantland, D. J., Portillo, C. J., Holzemer, W. L., Slaughter, R., & McGhee, E. M. (2004). The effectiveness of Web-based vs. non-Web-based interventions: A meta-analysis of behavioral change outcomes. *Journal of Medical Internet Research, 6*(4), e40. doi:10.2196/jmir.6.4.e40

Warburton, D. E., Gledhill, N., & Quinney, A. (2001a) Musculoskeletal fitness and health. *Canadian Journal of Applied Physiology, 26*(2), 217-237.

Warburton, D. E., Gledhill, N., & Quinney, A. (2001b). The effects of changes in musculoskeletal fitness on health. *Canadian Journal of Applied Physiology, 26*(2), 161-216.

Ware, J. (1994). SF-36 health survey (Version 1.0) for use in Australia (also known as the medical outcomes study (MOS) 36-item short form health survey). *Centre for Health Service Development.* Retrieved from http://chsd.uow.edu.au

Ware, J., Kosinski, M., Bjorner, J. B., Turner-Bowker, D. M., Gandek, B., & Maruish, M. E. (2007). *User's manual for the SF-36v2TM health survey* (2nd Ed.). Lincoln, RI: QualityMetric Incorporated.

Ware, J. E., Kosinski, M., & Dewey, J. E. (2000). *How to score version two of the SF36 health survey*. Lincoln, RI: QualityMetric Incorporated.

Wayne, P. M., & Fuerst, M. L. (2013). *The Harvard Medical School guide to Tai Chi. 12 weeks to a healthy body, strong heart & sharp mind*. Boston, MA, USA: Shambhala Publications, Inc.

Webb, T., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery. *Journal of Medical Internet Research, 12*(1), e4.

Webster, C. S., Luo, A. Y., Krägeloh, C., Moir, F., & Henning, M. (2016). A systematic review of the health benefits of Tai Chi for students in higher education. *Preventive Medicine Reports 3*, 103-112. doi:10.1016/j.pmedr.2015.12.006

West, J., Otte, C., Geher, K., Johnson, J., & Mohr, D. C. (2004). Effects of Hatha Yoga and African dance on perceived stress, affect, and salivary cortisol. *Annals of Behavioral Medicine, 28*(2), 114-118.

Witek-Janusek, L., Albuquerque, K., Chroniak, K. R., Chroniak, C., Durazo-Arvizu, R., & Mathews, H. L. (2008). Effect of mindfulness based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. *Brain, Behavior, and Immunity, 22*(6), 969-981.

Wolsko, P. M., Eisenberg, D. M., & Davis, R. B. (2004). Use of mind-body medical therapies: Results of a national survey. *Journal of General Internal Medicine, 19*(1), 43-50.

Wong, K. K. (2002). *Tai Chi chuan. A comprehensive guide to the principles and practice*. Vermont, USA: Tuttle Publishing.

Woodyard, C. (2011). Exploring the therapeutic effects of Yoga and its ability to increase quality of life. *International Journal of Yoga, 4*(2), 49-54.

Woolery, A., Myers, H., Sternlieb, B., & Zeltzer, L. (2004). A Yoga intervention for young adults with elevated symptoms of depression. *Alternative Therapies in Health and Medicine, 10*(2), 60-63.

Woolf, S. H., Krist, A. H., Johnson, R. E., Wilson, D. B., Rothemich, S. F., Norman, G. J., & Devers, K. J. (2006). A practice-sponsored Web site to help patients pursue healthy behaviors: An ACORN study. *Annals of Family Medicine, 4*(2), 148-152.

World Health Organization. (2015). Ageing and life-course. An internet-based intervention for informal caregivers of people with dementia. Retrieved from http://www.who.int/ageing/features/internet-intervention-dementia/en/

World Health Organization. (2016). Physical activity. Retrieved from http://www.who.int/topics/physical_activity/en/

World Health Organization and Alzheimer's Disease International. (2012). Dementia, a public health priority. Retrieved from http://www.who.int/mental_health/publications/dementia_report_2012/en/

Wu, G., Keyes, L., Callas, P., Ren, X., & Bookchin, B. (2010). Comparison of telecommunication, community, and home-based Tai Chi exercise programs on compliance and effectiveness in elders at risk for falls. *Archives of Physical Medicine and Rehabilitation, 91*(6), 849-856. doi:10.1016/j.apmr.2010.01.024

Wu, H., Wang, J., Cacioppo, J. T., Glaser, R., Kiecolt-Glaser, J. K., & Malarkey, W. B. (1999). Chronic stress associated with spousal caregiving of patients with Alzheimer's dementia is associated with down regulation of B-lymphocyte GH mRNA. *Journal of Gerontology Series A, Biological Sciences and Medical Science, 54*(4), M212-M215.

Wurz, A., Chamorro-Vina, C., Guilcher, G. M., Schulte, F., & Culos-Reed, S. N. (2014). The feasibility and benefits of a 12-week yoga intervention for pediatric cancer out-patients. *Pediatric Blood & Cancer, 61*(10), 1828-1834. doi:10.1002/pbc.25096

Yabroff, K. R., & Kim, Y. (2009). Time costs associated with informal caregiving for cancer survivors. *Cancer, 115*(18), 4362-4373. doi:10.1002/cncr.24588

Yachoui, R., & Kolasinski, S. L. (2012). Complementary and alternative medicine for rheumatic diseases. *Aging Health, 8*(4), 403-412. doi:10.2217/ahe.12.45

Yang, J-M. (2010). *Tai Chi chuan. Classical Yang style*. New Hampshire, USA: YMAA Publication Center.

Yang, K. (2007). A review of Yoga programs for four leading risk factors of chronic disease. *Evidence Based Complementary and Alternative Medicine, 4*(4), 487-491.

