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AN EXAMINATION OF RESISTANCE TRAINING BEHAVIOURS AMONG OLDER ADULTS IN ALBERTA

BY

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Abstract

There is not a clear understanding of demographic and health-related factors associated with resistance training; programming preferences; or the impact of sedentary activities for older Albertans. The purpose of this two-phase study was to explore resistance training behaviours among older Albertans. Study 1 objective: gain a better understanding of resistance training behaviours among older adults. Study 2 objective: gain a better understanding of the health-related quality of life (HRQoL) and other psychosocial factors associated with resistance training and sedentary behaviour. Results: older Albertans have unique preferences for receiving resistance training counseling and programming. These preferences were associated with specific demographic and health-related variables. Specific profiles of resistance and sedentary activity are associated with HRQoL and psychosocial health. Participants engaging in high sedentary time as well as not meeting training guidelines reported significantly poorer HRQoL. Strategies designed to facilitate resistance training and reduce sedentary time need to be tested and implemented.

Keywords: aging, resistance-training, health-related quality of life, older adults, psychosocial health, sedentary

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CHAPTER I — Introduction

The benefits of physical activity for older adults are numerous. Mounting research suggests that physical activity is associated with increased longevity, reduction of chronic disease, improved cholesterol levels, improved oxygen efficiency, reduced chance of falling, and improved overall quality of life (Cowan, Radman, Lewis, & Turpie, 2009). However, many older adults do not achieve the required physical activity levels to maintain functional independence and health (Paterson & Warburton, 2010; Colley, Garriguet, Janssen, Craig, Clarke, & Tremblay, 2011). It is estimated that only 35% of older Albertans are physically active (Alberta Centre for Active Living, 2013). This estimate is likely inflated given the self-report methods used to determine this prevalence estimate. Objectively determined physical activity data (using accelerometers) from the United States National Health and Nutrition Examination Survey (NHANES) suggests that <5% of older adults are achieving the public health guidelines for physical activity (i.e., at least 150 minutes of moderate intensity physical activity per week) (Troiano et al., 2008).

One type of physical activity, resistance training (e.g., strength training, weight lifting), has been found to have unique benefits for older adults. For example, Peterson, Rhea, Sen, and Gordon (2010) found that resistance training is beneficial physical activity behaviour for older adults to increase lean skeletal muscle mass and improve muscular fitness. Strength training helps ward off physical decline by maintaining muscle strength, muscle power, and endurance and helps to maintain a healthy body weight (Hanson et al., 2009). Resistance training can enhance many functional parameters, such as balance, coordination, speed, agility, and jumping ability (American

College of Sports Medicine [ACSM], 2009). When resistance training is part of a comprehensive activity program, the benefits can include improved cardiac function, functional capacity, and reduced risk factors for diabetes, osteoporosis, and even colon cancer (ACSM, 2009).

Despite these benefits, it is anticipated that prevalence of engaging in resistance training among older adults is low. Unfortunately, resistance training rates for older adults are not tracked in Canada; however, the Alberta Centre for Active Living (2013) measured older adults' physical activity rates and found them to be only 35 percent. Resistance training was not specifically captured in this report. In a literature review, Peterson (2010) reported that only 27% of the US population participated in regular resistance training. Peterson (2010) further reported that participation rates for resistance training were significantly less for older adults, with some literature reporting this rate as low as 10 percent.

In concert with exploring older adults' physical activity, it is important to also explore sedentary behaviours. Sedentary behaviour is an emerging and important field of scientific enquiry for older adults. Sedentary behaviours are activities low in energy expenditure (e.g., watching television, sitting at a computer). They have been conceptualized as sitting or reclining and are in the energy-expenditure range of 1.0 to 1.5 metabolic equivalents (METs) (Owen, 2012). Sedentary behaviours are not to be confused with physical inactivity (i.e., performing insufficient amounts of moderate- to vigorous-intensity physical activity) (Sedentary Behaviour Research Network, 2012). Preliminary evidence suggests older adults who spend large amounts of time sitting report poorer HRQoL compared to older adults who sit less (Vallance, Eurich, Marshall,

Lavallee, & Johnson, 2013). Associations have also been demonstrated between sedentary behaviour and depression scores (Vallance, Winkler, Gardiner, Healy, Lynch, & Owen, 2011). Despite the emerging evidence, older adults spend the overwhelming majority of their day in sedentary activities (Jefferis et al., 2014; Marshall et al., 2014). Recent studies have examined physical activity in concert with sedentary time with data suggesting large amounts of sedentary time have hazardous health consequences irrespective of how physically active an individual is (Owen, Healy, Matthews, & Dunstan, 2010; van der Ploeg, Chey, Korda, Banks, & Bauman, 2012). To date, no studies have dually-considered patterns of both resistance training and sedentary behaviours among older adults. Studies that have examined self-reporting of physical activity have captured all forms of physical activity but have not isolated resistance training therefore it is not known how self-reporting of resistance training aligns with objective measures of this type of physical activity.

The primary purpose of this two-phase cross-sectional study was to gain a better understanding of resistance training behaviours among older adults in Alberta. The primary objectives were to (a) determine the prevalence of resistance training and sedentary behaviours among older Albertans, (b) determine the demographic and health-related factors associated with resistance training and sedentary behaviours, and (c) gain a better understanding of the associations of health-related quality of life (HRQoL) and psychosocial factors (e.g., satisfaction with life, level of self-esteem, anxiety, depression) with resistance training and sedentary behaviour.

The following terms are operationally defined for the purposes of this study:

a. **Older adult:** Adults 65 years and older unless otherwise specified as adults 55 years and older.

b. **Physical activity:** Any activity bout that last longer than 10 minutes duration and include mild-effort activities (such as easy walking), moderate-effort activities (such as non-exhausting activities like brisk walking or easy bicycling), and strenuous-effort activities (such as activities that cause a rapid heart rate and sweating like jogging or aerobics classes).

c. **Resistance training:** Resistance training, also called strength training or weight training, is a physical activity that involves challenging the muscles against a resistance (such as a dumbbell or physical-activity band) to build strength and endurance. Resistance training may be performed using free weights, weight machines, physical-activity bands, or one's body weight (American College of Sports Medicine, 2009).

d. **Health-related quality of life (HRQoL):** HRQoL is a measure of physical and mental dimensions of health measured by the RAND-12 scale (Ware, Kosinski, & Keller, 1996). The physical health components include measures that indicate health problems which impede functioning, such as varying degrees of disability. The mental health components include measures that reflect a person's perception of their psychological symptoms or their outlook with life in general.

e. **Sedentary behaviours:** Sedentary behaviours are activities low in energy expenditure (e.g., watching television, sitting at a computer). They have been conceptualized as sitting or reclining and are in the energy-expenditure range of 1.0 to 1.5 metabolic equivalents (METs) (Owen, 2012). Sedentary behaviours are not to be

confused with physical inactivity (i.e., performing insufficient amounts of moderate- to vigorous-intensity physical activity) (Sedentary Behaviour Research Network, 2012).

CHAPTER II — Literature Review

Older Adults as a Growing Demographic

The healthcare system is challenged with a population that is aging. The United Nations suggests the proportion of older people over the age of 60 worldwide has grown from 8% in 1950 to 10% in 2000. By 2050, the proportion of this population worldwide is expected to be as high as 22% (Granacher, Muehlbauer, Zahner, Gollhofer, & Kressig, 2011). Statistics Canada estimates the number of Canadian citizens 65 years and older is projected to reach 10.9 million by 2036, more than double the 2009 level of 4.7 million (Statistics Canada, 2009b). Projections indicate a further rise to between 23% and 25% in 2036 and between 24% and 28% in 2061 (Statistics Canada, 2009b). The old-age dependency ratio, referring to those persons 65 years and older as a ratio of those in the 15 to 64 years bracket, is increasing from 16.6 in 1991 to 39 in 2036 (Statistics Canada, 2009a). Currently, 320,000 seniors reside in Alberta — approximately 1 in 10 persons.

Disability and Frailty of Older Adults

The aging population is an important issue for health professionals, as health and policy strategies are developed to assist older adults in warding off disability and frailty and in maximizing HRQoL. Disability refers to the restriction of activities of daily living due to varying factors and chronic conditions (Chappell & Cooke, 2013). Frailty refers to the level of dependency resulting from a chronic illness, aging, and deterioration of systems such as the musculoskeletal system, leading to adverse outcomes (Siparsky, Kirkendall & Garrett, 2014). While poorer health, chronic conditions, or disability can be caused by genetics, they can also be caused by a lifetime of not taking care of physical, biochemical, and nutritional needs (Baker, 2012). *Vision 2020* reports that the Alberta

population is aging, and chronic disease, disability, and frailty will add to the costs in the health care system (Alberta Health, 2008). As adults age, health declines and chronic illnesses such as diabetes, arthritis, and musculoskeletal conditions increase (Canadian Institute of Health Information [CIHI], 2009). The health of older Canadians is impacted by cardiovascular disease, osteoporosis, fractures from falls, and dementia (Baker, 2012). These conditions increase the probability of disability and frailty; most persons 65 years and older have at least one chronic illness (CIHI, 2011a). Chappell and Cooke (2013) report that rates for Canadian older adults with chronic conditions have increased from the 1970s to the 1990s and that these older adults perceive themselves as having poorer health when compared with younger adults.

Impact of Older Adults' Health on Healthcare

In 2009, the per capita healthcare expenditure for Canadian's 65 years and older ($11,196) was 4.5 times greater than expenditure for adults aged 20 to 64 years ($2,494) (CIHI, 2011a). Compared with other age groups in Canada, a disproportionate amount of hospital services is spent on adults 65 years and older (CIHI, 2011a). For example, in 2009-2010, even though persons 65 years and older made up 14% of the Canadian population, they accounted for 40% of acute hospital stays (CIHI, 2011a). In regards to muscle strength and older adults, Cawthon et al. (2009) state that the loss of muscle mass has a direct correlation with older adults' decline with aging and thus higher healthcare costs. For example, the health costs of sarcopenia amongst older adults in the United States was 18.2 billion dollars or 1.5% of total costs in 2000 (Janssen, Shepard, Katzmarzyk & Roubenoff, 2004). Cawthon et al. (2009) suggest that overall healthcare costs can be negatively impacted due to poor physical function in older adults, such as

weaker muscle strength and poor balance leading to falls, fractures, mobility limitation, and hospitalizations. In Canada, falls are the leading cause of injury hospitalization among older adults, accounting for 9% of all emergency department visits in 2009-2010 (CIHI, 2011b).

The amount of health care services older adults use is related to the number of chronic conditions they have (CIHI, 2011a). There is a strong correlation between the existence of multiple chronic diseases and the higher use of the health care system (CIHI, 2011a). The impact of this aging population on health care costs and the ability of society to adequately look after this population are growing concerns within the health care field (Cowan et al., 2009).

It is important to support healthy aging in the older adult population to minimize the impact of chronic disease, reduce the need for health services, and help promote a healthy, active Canadian population (Canadian Nurses Association, 2011). Recent research (Cowan et al., 2009) suggests that a one-year participation timeframe by older adults in a physical activity and strengthening program was enough to demonstrate improved strength and functioning, resulting in a reduction in health service utilization and potentially saving the health industry costs.

Muscle Strength and Older Adults

Achieving healthy muscle strength is one strategy for aiding this growing demographic in preventing disability, frailty, and maximizing HRQoL. As a person ages, sarcopenia increases, presenting as a gradual loss of muscle mass and strength (Verdijk et al., 2010). Sarcopenia is defined as loss of muscle mass due to the aging process and consequent decreased function (Peterson, 2010). This term is not to be confused with

cachexia or muscle wasting, which is related to cancer or those with terminal neuromuscular diseases. The term sarcopenia is used to describe persons with increased muscle weakness, functional deficits, disability, and diminished autonomy (Peterson, 2010). The prevalence of sarcopenia is approximately 25% after 60 years, and 50% after 80 years, due to the progressive nature of muscle mass and muscle strength loss (Verdijk et al., 2010). With progressing age, muscle bulk and strength decline in the fifth decade of life and rapidly decline after the age of 70 (McCance & Huether, 2010). This aging-related loss of muscle mass is associated with a decline in muscle strength, muscle power, muscle quality, and physical function, and it ultimately increases mortality (Hanson et al., 2009).

The older adults' muscle strength is impacted at the muscle's cellular level. For example, the muscles have a reduced RNA synthesis and a loss of mitochondrial volume (McCance & Huether, 2010). Other changes include a decrease in the number of motor units and a decrease in the innervation ratio and muscle atrophy, with accompanying weakness and fatigue (McCance & Huether, 2010). Holviala, Sallinen, Kraemer, Alen, and Hakkinen (2006) have found that there is a reduction in the number and size of individual muscle fibers, especially the type II fibers. By the time a person reaches 70 years, they have lost more than 25% of their type II fast twitch muscle fibers, which are most crucial for strength and every day activities (McCance & Huether, 2010).

The impact of a change in hormone balance is also a factor for older adults (Holviala et al., 2006). In a cross-sectional analysis of 41 community-dwelling elderly men, researchers found a significant positive correlation between bioavailable testosterone concentration, muscle II fiber size, muscle mass, and muscle strength

(Verdijk et al., 2010). The higher levels of testosterone were positively associated with larger muscle mass and also associated with a greater percentage of muscle being occupied by type II muscle fibers (Verdijk et al., 2010). The levels of the muscle-building hormone testosterone decline with age, and research has demonstrated that men suffer a 10% loss of this hormone per decade of age (Shippen & Fryer, 2008). For women, estrogen receptors have been discovered on skeletal muscle, and some cross-sectional studies have noted a strong association between women who have higher estrogen levels and therefore more muscle strength post-menopause, compared to women with lower estrogen levels post-menopause (Kenny, Kleppinger, Wang, & Prestwood, 2005). Clearly, muscle loss from the aging process has significant consequences of various health parameters. Resistance training is one physical activity behaviour in which older adults can prevent some of the negative consequences aging has on muscles, muscle strength, and muscle physiology.

Resistance Training

Resistance training is a type of physical activity where muscles are contracted against an external load (weight) to ultimately maintain function and to counteract the effects of muscle loss (Mangione, Miller, & Naughton, 2010). Resistance training is an activity that forces a muscle to work against an applied weight, and physical activity is body movement produced through skeletal muscle contraction that in turn increases energy expenditure (Chodzko-Zajko et al., 2009). Muscle strength is determined by measuring isometric, isokinetic, and multiple repetition, maximum-effort protocols (Chodzko-Zajko et al., 2009) and is defined as the degree of force produced by a muscle (Mangione et al., 2010). Muscle endurance is measured by a person's ability to

repeatedly produce both muscle force and muscle power over a set time period (Chodzko-Zajko et al., 2009).

Resistance training can include both isometric and isotonic physical activity. During isometric contraction (static or holding contraction), the muscle maintains constant length as tension is increased. An example of isometric contraction includes pushing against a wall and holding this position to work the arm muscles. In contrast, isotonic physical activity (shortening contractions) maintains constant muscle tension as muscle is moved through the physical activity. An example of isotonic contraction includes push-ups or doing leg-curls on a physical activity machine.

Resistance training can also be described as either high-intensity or low-intensity training, based on the workload used and the number of repetitions. High-intensity resistance training is a strengthening physical activity that involves heavier weights (called overloading) that stimulate the muscles to increase in strength and size (Granacher et al., 2011). Low intensity training involves lower weights, more repetitions, and is more gradual for building muscle strength and size (Granacher et al., 2011).

Progressive resistance training refers to systematically increased weights or loads (sometimes called dosing), which has been demonstrated in research to produce large increases in strength and moderate increases in bone density, lean body mass, insulin sensitivity, and endurance (Mangione et al., 2010). Specifically, progressive resistance training performed with a dose of 2 to 3 times a week has been shown to improve day to day functional abilities, such as gait speed and chair rise time, through improved leg muscle strength (Mangione et al., 2010).

