EFFECTS OF PHYSICAL ACTIVITY AND EXERCISE ON PHYSICAL AND MENTAL HEALTH OUTCOMES IN FEMALE OLDER ADULTS WITH ARTHRITIS

BY

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A THESIS

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ABSTRACT

Background: Arthritis is a chronic, degenerative disease, which affects two million older Canadians of which the majority are older females (65+ years). In 2015, health care costs were in excess of 219 billion dollars and older adults were major users of our health care system. By 2041, it is predicted that over 9.2 million older adults will be present in Canada. With no cure for arthritis, methods to improve arthritic symptoms are essential to maintain physical and mental health. Physical activity (PA) and exercise may be advantageous strategies for improving arthritis-related symptoms and mental health outcomes, yet there is a lack of consistent evidence surrounding these terms.

Aims and Significance: The aim of this cross-sectional study was to evaluate the health-related benefits of PA and exercise and assess the relationship between leisure-time activity levels and pain; discomfort; physical function; range of motion (ROM); mobility, and health-related quality of life (HRQOL) outcomes in females aged 65 years and older.

Methods: 40 older females residing in the Durham Region of Ontario participated in the study of which 60% (N=24) were categorized as active (71 years $\pm$ 6.47) and 40% (N=16) were considered inactive (82 years $\pm$ 8.77). Self-reported questionnaires were employed to investigate pain symptoms (visual analog scale [VAS] and health questionnaire), physical function levels (medical outcomes short form-12 [SF-12]) and VAS), ROM ability (VAS), mobility (VAS), HRQOL measures (SF-12 and VAS), and PA and exercise levels (activity levels questionnaire for older adults [ALQOA]).

Results: Older active arthritic females reported less pain ($p<0.001$); less discomfort ($p<0.001$); higher physical function ($p<0.0001$); higher ROM ($p<0.001$); higher mobility ($p<0.0001$), and higher HRQOL ($p<0.0001$), in comparison to their inactive counterparts.

Conclusion: In support of my hypotheses, older females with arthritis who were active reported significantly: (i) Less pain; (ii) lower discomfort; (iii) higher HRQOL; (iv) higher mobility; (v) higher physical function, and (vi) higher ROM. These preliminary findings suggest that older females with arthritis living an active lifestyle can have both physical and mental health benefits.

Key words: Arthritis, rheumatoid arthritis, osteoarthritis, physical activity, exercise, pain, health-related quality of life, range of motion, mobility, physical function, physical health, mental health, older adults, seniors.

DEDICATION

I dedicate this thesis work to Sylvia.

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GO RIDGEBACKS!

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LIST OF ABBREVIATIONS

6MWT – 6-Minute Walk Test

AAP – Adelaide Activities' Profile

ABC – Activity-specific Balance Confidence Scale

ADL – Activities of Daily Living

AE – Aerobic Exercise

ANCOVA - Analysis of Covariance

ANOVA - Analysis of Variance

ASES – Arthritis Self-Efficacy Scale

ASEQ – Arthritis Self-Efficacy Questionnaire

AT – As-treated

BRFSS – Behavioral Risk Factor Surveillance System

BMI – Body Mass Index

CCHS – Canadian Community Health Survey

CES-D – Center for Epidemiological Studies Depression

CG – Control Group

CI – Confidence Interval

CIHI – Canadian Institute for Health Information

CPAG – Canadian Physical Activity Guidelines

CRP – C-reactive protein

CSEP – Canadian Society for Exercise Physiology

DAS-28 – Disease Activity Score-28

DISINDX – Disability Index

DR – Durham Region

DRI – Disability Rating Index

EG – Exercise Group

ES – Effect Size

ESSE – Ewart's Scale of Self-Efficacy

EX - Exercise

FAP – Functional Ambulation Performance

FAST – Fitness and Arthritis in Seniors Trial

GARS – Groningen Activity Restriction Scale

GH – General Health

GHQ – General Health Questionnaire

GP – General Practitioner

GS – Graduate student

HADS – Hospital Anxiety and Depression Scale

HAQ – Health Assessment Questionnaire

HE – Health Education

HI – High-intensity

HHS – Harris Hip Score

HRQOL – Health-related Quality of Life

IDEA – Intensive Diet and Exercise for Arthritis

IG – Intervention Group

IRGL – Influence of Rheumatic Disease on General Health and Lifestyle

ITT – Intention-to-treat

JIA – Juvenile Idiopathic Arthritis

KKD – Kilocalories per kilogram per day

KOOS – Knee Injury and Osteoarthritis Outcome Score

LI – Light intensity

LTPA – Leisure-time Physical Activity

LTPAEE – Leisure-time Physical Activity Energy Expenditure

MACTAR – McMaster Toronto Arthritis Patient Preference Interview

MANOVA – Mixed-model Multivariate analysis of Variance

MCS – Mental Composite Score

MD – Medical Doctor

MET – Metabolic Equivalent

MI – Moderate intensity

NCDs – Non-communicable diseases

NHP – Nottingham Health Profile

NWB – Nonweight-bearing

OA – Osteoarthritis

OR – Odds Ratio

OTCM – Over-the-counter medication

P – Probability

PA – Physical Activity

PACE – People with Arthritis Can Exercise

PASE – Physical Activity Scale for the Elderly

PCS – Physical Composite Score

PE – Patient Education

PE+SE – Patient Education and Supervised Exercise

PHAC – Public Health Agency of Canada

PPA – Physiological Profile Assessment

PQOL – Perceived Quality of Life

PT – Physical Therapy

QOL – Quality of Life

QWB – Quality of Well-being Scale

RA – Rheumatoid Arthritis

RAPIT – Rheumatoid Arthritis Patients in Training

RCT – Randomized Control Trial

RE – Resistance Exercise

REB – Research Ethics Board

ROM – Range of Motion

RR – Relative Risk

RV – Relative Validity

SD – Standard Deviation

SE – Strengthening Exercise

SEPA – Self-Efficacy for Physical Activity

SF-12 – Medical Outcomes Short Form-12

SF-36 – Medical Outcomes Short Form-36

SIP – Sickness Impact Profile

SMD – Standardized Mean Differences

SPF – Summary Physical Function

SPT – Standardized Physical Therapy

TAE – Therapeutic Aquatic Exercise

TCPS – Tri-Council Policy Statements

TENS – Transcutaneous Electric Nerve Stimulation

TPT – Thai Traditional Physical Therapy

TUG – Timed Up and Go test

UC – Usual Care

VAS – Visual Analog Scale

VI – Vigorous intensity

WB – Weight-bearing

WHO – World Health Organization

WMD – Weighted Mean Difference

WOMAC – Western Ontario and McMaster Universities Osteoarthritis Index

WT – Weight Training

GLOSSARY OF KEY TERMS

Activities of Daily Living (ADL): Routine and consistent activities individuals regularly conduct, without the help of others and include; dressing and undressing, continence, eating, bathing, transferring (mobility) and toileting (Pendleton & Schultz-Krohn, 2013).

Active Lifestyles: Defined as a value > 1.5 kilocalories per kilogram (kkd) in accordance with the Leisure-time PA Energy Expenditure (LTPAEE) calculation (Bryan & Katzmarzyk, 2009).

Aerobic Exercise: Any form of physical exercise of low to high intensity involving oxygen consumption and increased cardiovascular endurance. Examples of AE include walking; running; swimming, and cycling (de Vos et al., 2005).

Arthritis: A chronic, non-communicable disease categorized by inflammation of one or more joints, and typically accompanied by pain, discomfort, stiffness, swelling, and decreased range of motion (ROM) of the affected joint(s) (Centers for Disease Control and Prevention [CDC], 2015a).

Duration: The time at which something continues (e.g. how long an individual exercise for). It is generally expressed in minutes (Macmillan Dictionary, 2009).

Energy expenditure: The amount of energy or calories that a person requires for physical movement or other bodily functions such as breathing, digesting food and/or circulating blood (Scott, 2016).

Exercise: A subset of physical activity that involves structured, planned and/or repetitive bodily movements, utilizing skeletal muscles, requiring energy expenditure, which typically results in sustained and increased heart and respiratory rates through various levels of frequency, duration and intensity, and is positively correlated with physical

fitness, ultimately seeking to maintain or improve physical fitness components (e.g. jogging, swimming, weight lifting) (Caspersen, Powell & Christenson, 1985).

Frequency: The rate at which something occurs or is repeated over a period of time (e.g. how many times a week one exercises). It is generally expressed in sessions, episodes or bouts per week (Cambridge University Press, 2015).

Health-related Quality of Life (HRQOL): A self-reported appraisal of an individual's negative and positive aspects of life, which generally affects physical and/or mental health (CDC, 2011).

Inactive Lifestyle: Defined as a value of $\leq$1.5 kilocalories per kilogram (kkd) in accordance with the calculated LTPAEE value (Bryan & Katzmarzyk, 2009).

Intensity: The magnitude of effort necessary to perform an activity or the rate at which activity is being performed (e.g. MI) (World Health Organization [WHO], 2015b).

Joint pain and discomfort: Physical suffering or discomfort caused by arthritis illness or injury (e.g. sprain) (Longo et al., 2011 & Merriam-Webster, n.d.).

Light-intensity (LI): Common activities of daily living (ADL), not requiring a lot of effort (e.g. light dusting, washing dishes, brushing teeth) (National Institute of Health [NIH], 2011).

Mental Health: An individual's ability to feel and act in various positive ways, improving the capacity to enjoy things and overcome everyday obstacles. It includes an individual's beliefs, values, well-being, equity, social connections, dignity and justice (Cheprasov, 2015).

Metabolic Equivalents (METs): A measure of the energy cost (or calories) of physical activities and/or exercise (Bushman, 2012).

Mobility: The ability to move and participate in PA and ADLs (Canadian Institutes of Health Research [CIHR], 2007).

Moderate-intensity (MI): A level of activity intensity requiring moderate effort that increases the heart's, lungs and muscle work slightly (e.g. gardening, cleaning gutters) (NIH, 2011).

Nonweight-bearing Exercise (NWB): Motions that do not use weight bearings and seek to improve muscle strength rather than joint function (e.g. swimming and bicycling) (Jan, Lin, Lin, Lin & Lin, 2009).

Osteoarthritis (OA): A type of arthritis in which, any joint(s) are generally prone to deteriorating changes including, yet not limited to, the depletion of cartilage, sclerosis of the bone and the formation of osteophytes. These changes are customarily accompanied by symptoms ranging from swelling, stiffness, pain, discomfort and limited joint function (Thompson, 2011b).

Over-the-counter-medications (OTCM): Non-prescription based pharmacological agents that can be readily purchased by consumers (e.g. Tylenol, Advil, ASA) (U.S. Food and Drug Administration [FDA], 2013).

Physical Activity (PA): A lifestyle, activities of daily living and any bodily movement involving skeletal muscle(s), requiring energy expenditure that varies continuously from high to low levels, and which is not routine or structured to improve and maintain physical fitness components (e.g. gardening, washing the dishes, taking the stairs instead of the elevator) (WHO, 2014).

Physical Exertion: Defined as a feeling of how hard a body is working during PA. This can include increased heart rate, breathing rate and sweating (CDC, 2015b).

Physical Fitness: A set of attributes that are either health-or skill-related and are components that individuals either have or want to achieve through regular exercise. Physical fitness components include; cardio-respiratory endurance, muscular strength, muscular endurance and flexibility (Caspersen et al., 1985).

Physical Function: Basic actions and activities; essential for maintaining independence (Peeters, Dobson, Deeg & Brown, 2013).

Physical Health: Defined as a measure of the body's ability to function (Canadian Mental Health Association [CMHA], 2015).

Physical Therapy (PT): Both passive and active forms of exercise or massages, which seek to promote range of motion (ROM) and improve strength, endurance, balance, coordination, posture and motor function (e.g. walking; AE; strength training; muscle stretching; joint-specific exercise programmes) (Deyle et al., 2000 & 2005).

Reliability: Defined as the extent in which a questionnaire provides similar results when re-administered to the same group in the same conditions (Gerrish & Lacey, 2010).

Rheumatoid Arthritis (RA): An inflammatory condition, in which the collagen protecting joints is compromised and destroyed by antibodies, generally resulting in pain, discomfort, swelling, heat and limited joint function (Thompson, 2011a).

Range of Motion (ROM): Measurement of movement around a joint (McLaughlin, n.d.).

Strengthening Exercise (SE): Exercise enhancing the power and strength of small or large muscles and bones and can include resistance; stretching; strength, and endurance components. Machines and/or tools such as a leg press, universal gym or an elastic band can be employed (de Vos et al., 2005).

Quality of Life (QOL): A framework designed to represent an individual's independence, social activity and well-being, ranging from emotion well-being, material, and/or physical well-being for all people, equally, regardless of health state (CDC, 2011).

Validity: Defined as the ability of a questionnaire to measure what it is intended to measure (Gerrish & Lacey, 2010).

Vigorous-intensity (VI): The highest activity level of intensity requiring a large amount of effort that increases the heart's, lungs and muscles work drastically (e.g. carrying large bags of soil, shoveling heavy snow falls) (NIH, 2011).

Weight-bearing Exercise (WB): Motions working against gravity that seek to improve function and ROM (e.g. weight training, hiking, jogging) (Munneke & de Jong, 2000).

CHAPTER 1

Introduction

1.1 What is Arthritis?

Arthritis is defined as a chronic, non-communicable disease (NCD) categorized by inflammation of one or more joints, which is typically accompanied by pain; discomfort; stiffness; swelling; decreased range of motion (ROM), and reduced mobility of the affected joints (Center for Disease Control and Prevention [CDC], 2015a). Arthritis is regarded as one of the most debilitating health conditions globally. Presently, there is no cure. There are over 100 varying types of arthritis. Arthritis is a disease with multiple etiologies (Bombardier, Hawker & Mosher, 2011). The most common types of arthritis are osteoarthritis (OA) and rheumatoid arthritis (RA). OA is characterized by deteriorating changes of the cartilage and synovial fluid of the bone of the affected joint(s), generally resulting in sclerosis of the bone and the formation of osteophytes (Thompson, 2011b).

In RA conditions, the immune system attacks healthy tissues like collagen, which is a liquid substance protecting joints. Joints and synovial fluid are then compromised and destroyed by antibodies (Thompson, 2011a). OA and RA account for the majority of arthritic diagnoses, especially amongst the older adult and female populations (Arthritis Community Research Evaluation Unit [ACREU], 2013). This is largely due to their longer life expectancy and the negative health effects associated with bone mass loss caused by menopausal hormonal changes with associated decreased levels of estrogen. After menopause, estrogen levels decline, resulting in osteoporosis (Bonnick, Harris, Kendler, McClung & Silverman, 2010).

1.2 Growing Prevalence of Arthritis in Canada and Globally

Arthritis is an age-related condition, which tends to affect females predominantly. As population age and life expectancies increase, the prevalence of arthritis is expected to rise

worldwide (ACREU, 2013). In Canada, this is mainly the consequence of the aging baby boomer generation, defined as those born between the years 1946 and 1965 (Pruchno, 2012). In 2011, Canada's national population consisted of approximately five million (15%) older adults aged 65+ (Statistics Canada, 2015a), and 56% of whom were women (Statistics Canada, 2013). It is estimated that by 2041, there will be 9.2 million Canadians over the age of 65 years (Bartfay & Bartfay, 2016). Hence, the growing trends of an aging society with longer life expectancies, combined with the rise of chronic conditions, will undoubtedly result in an increase of individuals affected by arthritis. In Canada, two million (44%) older adults aged 65 and over currently live with arthritis (Bombardier et al., 2011). Notably, one-in-two (50%) Canadian older females reported having arthritis, compared to one-in-three (35.5%) males (Statistics Canada, 2015b). Globally, arthritis is most prominent in developed high-income countries (e.g. Canada, USA, England, Germany, Australia, France, New Zealand) affecting one-in-six people (Wong, Davis, Badley, Grewal & Mohammed, 2010). These numbers are predicted to increase by one percent every five years, virtually doubling by 2031 (Public Health Agency of Canada [PHAC], 2011).

1.3 Growing Health Care Costs of Arthritis in Canada and Globally

Our aging population in Canada with concurrent increases in the incidence of chronic diseases results in escalating health care spending. In 2015, health care expenditures were estimated to total 219.1 billion dollars, or $6,105 per Canadian. For those aged 65 years and older, health costs reached $11,598, and for those aged 80 years, spending was a staggering $20,917 per person (Canadian Institute for Health Information [CIHI], 2015). Moreover, Canada's total economic burden for arthritis was 233.5 billion dollars between

the years 2010 and 2015. These numbers total 33 billion dollars per year in direct and indirect health care costs and lost productivity, or $11,500 per person per year (Arthritis Consumer Experts, 2008 & The Arthritis Society, 2015). By 2031, the impact of arthritis on the Canadian economy is expected to rise to 67 billion dollars annually (The Arthritis Society, 2015). On a global scale, developed countries such as Canada have the largest associated economic burden (Wong et al., 2010). Direct costs associated with arthritis include prescription and over-the-counter (OTC) drugs; MD and GP consultations and referrals to specialists; research, and hospitals. Indirect costs of arthritis include premature mortality; disability, and out-of-pocket expenses (e.g. knee braces, canes, walkers, transcutaneous electric nerve stimulation [TENS] machines) (CIHI, 2015).

In addition to health care costs, health care services are also primarily consumed by older adults. In short, 45% of available health care services are utilized by older adults aged 65 years and above in Canada. As they grow older, the need for health care utilization also often increases, in concurrence with the development of chronic diseases (CIHI, 2015). Research shows that older adults with arthritis use a higher proportion of health care services (CIHI, 2015). This is due to the symptoms and comorbidities of arthritis, and the need of utilizing health care dollars and services for treating physical and mental health burdens (e.g. out-of-pocket costs for medications, physician visits) (CIHI, 2011).

1.4 Physical and Mental Symptoms

Physical health is an essential and perceptible component to an individual's overall health. It is defined as a measure of the body's ability to function (Canadian Mental Health Association [CMHA], 2015). People with arthritis generally report having poor physical health. Symptoms such as joint pain and discomfort; swelling; inflammation, and stiffness

can affect physical health. This can lead to debilitating changes in physical function; decreased mobility and range of motion (ROM); disability; deformity, and increased risk of falls and injuries (CDC, 2015a). Consequently, individuals with arthritis are almost twice as likely to be hospitalized due to a disability, injury or associated physical health condition (e.g. the need for hip or knee surgery) (The Arthritis Society, 2014). Although rare, mortality is also a potential outcome for arthritic clients, with two per 100,000 deaths reported (Arthritis Consumer Experts, 2015 & World Health Organization [WHO], 2015a). In addition, research shows persons living with chronic conditions and poor physical health are more likely to report decreased health-related quality of life (HRQOL) and mental health. These individuals are at a higher risk for developing depression and/or other associated mental health issues (CMHA, 2015).

Mental health is achieved by an individual's ability to feel and act in various positive ways, improving the capacity to enjoy things and overcome everyday obstacles (Cheprasov, 2015). It includes an individual's beliefs, values, well-being, equity, social connections, dignity and justice (Cheprasov, 2015). Individuals with arthritis often develop mental health issues. Moreover, this is often associated with issues including fixation on death; feelings of guilt; anxiety; loss of interest, and trouble concentrating. Indeed, a person with arthritis is three times more likely to suffer from depression, anxiety and/or mood disorders, in comparison to a person without any chronic illnesses (The Arthritis Society, 2015). When arthritis flares up, metabolic changes occur in the body, causing a rise in inflammation cytokines, which can worsen depression (Davis, n.d.). Research shows that older women aged 65 years and older are more likely to suffer from mental illnesses, compared to men, although the exact mechanisms remain to be elucidated (PHAC, 2010).

Previous studies have reported that persons with arthritis often experience a so-called "domino effect". Specifically, the occurrence of a physical condition (i.e. OA or RA) triggers a series of other conditions (e.g. low mobility, pain, compromised HRQOL and mental health issues) (Gardner, 2011). Older adults aged 65 and over, whose health statuses are the most vulnerable due to age have the highest risk. The older adult female population is especially susceptible to have health status compromised, as opposed to their male counterparts (PHAC, 2010). By understanding the implications of comorbidities in older adults with arthritis, and the growing trends of chronic disease and an aging population as modest drivers of increasing health care costs, future treatment and funding options may be considered.

1.5 Physical Activity and Exercise Strategies

As noted in Section 1.1, arthritis is a chronic, NCD with no known cure. To prevent specific disabilities, loss of physical function, joint pain or any other symptoms associated with arthritis, pharmacological (e.g. acetaminophen, ibuprofen, cortisone) and non-pharmacological (e.g. exercise, surgery, physiotherapy, knee braces, assisted walking devices like canes, TENS) treatment and management options are available. These treatments often vary according to the type and severity of arthritis. Health promotion and prevention are public health approaches that encourage healthy behaviours, lifestyles and environments to improve health and well-being (Bartfay & Bartfay, 2016). Specific to arthritis, exercise and/or physical activity (PA) have become interventions to maintain and/or restore physical and mental health at the secondary and tertiary health prevention levels (Callahan & Ambrose, 2015; Westby, 2015). They are beneficial in reducing the risk of complications associated with chronic disease and premature death (Canadian Society

for Exercise Physiology [CSEP], 2012). Being active may also help to decrease pain in the affected joint(s) and improve function, mobility, ROM of joints, manage body weight and positively contribute to mental health (CDC, 2016 & CSEP, 2012). Although exercise and PA are often used interchangeably in the mass and social medias, and often possess similar characteristics, they are different in nature (see Table 1.1 below).

Table 1.1 Comparison between PA and Exercise

Physical Activity	Exercise
• Any bodily movement involving skeletal muscles • Requires in energy expenditure that continuously differs from low to high levels • Positively correlated with physical fitness and cardio-respiratory conditioning	• Any bodily movement involving skeletal muscles • Requires in energy expenditure that continuously differs from low to high levels • Highly positively correlated with physical fitness and cardio-respiratory conditioning and endurance • Structured, planned and repetitive in nature • Ultimate goal is to maintain or improve physical fitness attributes and muscle strength

Source: adapted from Caspersen et al., 1985

Physical activity (PA) is defined as a lifestyle, activities of daily living (ADL) or any bodily movement, involving large skeletal muscle groups that require energy expenditure and which vary continuously from high to low levels (WHO, 2014). PA is positively correlated to physical fitness, although it does not objectively improve and maintain physical fitness components (WHO, 2014). Everyone performs PA to sustain life.

PA in daily life can be grouped into household, occupational, leisure (e.g. sports, exercise) or transportation activities (Bryan & Katzmarzyk, 2009; Caspersen et al., 1985). Activities are typically categorized into three levels: (i) Light-intensity (LI) (e.g. brushing teeth); (ii) moderate-intensity (MI) (e.g. sweeping floor), and (iii) vigorous-intensity (VI) (e.g. carrying heavy loads) (National Institute of Health [NIH], 2011 & Prosch, 2013). Table 1.2 below provides salient examples for each of three levels of PA.

Table 1.2 Levels of Physical Activity

Levels of Intensity	Description	Examples
Light-intensity (LI)	Common activities of daily living, not requiring much effort	Brushing teeth, washing dishes, putting food away in cupboards, light gardening
Moderate-intensity (MI)	Activities that require moderate effort and increase the heart's, lungs and muscles work slightly	Cleaning gutters, hanging laundry on a clothesline, packing or unpacking boxes, walking
Vigorous-intensity (VI)	Activities that require significant effort and increase the heart's, lungs and muscles work drastically	Carrying several heavy bags of groceries, digging ditches, playing a heavy musical instrument, lane swimming

Source: adapted from NIH, 2011 & Prosch, 2013

Exercise is a subset of PA that is planned, structured and repetitive in nature exertions, and which is defined by the intensity, frequency and duration of bodily movements, utilizing skeletal muscles, requiring increased energy expenditure. Exercise can be categorized into five different groups, which collectively seek to improve health: (i) Aerobic; (ii) anaerobic; (iii) balance; (iv) strength, and (v) flexibility exercises that target

specific body parts (see Table 1.3 below for examples). Exercise is positively correlated with physical fitness, and ultimately seeks to improve or maintain physical fitness (Caspersen et al., 1985). Performing regular exercise can help achieve at least one physical fitness attribute including improved cardio-respiratory endurance, muscular strength and endurance, and/or flexibility (Robb, 2009).

Table 1.3 Types of Exercise

Types and level of exercise	Description	Examples
Aerobic (LI to VI)	Exercise involving oxygen consumption by the body and increase cardiovascular endurance to improve physical fitness in a routine manner	Cycling, brisk walking, running, cross country skiing, lane swimming, tennis
Anaerobic or Strength (MI to VI)	Exercise enhancing the power and strength of small or large muscles and bones	Weight training, power lifting, jumping rope, strength exercise (using dumbbells, plates, universal weight machines, rubber or elastic resistance bands)
Balance (LI to MI)	Exercise to help in the prevention of falls	Tai Chi, heel-to-toe walking
Flexibility (LI)	Exercise that strengthens muscles, improves joints' ROM and adds flexibility	Stretching (arm, calf), yoga

Source: adapted from de Vos et al., 2005 & Knuttgen & Wilmore, 2003.

Understanding the terminologies can distinguish the relations, differences and associated health-related benefits for each concept (Caspersen et al., 1985). In this study,

measuring both exercise and PA at onset will help clarify the confusion and overlap between these activities, which often occurs (e.g. treading water fast, a VI sports PA can change to become an exercise). The levels of intensity, duration and frequency are measures associated with PA and exercise, and can be used to determine the total energy expenditure of an activity. Exercise is further characterized by these levels for the attainment of improving fitness through planned, repetitive and structured activities. **Intensity** is defined as the magnitude of effort necessary to perform an activity (WHO, 2015b). **Duration** is defined as the total number of minutes or hours of activity performed per week. **Frequency** is how many days per week one is physically active. These are all subjective classifications that should be adopted and individualized to match varying age cohorts, needs, abilities, activity levels and health statuses (WHO, 2015b). The consideration of certain health conditions (e.g. arthritis) and demographics (e.g. an older population) are vital for the succession of beneficial outcomes associated with being active. Specific to arthritis, starting off slow with low intensity (e.g. walking) and daily flexibility exercises are recommended as per one's abilities and health goals, which can eventually increase to more vigorous and frequent activities (CDC, 2016).

There is no gold standard to measure PA and/or exercise levels (Naal, Impellizzeri & Leung, 2008). To date, there is a lack of specific activity guidelines or measures associated with arthritis and the various sub-types. From a general perspective, Canadian PA guidelines are in place to highlight the specific type and amounts of activity recommended for Canadians of all ages for health benefits. For older adults aged 65 years and above, 150 minutes of moderate to vigorous-intensity activity per week is recommended (CSEP, 2012). This number can be fluid and subjective in nature conforming

to varying abilities, conditions and needs. Based on a Canadian study by Bryan & Katzmarzyk (2009), assessing total daily energy expenditure from specific leisure-time activities is a method used in surveying self-reported activity levels of Canadians, including older adults. The respondent indicates the number of times they participated in a specific leisure activity and the average duration of each session. The level of leisure-time activity can then be determined in association to the leisure-time physical activity energy expenditure (LTPAEE) values that categorize who is active versus inactive. According to this criteria guideline, adapted from the Canadian Community Health Survey (CCHS) (2014), 43% of older Canadians aged 65+ were classified as moderately active or active during leisure time (Statistics Canada, 2015d). Monitoring activity levels in Canada is important for future public health interventions or surveillance.

Potential activity barriers can arise (e.g. joint pain, low physical function, mental comorbidities) that may hinder one's ability to engage in activity. This largely influences the escalating rates of inactivity among Canadians, especially older adults (ACREU, 2013). According to the Canadian Fitness and Lifestyle Research Institute, 57% of older Canadians aged 65+ were insufficiently active. Inactive lifestyles, smoking and obesity are well-known major modifiable risk factors associated with the development of arthritis and other chronic, non-communicable diseases (NCDs), and is recognized as an important public health issue in Canada (Bryan & Katzmarzyk, 2009).

The increasing inactivity rates highlight the importance of the beneficial effects of activity. Research that seeks to investigate the benefits of activity in older females with arthritis is essential to identify the magnitude of effects on physical and mental health burdens and help mitigate associated health care costs.

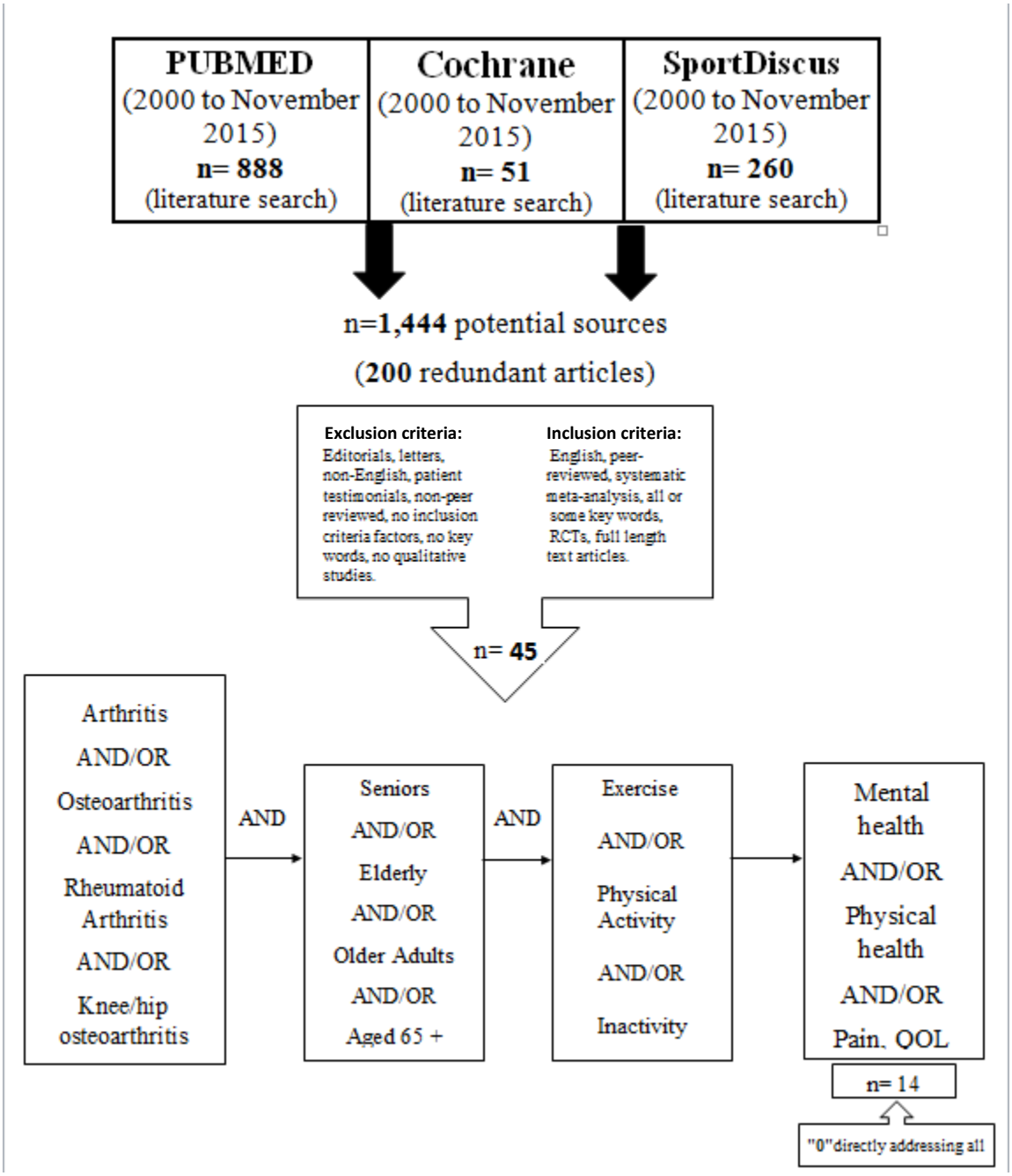
Chapter 2

Literature Review

2.1 Search Strategies

Peer-reviewed articles on physical activity (PA), exercise and arthritis were identified via electronic database searches, which included PubMed, Cochrane Reviews, and SPORTDiscus. Databases were searched from January, 2000 to November, 2015 using the key words, *physical activity*, *exercise*, *arthritis*, *older adults*, *seniors*, *mental health* and *physical health.* Various combinations of these keywords were used to locate potential articles for review. Inclusion criteria for these internet-based searches included: (i) Available abstract and full-length peer-reviewed articles; (ii) published in English, and (iii) studies were limited to human quantitative approaches. Editorials, guidelines, letters, patient testimonials, non-English and non-peer reviewed articles were excluded. Further exclusion criteria included: (i) Children as the target population; (ii) juvenile idiopathic arthritis (JIA) as the focal arthritis being studied; (iii) qualitative studies, and (iv) studies that utilized animal and/or nonhuman research models. Once the primary articles were identified, their reference lists were reviewed to retrieve potential additional secondary sources. The literature search process and results are summarized in Figure 2.1 below.

Figure 2.1 Flowchart of literature search process



In brief, the screening located 1,444 potential sources of which were 200 redundant articles. A total of 45 articles met the inclusion criteria for review. A ranking system of eight levels was used to represent the strength and quality of evidence (see Appendix A for a description of the ranking levels). Level I is the highest ranking consisting of systematic

reviews of randomized controlled trials (RCTs) or meta-analyses (17 articles were ranked I). Level II includes single, blinded RCTs (23 articles were ranked II). Level III includes systematic reviews of correlational or longitudinal studies. Levels IV include longitudinal or correlational studies (one article was ranked IV). Level V consists of systematic reviews of descriptive or qualitative studies. Level VI includes single, descriptive or qualitative studies (one article was ranked VI). Level VII includes cross-sectional surveys (three articles ranked VII). Level VIII, the lowest ranking, consists of expert opinions and patient testimonials (Bartfay & Bartfay, 2016). The rankings are consistent with those employed for systematic reviews by Cochrane Collaboration. The 45 studies are classified according to the interventions and the health outcomes.