Yeh, G. Y., Wood, M. J., Lorell, B. H., Stevenson, L. W., Eisenberg, D. M., Wayne, P. M., … Phillips, R. S. (2004). Effects of Tai Chi mind-body movement therapy on functional status and exercise capacity in patients with chronic heart failure: A randomized controlled trial. *American Journal of Medicine, 117*(8), 541-548.

YogaGlo. (2016). Everyone's Yoga. *YogaGlo.com*. Retrieved from https://www.Yogaglo.com/features

Yoga Journal. (2012). Yoga in America. *Yoga Journal.* Retrieved from https://www.yogajournal.com/press-releases/yoga-journal-releases-2012-yoga-in-america-market-study

Yoga Journal. (2016). Yoga in America. *Yoga Journal.* Retrieved from https://www.yogajournal.com/page/yogainamericastudy

Yogendra, J., Yogendra, H. J., Ambardeka, S., Lele, R. D., Shetty, S., Dave, M., & Husein, N. (2004). Beneficial effects of Yoga lifestyle on reversibility of ischaemic heart disease: Caring heart project of International Board of Yoga. *Journal of Association of Physicians of India, 52*, 283-289.

Young, S. 1997. *The science of enlightenment*. Boulder, CO, USA: Sounds True.

Zhang, L., Layne, C., Lowder., T., & Liu, J. (2012). A review focused on the psychological effectiveness of Tai Chi on different populations. *Evidence-Based Complementary and Alternative Medicine*, 1-9. doi:10.1155/2012/678107

Zheng, G., Lan, X., Li, M., Ling, K., Lin, H., Chen, L., … Fang, Q. (2015). Effectiveness of Tai Chi on physical and psychological health of college students: Results of a randomized controlled trial. *PLoS One, 10*(7), 1-14. doi:10.1371/journal.pone.0132605

Zhuang, H. (2015). *The mind inside Tai Chi*. Wolfeboro, NH, USA: YMAA Publication Center.

Appendix A

Comprehensive Description of *Ujjayi* Breath

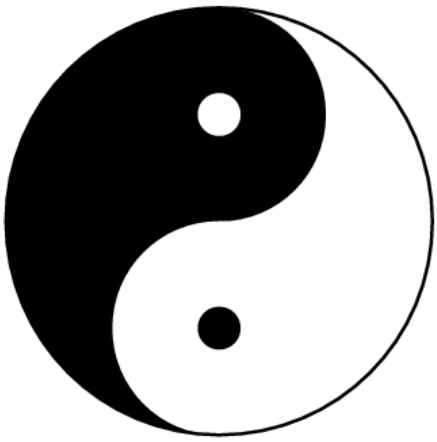
Picture from: www.Yogajournal.com

Ujjayi breath, which translates from Sanskrit to ‘victorious’ breath in English, is synchronized with *asanas* (physical postures). While performing *Ujjayi* breath, the lungs are fully expanded, with the chest pushed out like a victorious conqueror. *Ujjayi* breathing is mainly known for its slow, rhythmic, and loud ocean sound, which is created as the breath is drawn down toward the back of the throat and swirled there during nostril exhalation (Fraser, 2007; Schultz, 2006; Sobi-Wilderman, 2014). *Ujjayi* breath helps to guide the Yoga practitioner’s Yoga session by giving the practitioner a rhythm to follow. Additionally, *Ujjayi* breathing helps to reduce distractions, keeping the practitioner self-aware and present in their practice (Fraser, 2007; Schultz, 2006).

The benefits of utilizing and performing *Ujjayi* breath include developing respiratory stamina and mental focus, detoxifying the tissues and organs, calming the brain and body, increasing concentration and *chi/qi* (life force/energy), and strengthening the nervous and digestive systems (Fraser, 2007; Schultz, 2006).

Appendix B

Picture and Description of the Tai Chi Emblem



Picture from: http://www.risingdragonfengshui.com/

The Tai Chi emblem, also know as the yin/yang symbol, is comprised of a simple pattern with profound significance. The emblem is a representation of the universe, life, matter, energy, movement, and structure (Zhuang, 2015). The significance of the Tai Chi emblem involves the mutual containment and entrenchment of yin and yang, the strong and weak mutual consumption of yin and yang, and the waxing and waning property of the two energies; things tend to develop contrarily when reaching an extreme (Zhuang, 2015).

Yin and yang are always in dynamic interplay with one another, without exception. There is no ‘pure’ yin or yang; they always exist in relative measure (Chitty, 2013). Notably, the Tai Chi emblem represents the fundamental principles of both yin and yang and Tai Chi philosophy, including: 1) yin and yang are opposites and entirely interdependent – they are both essential for function and existence and 2) the relative levels of yin and yang are continuously changing and inter-transforming – the same thing

(e.g., a person) can be predominantly yin one day and yang the next, while what is yin in one instance (e.g., water as ice) is yang in another (e.g., water as steam; Chitty, 2013; Zhuang, 2015).

Appendix C

Comprehensive Description of *Qigong*

Practitioners perform *qigong* before performing Tai Chi forms. *Qi* translates from Chinese to 'life/energy' in English, while *gong* translates from Chinese to 'work/perseverance and practice'. Taken together, *qigong* refers to a system/practice used to enrich and balance life energy (Cohen, 1997). *Qigong* aligns breath, awareness, and movement and encompasses rhythmic breathing coordinated with slow fluid movements, mindfulness, and visualization and sensation of *chi/qi* (life force, energy) throughout the body. *Qigong* involves working with the life energy, learning how to control the flow and distribution of *chi/qi* to improve overall health and harmonize the mind and body (Cohen, 1997).