At the microscopic level, resistance training causes tiny tears to the muscle cells, which then are repaired by the body so muscles regenerate, hypertrophy, and grow stronger (McCance & Huether, 2010). As the muscle is challenged, it is broken down (catabolism) and then repaired (anabolism) (McCance & Huether, 2010). In other words, the purpose of catabolism is to break down substances into simpler components and make energy available to power cells, whereas anabolism takes simple compounds and manufactures materials required for growth, repair, and rebuilding (McCance & Huether, 2010). The repair of muscles after resistance training is also aided by testosterone, insulin-like growth factor, the human growth hormone, proteins, and other nutrients (McCance & Huether, 2010).

Benefits of Resistance Training for Older Adults

Introduction to Benefits

The benefits of resistance training for older adults are cited across numerous sources and may facilitate the reality of a healthy aging population (Peterson, 2010). The American College of Sports Medicine recommends resistance training as part of a comprehensive activity program to maintain overall function, strength, agility, endurance, and psychosocial well-being (American College of Sports Medicine, 2009). The American Heart Association recommends resistance exercise as part of physical activity in order to prevent cardiovascular disease (American Heart Association, 2013). The Canadian guidelines state older adults should engage in resistance training twice a week as part of an overall physical activity program (Canadian Society for Exercise Physiology [CSEP], 2012). Resistance training is cited in a literature review summary as particularly important in the prevention and management of two major cardiovascular risk factors:

diabetes and obesity (Tresierras & Balady, 2009). In one meta-analysis of resistance training studies among older adults, Peterson et al. (2010) found a robust association between full body resistance training and strength improvement related to the prevention of age-related declines in muscle function. The meta-analysis focused on studies with randomized controlled trials or quasi-randomized clinical trials, where the primary outcomes were related to muscle strength and the subjects were men and women over the age of fifty years. Participants ranged from those in the general community, older adult communities, and hospitals, and they included both fit and healthy subjects as well as those with disabilities. Interventions included whole body strength training in accordance with protocols from the American College of Sport Medicine (Peterson et al., 2010). Specifically, the pooled results of the various studies demonstrated a positive increase in strength for key measures (e.g., the leg press, chest press, knee extension, and lat pull) and a superiority in higher intensity programs compared to lower intensity strength programs (Peterson et al., 2010). The researchers emphasized the significance of these findings, considering the significant muscle strength decline seen in sedentary persons over 50 years of age as well as negative consequences of sarcopenia to disability or movement impairment (Peterson et al., 2010). These outcomes align with other resistance training literature and offer valuable information to assist with the prevention of age-related functional decline. Health and exercise professionals need to facilitate opportunities for the provision of resistance training in older adults' activity programs as a part of healthy aging strategies.

Quality of Life and Psychosocial Health

Physical activity among older adults is well known to have positive effects on psychosocial health, such as mood and anxiety reduction, thus increasing HRQoL (Kimura et al., 2010). Unfortunately, most literature has been primarily focused on aerobic exercise and not on resistance training (Kimura et al., 2010). The research that does exist on resistance training, older adults, and HRQoL are presented in this section.

In research by Dionigi and Cannon (2009), a positive link was found between strength training and older adults' psychosocial health and self-esteem, which in turn may enhance HRQoL. Their sample included six women and three men, aged 65 years to 72 years, who were involved in a resistance training program. The study employed the hierarchical theoretical Exercise and Self-Esteem Model (EXSEM) by Sonstroem, Harlow, and Josephs (1994). This model proposes that exercise first improves self-perceptions such as self-efficacy, progresses to a feeling of physical self-worth (a mediator), and finally progresses to a global and higher self-esteem (at the apex of the model) (Sonstroem et al., 1994). Dionigi and Cannon stated that the expanded version of the EXSEM was an effective tool to examine older adults' physical self-perceptions with regard to resistance training, as the model shows subsequent possible effects of this type of exercise intervention. They concluded that positive changes in the participants' physical self-perceptions and increases in muscle strength were related to perceived increases in psychological outcomes in their participants.

Kimura et al. (2010) employed a single-blind randomized controlled trial to study strength-training programs for older adults. They found that mental health scores improved for the training group compared with the control group after 12 weeks. These researchers used the SF-36 Health Status Survey and a neurocognitive assessment tool to

assess changes in HRQoL and executive cognitive function for the 119 participants who were 65 years and older (Kimura et al., 2010). One interpretation suggested by these researchers is that the social activity of actually going out and participating with others in strength training is enough to elicit positive psychosocial benefits. Kimura also suggested a second interpretation: that participating in strength training programs can result in feelings of achievement that is otherwise lacking in the lives of older adults, however, did not specifically find improvement in the cognitive areas of the SF-36 Health Status Survey results with this population.

In a randomized controlled trial, Brovold, Skelton, and Bergland (2012) found that function, vitality, and HRQoL increased significantly within three months for a sample of 110 adults aged 60 years and older participating in a resistance-training program. The three month study specifically evaluated the effects of a program of counselling, exercise, and strength training on HRQoL, using the Medical Outcome Study 36-item Short-Form Health Survey. Participants were excluded if they scored lower than 24 on the Mini Mental State Examination, as a low score would indicate a cognitive change and possible challenges for the counselling portion of the research intervention. Strength training included those as per guidelines in the National Institute on Aging and included activities such as completing leg raises while wearing ankle weights. Researchers noted that participants also experienced lower bodily pain levels at the end of the study period. Brovold et al. (2012) stressed that this research was especially significant for older adults who can be frail, have increased hospitalizations, and thus experience lower self-efficacy and a lower HRQoL.

In a cross-sectional study of coronary heart disease patients, Lapier, Cleary, and Kidd (2009) studied the possible links between HRQoL and self-efficacy to the physical activity patterns of older adults. Participants (N=50) included, mainly men, who self-reported on several instruments, including the RAND 36-item Health Survey, the Self-Efficacy for Exercise Behaviour Scale, and the Telephone Interview for Cognition Status. The researchers found a positive correlation between a participant's physical function and components of self-efficacy for exercise, which were described as important for achieving the benefits of independence and experiencing HRQoL. Income was identified as an important factor, which the researchers suggested may have helped some participants' access exercise easier than those participants in lower income brackets. Although this research was not specific to strength training, it may have some significance for older adults, strength training, and the relationship to HRQoL.

In a randomized controlled trial examining a 12-week strength training program for older adults, Katula, Rejeski, and Marsh (2008) reported positive results on multiple domains of HRQoL, including self-efficacy, satisfaction with physical function, and life satisfaction. Inclusion criteria for this study stipulated persons 65 years and older who were independently mobile and had successfully passed a pre-study resistance training safety screen, but who had difficulty with lower extremity functioning, such as climbing stairs or rising from a chair. Participants were randomly placed in either a progressive resistance strength-training (ST) group, a high velocity power-training (PT) group, or a wait-list control group. While there were differences in the interventions regarding pacing and speed, both the ST group and PT group completed lower extremity and upper body strength exercises with resistance machines and dumbbells 3 times a week for 12

weeks. Researchers used several scales, such as the Satisfaction with Life Scale (SWLS), and found that while both treatment groups had positive results, the PT group produced more dramatic positive changes across all measures of HRQoL.

In summary, a small but growing body of research has demonstrated an association between resistance training, HRQoL, and positive psychosocial factors, as presented in the above examples. In addition, some research has demonstrated that resistance training as part of physical activity programs can also positively impact an older adult's functional capacity, balance, and gait speed and thus support independent living and improve HRQoL (Orr, Raymond, & Singh, 2008). Muscle strength directly impacts independence and ability to carry out activities of daily living, and thus it impacts HRQoL for older adults (Jones & Frederick, 2003; Paterson &Warburton, 2010). Unfortunately, most of the research linking exercise, HRQoL, and psychosocial health are based on aerobic exercise only or aerobics combined with resistance training, but there are some messages that can be applied to future research that focus only on resistance training.

Fall Prevention

The benefits of strength training for older adults can be viewed in the contexts of both a person's HRQoL and also the impact on the Canadian health system. The most common cause of injuries amongst older Canadian is falls (Public Health Agency of Canada, 2010). During 2008/2009, approximately 50,000 older Canadians (persons 65 years and older) were admitted to hospital due to a fall (Public Health Agency of Canada, 2010). Loss of muscle strength is a significant factor in increased falls in older adults; such falls negatively impact health through fractures and hospitalizations (Granacher et

al., 2011). During the past 30 years, research efforts have demonstrated the many benefits of strength enhancing/maintenance programs including postural control, physical functioning, increased ability to carry out activities of daily living, and the reduction of falls (Granacher et al., 2011). It has been suggested that 28-35% of individuals 65 years and older sustain at least one fall over a one-year period. The occurrence of falls increases to 32-42% in adults over the age of 75 years of age (Granacher, Gruber, & Gollhofer, 2009).

Maintaining muscle mass and strength in the lower extremities is a key factor in an older adult's ability to maintain postural control, overall function, and prevent falls (Granacher et al., 2009). Mangione et al. (2010) published a Cochrane Review to demonstrate the benefits for older adults in preventing falls through improving muscle strength, balance and gait. Their systematic review included 121 trials and concluded that older adults who participated in resistance training were more likely to demonstrate meaningful gains in muscle strength (especially in the large leg muscles) and a reduction in physical disability, compared to a control group who did not participate in any resistance training. All of these trials included an intervention that involved strength training using both exercise machines and elastic bands for a duration of up to 12 weeks. Focusing on large leg muscles and strength has the greatest impact on reducing falls in older adults, as these individuals achieve better mobility and balance (Holviala et al., 2006). Reducing the number of falls in persons 65 years and older benefits both the health of older Canadians and the health care system. Research demonstrates that resistance training helps older adults build the strength and balance to reduce falls.

Glycemic Control

Strength training has been shown to have a significant impact on helping older adults with glycemic control, with research participants reporting an increase in overall strength and increased muscle mass (Centers for Disease Control and Prevention, 2011). Abnormal glycemic control or plasma glucose levels are estimated to be in 0.9 % of the Canadian population, for persons aged 6 years and above (Public Health Agency of Canada, 2011). Abnormal glycemic control is an indication of pre-diabetes or undiagnosed diabetes, one of the most common chronic illnesses in Canada, impacting an estimated 1,104,719 Canadians aged 65 years and older (Public Health Agency of Canada, 2011). The issue of glycemic control is an important one for older adults since diabetes rates increase with age, with the highest increase of diabetes seen in persons in the 60 to 64-year age group (Public Health Agency of Canada, 2011). Irvine and Taylor (2010) reviewed 9 randomized controlled studies that used an intervention of resistance training to determine impact on glycemic control. Collectively, these studies included a total of 352 participants with an average age 58 years who completed an average of 20 weeks of resistance training for up to 10 major muscle groups. The outcome measure for seven of these studies—percentage of glycosylated hemoglobin—demonstrated a reduction of 0.3%, a small but clinically significant reduction. The authors concluded that the research outcomes were positive for the resistance training groups and noted that a 1% decrease in glycosylated hemoglobin is associated with a 37% decrease in risk of microvascular complication. Aging is associated with not only decreased muscle strength but also impaired beta-cell function, glucose intolerance, and altered insulin clearance (Ng, C., Tai, E., Goh, S, & Wee, H., 2011). In a comparative review of 14 studies that pertained to resistance training and non-insulin dependent diabetes, Davis and Green

(2007) concluded that resistance-training programs have a positive impact on glycemic control, fat reduction, and insulin sensitivity for persons with diabetes. All of the studies reviewed included a form of resistance training and an assessment of the research participants' metabolic variables, including glycemic control factors. These factors impact the risk of impaired insulin resistance and glycemic control (Davis & Green, 2007). Tresierras and Balady (2009) draw similar conclusions, stating that resistance training enhances insulin sensitivity, improves glucose tolerance, and alters body composition in both men and women. This body change was noted for diabetics with and without calorie-restricted diets. With the increase in diabetes and risk factors for diabetes in Canadians, strategies such as resistance training need to be viewed as an effective addition to physical activity plans for older adults. Research demonstrates that resistance training can have a positive impact on glycemic control and in the prevention of diabetes.

Cognitive Function

Cognitive functions, as part of executive control, can include functions such as scheduling, computation, coordination, and skills of selection and are mediated by the pre-frontal brain (Liu-Ambrose & Donaldson, 2009). The economic impact of cognitive decline with aging is substantial, and exercise is an inexpensive intervention that promises preventative and restorative properties for cognition (Liu-Ambrose & Donaldson, 2009). While several studies link the benefits of aerobic exercise to cognitive function, the specific benefits of resistance training and cognition for older adults have received minimal investigation (Liu-Ambrose, Nagamatsu, Graf, Beattie, Ashe, & Handy, 2010). Although research has demonstrated some positive results for the impact on executive functions in older adults participating in strength training, further investigation

is required to determine strength-training duration and intensity dosing (Snowden et al., 2011). Snowden et al., (2011) reviewed six scientific databases, 30 research articles, and consulted an eight-member multidisciplinary panel, thus highlighting some of these research gaps. While resistance training was grouped in with other types of physical activity in this review, the researchers did not find sufficient evidence of a positive association between exercise and cognition due to research methodology inadequacies, such as participant drop-out rates, short study durations, data availability, lack of generalizability of samples, and lack of blinding. These researchers recommended the need for larger, randomized samples; more rigorous methodologies; longer intervention time-lines; and follow up strategies. The following is a sampling of some of the research studies reporting on links between resistance training and cognition.

A six-month trial with older men participating in a resistance-training program demonstrated positive changes to executive control, such as memory performance and verbal concept formation (Cassilhas et al., 2007). The purpose of this study was to specifically examine the impact of strength training on cognitive function in men aged 65 to 75 years, with a sample size of 62 participants. A mini-mental exam was used to exclude participants with dementia symptoms. Participants carried out strength-training exercises following guidelines of the American College of Sports Medicine, including activities such as the chest press, leg press, and abdominal crunches. A control group did not train but instead participated in warm-up and stretching programs. Better performance was especially noted in the treatment group in cognitive areas of short- and long-term memory, central execution functions, and attention. More research is required to understand the reasons for the cognitive benefits, but the researchers suggested that

increased blood flow to the brain during training, and also increased growth factors such as IGF-1, lead to cognitive benefits.

In a study of 155 community-dwelling older women, Liu-Ambrose et al. (2010) conducted a 52-week prospective single-blinded trial to examine the impact of once-a-week and twice-a-week resistance training, paired with balance and tone exercises, on cognition. Participants had to have scored at least 24 on the Mini Mental State Examination to be in the study. The women were randomly assigned to the resistance-training group or a control group. The progressive resistance-training classes included 10 minutes of warm-up, 40 minutes of resistance training, and a 10-minute cool down. Example exercises included bicep curls, seated row, and the leg press. The authors concluded that for a 12-month resistance-training program, a demonstrable and positive link was seen between resistance-training practises of older women and cognition such as the executive functions of selective attention, memory, verbal concept formation, and conflict resolution.

In the EXCEL (Exercise for Cognition and Everyday Living) study, a six-month randomized study of resistance training among 86 community-dwelling older women, data indicated that subjects improved in selective attention and conflict resolution, associative memory, and regional patterns of functional brain plasticity (Nagamatsu et al., 2012). In this EXCEL study, inclusion criteria comprised women who were classified as having mild cognitive impairment scoring lower than 26 out of 30 on the Montreal Cognitive Assessment scale. The women participated in a twice-weekly, 60-minute program that included resistance training, aerobic training, or balance and toning classes. The resistance-training group in particular showed significant improvements compared to

the other two groups, demonstrating positive changes in areas such as memory, recall of associations, and functional changes in three regions of the cortex.

