

**ASSOCIATION AND MEDIATORS OF LEISURE TIME PHYSICAL ACTIVITY  
AND MENTAL HEALTH AMONG PEOPLE WITH SPINAL CORD INJURY.**

By

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A thesis submitted to the

School of Graduate Studies

in partial fulfillment of the requirements for the degree of

**Masters of Kinesiology**

School of Human Kinetics and Recreation

Memorial University of Newfoundland

July 2017

St. John's

Newfoundland

### **Abstract**

This cross-sectional survey based study examined the association and mediators of leisure time physical activity (LTPA) and mental health among people with the spinal cord injury (SCI) in Canada. Self-esteem, coping self-efficacy, social support and perceived barriers to LTPA were measured as the potential mediators. Participants (N = 37) Canadians with the SCI completed the self-administered survey. Data were analyzed using correlation analysis and bootstrapping for multiple mediation. Data from the present study did not demonstrate any association between LTPA and mental health among people with SCI. None of the potential mediators demonstrated the significant mediation, but it was found that coping self-efficacy and perceived barriers to LTPA significantly predicted anxiety and depression respectively. The present study addressed the need of future research in the field of LTPA and mental health in SCI.

*Keywords:* Spinal cord injury, LTPA, depression, anxiety, mediation, self-esteem, coping self-efficacy, social support and perceived barriers to LTPA.

### **Acknowledgement**

I would like to appreciate and acknowledge all, who have contributed in their best possible manner towards the successful completion of my dissertation. First and foremost, I would thank Lord almighty, dear lord, you were right next to me in this entire journey. You gave me courage, wisdom and strength through out this time.

I owe a deep and profound sense of gratitude and indebtedness to my thesis supervisors, Dr. Linda Rohr and Dr. Angela Loucks-Atkinson in School of Human Kinetics and Recreation, Memorial University of Newfoundland and Labrador. Their office doors were always open for me to answer my questions and help me in the best possible ways. Their help was so substantial that I didn't realize when my dissertation became our dissertation. Special thanks to Dr. Angela Loucks-Atkinson for being an elder sister rather than a supervisor. Matthew Sir (Dr. Angela's husband) your help to simplify the Greek statistics was great. Hey Luke and Jackson (Dr. Angela's kids), though I never met you, but your funny incidences were stress buster for me and made me laugh a lot. Also, I would like to recognize efforts by Brandon (Dr. Linda's son) to carry the survey packages to Nova Scotia paraplegic association.

I would like to thank all the SCI organizations in Canada, who helped me to reach to potential participants. I am most thankful to all the participants who completed the survey, without them this study would have never been possible. Moving further, I would like to attest the efforts of my family and friends in India. Thank you, mom for your patience to listen everything about my research, despite the fact that you had no idea what I am talking about. A big thanks to you dad, for putting your faith in me, which made you believe, that I could come so far and make you proud. Next I would express my gratitude

to my friend, Pooja Chhabra for her long distance calls to encourage me and keep me motivated. Thank you for patiently listening to me when was stressed and telling me that I can do it. Last but not the least I would like to thank all people whom I could not mention above for their efforts to make my dissertation a success.

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## **Chapter 1: Introduction**

### **1.1 Background of the Study**

The spinal cord is a bundle of nerve fibers, connected to the brain, that travel in the spinal canal formed by the vertebrae of the spinal column. Along with the brain, the spinal cord constitutes the central nervous system. The function of the spinal cord is to transmit impulses both to and from the brain (Snell, 2010). Disruption in impulse transmission due to spinal cord damage results in loss of sensory, motor and autonomic functions below the level of the lesion. Insult to the spinal cord resulting in a temporary or permanent loss of function is termed spinal cord injury (SCI).