Notably, *qigong* techniques are divided into two categories: dynamic and active (*yang*) *qigong* and tranquil and passive (*yin*) *qigong.* Dynamic *qigong* includes obvious movement of the arms and body, as though performing a dance. Dynamic *qigong*, although predominantly *yang*, seeks to balance *yin* and *yang* in its practice; externally there is movement (*yang*), while internally the mind is quiet and peaceful (*yin*) – thus, the *yin* is merely concealed (Cohen, 1997). Tranquil *qigong* involves an entirely still body; the *chi/qi* is controlled by mental concentration and visualization. Tranquil *qigong*, although predominantly *yin*, seeks to balance *yin* and *yang* in its practice; externally the body is still (*yin*), while internally, the mind is vigilant and actively visualizing, sensing, and moving *chi/qi* (Cohen, 1997). Thus, while practicing *qigong*, it is important to find balance between *yin* and *yang.*

Appendix D

Leisure Time Exercise Questionnaire

Godin Leisure-Time Exercise Questionnaire

- Please do not include activities performed from our Yoga/Tai Chi program.
- Considering a 7-Day period (one week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time (write in each box the appropriate number):

Times Per Week

A) Strenuous Exercise
(Heart Beats Rapidly)
(e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

B) Moderate Exercise
(Not Exhausting)
(e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

C) Mild Exercise
(Minimal Effort)
(e.g., archery, fishing, bowling, horseshoes, golf, snowmobiling, easy walking)

Appendix E

Physical Activity Readiness Questionnaire (PAR-Q+)

CSEP approved Sept 12 2011 version

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 the Canadian 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 CSEP Certified Personal Trainer® (CSEP-CPT).
- If you are over the age of 45 yrs. 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 PARmed-X for Pregnancy 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.

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

 1 / 4

SECTION 2 - CHRONIC MEDICAL CONDITIONS

		Please read the questions below carefully and answer each one honestly: check YES or NO.	YES	NO
1.		Do you have Arthritis, Osteoporosis, or Back Problems?	☐ If yes, answer questions 1a-1c	☐ 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)	☐	☐
	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)?	☐	☐
	1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	☐	☐
2.		Do you have Cancer of any kind?	☐ If yes, answer questions 2a-2b	☐ 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?	☐	☐
	2b.	Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)?	☐	☐
3.		Do you have Heart Disease or Cardiovascular Disease? This includes Coronary Artery Disease, High Blood Pressure, Heart Failure, Diagnosed Abnormality of Heart Rhythm	☐ If yes, answer questions 3a-3e	☐ 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)	☐	☐
	3b.	Do you have an irregular heart beat that requires medical management? (e.g. atrial fibrillation, premature ventricular contraction)	☐	☐
	3c.	Do you have chronic heart failure?	☐	☐
	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)	☐	☐
	3e.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?	☐	☐
4.		Do you have any Metabolic Conditions? This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes	☐ If yes, answer questions 4a-4c	☐ If no, go to question 5
	4a.	Is your blood sugar often above 13.0 mmol/L? (Answer YES if you are not sure)	☐	☐
	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?	☐	☐
	4c.	Do you have other metabolic conditions (such as thyroid disorders, pregnancy-related diabetes, chronic kidney disease, liver problems)?	☐	☐
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)	☐ If yes, answer questions 5a-5b	☐ 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)	☐	☐
	5b.	Do you also have back problems affecting nerves or muscles?	☐	☐

Please read the questions below carefully and answer each one honestly: check YES or NO.			YES	NO
6.	Do you have a Respiratory Disease? This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure		☐ If yes, answer questions 6a-6d	☐ 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)	☐	☐
	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?	☐	☐
	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?	☐	☐
	6d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?	☐	☐
7.	Do you have a Spinal Cord Injury? This includes Tetraplegia and Paraplegia		☐ If yes, answer questions 7a-7c	☐ 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)	☐	☐
	7b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?	☐	☐
	7c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?	☐	☐
8.	Have you had a Stroke? This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event		☐ If yes, answer questions 8a-c	☐ 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)	☐	☐
	8b.	Do you have any impairment in walking or mobility?	☐	☐
	8c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?	☐	☐
9.	Do you have any other medical condition not listed above or do you live with two chronic conditions?		☐ If yes, answer questions 9a-c	☐ 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?	☐	☐
	9b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?	☐	☐
	9c.	Do you currently live with two chronic conditions?	☐	☐

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 yrs. 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 from a licensed health care professional before becoming more physically active or engaging in a fitness appraisal and/or visit a or 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 profesional, and/or complete the PARmed-X for Pregnancy 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 Canadian Society for Exercise Physiology, the PAR-Q+ Collaboration, 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:
Canadian Society for Exercise Physiology
www.csep.ca

KEY REFERENCES
1. Jamnik VJ, Warburton DER, Makarski J, McKenzie DC, Shephard RJ, Stone J, and Gledhill N. Enhancing the eectiveness 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.

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.

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

CSEP approved Sept 12 2011 version

Appendix F

Physical Activity Readiness Medical Examination

Physical Activity Readiness Medical Examination (revised 2002)

PARmed-X PHYSICAL ACTIVITY READINESS MEDICAL EXAMINATION

The PARmed-X is a physical activity-specific checklist to be used by a physician with patients who have had positive responses to the Physical Activity Readiness Questionnaire (PAR-Q). In addition, the Conveyance/Referral Form in the PARmed-X can be used to convey clearance for physical activity participation, or to make a referral to a medically-supervised exercise program.

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. The PAR-Q by itself provides adequate screening for the majority of people. However, some individuals may require a medical evaluation and specific advice (exercise prescription) due to one or more positive responses to the PAR-Q.

Following the participant's evaluation by a physician, a physical activity plan should be devised in consultation with a physical activity professional (CSEP-Certified Personal Trainer™ or CSEP-Certified Exercise Physiologist™). To assist in this, the following instructions are provided:

PAGE 1: • Sections A, B, C, and D should be completed by the participant BEFORE the examination by the physician. The bottom section is to be completed by the examining physician.

PAGES 2 & 3: • A checklist of medical conditions requiring special consideration and management.

PAGE 4: • Physical Activity & Lifestyle Advice for people who do not require specific instructions or prescribed exercise.