Liu-Ambrose and Donaldson (2009) reviewed three randomized trials regarding older adults participating in resistance training and discovered evidence that cognition of research participants improved in all three studies. They also conducted a meta-analysis that showed that adding resistance training to aerobic programs results in a more positive impact on cognition than when older adults use aerobic exercise without resistance training. The three randomized trials examined included a six-month trial of moderate and high-intensity resistance training for older men, an individualized six-month home-based strength re-training program for adults 70 years and older with a recent history of falls, and a 12-month group-based strength and balance program for older adults residing in retirement villages. Some of the positive results cited by Liu-Ambrose and Donaldson (2009) included participants demonstrating improved short- and long-term memory, better verbal reasoning, and heightened fluid intelligence. It was proposed that the improved cognitive health may have been due to processes involving insulin-like growth factor I and homocysteine, due to their review of the literature and early evidence of this link between resistance training and cognition, and that these links would require further research. In summary, they stated that the positive results from these three reviewed studies reinforce the guidelines from the American College of Sports Medicine (ACSM) on resistance training for older adults.

Older adults are at risk for cognitive decline, which impacts HRQoL and health care costs (Davis, Marra, Robertson, Najafzadeh, & Liu-Ambrose, 2011); therefore any interventions that could prevent or delay the cognitive declines of aging would have

significant societal value (Liu-Ambrose & Donaldson, 2009). There is a benefit, therefore, to prevent or slow cognitive decline with resistance training as part of a physical activity program (Davis et al., 2011). Although these benefits to cognition have been demonstrated with resistance training in some studies, very few research studies have focused on the role of resistance training in promoting cognitive health in older adults (Liu-Ambrose & Donaldson, 2009).

Prevalence of Resistance Training among Older Adults

Despite the literature and information sources highlighting the benefits of resistance training, the prevalence of engaging in this behaviour for older adults is low. In regards to general physical activity and leisure-time activity levels, the majority of older Canadians are considered to be physically inactive (Public Health Agency of Canada, 2010). For those 65 years and older, approximately 50% of men and 64% of women are inactive, and these percentages increase with older adults who have low-income or education levels or who suffer from chronic conditions and pain (Public Health Agency of Canada, 2010). In Alberta, the percentage of adults 65 years and older with sufficiently active lifestyles was significantly lower than the younger population, with only 35% of older adults reporting leisure-time physical activity (Alberta Centre for Active Living, 2013). The above self-reported activity rates may actually be lower, as self-reporting of physical activity is often higher than actual rates (Colley et al, 2011). To assess general physical activity prevalence, the Canadian Health Measures Survey (CHMS) was used to objectively measure physical activity among a nationally representative sample of Canadians. The authors examined physical activity outcomes for 2,832 respondents aged 20 to 79 years who accepted the use of an accelerometer to

objectively monitor their physical activity and sedentary time (Colley et al., 2011). This CHMS study reported that only 15% of the participants were meeting the Canadian physical activity recommendations (i.e., 150 minutes of at least moderate intensity physical activity per week) and most of the participants (69%) were sedentary (Colley et al., 2011). For adults 60 to 79 years, only 13% of participants were meeting the activity recommendations. This study did not delineate resistance training from physical activity.

While much is known about the prevalence rates of physical activity, less is known about resistance-training prevalence among the general population, let alone older adults. Research of resistance training in older adults is still an emerging research field and there is no gold standard resistance training measurement tool that has been tested for validity and reliability. This includes any measurement tools that have adequately addressed all of the following: resistance training technique, training duration, weight dosing, repetitions, rotation of muscle groups addressed during training and required rest between training sessions. In a report by the National Center for Chronic Disease Prevention and Health Promotion, it was found that only 11% of older adults engaged in strength training activities (minimum two days per week) (Centers for Disease Control and Prevention, 2004). These researchers found the percentage decreased further with age but increased with level of education and increased for those older adults already engaged in other physical activity regimes (Kruger, Brown, Galuska, & Buchner, 2004). In a literature review, Peterson (2010) reported that only 27% of the US population participated in regular weekly resistance physical activity. Peterson (2010) further reports that participation rates for resistance physical activity is significantly less for older adults, with some literature reporting this rate as low as 10%. The Centers for

Disease Control analyzed 1998 to 2004 results from the National Health Interview Survey (NHIS) and determined the national prevalence rate of strength training for all adults to be 21.9% for men and 17.5% for women (training two or three times per week) (Centers for Disease Control, 2006). For adults 65 years and older, the prevalence was the lowest of all age groups, at 14.1% for men and 10.7% for women.

There is a lack of information regarding the prevalence of engaging in resistance training among Canadian adults, and specifically older adults (i.e., over 55 years of age). While there are certainly Alberta and Canadian organizations and initiatives focused on health and physical activity for older adults (e.g., Alberta Centre for Active Living, Canadian Fitness and Lifestyle Research Institute, Canadian Community Health Survey), these organizations do not measure rates of resistance training.

Sedentary Behaviours

When considering physical activity, it is also important to review the impact of sedentary behaviour in the lifestyles of older adults. The overall picture of an older adult's activity is more complete when examining the amounts of both sedentary behaviour and physical activity. Sedentary behaviours are not the same as physical inactivity such as performing insufficient amounts of moderate- to vigorous-intensity physical activity (Sedentary Behaviour Research Network, 2012). Sleep is not considered a sedentary behaviour, since sleep has an important restorative function.

Sedentary behaviour is an emerging and important field of scientific enquiry for older adults. More specifically, dedicating large amounts of time sitting is increasingly acknowledged as a distinct or independent risk factor for chronic disease among older adults (Vallance et al., 2013). Preliminary evidence suggests older adults who spend

large amounts of time sitting report poorer HRQoL compared to older adults who sit less (Vallance et al., 2013). Similar associations have also been demonstrated between those who spend large amounts of time sitting and reported rates of depression (Vallance et al., 2011). Despite the emerging evidence, older adults spend the overwhelming majority of their day in sedentary pursuits (Jefferis, Sartini, Shiroma, Whincup, Wannamethee, & Lee, 2014; Marshall et al., 2014). One recent systematic review suggested older adults are sedentary for an average 9.4 hours a day (Marshall et al, 2014). Recent studies have examined physical activity in concert with sedentary time with data suggesting large amounts of self-reported sedentary time (>11 hours per day) have hazardous health consequences irrespective of how physically active an individual is (Owen, Healy, Matthews, & Dunstan, 2010; van der Ploeg, Chey, Korda, Banks & Bauman, 2012). To date, no studies have dually-considered patterns of both resistance training and sedentary behaviours among older adults.

Objective, Aims, and Hypotheses

There is a growing body of research suggesting resistance training as an effective strategy in assisting older adults with maintaining physical function, preventing conditions of aging, and experiencing a higher HRQoL. Knowledge gaps still exist in the research however, pertaining to resistance training and older adults. First, the prevalence of resistance training needs to be established for older Albertans. This prevalence rate must be delineated from other physical activity rates and aerobic activity rates. Similarly, literature on psychosocial benefits and HRQoL measures are minimal and many are focused on other types of physical activity or are focused on younger age groups. More importantly, resistance training behaviours in conjunction with older adults' sedentary

behaviour profiles have not been explored. Research has examined consequences of being both physically active and highly sedentary (i.e., 'active couch potatoes). However, such patterns with resistance training have not been explored. The primary purpose of this thesis was to gain a better understanding of resistance training behaviours among older adults in Alberta.

Study One

The primary objectives of study one were to a) determine the prevalence of weekly resistance training among older Albertans, b) determine the demographic and health-related factors associated with resistance training, and c) elicit older adults' resistance training programming preferences. We hypothesized a) the prevalence of resistance-training behaviours among the sample of adults 55 years and older would be low (<10%), and b) key demographic e.g. age groups, gender, marital status, level of education, income, and health-related factors e.g. smoking status, body mass index, presence of chronic disease would be associated with resistance training behaviours and resistance training programming preferences.

Study Two

The primary objectives of study two were to gain a better understanding of the associations of health-related quality of life (HRQoL) and psychosocial factors (e.g., satisfaction with life, level of self-esteem, anxiety, depression) with resistance training and sedentary behaviour profiles. We hypothesized a) participants who engage in regular resistance training (frequency of at least two sessions per week), and report low sedentary time would report higher HRQoL compared to participants engaging in less than two resistance training sessions per week and reporting large amounts of sedentary time, and

b) participants who engaged in regular resistance training and low amounts of sedentary time would report more optimal psychosocial health outcomes compared to participants engaging in less than two resistance-training sessions per week and reporting large amounts of sedentary time.

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CHAPTER III

Study 1: An Examination of Resistance Training Behaviours among Older Adults in Alberta

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Abstract

The primary objective of this study was to gain a better understanding of resistance training behaviours among older adults in Alberta. Older adults from 37 Alberta communities were invited to participate in this study. Participants completed self-reported measures of resistance training behaviour, demographics, health-related information, and resistance training programming interest and preferences. A total of 358 participants returned a completed survey, for a response rate of 91.1% (358 out of 393). Overall, 53.1% met Canadian resistance training guidelines. On average, participants engaged in resistance training on 1.8 (SD=1.9) days per week for an average of 1.6 hours (1.3). The majority (89.3%) were "possibly interested" in participating in a resistance training program designed for older adults. Preferences included resistance training in a fitness club (45.7%) or seniors club (22.7%), receiving face-to-face information (76.6%), progressive intensity training (75.8%), and morning training times (51.7%). Being interested in a resistance training program was positively associated with university education (*OR* = 2.0; 95% CI,.95 to 4.0), being overweight or obese, (*OR* = 1.9; 95% CI, .92 to3.7), being male (*OR* = 1.9; 95% CI,.97 to3.8). Older adults had unique preferences for receiving resistance training counseling and programming. These preferences were associated with specific demographic and health-related variables.

Introduction

Mounting research suggests that physical activity is associated with increased longevity, reduction of chronic disease, improved cholesterol levels, improved oxygen efficiency, reduced chance of falling, and improved overall quality of life in older adults (Cowan, Radman, Lewis, & Turpie, 2009). Resistance training (e.g., strength training, weight lifting) has been found to have unique benefits for older adults (American College of Sports Medicine [ACSM], 2009). For example, resistance training can help prevent physical decline by maintaining muscle strength, muscle power, and endurance and helps to maintain a healthy body weight (Hanson, Srivatsan, Agrawal, Menon, Delmonico, Wang, & Hurley, 2009). Resistance training can also enhance many fitness parameters such as balance, coordination, speed, agility, and jumping ability (ACSM, 2009). When resistance training is part of a comprehensive activity program, the benefits can include improved cardiac function, functional capacity, and reduced risk factors for diabetes, osteoporosis, and even colon cancer (ACSM, 2009).

Unfortunately, resistance training rates for older adults are not measured in Canada. Peterson, Rhea, Sen, & Gordon (2010) reported that only 27% of the overall US population participated in regular resistance training, and rates were significantly less for older adults, with some literature reporting this rate as low as 10%. Similar resistance training rates were reported from a review of the 2011 US Behavioural Risk Factor Surveillance System (United States Centers for Disease Control and Prevention, 2014). Researchers reported that less than one-quarter of adults over the age of 45 met muscle-strengthening recommendations (i.e., at least two days per week). However, these estimates are likely inflated given the self-report methods used to determine these

prevalence rates. Objectively determined physical activity data (using accelerometers) from the United States National Health and Nutrition Examination Survey (NHANES) suggested that <5% of older adults are achieving the public health guidelines for physical activity (Troiano et al., 2008).

The primary objective of this cross-sectional study was to gain a better understanding of resistance training behaviours among older adults in Alberta. Specific aims were to a) determine the prevalence of weekly resistance training among older Albertans, b) determine the demographic and health-related factors associated with resistance training, and c) elicit older adults' resistance training programming preferences. We hypothesized 1) the prevalence of resistance-training behaviours among the sample of older adults would be low (<10%), and 2) key demographic and health-related factors would be associated with resistance training behaviours and programming preferences.

Methods

Prior to any recruitment related procedures, ethical approval was obtained from the Athabasca University Research Ethics Board. Older adults (men and women) across Alberta were invited to participate in this study. Participants were recruited from September 2013 to January 2014. Inclusion criteria included a) men and women ≥55 years of age, b) free from chronic medical and orthopedic conditions that would preclude physical activity and/or resistance training (e.g., congestive heart failure, use of a mobility aid, recent knee or hip replacement), c) having the ability to read and understand English, and d) residing in Alberta.

Older adults were recruited by placing a series of research notices in urban and rural newspapers. Newspapers included the Calgary Herald ("Real Life" section), Lethbridge Herald ("Lifestyles" section), Edmonton Journal ("Country Asides", "Family and Fitness" and "Today's Senior" sections), Medicine Hat News ("Generations" section), Grande Prairie Daily Herald-Tribune ("Health" section), Fort McMurray Today, Red Deer News ("Healthy Seniors" section) and Red Deer's Rural newspaper version. Other recruitment strategies included both presentations and advertisements with older adults' and other community organizations. Presentations included the Alberta55 Plus provincial organization, the Meadowlark Primary Physician's Clinic "Weight-Loss Alumni Group", the Tofield Senior's Community group, the Strathcona Place Seniors Centre group, and the Edmonton Rotary Southside. Recruitment also occurred through advertisements on bulletin boards or in newsletters through the Seniors Association of Greater Edmonton (SAGE), Golden Circle Seniors Centre in Red Deer, and many seniors' centres around Alberta. Seniors' organizations accessed, outside the major centres of Edmonton and Calgary, included: High Prairie Golden Age Club, Jasper Seniors Society, Lethbridge Senior Citizens Organization, and the Athabasca and District Seniors Society.

Interested participants contacted the study coordinator (EB) via telephone or email. After pre-screening, a survey package containing a detailed information letter, questionnaire, business reply envelope and $5 Tim Horton's gift card was sent to each interested participant. Please see Appendix B for the information letter and Appendix D for the questionnaire. Completion of the survey served as implied consent. This mail protocol was based on a slightly altered version of the Total Design Method (Dillman,

2000) that consists of an initial mail out, with information letter and business reply envelope, then a second mail out three weeks later to those subjects who did not respond to the initial mail out. No reminder phone calls were made.

The target sample size was 300 since a larger sample size would have required resources, funds and time beyond that of a graduate student. Nonetheless, to detect a small correlation of .20 with an alpha of .05 and .80 power, a sample size of 153 participants is required. Given our planned subgroups analyses, we planned to recruit at least 300 participants.

Measures

Demographic and health information were self-reported and included age, gender, height, weight, marital status, family income, education and employment status, smoking status, culture, co-morbidities and current medication use.

Resistance training was assessed by three survey items addressing overall experience (i.e. years resistance training, have never resistance trained), resistance training frequency and typical training session duration. Participants were asked how often they did resistance training activities over a typical week during the past month. Possible answers included the full spectrum from none or zero days per week, right up to seven days per week. For those who resistance trained, participants were asked to indicate duration of their typical training sessions (i.e., less than 10 minutes, between 10 and 30 minutes, between 30 and 60 minutes and more than 60 minutes).

Programming preferences were elicited by asking participants whether they were (1) able to participate in a resistance training program designed for older adults (i.e., yes, no, maybe); and (2) interested in participating in a resistance training program designed

for older adults (i.e., yes, no, maybe). Participants checked one or more categories from questions based on what they preferred to do. Questions also included: preferred period of resistance-training initiation (i.e., fall, winter, spring, summer); company (i.e., alone, with others my age, with friends, with family, no preference); time of day (i.e., morning, afternoon, evening, no preference); location (at a senior's club, regular fitness centre, in-home program, no preference); receipt of supplemental information (face-to-face, telephone, brochure, internet, group setting, other); equipment (free weights, weight machines, resistance bands, core strengthening equipment); intensity (only light-intensity, progressive resistance training to higher intensities with physical ability); supervision (supervised by trainer, train unsupervised once a trainer has set up program); and scheduling (pre-set, flexible).

Statistical Analysis

Statistical analyses were performed using SPSS version 19. Prior to any analyses, data were checked (via frequency distributions) for outliers and discrepancies. Descriptive statistics were used to examine the demographic and health characteristics of the sample and the percentage of participants meeting resistance training guidelines (i.e., at least two resistance training sessions per week).