As per the etiology, SCI can be classified as traumatic and non-traumatic. When damage to the spinal cord occurs due to an external force, for instance a motor vehicle accident, a fall from height, or violence, it is called a traumatic SCI. When similar damage to the spinal cord takes place due to infection, space occupying lesion or any other disease other than physical damage, it is termed non-traumatic SCI. Regardless of classification, after the SCI the functional outcomes for an individual depend on the level and completeness of injury. The level of injury is determined using the American Spinal Injury Association (ASIA) impairment scale and is defined as the most caudal segment of the spinal cord with normal sensory and motor function on both sides of body. Based on the level of injury the consequence of the SCI is classified as tetraplegia (loss of functions in all four extremities including trunk due to damage to the cervical region of spinal cord) and paraplegia (loss of function in legs with spared arm function, trunk may or may not be involved; Kirshblum et al., 2011). Completeness of injury depends on preservation of

sensory and/or motor function below the neurological level of injury (NLI). Preservation of function below NLI is considered an incomplete injury; whereas no function below NLI is considered a complete injury (Waters, Adkins & Yakura, 1991).

The spinal cord is the major conduit to transfer information between the brain and the body and its damage brings changes to the affected individual in all life spheres (physical, social, psychological; North, 1999). Such widespread changes in life have predisposed people with spinal cord injury to mental health issues. Researchers have studied a wide range of variables under the umbrella term of mental health among people with the SCI including post-traumatic stress disorder (e.g., Migliorini, Tonge & Taleporos, 2008), depression (e.g., Craig, Tran & Middleton, 2009; Elliott & Frank, 1996; Judd, Burrows & Brown, 1986; Kennedy & Rogers, 2000), anxiety (e.g., Harper Coleman, Olivera, Perdomo & Arango, 2014; Kennedy & Rogers, 2000), self-esteem (e.g., Harper et al., 2014), subjective well-being (e.g., Martin Ginis, Jetha, Mack & Hetz, 2010; Martin Ginis et al., 2003), quality of life (e.g., Coleman et al., 2015; Kennedy, Lude & Taylor, 2006; Stevens, Caputo, Fuller & Morgan, 2008), and global life satisfaction (e.g., Coleman et al., 2015; Harper et al., 2014). Amongst the above-mentioned constructs of mental health, depression and anxiety are widely studied and are considered most relevant. Depression in the SCI is associated with poor subjective health, lower life satisfaction and difficulty with activities of daily living (ADLs; Bombardier, Richards, Krause, Tulskey & Tate, 2004). Rates of depression and anxiety are higher in individuals with the SCI compared to the general population (Craig, Hancock & Dickson, 1994; Hancock, Craig, Dickson, Chang, & Martin, 1993; Harper et al., 2014; Post & van Leeuwen, 2012) and both have a large

financial burden (Harper et al., 2014; O'Connor, Raglin & Martinsen, 2000; O'Neal, Dunn & Martinsen, 2000).

Despite vulnerability to mental health issues, adequate interventions are not available for the SCI population. Three possible reasons may account for this lack of interventions. First, is the poor life expectancy for people with the SCI by health professionals. Prior to the 1940s only 10 – 20% of people with the SCI survived for 2 – 3 years, eventually dying with sepsis from urinary tract infections or pressure sores (Guttmann, 1976). Second, there is a prevalent belief that health care is focused on primary disability prevention rather than reducing secondary health conditions (Brandon, 1985; Brooks, 1984; Patrick, 1997). Third, there is a lack of extensive knowledge about psychological effects (Orbaan, 1986) of the SCI and the belief that anxiety and depression are inevitable following SCI.

Sedentary lifestyles and unstructured free time have further contributed towards mental health issues among people with the SCI. People with the SCI are the most inactive segment of society due to mobility loss (Dearwater, LaPorte, Cauley & Brenes 1985). Adults with the SCI spend three times more time watching TV compared to those without disabilities (Yerxa & Locker 1990). Sedentary behavior in the SCI increases the risk of chronic diseases such as cardiovascular disease, type II diabetes, osteoporosis and obesity (Kocina, 1997). Lack of activity is associated with depression (Coyle & Kinney 1990) and social isolation (Levi, Hulting & Seiger, 1996) in the SCI population. Considering physical inactivity and loss of mobility as the cause for all secondary complications, Rimmer (1999) recommended physical activity for people with the SCI. Physical activity has demonstrated benefits for physical health and psychological well-being in the general as well as clinical

populations (Dimeo, Bauer, Varahram, Proest, & Halter, 2001; Kritz-Silverstein, Barrett-Connor, & Corbeau, 2001; Martinsen, Hoffart & Solberg, 1989; Stephens, 1988; Tawashy, Eng, Lin, Tang & Hung, 2009).