• Physical Activity Readiness Conveyance/Referral Form - an optional tear-off tab for the physician to convey clearance for physical activity participation, or to make a referral to a medically-supervised exercise program.

This section to be completed by the participant

A PERSONAL INFORMATION:

NAME _____

ADDRESS _____

_____

TELEPHONE _____

BIRTHDATE _____ GENDER _____

MEDICAL No. _____

B PAR-Q: Please indicate the PAR-Q questions to which you answered YES

- ❑ Q 1 Heart condition
- ❑ Q 2 Chest pain during activity
- ❑ Q 3 Chest pain at rest
- ❑ Q 4 Loss of balance, dizziness
- ❑ Q 5 Bone or joint problem
- ❑ Q 6 Blood pressure or heart drugs
- ❑ Q 7 Other reason: _____

C RISK FACTORS FOR CARDIOVASCULAR DISEASE:
Check all that apply

- ❑ Less than 30 minutes of moderate physical activity most days of the week.
- ❑ Currently smoker (tobacco smoking 1 or more times per week).
- ❑ High blood pressure reported by physician after repeated measurements.
- ❑ High cholesterol level reported by physician.
- ❑ Excessive accumulation of fat around waist.
- ❑ Family history of heart disease.

***Please note:** Many of these risk factors are modifiable. Please refer to page 4 and discuss with your physician.*

D PHYSICAL ACTIVITY INTENTIONS:

What physical activity do you intend to do?

_____

_____

_____

This section to be completed by the examining physician

Physical Exam:

Ht	Wt	BP i) /
		BP ii) /

Conditions limiting physical activity:

- ❑ Cardiovascular
- ❑ Musculoskeletal
- ❑ Respiratory
- ❑ Abdominal
- ❑ Other

Tests required:

- ❑ ECG
- ❑ Blood
- ❑ Exercise Test
- ❑ Urinalysis
- ❑ X-Ray
- ❑ Other

Physical Activity Readiness Conveyance/Referral:

Based upon a current review of health status, I recommend:

Further Information:
- ❑ Attached
- ❑ To be forwarded
- ❑ Available on request

- ❑ No physical activity
- ❑ Only a medically-supervised exercise program until further medical clearance
- ❑ Progressive physical activity:
  - ❑ with avoidance of: _____
  - ❑ with inclusion of: _____
  - ❑ under the supervision of a CSEP-Certified Exercise Physiologist™
- ❑ Unrestricted physical activity–start slowly and build up gradually

Supported by: Public Health Agency of Canada / Agence de la santé publique du Canada

Physical Activity Readiness
Medical Examination
(revised 2002)

PARmed-X PHYSICAL ACTIVITY READINESS MEDICAL EXAMINATION

Following is a checklist of medical conditions for which a degree of precaution and/or special advice should be considered for those who answered "YES" to one or more questions on the PAR-Q, and people over the age of 69. Conditions are grouped by system. Three categories of precautions are provided. Comments under Advice are general, since details and alternatives require clinical judgement in each individual instance.

	Absolute Contraindications	Relative Contraindications	Special Prescriptive Conditions	ADVICE
	Permanent restriction or temporary restriction until condition is treated, stable, and/or past acute phase.	Highly variable. Value of exercise testing and/or program may exceed risk. Activity may be restricted. Desirable to maximize control of condition. Direct or indirect medical supervision of exercise program may be desirable.	Individualized prescriptive advice generally appropriate: • limitations imposed; and/or • special exercises prescribed. May require medical monitoring and/or initial supervision in exercise program.	
Cardiovascular	❑ aortic aneurysm (dissecting) ❑ aortic stenosis (severe) ❑ congestive heart failure ❑ crescendo angina ❑ myocardial infarction (acute) ❑ myocarditis (active or recent) ❑ pulmonary or systemic embolism—acute ❑ thrombophlebitis ❑ ventricular tachycardia and other dangerous dysrhythmias (e.g., multi-focal ventricular activity)	❑ aortic stenosis (moderate) ❑ subaortic stenosis (severe) ❑ marked cardiac enlargement ❑ supraventricular dysrhythmias (uncontrolled or high rate) ❑ ventricular ectopic activity (repetitive or frequent) ❑ ventricular aneurysm ❑ hypertension—untreated or uncontrolled severe (systemic or pulmonary) ❑ hypertrophic cardiomyopathy ❑ compensated congestive heart failure	❑ aortic (or pulmonary) stenosis—mild angina pectoris and other manifestations of coronary insufficiency (e.g., post-acute infarct) ❑ cyanotic heart disease ❑ shunts (intermittent or fixed) ❑ conduction disturbances • complete AV block • left BBB • Wolff-Parkinson-White syndrome ❑ dysrhythmias—controlled ❑ fixed rate pacemakers	• clinical exercise test may be warranted in selected cases, for specific determination of functional capacity and limitations and precautions (if any). • slow progression of exercise to levels based on test performance and individual tolerance. • consider individual need for initial conditioning program under medical supervision (indirect or direct).
			❑ intermittent claudication	progressive exercise to tolerance
			❑ hypertension: systolic 160-180; diastolic 105+	progressive exercise; care with medications (serum electrolytes; post-exercise syncope; etc.)
Infections	❑ acute infectious disease (regardless of etiology)	❑ subacute/chronic/recurrent infectious diseases (e.g., malaria, others)	❑ chronic infections ❑ HIV	variable as to condition
Metabolic		❑ uncontrolled metabolic disorders (diabetes mellitus, thyrotoxicosis, myxedema)	❑ renal, hepatic & other metabolic insufficiency	variable as to status
			❑ obesity ❑ single kidney	dietary moderation, and initial light exercises with slow progression (walking, swimming, cycling)
Pregnancy		❑ complicated pregnancy (e.g., toxemia, hemorrhage, incompetent cervix, etc.)	❑ advanced pregnancy (late 3rd trimester)	refer to the "PARmed-X for PREGNANCY"

References:

Arraix, G.A., Wigle, D.T., Mao, Y. (1992). Risk Assessment of Physical Activity and Physical Fitness in the Canada Health Survey Follow-Up Study. **J. Clin. Epidemiol.** 45:4 419-428.