2.1.1 Effects of Physical Activity on Mental Health with Arthritis

Individuals with arthritis commonly experience poor mental health. In fact, persons with arthritis are three times more likely to have mental health issues (The Arthritis Society, 2015). These individuals suffer from feelings of guilt, trouble concentrating, loss of interest and fixation on death. Depression, anxiety and mood disorders are also prevalent in people with arthritis. Mental and arthritic comorbidities can also lead to a lower health-related quality of life (HRQOL), which helps indicate the effect of arthritis on one's health (Canadian Institute for Health Information [CIHI], 2011).

Physical activity (PA) was found to be an effective and preventative ailment that improves mental health burdens (Abell, Hootman, Zack, Moriarty & Helmick, 2005; Austin, Qu & Shewchuk, 2012). Table 2.1 shows the two studies associated with PA and mental health benefits. Subjects with arthritis were recruited from the 2007 Behavioural Risk Factor Surveillance System (BRFSS). Data showed that 40% of subjects were

considered active; 38% were insufficiently active, and 22% were inactive according to PA guidelines. Those who were inactive were approximately twice as likely to report decreased HRQOL, compared to their active counterparts. In addition, the inactive persons were 1.12 to 1.14 times more likely to report physical and mental unhealthy days. These studies also found that active individuals with arthritis had less pain and greater physical function and mental health, reciprocating a high HRQOL. Interestingly, older adults and those with lower education levels had the highest prevalence of unhealthy days, both mentally and physically. Taken together, these investigations collectively suggest that PA improves mental health by increasing HRQOL in subjects with arthritis.

Table 2.1 Effects of PA on HRQOL with Arthritis

Author(s), Year and Country	Methodology	Research Findings	Rank
Abell et al., 2005, U.S.A.	Cross-sectional survey, N= 212,000 adults aged 18+ with arthritis, PA categorized as: recommended, insufficient or inactive. Physically and mentally unhealthy days collected in past 30 days (0 days, 1-13 days; moderately impaired HRQOL, 14-30 days; severely impaired HRQOL). Tools: BRFSS, PA questionnaire, SF-36.	- Inactive men and women with arthritis were 1.2-2.4 times more likely to report impaired HRQOL compared to actives. - 40% met US PA recommendations, 38% were found insufficient and 22% were found inactive. - Results also found fewer physically and mentally unhealthy days in actives.	VII
Austin et al., 2012, U.S.A.	Cross-sectional study, N= 33, 71 US adults with arthritis aged 45+. Researchers studied the	- 40% of participants adhered to PA guidelines.	VII

Author(s), Year and Country	Methodology	Research Findings	Rank
	association between adherence to PA guidelines and HRQOL of people with arthritis. Tools: BRFSS, HRQOL questionnaire, demographic data.	- Inactives had 1.14 times more physically unhealthy days and 1.12 times more mentally unhealthy days than active counterparts. - Higher age, female sex, race (non-white), marital status (unmarried) and employment status (unemployed) related to mentally and physically unhealthy days.	

Legend: BRFSS= Behavioral Risk Factor Surveillance System; HRQOL= Health-related quality of life; PA= Physical activity; SF-36= Medical Outcomes Short Form 36.

2.1.2 Effects of Physical Activity on Physical Health with knee OA

PA is also a preventative intervention to maintain and/or improve physical health for people with arthritis, in terms of reducing the likelihood of injury or disability (Canadian Mental Health Association [CMHA], 2015). Indeed, the leading cause of disability in older adults is osteoarthritis (OA), which is characterized as a deteriorating disease that frequently limits mobility and functional capabilities (Chmelo et al., 2013).

Partaking in regular PA and activities of daily living (ADL) is effective for improving overall physical function in older adults with knee OA ($P<0.0001$), when compared to a nonexercise group. Research also suggests that PA helps to decrease joint pain ($P<0.01$), which is a common symptom associated with arthritis (Chmelo et al., 2013). Improved physical performance involving walking and chair stands was also seen to benefit subjects with knee OA in a PA intervention for adults. Physical decline may be

hindered by engaging in PA. Factors including older age; the female sex; a large body mass index (BMI) and high pain levels are related to low PA amounts. Whereas a higher education level and being married are associated with higher PA levels (Dunlop et al., 2010). These studies provide important insight into how PA improves physical health by increased function and range of motion (ROM), decreased pain and higher performance capabilities that benefit persons with knee OA. Table 2.2 outlines the data extracted from the two studies on the effects of PA and physical health outcomes in arthritis clients.

Table 2.2 Effects of PA on Physical Function, Pain and Performance Outcomes with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Chmelo et al., 2013, U.S.A.	Cross-sectional study, N= 160 older adults with knee OA, enrolled in the IDEA study. Subjects were randomized to (1) EX only, (2) diet only or (3) EX and diet. Investigators examined the association between PA and physical function. EX included: walking, stationary bicycles and strength training. Tools: Demographic, BMI, WOMAC, the Kenx Lifecorder EX accelerometer, a 6MWT.	- PA was correlated with improved physical function. - Specifically, moderate-intensity activity interventions improved function and reduced pain in older OA subjects. - No correlations were observed between BMI and pain or PA levels. - Less PA time was correlated to older age.	VII
Dunlop et al., 2010, U.S.A.	Prospective cohort study, N= 2,274 adults with knee OA aged 45-79 years. Participants were selected from the OA Initiative	- Two-in-five people with knee OA improved or maintained high performance at one-year	IV

Author(s), year and country	Methodology	Research Findings	Rank
	public data. Investigators studied the association between PA and one-year functional performance in adults with knee OA. Tools: Timed 20-m walk and chair stand test, PASE, demographic information, Kellfren-Lawrence grade, the WOMAC, BMI and Charlson Index score.	follow-up. - One-in-four people showed improved function. - PA was also associated with good walk rate and chair stand outcomes. - Higher PA levels were related to good outcomes and were found to preserve function in people with knee OA.	

Legend: 6MWT= 6-Minute Walk Test; BMI= Body mass index; EX= Exercise; IDEA= Intensive Diet and Exercise for Arthritis; OA= Osteoarthritis; PA= Physical Activity; PASE= Physical Activity Scale for the Elderly; WOMAC= Western Ontario McMaster Universities Osteoarthritis index.

2.1.3 Effects of Aerobic Exercise on Physical and Mental Health with Arthritis

Aerobic exercise (AE) is defined as any form of physical exercise of low to high intensity involving oxygen consumption and increased cardiovascular endurance. Examples of AE include walking; running; swimming, and cycling. AE is beneficial for improving physical fitness and overall health (de Vos et al., 2005). It is also the most cost-effective intervention for managing arthritic symptoms. Pain, disability, physical function and mobility are the most prevalent physical symptoms associated with arthritis. Quality of life (QOL) may also be compromised in clients with arthritis. Bosomworth (2009) noted that disease management is improved and easier to tolerate with today's advances. The ability to manage arthritis severity can improve QOL and improve lifespan. By targeting these factors, health promotion strategies such as AE may improve health outcomes and enable people to better manage their arthritis.

Evidence shows that light-to-moderate forms of AE (e.g. running, walking, jogging, tennis) decreases pain (Bosomworth, 2009; Cooney et al., 2011, & Scarvell & Elkins, 2011) and increases physical function in clients with knee OA and RA (Bosomworth, 2009 & Cooney et al., 2011). Cooney and colleagues (2011) also reported improvements in terms of cardiorespiratory fitness and health; muscle strength, and mobility. In addition, AE interventions were shown to improve QOL measures ($P<0.05$) in persons aged 44 to 68 years of age with RA (Scarvell & Elkins, 2011). Nonetheless, AE may be potentially underused or under prescribed as a treatment option for persons with RA or OA. For example, Scarvell & Elkins (2011) and Bosomworth (2009) argue that given the vulnerability and health burdens associated with arthritis, AE is not linked to the progression of arthritis or worsening effects in disease activity ($P>0.05$). Persons with arthritis are therefore encouraged to participate in AE to reduce associated physical and mental health burdens (shown in Table 2.3 below).

Table 2.3 Effects of AE on Pain, Physical Function and QOL with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Bosomworth, 2009, Canada	Systematic review of literature, 25 studies, N= 37,422 adults with knee OA. The objective was to determine if exercise constitutes a benefit or risk in knee OA. Key words included: OA, arthritis and knee and exercise, physical training and run. Included trials ranged from RCTs, systematic reviews,	- Moderate exercise was found to reduce knee pain and disability during interventions for knee OA. - Exercise is underused as a treatment option. - Exercise does not lead to acceleration of knee OA.	I

Author(s), year and country	Methodology	Research Findings	Rank
	comparison trials, case-controls or expert opinions. Databases to January 2009.		
Cooney et al., 2011, UK	Systematic review of literature, approximately 30 studies (RCTs and published guidelines). Recruited adults with RA. Investigators highlighted the importance of exercise in people with RA and demonstrated the benefits on health.	- Exercise was reported to benefit people with RA in improved cardiorespiratory fitness and health, increased muscle mass, improved strength and physical function. - LI exercise was found to be more effective than HI. - Improvements found in joint mobility, pain, morning stiffness and fatigue.	I
Scarvell & Elkins, 2011, UK	Systematic review of literature, 14 RCTs, N= 1,040 subjects with RA aged 44-68 years. Investigators studied the effects of AE on pain, disease activity, functional ability and QOL. Studies included an AE intervention versus a CG with no exercise/a non-AE therapy (stretching, ROM or aquatic therapies). Disease duration average was one-16 years. Key search words included: RA, exercise therapy, ADLs and	- AE was found to significantly reduce pain; improve QOL, and disability when compared to CG. - No significant differences were found between the groups for joint and muscle soreness or disease activity.	I

Author(s), year and country	Methodology	Research Findings	Rank
	physical education and training. Searched databases included: PubMed, Cochrane and EMBASE. Tools: DAS-28 and the HAQ.		

Legend: ADL= Activities of daily living; AE= Aerobic exercise; CG= Control group; DAS-28= Disease Activity Score 28; HAQ= Health Assessment Questionnaire; HI= High-intensity; LI= Low-intensity; OA= Osteoarthritis; QOL= Quality of life; RA= Rheumatoid arthritis; RCT= Randomized control trial; ROM= Range of motion.

2.1.4 Effects of Aerobic and Strength Exercise on Physical and Mental Health with Arthritis

The benefits of exercise for a variety of disorders and conditions have been well documented globally. Given the success of AE programmes, researchers grouped AE with strengthening exercises (SE) to investigate the combined health-related effects for clients with arthritis. The noted AE and SE interventions can be achieved via a variety of means (e.g. strength, stretching, resistance, endurance, leisure, sports, bicycle training), and by using various devices (e.g. leg presses, free weights). The SE interventions target multiple body areas (e.g. upper and lower extremities).

Evidence shows major improvements in health outcomes, especially for those with OA (Hernandez-Molina, Reichenbach, Zhang, Lavalley & Felson, 2008). For example, physical function increased in persons with hip OA (P=0.03) (Carlson et al., 2011). Pain levels were also reduced by a variety of AE and SE programmes (Carlson et al., 2011; Hernandez-Molina et al., 2008; Jansen, Viechtbauer, Lenssen, Hendricks & de Bie, 2011; Pelland et al., 2004; Penninx et al., 2002; Roddy, Zhang & Doherty, 2005, & van Baar et

al., 2001). Interestingly, overall self-rated health status improved after the AE and SE interventions (Breedland, van Scheppingen, Leijsma, Verheij-Jansen & van Weert, 2011). In the study by Roddy and coworkers (2005), self-reported disability scores decreased. Disability is a frequent comorbidity with arthritis, and a common outcome for these clients (World Health Organization [WHO], 2015a). Penninx et al., (2002), for example, reported that walking speeds improved and depression symptomologies decreased. It is notable that the Canadian Psychological Association (2015) found that 20% of persons with RA are depressed. Recommended levels of exercise are shown to reduce depression prevalence in people with arthritis. Not surprisingly, researchers found this mental health comorbidity to be correlated with greater amounts of OA-related disability and pain (Penninx et al., 2002).

Researchers note that adherence to AE and SE regimens are vital to maintain these noted outcomes. By contrast, some studies reported no observed positive effects for disability (van Baar et al., 2001) or stiffness of joint(s) (Carlson et al., 2011; Fernandes, Storheim, Sandvik, Nordsletten & Risberg, 2010). In addition, AE and SE programmes failed to yield improvements in muscle strength; self-efficacy; pain (Breedland et al., 2011), and health-related quality of life (HRQOL) (Fernandes et al., 2010). However, participation in AE and SE programmes generally appears to be beneficial for the mental and physical health of those with hip and/or knee OA. These significant results are shown in Table 2.4, outlining the potential benefits of AE and SE on health outcomes.

Table 2.4 Effects of AE and SE on Function, Pain, Overall Health Status, Disability and Depression with Arthritis

Author(s), year and country	Methodology	Research findings	Rank
Breedland et al., 2011, Netherlands	RCT, N= 34 people diagnosed with RA, randomized into (1) an IG consisted of an 8-week physical exercise programme (bicycle training, muscle exercise circuit and sports) (n=19), or (2) a waiting list CG. Investigator studied the effects of a group-based AE and educational group. Tools: Cycle ergometer, Microfet dynamometer, the Dutch version of the AIMS and the ASES.	- Significant improvements in self-reported health status (P=0.07) and aerobic capacity for the IG. - No significant changes were seen in muscle strength, self-efficacy, pain and disease activity between the IG and CG.	II
Carlson et al., 2011, U.S.A.	Pilot study, N= 30 patients with hip OA aged 21+ years from the Oregon Health and Science University Orthopaedics Rehabilitation and Rheumatology clinics. Patients were randomly allocated to: (1) an active aerobic and resistance training group, or (2) a CG. The IG was comprised of a 3-month exercise intervention (hip-specific strengthening,	- Best improvement scores in 6MWT, function and the VAS scores in the IG. - No significant differences were seen in WOMAC pain and stiffness aspects. - Both groups found decreases in pain.	VI

Author(s), year and country	Methodology	Research findings	Rank
	flexibility and endurance exercise). Researchers compared the effects of AE on pain and disability in people with hip OA. Tools: 6MWT, WOMAC and VAS.		
Fernandes et al., 2010, Norway	RCT, N= 109 people with hip OA with mild to moderate symptoms. Subjects were randomized into either (1) a PE group or (2) PE+SE. Researchers compared the efficacy of patient education and supervised AE with patient education alone in hip OA symptoms. Tools: WOMAC, SF-36 and the PASE.	- No significant improvements in pain, stiffness, HRQOL and/or function outcomes in any groups.	II
Hernandez-Molina et al., 2008, U.S.A.	Meta-analysis, 9 trials, N= 1,234 subjects with hip OA. Searched databases included EMBase, PEDro, Medline and Cochrane. The included studies randomized subjects into (1) an AE or SE, or (2) a non-exercise CG. Reviewers investigated the efficacy of AE on hip OA. Tools: VAS, WOMAC and the HHS.	- A lack of information to support the benefit of performing exercise in relieving hip OA pain (only one RCT resulted in a positive result). - Three-out-of-nine studies reported minor adverse events related to exercise such as mild joint discomfort, lumbar pain and cramps.	I

Author(s), year and country	Methodology	Research findings	Rank
Jansen et al., 2011, Netherlands	Systematic review of literature, 12 RCTs on people with knee OA. Two reviewers assessed the quality of the studies. The reviewers assessed the effects of strength training, exercise therapy (SE with AE) and exercise with passive manual mobilisation. Tools: VAS and therapy (SE with AE) and exercise with passive manual mobilisation. Tools: VAS and WOMAC.	- Exercise with manual mobilisations improved pain more significantly than AE and SE alone (p=0.03). - No other statistically significant differences were found in function on pain levels in other intervention groups. - A positive significant correlation between the effects of pain and function (r=0.78, p=0.003).	I
Pelland et al., 2004, Canada	Meta-analysis, 21 RCTs, case-control and cohort studies; N= 2,325 patients with OA. Trials were identified with the use of Medline, EMBASE and the Cochrane Controlled Trials Register. Acceptable IG included any form of SE. Acceptable CGs included placebo, untreated or active interventions. Tools: Exercise programmes were analyzed by the following specifications: Supervised or unsupervised, setting, type of participation, nature of exercises, inclusion of	- Sufficient evidence to include SE in the rehabilitation programme for patients with OA. - Improvements were found for pain, strength, function and QOL. - SE provided clinical benefits for pain management (80% improvements seen in subjects at night, at rest and stair climbing). - SE were also seen to increase strength, especially in the affected joints (39%).	I

Author(s), year and country	Methodology	Research findings	Rank
	AE, duration, intensity and frequency, and type of equipment.	- Indirect effect between well-being and QOL on pain. - All SE IGs relayed greater results and benefits, in comparison to their CGs.	
Penninx et al., 2002, U.S.A.	RCT, N= 439 older adults aged 60+ with knee OA. Mean age was 68.8 years. Investigators studied the effects of AE and RE on emotional and physical function in older adults with knee OA. Subjects taken from the FAST. Randomized into (1) RE (upper and lower body exercises with weights), (2) AE (walking programme), or (3) health education CG. Tools: CESD-R, 6MWT, 23-item disability questionnaire and demographic information.	- At baseline, participants with high depressive symptoms were reported to have more physical disability, slower walking speed and more pain than those with lower depression. - Among 98 participants, a reduction in depressive symptoms was seen in the AE group ($P<0.001$). - No changes in depressive symptoms in the RE and CGs. - Both IGs (AE and RE) showed significant reductions in disability and pain, increases in walking speed (AE only) in those with high depressive symptomatology.	II
Roddy et al., 2005, UK	Systematic review of literature, 13 RCTs. Inclusion criteria included: OA of knee, aerobic and/or home based quadriceps SE. Two reviewers assessed	- Aerobic walking and home based quadriceps SE are effective at reducing pain and disability in subjects with knee OA.	I

Author(s), year and country	Methodology	Research findings	Rank
	the methodological quality and inclusion criteria. Tools: WOMAC, BMI and self-reported disability.		
van Baar et al., 2001, Netherlands	RCT, N= 201 people with knee or hip OA. Subjects were grouped into (1) an EG (muscle function, mobility, coordination and locomotion abilities), patient education and drug treatment for 12 weeks, or (2) a CG (restricted to the usual treatment given by their GP). Tools: VAS, observed disability (5 metre walking time, stand to sit time and stand to recline time), prescription data, IRGL, dynamometer, goniometer, Zutphen PA Questionnaire.	- At 24 weeks, a beneficial effect was seen in pain for the EG. - No effects were seen for disability, muscle strength and ROM for those in the EG and CG. - A slow decline of the beneficial effects of exercise treatment, indicating that measures must be taken to maintain the positive effects of exercise.	II

Legend: 6MWT= 6-Minute Walk Test; AE= Aerobic exercise; AIMS= Arthritis Impact Measurement Scale; ASES= Arthritis Self-Efficacy Scale; CESD-R= Center for Epidemiologic Studies-Depression Scale; CG= Control group; EG= Exercise group; FAST= Fitness and Arthritis in Seniors Trial; GP= General practitioner; HHS= Harris Hip Score; IG= Intervention group; IRGL= Influence of Rheumatic disease on General health and Lifestyle; OA= Osteoarthritis; PA= Physical activity; PASE= Physical Activity Scale for Elderly; PE= Patient education; PE+SE= Patient education and supervised exercise; RA= Rheumatoid arthritis; RCT= Randomized control trial; RE= Resistance exercise; ROM= Range of motion; SE= Strengthening exercise; SF-36= Medical Outcomes Short Form 36; VAS= Visual Analog Scale; WOMAC= Western Ontario McMaster Universities Osteoarthritis index.

2.1.5 Effects of Strengthening Exercise on Physical and Mental Health with Arthritis

Muscle weakness is common among persons with hip and/or knee OA. It is a major risk factor for disability, functional limitation, limited range of motion (ROM) and/or joint pain. Older adults are especially at risk. Strengthening exercises (SE) are therefore recommended as treatment options for older adults (Baker et al., 2001). **SE** is defined as exercise enhancing the power and strength of small or large muscles and bones and can include resistance; stretching; strength, and endurance components. Machines and/or tools such as a leg press, universal gym or an elastic band can be employed (de Vos et al., 2005). The available evidence demonstrates its efficacy on various health outcomes in adults aged 48 and older with hip or knee OA. The implementation of SE primarily decreased knee pain in adults with OA in the short-term evaluations only (Baker et al., 2001; Evcik & Sonel, 2002; Jan, Lin, Liau, Lin & Lin, 2008, & Tak, Staats, Van Hespen & Hopman-Dock, 2005). The long-term benefits of SE for decreasing pain in clients with OA remains to be elucidated. However, Juhakoski and coworkers (2011) did report long-term reductions for clients with OA. In general, short-term increases in physical function were typically observed with SE in clients with OA (Evcik & Sonel, 2002 & Jan et al., 2008). However, hip OA clients did not have an increased functional status, ROM (Juhakoski et al., 2011 & Tak et al., 2005), or increased QOL outcomes (Tak et al., 2005). Conversely, subjects with knee OA did report improved QOL outcomes after SE programmes (Evcik & Sonel, 2002). These findings suggest that SE programmes benefit individuals with knee OA mostly. Table 2.5 shows the studies associated with SE and the potential physical and mental health benefits.

Table 2.5 Effects of SE on Pain, Physical Function and QOL with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Baker et al., 2001, U.S.A.	RCT, N= 46 adults aged 55+ with knee pain and knee OA. Subjects were randomized into either (1) a four-month home-based progressive strength training program, or (2) a nutrition education program (the CG). Tools: WOMAC, exercise instruction booklet, 20 lb ankle weights, demographic questionnaire, the Kellgren/ Lawrence grading system, VAS, clinical knee exams, chair stand time and stair climb tests, SF-36 and ESSE.	- 71% improvement in knee strength in the training program, in comparison to only 3% in the CG (P<0.01). - 36% saw improvements in self-reported pain in the training program compared to only 11% in the CG (P=0.01). - 38% of participants saw improvements in self-reported physical function, in comparison to only 21% in the CG (P=0.01).	II
Evcik & Sonel, 2002, Turkey	RCT, N= 90 patients with knee OA, aged ranged between 48 to 71 years, 56 were female and 34 were male. Participants were randomized into (1) home-based exercise, 3 times weekly (n= 30), (2) regular walking program (n= 30) or (3) CG (n=30). All groups continued program for three months. Investigators studied the effects of home-based exercise and walking programs in the treatment of OA.	- Pain and function outcomes were lower for groups 1 and 2, in comparison to the CG (P< 0.01). - The difference between groups 1 and 2 was not statistically significant (P> 0.05). - Improvements in QOL for the walking group, in comparison to the home-	II

Author(s), year and country	Methodology	Research Findings	Rank
	Tools: WOMAC, VAS and NHP.	based exercise and CG (P< 0.01). - No significant differences were found in age, gender, disease duration or social isolation outcomes between groups.	
Jan et al., 2008, Taiwan	RCT, N= 102 older adults with knee OA. Subjects randomized into (1) a HR exercise group of 8 weeks (n= 34), (2) a LR exercise group of 8 weeks (n= 34), or (3) no exercise CG (n= 30). Investigators compared the effects of high-and low-resistance strength training in elderly subjects with OA. Tools: WOMAC, the Cybex 6000 dynamometer model and walking time.	- No difference between the groups at baseline. - No changes were seen in walking time, pain and muscle torque (knee extensors and flexor abilities) for the CG. - Both the HR and LR showed improvements in WOMAC and walking time scores (P<0.008) and muscle torque, compared to the CG. -The HR group had slightly greater improvements.	II
Juhakoski et al., 2011, Finland	RCT, N= 120 older adults aged 55 to 80 years old with hip OA. Subjects were randomized into (1) a combined exercise and GP care group (12 sessions), or (2) a CG of standard GP care. Researchers	- No statistically significant differences in hip pain, physical functioning, performance or BMI between the groups (in intervention).	II

Author(s), year and country	Methodology	Research Findings	Rank
	evaluated the short- and long-term effects of exercise on pain and function in hip OA. Tools: WOMAC, Finnish SF-36, 10-metre walk test and a TUG test.		
Tak et al., 2005, Netherlands	RCT, N= 109 older adults aged 55+ with hip OA. They were recruited based on their clinical diagnoses and approval of the American College of Rheumatology criteria. Subjects were randomized into (1) an EG with exercise (n=55), or (2) a CG (n=54). Researchers evaluated an 8-week exercise program with strength training and lifestyle advice for older adults with OA. Tools: HHS, VAS, TUG, walking test, stair climbing, toe reaching, SIP and GARS.	- No statistically significant differences were noted between groups at baseline. - A decrease noted in pain ($P<0.05$) and improvement in disability status in the EG, compared to the CG. - No significant effects in hip function, walking speed or QOL for both groups.	II

Legend: BMI= Body mass index; CG= Control group; EG= Exercise group; ESSE= Ewart's Scale of Self-efficacy; GARS= Groningen Activity Restriction Scale; GP= General practitioner; HHS= Harris Hip Scale; HR= High resistance; LR= Low resistance; NHP= Nottingham Health Profile; OA= Osteoarthritis; QOL= Quality of life; RCT= Randomized control trial; SF-36= Medical Outcomes Short Form 36; SIP= Sickness Impact Profile; TUG= Timed Up and Go test; VAS= Visual Analog Scale; WOMAC= Western Ontario McMaster Universities Osteoarthritis index.

2.1.6 Effects of Aquatic Exercise on Physical and Mental Health with Arthritis

Aquatic exercises are defined as low-impact water-based activities that are typically less strenuous on muscles and bones and are therefore ideal for individuals

suffering from arthritis. They typically encompass aerobic forms of exercise and include strength; flexibility; endurance, and warm-up targeted exercises in water-based environments (e.g. swimming pools). Many positive benefits have been associated with aquatic exercises in clients with arthritis, especially OA. Table 2.6 outlines the various health benefits in arthritis associated with aquatic exercise interventions. Aquatic exercises have relatively short-term health and wellness effects. However, researchers argue that aquatic exercise must be sustained to maintain these benefits (Cochrane, Davey & Edwards, 2005; Hale, Waters & Herbison, 2012). For example, aquatic and community water-based exercises were shown to result in reductions in pain (Cochrane et al., 2005 & Waller et al., 2014) and stiffness (Waller et al., 2014) in older adults with hip and/or knee OA. In a study conducted by Davey and Cochrane (2004), improvements in mobility and flexibility were also reported. From a mental health perspective, Waller et al., (2014) and Cadmus et al., (2010) found that aquatic exercises increased QOL for persons with OA. According to Cadmus and colleagues (2010), improvements in QOL were only seen in obese people; hence BMI was associated with QOL scores. By contrast, studies conducted by Davey & Cochrane (2004) and Hale et al., (2012) found no differences in pain; physical function; stiffness; balance, or social and emotional well-being.

Aquatic exercises have been beneficial for those with OA. Evidence suggests that aquatic programmes may be more effective for clients with OA, as opposed to affected hips. For example, a study by Bartels and colleagues (2009) examined the benefits of aquatic exercise in relation to hip and/or knee OA. Although aquatic interventions had no significant influences on hip OA walking ability; stiffness; pain; physical function, and QOL ($P>0.05$); clients with knee OA saw significant decreases in pain ($P<0.05$). However,

there were no noted improvements reported in regards to walking ability and stiffness. When looking at knee and hip OA, researchers found small-to-moderate effects in physical function and QOL, with a 6.6% decrease in pain levels. Taken together, these studies suggest that aquatic exercises may be more beneficial in improving QOL and physical function for persons with knee OA.

Table 2.6 Effects of Aquatic Exercise on Pain, Stiffness, Mobility, Flexibility, QOL, Balance and Social Well-being with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Bartels et al., 2009, Denmark	Review of literature, 6 RCTs, N= 800 adults with knee and/or hip OA. Investigators studied the effectiveness of aquatic EX in treatment of hip and knee OA. Two review authors screened articles for relevance. Tools: WOMAC, VAS, HAQ, AIMS, SF-36, DRI, ASEQ, FAP, SPF, AAP, PQOL, QWB and 6MWT.	- A small-to-moderate effect on function was found. - A small-to-moderate effect on QOL and a minor effect of 6.6% decrease in pain was found. - For aquatic EX on hip OA results showed no effects on walking ability, stiffness, pain, function or QOL. - In aquatic EX on knee OA, authors saw a large effect on pain, with no effect on walking or stiffness. - Aquatic EX are more beneficial for knee OA in comparison to hip OA.	I

Author(s), year and country	Methodology	Research Findings	Rank
Cadmus et al., 2010, U.S.A.	RCT, N= 249 adults aged 55 to 75 years with hip and/or knee OA. Subjects grouped into (1) an IG of two aquatic EX sessions per week for 20 weeks (termed a community-based aquatic EX intervention) (n=125), or (2) a CG where subjects told to maintain usual activity levels (termed the control on PQOL) (n=124). Researchers investigated the effectiveness of a community based aquatic EX program to improve QOL in OA clients. Tools: Demographic data, BMI, weekly postcard diaries, PQOL scale, ASES, VAS, HAQ, DISINDX and CES-D.	- Aquatic EX had a positive impact on PQOL scores (P< 0.01). - No effects were seen in depression, activity limitation or self-efficacy scores. - Moderated with BMI, where benefits were seen in obese subjects, in comparison to normal or overweight subjects. - Aquatic EX is effective in improving PQOL among adults with OA.	II
Cochrane et al., 2005, UK	Pre-experiment matched control study, N= 312 subjects aged 60+ with confirmed hip and/or knee OA; 196 were women and 116 were men. Subjects were randomized via computer-generate random number sequence into either (1) treatment group with aquatic EX, or (2) CG receiving usual care for hip	- Short-term efficacy of aquatic EX in the management of lower limb OA. - The treatment group saw an improvement in function scores and a reduction in pain. - Aquatic EX can be a useful adjunct in the management of	II

Author(s), year and country	Methodology	Research Findings	Rank
	and/or knee OA. Researchers studied the efficacy of community aquatic based therapy for OA. Tools: WOMAC, SF-36, EuroQol VAS, 8-foot walk, stair climb and quadriceps strength.	OA. - EX needs to be sustained to maintain the benefits.	
Davey & Cochrane, 2004, UK	RCT, N= 106 sedentary older adults aged 60+ with knee or hip OA. Subjects were randomized into (1) an IG with an aquatic exercise regimen twice a week for one hour (n=66), or (2) a nonexercising CG (n=40). Subjects were also age-matched. Researchers examined the effects of a 12-month community-based aquatic EX in older adults with knee or hip OA. The study was conducted at a public swimming pool in Sheffield, UK. Tools: WOMAC, AIMS2, timed 8-foot walk, ascending/descending stairs, chair rise, knee/hip flexion and lower limb strength.	- No statistically significant differences between the two groups at baseline in any outcome measure. - CG had a slightly higher test completion rate than the IG. - The IG reported improvements in performance ($P<0.05$). - Small-to-moderate improvements in mobility and flexibility, and better outcomes in physical function, in comparison to the CG. - No significant differences in WOMAC pain and function measures in both groups.	II
Hale et al., 2012, New Zealand	RCT, N=39 older adults aged 65+ with OA; 26 were women and 13 were men. Subjects were randomized into either (1) an IG of aquatic EX, twice weekly for	- After 12 weeks, no statistically significant differences in fall outcomes; balance; physical function; stiffness; pain; social and	II

Author(s), year and country	Methodology	Research Findings	Rank
	12 weeks (n=23), or (2) a CG, a time-matched computer training program (n=16). Tools: PPA, step test, TUG, WOMAC, AIMS2 and ABC Scale.	emotional well-being; fear of falling, and physical well-being in both the aquatic IG and computer program CG.	
Waller et al., 2014, Finland	Systematic review of literature and meta-analysis, 11 RCTs with an aquatic exercise group and a non-treatment CG. Reviewers examined the effects of TAE on symptoms associated with lower limb OA. Databases including Medline; PubMed; EMBASE; CINAHL; PEDro and SPORTDiscus were used. Search key words were hydrotherapy, water EX, aquatic EX, aquatic therapy and OA. Tools: SF-12, SF-36, self-reported pain and stiffness scores, TUG and angular velocities.	- After the intervention, TAE had small but significant effects on pain; stiffness; physical function, and QOL. - No effects on muscle strength for TAE groups and CGs.	I

Legend: 6MWT= 6-minute walk test; AAP= Adelaide Activities' Profile; ABC= Activity-specific Balance Confidence scale; AIMS= Arthritis Impact Measurement Scale; ASEQ= Arthritis Self-Efficacy Questionnaire; ASES= Arthritis Self-Efficacy Scale; BMI= Body mass index; CES-D= Center for Epidemiological Studies Depression; CG= Control group; DISINDX= Disability Index; DRI= Disability Rating Index; EX= Exercise; FAP= Functional Ambulation Performance; HAQ= Health Assessment Questionnaire; IG= Intervention group; OA= Osteoarthritis; PPA= Physiological Profile Assessment; PQOL= Perceived Quality of Life; QOL= Quality of life; QWB= Quality of Well-being Scale; RCT= Randomized Control Trial; SF-36= Medical Outcomes Short Form 36; SPF= Summary Physical Function; TAE= Therapeutic Aquatic Exercise; TUG= Timed Up and Go test; UK= United Kingdom; VAS= Visual Analog Scale; WOMAC= Western Ontario McMaster Universities Osteoarthritis index.

2.1.7 Effects of Physical Therapy on Physical and Mental Health with Arthritis

Physical therapy (PT) exercise is becoming increasingly used as a treatment option for those with arthritis, alongside pharmacological management (e.g. acetaminophen, cortisone injections). PT includes both passive and active forms of exercise, which seeks to promote range of motion (ROM) and improve strength; endurance; balance; coordination; posture, and motor function in clients with OA. Exercise types include fitness walking; AE; strength training; muscle stretching; joint-specific exercise programmes, and active and passive ROM exercises. This non-invasive therapy was found to increase walking distance and physical function by 10% to 13.1% and decrease pain and stiffness by 10% and 55.8% ($P<0.01$) in the randomized controlled trials (RCT) by Deyle et al., (2000 and 2005). Petrella (2000) also reported improvements in walking levels and reductions in pain and disability. A study by Fransen, Crosbie & Edmonds (2001) found increases in physical function, muscle strength, HRQOL ($P<0.01$) and decreases in pain ($P<0.01$). Hurkmans and colleagues (2009) reviewed land-based exercise therapy and noted positive effects in aerobic capacity ($P<0.001$); muscle strength ($P<0.05$); disease activity progression ($P<0.05$), but no significant differences were found in physical function or pain reductions ($P>0.05$). Conversely, in the aquatic therapy exercises, increases in physical function and aerobic capacity were found (Hurkmans et al., 2009). Pisters and coworkers (2007) found no significant effects on pain and physical function with PT interventions ($P>0.05$). All of the noted health improvements were short-term in nature. Hence, little is known about the long-term benefits, if any, regarding PT in clients with OA or RA. Table 2.7 describes the studies associated with PT interventions with arthritis.