Frequency counts and percentages were calculated to determine the resistance training activity programming preferences for the sample. To dichotomize the dependent variables for the logistic regression analysis, **"**yes**"** and **"**maybe**"** response options were combined. Chi-square tests for independence were conducted to determine what variables had statistically significant associations (i.e., $p<0.05$) with each counseling or program preference variable. Binary logistic regression was used to examine the

associations of demographic, medical, and resistance training behaviour variables (i.e., the variables that demonstrated significant chi-square statistics with the dependent variable) with the resistance training counseling and programming preference variables as the dependent variables.

Odds ratios (*OR*) reflect the increase (or decrease if the ratio is <1) in odds of being in one outcome category when the value of the predictor increases by one unit. In all analyses, adjusted ORs, as well as the associated 95 % confidence interval (CI), are presented for each level of the variable in comparison with the lowest (referent) level. For each preference variable, one logistic regression was run with the independent variables that demonstrated statistically significant associations with the dependent variable of interest in the chi-square analyses.

Results

A total of 393 surveys were mailed. A total of 358 participants returned a completed survey, for a response rate of 91.1% (358 out of 393). Demographic and health variables are presented in Table 1. The sample contained 236 women (65.9 percent). The mean age of the participants was 66.5 years (*SD* = 8.0), with a comparable mean across men and women. The mean body mass index was 25.4 (6.8). Smokers comprised 5.3% of the sample. At least one chronic disease was reported by 58.6% of the participants.

Prevalence of Resistance Training

Overall, 53.1% met resistance training guidelines. For those not meeting resistance training guidelines, 39.1% of respondents reported “zero” training sessions in a typical week and 7.8% of respondents reported “one” session a week. There were 3.1%

of respondents who reported they performed resistance training daily in a typical week and 0.6% who reported they trained six days in a typical week. For those who reported weekly resistance training, 33.7% stated these sessions were less than 10 minutes duration.

The range of experience with resistance training was zero years to 55 years, with a mean of 4.3 years (*SD* = 9.1 years, *M* = 0.0 years). Mean range of experience was 5.5 years (10.8 years) for men and 3.7 years (8.0 years) for women. The 60 to 69 years age group had the highest percentage of those meeting guidelines (54.5%). In comparison, 38.1% of those over 80 years were meeting guidelines.

Table 2 presents resistance training preferences of older Albertans. Overall, 89.3% of respondents were at least possibly interested in participating in a resistance training program and 96.1% felt that they would possibly be able to be involved in a resistance training program designed specifically for older adults. Table 3 provides a summary of older adults' preferences for coaching and information. The most preferred type of locations for resistance training coaching was at a regular fitness club (45.7%), home-based (27.3%) and at a seniors club (22.7%). For supervision, 61.1% reported they would like to be supervised initially and once the program is set up would prefer to train unsupervised. The most preferred type of mode for supplemental information was face-to-face (76.6%), followed by internet/email (11.4%), and print (10.8%). For program structure preferences, 65.9% stated they would prefer a pre-scheduled training session as opposed to spontaneous training sessions. The majority (75.8%) expressed the desire to have a resistance training program that was of progressive-intensity as opposed to an ongoing light-intensity program. The majority of respondents (33.7%) expressed a

preference to be with others their own age or with friends (8.7%). A smaller number (29%) expressed a preference for training alone. The majority stated they would prefer to start a resistance training program in the fall or winter (68.6%). The majority stated they prefer morning training times (51.7%) with afternoon being the second most popular choice (18.9%).

Associations of Demographic and Behavioural Variables

Table 4 provides a summary of the associations between demographic and behavioural variables and meeting resistance training guidelines. Being possibly interested in a resistance training program designed for older adults was positively associated with university education (*OR* = 2.0; 95% CI, .95 to 4.0), being overweight or obese, (*OR* = 1.9; 95% CI, .92 to 3.7), being male (*OR* = 1.9; 95% CI, .97 to 3.8). Being interested in receiving resistance training counseling was positively associated with university education (*OR* = 2.6; 95% CI, 1.3 to 5.1). Indicating a possible ability to participate in a resistance training program for older adults was associated (although p = .06) with not having a chronic disease (*OR* = .67; 95% CI, 0.43 to 1.02). No other variables were associated positively with perception of ability. Meeting resistance training guidelines, was positively associated with meeting physical activity guidelines (*OR* = 2.16; 95% CI, 1.36 to 3.42), and having an income of over $60,000 (*OR* = 2.09; 95% CI, 1.25 to 3.51).

Discussion

We reported that 53% participants in this study were meeting the Public Health Agency of Canada resistance training guidelines for older adults. Older adults had unique preferences for receiving resistance training counseling and programming. These

preferences were associated with specific demographic and health-related variables. Contrary to our hypothesis, we reported the majority of older adults in this study were meeting resistance training guidelines. This finding is likely related to the primary limitation of our study; the transparent nature of this study attracted many older adults who were already participating in resistance training initiatives. This limitation is discussed in more detail below.

Our resistance training prevalence rate cannot be compared to a Canadian rate since resistance training for older adults is not tracked separate from overall physical activity rates in Canada. Our prevalence rate appears much high compared to the literature that does exist from other countries. It could be that our prevalence rate is a result of the convenience sample method which appeared to attract older Albertans who were already interested in resistance training. This belief falls from the many comments received from respondents to the research recruitment efforts. Comments included "I exercise regularly and therefore was very interested when I saw your newspaper ad" or "I already workout with a trainer and really want to contribute to your project". For example, Peterson (2010) reported that participation rates for resistance training were significantly low for the older adult population, with some literature reporting this rate as low as 10 percent. The Centers for Disease Control and Prevention analyzed 1998 to 2004 results from the National Health Interview Survey (NHIS) and determined the national prevalence rate of strength training for all adults to be 21.9% for men and 17.5% for women (training two or three times per week) (United States Centers for Disease Control [CDC], 2006). A recent review of the 2011 US Behavioural Risk Factor

Surveillance System (CDC, 2014) reported less than one-quarter of adults over the age of 45 meeting resistance training recommendations.

Our study suggested that 68.4% of older adults were possibly interested in participating in a resistance training program for older adults. Further, 65.8% of the respondents expressed a possible interest in counselling specific to resistance training. The most preferred location for resistance training counselling was at a fitness club (68.4%), versus an in-home program (27.3%). For the club preference, 45.7% preferred a regular fitness club and 22.7% preferred a specific seniors' fitness club. This preference for training in a club with others aligns with findings from other research on older adults and exercise. In a qualitative study by Lubcke, Martin, & Hellstrom (2012) older adults reported a preference for exercise when it was at a location that created a forum to meet friends. In a study addressing motivation, group-based resistance training programs for older adults were deemed more effective for long-term adherence compared with home-based resistance training (Cyarto, Brown, & Marshall, 2006). Participants stated that the social aspect of the group kept their interest and involvement in the long term, when compared to older adults in home-based exercise programs (Cyarto et al., 2006). McGuire, Waltman, & Zimmerman (2011) also cite feedback as a predictor of exercise adherence, a factor more readily available in group-based programs as opposed to home-based programs.

The desired timing for resistance training was mornings (51.7%), afternoons (18.9%), evenings (13.0%), and no preference (16.4%). When questioned about intensity of training, only 24.2% preferred light intensity, whereas 75.8% preferred progressive intensity. There didn't appear to be comparable literature specific to older adults'

training intensity preferences. However, in a literature review by Granacher, Muehlbauer, Zahner, Gollhofer, & Kressig (2011) the authors summarized that progressive and high intensity resistance training was safe and more effective in muscle functional and strength gains. Progressive resistance training, as opposed to light training, can lead to significant increases in strength and muscles mass in older adults (Holviala, Sallinen, Kraemer, Alen, & Hakkinen, 2006).

Based on these findings from both the research sample and corresponding literature, the optimal resistance training program needs to be tailored to the preferences of the older adult, given the preferences observed in this study. Classes should be offered during morning or afternoons, focus coaching on safety and technique so participants experience confidence and success early in the training experience, allow for social interaction, and provide frequent feedback. Classes should also provide ongoing education in a face to face format, and instill the concept of progression so the older adults learn progressive intensity and experience results with muscle mass, functionality and strength.

Our research indicated less education and lower income was significantly associated with not meeting resistance training guidelines. This difference can be seen in the research literature for overall physical activity participation. The Public Health Agency of Canada (2010) reports that for those 65 years and older, approximately 50% of men and 64% of women are inactive, and these percentages increase with older adults who have low-income or low education levels. The rates referenced by reviewers of the 2011 US Behavioural Risk Factor Surveillance System (CDC, 2014) reflect many of the above findings. Researchers reported that the following groups were least likely to meet

resistance training guidelines: women, those in older age groups, and those with lower education levels. These findings may be due to the costs associated with resistance training. That is, to participate in resistance training, older adults are required to either purchase their own equipment (e.g., dumbbells, resistance training machine), or join a fitness centre or club.

Several factors were associated with resistance training programming preferences. For example, Kruger, Brown, Galuska, & Buchner (2004) reported that the percentage of resistance training regimes increased with level of education and increased for those older adults already engaged in other physical activity regimes. Our research shows comparable results where participants with higher levels of education were more likely to be interested in a resistance training program for older adults (*OR* = 2.0) and also be more likely to be interested in receiving counseling for resistance training (*OR* = 2.6). Also, older adults who were already engaged in meeting general physical activity guidelines, were also more likely to be meeting resistance training guidelines (*OR* = 2.16). The Alberta Centre for Active Living (2013) study found that Albertans in the lowest income brackets were less likely to be physically active. Our data supports this finding as older adults with lower levels of income were less likely to be interested in resistance training, and in contrast, those in higher income brackets were more likely to meeting guidelines (*OR* = 2.09). The Canadian Fitness and Lifestyle Research Institute (2009) reported there were higher activity levels for adults in higher socioeconomic status backgrounds compared to those in lower, possibly due to the costs of physical activity (e.g., joining a gym, buying proper runners). The Public Health Agency of Canada (2010) reported that older adults with few financial resources are less likely to participate in any kind of

physical activity. Taken collectively, our data adds to the previously published literature suggesting income and socioeconomic status is negatively associated with resistance training behaviours.

When interpreting the results of this study, limitations need to be recognized. The generalizability to rural communities and other provinces may not be appropriate if our study sample is sufficiently different from the general older adult population. Another limitation is the self-report nature of the survey. There is a body of research identifying multiple influences on individuals' responses on survey instruments that limit the reflection of reality (Streiner & Norman, 2008). A limitation is that the resistance training portion of the survey was not a pre-existing research instrument that had been tested for validity and reliability. Although our study utilized a multi-prong recruitment strategy of newspapers, newsletters, and presentations, this approach appeared to attract many older adults who were interested in resistance training. As a result, our study recruitment methods, and the transparent nature of the study, may have led to a response bias whereby active, interested individuals participated and thus were over-represented in the sample. This is evidenced in the finding that 53% of participants were actively engaged in resistance training, a percentage exceedingly higher than other published reports. As a result, we take caution in judging the representativeness of our sample to the larger Alberta population of adults 55 years of age and older.

This study provides new and unique information related to older Albertans and resistance training. The study results are a snapshot of 358 older Albertans, their overall rate of physical activity and resistance training, their resistance training beliefs, and their programming preferences. The detailed demographic, behavioural and health

information from this sample can be a basis for not only further research questions, but can also be used immediately in the design of resistance training and physical activity programs for those over 55 years. Health professionals and fitness experts can consider many of these outcomes presented in our research results; morning or afternoon structured programs geared to older adults, face to face supplemental training and health information, resistance training counselling that increases the participant's confidence, and a program design which incorporates the concept of progression. Specific strategies to increase participation of those from lower socioeconomic and education groups need to be considered. Strategies could include reaching out to these cohorts through local community centres who already work with these populations.

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Table 1

Demographic and behavioural characteristics of study participants

	Overall	Men N=122	Women N=236	*p*
Age	66.5 ± 8.0	66.5 ± 7.4	66.4 ± 8.4	0.16
Body Mass Index (n=346)				
Underweight	5 (1.4)	1 (0.8)	4 (1.8)	<0.368
Normal Weight	153 (44.3)	47 (39.8)	106 (46.7)	
Overweight	133 (38.6)	53 (44.9)	81 (34.3)	
Obese	54 (15.7)	17 (14.4)	37 (16.3)	
Marital Status (n=357)				
Never Married	11 (3.1)	2 (1.6)	9 (3.8)	<0.013
Married/Common Law	267 (74.8)	105 (86.1)	162 (68.9)	
Divorced/Separated	38 (10.6)	8 (6.6)	30 (12.8)	
Widowed	41 (11.5)	7 (5.7)	34 (14.5)	
Education (n=357)				
Some High School	23 (6.4)	10 (8.2)	13 (5.5)	<0.430
Completed High School	60 (16.8)	18 (14.8)	42 (17.9)	
Some Univ/College	62 (17.4)	18 (14.8)	44 (18.7)	
Completed Univ/College	151 (42.3)	49 (40.2)	102 (43.4)	
Some Graduate School	7 (2.0)	3 (2.4)	4 (1.7)	
Completed Graduate School	53 (14.8)	24 (19.7)	29 (12.3)	
Income (n=314)				
<$60,000	117 (37.3)	36 (32.4)	82 (34.7)	<0.004
$60,000 to <$100,000	88 (28.0)	23 (20.7)	65 (32.0)	
≥$100,000	109 (34.7)	52 (46.8)	57 (28.0)	
Employment status				
Full-time	73 (20.7)	33 (27.2)	40 (17.2)	<0.014
Part-Time	34 (9.6)	9 (7.4)	26 (11.1)	
Unemployed	2 (0.6)	1 (0.8)	1 (0.4)	
Retired	222 (62.7)	77 (63.6)	145 (62.5)	
Homemaker	14 (4.0)	0 (0)	14 (6.0)	
Disability	8 (2.3)	1 (0.8)	7 (3.0)	
Racial background (n=354)				
Caucasian	337 (95.2)	116 (95.9)	221 (94.8)	0.617
Other	17 (4.8)	5 (4.1)	12 (5.2)	

Smoke (n=357) Yes	19 (5.3)			
Comorbidities	46 (13.0)	18 (14.9)	28 (12.1)	0.457
Cancer	32 (9.1)	14 (11.6)	19 (8.2)	0.294
Diabetes	15 (4.2)	12 (9.9)	3 (1.3)	0.000
Heart Attack	6 (1.7)	4 (3.3)	2 (0.9)	0.093
Stroke	125 (35.4)	53 (43.8)	73 (31.3)	0.020
Hypertension	111 (31.4)	41 (33.9)	70 (30.2)	0.476
High Blood Cholesterol				

Numbers may not equal 358 due to missing data. Data are presented as the mean (*M*) and standard deviation (*SD*) for continuous variables (i.e., age, body mass index) and frequency (%) for categorical variables. Demographic and clinical characteristics of participants were compared using analysis of variance and chi square tests where appropriate.

Table 2

Resistance training preferences

Preference variable	Preference question	*N*	%
Would you be interested in a resistance training program designed specifically for people 55 years and older?			
	Yes or maybe	319	89.3
	No	38	10.6
Coaching	Would you be interested in being coached about resistance training at some point?		
	Yes or maybe	313	87.7
	No	44	12.3
Location	If you were to receive resistance training coaching, where would you prefer this to occur?		
	At a seniors' club	80	22.7
	At a regular fitness club	161	45.7
	As part of an in-home program	96	27.3
	Other type of coaching	12	3.4
	Not interested in coaching	3	0.9
Coaching	What would be your first choice for receiving supplemental information about maintaining muscle resistance?		
	Face to face (one to one; group)	269	76.6
	Telephone	3	0.9
	Brochure/print	38	10.8
	Internet/email	40	11.4
	Social Media (facebook, twitter)	1	0.3
Supervision	If you were to participate in regular ongoing resistance training, would you prefer to be supervised or unsupervised?		
	Be supervised	136	38.9
	Train unsupervised once program set up	214	61.1

Note: Some variables do not equal 358 due to missing data. Data are presented as the number of participants (N) and frequency (%).