Physical activity (PA) is defined as any type of bodily movement produced by skeletal muscles that result in energy expenditure (Caspersen, Powell & Christenson, 1985). This broad term is further categorized as energy expenditure during 1) sleep, 2) at work, and 3) at leisure. This categorization is based on calorie expenditure with different categories having distinct health effects. Only a few researchers have attempted to show the differential effect of physical activities on mental health. Stephens (1988) examined the association of physical activities and various aspects of mental health in the general population of United States and Canada. In this study, women with energy expenditure from recreation activities only were found to have higher positive affect than from women involved in both recreational and house-hold activities. Stephens postulated that recreational activities provide more diversion from stress than household activities. It was also found that sports participation was the only type of PA that positively impacted mental health amongst housework, biking to/from work, walking to/from work, and sports in able bodied population (Asztalos et al., 2009). It was stated that activities not chosen by individuals for enjoyment and recreation do not reduce stress. Supported by Asztalos et al. (2009) and Stephens (1988) along with the recommendation of Rimmer (1999), it can be said that physically active leisure can be useful to deal with mental health issues among people with the SCI.

Leisure time physical activities (LTPA) is not a well-explored research area among people with the SCI. Often, leisure activities are confused with routine activities other than

paid work. Moreover, sports are the only type of LTPA that has been explored for the SCI population (i.e., Gioia, Cerasa, Di Lucente, Brunelli, Castellano & Trallesi, 2006; Kim, Mun, Jun, Kim, Sim, & Jeong, 2011; Muraki, Tsunawake, Hiramatsu & Yamasaki, 2000). There can be several other options of LTPA available for the SCI population such as wheeling, gardening, wheelchair dance, yoga therapies, but no study has considered these options. Thus, there is a need to study different types of LTPA adopted by people living with the SCI and their level of participation in LTPA.

The association between PA (leisure and exercises) and mental health is complicated. It is not clear whether active engagement during free time leads to good mental health or vice versa. It is also possible that mental health and LTPA are related to some third variable that guides the relationship (Stephens, 1988). LTPA and mental health are both predicted by the presence or absence of a number of other variables. These variables are referred to as facilitators, barriers or constraints of PA/LTPA and mental health in the literature. A number of factors such as handicap, fitness (e.g., Manns & Chad, 1999), coping strategies, self-efficacy (e.g., Arbour-Nicitopoulos, Martin Ginis, & Latimer, 2009; Post & van Leeuwen, 2012), optimism, purpose in life (e.g., van Leeuwen, Edelaar-Peeters, Peter, Stiggelbout & Post, 2015), employment (e.g., Coyle & Kinney, 1990), partner status, premorbid psychological status, years of education (e.g., Craig, 2015), community access, finances (e.g., Carpenter, Forwell, Jongbloed & Backman, 2007), personal factors (physically active identity, disrupted body and self-relationship, perceived absences; e.g., Williams, Smith & Papathomas 2014), and social skills and support (e.g., Muller, Peter, Cieza, & Geyh, 2011) were studied as determinants of mental health and/or PA in the SCI population. Researchers have explored these predictors for mental health as

well as for PA/LTPA, but the relationship has not been clarified. Thus, it is essential to identify the mediators of the association between mental health and LTPA.

## 1.2 Purpose Statement

The Rick Hansen Institute estimated the incidence of the SCI in Canada in 2010 as 4,259 and prevalence as 85,556 (Farry & Baxter, 2010). Using the same methodology and assumptions, a projection of future incidence and prevalence in 2030 was calculated. Both incidence and prevalence of the SCI are projected to increase over this period of time to 5800 and 121,000 respectively. Additionally, with improvement in the quality of health care and rehabilitation services, life expectancy of people with the SCI has increased from weeks to up to 38 years in Canada (McColl, Walker, Stirling, Wilkins, & Corey, 1997). Thus, there is an increase in the number of people living with the SCI in Canada and health promotion is needed for this population.