Table 2.7 Effects of PT on Pain, Physical Function, Stiffness, Walking Distance, Disability, Muscle Strength and HRQOL with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Deyle et al., 2000, U.S.A.	RCT, N= 83 patients with OA of the knee. Patients randomly assigned using blank folders numbered 1-100 to either (1) an EG with manual therapy and a standardized knee EX program (ROM EX, stationary bike, stretching) (n=42), or (2) a placebo CG of an ultrasound of the knee (n=41). Tools: WOMAC, 6MWT and a demographic questionnaire.	- At four and eight weeks, improvements in walking distance (13.1%); WOMAC pain; function, and stiffness measures (55.8%) for the treatment group, in comparison to the placebo group. - 20% of patients in the placebo group and 5% of patients in the treatment group underwent knee arthroplasty. - A combination of manual PT and EX yields functional benefits and delays the need for surgical intervention.	II
Deyle et al., 2005, U.S.A.	RCT, N=134 men and women with knee OA. Participants randomized into (1) a clinic treatment group (n=66) (8 sessions with physician of manual therapy; individualized muscle stretching; physiological movements; soft tissue	- 10% improvements in pain; stiffness; function, and walking distance measures in both groups. - At the one-year follow-up, improvements were still significantly reported. - Compared to baseline, WOMAC scores were 32%	II

Author(s), year and country	Methodology	Research Findings	Rank
	mobilization; standardized knee EX programmes; ROM EX; muscle strengthening; muscle stretching, and riding a stationary bicycle), or (2) a home EX group (n=68) (same EXs are the clinical treatment group, yet only received verbal instructions). Researchers compared outcomes between a home-based PT program and a clinical-based PT program. Tools: Descriptive questionnaire, WOMAC, 6MWT and a clinical examination involving active and passive ROM assessment and muscle training.	better for the clinical group and 28% better for the home-based group. - No meaningful influences of potential confounding variables on outcome scores.	
Fransen et al., 2001, Australia	RCT, N=126 patients with knee OA; 73% were women. Subjects were randomized into one-of-three groups; (1) individual treatment (n=43); (2) small group format program (n=40), or (3) waiting list CG (n=43). *after eight weeks, subjects in the CG were again randomized into one-of-the-two active treatment groups. Authors	- PT group reported significant decreases in pain, physical function and improvements in HRQOL at week eight. - Subjects in the CG reported not differences. - Both forms of PT found significantly increased muscle strength levels.	II

Author(s), year and country	Methodology	Research Findings	Rank
	studied the effectiveness of PT in people with knee OA in terms of pain, function and HRQOL outcomes. Tools: WOMAC, SF-36, VAS, muscle strength and demographic data.	- No differences were reported between both PTs.	
Hurkmans et al., 2009, Netherlands	Cochrane review of literature; N= 8 RCTs (six with land-based EX and two trials water-based); n= 575 participants with RA. Two review authors selected eligible studies, rated the methodological quality and extracted data. The literature search was conducted to December 2008. Tools: MACTAR, HAQ, AIMS, VAS, maximal or submaximal ergometer test, isokinetic dynamometer, CRP count and DAS.	- Four-out-of-eight trials met most methodological criteria. <u>Land-based EX therapy (AE and muscle strength training)</u> - One-out-of-six trials found a significant positive effect on aerobic capacity ($P<0.001$) and muscle strength ($P<0.05$). - No trials reported effects of the EX intervention on pain or function. - Land-based EX is the recommended form of EX for RA routine practice. <u>Water + land-based activity therapy (AE capacity)</u> - Two-out-of-two trials found improvements in function and aerobic capacity ($P<0.05$). - No effects were reported on muscle strength or pain.	I

Author(s), year and country	Methodology	Research Findings	Rank
Petrella, 2000, Canada	Systematic review of literature, N=23 RCTs. Investigators reviewed the effectiveness of EX treatment in knee OA. A computerized literature search of Medline was carried out between June 1966 to January 2000. MeSH headings and textwords were used including OA, arthritis, knee, EX or PT. Inclusion criteria included knee OA only, randomization, at least one treatment had to be EX based and collected were pain, disability and walking.	-No dose-response relationship between aerobic or resistance EX and OA. - 17-out-of-23 studies concluded that EX is effective in clients with OA of the knee (short-term). - Effects were also found on pain, self-reported disability and walking levels (short-term). - 5-out-of-23 trials had sufficient power. - Minimal information is available on long-term effects of EX treatment in OA. - Results from some trials were inconclusive (e.g. comparing the effects of different EX regimens). - Major threats to the validity of clinical trials of EX treatments.	I
Pisters et al., 2007, U.S.A.	Systematic review of literature; N=11 RCTs. Researchers investigated the long-term effects of PT on pain and function in people with knee	- All studies reported nonsignificant effects of EX on pain and self-reported physical function in people with knee and/or hip OA	I

Author(s), year and country	Methodology	Research Findings	Rank
	and/or hip OA. Two reviewers conducted literature searches in databases including: PEDro, PubMed, EMBase, CINAHL, SciSearch and Cochrane. Reviewers analyzed methodologies and all trials included PT as an intervention. Outcomes: Pain, self-reported physical function.	(long-term). - The positive post treatment effects on pain and function declined overtime and finally disappeared.	

Legend: 6MWT= 6-minute walk test; AIMS= Arthritis Impact Measurement Scale; CG= Control group; CRP= C-reactive protein; DAS= Disease Activity Score; EG= Experiment group; EX= Exercise; HAQ= Health Assessment Questionnaire; HRQOL= Health-related Quality of Life; MACTAR= McMaster Toronto Arthritis Patient Preference Interview; OA= Osteoarthritis; PT= Physical Therapy; RA= Rheumatoid arthritis; RCT= Randomized Control Trial; ROM= Range of Motion; SF-36= Medical Outcomes Short Form-36; VAS= Visual Analog Scale; WOMAC= Western Ontario McMaster Universities Osteoarthritis Index.

2.1.8 Effects of Mixed Land-based Exercises on Physical and Mental Health with Arthritis

Land-based exercise programmes consist of a variety of exercises which include inter alia muscle strengthening; functional training; aerobic and endurance fitness (e.g. walking, cycling), and balance training. A systematic review by Fransen and colleagues (2014) examined the effectiveness of land-based exercise on physical and mental health outcomes in adults with hip OA. The researchers found significant decreases in pain levels and increases in QOL ($P<0.05$), but physical function was not affected ($P>0.05$). A systematic review by Fransen et al., (2015) examined the same symptomologies and exercise interventions in adults with targeted knee OA. It was found that those who participated in land-based exercises reported high-quality decreases in pain and increases

in physical function. QOL was also positively affected. Hence, land-based exercises appear to be more effective in clients with knee OA for improving physical and mental arthritis-related symptoms. Callahan and colleagues (2008) examined the "People with Arthritis Can Exercise" (PACE) programme effects on health. The intervention included active ROM; strengthening; balance; endurance, and weight-bearing (WB) exercises appropriate for one's functional abilities. Interestingly, pain and fatigue decreased in persons with arthritis, and self-efficacy increased significantly ($P<0.05$). A study by de Jong and coworkers (2003) implemented the "Rheumatoid Arthritis Patient in Training" (RAPIT) regimen. The intervention lasted two years and consisted of high-intensity bicycle load; endurance; strengthening exercises; sports, and mobility exercises. The authors found increases in physical function, emotional status and muscle strength outcomes. It is notable that the RAPIT programme was long-term in nature and the authors reported that it is vital to continue exercising in order to maintain the noted health benefits. Table 2.8 summarizes the effects of mixed land-based EXs on various health outcomes with arthritis.

The combination of land-based and aquatic exercises have also been shown to improve the physical health of individuals with arthritis. Evidence suggests that these mixed exercise programmes reduce pain and improve physical function in clients with knee OA (Golightly, Allen & Caine, 2015). For example, Lund et al., (2008) reported reductions in pain and increases in muscle strength. No differences were found in balance, QOL or physical function outcomes. All of these findings were short-term in duration. Additional research is required to confirm the effectiveness of land-based and aquatic exercise regimens on health outcomes.

Table 2.8 Effects of Mixed Land-based EX on Pain, Fatigue, Self-efficacy, Physical Function, Muscle Strength, Emotional Status, Disease Activity and QOL with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Callahan et al., 2008, U.S.A.	RCT, N=346 people with self-reported arthritis. Investigators reviewed the PACE program for health improvements such as function, symptoms, psychosocial outcomes. Participants were randomized into one-of-two groups: (1) An IG, or (2) a CG (the IG received the PACE, whereas the CG offered the intervention on a delayed basis after assessment). Tools: VAS, HAQ, timed 10-lb lifts, timed chair stands, timed 360-degree turn, 6MWT, RASE scale, SEPA, CES-D and the Helplessness Subscale of the Rheumatology Attitude Index.	- Improvements in pain, fatigue and self-efficacy for managing arthritis at eight weeks in the IG (short-term effects). - No significant differences were reported in PA, self-efficacy or helplessness for the IG. - Function and self-efficacy declined in IG after EX intervention.	II
de Jong et al., 2003, Netherlands	RCT, N=309 RA patients. Researchers compared the effectiveness of a two-year intensive EX program termed the RAPIT with those of a PT involving usual care (UC). Subjects were randomly assigned	- After two years, subjects in the RAPIT group showed greater improvements in function and muscle strength than those in the UC. - Increased aerobic fitness for those in the RAPIT group	II

Author(s), year and country	Methodology	Research Findings	Rank
	to either the RAPIT or the UC group. Tools: MACTAR Patient Preference Disability Questionnaire, HAQ, radiograph, HADS, DAS, ergometer test and an isokinetic dynamometer.	and decreased for those in the UC group. - The RAPIT program was also more effective in improving emotional status. - No increased damage in joints, except in patients with baseline damage.	
Fransen et al., 2014, Australia	Cochrane review of literature, N=10 RCTs; n= 549 adults with hip OA. Three review authors selected studies for inclusion. Trials included either tai chi or land-based EX regimens (muscle strengthening, functional training and aerobic fitness), compared to a non-EX group. Tools: SF-36, WOMAC, Lequesne OA Index scale, NHP and SIP.	- 9-out-of-10 studies provided immediate post-treatment effects on pain and function in all study subjects. - 3-out-of-10 studies reported very minimal effects on QOL.	I
Fransen et al., 2015, Australia	Cochrane review of literature, N=54 studies; RCTs or quasi-randomized with subjects with knee OA. Three teams of two reviewers independently extracted data, assessed risk of bias and the quality of evidence. Databases were searched up until May 2013. Trials included comparing groups between some	- 19-out-of-54 (20%) studies reported randomization therefore an overall low risk of bias. - High-quality evidence from 44-out-of-54 (n=3,537 subjects) trials reported reduced pain in EX groups. - 44-out-of-54 trials (n= 3,913 subjects) reported	I

Author(s), year and country	Methodology	Research Findings	Rank
	form of land-based therapeutic EX versus non-EX. Tools: SF-36 and -12, WOMAC, Lequesne OA Index, Global disability score, NHP and SIP.	improvements in function in EX groups. - High-quality evidence from 13-out-of-54 studies (n=1,073 subjects) found improvements in QOL in EX groups.	
Golightly et al., 2015, U.S.A.	Systematic review of literature, N=39 RCTs. Researchers investigated the effects of different types of EX regimens with OA. All trials included either land-based EX (aerobic, endurance, strength training with and without weights and balance training), aquatic EX or mixed aquatic and land-based regimens. Tools: WOMAC, SF-36.	- AE (land-based or aquatic and progressive strengthening EX found lower pain and improved physical function in people with knee OA. - EX for OA is short-term outcomes and not long-term benefits.	I
Lund et al., 2008, Denmark	RCT, N=79 subjects with knee OA (age range: 40 to 89 years). Mean age was 68 years. Subjects were randomized into one-of-three groups: (1) Aquatic EX (n=27); (2) land-based EX (n=25), or (3) CG (n=27). Interventions last eight weeks. Tools: VAS, KOOS Questionnaire, Balance Master	<u>Aquatic EX group</u> - Significant decrease in muscle strength. - No effects found in balance, pain, function or QOL outcomes. - 3 subjects reported adverse events (i.e. discomfort) in the aquatic EX group. <u>Land-based EX group</u>	II

Author(s), year and country	Methodology	Research Findings	Rank
	Pro (version 6.0), isokinetic dynamometer.	- Significant effect in muscle strength and a reduction in pain compared to the CG. - No effects on balance, KOOS pain, function or QOL outcomes. -11 subjects reported adverse events (i.e. discomfort) in the land-based EX group.	

Legend: 6MWT= 6-minute walk test; AE= Aerobic exercise; CES-D= Center for Epidemiological Studies Depression; CG= Control group; DAS= Disease Activity Score; HADS= Hospital Anxiety and Depression Scale; HAQ= Health Assessment Questionnaire; IG= Intervention group; KOOS= Knee Injury and Osteoarthritis Outcome Score; MACTAR= McMaster Toronto Arthritis; NHP= Nottingham Health Profile; OA= Osteoarthritis; PA= Physical activity; PACE= People with Arthritis Can Exercise; QOL= Quality of life; RA= Rheumatoid arthritis; RAPIT= Rheumatoid Arthritis Patients in Training; RASE= The Rheumatoid Arthritis Self-Efficacy Scale; RCT= Randomized Control Trial; SEPA= The Self-Efficacy for Physical Activity; SF-36= Medical Outcomes Short Form-36; SIP= Sickness Impact Profile; UC= Usual care; VAS= Visual Analog Scale; WOMAC= Western Ontario McMaster Universities Osteoarthritis index.

2.1.9 Effects of Weight-bearing and Nonweight-bearing Exercises on Physical Health with Arthritis

Traditionally, clients with arthritis were advised to avoid or minimize exercise and rest the affected limb or extremity. The health benefits of weight-bearing (WB) exercises are becoming more apparent and accepted in clients with arthritis. WB exercises aim to enhance function and ROM, and may include weight training, hiking, jogging and other types of exercises. A systematic review by Munneke & de Jong (2000) examined the effects of WB exercise therapy in RA clients. The researchers found that WB programmes increased muscle strength; range of motion (ROM); balance, and coordination. Moreover, more than 50% of the reviewed studies found increases in aerobic capacity, joint mobility

and muscle strength. Nonweight-bearing (NWB) exercises seek to improve muscle strength rather than joint function. Examples of NWB can include swimming or bicycling. A combination of WB and NWB exercises has shown that those who engage in these exercise regimens report increases in physical function; walking speed, and muscle torque (Jan et al., 2009). Moreover, decreases in pain levels were also reported in knee OA cases through the participation in WB and NWB exercises (Tanaka, Ozawa, Kito & Moriyama, 2013). Table 2.9 summarizes the effects of WB and NWB on various physical health benefits with arthritis.

Table 2.9 Effects of WB and NWB on Walking Speed, Muscle Torque, Strength, ROM, Balance, Aerobic Capacity and Pain with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Jan et al., 2009, Taiwan	RCT, N= 106 subjects with knee OA. Subjects were randomized into one-of-three groups: (1) WB EX; (2) NWB EX, or (3) CG (no EX). All interventions lasted eight weeks. Tools: WOMAC, Cybex 6000 isokinetic dynamometer, walking speed, knee reposition error measured by placing foot on the pedal of the Shuttle Mini Clinic device.	- Improvements in function, walking speed and muscle torque for the WB and NWB groups, in comparison to the CG. - No differences in the CG or between the WB and NWB in the variables measured.	II
Munneke & de Jong, 2000	Systematic review of literature, N= 20 RCTs. Included studies were published between 1985 and 2000. Investigators studied	- WB and AE regimens improved muscle strength, aerobic capacity, ROM, balance and coordination.	I

Author(s), year and country	Methodology	Research Findings	Rank
	articles surrounding the effects of intensive WB EX therapy in people with RA. EXs were performed under supervision either at home or in a group setting. Tools: Dynamometer and cycle ergometer.	- In more than 50% of the studies, positive influences were seen in at least one of the following aspects: Muscle strength; aerobic capacity, and joint mobility. - In 7-out-of-20 studies, a significant decrease in disease activity in the EX group was reported.	
Tanaka et al., 2013, Japan	Systematic review of literature and meta-analysis, N= 8 RCTs. All trials categorized into three groups: (1) NWB strengthening EX; (2) WB strengthening EX, and (3) AE. Included studies compared the effects of EX intervention with those of either no intervention or psycho-educational interventions.	- Reduction in pain with knee OA in muscle strengthening WB EX or NWB EX. - All eight studies reported that the effect of the EG was better than the CG. - Short-term EX of NWB were most effective at relieving pain.	I

Legend: AE= Aerobic exercise; CG= Control group; EX= Exercise; NWB= Nonweight bearing; RA= Rheumatoid Arthritis; RCT= Randomized Control Trial; ROM= Range of Motion; WB= Weight bearing; WOMAC= Western Ontario McMaster Universities Osteoarthritis Index.

2.1.10 Effects of Balance Tai Chi Exercise on Physical and Mental Health with Arthritis

Tai Chi is an old and traditional Chinese exercise believed to improve pain, strength, flexibility, balance and self-efficacy. Psychological outcomes are also believed to be affected by reducing depression and anxiety. Wang and colleagues (2009) note that this

body-mind approach is an ideal ailment for older adults with knee OA. This is important as it can help in the management of knee OA symptoms and the promotion of independence. Pain and limited physical function are common symptoms in arthritis. These physical components have been shown to improve in clients with knee OA receiving Tai Chi (Peungsuwan et al., 2014; Wang et al., 2009 & Yip, Sit, Wong, Chong & Chung, 2008). Table 2.10 summarizes the noted benefits associated with Tai Chi exercise with arthritis. The mental health component included a decrease in depression (Wang et al., 2009); an increase in self-efficacy (Wang et al., 2009 & Yip et al., 2008), and an improvement in overall mental health status (Peungsuwan et al., 2014 & Yip et al., 2008). By engaging in Tai Chi, mental and physical health burdens are minimized, and helps to maintain a healthy and independent older adult population.

Table 2.10 Effects of Tai Chi on Pain, Physical Function, Depression, Self-efficacy and overall Mental Health Status with Arthritis

Author(s), year and country	Methodology	Research Findings	Rank
Peungsuwan et al., 2014, Thailand	RCT, N= 31 subjects aged 50-85 years with knee OA. Subjects were randomized into either (1) TPT with traditional massage (n=17), or (2) SPT with Swedish massage (n=14). TPT consisted of wand EX emphasizing muscle strengthening and concentric and eccentric contraction.	- No statistical differences between the two groups. - Both TPT (20%) and SPT (9%) reported increases in walking capacity and overall physical and mental health. - SF-36 scores increased for both groups, however, TPT showed a decrease over time. - TPT group reported improvements in 6MWT,	II

Author(s), year and country	Methodology	Research Findings	Rank
	SPT consisted of six strengthening EX for the quadriceps and hamstring muscles. Tools: 6MWT, WOMAC, SF-36.	WOMAC and SF-36 scores (short-term). - At one-year follow-up, physical, mental and SF-36 scores decreased in both groups.	
Wang et al., 2009, U.S.A	RCT, N= 40 people with knee OA. Mean age was 65 years. Subjects were randomized into either (1) a 60-minute Tai Chi (active) group (n=20), or (2) a CG (n=20) involving education and stretching twice a week for 12 weeks. Tools: VAS, WOMAC, timed chair stand, 6MWT, standing balance, CES-D, SF-36.	- Tai Chi group exhibited greater improvements in pain, physical function, chair stand time, depression score, self-efficacy and QOL compared to the CG.	II
Yip et al., 2008, Hong Kong	RCT, N=95 subjects with knee OA. Mean age was 63 years. Participants were randomized into either (1) an IG (n=45), or (2) a CG (n=50). Investigators studied the effects of an adopted ASMP and EX regimen (stretching, walking, gentle movements) in self-efficacy and health outcomes in people with knee OA. Tools: ASE,	- At 12 months, significant reductions in pain and self-efficacy in the IG were reported. - The IG also noted significant increases in self-rated health.	II

	VAS, demographic data.		

Legend: 6MWT= 6-minute walk test; ASE= Arthritis Self-Efficacy; ASMP= Arthritis Self-Management Programme; CES-D= Center for Epidemiological Studies Depression; CG= Control group; EX= Exercise; IG= Intervention group; OA= Osteoarthritis; RCT= Randomized Control Trial; SF-36= Medical Outcomes Short Form-36; SPT= Standardized physical therapy; TPT= Thai tradition physical therapy; VAS= Visual Analog Scale; WOMAC= Western Ontario McMaster Universities Osteoarthritis Index.

2.2 Summary

Arthritis is a progressive and debilitating chronic NCD. As previously mentioned, the prevalence of arthritis in Canadian older adults is predicted to double by 2031 (Public Health Agency of Canada [PHAC], 2011). With no current cure, PA and exercise programmes have become increasingly popular non-pharmacological based interventions for the management of arthritis. They have been shown to benefit arthritis subjects by improving physical and mental health outcomes such as pain; physical function; stiffness; muscle strength; disability; performance; fatigue; QOL; HRQOL; self-efficacy, and depression. However, contradictory findings have been noted which question the consistency of findings based on their specific interventions. There are many types of PA and exercises that vary. Lastly, the vast majority of studies investigated were short-term in nature and duration. Hence, the long-term benefits, if any, of exercise and PA on managing arthritis remain to be elucidated.

2.3 Gaps in the Literature

Currently, there is a dearth of investigations, which have examined the positive health outcomes associated with PA and exercise for older females with arthritis. I did not find any studies directly addressing this population. Moreover, some of the studies conducted to date have relatively short-term benefits of prescribed exercise regimens or PA on health outcomes in adults with arthritis (Bosomworth, 2009; Cochrane et al., 2005; Cooney et al.,

2011; Golightly et al., 2015; Jansen et al., 2011; Petrella, 2000; & Tanaka et al., 2013). Nonetheless, both interventions appear to result in positive health outcomes on the arthritis population in general, which include:

(i) Decreased pain and discomfort (Baker et al., 2001; Bosomworth, 2009; Callahan et al., 2008; Chmelo et al., 2013; Cochrane et al., 2005; Deyle et al., 2000 and 2005; Golightly et al., 2015; Jan et al., 2008; Jansen et al., 2011; Lund et al., 2008; Petrella, 2000; Roddy et al., 2005; Tak et al., 2005; Tanaka et al., 2013; van Baar et al., 2001; & Yip et al., 2008)

(ii) Improved QOL, HRQOL and well-being (Abell et al., 2005; Austin et al., 2012; & Cadmus et al., 2010)

(iii) Increased function, ROM and mobility (Baker et al., 2001; Carlson et al., 2011; Chmelo et al., 2013; Cochrane et al., 2005; Cooney et al., 2011; Davey & Cochrane, 2004; de Jong et al., 2003; Deyle et al., 2000 and 2005; Dunlop et al., 2010; Golightly et al., 2015; Hurkmans et al., 2009; Jan et al., 2009 & Munneke & de Jong, 2000)

(iv) Improved overall general health (Breedland et al., 2011 & Yip et al., 2008)

(v) Improved mental and physical health outcomes (Bartels et al., 2009; Evcik & Sonel, 2002; Fransen et al., 2001, 2014 and 2015; Pelland et al., 2004; Penninx et al., 2002; Peungsuwan et al., 2014; Scarvell & Elkins, 2011; Waller et al., 2014 & Wang et al., 2009).

Taken together, these investigations suggest that the benefits noted are more pronounced for subjects with OA of the knee, in comparison to those with OA of the hip or RA.

Only a select three Canadian studies were found examining the effects of exercise on self-reported pain and discomfort levels; QOL outcomes; general health outcomes, and overall mental and physical health status (Bosomworth, 2009; Pelland et al., 2004 & Petrella, 2000). Moreover, one of the noted major limitations for all the investigations reviewed was their focus on young or middle-aged adults (< 65 years old), as opposed to older adults (≥ 65 years old).

In addition, the majority of these investigations focused on examining the positive health effects associated with exercise, as opposed to PA. It is notable that several investigations examining the effects of exercise used PA terminology interchangeably and did not clearly differentiate between these two critical concepts (Callahan et al., 2008 & Fernandes et al., 2010). Furthermore, some investigations were found to report no effects or adverse effects of exercise and PA in subjects with arthritis including:

(i) Pain (Davey & Cochrane, 2004; Hernandez-Molina et al., 2008; Hurkmans et al., 2009; Juhakoski et al., 2011 & Pisters et al., 2007)

(ii) Physical function, ROM, mobility and/or muscle strength (Davey & Cochrane, 2004; Jansen et al., 2011; & Pisters et al., 2007)

(iii) QOL, HRQOL, well-being or self-efficacy (Fernandes et al., 2010 & Tak et al., 2005)

(iv) Physical and mental health examined concurrently (Fernandes et al., 2010; Lund et al., 2008; & Hale et al., 2012).

Hence, the beneficial effects of exercise versus PA-type interventions for clients with arthritis remains inconclusive and contradictory in nature based on the best available evidence to date. Accordingly, this study sought to fill these noted gaps in the empirical

literature and differing results by examining the effects of being active versus inactive in older females with arthritis who reside in the Durham Region of Ontario, Canada.

2.4 Rationale and Directions for Future Research

In this study, duration, frequency and METs based on intensity levels for leisure-time activities were collected to calculate the total daily energy expenditures of activities and to draw a distinction between active versus inactive older females. **Energy expenditure** is defined as the amount of energy (or calories) that a person requires for physical movement of a specific PA or exercise, or other physical functions such as breathing or circulating blood (Scott, 2016). **Active lifestyles** are here defined as total leisure-time physical activity energy expenditure (LTPAEE) values larger than 1.5 kilocalories per kilogram (>1.5 kkd). **Inactive lifestyles** are here defined as LTPAEE less than or equal to 1.5 kilocalories per kilogram ($\leq$1.5 kkd) (Bryan & Katzmarzyk, 2009).

Furthermore, by investigating the various amounts of activity engaged in by older females with arthritis, the potential positive health outcomes associated with exercise and PA were understood. Health outcome measurements in this study were both physical and mental in nature, which included arthritis-related pain; discomfort; function; mobility; range of motion, and HRQOL. These self-reported outcome measures were collected via scales and comparisons were made between inactive and active subjects. This provided insights into the prevalence and severity of arthritic symptoms, and which type of arthritis was most common among older females in the Durham Region of Ontario, Canada.

Data also provided insights into activity and inactivity rates among older females with arthritis. It was predicted that subjects who partook in greater amounts of activity

experienced greater health improvements. In addition, preferred activities (e.g. walking, stretching) among older females in the Durham Region of Ontario, Canada were noted.

This study specifically targeted older females aged 65 years and older because they are generally more vulnerable and susceptible for the development of chronic health conditions such as arthritis (Statistics Canada, 2013 & ACREU, 2013); are more likely to suffer from a mental illness (PHAC, 2010), and be more inclined to be physically inactive (PHAC, 2014). Taken together, these factors may result in a greater magnitude of effect on health outcomes. There is also a lack of evidence surrounding arthritis with older females and how exercise or PA may positively or negatively effect health outcomes and HRQOL. In addition, Canada's increasing aging trends with noted increases in the prevalence of chronic diseases and associated health care costs should be primary concerns for research.

2.5 Research Questions

(i) Do active older females with arthritis living in the Durham Region (DR) of Ontario, Canada have lower levels of joint pain and discomfort associated with arthritis, in comparison to inactive participants?

(ii) Do active older females with arthritis living in the DR of Ontario, Canada have higher HRQOL, in comparison to inactive participants?

(iii) Do active older females with arthritis living in the DR of Ontario, Canada have higher physical function, mobility and ROM, in comparison to inactive participants?

2.6 Research Hypotheses

(i) Active older females with arthritis will report lower levels of joint pain and discomfort, in comparison to inactive participants.

(ii) Active older females with arthritis will have higher HRQOL scores, in comparison to inactive participants.

(iii) Active older females with arthritis will report higher physical function, mobility and ROM levels, in comparison to inactive participants.

Chapter 3

Study Design and Methods

3.1 Research Design

A cross-sectional study employing non-probability convenience sampling was used to elicit information related to the effects of active versus inactive lifestyles on: (i) Joint pain and discomfort levels; (ii) health-related quality of life (HRQOL); (iii) range of motion (ROM) levels; (iv) physical function levels, and (v) mobility levels in older females living with arthritis. This information was simultaneously collected at one single point in time. Limitations for this type of design include possible high rates of refusals; no causality; no temporality, and a non-representative sample (Bassil & Zabkiewicz, 2014). Nonetheless, the cross-sectional method has been shown to be typically easy to conduct; are cost-effective and time efficient in nature, and can help to examine the relationship between key independent variables (e.g. active and inactive lifestyles) on key dependent variables of interest (e.g. pain levels; discomfort; ROM; physical function; mobility, and HRQOL). The cross-sectional design is also beneficial in commonly being used to measure leisure-time physical activity (LTPA) (Bryan, 2009).

3.2 Recruitment of Participants

A non-random, convenience sampling method was used to target older females residing within the Durham Region (DR) of Ontario, Canada. The recruitment of the older female subjects was conducted at multiple sites. Specifically five community senior centres and one retirement residence for a relatively representative sample (see Appendix B). Electronic invitations and posters were sent to the site Directors and Managers (see Appendices C and D). Potential subjects either contacted the graduate student (GS) through e-mail, or approached the GS in-person during on-site visits. Within this study area, there are approximately 91,336 older adults aged 65+, which accounts for 13.8% of the total

population (total DR population, N= 661,190). Of the total older adult DR population, 55.5% are women (N=50,647) (Durham Region Health Department, 2016).

Sampling is a method in which a researcher selects a proportion of subjects from a source population (Polit & Beck, 2004). I acknowledge that a possible limitation with non-probability sampling is that it may not be representative of all older adults in the DR of Ontario or Canada, which may increase the chance for under-or-over representation (Polit & Beck, 2004). Hence, this technique is considered the weakest form of sampling (Haber, 2006). However, this study employed a non-random, convenience sampling method because it is low cost in nature; targets a specific population (i.e. older females); requires a limited time and cost commitment, and can help to determine the effects of key variables and outcomes (Haber, 2006). Taken together, it was inferred that the participants were aware of their self-diagnosis of arthritis, and would permit the collection of current and first-hand information regarding their activity levels, in terms of duration, frequency and intensity of mentioned activities, and the physical and mental health outcomes experienced.

A total of 40 older females aged 65+ years with arthritis from the DR participated in this study. The sample size was determined given the limited master's time frame and in confirmation and approval of the supervisory committee.

3.3 Medical Outcomes Short Form-12 Health Survey (SF-12)

The SF-12 was the instrument used in this study (see Appendix E) to help assess the physical and mental HRQOL of individuals (Ware, Kosinski & Keller, 1996). The questionnaire was completed via paper-pencil method, in person and on-site with the GS. The SF-12 is the shortened version of the SF-36, which has been universally used and

validated as a HRQOL measurement tool for the general population (Lacson et al., 2010). The data obtained through the SF-12 provides specific and targeted information on general health; any emotional limitations; pain levels; any physical functioning limitations; overall social health, and overall mental (e.g. depression) health. The self-rated questions asked subjects how they viewed their health in terms of how they felt within the last week, and their abilities to conduct certain activities. The SF-12 has categorical questions in a yes/no format that measures limitations in role functioning from physical and emotional health. The SF-12 also has Likert scale questions that include summative statements ranging between positive and negative wording (Boone & Boone, 2012). As such, a three-point scale (e.g. limited a lot, limited a little or not limited at all) was used to measure limitations in PA and physical role functioning. Additionally, a five-point scale ranging from not at all (1) to extremely (5) was used to assess pain, and a five-point scale (e.g. excellent, very good, good, fair and poor) was used to measure overall health. Moreover, the SF-12 survey also used a six-point scale ranging from all of the time (1) to none of the time (6) to measure mental health, vitality and social functioning (Larson, 2002). The SF-12 is a generic measure that can be used for all disease or age groups, including individuals with arthritis to measure mental and overall physical health composite (MCS and PCS) respectively (Cadmus et al., 2010; Utah Department of Health, 2001 & Waller et al., 2014).

The survey's MCS-12 and PCS-12 scores measure the lowest (0) and the highest (100) levels of physical and mental health using the questionnaire scores to report the HRQOL. QualityMetric's recommended Medical Outcomes Study SAS software programme was used to calculate the two summary scores. The PCS and MCS can then be compared to the mean difference score to determine the proportion of individuals who are below or above

average. Typically, for older adults aged 65+ years, the MCS average is higher than the PCS average (Utah Health Department, 2001).

The extent in which the SF-12 produces similar results if re-administered to the same group under the same conditions, termed **reliability,** was found to be 89% and 76% for the PCS and MCS, respectively (Gerrish & Lacey, 2010; Ware et al., 1996). Notably, **validity** is defined as the ability of a questionnaire to measure what is intended (Gerrish & Lacey, 2010). The relative validity (RV) of the SF-12 PCS ranged between 0.43 to 0.93, and was found to be 0.60 to 1.07 for the MCS, in comparison to the SF-36 (Ware et al., 1996). Permission to use this survey was obtained from the developer (see Appendix M). No costs were expected for the use of the survey.