Table 3

Resistance training programming preferences

Preference variable	Preference question	*N*	%
Ability	Do you think you would be able to participate in a resistance training program designed specifically for people 55 years and older?		
	Yes or maybe	343	96.1
	No	14	3.9
Company	If you were to participate in regular resistance training, who would you prefer to be active with?		
	Alone	103	29.0
	With others my age	120	33.7
	With friends	31	8.7
	With family	14	3.9
	No preference	88	24.7
Timing	When would you prefer the program to start?		
	Fall	100	28.6
	Winter	140	40.0
	Spring	64	18.3
	Summer	17	4.8
	Anytime	29	8.3
Timing	When would you prefer to be active?		
	Mornings	183	51.7
	Afternoons	67	18.9
	Evenings	46	13.0
	No preference	58	16.4
Structure	How would you prefer the structure of your training program?		
	Scheduled (i.e. specific days/times)	230	65.9
	Spontaneous/flexible	119	34.1

Intensity	If you were to participate in regular resistance training, how intense would you prefer to train?		
	Light intensity	85	24.2
	Progressive intensity	266	75.8
Supervision	If you were to participate in regular resistance training, would you prefer to be supervised or unsupervised?		
	Be supervised	136	38.9
	Train unsupervised once program set up	214	61.1
Equipment	Do you currently have any of the following resistance training equipment in your home?		
	Free weights	257	71.8
	Weight machines	43	12.0
	Resistance bands	196	54.7
	Core resistance equipment	141	39.4
Equipment	If you currently resistance train, what is your most preferred type of training? (n=358)		
	Free weights	120	33.5
	Weight machines	56	15.6
	Resistance bands	36	10.1
	Using own body weight	14	3.9
	I don’t resistance train	106	29.6
	Didn’t respond to question	26	7.3

Note: Some variables do not equal 358 due to missing data. Data are presented as the number of participants (N) and frequency (%).

Table 4

Associations Between Variables and Meeting Resistance Training Guidelines

	Meeting RT Guidelines	Not Meeting in RT Guidelines	X^2	*p*
Variable	190 (53.1)	168 (46.9)		
Gender				
Female (n=233)	126 (53.0)	110 (47.0)		
Male (n=121)	64 (52.5)	58 (47.5)	0.28	0.867
Age				
Under 65 yrs (n=159)	79 (50.0)	80 (50.0)		
65 yrs and above (n=198)	110 (55.5)	88 (44.5)	1.22	0.269
BMI				
Normal BMI (n=169)	88 (48.0)	81 (52.0)		
Overweight (n=187)	101 (54.0)	86 (46.0)	0.134	0.714
Smoking				
Smokes (n=19)	7 (37.0)	12 (63.0)		
Does not smoke (n=338)	182 (46.2)	156 (53.8)	2.10	0.148
Education				
Less than University (n=86)	42 (48.8)	44 (51.2)		
University (n=271)	147 (54.2)	124 (45.8)	0.766	0.381
Income				
Below $60,000 (n=118)	55 (46.6)	63 (53.4)		
Above $60,000 (n=240)	135 (56.2)	105 (43.8)	2.95	0.086
Work Status				
Retired (n=222)	120 (54.0)	102 (46.0)		
Working (n=132)	69 (52.3)	63 (47.7)	0.106	0.745
Physical Activity				
Meets PA (n=195)	136 (69.7)	59 (30.3)		
Doesn't meet PA (n=163)	54 (33.1)	109 (66.9)	47.49	0.000

RT = Resistance Training. PA = Physical Activity. Numbers may not equal 358 due to missing data. Data are presented as the number of participants (N) and percentage (%).

CHAPTER IV

Study 2: Patterns of resistance training behaviour and sedentary time among older adults: Associations with health-related quality of life and psychosocial health

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Abstract

To date, no studies have dually-considered patterns of both resistance training (RT) and sedentary behaviours (SED) among older adults. The primary objective of this study was to gain a better understanding of the associations of health-related quality of life (HRQoL) and psychosocial factors (e.g., satisfaction with life, level of self-esteem, anxiety, depression) with resistance training and sedentary behaviour profiles. Methods: Older adults across Alberta completed measures of resistance training behaviour, sedentary time, HRQoL, and psychosocial factors (i.e., depression, anxiety, self-esteem, satisfaction with life). Participants were placed into one of four patterns with respect to their sedentary and resistance training behaviours. A total of 358 participants returned a completed survey, for a response rate of 91.1% (358 out of 393). Results: Pairwise comparisons indicated that those who were low SED/low RT had a higher mental health composite (MHC) score compared to those in the high SED/low RT group (M_{diff} = 3.9, p = .008). Compared to those in the high SED/low RT group, participants in the low SED/high RT groups had significantly higher MHC scores (M_{diff} = 4.8, p < .001). For PHC, compared to the high SED/low RT group, participants in the low SED/high RT group reported significantly higher PHC scores (M_{diff} = 3.7, p = .019). For depression, compared to the high SED/low RT group, lower depression symptom scores were observed in the low SED/high RT groups (M_{diff} = -0.60, p < .001). Conclusion: Resistance training, regardless of sitting time, was significantly associated with HRQoL and psychosocial health. Rather than simply encouraging older adults to engage in resistance training, those working with older adults should also recommend older adults limit their time spent in sedentary pursuits.

Introduction

A plethora of research convincingly concludes moderate-to-vigorous physical activity (MVPA) among older adults has positive effects on participant-reported psychosocial health outcomes such as depression, mood, anxiety, and health -related quality of life (HRQoL) (Kimura et al., 2010). Unfortunately, most literature has been primarily focused on aerobic exercise and not on resistance training (Kimura et al., 2010).

A small but growing body of intervention research has demonstrated associations of resistance training (RT) with HRQoL and psychosocial health outcomes (Brovold, Skelton, & Bergland, 2008; Dionigi & Cannon, 2009; Katula, Rejeski, & Marsh, 2008; Kimura et al., 2010). In these studies, older adults engaging in regular and sustained resistance training activities reported better HRQoL and fewer depression and anxiety symptoms compared to participants not engaging in resistance training.

Sedentary behaviour (SED) is an emerging and important field of scientific enquiry for older adults. Sedentary behaviours are activities low in energy expenditure (e.g., watching television, sitting at a computer). They have been conceptualized as sitting or reclining and are in the energy-expenditure range of 1.0 to 1.5 metabolic equivalents (METs) (Owen, 2012). Sedentary behaviours are not to be confused with physical inactivity (i.e., performing insufficient amounts of moderate- to vigorous-intensity physical activity) (Sedentary Behaviour Research Network, 2012). Sedentary behaviour does not include sleep, which has important restorative functions. Among older adults spending large amounts of time sitting is increasingly acknowledged as a distinct risk factor for chronic disease (Owen, 2012; Dunstan, Howard, Healy, & Owen, 2012). Preliminary evidence suggests older adults who spend large amounts of time

sitting report poorer HRQoL compared to older adults who sit less (Vallance, Eurich, Lavallee, Marshall, & Johnson, 2011). Associations have also been demonstrated with depression (Vallance, Winkler, Gardiner, Healy, Lynch, & Owen, 2011). Despite the emerging evidence, older adults spend the overwhelming majority of their day in sedentary pursuits (Jefferis et al., 2014; Marshall et al, 2014). One recent systematic review suggested older adults spend on average 9.4 hours a day sedentary (Harvey, Chastin, & Skelton, 2014).

Recent studies have examined physical activity in concert with sedentary time with data suggesting large amounts of sedentary time have hazardous health consequences irrespective of how physically active an individual is (Owen, Healy, Matthews, & Dunstan, 2010; van der Ploeg, Chey, Korda, Banks, & Bauman, 2012). To date, no studies have dually-considered patterns of both resistance training and sedentary behaviours among older adults. The primary objective of this study was to gain a better understanding of HRQoL and psychosocial factors (e.g., satisfaction with life, level of self-esteem, anxiety, depression) associated with resistance training and sedentary behaviour. We hypothesized 1) participants who do engage in regular resistance training (frequency of at least 2 sessions per week), and report low sedentary time would report higher HRQoL (i.e., physical, mental, and global composite scores) compared to participants engaging in <2 resistance training sessions per week and reporting large amounts of sedentary time, and 2) participants who engaged in regular resistance training and low amounts of sedentary time would report more optimal psychosocial health outcomes (i.e., less anxiety and fewer depressive symptoms, and better self-esteem and

satisfaction with life) compared to participants engaging in <2 resistance-training sessions per week and reporting large amounts of sedentary time.

Methods

Participants and Procedures

Prior to any recruitment related procedures, ethical approval was obtained from the Athabasca University Research Ethics Board. Older adults (men and women) across Alberta were invited to participate in this study. Participants were recruited from September 2013 to January 2014. Inclusion criteria included (a) men and women ≥55 years of age, (b) free from chronic medical and orthopedic conditions that would preclude physical activity and/or resistance training (e.g., congestive heart failure, use of a mobility aid, recent knee or hip replacement), (c) having the ability to read and understand English, and (d) residing in Alberta.

Older Albertans were recruited by placing a series of research notices in urban and rural newspapers. Newspapers included the Calgary Herald ("Real Life" section), Lethbridge Herald ("Lifestyles" section), Edmonton Journal ("Country Asides", "Family and Fitness" and "Today's Senior" sections), Medicine Hat News ("Generations" section), Grande Prairie Daily Herald-Tribune ("Health" section), Fort McMurray Today, Red Deer News ("Healthy Seniors" section) and Red Deer's Rural newspaper version. Other recruitment strategies included both presentations and advertisements with older adults' and other community organizations. Presentations included the Alberta55 Plus provincial organization, the Meadowlark Primary Physician's Clinic "Weight-Loss Alumni Group", the Tofield Senior's Community group, the Strathcona Place Seniors Centre group, and the Edmonton Rotary Southside group. Recruitment also occurred

through advertisements on bulletin boards or in newsletters through the Seniors Association of Greater Edmonton (SAGE), Golden Circle Seniors Centre in Red Deer, and many seniors' centres around Alberta. Seniors' organizations accessed, outside the major centres of Edmonton and Calgary, included: High Prairie Golden Age Club, Jasper Seniors Society, Lethbridge Senior Citizens Organization, and the Athabasca and District Seniors Society.

Interested participants contacted the study coordinator (EB) via telephone or email. After pre-screening, a survey package containing a detailed information letter, questionnaire, business reply envelope and $5 Tim Horton's gift card was sent to each interested participant. Completion of the survey served as implied consent. This mail protocol was based on a slightly altered version of the Total Design Method (Dillman, 2000) that consists of an initial mail out, with information letter and business reply envelope, then a second mail out three weeks later to those subjects who did not respond to the initial mail out. No reminder phone calls were made.

Measures

Demographic and health information were self-reported and included age, gender, height, weight, marital status, family income, education and employment status, smoking status, moderate-to-vigorous physical activity (MVPA), co-morbidities and current medication use.

Resistance training was assessed by three survey items addressing overall experience (i.e. years resistance training, have never resistance trained), resistance training frequency and typical training session duration. Participants were asked how often they did resistance training activities over a typical week during the past month

(i.e., 0 to 7 days). For those who resistance trained, participants were asked to indicate duration of their typical training sessions (i.e., less than 10 minutes, between 10 and 30 minutes, between 30 and 60 minutes and more than 60 minutes). Participants were also asked to indicate how many years of experience they have resistance training.

Sedentary time was assessed using the Total and Domain Specific Measure of Sitting developed and evaluated by Marshall and colleagues (Marshall et al., 2010) that included five items assessing time spent sitting (hours and minutes) each day in the following domains: a) while traveling to and from places, b) while at work, c) while watching television, d) while using a computer at home, and e) at leisure not including watching television, on a weekday and a weekend day. Recent research provides acceptable evidence of test-retest reliability and validity using both logbook and accelerometer data as criterion measures (Marshall et al., 2010). For the purposes of this study, weekday and weekend sitting time was combined to create one total sedentary time variable.

HRQoL was assessed using the RAND-12 (12 items) (Ware, Kosinski, & Keller, 1996), which measures physical and mental dimensions of HRQoL taken from the RAND-36 Health Status Inventory (Maddigan, Feeny, & Johnson, 2004). The RAND-12 gives two scores; a mental health component scale (MHC) and a physical health component scale (PHC), each comprising six items. A global health score (GHC) was also generated by combining the MHC and PHC scores. Scores range from 0 to 100 and lower scores on the MHC and the PHC indicate greater disability (>50 = no disability; 40-50 = mild disability; 30-40 = moderate disability). A PHC score $\leq$ 42 suggests that perceived physical health problems are impeding life functioning, while an MHC score $\leq$

38 likely indicates that an individual is experiencing psychological symptoms that might be impeding life functioning (Ware et al., 1996).

Depression symptoms were assessed using the Patient Health Questionnaire, PHQ-2, a two-item version of the PHQ-9 depression screener (Forti & Organisation for Economic Cooperation and Development, 2014). The PHQ-2 inquires about the frequency of depressed mood and anhedonia over the past 2 weeks, scored each as 0 (not at all) to 3 (nearly every day). The PHQ-2 has demonstrated a high degree of construct and criterion validity (Kroenke, Spitzer & Williams, 2007).

Anxiety was assessed using the two-item Generalized Anxiety Disorder scale (GAD-2) (Kroenke et al., 2007). The GAD-2 asks participants how often over the last 2 weeks they were bothered by 1) feeling nervous, anxious, or on edge, and 2) not being able to stop or control worrying. The GAD-2 has demonstrated high sensitivity and specificity for GAD and high specificity for panic disorder, social anxiety disorder, and post-traumatic stress disorder.

Self-esteem was measured by the Rosenberg Self-Esteem Scale (RSES). The RSES consists of 10 items rating factors on a four-point Likert scale ranging from strongly agree to strongly disagree, with phrases such as “I am able to do things as well as most other people,” or “Ultimately, I tend to feel like a failure” (Zhao et al., 2013). This scale has been shown to have a high degree of reliability and validity (Zhao et al., 2013).

Satisfaction with life was assessed using Diener’s Satisfaction With Life Scale (SWLS) (Diener, Emmons, Larsen, & Griffin, 1985). The SWLS is a short five-item instrument designed to measure global cognitive judgments of satisfaction with one’s life

(e.g., “The conditions of my life are excellent” and “In most ways, my life is close to my ideal”). Participants were asked to indicate their degree of agreement or disagreement on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). The scale has been demonstrated to have a high degree of internal consistency and temporal reliability (Diener et al., 1985).

Statistical Analysis

Data were entered into SPSS version 19. Descriptive statistics (frequency, mean, standard deviation, range, and percentages) were used to examine the demographic, behavioural, and medical characteristics of the sample. Self-reported resistance training behaviour was coded as 0 (not meeting resistance training guidelines) or 1 (meeting resistance training guidelines). A median-split protocol was employed to create a low sedentary time group (<482.14 min/week; coded as 0) and a high sedentary time group (≥482.14 min/week; coded as 1). Based on these two variables (i.e., sedentary time and resistance training), four behavioural profiles were generated and included 1) low sedentary/not meeting resistance training guidelines (low SED/low RT), 2) low sedentary/meeting resistance training guidelines (low SED/high RT), 3) high sedentary/not meeting resistance training guidelines (high SED/low RT), and 4) high sedentary/meeting resistance training guidelines (high SED/high RT).

Multivariate analysis of covariance variance (MANCOVA) procedures were used to test differences in HRQoL (i.e., PHC and MHC) and psychosocial health variables (i.e., depression, anxiety, self-esteem, and SWL) between SED and RT behavioural profiles. Variables that were associated with the dependent variables ($p<.20$) were included as covariates. The first model examined MHC and PHC (i.e., HRQoL) as the

dependent variables. For HRQoL, covariates included age, smoking, income, marital status, gender, and chronic disease (i.e., at least one chronic disease). The second model examined psychosocial health variables as the dependent variables. For the psychosocial model, covariates included age, income, employment status, education, marital status, gender, and chronic disease (i.e., at least one chronic disease). A significant MANCOVA was followed by univariate analyses of variance (ANOVAs) for each specific HRQoL and psychosocial health outcome endpoint. Linear independent pairwise comparisons were analyzed (using Bonferroni corrections) to examine the magnitude of the differences in the mean scores of the dependent variables.