SCI is a devastating injury with a huge impact on the mental health of the affected individual. Studies (Fann Bombardier, Richards, Tate, Wilson, Temkin & PRISMS Investigators, 2011; Hoffman, Bombardier, Graves, Kalpakjian & Krause, 2011; Williams & Murray, 2015) suggest 18 – 37 % of the SCI population have depression and 30 % have clinically elevated levels of anxiety (Craig et al., 1994; Kennedy & Rogers, 2000). The experience of mental health issues with physical disability can reduce one’s social skills, ultimately deepening the depression (Wells, 1985). Thus, a number of interventions such as counseling and cognitive behavioural therapy have been undertaken (Dorstyn, Mathias & Denson, 2010; King & Kennedy, 1999). These interventions effectively deal with mental health issues among people with the SCI but, the quality of service varies depending upon the organization. As psychological services are not available in all hospitals and

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rehabilitation settings; they are considered less important for people with the SCI (Middleton, Perry & Craig, 2014; Milgrom, Walter & Green, 1994). This highlights the need of alternate interventions for mental health issues among people with the SCI.

Coyle and Kinney (1990) observed an association between depression and lack of active engagement during free time among individuals with the SCI. Later, Kewman and Tate (1998) recommended skill development for active management of free time; it was considered critical for those who are at risk of poor psychological adjustment after the SCI. Involvement in LTPA can be a good option for active engagement among the SCI population, as leisure activities are intrinsically motivating, encourage self-determination and have the ability to buffer the negative impact of injury and the resulting disability (Caldwell, 2005; Dattilo, Caldwell, Lee & Kleiber, 1998; Kleiber, Brock, Lee, Dattilo & Caldwell, 1995). LTPA is recommended to reduce secondary health complications (Buchholz, Martin Ginis, Bray, Craven, Hicks, Hayes & Wolfe, 2009), but its role in improving mental health has not been explored. To implement LTPA as an intervention to promote psychological well-being in the SCI population, it is necessary to explore this area more thoroughly. Thus, the purpose of this study is to explore the association between LTPA and mental health in the SCI population. The following research questions were addressed in this study: 1) What is the level of participation in LTPA among people with the SCI in Canada?; 2) What is the association of mental health (depression & anxiety) and LTPA among people with the SCI?; and 3) How do self-esteem, coping self-efficacy, social support and perceived barriers to LTPA, mediate the association of LTPA and mental health?

### **1.3 Significance of the Study**

Physical Activity is recommended for the general population as well as the clinical population to improve psychological well-being. PA has been reported to bring changes in mood, depressive symptoms, anxiety and stress. Specifically, LTPA has shown to be more effective in improving mental health among the general population (Asztalos et al., 2009; Stephens, 1988) as it gives individual controls over their existing life events and is intrinsically motivating. There is limited literature available on LTPA; some literature is available related to the general population and for people with disabilities but, to the best of my knowledge only a few studies have explored the effects of LTPA on health in the SCI population. Buchholz et al. (2009) explored the effect of LTPA on chronic health conditions in the SCI population. Other studies looked at the effect of sport participation on mental health in people with the SCI (i.e., Gioia et al., 2006; Kim et al., 2011; Muraki et al., 2000); but, sports activities do not cover all possible leisure activities available. Also, researchers have explored the predictors of LTPA and mental health individually but the multiple predictors of the association between LTPA and mental health is a single model are not known.

The present study explores the relationship between LTPA and mental health and the associated predictors of this relation among people with the SCI. An understanding of this relationship and its predictors will be helpful for organizations working with a mandate for the health promotion of people with the SCI or other mobility impairments. As LTPA may have a preventive role, an early introduction of LTPA during the rehabilitation phase may prevent the development of mental health issues. An important implication will be awareness of the predictors of this relationship so that the nature of this relationship is

understood and appropriate measures can be taken to prevent mental health and promote LTPA.