3.4 Health Questionnaire and Visual Analog Scale (VAS)

The "Health Questionnaire" that was used in this study consisted of 34 questions in total and was comprised of four sections: (i) Part I demographic information; (ii) part II arthritis history; (iii) part III health risk profile, and (iv) part IV a visual analog (VAS) (see Appendix F). The questionnaire was completed on-site and in person with the GS via a paper-pencil method. Part I of the questionnaire consisted of 11 questions asking for demographic information such as age; ethnicity; marital status; income level; education level; location of residence; height; weight, and the type of arthritis diagnosed or self-reported (e.g. RA, OA).

Part II of the questionnaire determined the subject's arthritis history. A series of four questions were asked to specify the type of arthritis, the year of diagnosis (if known), the

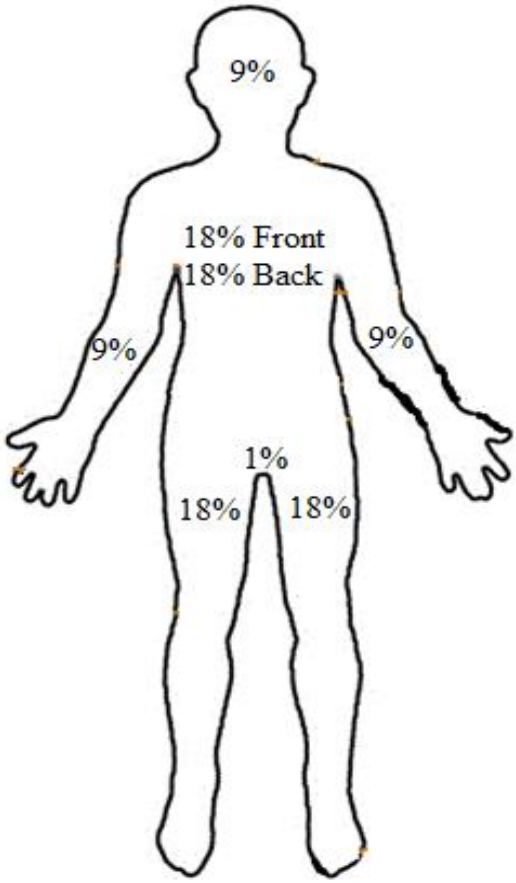
period of time they have had arthritis and if there was a family history of this inflammatory condition.

Part III of the questionnaire consisted of eight questions related to health and risk factor information (e.g. smoking; consuming alcohol, and the use of assistive devices such as canes, walkers, and knee braces). In addition, "yes" or "no" forced-choice close-ended format questions were intended to gather information on prescription and over-the-counter medication (OTCM) use in older females with arthritis for the management of arthritis and pain or discomfort.

Part IV of the questionnaire utilized a visual analog scale (VAS), which was employed to measure the strength, magnitude or intensity of the participant's subjective feelings, sensations or attitudes about specific symptoms, situations, experiences or behaviours (Wewers & Lowe, 1990). The VAS is a highly valuable and adaptable tool for observing changes in individuals, while comparing results to controls (Wewers & Lowe, 1990). The VAS was found to have a reliability ranging between 71% to 94%. It is notable that in the lack of a gold standard for pain, validity is difficult to measure, however, on a five-point verbal and numeric scale, correlations ranged from 0.71 to 0.78, and 0.62 to 0.91, respectively. An estimated 1.1 points change on an 11-point VAS was found to be minimally clinically significant in detecting change (Hawker, Mian, Kendzerska & French, 2011). This type of scale was used to assess the level of intensity, degree or magnitude of various health factors/attributes/symptoms between active and inactive subjects with arthritis. Participants were asked to rate 10 different items ranging from 0-4 by either circling the number and/or associated word descriptor or drawing a line on the continuous scale to indicate the extent/position/score of intensity of the attributes. These attributes

included: (i) Joint pain and discomfort, using a "no symptom present to excruciating" scale; (ii) ROM; (iii) HRQOL; (iv) mobility; (v) physical functioning, and (v) overall physical, mental and social health utilizing the "very poor" to "excellent" scale for ratio type data. At the end of the scale, subjects were also provided with a black and white contour figure of a human body, and asked to shade in the area(s) where they felt pain and discomfort (see Appendix F). This information was quantified using the "Rule of 9s", which was first employed clinically to provide guidelines on burn percentage by estimating the body surface area that has been burned by using multiples of nine. In respect to this study, the "Rule of 9s" was adapted from burn patients to arthritis clients to estimate the percentage of pain and discomfort of the affected body area(s) of older females. For example, the front and back leg area totals 18% and one front arm is 4.5% (see Figure 3.1 below outlining burn percentage) (Daller, 2016).

Figure 3.1 "Rule of 9s" pain percentage



Source: adapted from Daller, 2016.

3.5 Activity Levels Questionnaire for Older Adults (ALQOA)

There are many tools available to directly and indirectly measure activity levels. There is however, no existing gold standard method to measure activity (Naal et al., 2009). Accelerometers, heart rate monitors or pedometers are examples of direct physical activity measurements, which are typically more accurate, however are more expensive and time-consuming. Self-reported questionnaires (e.g. International Physical Activity Questionnaire [IPAQ]) are examples of indirect activity measurements (Kowalski et al.,

2012). To expand knowledge in indirectly measuring activity levels, the ALQOA was created by the GS (see Appendix G). It is a personalized continuous and discrete scale, comprised of 21 questions used to assess specific leisure-time physical activity (LTPA) and/or exercises found appropriate for older females (e.g. dancing, walking) adapted from the Canadian Community Health Survey (CCHS) and Durham Region senior centre programme activity guide (Active Oshawa, 2016). The questionnaire was completed on-site with the GS via a paper-pencil method and was easy, quick and inexpensive to conduct. Participants were required to indicate the number of times (in days) they participated in specific activities and the estimated duration (in minutes) of each session in an average week. Study subjects were also asked to choose the appropriate intensity levels (light, moderate or vigorous) corresponding to each activity based on the Borg Scale (Centers for Disease Control and Prevention [CDC], 2015b), a method of rating perceived exertion and activity intensity level. **Perceived exertion** is a feeling of how hard a body is working during PA. This can include increased heart rate, breathing rate, muscle fatigue and sweating. The Borg Scale was adapted for this study in grouping the perception of exertion into three levels by appraising an individual's feeling of effort associated with each level (CDC, 2015b). For example, level one was termed "light" and was defined as comfortable, minimal sweating, heart beats slightly faster and can talk. Level two was named "moderate" and consisted of increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty. Level three was termed "vigorous" categorized by sustained sweating, heart rate increases a lot, difficulty breathing, cannot talk. Ultimately, the Borg Scale can help to maintain a moderate level of exertion (MyFitScript, 2016). These values were then inputted into the Leisure-time Physical Activity Energy

Expenditure (LTPAEE) index. The LTPAEE was employed to assess activity levels through the total daily average energy expenditure of total burned calories or energy used (in kilocalories per kilogram [kkds]) of body weight for each non-work activity from the CCHS and ALQOA (Bryan & Katzmarzyk, 2009). LTPAEE was calculated using the following equation:

$$\text{LTPAEE (kkd)} = \Sigma\ [(N_i \times D_i \times MET_i)/7]$$

where N_i is the frequency of activity over a week (in days); D_i is the duration of activity (in hours), and MET_i is a constant, pre-assigned value for metabolic energy/calorie costs of activity (in kilocalories per kilogram of body weight per hour) (Bryan & Katmarzyk, 2009). MET values also differ based on intensity levels. For light activities, MET totals are < 3.0, in moderate intensity MET ranges from 3.0 to 6.0, and for vigorous intensity activities MET levels are $\geq$ 6.0 (Bryan & Katzmarzyk, 2009). MET values were determined in accordance with the 2011 *Compendium of Physical Activities* (Ainsworth et al., 2011) (see Appendix O for a list of included activities and the corresponding METs). Based on the calculated LTPAEE, participants were either categorized as inactive (using $\leq$ 1.5 kkd of body weight per day) or active (using > 1.5 kkd of body weight per day) (Bryan & Katzmarzyk, 2009; Gilmour, 2007; Ministry of Health and Long-term Care, 2016 & Statistics Canada, 2015c). This index has been used worldwide as a method to quantify physical activity levels using Canadian datasets. The ALQOA is a newly developed scale that may contribute to the science and knowledge of quantifying activity levels. Greater accuracy will be supported by using this new tool with a pre-existing PA index.

To ensure the reliability of the ALQOA, a test-retest was conducted. The ALQOA was given to five respondents on two occasions. The questionnaire scores were totaled and

inputted into an Excel datasheet. After one week, the test was administered a second time. Results showed a reliability coefficient of 0.97, indicating an excellent reliability (Vaz, Falkmer, Passmore, Parsons & Andreou, 2013). Validity was ensured by face and content validity via committee members who assessed that the ALQOA looked as though it was measuring the appropriate construct and subjectively judged adequate and appropriate coverage of the content area being measured through first-hand knowledge and review of the literature (Polit, Beck, Loiselle & Profetto-McGrath, 2007).

3.6 Data Analysis

In this study, a database employing the Statistical Package for Social Science (SPSS) ™ version 21 (Chicago, Illinois, USA) and Microsoft Excel ™ 2011 was created for statistical data analysis. The key independent variables were age; the LTPAEE of activities (in kkds); duration of exercise and/or PA per week (minutes total); frequency of exercise and/or PA per week (number of times), and intensity. The key dependent variables consisted of self-reports of joint pain or discomfort in different anatomical regions (e.g. ankle, knee, hip, wrist, fingers); HRQOL; physical function; mobility, and ROM. Data using descriptive statistics (e.g. mean, standard deviation [SD], ranges, percentages and/or mode) are presented in graphic or table formats. Inferential statistics included Chi-Squared test; Student's Two-Sample *t*-tests, and Pearson Correlations. A p-value of ≤ 0.05 was deemed significant *a priori* for all statistical tests conducted.

Measures including means; SD; ranges; percentages, and mode were calculated for all descriptive statistics on key independent variables such as age and LTPAEE of activities (in kkds), and dependent variables such as joint pain and discomfort levels; HRQOL; physical function; mobility, and ROM. Demographic data such as ethnicity; income;

education; BMI; marital status, and city of residence are also reported through descriptive statistics. The mean is a frequency used measure of central tendency. Ranges are the differences between the highest value and the smallest (Polit & Beck, 2004). SD is a measure of variability (Altman & Bland, 2005). Percentages can be calculated for categorical and/or ordinal data (Waller, 2012). Mode is the most common occurring value in nominal data (Manikandan, 2011).

The Chi-squared test was used for categorical data, specifically the proportion of active versus inactive females with arthritis with self-reported additional health issues; demographic data; medication use; alcohol consumption, and the use of assistive devices scores at a significance level of 0.05. The Pearson's chi-square examines possible relationships between two categorical variables via a contingency table (Waller, 2012).

Student two sample *t*-tests were used to measure differences between means for two different samples with unequal variances (Waller, 2012). This test was employed for continuous variables (i.e. height; weight; age; age of diagnosis; BMI; activity kkds; activity duration; VAS pain; VAS discomfort; VAS ROM; VAS physical function; VAS mobility, and SF-12 variables).

Pearson's correlation coefficients were employed to show the relationship, strength and direction of any linear associations between two variables (interval and/or ratio variables) including age; age of arthritis diagnosis; total activity kkds, and VAS variables. Pearson's correlation is denoted by 'r' (Polit & Beck, 2004).

3.7 Ethical Considerations

Ethical approval was obtained from the University of Ontario Institute of Technology (UOIT) Research Ethics Board (REB). This study conformed to Tri-Council Standards for Canada regarding Human Research TCPS II for respect of human right and morality ensuring that all human subjects are regarded with respect during research studies (Canadian Institute of Health Research [CIHR], 2010). See Appendix J for REB approval by UOIT. Additionally, please see Appendix N for the Tri-Council Policy statement certificate of completion.

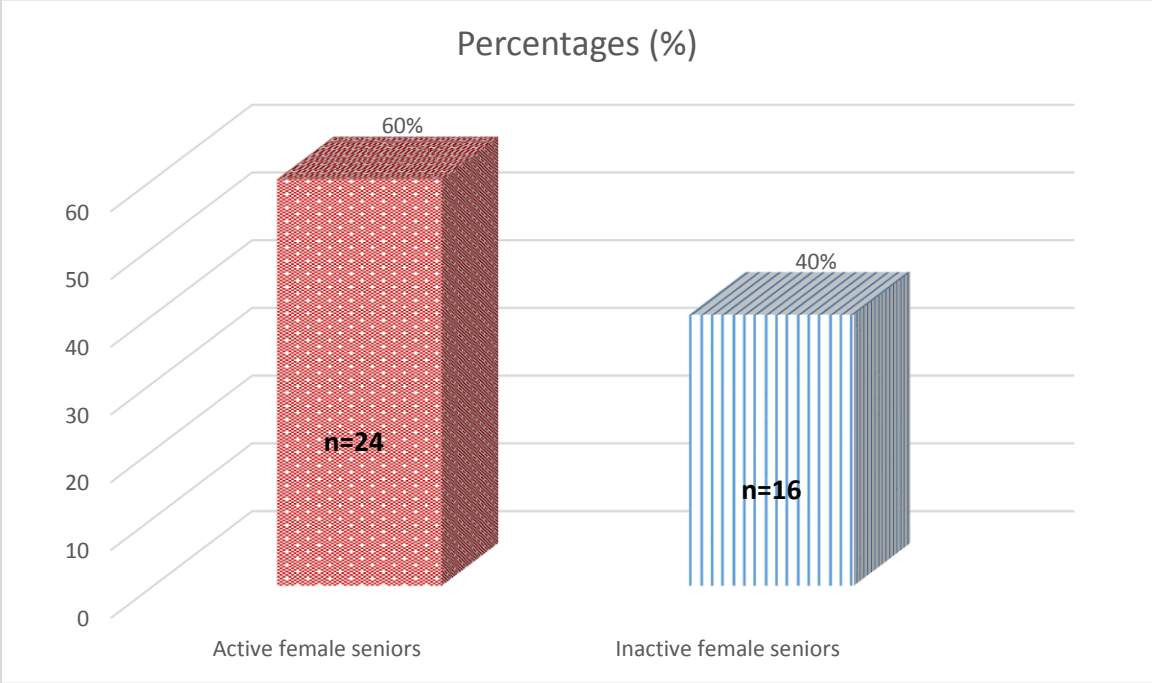
Chapter 4

Results

4.1 Demographic Results

This chapter provides the results of active versus inactive lifestyle effects on physical and mental health outcomes in older females with arthritis. A total of 40 older females aged 65+ from the Durham Region (DR) participated in this study, of which 60% (n=24) were active and 40% (n=16) were inactive. This was based on the calculated LTPAEE guidelines, in which actives used >1.5 kkds of body weight per day, in comparison to inactives using ≤1.5 kkds of body weight per day (Bryan & Katzmarzyk, 2009) (see Figure 4.1 below).

Figure 4.1 Frequency table of activity classifications by percentages (N=40)



Of the 40 older females sampled, 24 individuals were categorized as active and 16 individuals were considered inactive. Cities or regions included in the analysis were Clarington, Oshawa, Whitby, Ajax, Pickering and Scugog within the Durham Region of Ontario, Canada. Brock and Uxbridge were excluded from the analysis as no study

participants resided from those cities. For older females who were classified as active, the mean age was 71.4 years old (SD= 6.5). The mean age for the inactive group was 81.8 years old (SD= 8.8). The difference was statistically significant (P<0.001). Interestingly, active individuals were diagnosed with arthritis at a younger age, in comparison to inactive older females. Of the active sample, the mean age of diagnosis was 52.6 years old (SD= 15.1). In the inactive group, the mean age of an arthritis diagnosis was 65.8 years old (SD= 10.7). The difference was statistically significant (P<0.01).

Active arthritic older females were less likely to report using assistive devices (e.g. cane, walker, braces), in comparison to inactive counterparts. Of the active arthritis sample, nine older females (37.5%) reported using assistive devices and 15 did not (62.5%). Of the inactive arthritis sample, 14 older females (87.5%) reported using assistive devices and two did not (6.3%). The difference was statistically significant (P<0.01).

Active arthritic older females were more likely to be married, when compared to inactive counterparts. In the active arthritis sample, 13 older females (54.2%) reported being married and one older female (4.2%) reported being common law. A total of three older females (12.5%) reported being divorced, five (20.8%) reported being widowed and two (8.3%) reported being single. In the inactive arthritis sample, a total of two older females (12.5%) reported being married and one (6.3%) reported being common law. Two older females (12.5%) reported being separated, four (25%) reported being divorced, seven (43.8%) reported being widowed or none reported being single. This was statistically significant (P<0.05).

Interestingly, active older females were more likely to report a family history of arthritis, in comparison to inactive older females. For the sample of arthritis and active, 18

older females (75%) reported an arthritis family history, five did not (20.8%) and one did not know (4.2%) ($P<0.05$). For the sample of arthritis and inactive, eight older females (50%) reported a family history of arthritis, four did not (25%) and four did not know (25%).

There were no statistically significant differences in ethnicity ($P=0.41$); education ($P=0.25$); income ($P=0.08$); hours of sleep on weekdays ($P=0.48$) or weekends ($P=0.24$); body mass index (BMI) ($P=0.47$); type of arthritis ($P=0.38$), or arthritis duration in years ($P=0.65$). There were no differences found in using prescription medications ($P=0.12$) or over-the-counter medications (OTCM) ($P=1$) for the management of arthritis, or using prescription medications ($P=0.14$) or OTCMs ($P=0.69$) to manage arthritis pain and discomfort. Additionally, there were also no differences found in drinking alcohol ($P=0.30$); having high blood pressure ($P=0.15$); having heart disease ($P=0.31$); having cancer ($P=0.24$); having depression ($P=0.59$); having anxiety ($P=0.52$); having diabetes ($P=1$); having kidney disease ($P=0.33$); having lung disease ($P=0.13$); having ulcer or stomach disease ($P=0.52$); having anaemia ($P=0.09$), or other health issues including Meniere's, atrial fibrillation, Parkinson's disease, Diverticuldis, thyroid, edema, asthma, shoulder surgery or a hip replacement ($P=0.46$). Liver disease was excluded from analysis since no individuals reported having it. See Table 4.1 for a summary of all descriptive statistics below.

Table 4.1 Descriptive characteristics of older females with arthritis, active versus inactive, aged 65 years and Over, Durham Region, Ontario, Canada (combined)

	Active (N=24)	**Inactive (N=16)**	***t* or x^2**	**P-value**
I- Demographic Data				
Age (years)	71.38 ± 6.47 *(65-92)*	81.75 ± 8.77 *(65-95)*	-4.05	C (4.1E-04)
Height (cm)	160.79 ± 5.99 *(150-175)*	159.44 ± 6.27 *(150-168)*	0.68	N/S (0.50)
Weight (lb)	160.41 ± 31.73 *(121-235)*	166.38 ± 42.52 *(110-240)*	-0.47	N/S (0.64)
BMI (kg/m^2)	28.14 ± 4.99 *(20.7-40.3)*	29.68 ± 7.30 *(19.1-42.6)*	-0.73	N/S (0.47)
City of Residence			1.05	N/S (0.96)
Oshawa	12 (50%)	8 (50%)		
Whitby	1 (4.2%)	1 (6.3%)		
Ajax	2 (8.3%)	2 (12.5%)		
Pickering	4 (16.7%)	3 (18.8%)		
Scugog	1 (4.2%)	--		
Clarington	4 (16.7%)	2 (12.5%)		
Ethnicity			0.68	N/S (0.41)
White	23 (95.8%)	16 (100%)		
Black	1 (4.2%)	--		
Marital Status			11.40	A (0.04)
Married	13 (54.2%)	2 (12.5%)		
Common Law	1 (4.2%)	1 (6.3%)		
Separated	--	2 (12.5%)		
Divorced	3 (12.5%)	4 (25%)		
Widowed	5 (20.8%)	7 (43.8%)		
Single	2 (8.3%)	--		

Education			6.64	N/S
JK to Grade 8	1 (4.2%)	3 (18.8%)		(0.25)
Secondary School	5 (20.8%)	7 (43.8%)		
Apprenticeship	--	--		
College	7 (29.2%)	2 (12.5%)		
University	5 (20.8%)	1 (6.3%)		
Professional/Graduate	3 (12.5%)	2 (12.5%)		
Other	3 (12.5%)	1 (6.3%)		
Income			11.27	N/S
>$10,000	--	--		(0.08)
$10,000-$20,000	--	4 (25%)		
$20,000-$30,000	3 (12.5%)	2 (12.5%)		
$30,000-$40,000	1 (4.2%)	1 (6.3%)		
$40,000-$50,000	5 (20.8%)	1 (6.3%)		
$50,000-$60,000	1 (4.2%)	--		
$60,000-$70,000	4 (16.7%)	1 (6.3%)		
<$70,000	3 (12.5%)	--		
Employment			--	--
Retired	24 (100%)	16 (100%)		
Hours of Sleep (Mon to Fri)			2.5	N/S (0.48)
0-2 hours	--	--		
2-4 hours	--	1 (6.3%)		
4-6 hours	5 (20.8%)	5 (31.3%)		
6-8 hours	18 (75%)	9 (56.3%)		
8-10 hours	1 (4.2%)	1 (6.3%)		
+10 hours	--	--		
Hours of Sleep (Sat to Sun)			4.24	N/S (0.24)
0-2 hours	--	--		
2-4 hours	--	2 (12.5%)		

4-6 hours	5 (20.8%)	5 (31.3%)		
6-8 hours	16 (66.7%)	8 (50%)		
8-10 hours	3 (12.5%)	1 (6.3%)		
+10 hours	--	--		
II- Arthritis History				
Type of Arthritis			5.31	N/S
Rheumatoid Arthritis	1 (4.2%)	4 (25%)		(0.38)
Osteoarthritis	20 (83.3%)	12 (75%)		
Fibromyalgia	1 (4.2%)	1 (6.3%)		
Scleroderma	1 (4.2%)	-		
Gout	1 (4.2%)	-		
Other:				
Arthritis (general)	2 (8.3%)	3 (18.8%)		
Arthritis duration (years)	18.1 ± 11.9 *(3-50)*	16.5 ± 9.3 *(2-30)*	0.46	N/S (0.65)
Age of diagnosis (years)	52.6 ± 15.1 *(17-75)*	65.8 ± 10.7 *(47-87)*	-3.12	B (3.6E-03)
Arthritis Family History			6.36	A (0.04)
Yes	18 (75%)	8 (50%)		
No	5 (20.8%)	4 (25%)		
I Don't Know	1 (4.2%)	4 (25%)		
III- Health Risk Profile				
Rx for management of arthritis			2.40	N/S (0.12)
Yes	5 (20.8%)	7 (43.8%)		
No	19 (79.2%)	9 (56.3%)		
OTCM for management of arthritis			0	N/S (1)
Yes	12 (50%)	8 (50%)		
No	12 (50%)	8 (50%)		

Rx to manage arthritis pain			2.22	N/S (0.14)
Yes	4 (16.7%)	6 (37.5%)		
No	20 (83.3%)	10 (56.3%)		
OTCM to manage arthritis pain			0.16	N/S (0.69)
Yes	15 (62.5%)	9 (56.3%)		
No	9 (37.5%)	7 (43.8%)		
Drinking alcohol			1.07	N/S
Yes	13 (54.2%)	6 (37.5%)		(0.30)
No	11 (45.8%)	10 (62.5%)		
Use of assistive devices			9.82	B
Yes	9 (37.5%)	14 (87.5%)		(1.7E-03)
No	15 (62.5%)	2 (6.3%)		
Additional medical issues				
High blood pressure			2.04	N/S
Yes	11 (45.8%)	11 (68.8%)		(0.15)
No	13 (54.2%)	5 (31.3%)		
Heart disease			1.04	N/S
Yes	3 (12.5%)	4 (25%)		(0.31)
No	21 (87.5%)	12 (75%)		
Cancer			1.40	N/S
Yes	2 (8.3%)	-		(0.24)
No	22 (91.7%)	16 (100%)		
Depression			0.29	N/S
Yes	3 (12.5%)	3 (18.8%)		(0.59)
No	21 (87.5%)	13 (81.3%)		
Anxiety			0.42	N/S
Yes	4 (16.7%)	4 (25%)		(0.52)
No	20 (83.3%)	12 (75%)		

Diabetes			0	N/S (1)
Yes	3 (12.5%)	2 (12.5%)		
No	21 (87.5%)	14 (87.5%)		
Alcohol or drug use			0.68	N/S
Yes	1 (4.2%)	-		(0.41)
No	23 (95.8%)	16 (100%)		
Kidney disease			0.96	N/S
Yes	1 (4.2%)	2 (12.5%)		(0.33)
No	23 (95.8%)	14 (87.5%)		
Lung disease			2.27	N/S
Yes	1 (4.2%)	3 (18.8%)		(0.13)
No	23 (95.8%)	13 (81.3%)		
Ulcer or stomach			0.42	N/S
Yes	3 (12.5%)	1 (6.3%)		(0.52)
No	21 (87.5%)	15 (93.8%)		
Anaemia or other			2.96	N/S
Yes	4 (16.7%)	-		(0.09)
No	20 (83.3%)	16 (100%)		
Other			0.56	N/S
Yes	5 (20.8%)	5 (31.3%)		(0.46)
No	19 (79.2%)	11 (68.8%)		

Note: All values reported are $\bar{x} \pm S.D.$, N (%) and/or range (*min-max)*. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

4.2 Activity Levels

This section provides a summary of the results pertaining to subjectively assessed specific leisure-time activity levels between active and inactive groups. Table 4.2 shows the kilocalories per kilogram of body weight (kkds) of activities as per the Leisure-Time Physical Activity Energy Expenditure (LTPAEE) formula and Table 4.3 shows the

duration times (in minutes) that were measured in an average week employed to categorize females as active versus inactive.

Table 4.2 Activity kilocalories per kilogram of body weight (kkds) per day of active and inactive samples, 65 years and older, in Durham Region of Ontario, Canada (combined)

Activities	**Active (N=24)**	**Inactive (N=16)**	***t***	**P-values**
Gardening (in kkds)	0.69 ± 0.59	0.43 ± 0.20	1.21	N/S (0.28)
Yard Work (in kkds)	0.71 ± 0.58	--	--	--
Walk for Fun (in kkds)	0.73 ± 0.50	0.84 ± 0.24	-0.61	N/S (0.55)
Walking for Exercise (in kkds)	1.41 ± 1.08	(1.02)	--	--
Bowling/Lawn Bowling (in kkds)	1.43 ± 1.0	--	--	--
Golfing (in kkds)	(1.37)	--	--	--
Dancing (in kkds)	1.05 ± 0.88	--	--	--
Bicycling (in kkds)	1.73 ± 0.29	--	--	--
Swimming for Fun (in kkds)	1.76 ± 1.24	--	--	--
Lane/Lap Swimming (in kkds)	2.12 ± 2.11	--	--	--
Jogging (in kkds)	(1.33)	--	--	--
Calisthenics (in kkds)	0.84 ± 0.28	--	--	--
Resistance Training (in kkds)	0.70 ± 0.42	0.63 ± 0.18	0.42	N/S (0.70)
Stretching (in kkds)	0.41 ± 0.54	0.45 ± 0.33	-0.21	N/S (0.83)

Yoga (in kkds)	0.77 ± 0.48	--	--	--
Tai Chi (in kkds)	0.21 ± 0	(0.43)	--	--
Water Aerobics (in kkds)	1.24 ± 0.57	--	--	--
Other: *Home Exercise* **Leg Lifts** (in kkds)	(0.18)	(0.63)	--	--
Other: *Home Exercise* **Treadmill** (in kkds)	(0.54)	--	--	--
Other: *Exercise Classes* **Curves Circuit** (in kkds)	(0.64)	--	--	--
Other: *Exercise Classes* **Stretch + Sculpt** (in kkds)	0.54 ± 0	--	--	--
Other: *Exercise Classes* **Zumba** (in kkds)	0.57 ± 0	--	--	--
Other: **Softball** (in kkds)	(1.07)	--	--	--
Total Activity (in kkds per day)	4.63 ± 2.61	0.73 ± 0.55	7.09	D (1.6E-07)

Note: All values reported are $\bar{x} \pm S.D.$ N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.2 (above) outlines the average total kilocalories per kilogram of body weight (kkds) burned per day in specific leisure-time physical activities and exercises adapted from the Canadian Community Health Survey (CCHS) and DR senior centre activity guides (Active Oshawa, 2016). As previously mentioned, according to the study

by Bryan & Katzmarzyk, (2009), actives were categorized as those whose leisure-time physical activity energy expenditure (LTPAEE) values were larger than 1.5 kkd, whereas inactives were those whose LTPAEE were less than or equal to 1.5 kkd. These values were calculated based on the duration, frequency and METs of specific leisure-time activities. In total, active arthritic older females reported higher kkds averages from these leisure activities (4.63 $\pm$ 2.61), in comparison to inactive counterparts (0.73 $\pm$ 0.55). This difference was statistically significant ($p<0.0001$). No significant differences were observed between gardening kkds (P= 0.28); walking for fun kkds (P= 0.55); resistance training kkds (P= 0.70) or stretching kkds (P= 0.83). No inactive arthritic older females participated in leisure activities including yard work; bowling/lawn bowling; golfing; dancing; bicycling; swimming for fun; lane/lap swimming; jogging; calisthenics; yoga, and/or water aerobics. Moreover, no older females participated in tennis/squash, shuffleboard or curling, which were not included in the analyses.

Table 4.3 Activity duration times (in minutes) per week of active and inactive samples, 65 years and older, in Durham Region of Ontario, Canada (combined)

Activities	**Active (N=24)**	**Inactive (N=16)**	***t***	**P-values**
Gardening Times (in minutes)	124 $\pm$ 116 *(30-480)* *120	105 $\pm$ 64 *(60, 150)*	0.33	N/S (0.77)
Yard Work Times (in minutes)	90 $\pm$ 74 *(30-180)* *30	-- --	--	--
Walk for Fun Times (in minutes)	120 $\pm$ 99 *(30-420)* *120	106 $\pm$ 34 *(60-140)*	0.47	N/S (0.65)
Walking for Exercise Times (in minutes)	138 $\pm$ 106 *(30-420)* *30	-- *(150)*	--	--

Bowling/Lawn Bowling Times (in minutes)	200 ± 139 *(120-360)* *120 --	-- --	--	--
Golfing Times (in minutes)	-- *(120)*	-- --	--	--
Dancing Times (in minutes)	75 ± 21 *(60, 90)*	-- --	--	--
Bicycling Times (in minutes)	107 ± 23 *(80-120)* *120	-- --	--	--
Swimming for Fun Times (in minutes)	123 ± 87 *(30-320)* *120	-- --	--	--
Lane/Lap Swimming Times (in minutes)	79 ± 67 *(30-180)*	-- --	--	--
Jogging Times (in minutes)	-- *(80)*	-- --	--	--
Calisthenics Times (in minutes)	93 ± 31 *(60-120)*	-- --	--	--
Resistance Training Times (in minutes)	65 ± 35 *(20-120)* *60	90 ± 42 *(60, 120)*	-0.80	N/S (0.57)
Stretching Times (in minutes)	76 ± 98 *(10-420)* *30	77 ± 64 *(25-240)* *70	-0.05	N/S (0.96)
Yoga Times (in minutes)	129 ± 81 *(60-270)* *60	-- --	--	--
Tai Chi Times (in minutes)	60 ± 0 *(60, 60)*	-- *(60)*	--	--
Water Aerobic Times (in minutes)	95 ± 43 *(45, 120)* *120	-- --	--	--
Other: *Home Exercise* **Leg Lifts Times** (in minutes)	-- *(20)*	-- *(70)*	--	--

Other: *Home Exercise* **Treadmill Times** (in minutes)	-- *(60)*	-- --	--	--
Other: *Exercise Classes* **Curves Circuit Times** (in minutes)	-- *(90)*	-- --	--	--
Other: *Exercise Classes* **Stretch + Sculpt Times** (in minutes)	47 ± 23 *(20-60)* *60	-- --	--	--
Other: *Exercise Classes* **Zumba Times** (in minutes)	60 ± 0 *(60)*	-- --	--	--
Other: **Softball Times** (in minutes)	-- *(90)*	-- --	--	--
Total Activity (in minutes per week)	483 ± 298 *(120-1230)* *345	112 ± 91 *(0-270)* *0	5.72	D (3.5E-06)

Note: All values reported are $\bar{x} \pm S.D.$, range (*min-max)* and *mode. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.3 (above) shows the mean duration times (in minutes) of the active and inactive groups through participation in specific leisure-type activities (e.g. walking, stretching) in an average week as per the Activity Levels Questionnaire for Older Adults (ALQOA) outlined in chapter three. As previously mentioned, Canadian Physical Activity (PA)

guidelines state that active lifestyles consist of approximately 150 minutes of moderate-to-vigorous PA in an average week. For this purpose, duration times were collected and analyzed.

No older females participated in tennis; squash; curling, or shuffleboard activities, which were omitted from the analysis. In addition, no inactive arthritic older females participated in water aerobics; yoga; calisthenics; jogging; lane/lap swimming; swimming for fun; bicycling; dancing; golfing; bowling/lawn bowling, or yard work. There were no significant differences found between active versus inactive arthritic older females in gardening times (P=0.77), walking for fun times (P=0.65), resistance training times (P=0.57) or stretching times (P=0.96) in an average week, respectively.

In total, active older females reported spending more time (in minutes) (483 $\pm$ 298) on all mentioned leisure-type activities, in comparison to inactive older females (112 $\pm$ 91) in an average week, respectively. The difference was statistically significant (P<0.0001).

4.3 Pain/Discomfort, Range of Motion, Physical Function, Mobility, Health-related Quality of Life, and Physical and Mental Visual Analog Scale Health Outcomes

This section highlights the findings related to health outcomes associated with being active versus inactive. Table 4.4 below provides an overview of the active versus inactive outcomes related to physical health components including arthritic pain and discomfort; range of motion (ROM); physical function, and mobility. Mental and physical health outcomes included HRQOL. Overall, physical; mental, and social health outcomes were also examined. These results were collected by employing a continuous Visual Analog

Scale (VAS), with values ranging from 0 (*"no pain/discomfort"* or *"poor"* for all other variables) to 4 (*"excruciating"* for pain/discomfort or *"excellent"* for other variables). Active older females were more likely to report lower pain levels and discomfort (1.33 $\pm$ 0.56) and (1.33 $\pm$ 0.48), in comparison to their inactive counterparts (2.5 $\pm$ 0.89) and (2.25 $\pm$ 0.77) respectively. The differences were statistically significant ($p<0.001$).