Results

A total of 393 surveys were mailed in response to the various recruitment activities. After a brief phone call with each of these potential participants, to screen for inclusion criteria, each was deemed eligible. A total of 358 participants returned a completed survey, for a response rate of 91.1% (358 out of 393). The sample contained 236 women (65.9%). The mean age of the participants was 66.5 years (*SD* = 8.0), with a comparable mean across men and women. The mean BMI was 25.4 (*SD* = 6.8). Smokers represented 5.3% of the sample. Reports of chronic disease included hypertension (35.4%), high cholesterol (31.4%), cancer (13.0%) and diabetes (9.1%). Collectively, 58.6% of participants reported at least one chronic disease. For a detailed account of demographic, behavioural, and medical characteristics of the sample, see Table 1 in previous chapter of paper.

An overview of the descriptive statistics for sedentary behaviours among older Albertans in this sample are displayed in Table 1, and the HRQoL and psychosocial

health mean scores (adjusted) across resistance training and sedentary time profiles are displayed in Table 2, in this chapter below. In Table 1, participants' sedentary activity (reported as sitting time duration and frequency) is summarized for weekday and weekend time spent travelling, working, watching television, using a computer and in leisure. The total average sitting time per day was 544.4 minutes (*SD* = 369.1), or 9.06 hours per day. Table 1 indicates context-specific sitting time across both the weekday and weekend. In Table 2, the four categories representing participant's activity levels are as follows: Low SED/ Low RT (*n* = 78); Low SED/ High RT (*n* = 103); High SED/Low RT (*n* = 88); and High SED/ High RT (*n* = 89). For HRQoL, the RAND mean scores were as follows: mental health composite (MHC) score (*M* = 47.63, *SD* = 8.16); physical health composite (PHC) score (*M* = 52.30, *SD* = 9.37); and global health composite (GHC) score (*M* = 49.67, *SD* = 8.54). These mean scores reflect a mild disability level.

For HRQoL (RAND-12), the overall MANCOVA was significant when comparing behavioural profiles [Wilks' $\lambda = .935$, $F(6,664) = 3.789$, $p = .001$]. Univariate analyses were statistically significant for both MCH and PHC (both p's < .03). Pairwise comparisons indicated that those who were low SED/low RT had a higher mental health composite (MHC) score compared to those in the high SED/low RT group ($M_{diff} = 3.9$, $p = .008$). Compared to those in the high SED/low RT group, participants in the low SED/high RT groups had significantly higher MHC scores ($M_{diff} = 4.8$, $p < .001$). Finally, high SED/high RT participants reported higher MHC scores compared to high SED/low RT ($M_{diff} = 4.1$, $p = .003$). For PHC, compared to the high SED/low RT group, participants in the low SED/high RT group reported significantly higher PHC scores $M_{diff} = 3.7$, $p = .019$).

For the psychosocial health variables, the overall MANOVA was significant when comparing behavioural profiles [Wilks' λ = 0.897, $F(12,897) = 3.115$, $p < .001$]. Univariate analyses indicated all four dependent variables (i.e., depression, SWL, anxiety, self-esteem) were statistically significant (all p's<.035). For depression, compared to the high SED/low RT group, lower depression symptom scores were observed in both the low SED/low RT (M_{diff} = -0.48 p = .014) and low SED/high RT groups (M_{diff} = -0.60, $p < .001$). For SWL, compared to the high SED/low RT group, higher scores were observed in both the low SED/low RT (M_{diff} = 2.8, p = .022) and low SED/high RT groups (M_{diff} = 4.3, $p < .001$). For anxiety, the low SED/high RT group reported significantly lower scores compared to the high SED/low RT group (M_{diff} = -0.67, p = .001). The low SED/low RT group reported significantly lower scores than the high SED/low RT group (M_{diff} = -0.57, p = .018).

Discussion

Our data indicated that specific profiles of resistance training and sedentary time are associated with HRQoL and psychosocial health. In particular, participants engaging in high volumes of sedentary time (i.e., ≥482.14 min/day) as well as not meeting resistance training guidelines (i.e., at least two times per week) reported significantly poorer (and the poorest) HRQoL (i.e., poorer scores on the PHC and MHC). These individuals also reported significantly more depression and anxiety symptoms, and lower satisfaction with life. Of interest, irrespective of resistance training status, participants with high volumes of sedentary time reported significantly lower HRQoL and depression scores compared to participants with low sedentary time (i.e., and no resistance training).

Physical activity among older adults is well known to have positive effects on psychosocial health, such as mood and anxiety reduction, thus increasing HRQoL (Kimura et al., 2010). Vagetti, Filho, Moreira, de Oliveira, Mazzardo, & de Campos (2014) reviewed original studies examining the association between physical activity and HRQoL for older adults. Of the 42 studies meeting their inclusion criteria, most reported a positive association between physical activity and HRQoL especially in the following domains: functional capacity, autonomy, mental health measures, vitality and psychological measures. However fewer studies have isolated resistance training from other physical activity modes to explore associations between resistance training and HRQoL outcomes. Resistance training has been shown to improve several indices of well-being including depression, anxiety and quality of life for older adults (Chodzko-Zajko et al., 2009). For example, in one trial examining a resistance training program for older adults, Katula et al. (2008) reported positive results on multiple domains of HRQoL, including self-efficacy and satisfaction with life. Data supporting an association between sedentary time and HRQoL and psychosocial health is emerging. For example, among older adults, Vallance et al. (2013) found those in the highest quartile of sedentary time had poorer HRQoL compared to older adults in the lowest quartile of sedentary time. Further, a substantial body of evidence supports the link between sedentary time and depression (e.g., Vallance et al., 2011; Zhai et al., 2014). Our data certainly coincides with the above-mentioned research and provides further support for the role of resistance training in fostering HRQoL and psychosocial health. However, our data extend this literature base by examining different profiles of sedentary time and resistance training behaviours. As expected, older adults who did not resistance train,

and were largely sedentary, demonstrated poorer outcomes (and the poorest) compared to participants who engaged in resistance training, and had low sedentary time.

With respect to HRQoL and some psychosocial factors, it appears resistance training does not have a protective effect in the case of high sedentary time. We observed that older adults who engaged in low sedentary time and no resistance training reported better scores on HRQoL and depression than those who engaged in high volumes of sedentary time as well as regular resistance training. In the general population, some evidence has emerged suggesting that health consequences associated with excessive sedentary time (e.g., higher mortality) are independent of whether an individual is physically active or not (e.g., the 'active couch potato' hypothesis) (Owen, 2012; van der Ploeg et al., 2012). Our data provides some confirmation (albeit with respect to resistance training) of this hypothesis given low SED/low RT participants reported significantly lower HRQoL and depression scores compared to participants in the low SED/high RT group.

The primary limitation of this research study is a lack of generalizability to the older Albertan population. This research used a convenience sample, not a randomized sample. Participants included those from Alberta cities where advertising had reach, such as the Edmonton, Calgary, Medicine Hat, Red Deer, Ft. McMurray, Athabasca, Grande Prairie, and Lethbridge regions. Therefore, the generalizability to other smaller communities or to older adults who are not engaged in community programs may not be appropriate if the sample from this research is sufficiently different from the overall older adult population. This study appeared to attract older Albertans who were engaged in physical activity and appeared keen to express their experiences with both physical

activity and resistance training. The overall descriptive statistics for the HRQoL, depression, anxiety, self-esteem, and satisfaction with life variables suggest that our sample of older adults was generally very healthy. For example, the HRQoL global health score mean was 49.67 (*SD* = 8.54), indicating only a mild disability level. Although our study utilized a multi-faceted recruitment strategy of newspapers, newsletters, presentations, this appeared to attract many older adults who were interested in physical activity and/or resistance training. As a result, our study recruitment methods may have led to a response bias whereby primarily individuals interested in the study topic participated. As a result, we take caution in judging the representativeness of our sample to the larger Alberta population of adults 55 years of age and older.

The American College of Sports Medicine (ACSM) does specifically recommend resistance training as part of a comprehensive activity program to maintain overall function and psychosocial well-being (American College of Sports Medicine, 2009). Our data suggests that specific profiles of resistance and sedentary activity are associated with HRQoL and psychosocial health. In particular, participants engaging in high volumes of sedentary time (i.e., ≥482.14 min/day) as well as not meeting resistance training guidelines (i.e., at least two times per week) reported significantly poorer HRQoL (i.e., poorer scores on the PHC and MHC). Rather than simply encouraging older adults to engage in resistance training, those working with older adults should also recommend older adults limit their time spent in sedentary pursuits. Rather than recommending health behaviours in isolation, older adults should be encouraged to change other health behaviours that may be impeding health gains.

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Table 1

Descriptive statistics for sedentary behaviours among older Albertans

Sedentary Behaviours	Weekday		Weekend		*p*
	Mean(*SD*)	Range	Mean(*SD*)	Range	
a. Minutes spent sitting while travelling to and from places	60.9 (48.1)	(0,300)	59.9 (57.1)	(0,420)	0.000
b. Minutes spent sitting while working or volunteering	113.2 (161.1)	(0,600)	34.0 (91.0)	(0,720)	0.000
c. Minutes spent sitting watching television	153.3 (108.4)	(0,720)	171.2 (122.6)	(0,925)	0.000
d. Minutes spent sitting while using computer at home	86.1 (100.5)	(0,600)	81.2 (104.9)	(0,900)	0.000
e. Minutes spent sitting during leisure time	117.6 (105.6)	(0,720)	144.0 (113.3)	(0,720)	0.000
f. Total sitting time	563.4 (428.0)	(0,5130)	496.9 (292.1)	(0,2700)	0.000

Data are presented as the mean (M), standard deviation (SD) and range.

Table 2

HRQoL and psychosocial health (adjusted) mean scores across resistance training and sedentary time profiles

Model	Low SED / Low RT[1] (N=78)	Low SED / High RT[2] (N=103)	High SED / Low RT[3] (N=88)	High SED / High RT[4] (N=89)	*F*
HRQoL (N=343) [Wilks' λ□= 0.985, F(6,664) = 3.789, p < .001]					
PHC	52.8 (0.97)	54.0 (0.84)[3]	50.3 (0.89)[2]	52.2 (0.92)	3.00, p=0.031
MHC	48.4 (0.88)[3]	49.3 (0.76)[3]	44.5 (0.82)[1,2,4]	48.6 (0.84)[3]	7.06, p<0.001
Psychosocial Health (N=351) [Wilks' λ□= 0897, F(12,897) = 3.115, p < .001]					
Depression	0.43 (0.11)[3]	0.31 (0.10)[3]	0.91 (0.11)[1,2]	0.63 (0.11)	6.04, p<0.001
Anxiety	0.71 (0.14)	0.60 (0.12)[3]	1.3 (0.13)[2]	1.1 (0.13)	5.82, p=0.001
Satisfaction with life	27.7 (0.70)[3]	29.2 (0.61)[3]	24.9 (0.66)[1,2]	27.1 (0.66)	7.62, p<0.001
Self esteem	16.4 (0.56)	14.4 (0.49)	16.2 (0.52)	15.8 (0.53)	2.91, p=0.035

SED = Sedentary time; RT = Resistance training
Data are presented as the mean and standard error.
Superscript numerals denote statistically significant group comparison.
Data are presented as the mean (*M*), standard deviation *(SD*), and standard error (SE). PHC = Physical Health Composite score, MHC = Mental Health Composite score. HRQoL model adjusted for income, age, chronic disease, gender, and marital status. Psychosocial health model adjusted for employment status, education, income, age, chronic disease, gender, and marital status.

CHAPTER V

Conclusion and Implications

As the population ages, then the need for healthy aging strategies grows. A plethora of literature already exists on the benefits of physical activity for older adults. However other strategies have not been well explored, such as resistance training and its specific role in healthy aging. The overall purpose of this study was to gain a better understanding of resistance training among older adults in Alberta. This study also explored sedentary behaviours within the context of older adults meeting or not meeting resistance training guidelines.

Study One

Overall, 53% met resistance training guidelines. For those not meeting resistance training guidelines, 39% of respondents reported "zero" training sessions in a typical week and just below 8% of respondents reported "one" session in a typical week. There were 3.1% of respondents who reported they performed resistance training daily in a typical week and 0.6% who reported they trained six days in a typical week. For those who reported weekly resistance training, 33.7% stated these sessions were less than 10 minutes duration. The range of experience with resistance training was zero years to 55 years, with a mean of 4.3 years (*SD* = 9.1 years, *Median* = 0.0 years). Mean range of experience was 5.5 years (*SD* = 10.8 years) for men and 3.7 years (*SD* = 8.0 years) for women. The 60 to 69 years age group had the highest percentage of those meeting guidelines (54.5%). In comparison, 38.1% of those over 80 years were meeting guidelines. Our prevalence rate appears much high compared to the literature. This appears to be due to many physically active older Albertans being attracted to this type of

research, as they are already interested in exercise and resistance training. Most recently, resistance training rates were reported from a review of the 2011 US Behavioural Risk Factor Surveillance System (U.S. Centers for Disease Control and Prevention, September 18, 2014), as less than one-quarter of adults over the age of 45 meeting resistance training recommendations. It is difficult to compare our resistance training rate to broader Canadian population given such data does not exist.

Overall, 89% of our sample expressed an interest in participating in a resistance training program for older adults, and 53% of this group were actually meeting the Public Health Agency of Canada resistance training guidelines for older adults. When respondents were asked if they thought they would be able to participate in a resistance training program designed for older adults, 96.1% felt they would be able. Overall, 87.7% of the respondents expressed an interest in counselling specific to resistance training. The most preferred location for resistance training counselling was at a regular fitness club (45.7%), in home program (27.3%) and at a seniors club (22.7%). This preference for training in a club with others aligns with findings from other research on older adults and exercise. In a qualitative study by Lubcke, Martin, and Hellstrom (2012) older adults reported a preference for exercise when it was at a location that created a forum to meet friends. Given these findings from both the research sample and corresponding literature, the optimal resistance training program needs to be tailored to the preferences of the older adult, given the varying preferences observed in this study. Based on the preferences of this cohort, classes should be offered during morning or afternoons, focus coaching on safety and technique so participants experience confidence

and success early in the training experience, allow for social interaction, and give frequent feedback.

Our research is consistent with published literature suggesting participants with higher levels of education were more likely to be interested in a resistance training program for older adults (OR = 2.0) and also be more likely to be interested in receiving counseling for resistance training (OR = 2.6). Also, older adults who were already engaged in meeting general physical activity guidelines, were also more likely to be meeting resistance training guidelines (OR = 2.16). Our research shows comparable results where participants with lower levels of income were least likely to be interested in resistance training, and in contrast, those in higher income brackets were more likely to be interested (OR = 2.09). Taken collectively, these results add to the previously published literature suggesting income/socioeconomic status is negatively associated with resistance training behaviours.

Study Two

Results from this research indicate that specific profiles of resistance and sedentary activity are associated with HRQoL and psychosocial health. In particular, participants engaging in high volumes of sedentary time (i.e., ≥482.14 min/day) as well as not meeting resistance training guidelines (i.e., less than two times per week) reported significantly poorer HRQoL (i.e., poorer scores on the PHC and MHC). These individuals also reported significantly more depression and anxiety symptoms, and lower satisfaction with life. Of interest, irrespective of resistance training status, participants with high periods of sedentary time reported significantly lower HRQoL and depression scores compared to participants with low sedentary time (i.e., and no resistance training).

As expected, older adults who did not resistance train, and were largely sedentary, demonstrated poorer HRQoL and psychosocial health compared to participants who engaged in resistance training, and had lower sedentary time. Although preliminary, with respect to HRQoL and some psychosocial factors, it appears resistance training does not have a protective effect in the case of high sedentary time. We observed that people who engaged in low sedentary time and no resistance training reported better scores on HRQoL and depression than those who engaged in high volumes of sedentary time as well as regular resistance training. From our Alberta sample of older adults, our data shows that low SED/low RT participants reported significantly lower HRQoL and depression scores compared to participants in the low SED/high RT group.

