Fear of Falling, Physical Activity Volume, and Stage of Motivational Readiness to Change Physical Activity Behaviour in Adults in Late Midlife

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List of Abbreviations

ACSM	American College of Sports Medicine
FOF	Fear of Falling
GPAQ	Global Physical Activity Questionnaire
MVPA	Moderate to Vigorous Physical Activity
MET*min/week	Metabolic Equivalent of Task (a measure of energy expenditure according to intensity of PA) multiplied by minutes per week of physical activity
NCDs	Non-communicable Diseases
Short FES - I	Short form (7-item) Falls Efficacy Scale – International
SOC	Stages of Motivational Readiness to Change Physical Activity Behaviour
SPOR	Strategies for Patient Oriented Research, an initiative of the Canadian Institutes for Health Research (CIHR)
PA	Physical Activity
PASCM	Physical Activity Stages of Change Measure
PEI	Prince Edward Island
PHAC	Public Health Agency of Canada
WHO	World Health Organization

Glossary

Decisional Balance, also called pros and cons, is a construct in the transtheoretical model. Cons (or barriers) are negative factors that inhibit or reverse behaviour change. Pros (or facilitators) are positive factors that enable and sustain behaviour change (Prochaska & DiClemente, 1984).

Disability, according to the Canadian Survey on Disability (Statistics Canada, 2012), refers to individuals' daily activities and tasks being limited due to a chronic condition. The most common types of disability reported were pain-related, flexibility, and mobility disability. The most common causes of disability were arthritis and back pain.

Domains of physical activity in the GPAQ include work (or occupational), travel (or transportation), and recreation (or leisure). Work may be paid or unpaid. Frequency and duration of moderate and vigorous activity are measured for work and recreation activity. Travel may include cycling and walking, for which frequency and duration of moderate activity are collected (Armstrong & Bull, 2006).

Falls are occurrences that result "in a person coming to rest inadvertently on the ground or floor or other lower level" (World Health Organization, 2016).

Fear of falling is operationally defined as "a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing" (Tinetti & Powell, 1993, p. 36).

Frailty "is a medical syndrome with multiple causes and contributors that is characterized by diminished strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or death" (Morley et al., 2013, p. 2). According to the Women's Health and Aging Study, frailty is indicated if three or more of the following criteria are present: weakness, exhaustion, low levels of activity, slowness while walking, and unintentional weight loss (Fried et al., 2001).

Late midlife is defined in this research study as the ages of 50 to 70 years, and is based on the use of this term by Mortensen et al. (2014).

Metabolic Equivalents (METs) are a measure of energy expenditure. One MET is the average energy required for an adult to sit quietly. In this study, moderate activity is considered to require four METs and vigorous activity requires eight METs.

Moderate intensity refers to "activities that require moderate physical effort and cause small increases in breathing or heart rate" (Armstrong & Bull, 2006, p. 68). In this study, for the purposes of measurement, moderate activity is considered to require four METs (Chu, Ng, Koh, & Müller-Riemenschneider, 2016).

Noncommunicable diseases are conditions or diseases that cannot be transmitted to other people; the four main types are cardiovascular disease, cancer, chronic lung disease, and diabetes (World Health Organization, 2015c).

Obesogenic environments are physical environments that inhibit physical activity and lead to overweight and obese populations. In the North American context, this is caused by urban sprawl and land use mix, which discourage active transportation, especially cycling and walking (Mackenbach et al., 2014).

Physical activity volume is the intensity, type, and duration of activity (Chu et al., 2016).

Pre-frailty is a condition between being non-frail (or robust) and frail, and is measured as having one or two of the Women's Health and Aging Study frailty criteria, which include weakness, exhaustion, low levels of activity, slowness while walking, and unintentional weight loss (Fried et al., 2001).

Processes of change are 10 cognitive and behavioural strategies that help individuals change their behaviour, and include: consciousness raising; counterconditioning; dramatic relief; environmental reevaluation; helping relationships; reinforcement management; self-liberation; self-reevaluation; social-liberation; and stimulus control (Prochaska & DiClemente, 1984).

Sarcopenia is decreased muscle strength, power, and mass (Woo & Kim, 2014).

Self-efficacy is the confidence that an individual can attain a specific goal, or perform a specific task, and predicts ability to achieve the goal or task (Bandura, 1997b).

Stages of motivational readiness to change physical activity behaviour are five stages that people go through when trying to improve their physical activity. Motivational readiness was added to the phrase stages of change, to highlight motivation, which precedes behaviour change (Prochaska & Marcus, 1994).

Transtheoretical model is a behaviour change model, which consists of four constructs: stages and process of change, self-efficacy, and the decisional balance (pros/cons) of behaviour change (Prochaska & DiClemente, 1984).

Vigorous intensity refers to "activities that require hard physical effort and cause large increases in breathing or heart rate" (Armstrong & Bull, 2006, p. 68). In this study, vigorous activity is considered to require four METs (Chu, et al., 2016).

Abstract

The purpose of this research was to study the fear of falling, physical activity levels, and interest in increasing physical activity in adults between the ages of 50 and 70. Fear of falling (FOF) was operationalized as falls efficacy. Intensity, type, and time of physical activity (PA) levels were measured for men and women. Moderate and vigorous intensities of physical activity (MVPA) were studied in terms of national guidelines for MVPA, domains of PA were work, travel, and recreation, and PA time was measured in minutes per week for each type and intensity, and converted to energy expenditure. Interest in increasing PA was represented by Stages of Motivational Readiness to Change Physical Activity Behaviour (SOC). A survey using online and paper methods was conducted in Prince Edward Island, with 147 participants. The main findings included three predictive models of FOF found through multiple linear regression analysis. Common to these models was that women in lower socioeconomic levels are at higher risk of FOF in this cohort. When combined with lower recreational PA in terms of either intensity or volume (intensity, type, and duration), or lower interest in increasing PA, women in lower socioeconomic levels were at an even greater risk of FOF and falls.

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CHAPTER 1

The Research Problem

Background

Falls prevention is a significant area of concern in healthcare (Accreditation Canada, Canadian Institute for Health Information, & Canadian Patient Safety Institute, 2014; Centers for Disease Prevention and Control [CDPC], 2014; World Health Organization [WHO], 2007). Falls and falls-related injury prevention are important throughout the life course, especially for adults in later life. Approximately 28% to 35% of people over the age of 65 fall (See Glossary for definition of a fall) at least once each year, and rates of falling increase with age and frailty (WHO, 2015a). Demographic changes will continue to increase the number of people in the latter half of the life course. These changes are happening worldwide, but are greatest in developed countries. Increased numbers, especially of those over 65, could potentially dramatically increase rates of falling and falls-related injuries. Prevention strategies implemented in midlife and later life, to prevent falls and injuries, are urgently needed and are feasible (WHO, 2015e).

Falling is a geriatric syndrome related to frailty (Brown-O'Hara, 2014). Correlates of falls include decreased strength and balance, gait variability, cognitive impairment, and fear of falling [FOF] (Montero-Odasso, Verghese, Beauchet, & Hausdorff, 2012; Young & Mark Williams, 2015). Fear of falling is a psychological condition that leads to activity restriction and increased risk of falling (Boltz, Resnick, Capezuti, & Shuluk, 2014). However, fear of falls and falls risks can be decreased through increased physical activity (PA) in community-dwelling older adults (Cameron et al., 2012). Physical activity promotion has been supported as a positive

approach to healthy ageing across the life course, particularly in midlife, since this has been shown to affect later life health (Ory et al., 2014; Warburton, Nicol, & Bredin, 2006).

Midlife has recently become a growing area of interest in health research (Lachman, Teshale, & Agrigoroaei, 2015). One of the reasons for this is the potential of midlife to be a time of transitions. Midlife transitions may include health changes, becoming a caregiver of parents or grandchildren, changes in occupation or position, and retirement. These transitions offer potential for change (plasticity) in behaviour, relationships, thought processes, knowledge, and skills (Meleis, 2010). For health promotion, midlife is an opportune time to decrease the potential for frailty, disability, and noncommunicable diseases (NCDs), including neurocognitive impairment, in later life, as well as to decrease the incidence of falls (Lachman et al., 2015).

Falls prevention, with a focus on maintenance of mobility, is important to adults in late midlife (Li et al., 2006; National Council on Aging [NCOA], 2015; Smith et al., 2014; Volpe, 2014). The Public Health Agency of Canada (PHAC) defines the current late midlife cohort as those born between 1946 and 1965, or 51 to 70 years of age in 2016 (Statistics Canada [StatCan], 2011). As adults in late midlife age, the numbers of falls, injuries, and deaths from falls are increasing (PHAC, 2014). As well, physical inactivity and sedentary behaviour have been increasing in this cohort (Colley et al., 2011). Nurses are well positioned to influence falls and injury prevention throughout the life course, including in the late midlife population. Awareness of the personal, familial, healthcare, and economic consequences of falls is vital to nurses, the healthcare system, and society.

Consequences of Falls

Personal consequences of falls include both physical injuries and psychological effects, including FOF (Accreditation Canada et al., 2014). A non-injurious fall can cause FOF, which

can lead to voluntary activity restriction, low self-perceived wellbeing, anxiety, and depression (Ayoubi, Launay, Annweiler, & Beauchet, 2015; Hull, Kneebone, & Farquharson, 2013). People may have FOF even if they have not experienced a fall themselves, with the potential for the same result of increased risk (Friedman, Munoz, West, Rubin, & Fried, 2002). Fear of falling has been found to be common in people with frailty syndrome (Helbostad et al., 2010), as well as those with NCDs, including diabetes (Bruce, Hunter, Peters, Davis, & Davis, 2015; Pijpers et al., 2012), heart disease (LaPier, Cleary, & Kidd, 2009), multiple sclerosis (Kasser et al., 2014), chronic low back pain (Champagne, Prince, Bouffard, & Lafond, 2012), chronic obstructive pulmonary disease (Oliveira, McGinley, Lee, Irving, & Denehy, 2015), mild cognitive impairment, early dementia (Hauer et al., 2010), and Parkinson's Disease (Cakit, Saracoglu, Genc, Erdem, & Inan, 2007; Tremblay et al., 2011). Even healthy adults may have FOF that causes them to restrict their PA (Bruce, Devine, & Prince, 2002). Physical inactivity and psychological factors, such as FOF, that lead to activity restriction can contribute to an increased level of frailty, which is associated with falls, fractures, hospitalization, institutionalization, and mortality (Gobbens, Luijkx, Wijnen-Sponselee, & Schols, 2010; Li et al., 2014).

Falls and FOF in individuals can also have effects on families and other informal caregivers, including neighbours or friends. If older adults have a high FOF, they may be fearful of being alone or doing activities they had previously enjoyed (Tinetti & Powell, 1993). A care recipient with recurrent falls or a high FOF often causes a change in caregiving requirements or attitudes, therefore affecting family members and other caregivers' caregiving burden (Reinhard, Given, Huhtala Petlick, & Bemis, 2008). Falls and FOF may increase the burden of care if older adults become more dependent, inactive, frail, or depressed (Faes et al., 2010; Kuzuya et al., 2006). Relationships may also change, especially due to issues around safety and independence.

If an older adult has a fall, yet does not see this as indicative of a risk, caregivers may become protective and attempt to restrict the care recipient's physical independence, leading to activity restriction. Depression and decreased mobility, as well as increased frailty and risk of falls can result (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013; Kilian, Salmoni, Ward-Griffin, & Kloseck, 2008). Injurious falls raise the prospect of possible long-term care admission, causing individuals and their family members stress related to finances, decision-making, and change (Kilian et al., 2008).

The healthcare system has fall-related effects through hospitalization and long-term care rates, lengths of hospital stay (LOS), and disability and mortality related to injurious falls. Falls are the leading cause of hospitalization in adults 65 years and over, and can lead to long-term care admission. Fall-related hospitalization average LOS is 9 days longer than for other causes (PHAC, 2014). As the population is ageing, self-reported falls are increasing and the majority of reported falls result in fractures, one-third of which are hip fractures. Mortality from falls has also been increasing, possibly due to the increasing proportion of the population that is over 85 years, as this age group tends to have the highest rates of frailty (Clegg et al., 2013). Fall-related injuries such as hip fractures can have chronic or recurring physical and mental consequences, which require ongoing healthcare resources, such as time and finances (PHAC, 2014).

Falls-related risks of hospitalization and fractures, particularly hip fractures, have high financial costs. Hip fractures currently cost the Canadian health care system $1.1 billion per year (Nikitovic, Wodchis, Krahn, & Cadarette, 2013), and this number is expected to rise to $2.4 billion by 2041 (Wiktorowicz, Goeree, Papaioannou, Adachi, & Papadimitropoulos, 2001). However, economic costs related to falls injuries can be offset by the primary and secondary prevention of falls and frailty (Buckinx et al., 2015; PHAC, 2014).

Frailty and Pre-frailty

Frailty increases the prevalence of falls (British Geriatrics Society, 2014; Montero-Odasso et al., 2011; Morley, Malmstrom, & Miller, 2012), the risk of new cases of falls (Clegg et al., 2013) and has the potential to affect all adults (Brothers, Theou, & Rockwood, 2014; Ness et al., 2013; Salem et al., 2014), but mostly affects adults in later life. Pre-frailty, a transitional state between non-frailty and frailty, is common in adults in late midlife, particularly at older ages and in women (Gale, Cooper, & Aihie Sayer, 2015). Researchers in frailty have stated that by increasing PA, pre-frailty, and frailty can be prevented or decreased (Ali & Garcia, 2014; Gary, 2012; Liu & Latham, 2009; Liu & Fielding, 2011), as well as decreasing depression, anxiety, and FOF (Chodzko-Zajko et al., 2009; Jefferis, Iliffe, et al., 2014; Morley et al., 2013).

Physical activity as falls and frailty prevention strategy. Physical activity is particularly important to prevent the development of frailty and disability in late midlife (Britton, Shipley, Singh-Manoux, & Marmot, 2008; Janssen, Dugan, Karavolos, Lynch, & Powell, 2014; Low Choy, Brauer, & Nitz, 2007). Disability and comorbidity are distinct conditions, which tend to have increasing overlap with increasing age and frailty level (Fried, Ferrucci, Darer, Williamson, & Anderson, 2004). Comorbidity is defined as having two or more NCDs (Fried et al., 2001). Physical activity is recommended for decreasing the incidence or severity of NCDs, frailty, and disability, thereby preventing or decreasing falls (Buckinx et al., 2015; WHO, 2015c).

Internationally, governments of most countries recognize the necessity of using an ecological approach to falls prevention (Wendel, Garney, & McLeroy, 2015), by addressing falls and falls-related injury prevention at the individual and societal levels (Allegrante, Marks, & Hanson, 2006). The WHO facilitates the building of international consensus on healthy and

active ageing, with the added goal of falls prevention (Chodzko-Zajko & Schwingel, 2009). Increasing PA and decreasing sedentary behaviour are essential components of healthy ageing and falls prevention strategies (American Geriatrics Society/British Geriatrics Society [AGS/BGS], 2011; Gillespie et al., 2012; Sherrington, Tiedemann, Fairhall, Close, & Lord, 2011; Thibaud et al., 2012).

For falls prevention, public health places high priority on PA as a single intervention, or on multifactorial interventions that include PA (Chodzko-Zajko et al., 2009; Gillespie et al., 2012; Scott, Wagar, & Elliott, 2010). Physical activity decreases incidences of falls, yet many in late midlife are not as active as suggested by globally recommended guidelines for PA (Colley et al., 2011; Garber et al., 2011; Tremblay et al., 2011). Investigation of PA volumes of adults in late midlife, as well as FOF scores, and stages of motivational readiness to change physical activity behaviour (SOC), will advance understanding of current low levels of PA. Understanding and use of behaviour change theory may help health professionals design more effective PA interventions (Lee, Park, & Min, 2015; Prochaska & Marcus, 1994).