Active older females with arthritis were more likely to report higher levels of mobility and physical function (2.71 $\pm$ 0.81) and (2.67 $\pm$ 0.64), compared to inactive arthritic older females (1.25 $\pm$ 0.68) and (1.63 $\pm$ 0.5) (see Table 4.4 below). These differences were also statistically significant ($p<0.0001$). Moreover, active older females reported higher mean ROM values (2.38 $\pm$ 0.88, $p<0.0001$); whereas inactive older females reported lower ROM levels (1.25 $\pm$ 0.58) respectively. Higher mean values in physical health were also reported for active older females with arthritis (2.63 $\pm$ 0.65, $p<0.0001$), when compared to inactive individuals (1.56 $\pm$ 0.63) overall.

Of the active arthritic sample, older females were more likely to report higher HRQOL levels (2.70 $\pm$ 0.62) and higher overall mental health status (3 $\pm$ 0.88), when compared to older females of the inactive arthritic sample (1.63 $\pm$ 0.62) and (2 $\pm$ 0.73). The differences were statistically significant ($p<0.0001$) and ($p<0.001$).

Active older females with arthritis were more likely to report greater overall social health, in comparison to inactive counterparts. Social health mean values were higher in older females from the active arthritis sample (2.92 $\pm$ 0.78, $p<0.05$), in comparison to inactive counterparts (2.25 $\pm$ 0.77) overall.

Table 4.4 Student Two-sample *t*-test outlining VAS health outcome scores between active and inactive (combined)

Variable	**Active (N=24)**	**Inactive (N=16)**	***t***	**P-value**
Pain	1.33 ± 0.56 *(0-2)* *1	2.5 ± 0.89 *(1-4)* *2	-4.64	C (1.2E-04)
Discomfort	1.33 ± 0.48 *(1-2)* *1	2.25 ± 0.77 *(1-4)* *2	-4.22	C (3.2E-04)
Health-related quality of life (HRQOL)	2.70 ± 0.62 *(1-4)* *3	1.63 ± 0.62 *(0-2)* *2	5.40	D (6.1E-06)
Range of motion (ROM)	2.38 ± 0.88 *(1-4)* *2	1.25 ± 0.58 *(0-2)* *1	4.90	D (1.8E-05)
Mobility	2.71 ± 0.81 *(2-4)* *2	1.25 ± 0.68 *(0-2)* *1	6.15	D (4.4E-07)
Physical Function	2.67 ± 0.64 *(1-4)* *3	1.63 ± 0.5 *(1-2)* *2	5.78	D (1.3E-06)
Overall physical health	2.63 ± 0.65 *(1-4)* *3	1.56 ± 0.63 *(0-2)* *2	5.17	D (1.1E-05)
Overall mental health	3 ± 0.88 *(2-4)* *2	2 ± 0.73 *(1-4)* *2	3.89	C (4.1E-04)
Overall social health	2.92 ± 0.78 *(1-4)* *3	2.25 ± 0.77 *(1-4)* *2	2.67	A (1.2E-02)

Note: All values reported are $\bar{x} \pm S.D.$, range (*min-max)* and *mode**.*** N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.5 (below) highlights the active versus inactive outcomes related to specific pain components. These results were also collected via a Visual Analog Scale (VAS), with values ranging from 0 (none) to 4 (excruciating). No statistically significant differences were found for stabbing (P=0.20); throbbing (P=0.58); shooting (P=0.52); cramping

(P=0.91); sharp (P=0.33); burning/hot (P=0.71); aching (P=0.20), or heavy (P=0.43) pain descriptive components. Interestingly, inactive arthritis older females were more likely to report lower levels of tenderness in their affected joint(s) (0.38 $\pm$ 0.89, p<0.001), in comparison to active arthritic older females (1.5 $\pm$ 1.06).

Table 4.5 Student Two-sample *t*-test outlining VAS pain component scores between active and inactive (combined)

Pain component	Active (N=24)	Inactive (N=16)	*t*	P-values
Stabbing	0.46 $\pm$ 0.78 (0-2) *0	0.19 $\pm$ 0.54 (0-2) *0	1.29	N/S (0.20)
Throbbing	1.08 $\pm$ 1.02 (0-3) *0	1.31 $\pm$ 1.40 (0-4) *0	-0.56	N/S (0.58)
Shooting	0.54 + 0.83 (0-2) *0	0.75 + 1.06 (0-3) *0	-0.66	N/S (0.52)
Cramping	0.92 + 1.06 (0-3) *0	0.88 + 1.26 (0-4) *0	0.11	N/S (0.91)
Sharp	0.71 + 0.91 (0-3) *0	1.13 + 1.5 (0-4) *0	-0.996	N/S (0.33)
Burning/Hot	0.63 + 1.01 (0-3) *0	0.75 + 1.06 (0-3) *0	-0.37	N/S (0.71)
Aching	1.71 + 0.95 (0-3) *2	2.19 + 1.22 (0-4) *3	-1.32	N/S (0.197)
Tender	1.5 + 1.06 (0-3) *2	0.38 + 0.89 (0-3) *0	3.63	C (8.7E-04
Heavy	0.17 $\pm$ 0.57 (0-2) *0	0.06 $\pm$ 0.25 (0-1) *0	0.79	N/S (0.43)

Note: All values reported are $\bar{x} \pm S.D.$, range (*min-max)* and *mode. N/S= Not significant, A= p $\leq$ 0.05, B= p $\leq$ 0.01, C= p $\leq$ 0.001, D= p $\leq$ 0.0001.

Figure 4.2 (below) illustrates the frequencies and percentages of pain or discomfort outcomes between the active versus inactive groups on specific body areas (e.g. knee pain, pain in the ankles). Figure 4.2 below provides the percentage of arthritic neck pain or discomfort reported by active versus inactive older females. It was found that 29.2% of active older females (N= 7) experienced arthritic pain or discomfort in the neck when compared to inactive older females (31.3%, N= 5). Approximately 20.8% (N= 5) of active older females reported shoulder pain/discomfort, compared to 50% (N= 8) of inactive older females. Additionally, no active older females reported experiencing pain or discomfort in the elbows, compared to 12.5% (N= 2) of inactive older females who reported pain in this area.

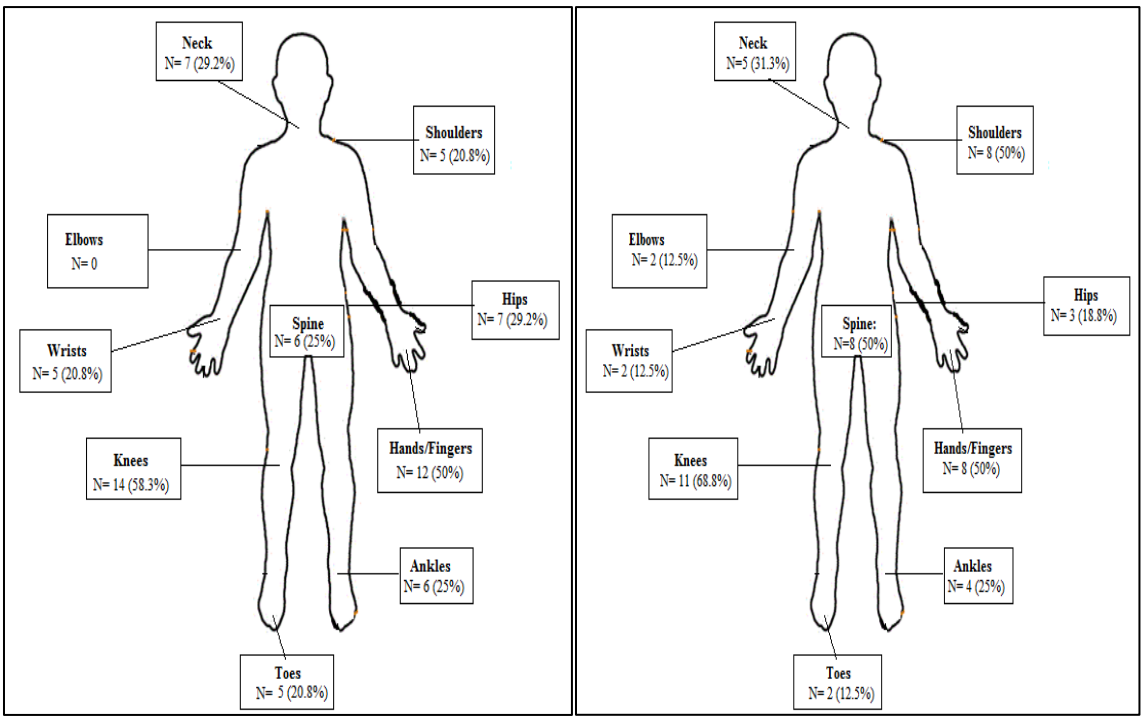
Interestingly, a higher percentage of active older females with hip arthritic pain/discomfort (29.2%, N= 7) was reported, compared to their inactive counterparts (18.8%, N= 3). 20.8% (N= 5) of active females aged 65 and over reported arthritic pain/discomfort in the wrists, when compared to 12.5% (N= 2) of inactive older females. An equal percentage of 50% of arthritis-related pain/discomfort in the hands was reported in both the active older female (N= 12), and the inactive older females (N= 8).

Figure 4.2 shows the percentage of arthritic pain or discomfort reported in the lower extremities for active and inactive older females. Approximately 58.3% (N= 14) of active older females reported arthritic pain/discomfort in the knee(s), in comparison to their inactive counterparts (68.8%, N= 11). 25% (N= 6) of active older females reported experiencing pain/discomfort in the ankle(s) associated with arthritis, when compared to an equal 25% (N= 4) of inactive older females experiencing pain or discomfort in the same area. Six active older females (25%) also reported arthritic pain/discomfort in the posterior

spinal area, in comparison to 50% (N= 8) of inactive older females. Interestingly, these findings suggest a higher percentage of active 65+ females with toe(s) pain/discomfort (20.8%, N= 5), in comparison to their inactive counterparts (12.5%, N= 2).

No comparative statistics were conducted as this was a preliminary look to estimate the frequency percentage of pain or discomfort of various affected anatomical locations of the body of older females with arthritis. This figure was adapted from the "Rule of 9s" burn patients to arthritis clients (Daller, 2016).

Figure 4.2 Pain and discomfort location areas between active versus inactive older females, aged 65 and over, Durham Region, Ontario, Canada



Note: Active (N=24) & Inactive (N=16). All values are reported as *N (%).*

4.4 Physical and Mental Health Outcomes

This section highlights the findings associated with active versus inactive outcomes as well as various physical and mental health outcomes. This was assessed via a Likert scale Medical Outcomes Short Form-12 (SF-12) survey for physical and mental health subscale scores; which included general health (GH); physical function (PF); role physical (RP); role emotional (RE); bodily pain (BP); mental health (MH); vitality (VT), and social functioning (SF). Moreover, QualityMetric's Medical Outcomes Study SAS software programme was used to score the eight subscale scores and two summary mental health (MCS-12) and physical health (PCS-12) composite scores. Table 4.6 (below) provides a summary of active versus inactive GH. All values ranged from *excellent* to *poor*. Of the active arthritic sample, older females were more likely to report higher GH scores (72.7 $\pm$ 16.7), when compared to inactive older females (45.3 $\pm$ 24.9). The difference was found to be statistically significant ($p<0.001$).

Table 4.6 Student Two Sample t-Test outlining SF-12 General Health (GH) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q1: In general, would you say your health is?	72.7 $\pm$ 16.7 *(25-100)*	45.3 $\pm$ 24.9 *(0-85)*	3.86	C (7.5E-04)

Note: All values reported are $\bar{x} \pm S.D.$ & range (*min-max)*. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.7 (below) provides an overview of self-reported PF scores between active versus inactive older females with arthritis combined. PF encompassed questions if health

limits the ability to participate in moderate activities (e.g. moving a table, bowling, golf) and/or climbing several flights of stairs. Values ranged from yes, limited a lot to no, not limited at all. In the active arthritis sample, older females were more likely to report higher physical function scores (66.7 $\pm$ 27.3, p<0.0001), in comparison to inactive arthritic older females (12.5 $\pm$ 22.4).

Table 4.7 Student Two Sample t-Test outlining SF-12 Physical Function (PF) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q2: Does your health now limit you in these activities? If so, how much? a. **Moderate activities (moving a table, pushing a vacuum cleaner, bowling or playing golf** b. **Climbing several flights of stairs**	66.7 $\pm$ 27.3 *(25-100)*	12.5 $\pm$ 22.4 *(0-75)*	6.87	D (4.9E-08)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$**.** N/S= Not significant, A= p $\leq$ 0.05, B= p $\leq$ 0.01, C= p $\leq$ 0.001, D= p $\leq$ 0.0001.

Table 4.8 (below) provides summaries of active versus inactive role outcomes related to physical components in *"accomplishing less"* and/or *"being limited in the kind of work or regular daily activities"* as a result of physical health. Values ranged from *all of the time* to *none of the time*. The active arthritic older females were more likely to report higher RP (78.6 $\pm$ 21.3) in terms of reporting no times of *"accomplishing less"* and *"being*

limited in the kind of work or other activities" due to their physical health when compared to inactive arthritic older females (23.4 ± 22.3). The difference was found to be statistically significant ($p<0.0001$).

Table 4.8 Student Two Sample t-Test outlining SF-12 Role Physical (RP) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q3: During the past week, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health? a. **Accomplished less than you would like?** b. **Were limited in the kind of work or other activities?**	78.6 ± 21.3 *(37.5-100)*	23.4 ± 22.3 *(0-62.5)*	7.80	D (8.3E-09)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.9 (below) provides findings on active versus inactive outcomes related to role emotional (RE) components in having any problems with work or regular daily activities as a result of emotional problems such as feeling depressed or anxious (e.g. accomplishing less and/or doing work or other activities less carefully than usual). Values ranged from *all of the time* to *none of the time*. It was found that the active arthritis sample was more likely to report higher RE in terms of reporting *"accomplishing less"* and *"doing*

work less carefully than usual" none of the time (87.5 $\pm$ 18.4, p<0.05), in comparison to inactive counterparts (64.8 $\pm$ 34.8).

Table 4.9 Student Two Sample t-Test outlining SF-12 Role Emotional (RE) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q4: During the past week, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? **a. Accomplished less than you would like?** **b. Did work or other activities less carefully than usual?**	87.5 $\pm$ 18.4 *(50-100)*	64.8 $\pm$ 34.8 *(0-100)*	2.39	A (0.03)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$. N/S= Not significant, A= p $\leq$ 0.05, B= p $\leq$ 0.01, C= p $\leq$ 0.001, D= p $\leq$ 0.0001.

Table 4.10 below outlines associations between active versus inactive outcomes in relation to bodily pain (BP) measures. Older females reported how much pain interfered with their normal work (i.e. work outside the home and housework) during the past said week with values ranging from *not at all* to *extremely*. Active arthritic older females were more likely to report improved BP outcomes (71.9 $\pm$ 27.9), when compared to their inactive

counterparts (31.3 ± 28.1), who were more likely to report extreme BP. This was found to be statistically significant ($p<0.0001$).

Table 4.10 Student Two Sample t-Test outlining SF-12 Bodily Pain (BP) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q5: During the past week, how much did pain interfere with your normal work (including both work outside the home and housework)?	71.9 ± 27.9 *(0-100)*	31.3 ± 28.1 *(0-100)*	4.49	D (8.7E-05)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

The following table (below) highlights to the reader findings on active versus inactive outcomes in relation to mental health (MH) measures including "*feeling calm and peaceful"*, and *"feeling downhearted and depressed"*. Values ranged from *all of the time* to *none of the time*. Table 4.12 shows that the active arthritis sample was more likely to report higher MH (77.1 ± 18.8, $p<0.01$), in comparison to the inactive arthritis sample (57.0 ± 24.6).

Table 4.11 Student Two Sample t-Test outlining SF-12 Mental Health (MH) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q6: How much of the time during the past week… a. **Have you felt calm and peaceful?** b. **Have you felt downhearted and depressed?**	77.1 ± 18.8 *(50-100)*	57.0 ± 24.6 *(25-100)*	2.80	B (0.009)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.12 (below) provides the reader with findings of active versus inactive outcomes related to vitality (VT) scores including *"having a lot of energy"*. Values ranged from *none of the time* to *all of the time.* Interestingly, active arthritic older females were more likely to report higher VT scores (67.7 ± 21.5), in comparison to inactive arthritic older females (32.8 ± 21.8). This difference was statistically significant ($p<0.0001$).

Table 4.12 Student Two Sample t-Test outlining SF-12 Vitality (VT) subscale scores between active and inactive (combined)

	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q6: How much of the time during the past week… **a. Did you have a lot of energy?**	67.7 ± 21.5 *(25-100)*	32.8 ± 21.8 *(0-75)*	4.99	D (2.1E-05)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$. N/S= Not significant, A= $p \leq 0.05$, B= $p \leq 0.01$, C= $p \leq 0.001$, D= $p \leq 0.0001$.

Table 4.13 below provides a summary of active versus inactive outcomes in association with social functioning (SF). Values ranged from *all of the time* to *none of the time* to rate how much of the time physical health or emotional problems interfered with social activities (e.g. visiting friends, relatives). Interestingly, active arthritic older females were more likely to report higher SF by having no physical health or emotional issue interferences with their social activities (88.5 $\pm$ 16.5, p<0.01), when compared to their inactive counterparts (60.9 $\pm$ 35.3).

Table 4.13 Student Two Sample t-Test outlining SF-12 Social Functioning (SF) subscale scores between active and inactive (combined)

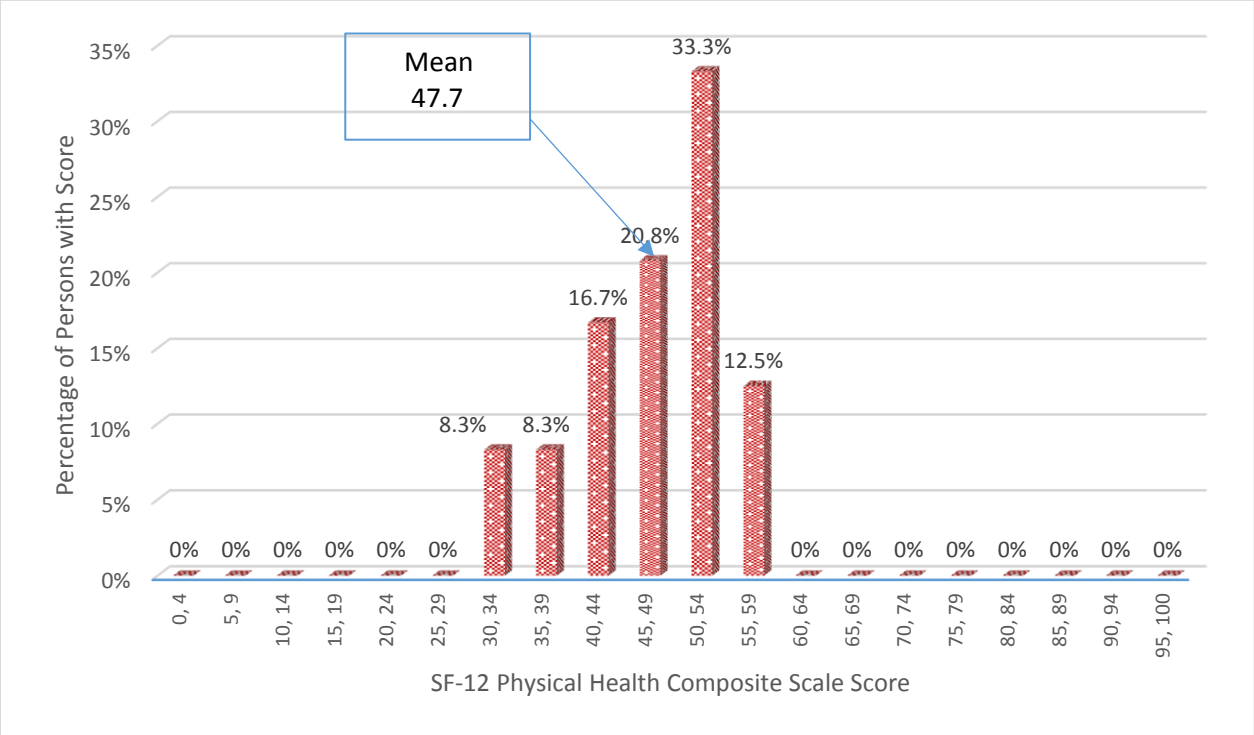
	Active (N=24)	**Inactive (N=16)**	***t***	**P-values**
Q7: During the past week, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?	88.5 $\pm$ 16.5 *(50-100)*	60.9 $\pm$ 35.3 *(0-100)*	2.92	B (0.009)

Note: All values reported are $\bar{x} \pm S.D.$ & range $(min - max)$. N/S= Not significant, A= p $\leq$ 0.05, B= p $\leq$ 0.01, C= p $\leq$ 0.001, D= p $\leq$ 0.0001.

Taken together, the 12 questions obtained from the SF-12 can be assessed via the Physical and Mental Health Composite Scores (PCS and MCS). Figures 4.3 and 4.4 (below) provide the reader with graphic representations of the computed PCS in active and inactive arthritic older females. Active arthritic older females were more likely to report higher PCS scores (47.7 $\pm$ 7.8, p<0.0001), in comparison to inactive arthritic older females (30.1 $\pm$ 7.8). Interestingly, the findings revealed that overall, 62.5% (N=15) of active arthritic older females reported an above average PCS-12 score, in comparison to 37.5%

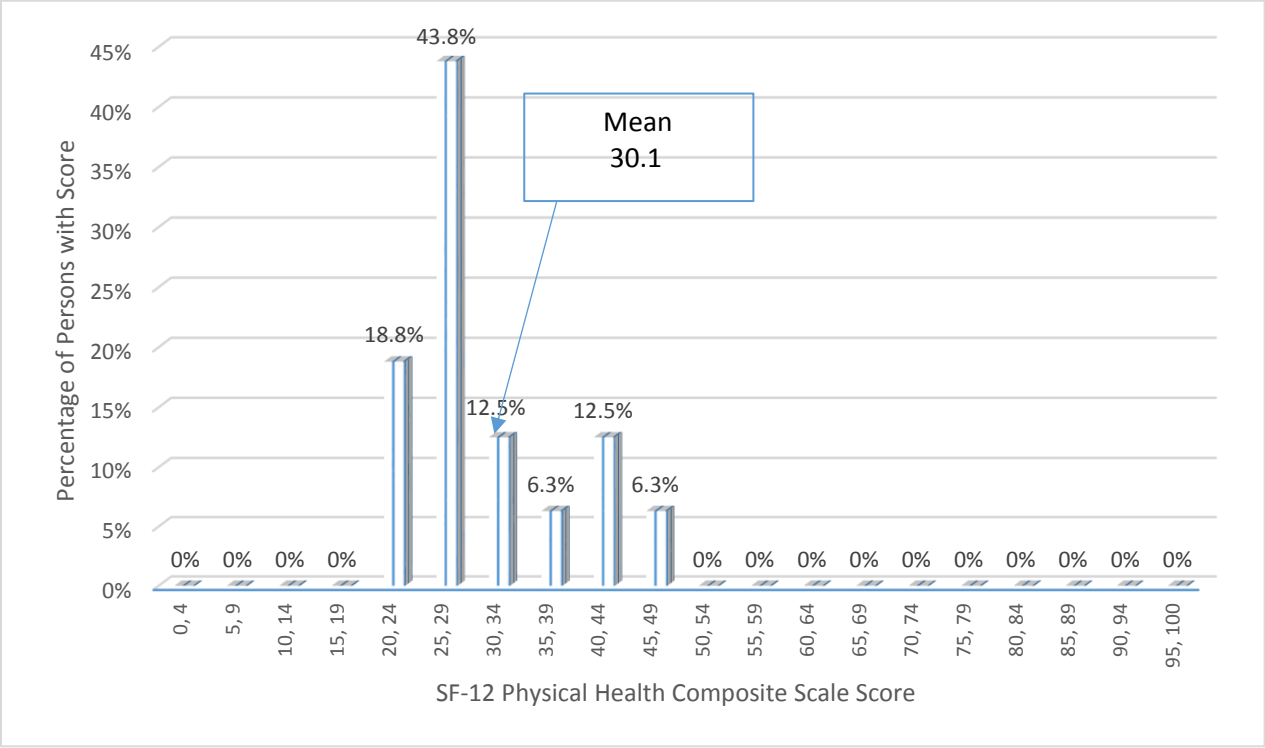
(N=6) of inactive arthritic older females. Additionally, 37.5% (N=9) of the active arthritis sample reported a below average PCS-12 score, when compared to 62.5% (N=10) of the inactive arthritis sample that reported a below average PCS-12 score.

Figure 4.3 Medical Outcomes SF-12 physical health composite scale scores, active older females aged 65 and over (N=24), Durham Region, Ontario, Canada (%)



Note: Active PCS = 47.7 $\pm$ 7.8

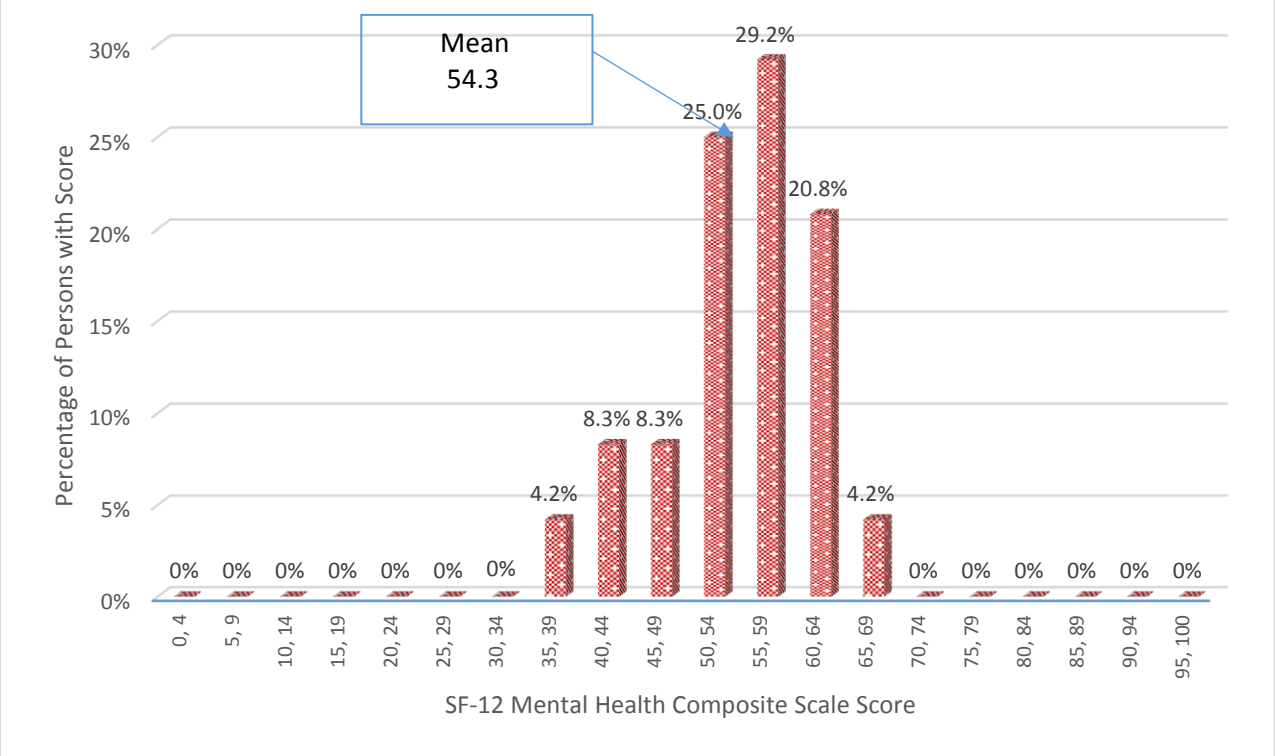
Figure 4.4 Medical Outcomes SF-12 physical health composite scale scores, inactive older females aged 65 and over (N=16), Durham Region, Ontario, Canada (%)



Note: Inactive PCS= 30.1 ± 7.8

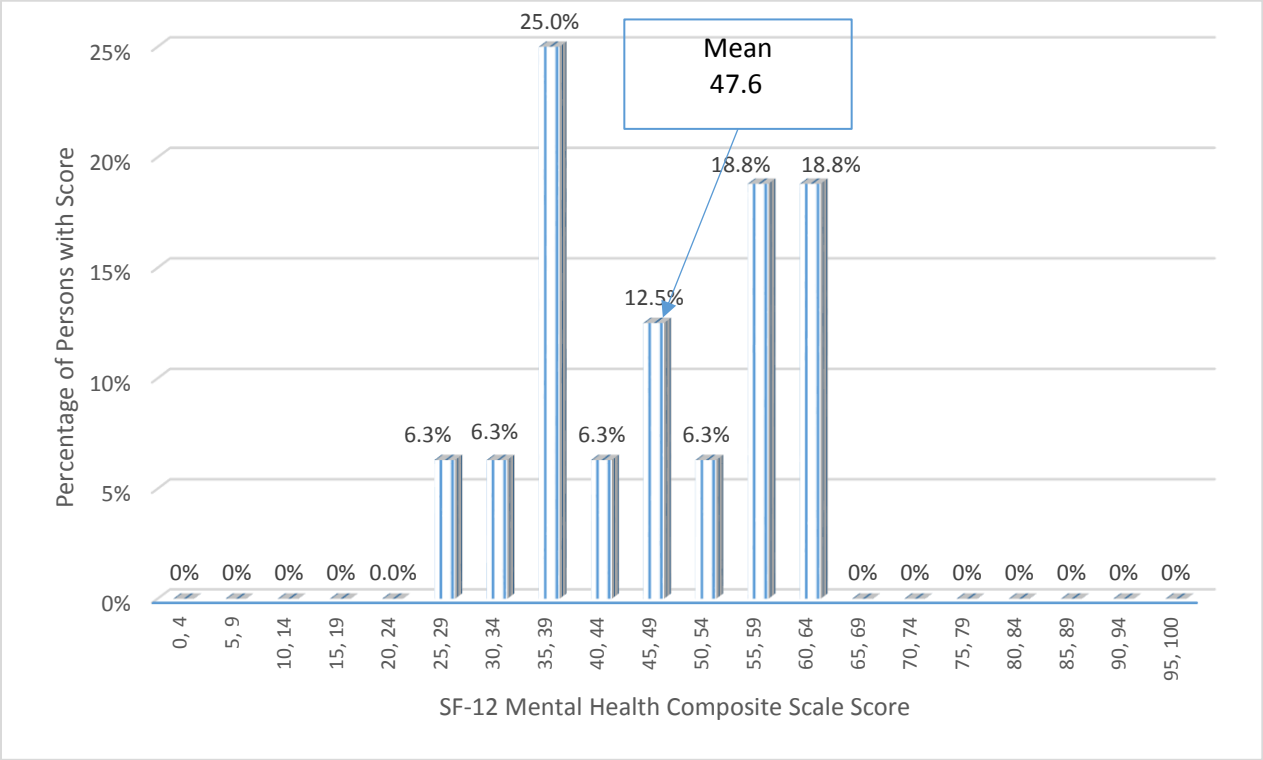
Figures 4.5 and 4.6 (below) illustrate graphic representations of the computed MCS in active and inactive arthritic older females. The calculated MCS mean difference score for the active arthritic sample was higher (54.3 ± 7.4, p=0.05), when compared to their inactive counterparts (47.6 ± 11.5). Interestingly, results showed that 54.2% (N=13) of the active arthritis sample reported above average MCS-12 scores, in comparison to only 50% (N=8) of the inactive arthritis sample. In addition, findings showed 45.8% (N=11) of the active arthritis sample reported below average MCS-12 scores, in comparison to 50% (N=8) of the inactive arthritis sample.

Figure 4.5 Medical Outcomes SF-12 mental health composite scale scores, active older females aged 65 and over (N=24), Durham Region, Ontario, Canada (%)



Note: Active MCS= 54.3 $\pm$ 7.4

Figure 4.6 Medical Outcomes SF-12 mental health composite scale scores, inactive older females aged 65 and over (N=16), Durham Region, Ontario, Canada (%)



Note: Inactive MCS= 47.6 ± 11.5

4.5 Pearson Correlation Analysis

The following tables (below) provide the reader with a comparative overview of the results showing the relationships between age and leisure-time associated physical activity and/or exercise energy expenditures (in kkds) in relation to various health outcomes in active, inactive or combined older females with arthritis. Table 4.14 suggests a moderately strong significant correlation between the total kkds of leisure-time physical activities or exercises among active and inactive arthritic older females and mobility levels ($r=.55$, $p<0.01$). Moderate but significant correlations were also observed between total kkds of leisure-time activities and VAS health-related quality of life (HRQOL) levels

(r=.41, p<0.01) and SF-12 physical composite scores (PCS) (r=.47, p<0.01). Additionally, there is a strong correlation between total kkds of leisure activities and VAS physical function levels (r=.57, p<0.01). Moreover, there are moderate (negative) correlations between total kkds of PA or exercise (leisure) and VAS pain levels (r= -.45, p<0.01) and VAS discomfort levels (r= -.43, p<0.01). Interestingly, there is a negative moderate correlation between total leisure-time PA or exercise kkds of active versus inactive arthritic older females and age (r= -.50, p<0.01).