The results from our research reflect that greater participation in resistance training with lower levels of sedentary activity are associated with better HRQoL in older adults. Few studies have isolated resistance training from other types of physical activity to explore associations between resistance training, HRQoL, and psychosocial outcomes. In addition fewer studies have explored resistance training and sedentary behaviours against HRQoL and psychosocial factors. Therefore, our research results will augment the current knowledge base of healthy aging specific to resistance training for older adults.

Practical application

HRQoL can be an effective indicator of older adults' overall health as it reflects their perception of their physical, mental and social well-being. For older Albertans, these outcomes can inform programming and healthy aging education for the Alberta

organizations serving adults over 55 years of age, such as community centres, fitness facilities, seniors' organizations, and masters-level sports groups.

Based on our research outcomes, older adults need to incorporate a resistance training programming as part of an overall physical activity plan within an active (low-sedentary) lifestyle. Our research outcomes specifically indicate the following for programming preferences: classes during morning or afternoons that are geared specifically for this demographic; a counselling focus of safety and technique so participants experience confidence and success early in the training experience; an allowance for social interaction and for frequent feedback; ongoing education in a face-to-face format; an incorporation of the concept of progression so the older adults learn progressive intensity and experience results with muscle mass, functionality and strength. Overall, resistance training programming must adhere to the Canadian Public Health Agency guidelines of including muscle strengthening activities of the major muscle groups at least twice a week, within the broader 2.5 hours of weekly aerobic physical activity. The American College of Sports Medicine also recommends resistance training as part of a comprehensive activity program to maintain overall function and psychosocial well-being.

Data supporting an association between sedentary time and HRQoL and psychosocial health is emerging, where sedentary behaviour is being viewed as a new risk factor for health. Our research data contribute to this knowledge base by examining different profiles of sedentary time and resistance training behaviours. Our data suggests that specific profiles of resistance and sedentary activity are associated with HRQoL and psychosocial health. In particular, participants engaging in high volumes of sedentary

time (i.e., ≥482.14 min/day) as well as not meeting resistance training guidelines (i.e., at least two times per week) reported significantly poorer HRQoL (i.e., poorer scores on the PHC and MHC).

Rather than simply encouraging older adults to engage in resistance training, those working with this demographic should also recommend limits on sedentary pursuits. Older adults should be encouraged to change other health behaviours that may be impeding health gains. Health professionals should start by clearly defining sedentary behaviour such as activities requiring lower metabolic rates - sitting or reclining, television viewing, computer use, reading time, and driving time. Older adults may not perceive the magnitude of their sedentary pursuits compared with their physical activity and/or resistance training time. The health professional should work with the older adult to compile an inventory of activities in the older adult's typical week, dividing these into sedentary activities and physical activities. This inventory can be used as a part of an assessment of health risk and a tool in health education. The next step is to provide education pertaining to the health risk of a low resistance training/high sedentary lifestyle. Many older adults may perceive that their physical activity is providing a protective mechanism, regardless of the hours spent in sedentary pursuits. Finally, it is important to work with the older adults to identify alternative activities which will increase overall resistance training and result in a low-sedentary lifestyle. Suggestions can include incorporating activities of several types (light, moderate, vigorous) that reflect the older adult's areas of interest and abilities. Alberta has many older adult clubs and organizations including the Alberta55Plus organization (with a sports focus), walking clubs, and masters sports teams, to name a few. In addition, many community centres

around the province offer physical activity, resistance training, and fitness classes geared to the older adult demographic.

Recommendations for Further Research

There is a growing body of research addressing resistance training as an effective strategy in assisting older adults with maintaining physical function, higher HRQoL and preventing conditions of aging. However, there are still knowledge gaps to be addressed. For example, a resistance-training prevalence rate still needs to be established for older Canadians and specifically, for older Albertans, delineated from overall physical activity and aerobic activity rates.

Health and fitness professionals and researchers can consult this study as a reference to contribute to their knowledge base and guide development of programs. However, there are many other research studies that can still contribute to this knowledge base. Strategies need to be further explored for assisting older adults to reduce high sedentary lifestyles and to increase physically active lifestyles and strengthening activities. Our research appeared to capture older Albertans who were keen about physical activity and resistance training, but missed many Albertans who are not physically active. Research needs to explore the reasons for this lack of engagement and explore how barriers can be removed so more Albertans can lead active lifestyles. This future research must also look at various sub-groups such as cultural groups, rural versus urban groups, older adults with chronic disease, men versus women, etc., to better under any unique beliefs and barriers, which impact an older Albertan's level of activity.

Resistance training and low-sedentary lifestyles can be explored further for psychosocial benefits and HRQoL measures specific to age categories of those over 55

years such as the younger cohort (e.g. 55 to 65 years), the middle cohort of older adults (65 to 85 years) and the oldest cohort of older adults (e.g. those over 85 years). One could hypothesize that the needs, goals and beliefs of a 55 year old Albertan are different than that of a 90 year old Albertans. The result from this type of research study could further inform education and program design. A future research study could even focus completely on perceived barriers to physical activity and resistance training from the perspective of older adults from any one of the cohorts mentioned above. For example, what factors facilitate engagement in and sustainment of resistance-training programs? Some of this information exists in research pertaining to younger adults or in research examining other types of activity, but no research focuses solely on older adults. Our research reaffirmed that disadvantaged groups such as those from lower socioeconomic and education groups need strategies to effectively engage in more active lifestyles which include resistance training. Further study can help uncover ways to manage these barriers and explore cost-effective, sustainable ways to ensure these demographic groups reduce sedentary times and increase resistance training. In addition, the literature is still sparse with regards to links between older adults' resistance training patterns (separated from other types of physical activity) older adults' cognitive abilities.

Our literature review also uncovered the scarcity of existing survey tools for exploring resistance training behaviours (in general), and for exploring resistance training behaviours specific to the older adult population. During the research process, it became apparent that a clear definition for resistance training was required to identify which research participants were meeting resistance training guidelines, and which participants were not meeting guidelines. For example, older adults consider various types of

activities as contributing to strength training such as use of own body weight during exercise, use of various types of therabands, or use of yoga poses. Older adults also reported a variety of approaches to resistance training in terms of session duration and number of muscle groups targeted per session. All of these variations in approach to resistance training impact categorization of the research participants within the study.

Appendix A

Ethics Approval

DATE: July 30, 2013

TO: Erin Bampton

COPY: Dr. Jeff Vallance (Supervisor)
Alice Tieule, Secretary, Athabasca University Research Ethics Board
Dr. Simon Nuttgens, Chair, Athabasca University Research Ethics Board
Eileen Paluck, Ass't to Dean, CNHS

FROM: Dr. Sharon Moore, Chair, CNHS Research Ethics Review Committee

SUBJECT: **Ethics Proposal #CNHS-13-01-Bampton-E: "***Resistance Training Behaviours Among Older Adults in Alberta"*

Thank you for providing the additional information requested by the Centre for Nursing & Health Studies (CNHS) Research Ethics Review Committee.

I am pleased to advise that the above-noted project has now been awarded **APPROVAL TO PROCEED**. **You may begin your research immediately.**

This approval of your application will be reported to the Athabasca University Research Ethics Board (REB) at their next monthly meeting. The REB retains the right to request further information, or to revoke the interim approval, at any time.

The approval for the study "as presented" is valid for a period of one year from the date of this memo. If required, an extension must be sought in writing prior to the expiry of the existing approval. **A Final Report is to be submitted when the research project is completed.** The reporting form can be found online at http://www.athabascau.ca/research/ethics/

As implementation of the proposal progresses, if you need to make any significant changes or modifications, please immediately forward this information along with an e-mail of support from your research supervisor for the changes, to the CNHS Research Ethics Review Committee via rebsec@athabascau.ca for further review.

If you have any questions, please do not hesitate to contact the Committee Chair Sharon Moore), or the Research Ethics Administrator at rebsec@athabascau.ca
If you have any questions, please do not hesitate to contact sharon.moore@athabascau.ca
.

I wish you all the best with your project.

Appendix B

Example Recruitment Advertisement

The following is an example of wording for a newspaper or newsletter advertisement. Wording may vary slightly based on the space available in the newspaper or newsletter and cost constraints**.**

Albertans 55 + required for health and strength-training survey.
I am a registered nurse, completing a research study. Focus: Albertans 55 years and older. Topic: how physical activity and strength training (e.g., lifting weights, resistance training) are related to health and illness prevention. I need 300+ Alberta participants willing to complete my 30 to 45 minute survey.

If you are interested, please contact me at email ErinBampton@gmail.ca. I will mail you an information letter, survey and Tim Horton's $5 gift card. A pre-addressed and stamped envelope will be included for you to mail the survey back. If you would like to do this survey on line, I can also direct you to the link.

The survey asks about current physical activities (exercise), including any strength training activities, thoughts/ feelings about physical activity, as well as your health and quality of life. If you don't do any strength training/exercise, that's OK, we will still be happy to have you complete the survey.

Appendix C

Information Letter

Health Survey for Albertans 55 Years and Older

This information letter is designed to give you an idea of what our research study is about. Please read this form carefully to make sure you are aware of all the information it provides. You can keep this form for your records. Participation in this study is entirely voluntary.

My name is Erin Bampton and I am currently a Masters of Nursing student in the Faculty of Health Disciplines at Athabasca University. As part of my Master's Thesis requirements, I am conducting a research study. I have a keen interest in older adults' health and well-being. In particular, I am interested in how strength training (e.g., lifting weights) is related to the health of older adults. My supervisor for this research study is Dr. Jeff Vallance, a physical activity researcher in the Faculty of Health Disciplines at Athabasca University.

Why is this study being done?

We know that being active is good for people's health and well-being. But we don't know much about the physical activity and strength-training activity habits of Albertans 55 years and older. We are interested in finding out a little bit about your general health and then seeing what your current physical activities are, including any strength-training activities in an average week and month. The purpose of our study is to further understand how physical activity and strength training activity can affect your health. The information gathered in this research study will be used to directly benefit and improve the health of Albertans.

How do I participate in the study?

We ask that you please complete the enclosed survey. This survey will ask you about the current physical activities you do, including any strength training activities, how much time you spend being sedentary (e.g., sitting, driving), your thoughts about physical activity, as well as your current quality of life and how you feel about yourself.

What if I do not do any strength training?

Absolutely yes, we would still like you to participate in this study if you don't do any strength training/exercise, or you think that you are a very active person. For the study to be successful, we need information from a wide range of activity levels: from those who think they are inactive and don't do any strength training, all the way to Albertans who are active every day and often strength train.

What am I being asked to do?

We would like to ask you to complete the tasks below:

a. Complete the enclosed survey as soon as possible (within the next day or two). The survey should take you 30 to 45 minutes to complete.
b. When you have finished the survey, return the finished survey in the self-addressed business reply envelope that is enclosed for you, and mail the envelope back to us. You do not have to pay for postage. We have done that for you already.
c. **It is very important that you don't change your normal physical activity and any strength-training activities during this study. We want to know what it is that you *normally* do**. Doing more physical activity than normal will not improve the results of this study. We will actually get more helpful information if you keep doing the activities that you normally do and don't change anything. Once you have completed the survey you are free to change any physical activity habits at that time if you choose.

How long will I be involved in the study?

Your involvement in the study is only to complete the survey and return it to our research team as per the above instructions. However, you have the right to refuse to participate and to withdraw from the study at no consequence to you. At your request, the data you provide will be removed and destroyed.

Do I have to travel somewhere to be in this study?

No, you do not need to travel anywhere to be in this study. This study is a home-based physical activity study. That means that this study can be done in the comfort of your own home. We just want you to continue with what activities are normal for you.

Are there any risks to participating?

There is a very small risk to being in this study. There is a small chance that some questions in the survey may make some people feel uncomfortable (e.g., questions about emotions). If this is the case for you, feel free to skip that question. Given that we are not asking you to do more physical activity and that we are just asking you to complete a survey, there is no physical risk.

Who sees your information?

Please do not put your name on this survey. All information will be held confidential, except when legislation or a professional code of conduct requires it to be reported. Even then your name will not be reported. Each survey has only an ID number on it, so you do not need to put your name on it. No one will see the data except the researcher Erin Bampton and her supervisor in the Faculty of Health Disciplines, Dr. Jeff Vallance. There is no way other people (e.g., other participants) will see your information. The data

we collect will be kept in a locked filing cabinet. Five years after publication (in research journals), all of the data will be destroyed. If you are interested, you are welcome to receive a final report of the study results. Just contact the researcher.

Do I need to sign something?

No, you don't need to sign anything. By doing this survey and returning it to us, you are lending your voluntary participation and consent to be in this study.

If you have any questions about the survey, please contact **Erin Bampton at XXX-XXX-XXXX** or e-mail at **erin.bampton@athabascau.ca**. Erin is conducting this study as part of her Master's Thesis requirements. You may also contact Erin's supervisor, Dr. Jeff Vallance at 403-488-7182. If you would like to speak to someone not involved with this survey, please contact Janice Green, Athabasca University Research Ethics Board Secretary at 1-800-788-9041, ext. 6718, or e-mail at janiceg@athabascau.ca if you have any questions or concerns. Ms. Green has no direct involvement with this project.

Thank you for being in our study. It is only through helping with these research projects that we can increase our knowledge of physical activity, strength-training activity, and health across Alberta for adults 55 years and older.

Yours in health,

Erin Bampton, RN, BScN
Master in Nursing Student
Athabasca University

Jeff Vallance, PhD
Associate Professor
Athabasca University
Alberta Innovates – Health Solutions Population Health Investigator

Appendix D

Reminder Letter to Participants

Month xx, 2013

Hello Mr./ Mrs./ Ms.,

Thank you so much for helping us with the Health Survey for Albertans 55 Years and Older. The response to our study has been overwhelming as over xxx individuals contacted us to participate in the study. Indeed, folks from Alberta have stepped up to the plate and shown an interest in health-related initiatives in our region. Thank you so much.

We are still waiting to receive the survey from a few people. So I just wanted to send this letter out as a friendly reminder to please return the survey at your earliest convenience. The more responses we get from participants the better we can understand the factors that affect physical activity, strength training, and health of Albertans 55 years and older. I completely understand that Fall is a very busy time of year, so it may have just slipped your mind. If you have lost your survey, let me know and I can send another package out to you.

If you have since decided not to complete the survey, and not participate in the study, that is okay as well. We thank you for taking an interest in the study.

In the new year, after we have analyzed all the data, I will send all participants a summary of our study results as well as a physical activity resource that gives you some helpful strategies for staying active!

If you have any questions, please don't hesitate to contact me personally at the number and/or e-mail address listed below. I have spoken with many of you over the phone and e-mail and have very much enjoyed those interactions.

Yours in health,

Erin Bampton, RN, BScN
Master in Nursing Student
Athabasca University

Appendix E

Survey

Health and Muscle Strength Study for Albertans 55 Years and Older

Centre for Nursing and Health Studies
Athabasca University
Erin Bampton, RN, BScN, MN Student

Survey Instructions

Thank-you for agreeing to participate in this study! In this survey, we are going to ask you a series of questions about yourself. There are no right or wrong answers and all we ask is that you provide responses that are as honest and accurate as possible. The survey should take about 30 to 40 minutes to complete. All responses are completely confidential and will never be used in any way that could link them to you. Please try to complete all questions. You will never be individually identified in any reports or presentations to the survey answers. If a question(s) makes you feel quite uncomfortable, you are allowed to skip that question(s) and move onto the next question. After completing your survey, please place it back in the stamped addressed envelope provided. Keep your Tim Horton's gift card as a thank you for participating. By completing this survey and returning it to us, you are indicating your voluntary participation and consent to be in this study. Many thanks in advance for participating in our study. We hope you find it informative. If you wish to withdraw from being in the research, simply refrain from completing the survey and dispose of the documents we sent you.