Mottola, M., Wolfe, L.A. (1994). Active Living and Pregnancy, In: A. Quinney, L. Gauvin, T. Wall (eds.), **Toward Active Living: Proceedings of the International Conference on Physical Activity, Fitness and Health**. Champaign, IL: Human Kinetics.

PAR-Q Validation Report, British Columbia Ministry of Health, 1978.

Thomas, S., Reading, J., Shephard, R.J. (1992). Revision of the Physical Activity Readiness Questionnaire (PAR-Q). **Can. J. Spt. Sci.** 17: 4 338-345.

The PAR-Q and PARmed-X were developed by the British Columbia Ministry of Health. They have been revised by an Expert Advisory Committee of the Canadian Society for Exercise Physiology chaired by Dr. N. Gledhill (2002).

Disponible en français sous le titre
«Évaluation médicale de l'aptitude à l'activité physique (X-AAP)»

Continued on page 3...

Physical Activity Readiness
Medical Examination
(revised 2002)

	Special Prescriptive Conditions	ADVICE
Lung	❑ chronic pulmonary disorders	special relaxation and breathing exercises
	❑ obstructive lung disease ❑ asthma	breath control during endurance exercises to tolerance; avoid polluted air
	❑ exercise-induced bronchospasm	avoid hyperventilation during exercise; avoid extremely cold conditions; warm up adequately; utilize appropriate medication.
Musculoskeletal	❑ low back conditions (pathological, functional)	avoid or minimize exercise that precipitates or exasperates e.g., forced extreme flexion, extension, and violent twisting; correct posture, proper back exercises
	❑ arthritis—acute (infective, rheumatoid; gout)	treatment, plus judicious blend of rest, splinting and gentle movement
	❑ arthritis—subacute	progressive increase of active exercise therapy
	❑ arthritis—chronic (osteoarthritis and above conditions)	maintenance of mobility and strength; non-weightbearing exercises to minimize joint trauma (e.g., cycling, aquatic activity, etc.)
	❑ orthopaedic	highly variable and individualized
	❑ hernia	minimize straining and isometrics; stregthen abdominal muscles
	❑ osteoporosis or low bone density	avoid exercise with high risk for fracture such as push-ups, curl-ups, vertical jump and trunk forward flexion; engage in low-impact weight-bearing activities and resistance training
CNS	❑ convulsive disorder not completely controlled by medication	minimize or avoid exercise in hazardous environments and/or exercising alone (e.g., swimming, mountain climbing, etc.)
	❑ recent concussion	thorough examination if history of two concussions; review for discontinuation of contact sport if three concussions, depending on duration of unconsciousness, retrograde amnesia, persistent headaches, and other objective evidence of cerebral damage
Blood	❑ anemia—severe (< 10 Gm/dl) ❑ electrolyte disturbances	control preferred; exercise as tolerated
Medications	❑ antianginal ❑ antiarrhythmic ❑ antihypertensive ❑ anticonvulsant ❑ beta-blockers ❑ digitalis preparations ❑ diuretics ❑ ganglionic blockers ❑ others	NOTE: consider underlying condition. Potential for: exertional syncope, electrolyte imbalance, bradycardia, dysrhythmias, impaired coordination and reaction time, heat intolerance. May alter resting and exercise ECG's and exercise test performance.
Other	❑ post-exercise syncope	moderate program
	❑ heat intolerance	prolong cool-down with light activities; avoid exercise in extreme heat
	❑ temporary minor illness	postpone until recovered
	❑ cancer	if potential metastases, test by cycle ergometry, consider non-weight bearing exercises; exercise at lower end of prescriptive range (40-65% of heart rate reserve), depending on condition and recent treatment (radiation, chemotherapy); monitor hemoglobin and lymphocyte counts; add dynamic lifting exercise to strengthen muscles, using machines rather than weights.

*Refer to special publications for elaboration as required

The following companion forms are available online: http://www.csep.ca

The **Physical Activity Readiness Questionnaire (PAR-Q)** - a questionnaire for people aged 15-69 to complete before becoming much more physically active.

The **Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for PREGNANCY)** - to be used by physicians with pregnant patients who wish to become more physically active.

For more information, please contact the:

Canadian Society for Exercise Physiology
202 - 185 Somerset St. West
Ottawa, ON K2P 0J2
Tel. 1-877-651-3755 • FAX (613) 234-3565 • Online: www.csep.ca

Note to physical activity professionals...

It is a prudent practice to retain the completed Physical Activity Readiness Conveyance/Referral Form in the participant's file.

Supported by: Public Health Agency of Canada / Agence de la santé publique du Canada

Continued on page 4...

Physical Activity Readiness
Medical Examination
(revised 2002)

PARmed-X PHYSICAL ACTIVITY READINESS MEDICAL EXAMINATION

CANADA'S to Healthy Active Living

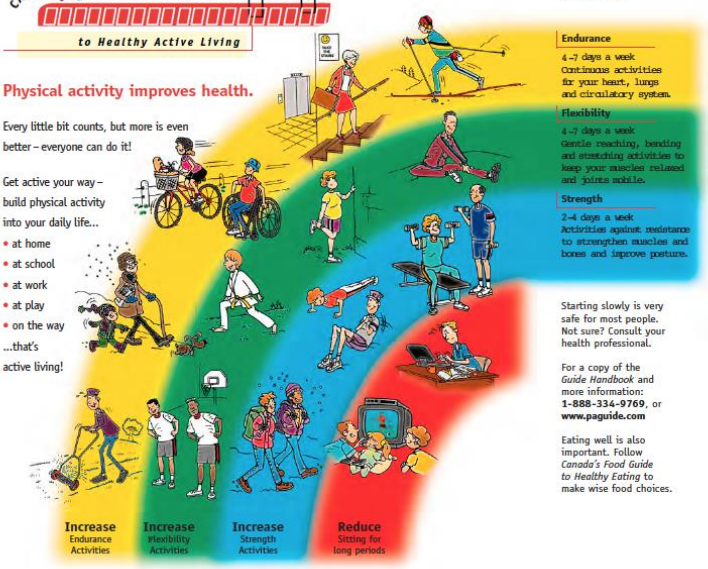
Physical activity improves health.