Transtheoretical Model

The transtheoretical model (TTM) is a well-known framework for understanding current behaviour and motivation to change (Prochaska, DiClemente, & Norcross, 1992). Behaviour change is an important element in the process of individuals and populations adopting PA as a healthy behaviour (Marcus & Simkin, 1993; Prochaska & Marcus, 1994). The TTM, especially stages of change (SOC), a central component of TTM, has evolved to become a useful approach for many health promotion efforts, including increasing PA and decreasing sedentary behaviour (Norcross, Krebs, & Prochaska, 2011; Scott, Wagar, Sum, Metcalfe, & Wagar, 2010; Velicer et al., 2000). This research study has used the transtheoretical model as a basis to deduce the

research questions, to support the use of the PA questionnaire, and to assist in the discussion of the research findings. The stages of change, the central construct in this model, consist of five stages: precontemplative, contemplative, preparation, action, and maintenance. This construct is used to determine individuals' motivational readiness to change (Marcus et al., 1998). The Physical Activity Stages of Change Measure, developed for the stages of motivational readiness to change exercise (Marcus & Owen, 1992), has recently been updated for physical activity (Marcus et al., 1998; Pekmezi, Barbera, & Markus, 2010). The questionnaire will be discussed in the Methods section, while the TTM will be discussed in more detail in the section entitled Theoretical Framework.

Problem Statement

Due to the growing older adult population, including both those in midlife and later life, as well as the increasing incidence of physical inactivity and FOF, it is imperative that nurses focus their efforts on falls prevention. Moreover, FOF is a factor that is associated with physical inactivity and falls, yet is poorly understood in the nursing literature. Physical activity is an established strategy for decreasing frailty and associated geriatric syndromes, including falls, however, many late-life adults are not meeting national requirements. Understanding where late-midlife adults are in terms of FOF, level of PA, and their motivation to change their PA will provide nurses and other healthcare professionals ways to develop specific falls prevention interventions.

Purpose

The purpose of this study was to determine to what extent FOF is influenced by PA volume, as mediated by the category for stages of change in a late midlife cohort, aged 50 to 70 years.

Research Questions

1. How does the FOF score vary by demographic characteristics of the sample?
2. How does the PA volume score vary by the demographic characteristics of the sample?
3. How does the stage of change score vary by the demographic characteristics of the sample?
4. How do PA volume, demographic characteristics, and stage of change influence the FOF score?

Significance to Nursing

Due to large numbers of adults in late midlife and later life, and a relative lack of knowledge about the fall prevention benefits of PA in these populations, the prevalence of falls has the potential to increase. In addition, the tendency for physical inactivity, sedentary behaviour, and FOF increases with age (WHO, 2007). With ongoing demographic change, nurses will continue to interact more with adults in late midlife and later life. This has led to increased interest in ageing in general, and gerontological nursing in particular.

Nurses and other healthcare professionals will play increasingly important roles in assessment, prevention, treatment, and facilitation of self-management of frailty, disability, and NCDs (Lekan, 2009). Strategies include comprehensive assessment (Brown-O'Hara, 2014; Sattar, Alibhai, Wildiers, & Puts, 2014) and a function-focused rehabilitative philosophy in all care settings (Baker, Gottschalk, Eng, Weber, & Tinetti, 2001; Boltz, Resnick, Capezuti, Shuluk, & Secic, 2012; Galik, Resnick, Hammersla, & Brightwater, 2014; Resnick, Galik, Gruber-Baldini, & Zimmerman, 2009; Resnick et al., 2016; Tinetti, Charpentier, Gottschalk, & Baker, 2012). Nurses can assist adults in late midlife and beyond to identify barriers and facilitators of PA (Kelly, Martin, Kuhn, Cowan, Brayne, & Lafortune, 2016), through motivational

interviewing (Kidd, Lawrence, Booth, Rowat, & Russell, 2015) and use of behaviour change theory (Lee et al., 2015; Lekan, 2009). Innovative nursing practice and education (Resnick et al., 2016), as well as research (Resnick, Klinedinst, Yerges-Armstrong, Choi, & Dorsey, 2015), and policy (Resnick & Boltz, 2016) will be needed for health promotion and rehabilitation in groups with NCDs, including those causing cognitive impairment, frailty, and disability. Improving outcomes for adults in late midlife and later life through increased gerontological nursing knowledge and practice will necessitate augmenting gerontological education at the nursing undergraduate, graduate, and faculty levels (Bryant et al., 2015; Deschodt, de Casterl, & Milisen, 2010), as well as for life-long learning of nurses and nurse practitioners (Panno, Kolcaba, & Holder, 2000).

Research supports PA interventions as primary prevention in public health and secondary prevention in NCDs (Nelson et al., 2007; Weiler, Feldschreiber, & Stamatakis, 2012) and as falls prevention interventions (PHAC, 2014; Robson, Edwards, Gallagher, & Baker, 2003). Various policies promote increasing PA to improve or maintain function in all areas of healthcare, including public health, home care, primary care, acute care, and long-term care (Canadian Gerontological Nurses Association [CGNA], 2010; Canadian Medical Association [CMA], 2015; Canadian Nurses Association [CNA], 2011; Canadian Society for Exercise Physiology [CSEP], 2011; PHAC, 2012).

Nursing, including gerontological nursing, is interested in the facilitation and function of PA, preventing or reducing frailty in older adults, and behaviour change theories and approaches. Late midlife is a time of transitions and offers opportunity for nurses to encourage behaviour change through education, support, referral, and provision of resources (Meleis, 2010). Increased knowledge of associations between PA and FOF, as well as use of theory in PA promotion, will

help nurses and other healthcare professionals to influence adults in late midlife and their families to promote PA, thereby decreasing falls and falls-related injuries.

Summary

Fear of falling is associated with falls, frailty, and physical inactivity. Research indicates that increasing physical activity behaviour in midlife decreases frailty and falls. The transtheoretical model, including the construct of stages of change, can be used to affect motivation and behaviour change to increase physical activity. Little research has focused on fear of falling and physical activity behaviour change in late midlife. Nurses need to promote physical activity across the life course, but particularly in the transitional period of late midlife. Therefore, the purpose of this study was to determine to what extent FOF is influenced by physical activity volume, as mediated by the category for stages of change in a late midlife cohort, aged 50 to 70 years.

CHAPTER 2

Literature Review

This chapter will focus on a review of the literature that focuses on the life course stage of late midlife, frailty's relationship to falls and FOF, and how FOF leads to an increased incidence of falls. Physical activity as a strategy for the prevention of frailty and falls, and current guidelines for PA will also be discussed. An overview of the TTM will also be provided.

Late Midlife

Adults in late midlife are in the second half of their life course (Elder, 1998; Kuh, Karunananthan, Bergman, & Cooper, 2014). Due to changing demographics worldwide, the life course approach to healthy ageing has been endorsed by the WHO (2015e), with an emphasis on the second half of individuals' lifetimes. Adults in this second half, i.e. adults in late midlife and beyond, are heterogeneous in their mental and physical capacities, as well as the environments they interact with, leading to functional abilities that cannot be solely predicted by chronological age or birth cohort (Mitnitski, Graham, Mogilner, & Rockwood, 2002; WHO, 2015e).

Many definitions for midlife are used in research. The National Survey of Midlife Development in the United States (MIDUS) study, for example, defines midlife as the period between 30 and 70 years of age (Inter-university Consortium for Political and Social Research [ICPSR], 2015). Im, a nurse and PA researcher, has defined midlife as 40 to 60 years of age (Im, Lee, Chee, & Stuifbergen, 2011; Im et al., 2013). Mortensen et al. (2014) have defined late midlife as approximately 50 to 70 years of age. Statistics Canada has described the baby boomer cohort as being in midlife to later life (Ramage-Morin, Shields, & Martel, 2010), showing that older adults in late midlife are beginning a stage of transition to later life. This study will define the stage of late midlife as 50 to 70 years of age.

Late midlife is a time of potential for change in resilience, health, and prevention of non-communicable diseases (Ryff et al., 2012). Much of the disability, frailty, and NCDs that affect adults in later life have their start earlier in the life course (Darnton-Hill, Nishida, & James, 2004; Rockwood, Song & Mitnitski, 2011). Conversely, healthier lifestyle practices begun in midlife can prevent, delay, or decrease the severity of these consequences (CNA, 2011; Chang et al., 2013).

Research has not established whether adults in late midlife have the same or worse general health than previous generations at the same age. Badley, Canizares, Perruccio, Hogg-Johnson & Gignac, (2015) found that the health of adults in late midlife is not significantly better than the previous generation or the following generation. The authors stated that the health benefits of increased income and education, as well as decreased smoking rates and heart disease, were offset by increased rates of obesity. No mention was made of inactivity. King, Xiang, and Brown (2014) state that adults in late midlife are more likely to have poorer health. In terms of physical health, adults in late midlife were found to have less-healthy diets, higher rates of physical inactivity and sedentary behaviour (Badley et al., 2015; Colley et al., 2011; Shields et al., 2010; Walker et al., 2010), and higher rates of obesity, hypertension, hypercholesterolemia, and diabetes than previous generations in late midlife (King, Matheson, Chirina, Shankar, & Broman-Fulks, 2013). This trend toward poor health was also found to have the potential to become worse for generations following the adults in late midlife (Pilkington, Taylor, Hugo, & Wittert, 2014). In terms of mental health, adults in late midlife were found to have higher rates of mental health disorders, including suicide, anxiety, depression, and alcohol and illicit drug use than previous generations (Choi, DiNitto, & Marti, 2015). These health issues in late midlife have implications for frailty levels.

Influences on physical and mental health in adults in late midlife contribute to differences in levels of frailty, and therefore to falls risks (Gobbens, van Assen, Luijkx, Wijnen-Sponselee, & Schols, 2010; Woo & Kim, 2014). Accurate data regarding rates of falls in adults in late midlife is not currently available from the Statistics Canada website (A. Szoo, personal communication, December 29, 2015). However, a Statistics Canada frailty index study, based on measures of determinants of health, found 29% of adults 50 to 64 years to be frail and 47% to be pre-frail. In adults 65 years and older in Canada, 43% were frail and another 43% were pre-frail (Department of Health & Wellness, 2014; Hoover, Rotermann, Sanmartin, & Bernier, 2013).

Women have been identified as having a higher risk of pre-frailty and frailty, as well as a higher risk of falls. However, men with frailty have a higher risk of 12-month mortality with falls from a standing height (Wong et al., 2015). Recent research in Canada has identified falls-protective and falls-risk factors for women and men. Higher PA levels were protective for both, while higher income was only protective for women. Risk factors for men consisted of stroke, nutritional risk, higher education, visual impairment, arthritis, and being widowed, separated, or divorced. Women's falls-risk factors included stroke, being 85 years or older, nutritional risk, consumption of at least one alcoholic drink per week, polypharmacy, arthritis, diabetes, and osteoporosis (Chang & Do, 2015). It is currently unknown if these significant differences also occur in midlife, however, it is reasonable to assume they start to develop earlier in the life course.

Frailty in adults in late midlife. In 2013, an group of frailty researchers reached consensus on the definition of frailty syndrome: "a medical syndrome with multiple causes and contributors that is characterized by diminished strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or

death" (Morley et al., 2013, p. 2). This definition developed from the two main approaches that have been hypothesized to assess frailty (Sun, Norman, & While, 2013). Fried et al. (2001) identified a frailty phenotype, a syndrome operationalized as having three or more of five frailty criteria. These criteria include weakness, exhaustion, low levels of activity, slowness while walking, and unintentional weight loss. Pre-frailty is a condition between being non-frail (or robust) and frail, and is measured as having one or two of the frailty criteria (Fried et al., 2001).

In the second approach to frailty assessment, frailty is measured by counting multidimensional health deficits (Mitnitski, Mogilner, & Rockwood, 2001; Rockwood, Andrew, & Mitnitski, 2007). Wang et al. (2014) also found that frailty might be decreased or prevented by multidimensional protective factors. Moreover, Fried et al.'s (2001) frailty phenotype is used both in frailty research and clinically to screen for frailty, while the deficit accumulation definition is often used for the health management of patients with frailty and pre-frailty, particularly in acute and primary care (Rockwood et al., 2007).

Frailty by either definition leads to an increased risk of falls with ageing (de Vries, Peeters, Lips, & Deeg, 2013). Falls are possible at any stage of life (Volpe, 2014), but the risk of injury and prolonged recovery increases with age and degree of frailty (Talbot, Musiol, Witham, & Metter, 2005). When frailty and pre-frailty occur in adults in late midlife (Hoover et al., 2013), the risks of falls, falls-related injury, and disability are increased for both the individual's midlife and later life (Kojima, 2015; Tom et al., 2013). Primary prevention becomes important to prevent frailty, FOF, and falls over the life course (Daniel, 2012; Hosking, Ameratunga, Morton, & Blank, 2011). Fear of falling, therefore, is an important concept in falls prevention (Friedman et al., 2002; Lach, 2005).

Fear of Falling

Fall-related psychological concerns include several closely related constructs: FOF (Tinetti & Speechley, 1989), falls self-efficacy (Tinetti, Richman, & Powell, 1990), balance confidence (Powell & Myers, 1995), and feared consequences of falling (Yardley & Smith, 2002). These constructs are closely related psychological concerns but are not identical (Hughes, Kneebone, Jones, & Brady, 2015). In this study, FOF will be used as the key concept. Fear of falling was the first construct identified and was initially thought to be a post-fall syndrome or phobia (Murphy & Isaacs, 1982). However, research has shown that FOF may develop in those that have not fallen (Arfken, Lach, Birge, & Miller, 1994). As well, falls and FOF are bidirectional, with falls causing fear and fear causing falls (Friedman et al., 2002).

Fear of falling is known to lead to activity restriction or avoidance, which can lead to risk factors for falls, including decreased strength and balance, a slower gait, shorter steps, and increased postural sway (Scheffer, Schuurmans, van Dijk, van der Hooft, & de Rooij, 2008). Frail late midlife and later life adults in acute care, palliative care, long-term care, and in the community are at risk of FOF and activity restriction (Boltz, Chippendale, Resnick, & Galvin, 2015; Galik et al., 2014). Fear of falling has the potential to affect pre-frail adults, as it may also decrease all intensities of PA (light, moderate, and vigorous) and increase sedentary behaviour (Jefferis, Iliffe, et al., 2014; Jefferis, Sartini et al., 2014). Participation in social and recreational activities is restricted by FOF, since people leave their home less and restrict any activity that puts them at a perceived risk of falling (Lach, 2005).

Falls self-efficacy, balance confidence, and feared consequences of falls (outcome expectancy) are constructs that have evolved from the application of Bandura's theory of self-efficacy (Bandura, 1997b) to FOF (Hughes et al., 2015). The issue in the falls prevention field is

that measures for these constructs are considered comparable by some researchers when studying FOF, while others recommend that like constructs be compared (Hughes et al., 2015; Jørstad, Hauer, Becker, & Lamb, 2005). All measures of FOF are more effective than asking a single categorical question about FOF, however, single questions have been found to be less informative than multiple item questionnaires (Jørstad et al., 2005). Falls self-efficacy is one of the most frequently used definitions to measure FOF in research and practice (Jung, 2008; Moore & Ellis, 2008).

Falls self-efficacy, also called confidence in performing activities of daily living (ADLs) without falling, was the initial operational definition and was mostly used for frail older adults at high risk of falling (Tinetti et al., 1990). Though this definition was found to be useful by healthcare professionals, Tinetti and Powell (1993) later stated that FOF and confidence in performing ADLs might have an indirect relationship. Confidence in doing activities without falling was therefore changed to the phrase: concern about falling. Falls self-efficacy as concern about falling was thought to explain the FOF concept more directly (Tinetti & Powell, 1993). Fear of falling was then operationally defined as "a lasting concern about falling that leads to an individual avoiding activities that he/she remains capable of performing" (Tinetti & Powell, 1993, p. 36).

Yardley et al. (2005) stated that FOF could also be measured in less frail individuals while doing more physically challenging activities beyond ADLs, as well as social activities. Fear of falling has also been measured in adults in late midlife and later life (Helbostad et al., 2010; Hill, McMeekin, & Parry, 2014; Kempen et al., 2008), including those with cognitive impairment (Hauer et al., 2010), and NCDs, for example, multiple sclerosis (van Vliet, Hoang, Lord, Gandevia, & Delbaere, 2013).

Research on FOF correlates has consistently supported an independent correlation with the variables of older age, female sex, and a history of one or more falls (Chang, Chen, & Chou, 2016). Other correlates reported in the research on older adults include impaired physical performance, depressive disorders, anxiety disorders, impaired cognitive function, impaired vision, living alone, fewer social contacts, loneliness, low general self-efficacy, low mastery, poor subjective health and quality of life, insomnia, lower educational attainment, frailty, and NCDs (Chang et al., 2016; Delbaere, Crombez, Vanderstraeten, Willems, & Cambier, 2004; Kempen, van Haastregt, Jolanda, McKee, Delbaere, & Zijlstra, 2009).