For further information or if you have any questions about completing the survey, please contact Erin Bampton at 780-953-3255 or email at erinbampton@gmail.com, or Dr. Jeff Vallance at 403-488-7182 or email at jeffv@athabascau.ca

SECTION A:
In this first part of the survey, we would like you to recall your **average weekly physical activity** in the past month. Considering a typical week (7 days) this past month, how many times per week on average, and for how long (duration), did you perform the following kinds of physical activity?

When answering these questions please:

- Only count physical activity sessions that lasted **10 minutes or longer** in duration.
- **Include only the physical activities that you did during your leisure time** (e.g., going to the gym, the leisure center, walking the dog, going for a walk, swimming, bicycling). **Do not** include activities you do at work or around the house (e.g. mowing the lawn, vacuuming).
- If you have not performed any physical activity, please write '0' in that space.
- Note that the difference between the three categories below is the intensity of the activity.

In the past month, my average weekly physical activity has been:
Write the average **times per week** in the first column, then write the **average duration** (i.e., in minutes) in the second column.

	Times Per Week	Average Duration (in minutes)
A1. STRENUOUS PHYSICAL ACTIVITY (HEART BEATS RAPIDLY, SWEATING) (e.g., aerobics classes, jogging, swimming laps, hard bicycling, singles tennis, soccer)	_____	_____
A2. MODERATE PHYSICAL ACTIVITY (NOT EXHAUSTING, LIGHT SWEATING) (e.g., brisk walking, doubles tennis, easy bicycling, skating, easy swimming, popular and folk dancing)	_____	_____
A3. MILD PHYSICAL ACTIVITY (MINIMAL EFFORT, NO PERSPIRATION) (e.g., easy walking, bowling, lawn bowling, shuffleboard, golf with a power cart)	_____	_____

Estimate how many hours you spend SITTING EACH DAY in the following situations: (please write your answer in the boxes in both columns where applicable)

	On a WEEK day		On a WEEKEND day	
	Hours	**Minutes**	**Hours**	**Minutes**
A4. While travelling to and from places				
A5. While at work or volunteering				
A6. While watching television				
A7. While using a computer at home				
A8. In your leisure time, NOT including television (e.g., visiting friends, movies, reading, dining out, etc.)				

SECTION B: in this section of the survey, we ask you to answer several questions about strength training activities.

Strength training is also called weight training or resistance training, and involves challenging the muscles against a resistance (such as a dumbbell or physical-activity band), to build muscle strength and endurance (American College of Sports Medicine, 2009).

Strength training programs are mainly performed with the use of free weights (dumbbells, barbells), weight machines, resistance bands (physical activity bands), and even just using one's own body weight.

For this section, please focus specifically on strength training types of activity.

B1. What do you think, **for you**, would be the main advantages and disadvantages of participating in regular strength training activities?

Main advantages	**Main disadvantages**
_____	_____
_____	_____
_____	_____

B2. What factors do you think would make it **easier** or **more difficult** for you to participate in regular strength training activities?

Factors making it easier	**Factors making it difficult**
_____	_____
_____	_____
_____	_____

B3. What people or groups would **approve** or **disapprove** of you participating in regular strength training activities? (e.g., spouse, friends, doctor, family)

People who would approve	**People who would disapprove**
_____	_____
_____	_____
_____	_____

The questions on this page ask about your strength training activity preferences. This information helps us in designing effective strength training programs for adults 55 years and older in the community.

Even if you do not do any strength training, please respond to the best of your ability. Please place a √ beside only one response for each question unless otherwise indicated.

B4. Would you be **interested** in a strength training program designed specifically for people **55 years and older**?

a. yes _____ b. no _____ c. maybe _____

B5. Do you think you would **be able** to participate in a strength training program designed specifically for people 55 years and older?

a. yes _____ b. no _____ c. maybe _____

B6. Would you **be interested** in being **counseled** about strength training at some point?

b. yes _____ b. no _____ c. maybe _____

B7. If you were to begin a strength training program**, when** would you prefer this program to start?

a. winter ____ b. spring _____ c. summer _____ d. fall _____

B8. If you were to participate in regular strength training, you **would prefer** to be active: **(check only one for each line below #a to #c)**

a. alone _____ others my age _____ with friends _____ with family _____

b. at home _____ fitness center _____ no preference _____

c. in mornings ____ afternoons _____ evenings _____

B9. **Coaching:** Strength training counseling or coaching should be provided by a strength training specialist who has appropriate certification.

If you were to receive strength training coaching, **where would you prefer this to occur**?

a. with a specialist at a **seniors' club** _____

b. with a specialist at a **regular fitness center** _____

c. with a specialist who sets up **in-home programs** _____

d. other (please specify): _____

B10. If you were to receive strength training coaching, how would you prefer to be given **supplemental/ extra information** about maintaining muscle strength?
(please note your 1st, 2nd and 3rd choice on the lines below)

a. face to face _____ b. telephone _____ c. brochure/print _____

d. internet/email _____ e. group _____ f. magazine_____

g. social media (facebook, twitter) _____ h. other _____

B11. **Equipment**: Do you have any of the following strength training equipment in your home? **(please check all that apply)**

a. free weights (dumbbells, barbells, hand weights) _____

b. weight machines _____

c. resistance bands (physical activity bands) _____

d. core strengthening equipment (stability ball, medicine ball) _____

B12. **Exercise intensity:** If you were to participate in regular strength training, you would prefer to do: **(please check only one)**

a. only light-intensity strength training _____

b. progressive strength training (gradually increasing my workouts) to higher strength training intensities, within my physical abilities _____

B13. **Supervision:** If you were to participate in regular strength training, you would prefer to: **(please check only one)**

a. be supervised by a trainer _____

b. train UNSUPERVISED once a trainer has set up program_____

B14. **Scheduling**: If you were to participate in regular strength training, you would prefer to have: **(please check only one)**

a. training sessions pre-set with specific dates and times _____

b. flexible or spontaneous training sessions_____

B15. **Frequency:** Over a typical week during the past month, **how often** did you do strength training activities? **(Please check only one)**

a. none/ 0 days per week _____

b. 1 day per week_____

c. 2 days per week_____

d. 3 days per week_____

e. 4 days per week_____

f. 5 days per week _____

g. 6 days per week_____

h. 7 days per week_____

B16. If you checked above that you did strength train, please indicate below how long (duration) your typical training session lasts. **(Check only one)**

a. less than 10 minutes _____

b. between 10 and 30 minutes _____

c. between 30 and 60 minutes _____

d. more than 60 minutes _____

B17. Overall, **how long** have you been doing strength training activities? **(Check only one)**

a. year(s) strength-training _____

b. have never strength-trained _____

B18. **How did you learn** how to do strength training or lift weights? **(Check all that apply)**

a. fitness or strength training specialist _____

b. health professional (e.g. Physio, Kinesiologist) _____

c. friend or family member who strength-trains _____

d. other way of learning (please specify): _____

e. I have never learned _____

B19. Number the following from your **most preferred type** of strength training (#1) to your **least preferred type** (#4).

a. free weights (dumbbells, barbells, hand weights) _____

b. weight machines _____

c. resistance bands (physical activity bands) _____

d. strength training using body weight against a resistance _____

e. not applicable, I don't strength-train _____

B20. How confident do you feel in your ability to perform strength training activities? **(Check only one)**

a. extremely confident _____

b. fairly confident_____

c. only somewhat confident_____

d. don't feel confident_____

B21. How do you prefer to do your strength training routines**? (Check all that apply)**

a. only light intensity routines_____

b. progressive intensity to my maximum ability for weights_____

c. supervised at all times by a strength-trainer_____

d. not supervised by a strength-trainer once my program is set_____

e. Not applicable, I do not do strength-training_____

SECTION C: In this section, we ask about your health and perceptions of your life. Please indicate the extent to which you have experienced each of the following by checking one answer for each, using the scales provided.

C1. In general, would you say your health is:
a. Excellent _____

b. Very Good_____

c. Good_____

d. Fair_____

e. Poor_____

The following couple questions address **activities you might do during a typical day,** and how your health may or may not limit you in these activities.

C2. Moderate activities such as moving a table, pushing a vacuum cleaner, bowling, or playing golf? **(Check only one)**
a. my health limits me a lot_____

b. my health limits me a little_____

c. my health does **not** limit me at all_____

C3. Climbing several flights of stairs? **(Check only one)**
a. my health limits me a lot_____

b. my health limits me a little_____

c. my health does **not** limit me at all_____

During the **past 4 weeks**, have you had any of the following problems with your work or if you are retired, your regular daily activities **as a result of your physical health**?

C4. Accomplished **less than you would like** because of physical health? **(Check only one)**
a. Yes_____

b. No_____

C5. Were limited in the kind of work or other regular daily activities because of physical health? **(Check only one):**

a. Yes_____

b. No_____

During the **past 4 weeks**, have you had any of the following problems with your work or regular daily activities due to **emotional health issues** (feeling depressed or anxious)?

C6. Accomplished **less than** you would like because of emotional health issues? **(Check only one)**

a. Yes_____

b. No_____

C7. Didn't do work or other activities **as carefully** as usual because of emotional health issues? **(Check only one)**

a. Yes_____

b. No_____

C8. **Pain**: During the **past 4 weeks**, how much did **pain** interfere with your normal work or regular daily activities (both work outside the home and at-home)? **(Check only one)**

a. Not at all_____

b. A little bit_____

c. Moderately_____

d. Quite a bit_____

e. Extremely_____

The following three questions are about how you feel, and how things have been with you in your life **during the past 4 weeks**. For each of the questions, **please check one answer** that **comes closest** to the way you have been feeling.

C9. How much of the time during the past 4 weeks, have you **felt calm, and peaceful**?

a. All of the time_____
b. Most of the time_____
c. A good bit of the time_____
d. Some of the time_____
e. A little of the time_____
f. None of the time_____

C10. How much of the time during the past 4 weeks, have you had a **lot of energy**?

a. All of the time_____
b. Most of the time_____
c. A good bit of the time_____
d. Some of the time_____
e. A little of the time_____
f. None of the time_____

C11. How much of the time during the past 4 weeks, have you felt downhearted and blue?

a. All of the time_____
b. Most of the time_____
c. A good bit of the time_____
d. Some of the time_____
e. A little of the time_____
f. None of the time_____

C12. During the **past 4 months**, how much of the time has your **physical health or emotional health** interfered with your **social activities** (like visiting with friends, relatives, going to community or social clubs etc.)?

a. All of the time_____

b. Most of the time_____

c. Some of the time_____

d. A little of the time_____

e. None of the time_____

SECTION D: In this section, we ask you about how you have been feeling mentally over the last little while.

Over the ***last 2 weeks***, how often have you been bothered by any of the following problems?

D1. Little interest or pleasure in doing things over the last 2 weeks. **(Check one)**

a. Not at all (0 day) _____

b. Several days (e.g., 1-7 days) _____

c. More than half the days (e.g., 8-12 days) _____

d. Nearly every day (e.g., 13-14 days) _____

D2. Feeling down, depressed, or hopeless over the last 2 weeks. **(Check one)**

a. Not at all (0 day) _____

b. Several days (e.g., 1-7 days) _____

c. More than half the days (e.g., 8-12 days) _____

d. Nearly every day (e.g., 13-14 days) _____

SECTION E: In this section, we give you five statements that require you to think about your life in general without reference to any particular area of your life.

The following group of questions ask about how you feel about your life right now. You may agree or disagree with each of the statements by **writing a number between 1 and 7 on the line beside <u>each of the statements, using this scale</u>**.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree

a. In most ways my life is close to my ideal. _____

b. The conditions of my life are excellent. _____

c. I am satisfied with my life. _____

d. So far I have gotten the important things I want in life. _____

e. If I could live my life over, I would change almost nothing. _____

SECTION F: In this section, we give you a couple of statements which people have used to describe themselves. Reflect on your own experience.

Over the ***<u>last 2 weeks,</u>*** how often have you been bothered by the following problems?

F1. Feeling nervous, anxious, or on edge. **(Check one)**

a. Not at all (0 day) _____

b. Several days (e.g., 1-7 days) _____

c. Over half the days (e.g., 8-12 days) _____

d. Nearly every day (e.g., 13-14 days) _____

F2. Not being able to stop or control worrying. **(Check one)**

a. Not at all (0 day) _____

b. Several days (e.g., 1-7 days) _____

c. Over half the days (e.g., 8-12 days) _____

d. Nearly every day (e.g., 13-14 days) _____

SECTION G: In this section, we ask you to reflect on how you feel about yourself. As with all survey sections, this information is kept confidential. You may agree or disagree with each below by circling one of the choices to the right of each statement. Use the scale below as your guide.

SA	A	D	SD
Strongly agree	Agree	Disagree	Strongly Disagree

G1. Below is a list of statements dealing with your general feelings about yourself.

a.	On the whole, I am satisfied with myself.	SA	A	D	SD
b.	At times, I think I am no good at all.	SA	A	D	SD
c.	I feel that I have a number of good qualities.	SA	A	D	SD
d.	I am able to do things as well as most other people.	SA	A	D	SD
e.	I feel I do not have much to be proud of.	SA	A	D	SD
f.	I certainly feel useless at times.	SA	A	D	SD
g.	I feel that I'm a person of worth, at least on an equal plane with others.	SA	A	D	SD
h.	I wish I could have more respect for myself.	SA	A	D	SD
i.	All in all, I am inclined to feel that I am a failure.	SA	A	D	SD
j.	I take a positive attitude toward myself.	SA	A	D	SD

Note: if answering any of the questions in the above sections on emotional health and on thoughts about life make you feel quite uncomfortable, and you wish to have access to a health professional, I have included one of several possible resources you may choose to contact: Alberta Health Link - 1-866-408-5465 (LINK); or Edmonton region – 780-408-5464(LINK); or Calgary region – 403-943-5465 (LINK);.

SECTION H: The purpose of this final section is to help us understand the characteristics of the participants in the study. For this reason, it is very important information. All information is held in strict confidence.

H1. Gender

a. Male _____ b. Female _____

H2. Marital Status:

a. Never married _____	b. Married _____	c. Common law _____
d. Separated _____	e. Widowed _____	f. Divorced _____

H3. What is your age? _____

H4. Do you smoke? a. no_____ b. yes_____

H5. Education (please check highest level attained):

a. Some high school _____	b. Completed high school _____	c. Some university / college _____
d. Completed university/ college _____	e. In graduate school (Masters/ PhD) _____	f. Completed graduate school _____

H6. Annual family income:

a. < 20,000 _____	b. 20-39,999 _____	c. 40-59,999 _____
d. 60-79,999 _____	e. 80-99,999 _____	f. >100,000 _____

H7. Employment status:

a. Disability _____ b. Retired _____ c. Part-time _____

d. Full-time _____ e. Homemaker _____ f. Temporarily unemployed_____

H8. Please weigh yourself and measure your height without shoes and report it here:

a. Height: _____

b. Weight: _____

H9. Has a doctor or nurse ever told you that you have had the following? **(Please check all that apply.)**

a. Angina ____yes ____no

b. Heart attack ____yes ____no

c. Stroke ____yes ____no

d. Diabetes ____yes ____no

e. High blood pressure ____yes ____no

f. High blood cholesterol ____yes ____no

g. Other cancer ____yes ____no

h. Other_____

H10. Are you currently on any medications? If so, please specify below:

_____

H11. People living in Canada come from many different cultural and racial backgrounds. What **best** describes your background?

a. Caucasian_____
b. Southeast Asian _____
c. Chinese_____
d. Black _____
e. South Asian (e.g. East Indian) _____
f. West Asian (e.g. Afghan) _____
g. African _____
h. Japanese _____
i. Korean_____
j. Latin American _____
k. Aboriginal (e.g. Metis, Inuit, First Nations) _____
l. Arab _____
m. Other _____

Is there anything else you would like to tell us? On this final page, please feel free to make any comments below about the study itself, physical activity or strength training activity. All comments are extremely helpful to us.

Please place this completed survey in the enclosed postage paid business reply envelope and mail back to us.

Thank you for your time! Please remember to keep your Tim Horton's gift card as a token of our appreciation for taking the time to participate in our study.