Every little bit counts, but more is even better – everyone can do it!

Get active your way – build physical activity into your daily life...

- at home
- at school
- at work
- at play
- on the way

...that's active living!



Choose a variety of activities from these three groups:

Endurance
4–7 days a week
Continuous activities for your heart, lungs and circulatory system.

Flexibility
4–7 days a week
Gentle reaching, bending and stretching activities to keep your muscles relaxed and joints mobile.

Strength
2–4 days a week
Activities against resistance to strengthen muscles and bones and improve posture.

Starting slowly is very safe for most people. Not sure? Consult your health professional.

For a copy of the *Guide Handbook* and more information: **1-888-334-9769**, or **www.paguide.com**

Eating well is also important. Follow *Canada's Food Guide to Healthy Eating* to make wise food choices.

Get Active Your Way, Every Day – For Life!

Scientists say accumulate 60 minutes of physical activity every day to stay healthy or improve your health. As you progress to moderate activities you can cut down to 30 minutes, 4 days a week. Add-up your activities in periods of at least 10 minutes each. Start slowly.. and build up.

Time needed depends on effort

Very Light Effort	Light Effort 60 minutes	Moderate Effort 30–60 minutes	Vigorous Effort 20–30 minutes	Maximum Effort
• Strolling • Dusting	• Light walking • Volleyball • Easy gardening • Stretching	• Brisk walking • Biking • Raking leaves • Swimming • Dancing • Water aerobics	• Aerobics • Jogging • Hockey • Basketball • Fast swimming • Fast dancing	• Sprinting • Racing

Range needed to stay healthy

You Can Do It – Getting started is easier than you think

Physical activity doesn't have to be very hard. Build physical activities into your daily routine.

- Walk whenever you can – get off the bus early, use the stairs instead of the elevator.
- Reduce inactivity for long periods, like watching TV.
- Get up from the couch and stretch and bend for a few minutes every hour.
- Play actively with your kids.
- Choose to walk, wheel or cycle for short trips.
- Start with a 10 minute walk – gradually increase the time.
- Find out about walking and cycling paths nearby and use them.
- Observe a physical activity class to see if you want to try it.
- Try one class to start – you don't have to make a long-term commitment.
- Do the activities you are doing now, more often.

Benefits of regular activity:	Health risks of inactivity:
• better health • improved fitness • better posture and balance • better self-esteem • weight control • stronger muscles and bones • feeling more energetic • relaxation and reduced stress • continued independent living in later life	• premature death • heart disease • obesity • high blood pressure • adult-onset diabetes • osteoporosis • stroke • depression • colon cancer

Health Canada Santé Canada

Canadian Society for Exercise Physiology

Source: Canada's Physical Activity Guide to Healthy Active Living, Health Canada, 1998 http://www.hc-sc.gc.ca/hppb/paguide/pdf/guideEng.pdf

PARmed-X Physical Activity Readiness Conveyance/Referral Form

Based upon a current review of the health status of _____, I recommend:

- ❑ No physical activity
- ❑ Only a medically-supervised exercise program until further medical clearance
- ❑ Progressive physical activity
  - ❑ with avoidance of: _____
  - ❑ with inclusion of: _____
  - ❑ under the supervision of a CSEP-Certified Exercise Physiologist™
- ❑ Unrestricted physical activity — start slowly and build up gradually

Further Information:
- ❑ Attached
- ❑ To be forwarded
- ❑ Available on request

Physician/clinic stamp:

_____ M.D.

_____ 20_____
(date)

NOTE: This physical activity clearance is valid for a maximum of six months from the date it is completed and becomes invalid if your medical condition becomes worse.

4

Appendix G

Ethics Approval

University of Regina

Research Ethics Board
Certificate of Approval

PRINCIPAL INVESTIGATOR	DEPARTMENT	REB#
Darren Candow	Kinesiology and Health Studies	2016-129

TITLE
The Efficacy of Online Vinyasa Yoga and Taijifit™ on physical health outcome measures and quality of life of adult informal caregivers

APPROVED ON:	RENEWAL DATE:
August 30, 2016	August 30, 2017

APPROVAL OF:
Application for Biomedical Research Ethics Review
Recruitment Poster
Consent Form
Adverse Event Form
PAR-Q+

Full Board Meeting ☐ Delegated Review ☒

The University of Regina Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol, consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS
In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: http://www.uregina.ca/research/for-faculty-staff/ethics-compliance/human/forms1/ethics-forms.html.

Dr. Katherine Robinson
Chair, Research Ethics Board

Please send all correspondence to:

Research Office
University of Regina
Research and Innovation Centre 109
Regina, SK S4S 0A2
Telephone: (306) 585-4775 Fax: (306) 585-4893
research.ethics@uregina.ca

Appendix H

Informed Consent

INFORMED CONSENT FORM

UNIVERSITY OF REGINA

Research Participant Information and Consent Form

Title of the study: The efficacy of online Vinyasa yoga and Taijifit™ on physical health outcome measures and quality of life of adult informal caregivers

Researchers: Darren G. Candow, Ph.D. (Principal Investigator), Faculty of Kinesiology and Health Studies, University of Regina, phone: 306-585-4906, email: Darren.Candow@uregina.ca; Andi Céline Martin, PhD student researcher (Co-Investigator), email: Andi.Martin@uregina.ca

Sponsor: N/A

24-hour emergency telephone contact: 306-209-0280 or 306-501-3499

Introduction:
You are being invited to participate in this research study because we want to determine the effects of yoga and tai chi on muscle strength and endurance, tasks of functionality (i.e., walking speed, balance, flexibility, hand-grip strength), and quality of life in the informal caregiver population.