Researchers have begun to study FOF-related activity restriction, or total time involved in movement, and FOF alone. Fear of falling without activity restriction may not decrease total time of activity (Boltz et al., 2014; K. Choi & Ko, 2015), but may decrease activity intensity or effort (Jefferis, Iliffe, et al., 2014). In a recent review, factors independently correlated with FOF-related activity restriction were being a woman, performance-based and questionnaire-based physical function, and mobility aids. Falls history and poor subjective health had lower correlation with FOF-related activity restriction (Denkinger, Lukas, Nikolaus, & Hauer, 2015), possibly because activity was already low.

In a Canadian population sample of 45 years and older, men and women both had increased FOF after falls. Only women with head injuries or bone fractures developed FOF-related activity restriction after injurious falls (LeBouthillier, Thibodeau, & Asmundson, 2013). FOF and falls have been found to be more prevalent in older populations (Zijlstra et al., 2007); however, prevention efforts in midlife may delay or prevent these consequences.

Preventing Falls and Frailty in Adults in Late Midlife

Falls prevention has been addressed using a public health approach across the lifespan, particularly in children and older adults (Kelsey, Procter-Gray, Hannan, & Li, 2012; Parachute, 2014; PHAC, 2015; Volpe, 2014). The incidence of falls in adults increases with age, with the sharpest increase after age 65 (PHAC, 2014). However, pre-frailty and frailty leading to risks of falls and falls injuries are significant for adults of any age (Li et al., 2014). Falls are a concern for adults in late midlife in occupational, household, social, transportation, and sport-related activities (Talbot et al., 2005; Volpe, 2014).

Weather can also be a factor in falls risks; in Canada and other countries where ice and snow are contributing factors, falls and injuries from falls are significant in the winter (Hedström, Svensson, Bergström, & Michno, 2010; McKiernan, 2005; Rikkonen et al., 2010). Injuries from falls are, however, largely preventable through falls prevention strategies (Baker, Gottschalk, & Bianco, 2007; CDPC, 2012; Jung, Lee, & Lee, 2009; National Council on Aging, 2014; PHAC, 2014; Tinetti et al., 2008). Adults in late midlife can decrease their risk by following PA guidelines, and individualizing their fitness level and preferences for occupational, transport, and recreational PA (Tremblay et al., 2011). Measurement of these types of physical activity will be discussed below.

Physical activity as falls and frailty prevention strategy. Physical activity is a well-established falls prevention recommendation that has been recognized internationally for older adults (Gillespie et al., 2012; McMahon & Fleury, 2012; WHO, 2007). Physical activity has also been advocated as a strategy for frailty and pre-frailty prevention and treatment in general, as well as specifically for falls prevention (Cameron, 2015; Clegg, Barber, Young, Iliffe, & Forster, 2014; Daniel, 2012; Morley et al., 2013; Theou et al., 2011). Increasing balance, executive

function, bone density and strength, muscular strength and power, and improvement of mental health are some of the effects of PA that decrease falls risks and frailty (Cheung & Giangregorio, 2012; Liu-Ambrose, Nagamatsu, Hsu, & Bolandzadeh, 2013; Mammen & Faulkner, 2013; Singh et al., 2012).

Around the age of 50 years, decreases naturally occur in the robustness and redundancy of the body's systems, requiring an increase in PA to prevent sarcopenia (decreased muscle strength, power, and mass), osteoporosis (decreased bone density and quality), falls, and other correlates of frailty (Resnick et al., 2014; Rockwood et al., 2011; Woo & Kim, 2014). Women and men may be at higher risk of conditions such as osteoporosis and sarcopenia due to physiological, genetic, hormonal, pharmacological, and cultural factors (Cederholm & Morley, 2015; Qi, Resnick, Smeltzer, & Bausell, 2011).

Physical activity, including resistance exercise, is considered the gold standard treatment of sarcopenia, one of the central components of frailty, and a factor in physical falls risks (Montero-Fernández & Serra-Rexach, 2013; Woo & Kim, 2014). Moderate PA is also recommended as an adjunct in the treatment of NCDs, such as cardiovascular disease (Jansen, Kenny, De Rooij, & Van, 2015), obesity (National Institutes of Health [NIH], 1998; Shukla, Buniak, & Aronne, 2015), low back pain, osteoporosis, and osteoarthritis (Vuori, 2001). These conditions also increase falls risks (Champagne et al., 2012; Dai, Ang, Yuan, & Koh, 2015; Jansen, Kenny, et al., 2015; Mitchell, Lord, Harvey, & Close, 2014; Prieto-Alhambra et al., 2013). Increasing PA behaviour to meet current PA guidelines would decrease many of the factors that contribute to frailty, falls, and NCDs (CNA, 2011; Chodzko-Zajko et al., 2009; Fried et al., 2001; Jansen, Kenny, et al., 2015; Rockwood et al., 2005; Svantesson, Jones, Wolbert, & Alricsson, 2015).

Current physical activity guidelines. Individualized PA guidelines have been developing internationally over time and are now produced by many countries (EU Working Group "Sport & Health", 2008; Garber et al., 2011; Tremblay et al., 2011), including the WHO (2010). The Canadian Society for Exercise Physiology (CSEP) produces Canada's PA Guidelines, which state:

> Adults aged 18 to 64 years should accumulate at least 150 min of moderate- to vigorous-intensity aerobic physical activity per week, in bouts of 10 min or more. It is also beneficial to add muscle- and bone-strengthening activities that use major muscle groups, at least 2 days per week. More physical activity provides greater health benefits. (Tremblay et al., 2011, p. 41)

For adults ages 65 and over, the CSEP advises the same guidelines and adds the following guideline: "Those with poor mobility should perform physical activities to enhance balance and prevent falls" (Tremblay et al., 2011, p. 41).

The American College of Sports Medicine (ACSM) guidelines (Garber et al., 2011), which are the same as the CSEP's guidelines (Tremblay et al., 2011), support the Physical Activity Stages of Change Measure (PASM), which is proposed for use in this study to assess SOC. The Physical Activity Stages of Change Measure will be discussed in the Methods section. The ACSM guidelines are the criterion of the volume of PA (frequency, intensity, duration) versus physical inactivity.

Physical activity is measured in many ways in the literature, however, to measure PA volume as part of an online questionnaire, a relatively simple and valid method is required. Historically, subjective methods such as questionnaires have been used. More recently, objective methods including pedometers, which count steps, and accelerometers, which calculate energy

expenditure, have been promoted (Colley et al., 2011). However, questionnaires remain an important approach, due to the ability to track domains and context of activity, as well as their low cost and high accessibility (Garriguet, Tremblay, & Colley, 2015; Kelly, Fitzsimons, & Baker, 2016; WHO, 2015d), especially within an online format (Cantrell & Lupinacci, 2007).

Theoretical Framework

The TTM has been used in behaviour change research and health behaviour interventions for more than 30 years. The TTM was originally formulated based on stages and processes of change identified in studies of smokers who were able to quit smoking without health professional intervention (Prochaska & DiClemente, 1984). To aid smokers with cessation, two more constructs from the psychotherapeutic field were added to create the model, specifically decisional balance [also known as pros and cons] (Janis & Mann, 1977), and self-efficacy, from Bandura's social cognitive theory (Bandura, 1997b).

Physical activity research traditionally did not use theoretical frameworks before the 1980's, when behaviour change theories, including the TTM, began to be considered. The TTM expanded from a focus on smoking cessation, to exercise and various other health behaviours (Marcus et al., 2006). Interest in NCDs and their prevention led to studies of tools to measure stages of exercise behaviour change (Marcus & Simkin, 1993; Marcus et al., 1992). Population-level PA interventions were also developed (Dishman, Vandenberg, Motl, & Nigg, 2010), as well as investigations into generalizability of use of the TTM for PA in various populations based on age, gender, ethnicity, and socioeconomic status (Nigg et al., 2011; Paxton et al., 2008). As well, use of national and international PA guidelines has guided the assessment of the level of PA in TTM-guided studies (Paxton et al., 2008).

There are several advantages to TTM that have ensured its longevity and that have influenced the choice of TTM to guide this study: (a) encouragement of empathy for individuals and populations that need to change their behaviour, and discouragement of treating those who relapse as failures; (b) behaviour change as a process instead of an event; (c) effective single or simultaneous multiple TTM-based behaviour change interventions; (d) evolution from individual treatment to targeted public health approach with potential for tailored (individualized) interventions; and (e) clear 'intuitive' nature of the model, making TTM-based assessment and intervention relatively easy to apply in many health care settings (Hellsten et al., 2008; Krebs, Prochaska, & Rossi, 2010; Nigg et al., 2011).

While it has been recommended that not just stages of change (SOC), but all aspects of the TTM be applied when designing and testing interventions (Spencer, Adams, Malone, Roy, & Yost, 2006), the current descriptive study, having no interventions, focused on the SOC and self-efficacy as they relate to falls prevention. In order to comprehend the full TTM, the SOC, processes of change, decisional balance, and self-efficacy will each be discussed in turn.

Stages of Motivational Readiness to Change

Motivational readiness has been added to the name 'stages of change' in order to reflect the fact that motivation often increases before behaviour change is apparent (Marcus & Owen, 1992). The SOC consist of five stages: precontemplation, contemplation, preparation, action, and maintenance. In the precontemplation stage, individuals are either not aware that they need to change, believe that they cannot change, or are not planning to change in the next 6 months. The contemplation stage involves increased awareness of a need for change, but disadvantages (cons) of change are perceived more strongly than advantages (pros). On discrete measures, contemplators agree that they intend to change within 6 months. However, both

precontemplation and contemplation stages can last for years and movement can occur between them. The next stage is preparation, in which individuals may be making attempts to change but have not reached a set criterion. An example of a criterion is the one chosen for this study; PA volume that meets national guidelines for frequency, intensity, and duration. Individuals in preparation are also planning to change their behaviour within 1 month. People in the action stage have reached the criterion for a period of up to 6 months. The maintenance stage involves meeting the criteria for a period beyond 6 months. Relapse is possible at any point in the SOC; in fact, most people will relapse at some point and spiral back to a previous stage (Prochaska et al., 1992).

Processes of Change

Processes of change (POC) are the cognitive and behavioural strategies that individuals use to change their behaviour. Physical activity POC were based on the TTM, and have been identified experimentally (Marcus, Selby, Niaura, & Rossi, 1992). Cognitive POC tend to be used more in the earlier stages and involve increasing knowledge, becoming aware of disadvantages, caring about consequences to others, understanding advantages, and increasing opportunities to be healthy. Behavioural POC are increasingly used in later SOC and include substituting alternatives for the undesired behaviour, seeking social support, using rewards, making commitments, forming habits, and using reminders (Marcus & Lewis, 2003).

Decisional Balance

Decisional balance, also called pros and cons, is a construct in the TTM based on decision-making theory (Janis & Mann, 1977; Prochaska et al., 1992). Cons (or barriers), including energy expenditure, loss, lack of resources such as time, and discomfort, are perceived most strongly in the earlier stages and decrease with stage progression. Pros (or facilitators),

which are specific to both the type of change and to the individual, increase with stage progression, culminating in the maintenance stage (Marcus & Owen, 1992).

Self-efficacy

Self-efficacy (SE) is the final construct and is an important part of the TTM (Prochaska et al., 1992). Self-efficacy, confidence that one can attain a specific goal or perform a specific task, strongly predicts actual ability to achieve the goal or task (Bandura, 1997b). Self-efficacy has also been linked to PA behaviour in adults in midlife and later life (Ayotte, Margrett, & Hicks-Patrick, 2010). Lippke, Wiedemann, Ziegelmann, Reuter, and Schwarzer (2009) found that self-efficacy is a moderator of behaviour change planning in the continuum of intention-planning-behaviour; if self-efficacy is not high enough, intention and planning will not lead to increased PA behaviour. Research has supported the concept that SE increases linearly through the SOC from precontemplation to maintenance (Marcus & Owen, 1992). For example, exercise SE increases from the precontemplation to maintenance stages of PA for adults in midlife and later life with Type 2 diabetes mellitus (Guicciardi et al., 2014).

Transtheoretical Model Critique

Use of the TTM has not been without critique. Objections have taken the form of (a) short-term effects of TTM-based interventions; (b) complexity; (c) lack of research on underserved populations; (d) the SOC as continuous rather than discrete; and (e) questions around validity of algorithms for measuring the SOC for exercise.

Short-term effects. Transtheoretical model-based interventions tend to have positive effects; however, they have been short-term, with reports of effects decreasing at 6 months post-intervention (Adams & White, 2005). Moreover, shorter-term effects have been attributed to social, cultural, and physical contexts that encourage inactivity (Nigg et al., 2011; Stokols, 1996).

In contrast, Krebs et al.'s (2010) meta-analysis of 88 studies found that TTM-based multiple behaviour change interventions have had a longer-term effect that peaked at 4 to 12 months post-baseline, with decreasing effect after 12 months. There was also no decrease in effect for up to three behaviours addressed simultaneously, for example smoking cessation, PA, and a healthy diet (Krebs et al., 2010). Contexts that encourage inactivity are also known as obesogenic environments, which encourage weight gain (Mackenbach et al., 2014). These types of environments often affect personal behaviour change efforts, decreasing effects of behaviour change interventions over time (Nigg et al., 2011).

Physical activity complexity. The TTM was originally based on smoking cessation; therefore some PA researchers have questioned whether it is appropriate for PA (Adams & White, 2003; Brug et al., 2005). Currently, PA is thought to be a complex behaviour with many intrapersonal, social, and physical environment influences (Buchan, Ollis, Thomas, & Baker, 2012; Nigg et al., 2011). Physical activity also has different domains, including occupational, transport, and leisure, as well as different intensities, including light, moderate, and vigorous (Armstrong & Bull, 2006).

Health promotion efforts have expanded more recently from mainly individual-level behavioural interventions to multi-level interventions. Single-level interventions include behaviour change theories and models such as the TTM (Compernolle et al., 2014). Multi-level interventions use ecological-based theories (McLeroy, Bibeau, Steckler, & Glanz, 1988; Stokols, 1996), as well as behaviour change theories. The TTM continues to be used, often in combination with other behaviour change theories such as self-determination theory (Vancampfort et al., 2014), and with comprehensive models that address social and physical environments, as well as policy (Michie, van Stralen, & West, 2011; Nigg et al., 2011).

Lack of research on underserved populations. In a systematic review, Spencer et al. (2006) stated that white, middle-class women were the main group that had been used in TTM research in the United States, preventing generalizability of the model. Further research has validated TTM-based interventions across different variables, including age, sex, ethnicity, health status, socioeconomic status, and nationality (Geller, Nigg, Motl, Horwath, & Dishman, 2012; Nigg et al., 2011; Paxton et al., 2008; Velicer, Redding, Sun, & Prochaska, 2007).

Stages of change as continuous. A number of researchers have questioned whether the SOC should be continuous (Armitage, 2009; Bandura, 1997a; Brug et al., 2005; Sutton, 2000), or discrete, as originally theorized (Hall & Rossi, 2008; Prochaska & DiClemente, 1983; Velicer et al., 2007). However, the TTM website now describes the TTM's SOC as "ordered categories along a continuum of motivational readiness to change a problem behavior", and offers instruments to measure SOC that use either discrete or continuous variables (Cancer Research Prevention Center [CRPC], 2015, para.1). The PASCM, the questionnaire used in this study, uses discrete variables (Marcus et al., 1998).

Validity of the motivational stages of change for exercise. Critique of the TTM has also focused on the validity of the algorithms for exercise SOC, particularly due to the difference in the constructs of exercise and PA (Adams & White, 2005; Brug et al., 2005). The terms exercise and PA are used interchangeably by the layperson, but exercise is considered a subtype of PA by researchers (Nigg et al., 2005). The terms do share the following elements "(a) bodily movement via skeletal muscles; (b) results in energy expenditure; and (c) energy expenditure (kilocalories) varies continuously from low to high" (Caspersen, Powell, & Christenson, 1985, p. 127). However, the difference is that exercise is also "very positively correlated with physical fitness" and is "planned, structured, and repetitive bodily movement," and has as a goal "to

improve or maintain physical fitness measure(s)" (Caspersen et al., 1985, p. 127). Early SOC for exercise algorithms may have been based on an implicit assumption of Caspersen et al.'s definition of exercise.