Table 4.14 Pearson's correlation coefficient (r) between the total kkds of leisure-activity and health outcomes in active and inactive older females, 65 years and above, Durham Region of Ontario, Canada (combined)

	Age	AD	VP	VD	VROM	VM	VPF	VHRQOL	PCS	MCS
Total PA/EX kkds	-.50**	-.25	-.45**	-.43**	.28	.55**	.57**	.41**	.47**	.18
Age		.60**	.61**	.54**	-.30	-.33*	-.25	-.36*	-.56**	-.02
AD			.40*	.42**	-.07	-.16	-.15	-.18	-.41*	-.10
VP				.88**	-.64**	-.65**	-.58**	-.51**	-.69**	-.31*
VD					-.57**	-.63**	-.61**	-.57**	-.65**	-.38*
VROM						.81**	.73**	.56**	.71**	.32*
VM							.82**	.59**	.68**	.45**
VPF								.78**	.75**	.48**
VHRQOL									.71**	.47**
PCS										.29

AD= Age of diagnosis; MCS= Mental Composite Score (SF-12); PA/EX= Physical activity/exercise (leisure-time); PCS= Physical Composite Score (SF-12); VD= VAS Discomfort; VHRQOL= VAS Health-related Quality of Life; VM= VAS Mobility; VP= VAS Pain; VPF= VAS Physical Function; VROM= VAS Range of Motion.

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.15 (below) shows no findings of significant correlations between the total leisure-time activities/exercise kkds and specific arthritis-related health outcomes in active arthritic older females. There are, however, associations found between these various health outcomes. Table 4.15 outlines a strong correlation between VAS pain and VAS

discomfort levels (r=.69, p<0.01) in the active sample. There are also strong and moderate correlations between VAS ROM and VAS mobility levels (r=.73, p<0.01), VAS physical function levels (r=.57, p<0.01) and PCS-12 (r=.49, p<0.05) in active older females. Moreover, there are strong correlations between VAS physical function levels and VAS mobility levels (r=.65, p<0.01), VAS HRQOL rates (r=.62, p<0.01) and PCS-12 (r=.67, p<0.01). In addition, strong correlations were observed for VAS HRQOL and PCS-12 (r=.53, p<0.01) and MCS-12 (r=.60, p<0.01) in this active sample.

Table 4.15 Pearson's correlation coefficients (r) between the total kkds of leisure-activity and health outcomes in active older females, 65 years and above, Durham Region of Ontario, Canada

	Age	AD	VP	VD	VROM	VM	VPF	VHRQOL	PCS	MCS
Total PA/EX kkds	-.22	.08	.03	-.02	-.21	.17	.24	-.13	-.15	-.24
Age		.47*	.14	.06	.18	-.03	.19	.24	-.14	.09
AD			.14	.29	.52*	.24	.29	.22	.01	-.07
VP				.69**	-.39	-.35	-.28	.17	-.37	.20
VD					-.16	-.30	-.33	-.10	-.29	-.20
VROM						.73**	.57**	.33	.49*	.08
VM							.65**	.26	.37	.14
VPF								.62**	.67**	.22
VHRQOL									.53**	.60**
PCS										.15

AD= Age of diagnosis; MCS= Mental Composite Score (SF-12); PA/EX= Physical activity/exercise (leisure-time); PCS= Physical Composite Score (SF-12); VD= VAS Discomfort; VHRQOL= VAS Health-related Quality of Life; VM= VAS Mobility; VP= VAS Pain; VPF= VAS Physical Function; VROM= VAS Range of Motion.

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.16 (below) provides no results of correlations between the total number of kkds of leisure physical activities/exercise and arthritis-related health outcomes in inactive arthritis older females. Interestingly, associations were found between these various health outcomes. Table 4.16 shows a strong correlation between inactive arthritic older females'

age and VAS pain levels (r=.55, p<0.05). There is a strong correlation found between VAS pain and discomfort levels (r=.87, p<0.01). Additionally, a strong negative correlation was observed between VAS pain and ROM levels (r= -.65, p<0.01) in the inactive sample. There are strong negative correlations between VAS discomfort and VAS ROM levels (r= -.75, p<0.01) and VAS mobility rates (r= -.50, p<0.05) among inactive arthritic older females.

There are strong correlations observed between inactive arthritic older females' VAS ROM levels and VAS mobility (r=.68, p<0.01), VAS physical function levels (r=.58, p<0.05) and PCS-12 (r=.65, p<0.01). Additionally, there are strong correlations between VAS mobility levels and VAS physical function rates (r=.68, p<0.01) and MCS-12 (r=.55, p<0.05). Furthermore, there are strong correlations found between VAS physical function levels and VAS HRQOL rates (r=.59, p<0.05) and MCS-12 (r=.57, p<0.05) among inactive arthritic older females.

Table 4.16 Pearson's correlation coefficient (r) between the total kkds of leisure-activity and health outcomes in inactive older females, 65 years and above, Durham Region of Ontario, Canada

	Age	AD	VP	VD	VROM	VM	VPF	VHRQOL	PCS	MCS
Total PA/EX kkds	-.19	.14	-.35	-.07	-.08	-.06	.09	.12	.18	.46
Age		.49	.55*	.47	-.21	.31	.27	-.22	-.36	.33
AD			-.23	.09	-.34	.26	.27	.07	-.34	.20
VP				.87**	-.65**	-.44	-.30	-.48	-.48	-.34
VD					-.75**	-.50*	-.43	-.49	-.46	-.25
VROM						.68**	.58*	.28	.65**	.33
VM							.68**	.24	.25	.55*
VPF								.59*	.17	.57*
VHR QOL									.27	.10
PCS										-.03

AD= Age of diagnosis; MCS= Mental Composite Score (SF-12); PA/EX= Physical activity/exercise (leisure-time); PCS= Physical Composite Score (SF-12); VD= VAS

Discomfort; VHRQOL= VAS Health-related Quality of Life; VM= VAS Mobility; VP= VAS Pain; VPF= VAS Physical Function; VROM= VAS Range of Motion.

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4.6 Summary

In conclusion, the preliminary results propose that via higher leisure-time physical activity (PA) and/or exercise by being active may positively affect various physical and mental health outcomes associated with arthritis in older females, in comparison to being inactive. Notably, the health benefits observed by the active group include lower pain and discomfort levels, and higher health-related quality of life, physical function, range of motion and mobility levels. The primary types of leisure activities for both groups of older females included walking for fun; gardening; stretching, and resistance training. Significant negative correlations were observed for combined total PA/exercise kkds and pain; discomfort, and age outcomes. Moreover, significant strong correlations were found between combined total PA/exercise kkds and mobility; physical function; health-related quality of life, and physical composite scores. Notably, these findings are preliminary in nature and should be interpreted with caution. Additional studies are needed to confirm and/or support the above mentioned evidence on the effects of leisure-time physical activity and/or exercise on the physical and mental health outcomes associated with arthritis in older females. I will discuss the implications of these aforementioned findings in the subsequent chapter (5) entitled “Discussion and Conclusion”.

Chapter 5

Discussion and Conclusion

The aim of this research was to assess potential positive arthritis-related health outcomes associated with being active versus inactive in older females in the Durham Region in Ontario, Canada. The results of this study add to the growing body of evidence suggesting that by being active and participating in leisure physical activity/exercise results in positive physical and mental outcomes prominent in arthritis including: (i) Lower pain and discomfort; (ii) higher health-related quality of life (HRQOL); (iii) higher physical function; (iv) higher range of motion (ROM), and/or (v) higher mobility. To my knowledge, this is the first study to examine these cumulated arthritis-related health outcomes associated with total leisure-type physical activity/exercise levels (e.g. walking, gardening) among older females in the Durham Region.

Arthritis is a chronic, non-communicable disease (NCD) that typically affects older adults. With the increasing older adult population, the prevalence of arthritis is expected to rise. It is estimated that by 2041, there will be 9.2 million Canadians over the age of 65 years (Bartfay & Bartfay, 2016), and arthritis rates will virtually double (Public Health Agency of Canada [PHAC], 2011). Physical activity and/or exercise are prominent interventions in arthritis treatment and/or management. In this study and in the empirical literature, being active corresponds to the average leisure-time physical activity energy expenditure (LTPAEE) values that are greater than 1.5 kilocalories per kilogram (>1.5kkd). Inactive, by contrast, represents average LTPAEE values of less than or equal to 1.5 kilocalories per kilogram (≤1.5kkd) (Bryan & Katzmarzyk, 2009 & Statistics Canada, 2015). Previous research suggests that the majority of older adults in Canada are inactive and currently less than 15% are meeting PA guidelines (Public Health Agency of Canada, 2014 & Statistics Canada, 2014). In this study, findings suggest that active older females

have significantly higher amount of kilocalories per kilogram (kkds) of body weight per day participating in leisure PA/exercise, in comparison to inactive counterparts. Moreover, this study's results found that active older females reported significantly higher amounts of time (in minutes) per week participating in leisure PA/exercise, in comparison to inactive older females. Specifically, the most prominent activities for the older females included: (i) Gardening; (ii) walking for fun; (iii) resistance training (e.g. using weights, elastic bands), and (iv) stretching. Additionally, significant moderate-to-strong correlations were reported between combined active and inactive total PA and exercise kkds and various health outcomes. Moreover, although not statistically significant, small-to-moderate correlations were found between PA and exercise kkds in active older females and the following health outcomes: (i) Pain; (ii) discomfort; (iii) range of motion (ROM); (iv) mobility; (v) physical function, and (vi) health-related quality of life (HRQOL).

5.1 Hypothesis One

This study hypothesized that active older females will report lower levels of pain and/or discomfort, in comparison to inactive females in the Durham Region of Ontario. The results of this study indicate that hypothesis one is supported. Based on the findings, active arthritic older females reported lower pain and discomfort levels from the visual analog scale (VAS) and Medical Outcomes Short Form-12 (SF-12) scores, in comparison to inactive arthritis older females. Nonetheless, I acknowledge that these are all preliminary findings that should be interpreted with caution until they are replicated by other researchers.

For pain outcomes, these findings are consistent with studies by Chmelo et al., (2013) and Bosomworth (2009) that reported reduced pain in older adults with knee osteoarthritis

(OA) in moderate-intensity (MI) PA or exercise interventions. The results of my present study were also consistent with studies conducted by Cooney et al., (2011) and Scarvell & Elkins, (2011) who reported decreased pain in adults with rheumatoid arthritis (RA). The interventions from other studies such as aerobic exercise interventions including walking, running, swimming and cycling were similar to the ones identified by the respondents. However, my study combined various other leisure types of physical activity and exercise forms, and focused on older females with different types of arthritis. Pelland et al., (2004) and Roddy et al., (2005) investigated pain outcomes between aerobic (e.g. walking) and strengthening exercises (e.g. using weights) in adults with knee OA. The researchers found those who participated in the strengthening and aerobic exercise group reported decreased pain in the affected joint(s), providing benefits for pain management, in comparison to the control group. Moreover, Pelland et al., (2004) observed an indirect effect between quality of life and pain.

Studies conducted by Baker et al., (2001), Evcik & Sonel, (2002) and Tak et al., (2005) reported decreased pain in adults with arthritis who participated in forms of strengthening exercise. Baker et al., (2001) and Evcik & Sonel, (2002) suggested major reductions in pain in adults with knee OA who participated in home-based progressive strength training. Moreover, similar to my study, Tak et al., (2005) focused on older adults and reported decreased pain for those in the strength training exercise programme with hip OA. However, their study was based in the Netherlands and only centred around OA and strengthening exercises, whereas my study included various activity forms categorized between active versus inactive, as opposed to implementing an exercise/physical activity intervention per se.

The results of this current study are also consistent with Bartels et al., (2009), Waller et al., (2014) and Cochrane et al., (2005) who found lower pain in adults and older adults with lower limb OA through aquatic exercises. Although their results did not examine differences between active versus inactive lifestyles per se. Here, aquatic activity interventions were studied and pain levels were self-reported using visual analog scales (VAS) and/or the Medical Outcomes Short Form-12 (SF-12), which were questionnaires used in my current study to measure pain outcomes. Their studies also only examined the effects of aquatic exercise exclusively, yet my study assessed various activity/exercise types on health outcomes (e.g. walking, biking, bowling).

The findings of my study are also in accordance with Deyle et al., (2000) and (2005) who examined the effects of manual physical therapy (e.g. passive movements and stretching) and supervised knee exercises (e.g. strengthening, stretching and stationary bicycle) on pain in adults with knee OA. Moreover, the results of my study are also in agreement with studies conducted by Fransen et al., (2014) and (2015) who reported reduced pain in adults with knee or hip OA. Their trials included land-based exercise regimens including muscle strengthening, aerobic fitness, functional training and/or tai chi. Golightly et al., (2015) also implemented various land-and/or aquatic-based exercises (e.g. aerobic, endurance, strength with and without weights, and balance training). Similarly, all of these results revealed lower pain through self-reported questionnaires (e.g. SF-36). However, these investigations did not focus on the older adult population or include as many activities to determine active versus inactive lifestyles as was done in my investigation.

Since the present study incorporated various activity and exercise types, other additional studies cumulated other forms of activity/exercise to assess its effect on pain outcomes. Tanaka et al., (2013) combined non-weight bearing (e.g. swimming, bicycling) and weight bearing (e.g. weight training) exercises and observed reductions in pain in persons with knee OA. Moreover, short-term non-weight bearing exercises were most effective at relieving pain. In contrast, my study focused on older females with differing types of arthritis. Similar to my study, Wang et al., (2009) recruited 40 older adults with knee OA and observed decreases in pain levels in the "*tai chi active group*". Their study also utilized similar self-reported measures (e.g. VAS, SF-36), however, my study included many other activity types to categorize between active versus inactive.

In contrast to the findings of my present study, Breedland et al., (2011), Hurkmans et al., (2009) and Fernandes et al., (2010) reported no significant changes in pain in individuals with rheumatoid arthritis (RA) or osteoarthritis (OA). The researchers implemented exercise regimens including bicycle training; muscle circuit; aquatic; land-based (e.g. muscle strengthening, aerobic exercise), and sports exercises. Their results incorporated varying activity/exercise types as per my study, however they did not focus on the older adult population and were primarily intervention-based. Similar to my study, Davey & Cochrane (2004) categorized between sedentary or active and implemented an aquatic exercise programme for older adults with knee and/or hip OA. The researchers revealed no significant changes in pain outcomes among active or sedentary study subjects. However, their results focused only on OA, whereas my study included multiple arthritis types. Moreover, in contrast to my present study, Jan et al., (2008), Juhakoski et al., (2011) and Hale et al., (2012) focused on older adults with knee or hip OA. Their findings revealed

no significant reductions in pain in older adults through participating in high/low resistance; strengthening, or aquatic exercises. This may be explained by Bartels et al., (2009) who provided evidence that PA/exercise interventions can be more beneficial for those with knee arthritis (lower limb), in comparison to arthritis in the hip.

Additionally, this study is the first of my knowledge to report specific pain descriptors in older Canadian females, which include stabbing; throbbing; shooting; cramping; sharp; burning/hot; aching; tender, and heavy pain sensations most relative to arthritis from visual analog scale (VAS) scores. As there are more than 100 types of arthritis and related diseases, each form causes pain in varying ways. For example, osteoarthritis (OA) can cause "*aching pain*" in affected joint(s), whereas fibromyalgia can result in a "*shooting-type pain"*, as it is considered a central pain syndrome (Arthritis Foundation, n.d.). Interestingly, in this present study, active older females reported significantly higher levels of tender pain, when compared to their inactive counterparts.

Since my study investigated specific types of pain experienced, there was also a collective assessment of pain/discomfort in specific body regions including upper body neck; shoulder(s); spine; finger(s)/hand(s); wrist(s), and elbow(s). Lower body areas included hip(s); knee(s); ankle(s), and toe(s). The results indicated that older females experienced pain and discomfort primarily in the hands/fingers, knees and spine regions. Specifically, in the active arthritis sample, the majority (50% or over) of older females reported pain and discomfort in the hands/fingers and/or knees regions. Additionally, inactive arthritic older females primarily (50% or over) reported pain and discomfort in more upper body areas including the shoulders, spine, hands/fingers and/or knees regions, respectively. My study is the first of my knowledge to assess pain/discomfort outcomes in

specific body regions of older Canadian females with arthritis who are either active versus inactive. Interestingly, according to the literature, greater improvements in pain are observed in persons with lower limb arthritis pain (e.g. knee) through PA or exercise. This is consistent with a study done by Bartels et al., (2009) that found significant effects on various health outcomes (i.e. pain, physical function) through an aquatic exercise intervention in persons with knee OA. Contrarily, no effects were observed in the same intervention group for persons with hip OA. This may suggest that PA/exercise interventions are more beneficial for those with knee arthritis, in comparison to arthritis in the hip.

In the present study, an association was observed between PA/exercise levels and discomfort levels. Specifically, active arthritic older females reported lower discomfort levels, in comparison to their inactive counterparts. Moreover, to my knowledge, my study is the first to report on discomfort levels in older Canadian females with arthritis. Notably, these are all preliminary and self-reported findings that should be interpreted with caution.

In contrast, according to Hernandez-Molina et al., (2008) and Lund et al., (2008), individuals with knee and hip OA participating in varying exercise programmes reported adverse reactions of discomfort in their affected joint(s). Exercise interventions included aerobic, strengthening, aquatic or land-based exercises. Regardless of the inconsistent nature of some of these studies, the evidence from the majority of these studies and my present investigation suggest a strong association between being active by higher leisure PA/exercise levels and lower pain and/or discomfort levels in general and specific body regions.

5.2 Hypothesis Two

It was hypothesized that active older females will report higher health-related quality of life (HRQOL) levels, in comparison to their inactive counterparts in the Durham Region of Ontario. Based on the VAS and SF-12 results, this hypothesis is supported. Specifically, my study found a moderate significant correlation between active and inactive (combined) total PA/exercise levels (in kkds) and HRQOL levels.

These findings were consistent with studies done by Abell et al., (2005) and Austin et al., (2012) who reported improved HRQOL in active PA groups compared to impaired HRQOL in inactives. According to Austin et al., (2012), the higher HRQOL may be associated with less pain, greater physical function and mental health in the active individuals. Conversely, the decreased HRQOL may be associated with age, sex, race, marital status and employment status. My study observed a significant moderate (negative) correlation between age and HRQOL levels in active and inactive older females with arthritis. Additionally, my study further found strong significant correlations between physical functioning and physical composite score (i.e. bodily pain, general health, role physical) and HRQOL levels in the active sample.

The studies by Abell et al., (2005) and Austin et al., (2012) similarly used adults with arthritis of all types. These were also the only studies to similarly categorize subjects as active versus inactive by adhering to the US PA guidelines, which are virtually the same as Canada's Physical Activity guidelines. However, to my knowledge, my findings are the first to report on older female Canadians with arthritis who are active versus inactive in nature. Moreover, specific leisure-time PA and exercises were found to not only improve HRQOL outcomes in older women with arthritis (i.e. osteoarthritis [OA], rheumatoid

arthritis [RA], scleroderma), but also lowered complaints related to pain and discomfort; range of motion (ROM); physical function, and mobility. This result is somewhat in agreement with a study by Pelland et al., (2004) that reported that improvements in quality of life (QOL) will indirectly affect pain.

Fransen et al., (2001) also reported improvements in HRQOL. Moreover, Fransen et al., (2001) included only subjects with knee OA and implemented physical therapy interventions, which consisted of both passive and active forms of exercise that sought to promote ROM, strength, endurance, balance, coordination, posture and motor function. Interestingly, the majority of persons in my study also reported suffering from OA. In contrast, Fernandes et al., (2010) reported no significant improvements in HRQOL between hip OA subjects.

A study conducted by Hopman et al., (2000) provided normative data of PCS (50.5 $\pm$ 15.3) and MCS (51.7 $\pm$ 9.1) averages for the Canadian population from the SF-12 to be used for comparative purposes. Compared to these mean values, my study determined that 45.8% of the active arthritis older females sample reported an above average score, whereas 0% of the inactive arthritis older females reported an above average score.

In terms of MCS, my study found 70.8% of active older females reported an above average MCS, in comparison to 43.8% of inactive counterparts. This indicates that active arthritic older females are healthier with improved HRQOL, in comparison to their inactive counterparts. Similarly, Abell et al., (2005) reported that active adults with arthritis reported fewer related physical and mental unhealthy days from the SF-36 scores when compared to the inactive sample. This is also indicative of improved HRQOL in active females as opposed to inactive females.

Although my study focused on HRQOL to determine persons self-reported negative and positive aspects of life which affect physical and/or mental health, various studies measured quality of life (QOL). QOL is a similar construct designed to represent an individual's independence, social activity and well-being, ranging from emotion well-being, material, and/or physical well-being for all people, equally, regardless of health state (Center for Disease Control, 2011). Scarvell & Elkins, (2011) and Pelland et al., (2004) reported improvements in QOL in persons with RA or OA participating in aerobic exercise (AE) or strengthening exercise (SE) interventions. These interventions are similar to certain activities I included in my survey to describe PA or exercise levels (e.g. walking for exercise is an AE, and calisthenics is a SE). However, in my study, multiple activity types were considered, not just one, which were favoured among the older population according to the Canadian Community Health Survey (CCHS, 2007 & 2011). Evidence suggests that aquatic exercises are a beneficial intervention amongst the older generation due to decreased pressure on the affected joint(s). Notably, the findings of the studies by Bartels et al., (2009) and Waller and colleagues (2014) suggested a small, but significant improvement in QOL in adults with knee OA partaking in aquatic exercise, whereas those with hip OA reported no effects on QOL.

In contrast, Tak et al., (2005) implemented an exercise intervention with strength training for persons with hip OA and reported no significant differences in QOL. Additionally, Lund et al., (2008) reported no effects on QOL in persons with knee OA participating in aquatic or land-based exercise interventions. These studies included middle-aged to older adult samples that are similar to my study. However, to my knowledge, my findings are the first to report on the Canadian demographic, which

specifically focused on the older female population. Taken together, the evidence from my study and others suggest a strong and significant association between being active and improved HRQOL in older females with arthritis.

5.3 Hypothesis Three

Hypothesis three stated that active older females with arthritis will report higher physical function, mobility and range of motion (ROM), in comparison to inactive controls. Based on the evidence from my study, this hypothesis is supported. Specifically, although not significant, weak correlations were found between total PA/exercise kkds in active older females and physical function; mobility, and ROM rates.

For physical function levels, this result is consistent with a study conducted by Chmelo et al., (2013) who reported improvements in physical function in older OA subjects enrolled in moderate-intensity activity exercise (i.e. walking, stationary bicycles and strength training). Notably, physical activity was positively correlated with improved physical function. Similarly, my study found a strong significant positive correlation between combined active and inactive total PA/exercise levels (in kkds) and physical function levels. Dunlop et al., (2010) also suggested improved function in adults with knee OA who were physically active. Higher levels of physical activity were also found to preserve function in persons with knee OA. Similarly, their study included self-reported physical activities such as gardening, yard work, walking and sports. However, this study also focused on lifestyle (e.g. housework, volunteer, work-related) activities. In contrast, my study excluded work-related activities and focused on leisure-time activities/exercises only that were appropriate for the older demographic, in accordance with the Canadian

Community Health Survey (CCHS, 2007 & 2011) recommendations and Durham Region senior centre activity guides (Active Oshawa, 2016).

In a study by Bartels et al., (2009), 800 adults with knee and/or hip OA were examined for physical function and other health outcomes. Researchers found a small-to-moderate effect on function and pain in persons with knee OA who participated in aquatic exercises. The findings of my study are consistent with the results of Bartels et al., (2009); however, my study focused on the older Canadian population. Similarly, a study conducted by Cochrane et al., (2005) supports the findings of my study on active older adults who reported improvements in physical function scores and pain. The older adults were randomized into either an aquatic exercise programme (active) or a usual care group. These findings are consistent with my study since my active sample reported higher physical function levels, in comparison to inactive older females. Although my survey incorporated various activity types, not just aquatic exercises, improvements in physical function as well as pain were observed. Although not significant, my study also found a weak (negative) correlation between physical function and pain levels in active arthritic older females, which may explain that when physical function levels improve in active older females, lower pain levels are observed. I acknowledge that these are preliminary findings, which should be interpreted with caution until replicated by other researchers. These results are also consistent with the findings of Golightly et al., (2015) who examined the effects of land-and-aquatic-based exercises on physical function outcomes in people with knee OA. Similar to my study, physical function levels improved for those in aquatic; land-based (e.g. aerobic, endurance, strength and weight training), or mixed aquatic and land-based programmes. The results of my study are also consistent with a study by Waller et al.,

(2014) who investigated the effects of aquatic exercise versus nonexercise on health outcomes associated with lower limb osteoarthritis. The researchers found increased physical function in those who participated in aquatic exercise, although my study incorporated a wider variety of non-intervention leisure physical activities and exercises and concentrated on female Canadian older adults.

In a study by Jan et al., (2009), 106 adults with knee osteoarthritis were randomized into either weight-bearing, nonweight-bearing or no exercise groups to evaluate their associated effects on physical function. The researchers concluded that improvements in physical function were found for both the weight-bearing and nonweight-bearing exercise programmes. The findings of my study are consistent with the evidence of Jan et al., (2009). However, my study focused on Canadian older female adults with different types of arthritis and compared between active versus inactive lifestyles, as opposed to exercise interventions per se. Wang et al., (2009) also concluded that their active group exhibited improvements in physical function, in comparison to those involved in an education and stretching regimen. This study solely focused on Tai Chi as the activity and knee osteoarthritis. In contrast, my study investigated various types of activities and exercises to consider one active including Tai Chi; walking; swimming; gardening; bowling and resistance training. Moreover, my study included many types of arthritis such as rheumatoid arthritis; osteoarthritis (mostly); fibromyalgia; scleroderma, and gout. My present study is also the first to my knowledge to examine this phenomenon in older Canadian females.

In contrast to my study's findings, Hale et al., (2012) found no statistically significant difference in physical function outcomes in older adults with osteoarthritis participating in

aquatic exercises. Additionally, Pisters et al., (2007) reported nonsignificant effects of physical therapy exercises (e.g. aerobic, strength) on self-reported physical function levels in persons with knee and/or hip osteoarthritis. Moreover, Lund et al., (2008) concluded that no effects of aquatic or land-based exercises (e.g. strengthening, stretching) on physical function outcomes in persons with knee osteoarthritis were found. In contrast to the results of Hale et al., (2012); Pisters et al., (2007), and Lund et al., (2008), the findings of my study observed significantly higher physical function levels among the active sample. Taken together, this evidence suggests a link between being physically active and/or engaging in exercise improves physical function levels in older Canadian females with arthritis.

In this present study, active older females reported higher range of motion levels, in comparison to their inactive counterparts. This finding is consistent with that of Munneke & de Jong (2000), who found improved range of motion in persons with rheumatoid arthritis participating in intensive weight-bearing therapy. The weight-bearing therapy included weight training, jogging and other types of exercises, which are similar to some of the leisure physical activities and exercises included in the ALQOA, however my investigation included additional activities and exercises. There are limited studies on range of motion outcomes and physical activity and/or exercise levels, especially among Canadian older adults. Taken together, my findings present an association between living an active lifestyle by higher leisure physical activity and/or exercise levels and improved range of motion in Canadian active arthritic older females.

Additionally, in my study, active arthritic older females reported higher mobility levels when compared to the inactive sample. This current study further concluded a strong significant correlation between combined active and inactive total PA/exercise levels and

mobility. Although not significant, a weak correlation between actives arthritic older females PA/exercise levels and mobility levels was indicated. This finding is in agreement with a study conducted by Davey & Cochrane (2004) who reported small-to-moderate improvements in mobility in older adults aged 60+ years with knee or hip OA who participated in an intervention of an aquatic exercise regimen, in comparison to a nonexercising group. Similar to my findings, health outcomes were compared between exercising and sedentary older adults. To my knowledge, however, my findings are the first to report on the Canadian older demographic with arthritis, specifically females. Similarly, Davey & Cochrane (2004) found better outcomes in physical function for their exercising intervention group. This may be explained by physical function levels being significantly and strongly correlated to mobility rates in my current study within the active sample. Taken together, the evidence from my current study and other investigations suggest a strong and significant association between being active and improved physical function; range of motion, and mobility in older females with arthritis.

5.4 Additional Findings

Interestingly, my current study reported significant differences in age between groups, in which the active group is younger, in comparison to the inactive sample. A small (negative) correlation was observed between PA/exercise (in kkds) and age. This finding is consistent with a study by Chmelo et al., (2013) that reported less PA (in minutes) was correlated to older age. Additionally, my study observed a significant difference in the age of diagnosis. The active sample reported younger age of diagnosis, in comparison to the inactive sample. Interestingly, although not statistically significant, the active group observed longer disease duration, when compared to the inactives for this degenerative

disease. According to Khani, Ziaee, Moradinejad & Parraneh (2013), a younger age of arthritis onset is linked with a family history of arthritis. This finding is in agreement with my study, in which the active sample observed a younger age of onset and more likely to report a family history of arthritis, when compared to the inactive sample. In contrast, the study by Evcik & Sonel, (2002) reported no significant differences in age or disease duration between the home-based exercise, walking or nonexercise groups in adults with knee OA.

This current study also found a significant difference in marital status. The active sample was more likely to report being married, in comparison to the inactive sample. This result is consistent with a study by Dunlop et al., (2010) that reported being married was associated with higher PA levels.

Research also shows that 89% of older Canadians suffer from at least one or more chronic conditions (Public Health Agency of Canada [PHAC], 2009). For Canadian older females, 80% have at least one or more chronic conditions (Statistics Canada, 2013). In my present study, 45% of older females reported arthritis and at least one other chronic condition (e.g. high blood pressure, diabetes, cancer). This can impact one's well-being and health care service usages (e.g. medications, physician visits).

5.5 Study Strengths

Since this study is a cross-sectional study, it was cost and time-effective and easy to conduct. Moreover, no risk to follow-up is noted as data was simultaneously collected at a single point in time. To my knowledge, this is the first Canadian study to propose preliminary research on leisure-time physical activity (LTPA) and exercise levels and

arthritis-related health outcomes. In addition, this is the first study to report total self-reported LTPA outcomes in older females with arthritis in the Durham Region of Ontario, Canada and various arthritis-related health outcomes including pain and discomfort; HRQOL and well-being; ROM; physical function, and mobility. According to the Public Health Agency of Canada (PHAC) (2011) arthritis rates have steadily increased and will continue increasing in the decades to come. Currently, 44% (N= 2 million) of Canadian older adults aged 65 and over live with arthritis. Specifically, this NCD is more prevalent in older females with one-in-two (50%) reporting arthritis, in comparison to one-in-three (35.5%) older males (Statistics Canada, 2015b). These numbers are predicted to increase by one percent every five years, virtually doubling by 2031. By focusing on older women with arthritis, previous research can be expanded on this population who is already at a larger risk of disability, chronic diseases and physical inactivity. This study also employed an easy, quick and inexpensive scale created by the GS named the "Activity Levels Questionnaire for Older Adults (ALQOA)", which was found to be a consistent and reliable (r=0.97) scale. The test-retest reliability was a simple way to test the consistency of the ALQOA and a suitable method to measure stable outcomes that do not necessarily change constantly such as activity levels (Shuttleworth, 2009).

5.6 Study Limitations

The cross-sectional design of this study ensured that causality and temporal relationships could not be established. As such, it cannot be said with certainty that active lifestyles are causing positive health outcomes, or the possibility that these positive health outcomes are leading to active lifestyles. This study employed a non-random convenience sample to recruit participants from several older adult centres in the Durham Region of

Ontario, Canada. I acknowledge that this encompasses a potentially non-representative sample. Therefore, the findings are preliminary and cannot be utilized to generalize among all older females aged 65 and older with arthritis. A high risk of refusals was also considered.

This study only focused on the female demographic and was limited to a specific age range of 65 to 95 years of age only. This can further limit generalizability (Zaccardi, Wilson & Mokrzycki, 2010). The sample size was limited to 40 study participants in total, which may have affected the power and significance of the study. This small sample size may have resulted in the lowered ability of a statistical test to demonstrate outcomes of a sample that are within the population and the lowered ability to detect significant differences between variables (Verial, 2017). For example, the power of the Pearson's correlation test to determine a relationship and/or strength and direction between variables including PA/exercise kkds and pain may have been limited due to the small sample size. This may be more evident in the correlation analyses of the two subdivided active versus inactive groups, which are even smaller, resulting in limited power of the study (Verial, 2017). Hence, these statistical inferences are preliminary and should be taken with caution.

Participants of this study were classified as active versus inactive based on their calculated Leisure-time Physical Activity Energy Expenditure (LTPAEE) from the ALQOA, thus sampling or information bias may have occurred. Sampling bias is when participants selected for the study are different than those not included, and a systematic error in the ascertainment of active versus inactive may arise. Information bias occurs when participants are systematically placed in the wrong groups (e.g. active, inactive) as a result of flawed data collection methods (e.g. self-reported questionnaires) (Gordis, 2014). Self-

reported questionnaires were used in this study. In accordance with this type of data collection method, response or recall bias must be considered. Response bias is when the respondent answers the question in an under-or-over-exaggerated fashion to match their desires or feelings (Bowling, 2005). Hence, the answer may not necessarily be honest or accurate in nature. Recall bias is when a respondent selectively answers a question and forgets to accurately remember past events (e.g. the intensity of pain in the past week) (Gordis, 2014). Notably, these findings are preliminary in nature and need to be interpreted with caution. Moreover, the personalized ALQOA employed a test-retest reliability to measure the consistency of the self-reported questionnaire by looking at the degree of similar test scores from the same individuals under the same situation/condition on two separate occasions (Polit, Beck, Loiselle & Profetto-McGrath, 2007). This method has limitations such as better performance/scores following the first test-taking session, which may lead to score increases (NetIndustries, 2017). Notably, my sample for the test-retest was limited to five individuals (males and females), the majority of whom were aged 25 to 65 years old, which may not be generalized to my study sample (i.e. 65+ females).

Additionally, data was collected from July to August 2016, in which some activity programmes at the participating senior centres stopped functioning during the summer months. Hence, respondents might have had a more limited selection in activities undertaken at the time of sampling.