Before you decide to participate, it is important that you understand what the research involves. This consent form will tell you about the study, why the research is being performed, what will happen to you during the study, and the possible benefits, risks, and discomforts.

If you wish to participate, you will be asked to sign this form. Your participation is entirely voluntary, so it is up to you to decide whether or not to participate in this study. If you decide to take part in this study, you are free to withdraw at any time without giving any reasons for your decision and your choice not to participate will not affect your relationship with any of the researchers or institutions conducting the research. Please take time to read the following information carefully and to discuss it with your family, friends, and doctor or health professional before you decide.

Why is this study being done?
The purpose of the study is to compare the effects of yoga and tai chi on muscle performance, tasks of functionality, and quality of life in the informal caregiver population. In addition, this study seeks to gather information regarding participation motives, perceived benefits of the study, the importance of and barriers to physical activity, delivery method (online), informal caregiver health and physical activity, desire

to continue with yoga or tai chi, and overall program satisfaction (critique/feedback on how to improve the intervention).

Who can participate in this study?
You can participate if you are ≥ 18 years of age, have not engaged in yoga or tai chi for ≥ 6 weeks prior to the start of the study, and you are an informal caregiver to someone (spouse/partner, family member, friend, neighbour, co-worker) for any reason, including but not limited to: aging, disease/illness, disability, mental-health conditions, or an accident/injury. Specifically, an informal caregiver provides help with activities of daily living or instrumental activities of daily living (including, but not limited to: transportation, help with housework, shopping, meal preparation, ambulation, personal hygiene, medication management, eating, and toileting). Females must not be pregnant or < 6 weeks post-natal.

What does the study involve?
If you agree to participate in this study, the following will occur:

You will initially be given a questionnaire (Physical Activity Readiness Questionnaire; PAR-Q+), which assesses whether you are at a health risk for participating in exercise. If you indicate a possible health risk, you will be required to get medical clearance before being enrolled in the study.

Prior to the start of the study, you will be shown how to perform the study measurements (below) to familiarize yourself with the exercises. A minimum of 48 hours after familiarization, you will perform the study measurements (below) prior to starting the intervention (i.e. baseline). You will then be randomized (i.e. assigned by chance by a computer) into either the yoga or tai chi group. Both groups will participate in 12 weeks of yoga or tai chi training and receive a free membership to an online yoga or tai chi community for the duration of the study. After the 12 weeks of yoga or tai chi training (i.e. post-intervention), you will perform the study measurements (below). Six weeks post-exercise, you will be asked to perform the study measurements again. Although 100% compliance to the yoga or tai chi protocol of 150 minutes per week is the expectation, it is unlikely that all participants will meet this goal. Our hope is that you will be able to perform as close to 150 minutes of yoga or tai chi per week. You are permitted to do other exercises outside of the study if you choose but we ask that you do not initiate any new forms of physical activity during the duration of the study.

<u>The following measurements will be performed prior to the intervention (i.e. baseline) and after the intervention (i.e. post-intervention) at 12 weeks:</u>

- Your lower (leg) and upper (chest) body strength will be determined using a 1-repetition maximum (1-RM) standard testing procedure. To assess muscular strength, we will first have you do a warm-up of stretching and stationary cycling exercise. We will then have you do 8-10 repetitions of the strength exercise with a light weight. We will then assess your ability to maximally lift the heaviest weight you can lift one time. The maximal attempts will be repeated until we find a weight that

you cannot lift. Two minutes of rest will be given between each attempt. These measurements will take approximately 15 minutes.

- Your lower body (leg), upper body (chest), and abdominal endurance will be assessed. Leg and chest muscular endurance performances will be determined as the maximum number of repetitions that can be performed for one set using 70% baseline 1-RM for chest press strength and 80% baseline 1-RM for leg press strength. Abdominal endurance will be determined as the maximum number of consecutive curl-ups (up to 25) performed in one minute. These measurements will take approximately 15 minutes.

- Handgrip strength will be assessed with a handgrip dynamometer. You will perform 3 handgrip strength assessments using the left and right hands. This test takes about 5 minutes.

- Balance and walking speed will be determined by walking backwards toe-to-heel on a board that is 5 cm above the ground for 6 meters. This test will be repeated twice. We will measure the time it takes you to do this test and the number of times you step off the board. This test takes about 5 minutes.

- Hamstring flexibility will be assessed using a sit-and-reach flexometer. You will have two attempts with a one-minute break between trials. The best attempt will be recorded to the nearest 0.5cm. This test takes about 2 minutes.

- We will give you a questionnaire that assesses overall quality of life. This questionnaire takes approximately 5-10 minutes to complete.

<u>The following measurement will be performed post-intervention (after 12 weeks):</u>

- A 10-item open-ended questionnaire will be administered to shed light on participation motives, perceived benefits of the study, the importance of and barriers to physical activity, delivery method (online), and overall program satisfaction (how to improve the intervention). This questionnaire takes approximately 10-15 minutes to complete. The measurements and open-ended questionnaire will be assessed in one session and will take approximately 1 hour.

<u>The following measurements will be performed 6 weeks post-exercise (6 weeks after the post-intervention measurements):</u>

- The same measurements assessed at baseline and post-intervention (at 12 weeks) will be assessed 6 weeks post-exercise (6 weeks after the post-intervention measurements). This includes: muscular strength and endurance, tasks of functionality (handgrip strength, balance, walking speed, and flexibility), and quality of life.