Furthermore, exercise levels were found to correlate with the SOC for exercise at higher intensity levels but not at lower levels, leading to recommendations for SOC algorithms specifically for 'lifestyle PA' (Schumann et al., 2002). At the same time, recognition of high levels of inactivity in the population as well as benefits of low to moderate intensity exercise, were increasing the focus on PA for prevention of NCDs (Pollock & Froelicher, 1990; Pollock et al., 1998; US Department of Health and Human Services, 2000). Stages of change tools for exercise have been updated by using a nationally recommended criterion of PA (physical activity guidelines) (Marcus et al., 1998). New SOC for PA have also been developed and validated (Hellsten et al., 2008; Nigg et al., 2005; Reed, Velicer, Prochaska, Rossi, & Marcus, 1997).

Use of the Transtheoretical Model in Physical Activity Promotion

The physical, psychological, and social benefits of increasing PA and decreasing sedentary behaviour are well known (Warburton et al., 2006). However, PA behaviour is complex and involves barriers at the personal, local, and national level (Katzmarzyk, 2010). The TTM has been advocated as a multilevel approach that addresses some of these barriers for a variety of PA promotion interventions, including at the individual and community level (Hellsten et al., 2008; Lach, Everard, Highstein, & Brownson, 2004; Nigg et al., 2011; Resnick et al., 2008). In the healthcare field, nurses and other professional groups have advocated the use of the TTM for primary and secondary prevention of NCDs (Burbank, Reibe, Padula, & Nigg, 2002; Greaney et al., 2008; Hellsten et al., 2008).

Summary

This literature review has used a life course perspective on FOF, focusing on adults in late midlife, which allows consideration of primary and secondary prevention of falls and frailty in this cohort. Physical activity interventions that use behaviour change theory to increase PA levels for older adults, including those in late midlife, have been found to be useful in decreasing FOF. The SOC from the TTM are an example of a useful behaviour change construct that can be used by nurses and other healthcare professionals in PA interventions for falls prevention in all healthcare contexts, for midlife and later life adults at risk of pre-frailty and frailty. Despite research knowledge of the three areas of FOF, PA levels, and SOC, these areas have not been used to study falls prevention in the midlife population. This study has addressed this knowledge gap, including studying demographic variables that were tested with these variables to predict FOF.

CHAPTER 3

Methods

Study Design

This study used a cross-sectional, descriptive design (Polit & Beck, 2012) to analyze relationships between FOF and the independent variables of demographic characteristics, PA volume, and the SOC. Demographic characteristics included age, sex, education, and income.

Sample

Inclusion Criteria

The inclusion criteria included being in late midlife (aged 50 to 70 years) and living in the province of Prince Edward Island (PEI), Canada.

Sample Size

The estimated non-random convenience sample size for the proposed study was 286 participants, based on the late midlife population aged 50 to 69 years who reside in PEI, and a calculation of 77% of this population that have broadband Internet availability (see Appendix A for sample size calculations). An expected response rate of approximately 25% (SurveyMonkey, 2017) would have afforded an acceptable sample of 72 participants, within 10% accuracy (see Table 1 for sample size estimates with 95% confidence level and accuracy levels).

The actual sample size obtained for this survey was 147 participants. With a 95% confidence level, this study is reporting that a sample size of 147 participants captures the true population estimates within 7% accuracy.

Recruitment of Sample

Participants were recruited through local community approaches on PEI such as media advertising (television and radio), social media (Twitter), an article in the *Voice for Island*

Table 1

Sample Size Estimates for Late Midlife Cohort in PEI, with Confidence and Accuracy Levels

Confidence Level	Accuracy Level	Number of Participants Needed (Sample Size)
95% Confidence	10% accuracy	72
95% Confidence	7% accuracy	146
95% Confidence	5% accuracy	286
95% Confidence	3% accuracy	782
95% Confidence	2% accuracy	1709

Note. Based on a late midlife population of 43,701 in PEI, with 77% broadband Internet availability, for a starting population of 33,650.

Seniors insert in the local newspaper, and personal contact of community group leaders. Oral and poster presentations on falls prevention were also conducted. V. Abd-El-Aziz, the Master of Nursing (MN) candidate, invited participation by email or a personal visit to representatives of: the Seniors' Active Living Centre at UPEI, the Women's Institute, the Seniors' Secretariat, Lions' Club, Kiwanis Club, the Seniors' Federation, Murphy's Community Centre (bowling and square dancing clubs), a provincial recreation group (Go!PEI), a bingo hall, several church leaders, other community groups, and the School of Nursing, University of Prince Edward Island (UPEI). Falls prevention and the online survey were introduced, and if participants preferred, paper surveys were provided.

Setting

Participants accessed an online survey via the Internet in their homes, other residences, or a public library, on a computer or other Internet accessible device.

Data Collection

Data were collected through the online or paper survey. Participants were reminded that they should not put their names or any identifying marks on the questionnaires. Envelopes were provided to those participating in paper surveys, to ensure confidentiality, and were collected by the MN candidate.

The self-report online questionnaire (or paper questionnaire) consisted of four sections: a demographic section, the Short Falls Efficacy Scale-International [Short FES-I] (Kempen et al., 2008), which operationalizes FOF, the Global Physical Activity Questionnaire [GPAQ] (Armstrong & Bull, 2006), which measures PA volume, and the Physical Activity Stages of Change Measure [PASCM] (Marcus & Owen, 1992), which measures SOC. Data collection took approximately 7 weeks to complete.

Variables

In this study, the dependent variable studied was FOF, while PA volume and SOC were treated as independent variables. Demographic variables, including age, sex, education level, and income status were also assessed and considered as independent variables. The income question had nine categories. Due to too many of these categories having very small numbers of responses, income was reported by condensing the categories to three. Education, originally with eight categories, was similarly reported with three categories for clearer reporting. The first level, elementary education, with no responses, was removed. Middle school, with one response, was added to high school, and the two highest levels with low numbers, graduate and professional degree, were combined.

Fear of falling. Fear of falling was operationalized as falls self-efficacy, which was measured by the Short FES-I (Kempen et al., 2008). The long form, the FES-I, has high test-

retest reliability (intraclass coefficient 0.94) and concurrent validity (correlation coefficient -0.84) (Morgan, Friscia, Whitney, Furman, & Sparto, 2013) with the Activities-specific Balance Confidence (ABC) Scale (Powell & Myers, 1995). Kempen et al. state the Short FES-I has comparable internal and test-retest reliability (Cronbach's alpha 0.92, intra-class coefficient 0.83), and as well as predictive validity, (Spearman correlation 0.97), with the FES-I. Psychometric testing based on FOF, physiological, and neuropsychological measures have further established validity and reliability of both the long form and the Short FES-I (Delbaere et al., 2010; Denkinger et al., 2009; Helbostad et al., 2010).

The Short FES-I consisted of seven questions about the concern of falling for specific activities or contexts. All questions had a Likert-style response of between 1 (not at all concerned) to 4 (very concerned), with total possible scores between seven (not at all concerned about falling) to 28, (severe concern about falling) (see Appendix B1 for the Short FES-I and Appendix B2 for permission to use the Short FES-I).

Physical activity volume. Total PA volume in a typical week, which includes type, intensity, duration, and frequency, was measured by the use of the GPAQ (Armstrong & Bull, 2006) and the GPAQ Analysis Guide (WHO, 2017), with further direction from Chu et al. (2015). The GPAQ was developed by the WHO, based on the International Physical Activity Questionnaire [IPAQ] (Craig et al., 2003), which was also used for population monitoring of PA. The GPAQ addressed the need for a tool to measure PA volume in three domains: work, travel, and recreation. Concurrent validity testing between the IPAQ and GPAQ found moderate to strong correlation between the two measures (Spearman's rho 0.45 – 0.65) (Bull, Maslin, & Armstrong, 2009). Criterion validity, testing by comparison with data from objective devices, including pedometry (counting steps) and accelerometry (measuring body movement), is

generally low for self-report PA questionnaires, and the GPAQ was found to be similar to the IPAQ in this regard (total PA pooled data correlation 0.31). Kelly, Fitzsimons, and Baker (2016) argued that this may be due to inaccurate use of objective measures of PA to measure criterion validity of the GPAQ. Reliability of the GPAQ was considered good: short-term coefficients were 0.83 to 0.96 and long-term were 0.53 to 0.83 (Bull et al., 2009; Herrmann, Heumann, Der Ananian, & Ainsworth, 2013) (see Appendix B3 for the GPAQ and Appendix B4 for permission to use GPAQ). Both the IPAQ and GPAQ continue to be considered valid and reliable for population level PA measurement (Cleland et al., 2014; Hallal et al., 2012; Herrmann et al., 2013; Mathews, Salvo, Sarma, Thankappan, & Pratt, 2016).

Objective and subjective measures of PA are complementary and increasingly used by research groups. However, while objective measures such as pedometers and accelerometers are an important innovation, they have limitations, including being unable to measure upper body movement, for example, shovelling, or other movements that do not involve stepping, including cycling and water sports (Colley et al., 2011). Objective measures also do not allow for recording of context. Self-report remains a valid approach of choice at the population level, due to the inclusion of PA context and intensity, as well as the low cost and ease of use (Garriguet & Colley, 2014; Kelly, Fitzsimons, & Baker, 2016).

Stages of motivational readiness to change physical activity behaviour. The PASCM has been developed based on the TTM's SOC (Marcus & Owen, 1992). Concurrent validity for the PASCM was assessed through comparison with a self-efficacy for exercise scale, and a pros and cons measure based on the TTM (Marcus & Owen, 1992), as well as the Seven Day Physical Activity Questionnaire (Marcus & Simkin, 1993; Sallis et al., 1985), and reported to be significantly correlated (coefficients were not reported). Reliability was measured by a Kappa

coefficient of 0.78 after 2 weeks (Marcus et al., 1992). The PASCM continues to be recommended for PA stage of change assessment at the population level by researchers and by the American College of Sports Medicine [ACSM] (Marcus & Lewis, 2003; Marcus & Forsyth, 2009; Pekmezi et al., 2010) (See Appendix B5 for PASCM and Appendix B6 for permission to use PASCM).

Data Analysis

The Statistical Analysis System (SAS), Education Analytic Suite, was used to analyze data from the online and paper surveys. Data analysis of FOF, PA volume, and SOC was conducted in three phases. In the first phase, demographic characteristics were tested and statistics obtained. In the second phase, analyses were conducted on PA volumes, SOC, and FOF, resulting in descriptive results. In the third phase, FOF models were tested using multiple linear regression analysis.

While studying PA volumes in the second phase, an interesting and useful independent variable called recreation group was also developed. Data collected from the GPAQ were also reorganized for further analysis. First, recreational PA answers from the GPAQ were used to provide a new category: recreation activity group. If participants responded no to both moderate and vigorous recreational PA, the response was coded as 1. If they responded yes to moderate but no to vigorous recreational PA, the response was coded as 2. If the response was yes to both moderate and recreational PA, it was coded as 3. This new variable was tested for FOF prediction along with the other variables in phase three.

Ethical Considerations

Ethical approval was granted from the Research Ethics Board at UPEI through a formal online application process (see Appendix C for Ethics Certificate). In the online survey, the first

web page that participants entered featured the consent form. For the paper survey, the consent form was also on the first page. Risks and benefits were listed and explained (see Appendix D1 for the online consent form and Appendix D2 for the paper consent form). Risks of the survey were minimal, but may have included misunderstanding the information. Participants were reminded that they could withdraw from the study at any time. Participants were also encouraged to seek out their healthcare provider if they had any concerns about increasing their PA. Benefits may have included increased education regarding preventing falls through PA. Checking the consent box at the bottom of the web page allowed the participant to enter the online survey.

The online survey ensured anonymity for participants, as it did not list names or other identifying information. Anonymity was ensured through analysis and discussion of aggregate data only. The Master of Nursing (MN) candidate, V. Abd-El-Aziz, and the website administrator, Dr. W. Montelpare, were the only researchers who had access to the raw data on the online survey website and the data analysis program, the Statistical Analysis System (SAS), Education Analytic Suite. The MN candidate entered data from the paper questionnaires into the online survey page.

Data were numeric and textual, including results of the survey, statistics, and analyses. The data will be stored for five years and then destroyed.

Summary

A cross-sectional, descriptive design was used to analyze relationships between FOF and the independent variables of demographic characteristics, PA volume, and the SOC. Demographic characteristics included age, sex, education, and income. All data were analyzed by SAS. In this chapter, data collection and analysis were discussed

CHAPTER 4

Research Findings and Analysis

This chapter describes the results of the statistical analyses for data collected using online and paper survey methods. First, the purpose of this study will be reviewed. Next, the process of data analysis will be described using three phases. In the first phase, descriptive results regarding demographic characteristics, as well as the dependent variable, FOF, and the independent variables, PA volume and SOC, will be reported. In the second phase, recreational PA volumes, recreation group, and further analyses of FOF, PA Volume, and SOC will be discussed. In the final phase, regression analysis results for FOF prediction will be provided.

Purpose

The purpose of this study was to determine the extent to which FOF is influenced by PA volume, as mediated by the category for stages of change in a late midlife cohort, aged 50 to 70 years. The demographic characteristics that were measured for this sample were age, sex, education, and income.

Descriptive Statistics in Phase One

The Statistical Analysis System (SAS), Education Analytic Suite, was used to analyze all numeric data in three analysis phases. In phase one, descriptive statistics were computed for the dependent variable, FOF, which was measured by the falls efficacy score, a proxy measure for FOF. Descriptive statistics were also obtained for the demographic characteristics, including age, sex, education, and income, as well as the independent variables measured by self-report questionnaire, including PA volume and SOC. See Tables 2 and 3 for descriptive statistical information for the demographic characteristics and the independent variables. Women made up

Table 2

Descriptive Statistics for Age, Education, and Income by Sex

Variable	Men (n) %	Women (n) %	Total* (N) %
Sex	(27) 18	(116) 79	(143) 97
Missing			(4) 3
Age			
1. 50-55	(4) 14.8	(15) 12.9	(20) 13.6
2. 56-60	(4) 14.8	(34) 29.3	(38) 25.8
3. 61-65	(8) 29.6	(37) 31.9	(46) 31.2
4. 66-70	(11) 40.7	(30) 25.8	(43) 20.2
Education			
1. Middle/high school	(6) 22.2	(10) 8.6	(16) 10.9
3. College/trade school	(7) 25.9	(36) 31.0	(44) 30.1
4. Bachelor's degree	(7) 25.9	(36) 31.0	(43) 29.4
5. Graduate or professional degree	(7) 25.9	(30) 25.5	(39) 26.7
Income			
1. <$29,999	(5) 20.0	(17) 17.1	(23) 18.1
2. $30,000-74,000	(14) 56.0	(55) 55.5	(69) 54.3
3. $>75,000	(6) 24.0	(27) 27.2	(35) 27.5

Note. *Values do not always add to 100% due to missing responses; n = sample size; N = total sample.

approximately 80% of the sample of 147 people that completed the survey. These statistics are based on a lower number of men (n=27) than women (n=116). Four participants did not report sex but were not excluded, leading to proportions that do not always add to 100% when results are categorized by sex. Only respondents that did not answer the question about age, or were

Table 3

Descriptive Statistics for Falls Efficacy, Physical Activity Volume, and Stages of Motivational Readiness to Change Physical Activity Behaviour by Sex

Variable	Men (n) %	Women (n) %	Total* (N) %
Falls Efficacy**			
1. Low (7-8)	(21) 77.7	(47) 40.5	(68) 46.2
2. Moderate (9-13)	(5) 18.5	(46) 39.6	(55) 37.4
3. High (14-28)	(1) 3.7	(15) 12.9	(16) 10.8
PA volume			
1. Low	(12) 44.4	(54) 48.6	(68) 47.8
2. Moderate	(7) 25.9	(30) 27.0	(38) 26.7
3. High	(8) 29.6	(27) 24.3	(36) 25.3
SOC			
1. Precontemplation	(1) 3.8	(5) 4.3	(7) 4.8
2. Contemplation	(3) 11.5	(26) 22.6	(31) 21.3
3. Preparation	(3) 11.5	(10) 8.7	(13) 9.0
4. Action	(1) 3.8	(5) 4.3	(6) 4.1
5. Maintenance	(18) 69.2	(69) 60.0	(87) 60.4

Note. *Values do not always add to 100% due to missing responses, n = sample size; N = total sample.
** $p<.05$.
PA – Physical Activity: low < 600MET*min/week; medium = 600 - 2999 MET*min/week; high = 3000 - 30,240 MET*min/week.
PA outliers removed: > 30,240 MET*min/week (9 hr vigorous PA/day or 18 hr moderate PA/day).

outside the age range, were excluded.