Lastly, this study did not examine the history of study participants in terms of previous or current injuries, disabilities or surgeries. These could act as potential confounders, which are third variables that may impact health outcomes (e.g. pain associated with knee replacement surgery mistaken for arthritic pain). Moreover, this study found differences in

age, marital status, type of arthritis, age of diagnosis and arthritis family history variables between the active versus inactive samples, which may be confounders. For example, the active sample was more likely to report being married, in comparison to the inactive sample. Previous research shows that being married results in higher activity levels (Dunlop et al., 2010). In regards to age, disability related to chronic disease tends to increase; the risk of OA tends to increase and activity levels tend to decrease (Chmelo et al., 2013), however this may also be a common negative stereotype about older adults in general. In fact, there are certainly expectations to the rule (e.g. older adults competing in marathons who are 90 years old; older adult weight lifting champion Gerda Shupre, or an 86 year old competitive gymnast Johanna Quass) (Bergquist, 2009; "Senior weightlifters dazzle at worlds in Las Vegas", 2012 & Nunez, 2013). Despite these limitations, the evidence contributes to the current empirical body of knowledge that active older females tend to have improved arthritis-related health outcome scores, in comparison to less active females.

5.7 Implications for Future Research

Moving forward, more longitudinal and interventional studies are warranted to broaden the understanding of the relationship of higher leisure-time physical activity (LTPA) and exercise levels in persons with arthritis in the Durham Region of Ontario, Canada. Additional studies should employ larger sample sizes to add power to the study, and additional and/or specific types of physical activity/exercise. This study found an association between higher leisure-time PA and exercise levels and improved health outcomes (e.g. pain, ROM, HRQOL, physical function and mobility), yet my sample size was too limited to determine exactly which PA or exercise type was most beneficial.

My study examined the effects of active versus inactive females, yet the effects of age, being males or ethnicity were not examined. Further studies should be conducted with males and matched according to various age cohorts. An age and sex-matched control study would be beneficial. Evidence suggests that sex, age and race differences were observed in activity levels (Chmelo et al., 2013). Moreover, this would enable a more precise comparison of this study's SF-12 PCS and MCS average scores to the age-and sex-standardized normative scores for Canadians as per the study by Hopman et al., (2000). Additionally, examining and addressing the effects of marital status, the type of arthritis (e.g. OA, RA), age of diagnosis and arthritis family history in future studies would be beneficial. Previous research shows that being married results in higher activity levels, which can be related to changes in health outcomes (e.g. pain levels) (Dunlop et al., 2010). The type(s) of arthritis should also be addressed and specified in future studies (e.g. including only those with OA) as each type differs in etiologies, symptomology, average age of onset, risk factors and treatment options (Arthritis Foundation, n.d.; Dewing, Setter & Slusher, 2012; Roth, 2015).

As the prevalence of arthritis is expected to increase and the population continues to age, research should be conducted involving more management and treatment-based interventions for older adults with arthritis. Research into the implementation and beneficial effects of PA and exercise programmes should be stressed for arthritis research within the Durham Region of Ontario, Canada. Determining which activity types are most effective for managing arthritis symptoms (e.g. pain, limited mobility) should come as a priority. Future studies conducted could also employ a cohort/prospective longitudinal study or intervention-based study with an exercise or PA intervention (e.g. hydrotherapy

to relieve pressure on arthritic joints) at six, 12 or 24 weeks repeated measures test to assess changes over time. Gathering data at baseline (pre) then following up and comparing it post hoc after intervention would provide insight into the prevalence of arthritis symptoms and the degree of effectiveness of LTPA in older adults overtime. This type of research can be important in reducing and improving the burden of disease for older adults with arthritis and the economy.

My study employed self-reported questionnaires as the only data collection tools to obtain subjective information on various health outcomes as rated by the respondent (e.g. pain levels, ROM ability). Additional studies should consider utilizing tools or devices that collect objective measurements of health outcomes. For example, a goniometer can be used to measure specific ROM angles to determine improvements (McGraw Hill Education, 2017) or a Timed Up and Go (TUG) test to objectively assess specific physical function capabilities in terms of standing and walking (Podsiadlo & Richardson, 1991). Moreover, an accelerometer could be utilized to objectively quantify PA levels in various individuals with arthritis (Pruitt et al., 2008).

5.8 Summary and Conclusion

An average of 44% (N= 2 million) of Canadian older adults are currently living with arthritis. Specifically, one-in-two (50%) are females. This study's preliminary results demonstrate that living an active lifestyle through higher leisure-time physical activity (LTPA) and/or exercise levels is related to positive arthritis-related health benefits (e.g. lower pain/discomfort, higher physical function). Specifically, the findings also reveal differences between active and inactive arthritic older females of the Durham Region,

Ontario, Canada in terms of pain; discomfort; physical function; range of motion (ROM); mobility, and health-related quality of life (HRQOL) levels.

There is a dearth of studies that have evaluated the health outcomes and effects of being active versus inactive in older adults with arthritis. This is the first Canadian, cross-sectional study to have examined the effects of leisure physical activity and exercise levels (in kkds) on various arthritis-related health outcomes in older females within the Durham Region of Ontario, Canada. Many other studies to date examined differing associations between PA and HRQOL; exercise and pain, and PA and physical function, however not simultaneously.

In conclusion, this unique study provides results that are preliminary in nature and should be interpreted with caution. Future experimental and longitudinal studies are warranted to examine the understanding of the positive health outcomes associated with being active amongst older adults with arthritis. Get moving Canada!

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APPENDIX A

A Description of Ranking Levels for Literature Review

Levels	Description
Level I	Highest: Systematic reviews of RCTs and nonrandomized clinical trials
Level II	Single RCT or nonrandomized trial
Level III	Systematic reviews of correlation and/or observation studies
Level IV	Single correlation or observation studies
Level V	Systematic reviews of descriptive, physiological and/or qualitative studies
Level VI	Single descriptive, physiological or qualitative study
Level VII	Lowest: Opinions of panels, committees or experts in their field

Source: Bartfay W. J. & Bartfay, E. (2016). *Public Health in Canada 2.0.* Toronto, ON. Kendall Hunt Publishing Company, 1753.

APPENDIX B

Senior Centre Recruitment Sites in the DR, ON, Canada

Name of Facility	**Address**	**Telephone number & e-mail address**	**Director and/or Manager**	**Hours of Operation**
Ajax Senior Citizens Friendship Centre	46 Exeter Road, Ajax	(905) 686-1573 ajaxseniorsclub@gmail.com	President: Fraser Grant	**Mon-Fri:** 9am-4:30pm 7pm-9:30pm
Bowmanville Older Adult Association (BOAA)	26 Beech Avenue, Bowmanville	(905) 697-2856 coaa@bellnet.ca	Executive Director: Angie Darlison	**Mon-Thurs:** 8am-6pm **Fri:** 8:30am-4:30pm
Oshawa Senior Citizens Centre (OSCC)	**Legends**: 1661 Harmony Road, North, Oshawa **John St:** 43 John Street West, Oshawa	(905) 576-6712 info@oscc.ca	Executive Director: Sandy Black Programs & Service Director: Colleen Zavrel	**Mon-Fri:** 8:30am-4:30pm **Sat:** 9am-5pm
South Pickering Seniors Club	910 Liverpool Road, Pickering	(905) 420-5049 spscl@sympatico.ca	Edward Fry	**Mon-Fri:** 9am-4pm **Sat:** 9am-12pm

Village Senior Citizen Centre	29 Linton Avenue, Ajax	(905) 683-8460	Jan Herbert	**Mon:** 10am-12pm **Tues:** 10am-3pm **Wed:** 9am-2pm **Thurs:** 9am-4pm **Fri-Sat:** 1pm-4pm
Carriage House Retirement Residence	60 Bond Street, East, Oshawa	(905) 725-2599	Sylvia C. Ward	

APPENDIX C

Site Letter of Permission

University of Ontario

Institute of Technology

Oshawa, Ontario, Canada

Date: _____

To Mr. / Mrs. _____ (Manager/Director)

Greetings!

I am conducting a research study entitled EFFECTS OF PHYSICAL ACTIVITY AND EXERCISE ON PHYSICAL AND MENTAL HEALTH OUTCOMES OF FEMALE OLDER ADULTS WITH ARTHRITIS as my thesis research requirement for the degree of Master of Health Sciences (MHSc), specialization in Community Health at the University of Ontario Institute of Technology in Oshawa, Ontario.

In connection to this, I would like to take this opportunity to ask for your help and permission in allowing me to recruit study participants on your premises, at the above mentioned location. Specifically, to collect the necessary data and information for my study pertaining to physical activity and exercise, and older female's mental health states and their physical health. Please note that participating is strictly voluntary, and all information and consent will be coded, and informed written consent obtained by all study participants in accordance with UOIT's REB and Tri-Council Policy Statements.

I would appreciate your support and permission in this particular research endeavour.

Thank you very much for your time and cooperation.

Sincerely,

Barbara Piasecka, BHSc
barbara.piasecka@uoit.ca
905-721-8668 ext. 3947
Graduate Student Researcher

Dr. Wally J. Bartfay, RN, PhD
wally.bartfay@uoit.ca
905-721-8668 ext. 2765
Research Supervisor

APPENDIX D

Recruitment Poster

UOIT
CHALLENGE INNOVATE CONNECT
UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

Want to win 1 out of 2 **$25 gift cards**, of your choice?

PARTICIPANTS NEEDED FOR RESEARCH ON *ARTHRITIS AND ACTIVITY*

I am looking for non-smoking female volunteers aged 65+ with arthritis to take part in a study looking at *various health outcomes (e.g. less pain & discomfort) of being active.*

You would be asked to complete 3 short questionnaires measuring your activity and exercise levels, physical and mental health.

Your participation will take approximately 30 minutes and takes place in person at a senior-based facility in the Durham Region.

In appreciation for your time, you will be entered into a draw for ***1 out of 2 $25 gift cards of your choice***.

For more information about this study, or to volunteer for this study, please contact:

Barbara Piasecka
Faculty of Health Science at UOIT, Oshawa, ON
905-721-8668 ext. 3947
Email: ***barbara.piasecka@uoit.ca***

This study has been reviewed by, and received ethics clearance by the UOIT Research Ethics Board. Ref #: 15- 124.

Compliance Officer: compliance@uoit.ca or 905-721-8668 ext. 3693

APPENDIX E

Medical Outcomes Short Form-12 (SF-12) Questionnaire

Question 1. In general, would you say your health is?

	□ **Excellent**	□ **Very good**	□ **Good**	□ **Fair**	□ **Poor**

Question 2. Does your health now limit you in these activities? If so, how much?

	□ **Yes, limited a lot**	□ **Yes, limited a little**	□ **No, not limited at all**
a. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf			
b. Climbing several flights of stairs			

Question 3. During the past week, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

a. Accomplished less than you would like?

b. Were limited in the kind of work or other activities?

	□ **All of the time**	□ **Most of the time**	□ **Some of the time**	□ **A little of the time**	□ **None of the time**

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

a. Accomplished less than you would like?

b. Did work or other activities less carefully than usual?

	☐ **All of the time**	☐ **Most of the time**	☐ **Some of the time**	☐ **A little of the time**	☐ **None of the time**

Question 5. During the past week, how much did pain interfere with your normal work (including both work outside the home and housework)?

	☐ **Not at all**	☐ **A little bit**	☐ **Moderately**	☐ **Quite a bit**	☐ **Extremely**

Question 6. How much of the time during the past week…?

a. Have you felt calm and peaceful?
b. Did you have a lot of energy?
c. Have you felt downhearted and depressed?

	☐ **All of the time**	☐ **Most of the time**	☐ **Some of the time**	☐ **A little of the time**	☐ **None of the time**

Question 7. During the past week, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc)?

	☐ **All of the time**	☐ **Most of the time**	☐ **Some of the time**	☐ **A little of the time**	☐ **None of the time**

APPENDIX F

Health Questionnaire and Visual Analog Scale (VAS)

Subject Code: _____ Date: _____

Part I: Demographic Information

Please provide the following information about yourself, and circle which applies best:

1. What is your date of birth? _____

2. How tall are you? _____ feet

3. How much do you weigh? _____ lbs

4. Where do you currently live? _____

Oshawa (1)
Whitby (2)
Ajax (3)
Pickering (4)
Uxbridge (5)
Brock (6)
Scugog (7)
Clarington (8)

5. What is your racial ethnic background? _____

White (1)
Black (2)
Hispanic (3)
Oriental (4)
South Asian (5)
Aboriginal (6)
Pacific Islander (7)
Mixed (8): _____
Other (9) Specify: _____

6. What is your current marital status? _____

Married (1)
Common Law (2)
Separated (3)
Divorced (4)
Widowed (5)
Single (6)

7. What is the highest level of education received? _____

Primary school (JK to grade 8) (1)
High school graduate (grades 9 to 13) (2)
Apprenticeship trade graduate (e.g. plumbing, electrician) (3)
College graduate (4)
University graduate (5)
Professional or graduate school (6)
Other (7) Specify: _____

8. What is your approximate family income including wages, retirement income, welfare and/or disability payment **per year**? _____

Less than $10,000 (1)

$10,000 - $20,000 (2)

$20,000 - $30,000 (3)

$30,000 - $40,000 (4)

$40,000 - $50,000 (5)

$50,000 - $60,000 (6)

$60,000 - $70,000 (7)

More than $70,000 (8)

9. Are you currently: _____

Retired (1)

Working (2)

Unemployed (3)

Other (4) Specify: _____

10. How many hours on average do you sleep per night during the regular work week, Monday to Friday? _____

0 to 2 hours (1)

2 to 4 hours (2)

4 to 6 hours (3)

6 to 8 hours (4)

8 to 10 hours (5)

10 + hours (6)

11. How many hours on average do you sleep per night on the weekend, Saturday to Sunday? _____

0 to 2 hours (1)

2 to 4 hours (2)

4 to 6 hours (3)

6 to 8 hours (4)

8 to 10 hours (5)

10 + hours (6)

Part II: Arthritis History

12. What kind of arthritis do you have? _____

Rheumatoid Arthritis (1)

Osteoarthritis (2)

Systemic Lupus Erythematosis (3)

Fibromyalgia (4)

Scleroderma (5)

Psoriatic Arthritis (6)

Reiter's Syndrome (7)

Gout (8)

Other (9) Specify: _____

13. How many years have you had arthritis? _____

14. At what age were you first diagnosed with arthritis? _____

15. Do you have a family history of arthritis? _____

YES (1) NO (2)

Part III: Health Risk Profile

16. I am currently taking prescription medications for the management of my arthritis?

YES (1) NO (2)

If yes, please list them.

_____
_____
_____
_____

17. I am currently taking over-the-counter (OTC) medications for the management of my arthritis?

YES (1) NO (2)

If yes, please list them.

_____
_____
_____
_____

18. I am currently taking prescription medications to manage pain or discomfort due to my arthritis?

YES (1) NO (2)

If yes, please list them.

_____
_____
_____
_____

19. I am currently taking over-the-counter (OTC) medications to manage pain or discomfort due to my arthritis?

YES (1) NO (2)

If yes, please list them.

_____
_____
_____
_____

20. In the past month, have you smoked?

YES (1) NO (2)

21. In the past month, have you consumed alcohol?

YES (1) NO (2)

22. In the past month, have you used any assistive devices or braces (e.g. knee braces, canes, walkers etc) that may limit mobility?

YES (1) NO (2)

23. Is your health currently affected by any of the following medical issues?

	Yes (1)	No (2)
High blood pressure	____	____

Heart disease	____	____
Cancer	____	____
Depression	____	____
Anxiety	____	____
Diabetes	____	____
Alcohol or drug use	____	____
Kidney disease	____	____
Lung disease	____	____
Liver disease	____	____
Ulcer or other stomach disease	____	____
Anaemia or other blood disease	____	____

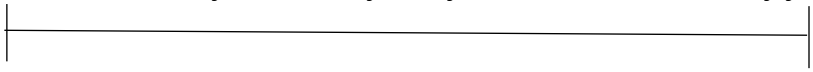
Other: (please specify)

_____

Part IV: Visual Analog Scale

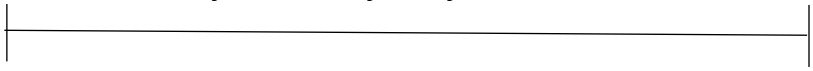
On a scale of 0 – 4, please rate the following, in terms of your health, and circle which best applies to you on the scale:

24. How would you currently rate your level of PAIN in any joint(s)?



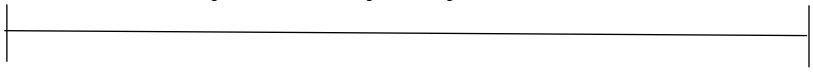
0	1	2	3	4
No pain	**Mild**	**Distressing**	**Horrible**	**Excruciating**

25. How would you currently rate your level of DISCOMFORT in any joint(s)?



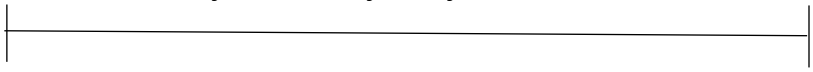
0	1	2	3	4
No discomfort	**Mild**	**Distressing**	**Major**	**Horrible**

26. How would you currently rate your RANGE OF MOTION of any joint(s)?



0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

27. How would you currently rate your level of MOBILITY of how you get around?



0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

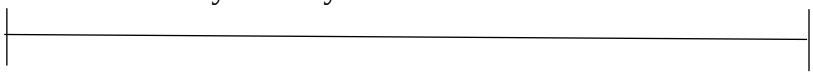
28. How would you rate the overall PHYSICAL FUNCTIONING?

0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

29. How would you rate your current HEALTH-RELATED QUALITY OF LIFE?

0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

30. How would you rate your overall PHYSICAL HEALTH?

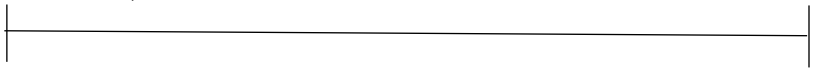


0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

31. How would you rate your overall MENTAL HEALTH?

0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

32. How would you currently rate your SOCIAL HEALTH (e.g. interactions with others)?

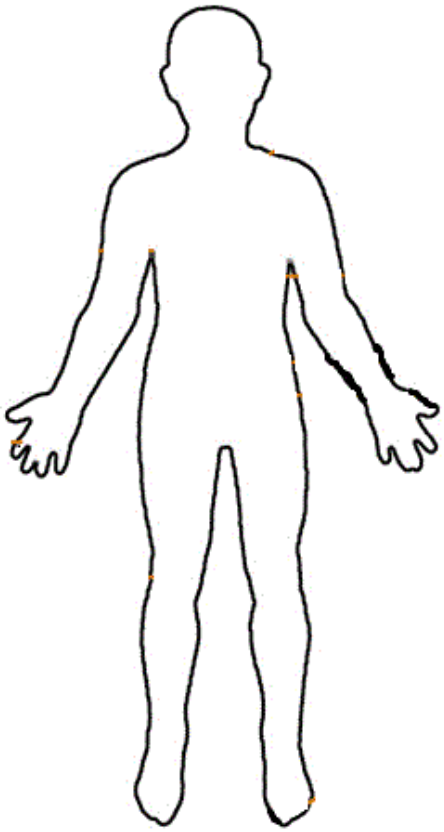


0	1	2	3	4
Very poor	**Poor**	**Good**	**Very good**	**Excellent**

33. Please rate the following pain components on a scale of 0 - 4, as best applies to you and the affected joint(s). Mark with an X.

	None (0)	**Mild (1)**	**Moderate (2)**	**Severe (3)**	**Excruciating (4)**
Stabbing	_____	_____	_____	_____	_____
Throbbing	_____	_____	_____	_____	_____
Shooting	_____	_____	_____	_____	_____
Cramping	_____	_____	_____	_____	_____
Sharp	_____	_____	_____	_____	_____
Burning/Hot	_____	_____	_____	_____	_____
Aching	_____	_____	_____	_____	_____
Tender	_____	_____	_____	_____	_____
Heavy	_____	_____	_____	_____	_____

34. Please indicate and shade in the area(s) you feel pain and discomfort.



Thank you for completing this questionnaire! ☺

APPENDIX G

Activity Levels Questionnaire for Older Adults (ALQOA)

Subject Code: _____ Date: _____

The following scale is concentrated on your activity levels. Please answer each question as best to your ability.

We'd like to see in a **typical week**, how often and how long you partake in specific forms of physical activity and exercise. Please answer each question to the best of your ability **on average in the past week**.

1. Did you do **GARDENING?** **YES** **NO**

- (Ex: Planting, watering, racking, weeding, pruning, mowing the lawn, decorating)
  a) If yes, how many **minutes per week?** _____
  b) How many **days per week?** _____
  c) What was your **level of effort or exhaustion?**

  - ☐ **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
  - ☐ **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
  - ☐ **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

2. Did you do **YARD WORK?** **YES** **NO**

- (Ex: Digging, chopping wood, lifting, mowing law with hand mower)

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)

- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)

- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

3. Did you go on a **WALK FOR FUN?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)

- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)

- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

4. Did you go **WALKING FOR EXERCISE?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

5. Did you go **BOWLING/LAWN BOWLING?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

6. Did you play **GOLF?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

7. Did you go **DANCING (social, ballroom, tap, line etc)?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

8. Did you go **BICYCLING?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

9. Did you play **CURLING?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

10. Did you play **SHUFFLEBOARD?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

11. Did you play **TENNIS/SQUASH?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

12. Did you go **SWIMMING FOR FUN?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

13. Did you go **LANE/LAP SWIMMING?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

14. Did you go **JOGGING?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

15. Did you engage in **CALISTHENICS?** **YES** **NO**

- (Ex: Push ups, sit ups, pull-ups)

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

16. Did you do any **RESISTANCE TRAINING?** **YES** **NO**

- (Ex: Using weights, elastic bands)

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)

- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)

- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

17. Did you do **STRETCHING?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)

- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)

- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

18. Did you do **YOGA?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

19. Did you do **TAI CHI?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

20. Did you do **WATER AEROBICS?** **YES** **NO**

a) If yes, how many **minutes per week?** _____
b) How many **days per week?** _____
c) What was your **level of effort or exhaustion?**

- **1 - LIGHT** (comfortable, minimal sweating, heart beats slightly faster, can talk)
- **2 - MODERATE** (increased sweating, slight breathlessness, heart beats faster than normal, can talk with difficulty)
- **3 - VIGOROUS** (sustained sweating, heart rate increases a lot, difficulty breathing, can't talk)

21. Did you engage in any other form of exercise or activity in an average week?

YES **NO**

If yes, please list them with duration and frequency: *Ex: Badminton- 30 mins, 2 days a week, MI.*

_____
_____
_____
_____
_____
_____

Thank you for completing this questionnaire ☺

APPENDIX H

Letter of Invitation

RESEARCH TITLE: RESEARCH TITLE: EFFECTS OF PHYSICAL ACTIVITY AND EXERCISE ON PHYSICAL AND MENTAL HEALTH OUTCOMES IN FEMALE OLDER ADULTS WITH ARTHRITIS

Greetings!

My name is Barbara Piasecka and I would like to invite you to participate in a research study examining the various health-related benefits associated with physical activity and exercise on older females living with arthritis in the Durham Region of Ontario, Canada. This study is being conducted in partial fulfillment of my Masters of Health Sciences degree at the University of Ontario Institute of Technology (UOIT).

The aim of this study is to identify the potential health-related benefits of physical activity and exercise related to various physical and mental outcomes. Eligible participants are older Canadian females, with arthritis, aged 65 and above, living in the Durham Region in Ontario. Through your participation, I hope to determine the potential physical and/or mental health-related benefits associated with arthritis in older females (i.e. lower pain and discomfort levels, higher physical function and health-related quality of life scores).

Any further questions or concerns can be gladly answered by me, so please do not hesitate to contact me at (905) 721-8668 ext. 3947 or barbara.piasecka@uoit.ca

Any questions regarding your rights as a participant, complaints or adverse events may be addressed to Research Ethics Board through the Ethics and Compliance Officer – researchethics@uoit.ca or (905) 721-8668 ext. 3693.

Thank you.

Graduate Student
Barbara Piasecka, BHSc
MHSc Candidate
Faculty of Health Sciences
UOIT
barbara.piasecka@uoit.ca
(905) 721-8668 ext. 3947

Faculty Supervisor
Dr.Wally J.Bartfay, RN, PhD
Associate Professor
Faculty of Health Sciences
UOIT
wally.bartfay@uoit.ca
905-721-8668 ext. 2765
Fax: 905-721-3189

APPENDIX I

Consent Form

RESEARCH TITLE: EFFECTS OF PHYSICAL ACTIVITY AND EXERCISE ON PHYSICAL AND MENTAL HEALTH OUTCOMES IN FEMALE OLDER ADULTS WITH ARTHRITIS

You are being cordially invited to participate in a study being conducted by Barbara Piasecka (MHSc Candidate) and Dr. Wally J. Bartfay from the Faculty of Health Sciences (FoHS) at the University of Ontario Institute of Technology (UOIT) in Oshawa, Ontario, Canada. This study is being performed in partial fulfillment of my Masters of Health Sciences degree by Ms. Piasecka, and is being supervised by Dr. Wally Bartfay. This study has been reviewed by the Research Ethics Committee and received clearance through the Research Ethics Board (REB) on the following date June 23, 2016 (REB file # 15-124).

Study Purpose

The aim of the study is to identify the potential health-related benefits of physical activity and exercise in older Canadian females with arthritis, aged 65 and above, localized within the Durham Region in Ontario, related to various physical and mental outcomes, in comparison to inactive controls.

Procedures

If interested in participating in this study, you will be asked to complete three brief paper and pencil-style self-reported questionnaires. The questionnaires consist of questions about yourself, your age, your socioeconomic status (SES), your education, health-related questions and your lifestyle. Other questions include how you are feeling, and behaviours and attitudes towards activity. This entire process will take about 30 minutes to complete. Please note that the collected information will be primarily used for this study and may be used for other research as secondary data.

Potential risks

If there are any questions or tasks that make you feel uncomfortable, inappropriate or are too difficult to complete, you have the right to refuse. There may be a psychological risk where you may feel demeaned, worried, embarrassed answering certain questions. If so, you have the right to skip the question or refuse to answer. We do not anticipate you will experience pain, discomfort or unease when participating in this study.

Potential benefits

Through your participation in this study, you can help identify plausible positive health outcomes associated with physical activity and exercise in female seniors with arthritis. Also, this study may show prevention methods resulting in positive and beneficial health states associated with an active lifestyle.

Compensation

Should you choose to participate in this study, your name will be entered into a random draw for a chance to win 1 out of 2 gift certificates of your choice, valued at $25 each. Must complete all questionnaires to be entered in the draw.

Confidentiality

All personal and health information, and questionnaire answers will be strictly confidential. The gathered information will be kept in a file under lock and key for a period of 5 years in a locked steel metal filing cabinet in the research supervisor's office, and then destroyed through a shredder. Only the research supervisor and the graduate student will have access to the office in which the cabinet is held. The electronic information and data analyses results will be saved as a file on a secured password protected computer. The electronic data will be destroyed within 5 years after the completion of the study using fileshredder, a free programme that permanently destroys filed from your electronic device that cannot be recovered. Your name will not be written on any questionnaires, documents, papers or publications. All collected data will be coded and will be anonymous. Your name will not appear in any peer-reviewed publications, reports or conference proceedings that may arise from the analysis of the data, and only group findings will be presented and/or published. Hence, no individual findings or names will be disclosed or entered into any data base. Only the supervisor, members of the supervisory committee and the graduate student will have access to the file(s).

Participation/Withdrawal

Participation is strictly voluntary. Withdrawing can be done so at any time, without any pertaining penalties or consequences. Your name will be omitted from any questionnaires, scales, reports, documents and/or publications. It is not be feasible to withdraw your information once data has been anonymized and grouped. The deadline to withdraw is December 1, 2016 after which withdrawal of information is not possible.

Your rights

You may freely choose to consent to partake in this study or not. You also have the right to withdraw your consent at any time throughout the study without any consequences. Any questions regarding your rights as a participant, complaints or adverse events may be addressed to Research Ethics Board through the Ethics and Compliance Officer at researchethics@uoit.ca or (905) 721-8668 ext. 3693. In addition, if you have any further questions, concerns or doubts about this study, feel free to contact myself, Barbara Piasecka at barbara.piasecka@uoit.ca, phone: (905) 721-8668 ext. 3947 and/or my supervisor Dr. Wally Bartfay at wally.bartfay@uoit.ca, phone: (905) 721-8668 ext. 2765. Thank you!

Sincerely,

Barbara Piasecka, B. HSc
MHSc Candidate
Faculty of Health Sciences
UOIT
barbara.piasecka@uoit.ca
(905) 721-8668 ext. 3947

Dr. Wally J. Bartfay, RN, PhD
Associate Professor
Faculty of Health Sciences
UOIT
wally.bartfay@uoit.ca
(905) 721-8668 ext. 2765
Fax: (905) 721-3189

Consent

I consent to partake in this study being conducted by Barbara Piasecka and supervised by Dr. Wally J. Bartfay.

Name of Participant (PRINT): _____

Signature: _____ Date: _____

Witness (Name and Sign): _____ Date: _____

Please enter me for the chance to win 1 of 2 $25 gift certificates.

Information for the $25 gift certificates draw.

Name: _____

Preferred contact (phone or e-mail address):

_____

***Must complete all questionnaires to be entered in the draw.**

APPENDIX J

UOIT REB Approval Letter

Date: June 23, 2016

To: Wally Bartfay (Supervisor)

From: Shirley Van Nuland, REB Chair

REB # & Title: (15-124) Effects of Physical Activity and Exercise on Physical and Mental Health of Female Seniors with Arthritis

Decision: APPROVED

Current Expiry: June 01, 2017

The University of Ontario Institute of Technology Research Ethics Board (REB) has reviewed and approved the research proposal cited above. This application has been reviewed to ensure compliane with the Tri-Council Policy Statement Ethical Conduct for Research involving Human (TCPS2 (2014)) and the UOIT Resarch Ethics Policy and Procedures. You are required to adhere to the protocol as last reviewed and approved by the REB.

Continuing Review Requirements (forms can be found on the UOIT website):

- **Renewal Request Form:** All approved projects are subject to an annual renewal process. Projects must be renewed or closed by the expiry date indicated above ("Current Expiry"). Projects not renewed within 30 days of the expiry date will be automatically suspended by the REB; projects not renewed within 60 days of the expiry date will be automatically closed by the REB. Once your file has been formally closed, a new submission will be requested to open a new file.
- **Change Request Form:** Any changes or modifications (e.g. adding a Co-PI or a change in methodology) must be approved by the REB through the completion of a change request form before implemented.
- **Adverse or Unexpected Events Form:** Events must be reported to the REB within 72 hours after the event occurred with an indication of how these events affect (in the view of the Principal Investigator) the safety of the participants.
- **Research Project Completion Form:** This form must be completed when the research study is concluded.

Always quote your REB file number (15-124) on future correspondence. We wish you success with your study.

REB Chair
Dr. Shirley van Nuland
shirley.vannuland@uoit.ca

Ethics and Compliance Officer
researchethics@uoit.ca

NOTE: If you are a student researcher, your supervisor has been copied on this page.

APPENDIX K

Thank-you Letter

Sub: Letter of Appreciation

Dear Madam,

On account of my successful completion of my research study at the University of Ontario Institute of Technology, I would like to deeply thank you for all your time and effort in helping me realize this study. I believe that passion and perseverance, with the right help and effort will take one's hard work to great lengths. I have always felt the desire to conduct research on arthritis. I was attracted to the local aspect of the Durham Region, and hoped I would somehow benefit this community with the results my research determines.

I greatly appreciate your patience, understanding, excitement, participation, willingness, dedication and kindness throughout this process. I could not have done it without your help!

I would like to thank you for your time and wish you the best for the future! All of your voluntary participation has been greatly appreciated and will never be forgotten.

Thank you!