- A 5-item open-ended questionnaire will be administered to shed light on the informal caregiving role and tasks performed, informal caregiver health and physical activity, perceived sustained benefits, desire to continue with yoga or tai chi, and overall program satisfaction (critique/feedback on how to improve the intervention). This questionnaire takes approximately 5-10 minutes to complete. The measurements and open-ended questionnaire will be assessed in one session and will take approximately 45 minutes.

What are the benefits of participating in this study?
You might increase your muscle strength and endurance, balance, walking speed, flexibility, and quality of life by participating in this study. These benefits are not guaranteed.

What are the possible risks and discomforts?
Yoga and tai chi may result in minor muscle pulls and strains. All yoga and tai chi sessions include proper warm-up and directions, which will minimize this risk. Adequate rest will be given between yoga/tai chi sessions and testing sessions to ensure that your muscles have recovered.

What are alternatives to the study?
You do not have to participate in this study to increase muscle performance, walking speed, balance, flexibility, or quality of life. You can perform alternative exercises (i.e. push-ups, chin ups, wall squats, stretching) or physical activities (walking, cycling) instead of the yoga or tai chi protocol.

What happens if I decide to withdraw?
Your participation in this research is voluntary. You may withdraw from this study at any time, up until December 1, 2016. After this date, it is possible that some results will have been analyzed, written up and/or presented and it may not be possible to withdraw your data. You do not have to provide a reason for your withdrawal. Your relationships with the researchers or the university will not be affected.

What happens if something goes wrong?
In the case of a medical emergency related to the study, you should seek immediate care and, as soon as possible, notify the principal investigator. Inform the medical staff you are participating in a clinical study. Necessary medical treatment will be made available at no cost to you. By signing this document, you do not waive any of your legal rights against the sponsor, investigators, or anyone else.

What happens after completion of the study?
We will inform you of your individual results and the overall study results after we have analyzed all data.

What will the study cost me?
You will not be charged for the yoga or tai chi membership or any research-related procedures. You will not be paid for participating in this study. Reimbursement for study-related expenses (e.g. travel, parking) is not available.

Will my participation be kept confidential?
In Saskatchewan, the Health Information Protection Act (HIPA) defines how the privacy of your personal health information must be maintained so that your privacy will be respected. Your name will not be attached to any information, nor mentioned in any study report, nor be made available to anyone except the research team. It is the intention of the research team to publish results of this research in scientific journals and to present the findings at related conferences and workshops, but your identity will not be revealed.

Who do I contact if I have questions about the study?
If you have questions concerning the study you can contact Dr. Darren Candow at 306-585-4906 or 306-209-0280 (24 hour cell) or Andi Céline Martin at 306-501-3499.

If you have any questions about your rights as a research subject or concerns about this study, you may contact the Chair of the University of Regina Research Ethics Board at (306) 585-4775 or email research.ethics@uregina.ca. Out of town participants may call collect.

Consent statement

- ○ I have read (or someone has read to me) the information in this consent form.
- ○ I understand the purpose and procedures and the possible risks and benefits of the study.
- ○ I have been informed of the alternatives to the study.
- ○ I was given sufficient time to think about it.
- ○ I had the opportunity to ask questions and have received satisfactory answers.
- ○ I am free to withdraw from this study at any time for any reason and the decision to stop taking part will not affect my future relationships at the university.
- ○ I agree to follow the principal investigator's instructions and will tell the principal investigator at once if I feel I have had any unexpected or unusual symptoms.
- ○ I have been informed there is no guarantee that this study will provide any benefits to me.
- ○ I give permission for the use and disclosure of my de-identified personal health information collected for the research purposes described in this form.
- ○ I understand that by signing this document I do not waive any of my legal rights.
- ○ I will be given a signed and dated copy of this consent form.
- ○ I give permission for my family physician to be informed about my participation in this study if need be:
  - ❑ Yes
  - ❑ No
  - ❑ I do not have a family physician

❑ I agree to participate in this study:

Printed name of participant: _____

Signature: _____

Date: _____

Printed name of person obtaining consent: _____

Signature: _____

Date: _____

Appendix I

Informal Caregiving and Yoga/Tai Chi Training Logs

Week 1

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 2

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 3

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 4

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 5

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 6

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 7

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 8

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 9

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 10

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 11

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Week 12

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Minutes of Yoga/ Tai Chi							
Hours of Informal Caregiving							

Appendix J

Informal Caregiving Logs – 6-Week Cessation Period

Week 1

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Hours of Informal Caregiving							

Week 2

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Hours of Informal Caregiving							

Week 3

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Hours of Informal Caregiving							

Week 4

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Hours of Informal Caregiving							

Week 5

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Hours of Informal Caregiving							

Week 6

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Hours of Informal Caregiving							

Appendix K

Adverse Event Form

Adverse Event Form

YOGA AND TAI CHI STUDY: ADVERSE EVENT FORM

SUBJECT ID#: _____ SUBJECT INITIAL: _____

Describe the adverse event:

_____

_____

_____

(Record diagnosis where available or describe event in as few words as possible).

Is this event a new event? _____

Is this event a change/resolution of an ongoing event? _____

Onset of Adverse Event (date/time): _____

Resolution of Adverse Event (date/time): _____

---

1. Is this event serious? Yes ☐ No ☐

(Results in death, is life threatening, requires hospitalization, result in persistent or significant disability).

Is this event intermittent? Yes ☐ No ☐

Rate intensity (severity): Please circle

Mild Moderate Severe Life threatening

2. Is the adverse event still present: Yes ☐ No ☐

3. Frequency: _____

4. Relationship to experimental procedure (exercise or other procedure):
Please circle

Not related Unlikely Possible Probable Definite

Was treatment administered? Yes ☐ No ☐

Details:

_____

_____

_____

*This is a SERIOUS ADVERSE EVENT – will be reported to the Research Ethics Board through their Status Report Form. For definitions of mild, moderate, severe, life threatening, not related, unlikely, possible, probably, and definite, refer to the MOP.

Signature: _____ Date: _____

Signature of PI: _____ Date: _____