While the range of age was 50 to 70 years, the men were older than the women, with 41% of men age 65 to 70 while only 26% of women were in this age group. Level of education varied widely with over 10% completing high school or less and 27% completing a graduate or professional degree. Income was distributed between the three categories with the most earning between $30,000 and $74,000. FOF, measured as falls efficacy, was significantly lower in men,

with over 77% having low concern about falling, while approximately 41% of women had low concern about falling. Conversely, more women had high concern about falling, at 24%, versus men at 3.9%. Despite their concern, 51.3% of women did meet PA guidelines, while 55.5% of men met PA guidelines. More men were in the higher SOC than women, though similar proportions of men and women were in the maintenance stage.

Age distributions for men and women were different, with a disproportionately large number of women in the 65-year age category. The distribution of men by age was closer to representing a normal distribution than observed in women. See Figure 1 for age distribution of men and Figure 2 for age distribution of women.

Descriptive Statistics in Phase Two

In the second phase, two significant measures of PA were found, recreation group and recreation PA volume. Initially, total minutes per week of PA were calculated from the participants' responses on the GPAQ. This tool provided self-report estimates of PA at work and during active travel and recreation. These amounts were obviously overestimated, with many being impossible, as they were over 10,080 minutes, the maximum minutes in 1 week. These results were not found to contribute to predictive models of FOF.

Based on PA conceptual frameworks that state that PA patterns are shifting from manual labour to recreational and travel-based PA (Rind & Jones, 2014), it was decided to start by studying PA based on the intensity of the recreational PA. A unique measure, called recreation group, was established through a simple analysis of three levels of intensity of recreational PA.

The first level involved a participant answering negatively on the GPAQ tool to the questions of participation in both moderate and vigorous PA in recreation time. The second level was a positive answer to participation in moderate but not vigorous activity. The third level was

a positive answer to both moderate and vigorous PA during recreation. It was not possible to obtain a travel group measure based on moderate and vigorous intensity, since the GPAQ

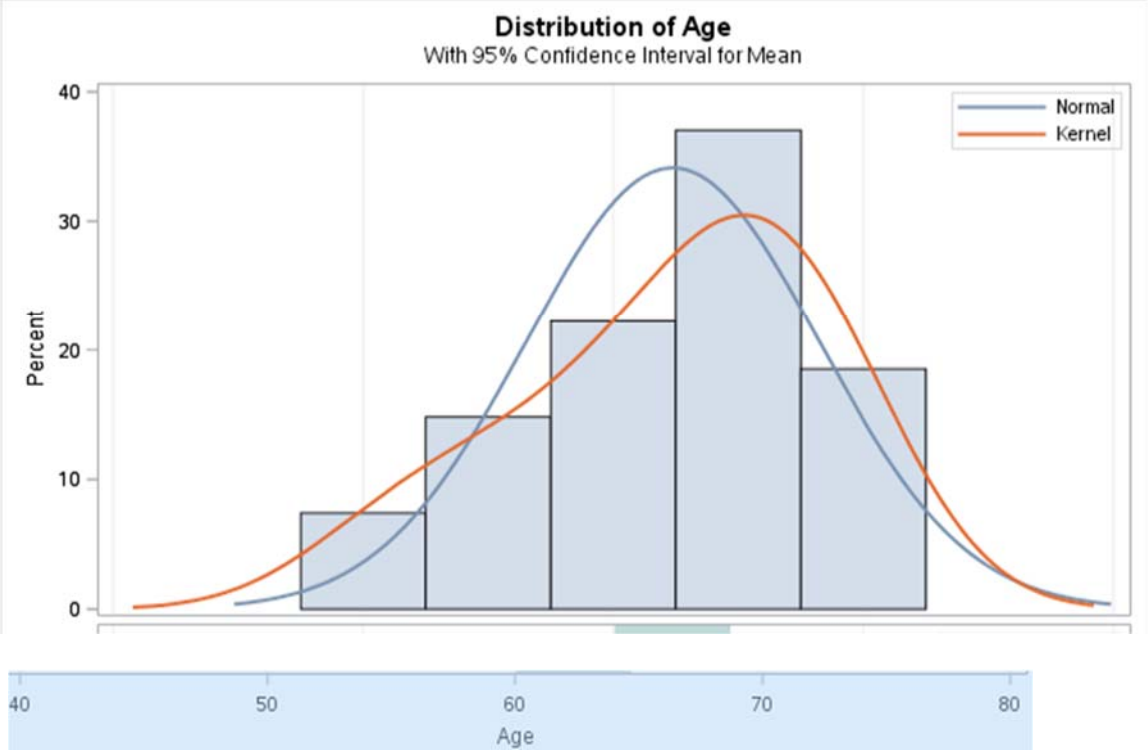

Figure 1. Distribution of Age by Sex (Men)

only allows moderate intensity answers for travel. A composite work PA group was also tested, but it did not significantly contribute to FOF prediction models.

This intensity-based recreational group measure was found to be useful, especially since it contributed to FOF regression models, which will be described in the next section. However, another GPAQ study was later found that described how to use GPAQ responses to calculate PA volume by converting total PA in minutes/week to a measure of energy expenditure, measured in MET*min/week. These results were then categorized into low, medium, and high volumes, thus controlling for overestimation (Chu et al., 2015).

The second type of measure, PA volume measured in MET*min/week, was also

determined from the participants' responses on the GPAQ. The GPAQ guidelines, as described by Chu et al. (2015), provided a measure of PA intensity whereby moderate PA refers to a metabolic equivalent of 4 ml/kg/min of oxygen consumption relative to workload, while

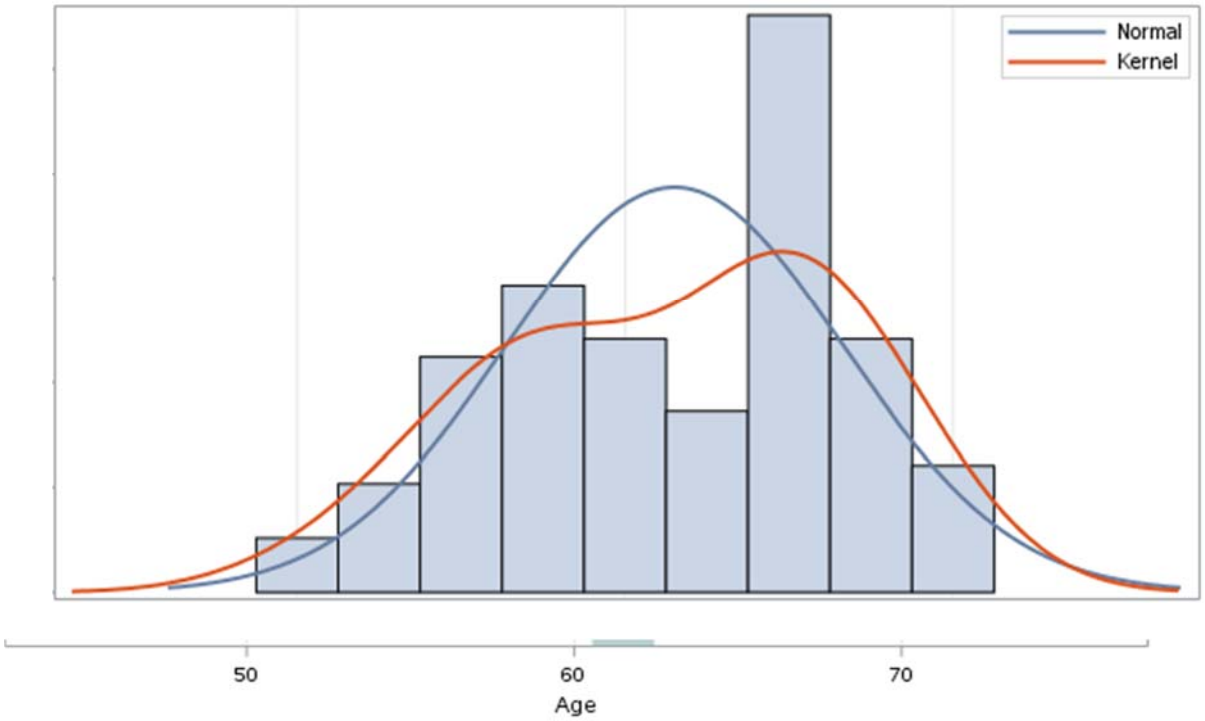

Figure 2. Distribution of Age by Sex (Women)

vigorous PA was defined as a workload stress requiring a metabolic equivalent of 8 ml/kg/min of oxygen consumption. The recreation group variable, the PA domain volumes, and a composite PA volume (which was a sum of all three domain volumes), were further tested in phase three.

Table 4 presents the proportion of individuals for the total sample, and for men and women, in moderate and vigorous PA intensity groups, which were then subcategorized into low, medium, and high PA volume groups. Participants could report both moderate and vigorous PA in work and recreation PA domains. For the travel domain, the GPAQ only measured moderate PA, therefore it was not included in vigorous PA groups. Men had higher PA volumes for

Table 4

Descriptive Statistics for PA Volume by Sex and PA Intensity Type (Moderate or Vigorous)

	Men (n) %	Women (n) %	Total Sample (N) %
Moderate intensity PA (work/travel/recreation)			
1. Low volume	(13) 48.1	(61) 54.4	(74) 51.7
2. Medium volume	(8) 29.6	(31) 27.6	(39) 27.2
3. High volume	(6) 22.2	(20) 17.8	(22) 15.3
Vigorous intensity PA (work/recreation)			
1. Low volume	(22) 81.4	(93) 81.5	(115) 80.4
2. Medium volume	(2) 7.4	(10) 8.7	(12) 8.3
3. High volume	(3) 11.1	(11) 9.6	(14) 9.7

Note. n = sample size; N = total sample.
PA – Physical Activity: low < 600MET*min/week; medium = 600 - 2999 MET*min/week; high = 3000 - 30,240 MET*min/week.
PA outliers removed: > 30,240 MET*min/week (9 hr vigorous PA/day or 18 hr moderate PA/day).

moderate intensity PA (in all three domains). Both men and women had low volumes of vigorous PA (for work and recreation).

Table 5 shows the means and standard deviations for composite PA volumes (a combination of work, travel, and recreation domains), as well as means and standard deviations for each of the work, travel, and recreational PA volumes. Composite PA volume consists of total moderate intensity PA volume (from the work, travel, and recreation domains of the GPAQ) plus total vigorous intensity PA volume (from the work and recreation domains of the GPAQ), and is displayed by age group, sex, education group, and income group. Composite PA volumes were significantly higher in men in the lowest age group who had attended college or trade

Table 5

Work, Travel, Recreational, and Composite PA Volume Mean Scores and Standard Deviations by Age, Sex, Education, and Income

Variable	Work Domain Mean (SD)	Travel Domain Mean (SD)	Recreational Domain Mean (SD)	Composite PA Mean Scores (SD)
Age				
50-55	2040 (6294)	252 (615)	980 (1758)	3526 (6655)
56-60	1042 (3063)	514 (1357)	878 (1268)	2477 (3763)
61-65	1227 (3206)	253 (1035)	1133 (4378)	1958 (3679)
66-70	1368 (2962)	435 (1088)	1183 (3128)	2987 (4825)
Sex				
Men	1223 (2748)	622 (1498)	973 (2352)	2818 (4039)
Women	1404 (3895)	328 (997)	942 (2929)	2464 (4479)
Education				
Middle/high school	1370 (4153)	515 (1464)	254 (483)	2140 (4513)
College/trade school	2453 (5496)	602 (1459)	415 (891)	3485 (5669)
University-bachelor's	768 (1739)	301 (902)	1928 (4732)	2325 (3633)
Graduate/ professional	800 (2167)	172 (516)	1320 (3092)	2344 (4067)
Income				
Low	1659 (3241)	144 (643)	427 (880)	2514 (3558)
Middle	1800 (4772)	427 (946)	1359 (3864)	3280 (5494)
High	322 (1142)	502 (1264)	1294 (3132)	1866 (3515)

Note. PA – Physical Activity: low < 600MET*min/week; medium = 600 - 2999 MET*min/week; high = 3000 - 30,240 MET*min/week.
PA outliers removed: > 30,240 MET*min/week (9 hr vigorous PA/day or 18 hr moderate PA/day).
SD – standard deviation.
Income: low <$29,999, middle = $30,000-74,000, high >$75,000.
Composite PA volumes: work + travel + recreation MET*min/week.

school, and who were in the middle-income group.

The GPAQ domain of work PA includes both moderate and vigorous intensity PA, and participants could report PA time in both intensities. Total work PA volumes were highest in the youngest group of women who had attended college or trade school and who were in the middle-income group. Mean total work PA volumes were some of the highest composite PA volumes of the three GPAQ domains.

The GPAQ allows for the measurement of moderate intensity travel PA that has been obtained through walking and cycling. Highest travel domain PA volumes were acquired by men aged 56 to 60, who had attended college or trade school, and who were in the highest income group.

The total recreation PA volumes were slightly higher in men than women, and highest in participants in the 66 to 70 age group who had a bachelor's degree and were in the middle-income group.

The SOC variable was one of the independent variables. Table 6 shows the mean scores and standard deviations for SOC by age group, sex, education group, and income group. Older age groups were in lower SOC, women were in slightly lower SOC than men, and those with higher education tended to be in higher stages.

Further analyses were then carried out to find mean falls efficacy scores associated with the independent variables. See Table 7 for falls efficacy (FOF) descriptive data, including falls efficacy mean and standard deviation by age group, sex, education group, and income group. Falls efficacy, also called concern about falling or FOF, was lower at younger ages, lower in men, lower with higher education, and lower in the higher income group. Concern about falling was lowest in men who were 56 to 60 years of age with a graduate or professional degree, and

with high income. Table 8 presents the descriptive statistics for the falls efficacy mean scores for total moderate and total vigorous intensity recreational PA by low, medium, and high volumes and sex. Fear of falling was lowest in men and women with high volumes of moderate and vigorous intensity PA. Of participants reporting vigorous PA, men with a high volume of PA had the lowest FOF.

Table 6

Stages of Motivational Readiness to Change Physical Activity Behaviour Mean Scores and Standard Deviations by Age, Sex, Education, and Income

Variable	SOC mean scores (SD)
Age	4.2 (1.22)
50-55	4.0 (1.41)
56-60	3.7 (1.49)
61-65	3.9 (1.42)
66-70	
Sex	
Men	4.2 (1.27)
Women	3.9 (1.41)
Education	
Middle/high school	3.5 (1.66)
College/trade school	3.6 (1.49)
University- bachelor's	4.2 (1.26)
Graduate/ Professional	4.2 (1.23)
Income	
Low	3.6 (1.49)
Middle	4.0 (1.41)
High	3.9 (1.35)

Note. SOC – stages of motivational readiness to change physical activity behaviour 1 = precontemplation, 2 = contemplation, 3 = planning, 4 = action, 5 = maintenance.
SD – standard deviation.
Income: low <$29,999, middle = $30,000-74,000, high >$75,000.

Table 7

Falls Efficacy Mean Scores and Standard Deviations by Age, Sex, Education, and Income

Variable	FOF mean scores (SD)
Age	8.9 (2.24)
50-55	8.8 (2.03)
56-60	10 (4.21)
61-65	9.9 (2.98)
66-70	
Sex	
Men	8.1 (2.03)
Women	9.7 (3.31)
Education	
Middle/high school	10.3 (3.99)
College/trade school	10.0 (3.05)
University- bachelor's	9.4 (3.62)
Graduate/ professional	8.4 (1.87)
Income	
Low	10.9 (2.98)
Middle	9.4 (3.53)
High	8.5 (1.69)

Note. SD – standard deviation.
Income: low <$29,999, middle = $30,000-74,000, high >$75,000.

Fear of falling (falls efficacy) mean scores, standard deviations, sample size, and minimum and maximum scores by recreational PA volumes and age group are presented in Table 9. Fear of falling tended to increase with age in those with low PA volumes (i.e., not meeting PA guidelines) for both moderate and vigorous intensity recreational PA. Response rates decreased with higher PA volumes for both intensities.