Sincerely,

Barbara Piasecka

Graduate Researcher

UOIT

APPENDIX L

Senior Centre Approvals

Figure 1. South Pickering Senior's Club Approval E-mail

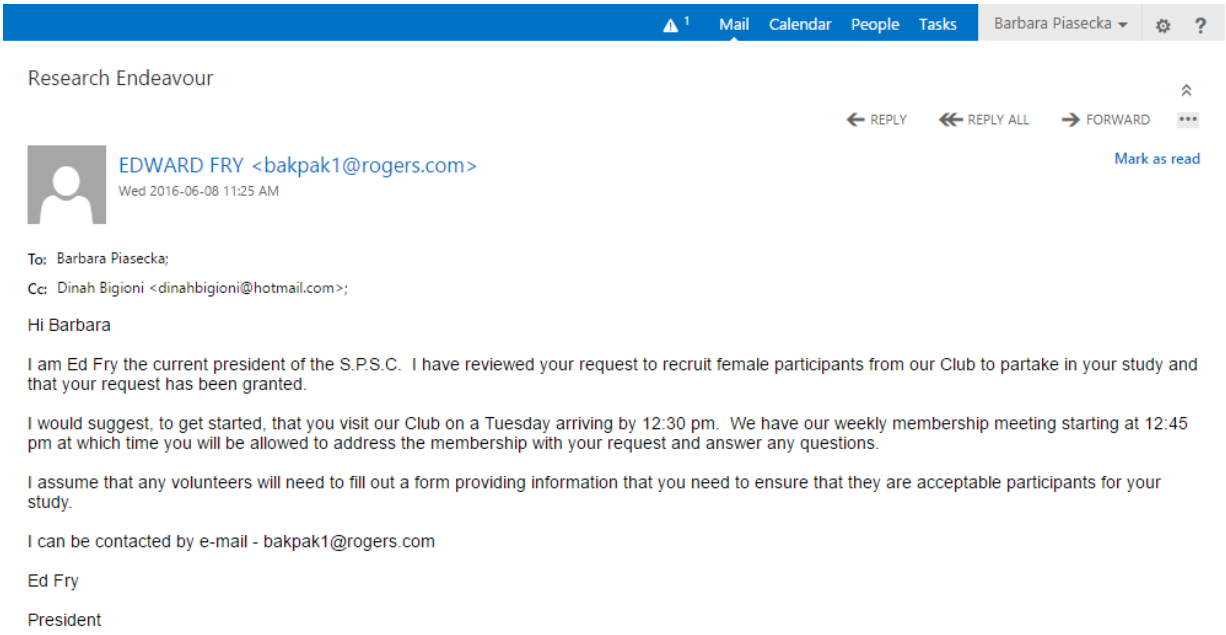


Figure 2. Bowmanville Older Adult Association Approval E-mail

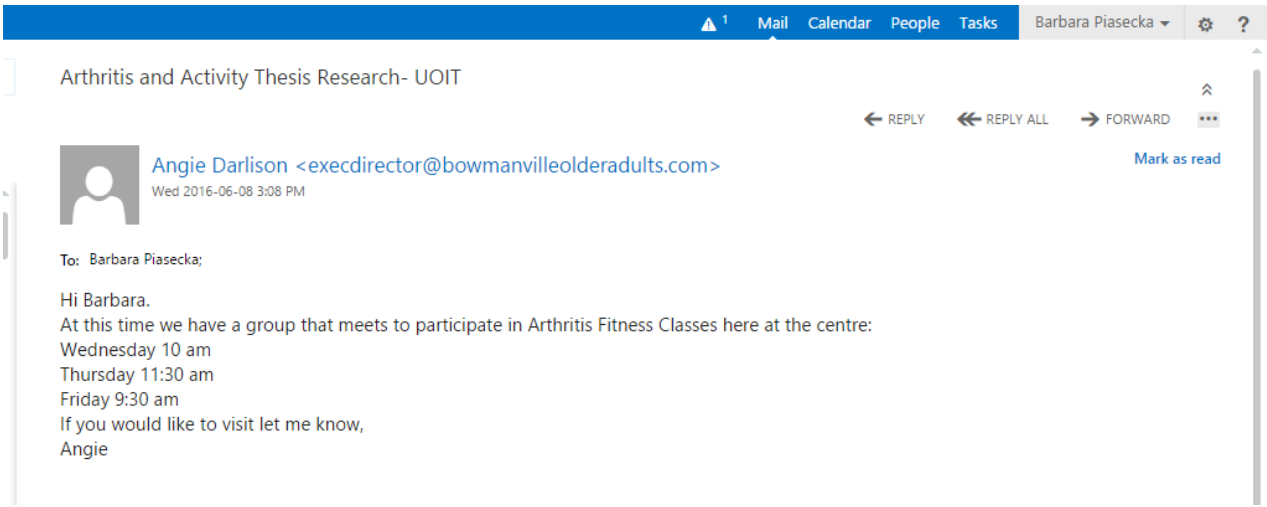
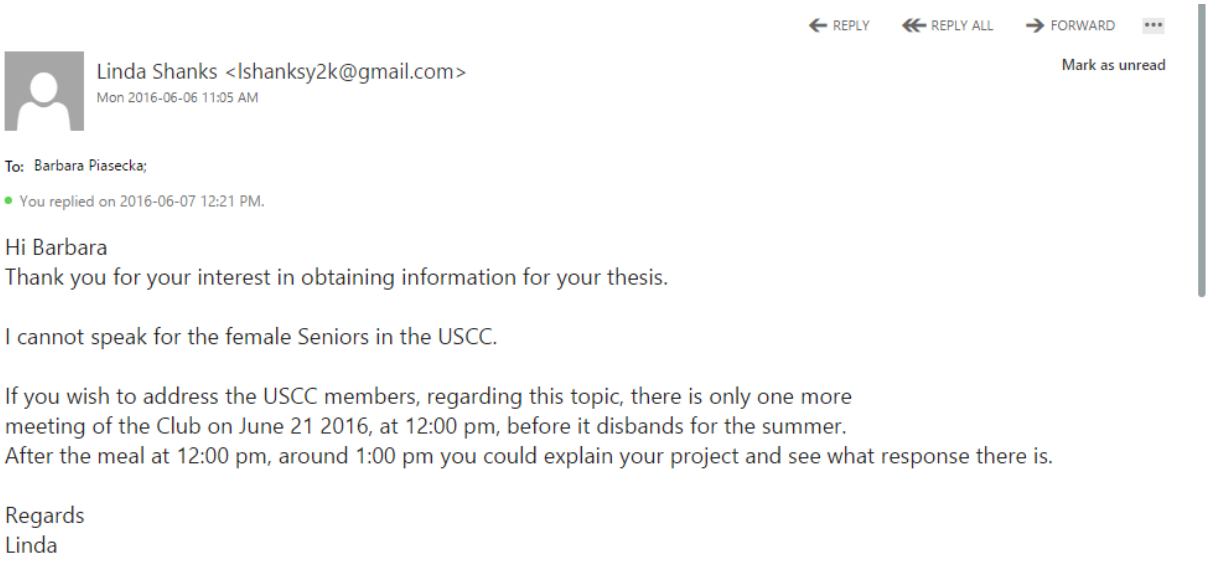


Figure 3. Uxbridge Senior Citizens Club Approval E-mail



REPLY REPLY ALL FORWARD

Mark as unread

Linda Shanks <lshanksy2k@gmail.com>
Mon 2016-06-06 11:05 AM

To: Barbara Piasecka;

You replied on 2016-06-07 12:21 PM.

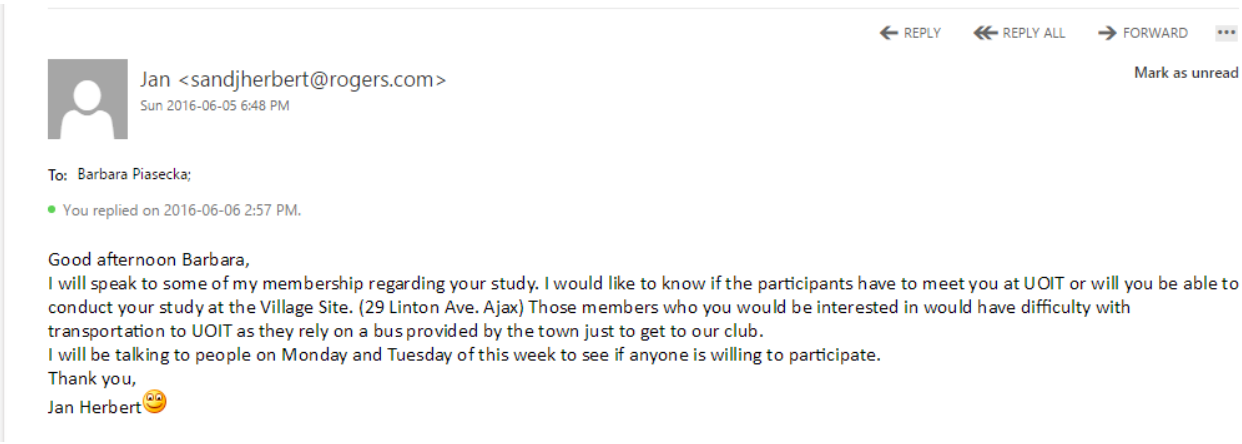
Hi Barbara
Thank you for your interest in obtaining information for your thesis.

I cannot speak for the female Seniors in the USCC.

If you wish to address the USCC members, regarding this topic, there is only one more
meeting of the Club on June 21 2016, at 12:00 pm, before it disbands for the summer.
After the meal at 12:00 pm, around 1:00 pm you could explain your project and see what response there is.

Regards
Linda

Figure 4. Village Senior Citizen Centre Approval E-mail



REPLY REPLY ALL FORWARD

Mark as unread

Jan <sandjherbert@rogers.com>
Sun 2016-06-05 6:48 PM

To: Barbara Piasecka;

You replied on 2016-06-06 2:57 PM.

Good afternoon Barbara,
I will speak to some of my membership regarding your study. I would like to know if the participants have to meet you at UOIT or will you be able to conduct your study at the Village Site. (29 Linton Ave. Ajax) Those members who you would be interested in would have difficulty with transportation to UOIT as they rely on a bus provided by the town just to get to our club.
I will be talking to people on Monday and Tuesday of this week to see if anyone is willing to participate.
Thank you,
Jan Herbert

Figure 5. Ajax Senior Citizens Club Approval E-mail

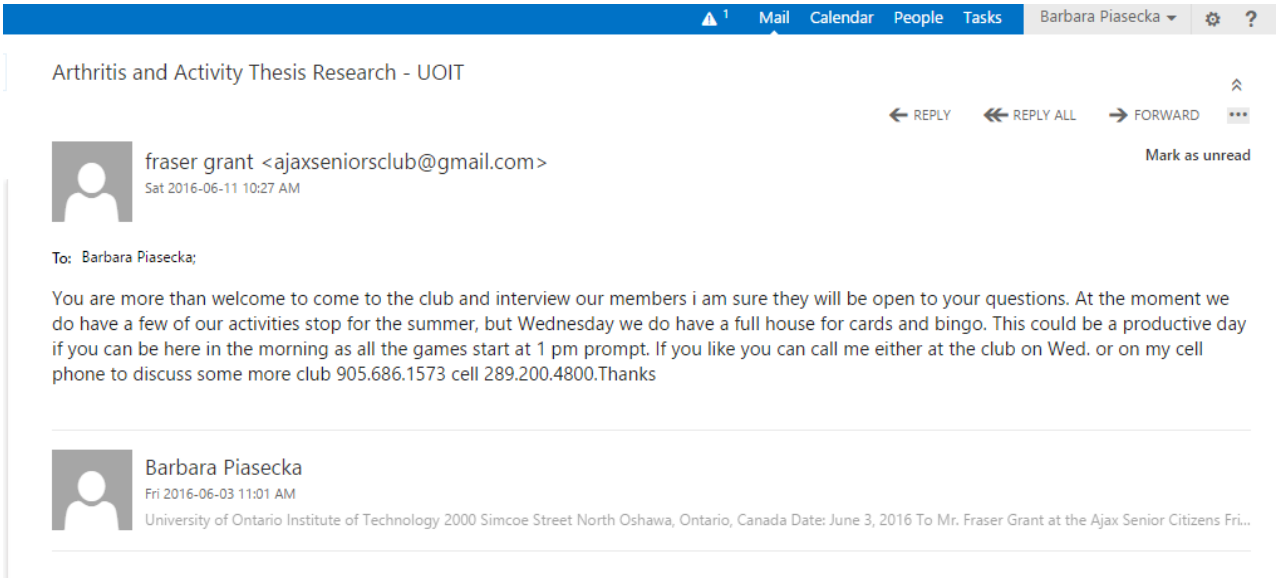


Figure 6. Oshawa Senior Citizens Centre Approval E-mail

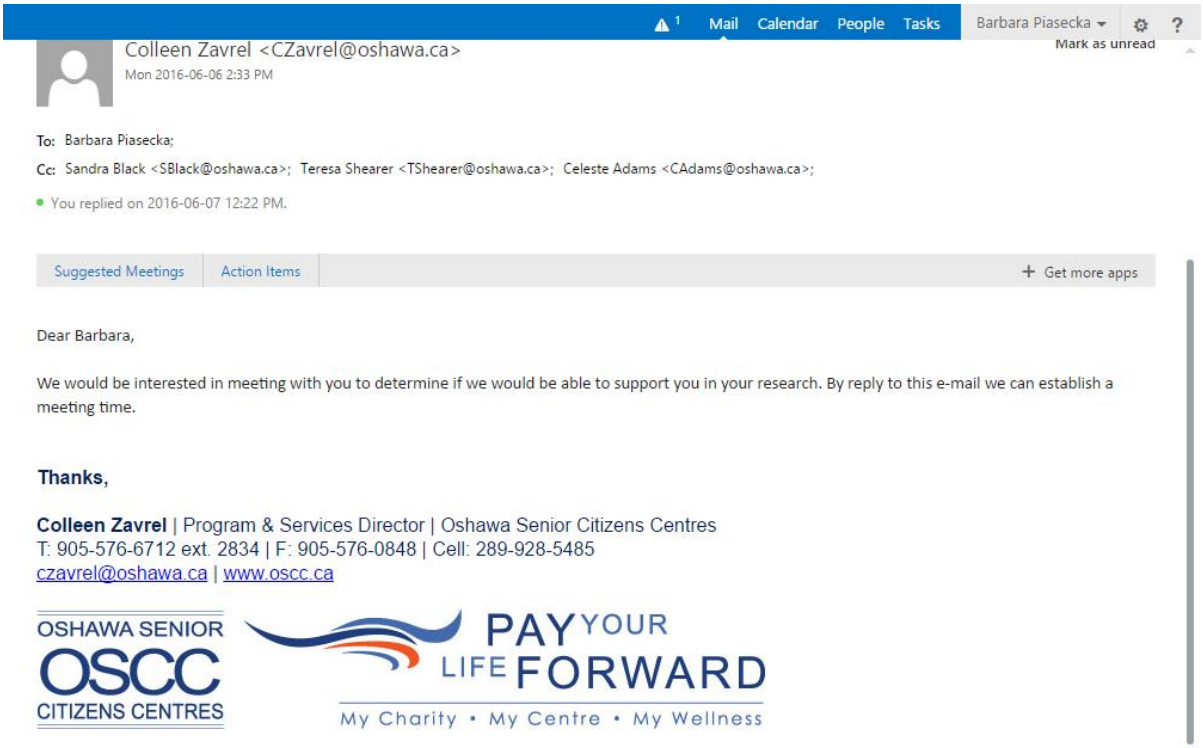


Figure 7. Carriage House Retirement Residence Approval E-mail

REPLY REPLY ALL FORWARD

Mark as unread

General Manager <generalmanager@carriagehouseoshawa.com>
Thu 2016-08-18 4:56 PM

To: Barbara Piasecka;

You replied on 2016-08-18 5:31 PM.

Come and see me on Tuesday and perhaps just sitting outside the dining room with your questionnaires might be okay!
Perhaps and announcement can be made by the activity director and if a female resident comes to your table then that would be okay. as long as there is no force.
Sylvia

APPENDIX M

SF-12 Approval to use Instrument

NON-COMMERCIAL LICENSE AGREEMENT
Office of Grants and Scholarly Research (OGSR)

License Number: QM035160

Licensee Name: Barbara Piasecka c/o University of Ontario Institute of Technology

Licensee Address: 747 Down Cres, Oshawa L1H 7X9 CA

Approved Purpose: Effects of exercise and physical activity on physical and mental health of female seniors with arthritis

Study Name: Thesis/Dissertation
Study Type: Non-commercial academic research and/or thesis – Unfunded Student
Data Collection Method: Paper

Therapeutic Area: Bones, Joints and Muscles

Royalty Fee: None, because this License is granted in support of the non-commercial Approved Purpose

A. Effective Date: This Non-Commercial License Agreement (the "Agreement") from the Office of Scholarly Grants and Research (OGSR) is made by and between OptumInsight Life Sciences, Inc. (f/k/a QualityMetric Incorporated) ("Optum"), 24 Albion Road, Building 400, Lincoln, RI 02865 and Licensee. This Agreement is entered into as of the date of last signature below and is effective for the Study Term set forth on Appendix B.

B. Appendices: Capitalized terms used in this Agreement shall have the meanings assigned to them in Appendix A and Appendix B. The appendices attached hereto are incorporated into and made a part of this Agreement for all purposes.

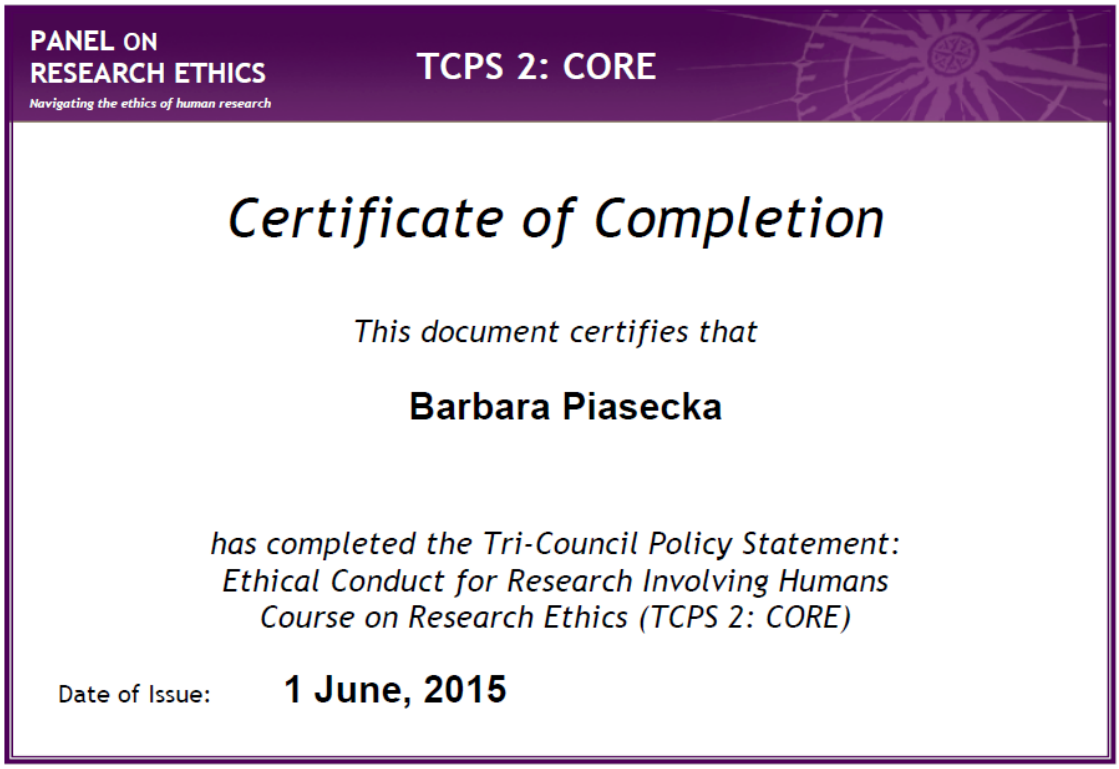
C. Grant of License: Subject to the terms of this Agreement, Optum grants to Licensee a non-exclusive, non-transferable, non-sublicensable worldwide license to use, solely for the Approved Purpose and during the Study Term, the Licensed Surveys, Software, SMS Scoring Solution, and all intellectual property rights related thereto ("Survey Materials"), in the authorized Data Collection Method, Modes of Administration, and Approved Languages indicated on Appendix B; and to administer the Licensed Surveys only up to the total number of Administrations (and to make up to such number of exact reproductions of the Licensed Surveys necessary to support such Administrations) in any combination of the specific Licensed Surveys and Approved Languages, Data Collection Method, and Modes of Administration.

EXECUTED by the duly authorized representatives as set forth below.

OptumInsight Life Sciences, Inc.	**Barbara Piasecka** (Licensee)
Signature:_____	Signature:_____
Name:_____	Name: Barbara Piasecka
Title:_____	Title: Ms.
Date:_____	Date: 5/10/2016

APPENDIX N

Tri-Council Policy Statement Certificate of Completion



PANEL ON RESEARCH ETHICS
Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Barbara Piasecka

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **1 June, 2015**

APPENDIX O

Leisure-time Physical Activities and Exercises and METs

Leisure-type Activities	METs
Gardening	LI: 2.3 MI: 3.0
Yard work	LI: 3.0 MI: 4.0 VI: 6.0
Walk for fun	3.5
Walking for exercise	4.3
Bowling/lawn bowling	3.0
Golf	4.8
Dancing	7.8
Bicycling	LI: 6.8 MI: 8.0 VI: 10.0
Swimming for fun	6.0
Lane/Lap swimming	LI/MI: 5.8 VI: 9.8
Jogging	7.0
Calisthenics	LI: 2.8 MI: 3.8 VI: 8.0
Resistance Training	LI: 3.5 MI: 5.0 VI: 6.0
Stretching	2.3
Yoga	2.5
Tai Chi	3.0
Water Aerobics	5.5

Home exercise	3.8
Exercise classes	5.5
Softball	5.0

Source: Based on the 2011 Physical Activity Compendium.
Legend: LI= Light intensity; MI= Moderate intensity, VI= Vigorous intensity

APPENDIX P

Curriculum Vitae

Barbara Piasecka

Email: barbara.piasecka@uoit.ca

SUMMARY OF QUALIFICATIONS

- Computer proficient in MS Word, Excel, PowerPoint, Outlook, SPSS, Adobe.
- Experience in research, methodology, data collection, analysis and dissemination
- Efficient writing skills and able to produce organized and concise theses, reports, labs, proposals, posters, manuscripts, grants and research ethics board (REB) applications.
- Conducting literature reviews, database searches (PubMed, Medline, etc.).
- Administering clinical assessment tools and standardized assessments for data collection purposes (SF-12, VAS).
- Quantitative data collection and analysis.
- Knowledge of study protocols, research methods and ethics in health science.
- Excellent oral communication and public speaking skills obtained through successes in conferences, poster presentations, teaching tutorials and emceeing events.
- Fluent in Polish, English and French (reading, writing and speaking).
- Certifications in TCPS: Core, WHMIS, Workplace Violence and Harassment Prevention, Worker Health and Safety Awareness and Health and Safety Orientation for Workers.

RESEARCH EXPERIENCE

Master's Thesis, Health Sciences **September 2014-April 2017**
UOIT, Oshawa, ON
Thesis: Effects of physical activity and exercise on physical and mental health outcomes of older females with arthritis

Supervisor: Dr. Wally J. Bartfay, RN, PhD

- A cross-sectional study evaluating the effects of physical activity and exercise on physical and mental health outcomes in older females aged 65 and above with self-reported arthritis. Outcome variables include pain; discomfort; range of motion; mobility, and health-related quality of life. Oral presentation of research at UOIT's Graduate Student Council Conference was ranked 1st.

Research Practicum Project, Neonatology **September 2011-April 2012**
Hospital for Sick Children, Toronto, ON
Thesis: Neurodevelopmental outcome at age 18-24 months for a cohort of newborn infants with severe jaundice

Supervisor: Dr. Andrew James, MD, MBChB MBI FRACP FRCPC

- Retrospective study that investigated the neurodevelopmental effect hyperbilirubinemia has on infants' motor and cognitive function, vision, hearing, and speech and language development, socio-adaptive behaviour along with demographic and clinical data collected. Oral presentation of results at UOIT's Annual Student Poster Research Day was ranked in the top 3

EDUCATION

The University of Ontario Institute of Technology (UOIT)
Master of Health Science **September 2014- April 2017**
Specialization in Community Health
Thesis: Effects of physical activity and exercise on physical and mental health outcomes in older females with arthritis

- Completion of the Following Relevant Courses: Epidemiology, Applied Biostatistics in Health Science, Research Methods, Public Health, Studies in Community Health.

The University of Ontario Institute of Technology (UOIT)
Honours Bachelor of Health Sciences **September 2008- April 2012**
Specialization in Health Science
Thesis: Neurodevelopmental Outcome at Age 18-24 Months for a Cohort of Newborn Infants with Severe Jaundice

- Dean's Honour List
- Completion of the Following Relevant Courses: Introductory Psychology, Critical Appraisal of Statistics in Health Sciences, Introduction to Epidemiology, Public Health in Canada, Global Health.

AWARDS AND SCHOLARSHIPS

1) **Graduate Student Professional Enhancement Funding (PERS Award)**
   March 2017

2) **UOIT Graduate Student Council (GSC) Conference**
   1st place in Graduate Student Conference (oral presentation)
   Featured on UOIT's Faculty of Health Sciences Newsletter
   May 3, 2016

3) **St. Stanislaus & St. Casimir Polish Parishes Credit Union Limited- 2x $1,000**
   December 2014 & December 2015

4) **UOIT Research Practicum Poster Presentation**
   3rd Place in Health Sciences Research Practicum Category (oral presentation and poster)
   Featured on UOIT's 2012 Student Research Poster Day Review.
   April 12, 2012

5) **W. Reymont Foundation Scholarship – 3x $750**

November 2009 – November 2011

6) **UOIT Entrance Scholarship**
September 2008

CONFERENCES (*Presenting Author)

1) **Piasecka B*.** Bartfay, W. Effects of physical activity and exercise on physical and mental health outcomes in older females with arthritis. *Public Health 2017.* Halifax, Nova Scotia. June 6, 2017 (poster).
2) **Piasecka B*.** Bartfay, W. Effects of physical activity and exercise on physical and mental health outcomes in older females with arthritis. *Graduate Student Council Conference.* Oshawa, Ontario. May 3, 2016 (oral). **WINNER:** Ranked 1st in oral presentations.
3) **Piasecka B*.** James, A. Neurodevelopmental Outcome at Age 18-24 Months for a Cohort of Newborn Infants with Severe Jaundice. *11th Annual Neonatal & Maternal-Fetal Medicine Research Day.* University of Toronto. Toronto, Ontario. April 25, 2012. (poster).
4) **Piasecka B*.** James, A. Neurodevelopmental Outcome at Age 18-24 Months for a Cohort of Newborn Infants with Severe Jaundice. *UOIT's Annual Student Poster Research Day.* Oshawa, Ontario. April 12, 2012 (oral and poster).
WINNER: Ranked in top 3 oral presentations.

WORK EXPERIENCE

University of Ontario Institute of Technology
Teacher's Assistant **September 2014-December 2016**

- Chosen as a TA for the following courses: Critical Appraisal of Statistics in Health Science (3rd year), Public Health I and II (3rd year), Research Applications II (4th year) and Research Methods (3rd year)
- Responsible for preparing and teaching tutorials twice a week for 70-80 students, creating review sessions before exams, marking assignments, inputting grades, holding weekly office hours for students, attending bi-weekly meetings with associate professors and leading lectures.

Canadian Polish Congress
Office Assistant/Event Planner **June 2013-September 2013**

- Organizing research and relevant materials for speaker and organization events
- Being in constant contact with the employer about task updates, duties, and attending weekly meetings, all while working independently in a fast paced environment

The Royal Agricultural Fair

Research Associate **November 2012**

- Addressed the public in appropriate ways (site population were young children to older adults) to participate in retrospective survey studies for the University of Guelph collected through iPads
- Educated and emphasized the importance of healthy eating

Self-employed
French Tutor **January 2011-July 2011**

- Weekly preparation, formation and organization of all learning materials for children aged between 10 to 15 years
- Creating a positive learning environment while supervising the children's learning progress

VOLUNTEER EXPERIENCE

UOIT's Annual Student Poster Research Day
Volunteer Judge **April 2017**
Oshawa, Ontario

UOIT 3-Minute Thesis Event (3MT)
Student Volunteer **April 2015**
Oshawa, Ontario

Lakeridge Health Oshawa
Recreational Therapy Stroke Aid Volunteer **January 2011-June 2011**
Oshawa, Ontario

Lakeridge Health Oshawa
Hospitality and Hospital Information Desk Volunteer **September 2010-December 2010**
Oshawa, Ontario

Lakeridge Health Oshawa
Pre-Surgical Department Student Volunteer **January 2010-April 2010**
Oshawa, Ontario

Durham Region Catholic School Board
Teaching Assistant in Grade 3 and Sr. Kindergarten **September 2004-June 2008**
Oshawa, Ontario

EXTRACURRICULAR EXPERIENCE

"Tatry" Polish Folk Song and Dance Ensemble **September 2015 – Present**
Teacher and Choreographer
Oshawa, Ontario

Toronto International Film Festival (TIFF)

Sales and Industry Volunteer, Hyatt Hotel **September 2011-September 2012**
Toronto, Ontario

Ottawa Bluesfest Music Festival
Accreditation Volunteer **June 2011-June 2012**
Ottawa, Ontario

St. Vincent de Paul Soup Kitchen
Food Preparation **January 2010-August 2014**
Oshawa, Ontario

Rogers TV Oshawa
Student Volunteer **September 2010-February 2011**
Oshawa, Ontario

COMMITTEE AND LEADERSHIP WORK

UOIT's first Alumni Association Committee (AAC)
Elected Member **September 2012-2013**

UOIT's Polish Student's Association (PSA)
Vice-President **September 2009-April 2012**

UOIT's Polish Student's Association (PSA)
Secretary and Treasurer **September 2008-April 2009**

CERTIFICATIONS

Workplace Violence and Harassment Prevention – November 16, 2016

Workplace Hazardous Materials Information System (WHMIS) – November 15, 2016

Health and Safety Orientation for Workers – November 15, 2016

Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE) – June 1, 2015

LANGUAGES

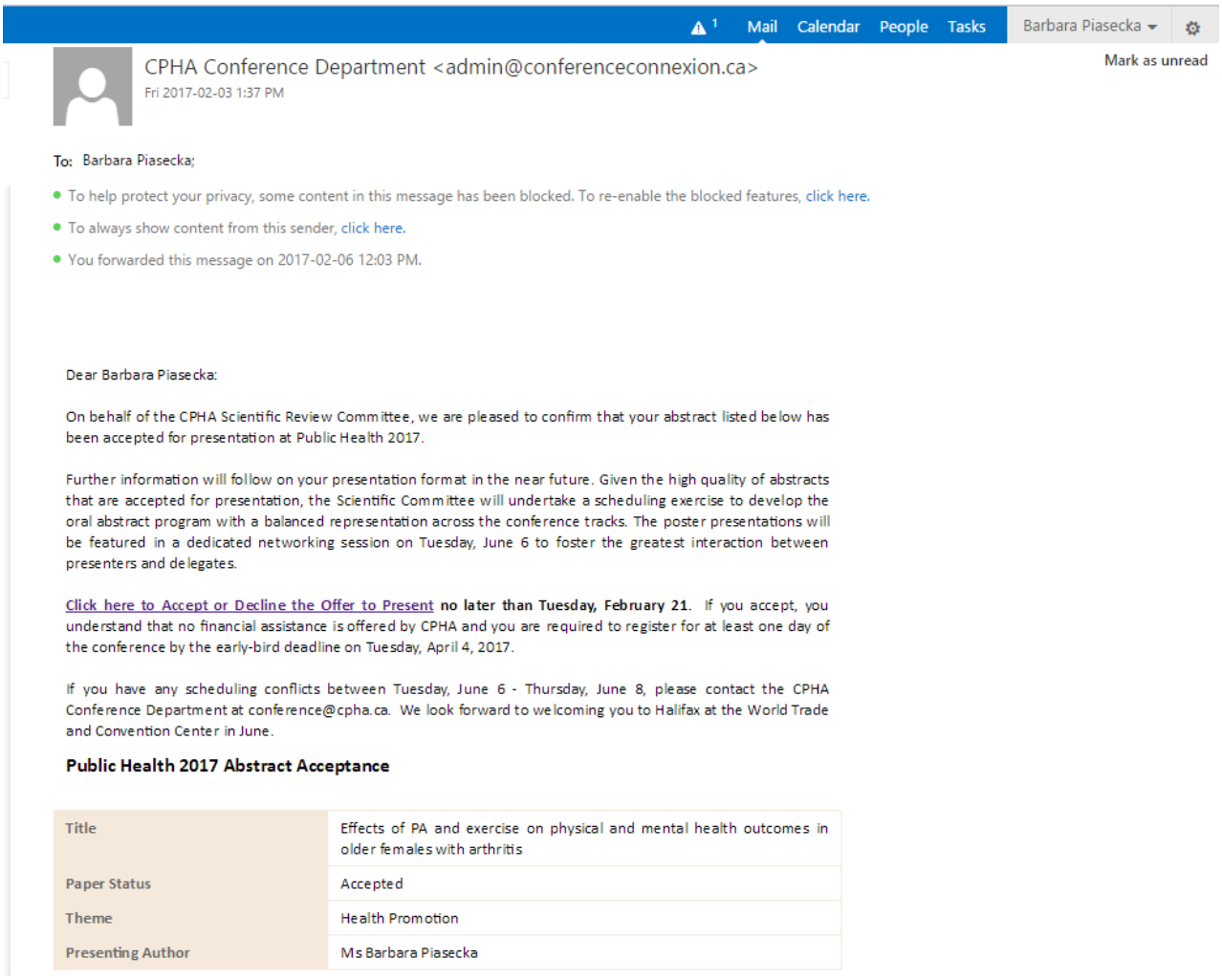
English- Speak/read/write fluently
Polish- Speak/read/write fluently
French- Speak/read/write fluently

HOBBIES AND INTERESTS

Reading books, playing beach volleyball, going on walks, playing board games
Music: Piano (2000- Present), clarinet (2004- 2008) and alto saxophone (2005- 2008)
Travel: Poland, England, Mexico, China and USA

APPENDIX Q

Public Health (PH) 2017 Conference Abstract Acceptance



Mail Calendar People Tasks Barbara Piasecka

Mark as unread

CPHA Conference Department <admin@conferenceconnexion.ca>
Fri 2017-02-03 1:37 PM

To: Barbara Piasecka;

- To help protect your privacy, some content in this message has been blocked. To re-enable the blocked features, click here.
- To always show content from this sender, click here.
- You forwarded this message on 2017-02-06 12:03 PM.

Dear Barbara Piasecka:

On behalf of the CPHA Scientific Review Committee, we are pleased to confirm that your abstract listed below has been accepted for presentation at Public Health 2017.

Further information will follow on your presentation format in the near future. Given the high quality of abstracts that are accepted for presentation, the Scientific Committee will undertake a scheduling exercise to develop the oral abstract program with a balanced representation across the conference tracks. The poster presentations will be featured in a dedicated networking session on Tuesday, June 6 to foster the greatest interaction between presenters and delegates.

Click here to Accept or Decline the Offer to Present **no later than Tuesday, February 21**. If you accept, you understand that no financial assistance is offered by CPHA and you are required to register for at least one day of the conference by the early-bird deadline on Tuesday, April 4, 2017.

If you have any scheduling conflicts between Tuesday, June 6 - Thursday, June 8, please contact the CPHA Conference Department at conference@cpha.ca. We look forward to welcoming you to Halifax at the World Trade and Convention Center in June.

Public Health 2017 Abstract Acceptance

Title	Effects of PA and exercise on physical and mental health outcomes in older females with arthritis
Paper Status	Accepted
Theme	Health Promotion
Presenting Author	Ms Barbara Piasecka

Secure | https://cpha.eventsair.com/ph2017/offertopresent/Site/Register

PUBLIC HEALTH 2017 SANTÉ PUBLIQUE

JUNE 6-8 | HALIFAX WORLD TRADE & CONVENTION CENTRE | DU 6 AU 8 JUIN

Thank you for responding to the offer to present at Public Health 2017. Click **Continue** and you will receive an email message confirming your decision.

Continue