Table 8

Falls Efficacy Mean Scores and Standard Deviations by Recreational PA Volume and Sex

Moderate intensity recreational PA	Low PA volume	Medium PA volume	High PA volume
1. Men (n) Mean, S	(20) 8.15, 2.08	(5) 8.6, 2.30	(2) 7, 0
2. Women (n) Mean, S	(81) 10.12, 3.52	(23) 9.13, 2.43	(2) 7, 0
Vigorous intensity recreational PA	**Low PA volume**	**Medium PA volume**	**High PA volume**
1. Men (n) Mean, SD	(24) 8.29, 2.11	(2) 7, 0	(1) 7
2. Women (n) Mean, SD	(92) 10, 3.49	(8) 9.25, 1.90	(6) 8, 0.89

Note. FOF – fear of falling (operationalized as falls efficacy); Falls efficacy scale range = 7 – 28.
SD – standard deviation.
(n) – sample size.
PA – Physical Activity: low < 600MET*min/week; medium = 600 - 2999 MET*min/week; high = 3000 - 30,240 MET*min/week.
PA outliers removed: > 30,240 MET*min/week (9 hr vigorous PA/day or 18 hr moderate PA/day).

Table 10 represents the falls efficacy descriptive statistics for the SOC independent variable. Fear of falling tended to be lower at higher stages for women. A very low response rate is noted for men.

Table 9

Falls Efficacy Mean Scores and Standard Deviations by Recreational PA Volume and Age

Moderate intensity recreational PA:	Low PA volume (n) Mean, SD	Medium PA volume (n) Mean, SD	High PA volume (n) Mean, SD
1. 50 – 55 years	(16) 9.18, 2.40	(3) 8, 1	(0)
2. 56 – 60 years	(25) 8.68, 1.97	(11) 9.36, 2.20	(0)
3. 61 – 65 years	(35) 10.45, 4.45	(4) 8.25, 1.5	(3) 7, 0
4. 66 – 70 years	(29) 10.20, 2.95	(10) 9.3, 3.12	(1) 7
Vigorous intensity recreational PA:	Low PA volume (n) Mean, SD	Medium PA volume (n) Mean, SD	High PA volume (n) Mean, SD
1. 50 – 55 years	(14) 9.07, 2.61	(3) 8.66, 1.52	(2) 8, 0
2. 56 – 60 years	(30) 8.96, 2.18	(4) 8.25, 1.25	(3) 8.33, 1.15
3. 61 – 65 years	(38) 10.07, 4.35	(3) 10, 3	(0)
4. 66 – 70 years	(36) 10.13, 3.04	(1) 8	(3) 7.66, 1.15

Note. FOF – fear of falling (operationalized as falls efficacy); Falls efficacy scale range = 7 – 28.
SD – standard deviation.
(n) – sample size.
PA – Physical Activity: low <600MET*min/week, medium = 600-2999 MET*min/week, high = 3000-30,240 MET*min/week.
PA outliers removed: >30,240 MET*min/week (9 hr vigorous PA/day or 18 hr mod. PA/day).

Processing Data with Regression Equations in Phase Three

In the final phase, regression equations were developed from the dependent variable and independent variables to produce FOF prediction models. Fear of falling, operationalized as a

Table 10

Falls Efficacy Mean Scores and Standard Deviations for Stages of Motivational Readiness to Change Physical Activity Behaviour by Sex

	Men Mean (S)	Women Mean (S)	Total sample Mean (S)
SOC:			
1. Precontemplation	7 (1)	10.8 (3.77)	10.5 (3.55)
2. Contemplation	10.3 (4.93)	12.8 (4.57)	12.4 (4.47)
3. Preparation	7.33 (0.57)	8.13 (1.46)	7.91 (1.30)
4. Action	10	8.8 (1.30)	9.00 (1.26)
5. Maintenance	7.94 (1.43)	8.82 (2.10)	8.63 (2.00)

Note. FOF – fear of falling (operationalized as falls efficacy); falls efficacy scale range = 7 – 28.
SOC - stages of motivational readiness to change physical activity behaviour.
SD – standard deviation; no SD for action (only one response).

falls efficacy score, was the dependent variable. All demographic characteristics were tested; sex and income were found to be significant contributors to falls efficacy score prediction. Sex and income were then established as fixed independent variables in the FOF model. Random combinations of the other independent variables, PA volume and SOC, were added to this model to test predictions of a falls efficacy score. Variables based on PA volume, including composite PA volume, moderate and vigorous intensity PA volumes, and a variety of PA volumes based on work, travel, and recreation, were also tested. Three multiple regression models for FOF prediction were developed, including the two fixed variables of sex and income, as well as three

independent variables: recreation group, SOC, and total recreational PA volume. A multiple linear regression model was used, with the basic formula for the line of best fit:

$y = a_i x + b$, where y is the dependent variable: FOF score, a_i represents the respective regression coefficient, x is the value of the independent variable(s), and b is the y-intercept (the point where the line of best fit crosses the y-axis). Each model will be presented below.

The first multiple regression model for FOF prediction included a measure of the simple recreation group score developed in phase two:

FOF = (1.40)(sex) – (0.88)(income group) – (0.77)(rec group) + 10.27

Based on this model, vigorously and moderately active men and women are predicted to have lower FOF scores than those that are physically inactive. Women are predicted to have FOF scores 1.40 times that of men ($p = 0.0427$), FOF decreases by 0.88 points for each increase in the income group ($p = 0.0483$), and FOF decreases by 0.77 points for each increase in the recreational activity category ($p = 0.0360$).

The second multiple regression model for FOF prediction included the SOC:

FOF = (1.29)(sex) – (1.13)(income group) – (0.77)(SOC) + 12.56

Women are predicted to have FOF scores 1.29 times that of men ($p = 0.0477$), FOF decreases by 1.13 points for each increase in the income group ($p = 0.0046$), and FOF decreases by 0.77 points for each increase in the SOC ($p < 0.0001$).

The third multiple regression model for FOF prediction included the total volume for the recreation PA, including both moderate and vigorous PA:

FOF = (1.75)(sex) – (1.07)(income group) – (0.88)(total rec PA volume) + 9.91

Women are predicted to have FOF scores 1.75 times that of men ($p = 0.0103$), FOF decreases by 1.07 points for each increase in the income group ($p = 0.0110$), and FOF decreases by 0.88

points for each increase in the total recreational PA volume ($p<0.0310$).

Further analysis of PA volumes was carried out by removing reported PA volumes that were deemed implausible, i.e. too high to be possible. Following this, recreational PA volume was no longer a significant contributor to the FOF model at a $p = 0.05$ significance level.

Summary

This chapter has outlined the main findings of analysis of this study's data. Three phases of analysis included results of demographic characteristics, initial analysis, and ultimately, multiple linear regression models. These models found three FOF prediction models, involving independent variables of sex, age group, recreation group, and total recreational PA volume. Total recreational PA volume was subsequently removed from the model due to the effect of PA volume outliers.

CHAPTER 5

Discussion

Fear of falling is a potentially modifiable risk factor that may lead to an increase in falls risks, and is therefore a useful variable for falls prevention research. In this study, FOF was examined in a community-based sample of adults in late midlife in PEI. Significant associations with demographic variables, as well as PA volumes and SOC, were identified. Statistical analysis identified several combinations of variables that are included in FOF predictive models for this sample's participants. Four research questions were used to establish the relationships between FOF, PA, SOC, and demographic characteristics of age, income, education, and sex. These variables will be discussed in view of this study's sample as well as current FOF literature.

Discussion will begin with the characteristics of the sample. Second, the study's measures will be considered. Third, the four research questions will be examined, with findings related to the FOF, PA, and SOC literature.

Sample Characteristics

The sample in this study, as is often the case in community-based convenience samples, was predominantly women, at 79% (Waters, Galichet, Owen, & Eakin, 2011). The age distribution of men more closely approached a normal distribution, however, when age was categorized into four groups, the largest percentage was in the 66 to 70 year age group. The age distribution of women showed a spike at age 65, with the largest group of women in the 61 to 65 year age group. These findings were not unexpected, since rates of falls increase exponentially at the age of 65 (PHAC, 2014). A wide range of education levels was noted, with more than 10% reaching middle or high school, and over 27% achieving university graduate level studies or professional degrees, such as law or medicine. However, the distribution was skewed to a higher

education level than average for PEI. Approximately 86% achieved tertiary education compared to less than 50% for PEI (StatCan, 2009). Income approached a normal distribution for the sample; see Table 2 for demographic characteristics of the sample. The mean income of $30,650 for PEI fits in the middle-income group of the sample, which was $30,000 to 74,000 (StatCan, 2014).

Study Measures

Measures used in this study were the Short FES-I to measure FOF, the GPAQ to measure PA, and the PASCM to measure SOC.

Fear of Falling and Demographic Characteristics

The first research question that was posed for this study related to how the FOF scores varied with the demographic characteristics of the sample. As shown in Table 6, analysis of FOF results indicated that FOF scores were lower in men in this cohort, with a mean FOF score of 8.1, while women had a mean FOF score of 9.7. This finding agrees with the literature on FOF in adults over the age of 65 (Kempen et al., 2008), as well as with the study by Andresen et al. (2006) that measured FOF in a cohort with a mean age of 57 years.

The WHO's (2007) risk factor model for FOF and falls identifies four main categories of risk: behavioural, biological, socioeconomic, and environmental. Sex, race, and age are considered non-modifiable biological risk factors. In this study, age, sex, education, and income were tested, and the variable of sex was found to be statistically associated with FOF. Mean scores for women were consistently higher than for men. Being a woman has been reported previously as a risk factor for frailty, decreased physical functioning, FOF, and an increase in the prevalence of falls in later life (Auais et al., 2016; Chang, Chen, & Chou, 2016; Delbaere et al., 2004). According to Fried et al. (2001), the determinants of frailty are physical inactivity,

slowness, weight loss, exhaustion, and weakness. Alexandre et al. (2016) found that greater complexity occurs in the interaction of the five determinants of frailty for women, and proposed that a combination of factors increases the complexity of frailty, leading to FOF and falls for women. This combination includes longevity, lower mortality associated with higher morbidity, particularly for degenerative diseases, as well as loss of muscle strength in midlife, leading to the frailty component of weakness in later life. Notwithstanding, it is important to recognize that the increased frailty risk for women may also be due to social and healthcare related inequities (Zunzunegui et al., 2015).

Wang et al. (2014) have noted that the development of frailty usually happens over the life course. Therefore, a need exists for primary and secondary prevention of frailty, falls, and FOF, through health and social intervention programs directed toward women at all ages. Socioeconomic status, including low income and education, inadequate housing, insufficient access to healthcare, and other social determinants of health have been associated with frailty, falls, and FOF (Kumar, Carpenter, Morris, Iliffe, & Kendrick, 2014; Stolz, Mayerl, Waxenegger, Rásky, & Freidl, 2016; Szanton, Seplaki, Thorpe, Allen, & Fried, 2010; WHO, 2007). Fear of falling was negatively associated with income level in this study; as income increased, FOF decreased. Education also affected FOF, with the lower education level having higher mean FOF scores. Refer to Table 6 for FOF scores for education and income.

In this study, adults in the 61 to 70 years age group had higher FOF scores than younger age groups. The 61 to 65 years age group also had greater variability, with responses indicating highest and lowest possible FOF scores. The literature suggests a positive association of advancing age and increasing frailty. However, a consensus among frailty researchers has stated that frailty is a medical syndrome, not an inevitable outcome of ageing. It has been suggested

that in a cohort of well adults in later life, frailty can be prevented or treated by exercise, a combination of protein, calories, and vitamin D, and prevention or reduction of polypharmacy (Morley et al., 2013). However, in midlife, PA components (endurance, flexibility, strength, and balance), a healthy diet, a decrease in and cessation of smoking, and following low-risk alcohol consumption guidelines are best-practice recommendations for the prevention of frailty, dementia, falls, injury, disability, and NCDs (Butt, Beirness, Stockwell, Gliksman, & Paradis, 2010; Colley et al., 2011; Garber et al., 2011; Lafortune et al., 2016).

Physical Activity and Demographic Characteristics

The second research question to be considered in this study was in relation to the volume of PA by demographic characteristics. This question was be considered in terms of each of the demographic variables: age, sex, education, and income.

Total PA volumes in this study were highest in men in the 50 to 55 years age group. However, women had more variability in their responses, with overestimation possibly more of a factor for women than men. Women in the middle education and income groups had the highest PA volumes at work, while men had the highest PA volumes for travel and recreational PA. As well, PA volume in the work domain of the GPAQ was negatively associated with income; as total PA at work decreased, income increased. For women with lower and middle income, this may be significant when they retire. If they are accustomed to being physically active at work, but then treat retirement as a rest, they may be at risk for increased frailty (Barnett, van Sluijs, & Ogilvie, 2012). Matsushita, Harada and Arao (2015) found that lower socioeconomic position was associated with increased work PA and less travel, recreational, and total PA volumes, however, this was more pronounced for men in their study.

Studies in the area of PA have been mixed for sex as a correlate of PA. Some research

groups state that being a woman is associated with lower PA volume in regards to meeting national and international PA guidelines (Shibata, Oka, Harada, Nakamura, & Muraoka, 2009; Tucker, Welk, & Beyler, 2011). However, a large European study documented more women achieving guidelines levels for PA volume than men (Marques, Martins, Peralta, Catunda, & Nunes, 2016). In the International Prevalence Study on PA, which included 20 countries, Bauman et al. (2009) state that younger men more frequently reported high levels of PA than women (in 17 of 20 countries), but this difference was significantly lower at older age.

Reports of women having lower PA may be based on the socioeconomic characteristics of the populations studied, particularly regarding norms and opportunities for women to participate in active work, travel, or recreation (Zunzunegui et al., 2015). Janssen et al. (2014) studied correlates of PA in women in midlife, and found that those with high motivation and self-efficacy were able to sustain a level that met PA guidelines of $\geq$ 150 min/week of moderate PA or $\geq$ 75 min/week of vigorous PA (600 or more METs per week), over a period of 15 years. Researchers are currently studying interventions to help lower socioeconomic groups to increase PA (Bull, Dombrowski, McCleary, & Johnston, 2014).

As reported in Table 2, PA findings indicated that 51.3% of women in this study met Canadian PA guidelines for moderate to vigorous PA (MVPA), while 55.5% of men met these guidelines. This is comparable to self-reported PA for Canadians. Conversely, when Canadians were objectively measured by accelerometry, only 15% had PA that met national guidelines (Colley et al., 2011). Overestimation of PA is common with self-report studies, and is taken into consideration by data analysis guidelines of the GPAQ (Bull et al., 2009; Chu et al., 2015).

Research in the area of PA generally recognizes that PA decreases with age, particularly for men. The Whitehall II study found that older age, obesity, lower education, and self-reported

general health were associated with PA (Hamer, Kivimaki, & Steptoe, 2012). Hamer et al.'s study also reported that PA in midlife, measured in 1997, was significantly associated with PA in a 2009/2010 follow-up study, independent of age, sex, smoking, employment, education or self-reported general health. A Canadian study that measured age, sex, body mass index (BMI), and objectively measured PA discovered that men 20 to 39 years had higher PA than women; whereas there was no difference for men and women ages 40 to 79, (Colley et al., 2011). However, while overweight and obese men and women at all ages had lower PA than average weight individuals, overweight and obese men had significantly higher PA than overweight and obese women in the Canadian study. In the current study, PA was found to be highest in younger men, with a small but noticeable resurgence in PA after age 65 for men and women (see Table 4).

In this study, results show that total work PA volumes were higher for those having college or trade school as their highest education level. For travel and recreational PA, the higher education levels showed higher PA volumes. In PA research, reports have been mixed on education level effects on PA volume. Vagetti et al. (2013) found that lower education correlated with lower PA in women. In the recent European Social Survey study, achieving PA guidelines was associated with secondary education, but not with primary or post-secondary education (Marques et al., 2016). Bauman et al.'s (2009) study found mixed results for an association of education and PA in 19 countries. Hamer et al. (2012) conjectured that their findings of an association between education and PA was related to improved knowledge regarding health.

Stages of Motivational Readiness to Change Physical Activity Behaviour and Demographic Characteristics

The third research question asked how the SOC score varied by the demographic characteristics within the sample. Intention for PA behaviour in this study was measured based on the TTM. The five SOC in the TTM are precontemplation, contemplation, preparation, action, and maintenance. In the current study, similar proportions of men and women were in the maintenance stage. More men than women were in both the action and maintenance stages, with 73% for men and 65% for women. Conversely, more women than men were in the lowest levels of precontemplation and contemplation, at 27% and 15%, respectively. Mean SOC scores were highest for the youngest age groups, as well as for the highest education and income groups.

Garber et al. (2008) identified age, sex, and race as correlates of the intention for PA behaviour. Marshall and Biddle (2001), in a meta-analysis of applications of the TTM to PA and exercise, found SOC are associated with "different levels of PA, self-efficacy, pros and cons, and processes of change" (p. 229). Adults in later life, people who were married, smokers, and those with lower socioeconomic status were most likely to be in the earlier SOC (Dumith, Gigante, & Domingues, 2007).

Fear of Falling, Physical Activity Volume, Demographic Characteristics, and Stages of Motivational Readiness to Change Physical Activity Behaviour

The fourth and final research question was: how do PA volume, demographic characteristics, and SOC influence the FOF score? In this study, variables that statistically predicted the FOF score by multiple regression analysis were sex, income, recreation group, SOC, and recreational PA volume. As discussed in Chapter 4, recreation group was based on

three levels of intensity of recreational PA: no moderate or vigorous PA, only moderate PA, and both moderate and vigorous intensity recreational PA. Alternatively, recreational PA volume was calculated based on intensity, duration, and frequency of PA in the recreation GPAQ domain, and converted to energy expenditure categories. Three FOF prediction models will be considered below.

Sex, Income, and Recreation Group

The variable developed in phase two of data analysis, recreation group, combined with variables of sex and income, predicted FOF score. This model means that women are predicted to have higher FOF scores compared to men, that lower income leads to higher FOF, and that increasing intensity of recreational PA leads to lower FOF. For women with lower income in this population who are at increased risk of FOF and falls, gradually progressing their intensity of recreational or leisure PA from light to moderate and if possible, to vigorous intensity, may help decrease their risk. The benefits of moderate PA include prevention or management of NCDs (Garber et al., 2011) and reduction of frailty (Rockwood et al., 2011). Vigorous PA may help with strength and balance and long-term weight maintenance through control of body fat percentage (Bailey, Tucker, Peterson, & LeCheminant, 2007; Garber et al., 2011). However, for midlife women who are very inactive, sedentary behaviour reduction, increased volumes of light and moderate PA, and empowerment, may be starting points for increasing to moderate and vigorous PA (Antonucci et al., 2012).

Dugan, Bromberger, Segawa, Avery, and Sternfeld (2015) have outlined recommendations for exercise prescription for midlife women, including balancing the benefits and risks of moderate and vigorous PA. For those who are inactive, overweight or obese, pre-frail, or have NCDs, functional limitations, or disabilities, recommending moderate rather than vigorous PA

may involve lower stress, more acceptance, and development of higher self-efficacy for PA (Im et al., 2011).

Sex, Income, and Stages of Motivational Readiness to Change Physical Activity Behaviour

The second predictive model of FOF involved a combination of the variables of sex, income and SOC. As well as similar demographic effects of sex and income status mentioned in the first model, in this model, higher SOC predicts lower FOF scores. Being in the action or maintenance stages significantly affects FOF, possibly related to meeting PA guidelines, increased strength and balance, and lower fear or anxiety related to falling.

Sex, Income, and Total Recreational Physical Activity Volume

In the third model, sex and income were again significant predictors of FOF, with the addition of total recreational PA volume as a predictive variable. In this study, higher SOC for PA were found to predict decreased FOF scores for women. While increasing PA in all aspects of life is often recommended as a healthy lifestyle (Peel, Bartlett, & McClure, 2007), this may not be realistic for many people in their daily occupation, as work is increasingly sedentary (Antonucci et al., 2012). Active travel is also increasingly being promoted as a way to help meet PA guidelines (WHO, 2010). The significance of women achieving higher levels of PA through work may mean that they will be at risk of frailty, NCDs, mobility disability, and falls in later life if they do not increase PA in other aspects of their lifestyle, such as recreation and active travel (Savela et al., 2013). Recreation time may include PA for leisure or social purposes, and planned exercise such as sports or gym attendance. In the predictive statistical model, the effect of recreational PA on FOF reduction was decreased by the effect of lower income level, since they had opposing effects. Though the recreation PA volume variable was no longer significant at the significance level of this study once outliers were removed, this would be an interesting

model to test with objective PA volume data. Overestimation by some participants may be due to social desirability bias, however, the degree of overestimation was not unexpected, based on previous studies with GPAQ data.

Summary

The results of this study contribute to knowledge about the midlife cohort in PEI, particularly in relation to women. Lower socioeconomic status in PEI and in the Atlantic provinces mean that many women in this population are at a higher risk of FOF and falls, and in greater need of increasing their PA. Men in this study also had FOF; these individuals may also be at risk for or suffering from frailty, NCDs, inactivity, and decreased mobility in midlife and be in need of increasing or maintaining PA. Use of the TTM elements, including SOC, could help health professionals assess, prescribe, plan, and evaluate PA for their clients whose social determinants of health lead to inequities, frailty, disability, and NCDs.

CHAPTER 6

Summary, Limitations, Implications, and Recommendations

In this chapter, the findings of the study and limitations will be discussed. Next, implications for nursing practice, theory, education, and policy will be reviewed. Lastly, recommendations for future research will be proposed.

Summary of Findings

The purpose of this study was to determine the extent to which FOF is influenced by PA volume, as mediated by the category for stages of change in a late midlife cohort, aged 50 to 70 years. The study used a cross-sectional descriptive design and was conducted with a sample of 147 participants, with women making up 80% (n=116), and men 20% (n=27) of the sample. The theoretical framework underlying the study was the TTM, specifically focusing on the stages of change (SOC), a central component of the TTM. In this study, several measurement tools were used: the self-report online questionnaire (or paper questionnaire) consisting of four sections: (a) demographic section, (b) Falls Efficacy Scale – International, short form (Short FES-I) (Kempen et al., 2008), which operationalized FOF, (c) GPAQ (Armstrong & Bull, 2006), which measured the PA volume; and (d) PASCM (Marcus & Owen, 1992), which measured stages of change (see Appendices B for measures and permission for use). The online version of the survey consisted of 78% of the sample, and the paper version, 22%. While the paper version had signatures for consent, once the paper questionnaire data was entered in the survey website, only aggregate data were studied with no identifiers of individuals.

The main findings being reported for this study are three statistical models for predicting FOF. These models, tested through multiple linear regression analysis, each had three variables. Two consistent variables in the FOF models are sex and income. The third variable in the first

FOF prediction model is recreation group and in the second FOF prediction model is SOC. Women with low socioeconomic status who do not engage in moderate or vigorous PA would be at a higher risk of FOF, and according to falls prevention research, a higher risk of falls. Women with low socioeconomic status who are in the precontemplation or contemplation stages would be considered at higher risk of FOF and falls. A third possibility is that economically disadvantaged women who do not participate in any, or very low levels of PA during leisure or recreational time, who are at a higher risk of FOF and falls.

Limitations

The study limitations were in the use of the research design, and are recognized and reported accordingly. First, the use of a cross-sectional descriptive design is effective in terms of research time and cost, however, it cannot be used to interpret cause and effect, or behaviour over time. Second, the majority of the participants were women, limiting generalizability about the study results to men. As well, women in this sample may not have been representative the majority of late midlife women on Prince Edward Island, particularly women with lower socioeconomic status, since the study sample was reflective of women who were more highly educated than average. Third, the GPAQ, though considered valid and reliable by the WHO, is a self-report questionnaire, thus could be subject to individual bias and subjective interpretations. However, the GPAQ is similar to other PA questionnaires with good reliability but relatively low validity scores. Fourth, the PASCM is reported to have fair reliability and, though reported to have significant validity, values for validity scores have not been reported. This measure has been used by many organizations, including the American College of Sports Medicine's global health initiative, *Exercise is Medicine* (2017). The Canadian Society for Exercise Physiology supports this initiative with *Canada* (2017). Fifth, a limitation of the TTM is the focus on the 6-

month timelines for movement from precontemplation to contemplation, and from contemplation to the planning stage. Further study is required to determine timelines specific to populations that spend more time in precontemplation and contemplation. The final limitation in the study was the potential for over- or under-estimation due to the self-report style of data collection. The GPAQ is known to result in PA overestimation. In this research study, in keeping with the recommendations of the GPAQ Guidelines (Chu et al., 2015), overestimation has been partially mitigated through the use of categorization of PA volume into three groups based on low, medium, and high PA volumes.

Study Implications

The FOF prediction model results have implications for nursing practice, theory, education, and policy. Each of these implications will be discussed.

Practice

Globally, an understanding of the importance of falls prevention has been increasing (WHO, 2015b). Physical activity may be useful for prevention of FOF in ageing adults at different stages of the life course, and in different settings. Nurses are ideally suited to promote PA in all healthcare settings. Nurses have many opportunities to promote falls prevention interventions and programs in home care, primary care, community, and institutional settings. Nurses using PA interventions to decrease FOF, and subsequent falls or injuries related to falls, may find that asking about their clients' SOC, PA, and recreational PA may give them insight into potential FOF in their clients. Either the short or long form of the FES-I could be used to measure FOF in a client, which would then be followed by discussion of PA, including PA type, intensity, and duration.

Nurses involved in health promotion in all settings can support clients and communities

to prevent FOF and falls through increasing PA, by using TTM based strategies and interventions, as well as other evidence informed practices that promote PA. A recent review of nurse-delivered PA interventions in primary care by Richards and Cai (2016) included studies of nurses and nurse practitioners successfully using counselling, individualized goal setting and monitoring, motivational support, and PA or exercise monitoring, including using devices and smart phone apps. Follow-up, exercise prescription, and provisions of booklets and other educational materials were also found to improve outcomes in these nurse-led interventions. The majority of studies in this review included adults in midlife, with some studies focusing on late midlife, indicating that this age group benefits from nurse-led interventions to increase PA.

Primary care nurses in clinics and occupational health nurses in workplaces could use behaviour change counselling skills, including motivational interviewing, with those in precontemplation or contemplation stages. Assessment for referral for more specialized counselling may also be appropriate (Murphy, Mash, & Malan, 2016; Noordman, de Vet, van der Weijden, & van Dulmen, 2013).

Correlates of falls and PA are complex, therefore, nurses planning falls prevention and PA behaviour change promotion interventions should also consider social determinants of health (SDH) in assessment, planning, delivery, and evaluation of interventions. Specific SDH that should be considered are age, gender, socioeconomic status, as well as access to, and motivation for, recreational PA.

Theory

Interventions based on behaviour change models, including the TTM, have been used to promote PA in many different populations, such as socially disadvantaged groups, especially those with physical and intellectual disabilities, hearing impairment, different levels of frailty,

and NCDs, such as diabetes (Bawadi, Banks, Ammari, Tayyem, & Jebreen, 2012; Bull et al., 2014; Korologou, Barkoukis, Lazuras, & Tsorbatzoudis, 2015). The prevalence of physical disabilities in midlife, associated with both physical inactivity and NCDs, are rising worldwide. This is particularly concerning for women. Environmental and personal resources affect disability; therefore, women with lower socioeconomic status are affected to a greater degree. However, disability associated with frailty often fluctuates, and opportunities for decreasing disability through increased PA in midlife are possible.

This study supports the usefulness of the TTM in assessing and promoting the health and safety of individual clients and groups in the community, as well as in the conduct of population level research. The TTM can also be used in evaluating interventions to prevent FOF and falls. The TTM can be used in community settings to plan which groups of clients are ready for behaviour change, to develop interventions for clients that are ready, to help clients identify their personal facilitators and barriers to PA, and to offer stage-based cognitive and behaviour processes that support behaviour change.

Although the TTM was utilized effectively for the purpose of this study, it would be of interest to explore the potential of combining the TTM with the concepts of frailty and FOF to develop a more robust model in the field of ageing.

Education

This study aims to contribute to the education of older adults, nurses, nurse educators, and nursing students working in health promotion in the community, including those at the University of Prince Edward Island. For older adults, educational approaches could include written and oral narratives of the research findings. The Women's Institute, other women's networks, and seniors' groups would benefit from the study's findings. The Seniors College at

the University of Prince Edward Island, and other universities, is another possible venue for dissemination of the findings. The Seniors' College has had presentations about falls prevention and healthy ageing in the lead-up to this research project.

The research findings will be presented through a Nursing Research to Practice Day, which is a collaborative conference sponsored by the University of Prince Edward Island, and Health PEI, the health authority for the province of Prince Edward Island. Additionally, the findings will be disseminated through publication in research journals.

Nursing students, including those in third and fourth year courses, which focus on health promotion in the community, could incorporate the study findings in health promotion activities and projects. Nurses and nursing students can learn more about physical activity, exercise, and exercise prescription and its application in NCDs, through massive open online courses (MOOCs). These online courses are free to anyone with internet access, and are available for learning more general knowledge about PA, and PA for specific conditions, including musculoskeletal injuries and NCDs (MOOC List, 2016, Physiopedia, 2016). Examples of course titles include: (a) *Sit Less, Get Active*; (b) *The Musculoskeletal System: The Science of Staying Active into Old Age*; and (c) *Exercise Prescription for the Prevention and Treatment of Disease*. Online courses are also available for falls prevention, for example, *The Canadian Falls Prevention Curriculum* (University of Victoria, 2017).

This research study contributes to the self-directed and nursing and healthcare professional-supported education of all older adults, including those in the stage of late midlife, regarding the use PA and SOC in FOF and falls prevention. As well, nurses in practice and education and nursing students at the undergraduate and graduate levels could benefit from learning about these topics in relation to health promotion in the midlife and later life adult

populations.

Knowledge about FOF and its relationship with falls could help practicing nurses, faculty, and student nurses, as well as other healthcare practitioners to prevent falls, especially for people ageing with disability, frailty, and NCDs. This study supports emphasis on preparation of current and future healthcare professionals for the demographic changes happening worldwide. A need exists for increased emphasis on PA promotion across the life course; nurses and nursing students are well positioned to take a more proactive role in this area, including around falls and frailty prevention.

Policy

Nurses can use their knowledge of population health to advocate for their client populations with municipal, provincial, and federal governments, as well as hospital or health region administrations. In Prince Edward Island, the Department of Health and Wellness, as well as the Chief Public Health Office, lead health promotion policy. The Department of Family and Human Services, particularly the Seniors Secretariat and the Senior Policy Advisor, develop and support policies regarding falls prevention. Nongovernmental organizations, such as Recreation PEI, and intersectoral organizations, such as Go!PEI, conduct physical activity promotion programs for midlife and later life adults.

Nurses can influence health promotion and falls prevention policies to ensure they provide resources for affordable, acceptable, and geographically accessible physical activity programs for urban and rural communities, especially those with inactive older women that have lower socioeconomic status. Nurses in acute care and long-term institutional contexts can also influence policy to promote PA for falls prevention for older adults, especially women that are frail, that restrict their activity due to FOF, and that have lower socioeconomic status.

Recommendations for Future Research

Several approaches could continue the area of research begun with this examination of FOF, PA volume, and SOC. To my knowledge, this study is the first to use the recreation PA group to compare measures of fear of falling. Future research in the area of FOF, PA volume, and SOC in late midlife is recommended and a number of ideas for potential studies are presented.

First, repetition of this study in another geographical area may yield interesting results, based on potential participant characteristics. Second, other measures including history of falls, questions about NCDs, disability, use of assistive devices, recreation PA group, caregiving responsibilities, urban versus rural contexts, social supports, or frailty measures could be included in the online or paper survey. Third, perhaps the future use of a mixed method research design in which one could use a qualitative interview process guide, rather than questionnaire method for self-report, may capture a different understanding of the nature of fear of falling. Fourth, a qualitative study focused on how people with NCDs, disability, or frailty in late midlife manage fear of falling could contribute valuable information for self-management of these conditions. Fifth, a qualitative study could be conducted with women who face health inequities and socioeconomic challenges, to determine the impact of these unique contextual variables on PA, SOC, and FOF. Following this, it would be important to collaborate with these women to plan interventions that meet their needs and the context in which they live. Lastly, a randomized controlled trial could test one or two PA interventions and compare them with a control group. These interventions could consist of a strength and balance training intervention, for example the *Otago Home-based Balance and Strength Retraining Program* (Liu-Ambrose et al., 2008), compared with a community-based PA intervention that focuses on lifestyle change. Objective

measures, including physiological measures and accelerometry, as well as self-report measures, such as the FES-I, GPAQ and the PASCM, could be compared between all three groups.

This study may provide inspiration for further development of the area of early falls prevention in the stage of late midlife, particularly using knowledge of physical activity as a strategy to decrease frailty and improve strength, balance, endurance, and flexibility. A variety of qualitative and quantitative approaches are recommended to advance research knowledge in this area.

Summary

In this study I focused on the association of demographic characteristics, PA, and SOC with FOF. The main findings of the three FOF prediction models led to the conclusion that being a woman, having low income, and being in an early SOC such as precontemplation or contemplation increase the risk of FOF. Moreover, having moderate to vigorous recreational PA, particularly in amounts that reach PA guidelines, decrease the risk of FOF. These findings could assist nurses and healthcare professionals in PA and falls prevention practice, theory, education, and research.

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APPENDIX A

Sample Size Calculation for Adults in Late Midlife Prince Edward Island

Table 1

Prince Edward Island (PEI) Population by Age and Gender, July 1, 2015

Age	Men	Women	Total
50 – 54	5,873	5,973	11,846
55 – 59	5,401	5,854	11,255
60 – 64	4,941	5,265	10,206
65 – 69	4,794	4,970	9,764
	21,009	22,062	43,071

Total population of Prince Edward Island, July 1, 2015 146,447

Source: (Prince Edward Island Statistics Bureau, 2015)

According to the Canadian Radio-television and Telecommunications Commission (CRTC), Internet broadband availability in PEI was 77% (CRTC, 2015).
43,071 X .77 = 33164
Therefore, 33,164 will be the total starting population of adults in late midlife (aged 50 – 70) with broadband availability that we will consider for sample size calculations.

Table 2

Sample Size Webulator Calculation for PEI

Initial pop.	Expected (pop.) proportion	Z_{alpha} for % confidence	Percent error
33164	25	1.96	.05

Sample Size

286

For sample size webulator, see http://health.ahs.upei.ca/webulators/SSprop.php

APPENDIX B

Data Collection Tools

APPENDIX B1. Short Falls Efficacy Scale – International, (Short FES – I)

Below are some questions about how concerned you are about the possibility of falling. Please reply thinking about how you usually do the activity. If you currently don't do the activity (for example, if someone does your shopping for you), please answer to show whether you think you would be concerned about falling IF you did the activity. For each of the following activities, please check the box which is closest to your own opinion to show how concerned you are that you might fall if you did this activity.

		Not at all concerned 1	**Somewhat concerned 2**	**Fairly concerned 3**	**Very concerned 4**
1	Getting dressed or undressed	1 _	2 _	3 _	4 _
2	Taking a bath or shower	1 _	2 _	3 _	4 _
3	Getting in or out of a chair	1 _	2 _	3 _	4 _
4	Going up or down stairs	1 _	2 _	3 _	4 _
5	Reaching for something above your head or on the ground	1 _	2 _	3 _	4 _
6	Walking up or down a slope	1 _	2 _	3 _	4 _
7	Going out to a social event (for example, religious service, family gathering, or club meeting)	1 _	2 _	3 _	4 _
	Total scores =	Add all 1's	Add all 2's	Add all 3's	Add all 4's

Total of all scores _____ Scoring: Low 7-8, Moderate 9-13, High 14-28
Permission for use from Kempen (2008). See Appendix B2.

APPENDIX B2

Permission for Use of Short Form of Falls Efficacy Scale – International (Short FES – I)

Kempen Ruud (HSR) <g.kempen@maastrichtuniversity.nl> Aug 11

Dear Valerie,

As the Short FES-I is publishes in the public domain (in the paper in Age and Ageing) it is free for use.

Please refer each time to the original paper when you refer to the Short FES-I.

Thanks for your interest.

Best wishes,

Ruud Kempen.

G.I.J.M. (Ruud) Kempen, PhD
Professor of Social Gerontology
Department of Health Services Research

- *Focusing on Chronic Care and Ageing* -

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The department of Health Services Research is part of the School for Public Health and Primary Care (CAPHRI) of the Faculty of Health, Medicine and Life Sciences.

@OuderenzorgZLim

APPENDIX B3

Global Physical Activity Questionnaire (GPAQ)

Table 1 **Physical Activity**	
I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. In answering the following questions 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.	
Question	**Response**
Work	
1. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?	Yes 1__ No 2__ If No, go to question 4
2. In a typical week, on how many days do you do vigorous intensity activities as part of your work?	Number of days __
3. How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours__ Minutes__
4. Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously?	Yes 1__ No 2__ If No, go to question 7
5. In a typical week, on how many days do you do moderate intensity activities as part of your work?	Number of days __
6. How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours__ Minutes__
Travel to and from places	
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship.	
7. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	Yes 1__ No 2__ If No, go to question 10

8. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days __
Table 1 (Continued). **Physical Activity**	
Question	**Response**
9. How much time do you spend walking or bicycling for travel on a typical day?	Hours__ Minutes__
Recreational Activities	
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure	
10. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously?	Yes 1__ No 2__ If No, go to question 13
11. In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (leisure) activities?	Number of days __
12. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours__ Minutes__
13. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, volleyball] for at least 10 minutes continuously?	Yes 1__ No 2__ If No, go to question 16
14. In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (leisure) activities?	Number of days __
15. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?	Hours__ Minutes__
Sedentary Behaviour	
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, traveling in car, bus, train, reading, playing cards or watching television, but do not include time spent sleeping.	
16. How much time do you usually spend sitting or reclining on a typical day?	Hours__ Minutes__

APPENDIX B4

Permission to Use Global Physical Activity Questionnaire (GPAQ)

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APPENDIX B5

Physical Activity Stages of Change Measure (PASCM)

Table E1

Physical Activity Stages of Change Scale (PASCM)
For each of the following questions, please circle Yes or No. Please be sure to read the questions carefully.

	No	Yes
I am currently physically active.	0	1
I intend to become more physically active in the next 6 months.	0	1

For activity to be regular, it must add up to a total of 30 minutes or more per day and be done at least 5 days per week. For example, you could take one 30-minute walk or take three 10-minute walks for a daily total of 30 minutes.

	No	Yes
I currently engage in regular PA	0	1
I have been regularly physically active for the past 6 months.	0	1

Scoring Algorithm:
If question 1 = 0 and question 2 = 0, then you are at stage 1.
If question 1 = 0 and question 2 = 1, then you are at stage 2.
If question 1 = 1 and question 3 = 0, then you are at stage 3.
If question 1 = 1 and question 3 = 1, and question 4 = 0, then you are at stage 4.
If question 1 = 1, question 3 = 1, and question 4 = 1, then you are at stage 5.

APPENDIX B6

Permission to Use Physical Activity Stages of Change Scale (PASCM)

Annie Spencer <aspencer@acsm.org>

HI Valerie,

ACSM grants permission to adapt the questions from the below table into an online survey. This permission is for a one-time usage only for the survey being conducted. This permission is contingent upon citing the source. Thanks!

APPENDIX C

Ethics Certificate

UPEI
UNIVERSITY of Prince Edward ISLAND
550 University Avenue
Charlottetown
Prince Edward Island
Canada C1A 4P3

To: Valerie Abd-El-Aziz
School of Nursing

Protocol Number: REB Ref # 6006788

Title: Fear of Falling, Physical Activity Volume, and Stage of Motivational Readiness to Change Physical Activity Behaviour in Late Midlife Adults

Date Approved: August 1 2016
End Date: July 31 2017

This research proposal has been reviewed and approved by the UPEI Research Ethics Board. Please be advised that the Research Ethics Board currently operates according to the Tri-Council Policy Statement 2: Ethical Conduct for Research Involving Humans (2014) and applicable laws and regulations.

It is your responsibility to ensure that the Ethics Renewal form is forwarded to Research Services prior to the renewal date. The information provided in this form must be current to the time of submission and submitted to Research Services not less than 30 days prior to the anniversary of your approval date. The Ethics Renewal form can be downloaded from the Research Services website (http://www.upei.ca/research/forms).

Any proposed changes to the study must also be submitted on the same form to the UPEI Research Ethics Board for approval.

The Research Ethics Board advises that **IF YOU DO NOT** return the completed Ethics Renewal form prior to the date of renewal:

- Your ethics approval will lapse
- You will be required to stop research activity immediately
- You will not be permitted to restart the study until you reapply for and receive approval to undertake the study again.

Lapse in ethics approval may result in interruption or termination of funding.

Notwithstanding the approval of the REB, the primary responsibility for the ethical conduct of the investigation remains with you.

Sincerely,

James E. Moran, Ph.D.
Chair, UPEI Research Ethics Board

APPENDIX D

Letter of Information and Consent

Appendix D1. Letter of Information and Consent, Online Version

Falls Prevention Research Study: Fear of Falling, Physical Activity Volume and Stage of Motivational Readiness to Change Physical Activity Behaviour in Late Midlife Adults

Master of Nursing Candidate
Valerie Abd-El-Aziz
School of Nursing, UPEI
vabdelaziz@upei.ca

Thesis Supervisor
Gloria McInnis-Perry
School of Nursing, UPEI
gjmcinnis@upei.ca

Purpose of the Survey

We are planning to conduct a survey for adults living on Prince Edward Island aged 50 to 70. The goal of the study is to find out more about PA, interest in increasing PA, and fear of falling in this age group. This will guide nursing care of older adults.

What will you be asked to do?

If you decide to take part, you are asked to complete this online survey. The survey is completely voluntary. You may skip any question that you do not wish to answer and you may exit the survey at any time without penalty. If you do not wish to continue, your survey information will be destroyed, and your information will not be included in the data analysis or report. You may print any part of this survey, including this information page and the consent form below.

Who will have access to your information?

We will not see your name or contact information. We will not give your name or contact information to any outside parties. Only the researchers will have access to the survey questions and answers. We will not attach any of your survey answers to your name. Your answers will be coded and put in a secure computer program. Your answers will not be made public, except as grouped data without your name. The results of this survey will be presented at conferences. The results will also be submitted to academic and professional journals.

What are the risks?

Some of the questions may seem personal and you may be uncomfortable sharing this information with us. If you are concerned about any of the information we have asked you about, contact your doctor or nurse practitioner.

What are the benefits?

You will be helping the researchers learn more about falls prevention, and help nursing care in adults aged 50 to 70.

How can I ask questions?

This survey has been reviewed by the Ethics Review Board of the University of Prince Edward Island as part of our research study. You may contact the Research Ethics Board at (902) 620-5104 or by email at reb@upei.ca if you have any concerns.

To ask questions about the research or to discuss your participation in the research, you may contact my supervisor or me. If you wish personal results of your survey, you may contact me:

Valerie Abd-El-Aziz
Master of Nursing Candidate
School of Nursing, UPEI
219 Health Sciences Bldg.
(902) 620-5206
vabdelaziz@upei.ca

Gloria McInnis-Perry
Assistant Professor
School of Nursing, UPEI
220 Health Sciences Bldg.
(902) 628-4301
gjmcinnis@upei.ca

If you decide to take part in this study, please read carefully, then click on the consent form below. This form is necessary to enter the survey.

Consent Form

I have read and understood the information provided above for the Falls Prevention Research Study (Fear of Falling, Physical Activity Volume and Stage of Motivational Readiness to Change Physical Activity Behaviour in Late Midlife Adults). I consent to be part of this study. I have been provided a contact number of the researcher. I have been invited to ask questions about the study or my participation in the study.

I understand that I can print any part of this survey for my records, including the information sheet and this consent form. I understand that I may withdraw from the study at any time. I understand that I may refuse to answer any question. I understand that if I decide not to be part of the study, my survey information will be destroyed.

I understand that my answers will not be published, except as part of a summary of all the survey findings. I understand that a written summary of the findings will be available through reports presented at conferences. The reports will also be submitted to academic and professional journals. I understand that I may contact the researcher to request personal results of my survey.

I understand that the information will be kept confidential within the limits of the law. All information will be stored on a USB stick with a secured password. Only the researcher and the

research team will be able to use this information. After 5 years, the information will be destroyed.

I understand that my consent does not take away my legal rights in the case of negligence or other legal fault of anyone who is involved in this study. I understand that I may contact the Research Ethics Board at (902) 620-5104, or by email at reb@upei.ca if I have any concerns about the ethical conduct of this study.

If you agree with the above statements, and consent to be part of this research, click below.

Click here to begin

APPENDIX D2: Letter of Information and Consent, Paper Version

Falls Prevention Research Study: Fear of Falling, Physical Activity Volume and Stage of Motivational Readiness to Change Physical Activity Behaviour in Late Midlife Adults

Master of Nursing Candidate
Valerie Abd-El-Aziz
School of Nursing, UPEI
vabdelaziz@upei.ca

Thesis Supervisor
Gloria McInnis-Perry
School of Nursing, UPEI
gjmcinnis@upei.ca

Purpose of the Survey

We are planning to conduct a survey for adults living on Prince Edward Island aged 50 to 70. The goal of the study is to find out more about physical activity levels, interest in increasing PA, and fear of falling in this age group. This will guide nursing care of older adults.

Who is doing the research?

Valerie Abd-El-Aziz, graduate student at the UPEI School of Nursing, is leading this study.

What will you be asked to do?

If you decide to take part, you are asked to complete this survey. The survey is completely voluntary. You may skip any question that you do not wish to answer. You may stop doing the survey at any time without penalty. If you do not wish to continue, your survey information will be destroyed, and your information will not be included in the data analysis or report. You may ask the researcher for a copy of any part of this survey, including this information page and the consent form below. The survey will take about ten to twenty minutes to finish.

Who will have access to your information?

We will not see your name or contact information. We will not give your name or contact information to any outside parties. Only the researchers will have access to the survey questions and answers. We will not attach any of your survey answers to your name. Your answers will be coded and put in a secure computer program. Your answers will not be made public, except as grouped data without your name. The results of this survey will be presented at conferences. The results will also be submitted to academic and professional journals. The student will also do public presentations on Prince Edward Island about this study.

What are the risks?

Some of the questions may seem personal and you may be uncomfortable sharing this

information with us. If you are concerned about any of the information we have asked you about, contact your doctor or nurse practitioner.

What are the benefits?

You will be helping the researchers learn more about falls prevention, and help nursing care in adults aged 50 to 70.

How can I ask questions?

This survey has been reviewed by the Ethics Review Board of the University of Prince Edward Island as part of our research study. You may contact the Research Ethics Board at (902) 620-5104 or by email at reb@upei.ca if you have any concerns.

To ask questions about the research or to discuss your participation in the research, you may contact my supervisor or me. If you wish personal results of your survey, you may contact me:

Valerie Abd-El-Aziz
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Gloria McInnis-Perry
Assistant Professor, Supervisor
School of Nursing, UPEI
220 Health Sciences Bldg
(902) 628-4301
gjmcinnis@upei.ca

If you decide to take part in this study, please read carefully, then sign the consent form below. This form is necessary to enter the survey.

Consent Form

I have read and understood the information provided above for the Falls Prevention Research Study (Fear of Falling, Physical Activity Volume and Stage of Motivational Readiness to Change Physical Activity Behaviour in Late Midlife Adults). I consent to be part of this study. I have been provided a contact number of the researcher. I have been invited to ask questions about the study or my participation in the study.

I understand that I may request a copy of any part of this survey for my records, including the information sheet and this consent form. I understand that I may withdraw from the study at any time. I understand that I may refuse to answer any question. I understand that if I decide not to be part of the study, my survey information will be destroyed.

I understand that my answers will not be published, except as part of a summary of all the survey findings. I understand that a written summary of the findings will be available through reports presented at conferences. The reports will also be submitted to academic and professional

journals. I understand that I may contact the researcher to request personal results of my survey.

I understand that the information will be kept confidential within the limits of the law. All information will be stored on a USB stick with a secured password. Only the researcher and the research team will be able to use this information. After 5 years, the information will be destroyed.

I understand that my consent does not take away my legal rights in the case of negligence or other legal fault of anyone who is involved in this study. I understand that I may contact the Research Ethics Board at (902) 620-5104, or by email at reb@upei.ca if I have any concerns about the ethical conduct of this study.

If you agree with the above statements, and consent to be part of this research, sign below.

_____ _____

Signature Date