## **Chapter 2: Literature Review**

Leisure time physical activity (LTPA) is a relatively unexplored area of research among the Spinal Cord Injury (SCI) population, despite being a modifiable risk factor that may promote positive mental health. This literature review is focused on 1) prevalence and impact of mental health issues among the SCI population; 2) level of inactivity among individuals with the SCI, its consequences and methodological issues identified in the literature related to physical activity (PA) among people with the SCI; 3) importance of LTPA; possible mechanisms through which LTPA can improve mental health among the SCI population; and the nature of the association between LTPA and mental health and 4) possible mediators of the association between LTPA and mental health among people with the SCI.

### **2.1 Prevalence and Impact of Mental Health Issues among the SCI Population**

Mental health is a very broad term; it is not only about an individual's psychological well-being, but their balance of mental, emotional, physical and spiritual health (Mood Disorder Society of Canada, 2009). The World Health Organisation (WHO) has defined mental health as a state of well-being in which the individual realises his or her abilities, can cope with normal stresses of life, work productively and fruitfully, and can contribute towards community (WHO, 2014). Accordingly mental health is more than personal well-being; mental health is impacted by work, family, relationships, community, leisure and one's ability to cope with stressors.

WHO considers mental health disorders a priority because of the high prevalence, recurrence and significant complications such as substance abuse, suicidal attempts and violent behavior (Glied & Pine, 2002; WHO, 2003). A number of mental health disorders

have been discovered and diagnosed, but depression and anxiety are the most common. In Canada, 7.9% – 8.6% of Canadians suffer with depression once in their lifetime. Anxiety disorders are more common in Canada than any other mental illness. In any given year 9% of men and 16% of women between 15 – 64 years of age are affected by anxiety disorders (Mood Disorder Society of Canada, 2009). Estimates of the prevalence of mental health issues among people with the SCI are affected by the nature of the measures used (e.g. self-reported, diagnostic criteria), how the mental health problems are defined, ageing characteristics of the samples studied and timing of assessment of psychological symptoms (Elliott & Frank, 1996). Overall, the prevalence of depression and anxiety is higher among the SCI population than the general population (Dryden et al., 2005; Howell, Fullerton, Harvey, & Klein, 1981; Krause, Kemp, & Coker, 2000; Hancock et al., 1993; Williams & Murray, 2015). A review showed that rate of depression following SCI varies widely across studies, ranging from 7% to 31% of the study sample, with estimates of the major depressive disorder typically reported in 15%-23% of individuals with the SCI (Bombardier et al., 2004). Similarly, Le and Dorstyn (2016) reported that prevalence of anxiety varied from 15% to 32% in the sample population with the SCI.

Poor psychological health is associated with increased stays in the hospital/rehabilitation settings (Malec & Neimeyer, 1983), increased mortality and morbidity (Zimmerman et al., 1994), fewer functional improvements during rehabilitation, difficulty in performing ADLs (Hays, Wells, Sherbourne, Rogers, & Spritzer, 1995), higher occurrence of medical complications such as pressure sores, less functional independence and mobility at discharge, poorer self-appraised health, more days in bed and greater use of paid personal care (Dryden et al., 2005). Despite the prevalence of mental health issues,

the adverse impact of poor mental health, and a widely explored research area there is relatively less focus on treatment interventions for mental health issues after SCI (Fann et al., 2011). Consequently, less research is published about the interventions to reduce the occurrence of psychological distress and to promote positive mental health among people with the SCI (Elliott & Kennedy, 2004). As a result, even today there is less focus on the psychological interventions for people with the SCI, but the need for such interventions has been continuously highlighted in the literature (Pelletier, Rogers, & Thurer, 1985; Hancock et al., 1993; Hoffman et al., 2011).

### **2.1.1 Possible reasons for lack of available mental health interventions for the SCI population.**

#### ***2.1.1.1 Depression is a part of the psychological adjustment.***

One possible reason for the lack of interest in treatment interventions for mental health issues was the wide acceptance of the belief that depression is one of the normal reactions to the SCI. In early studies, 100% of patients were identified as having a deep depression (Wittkower, Gingras, Mergler, Wigdor, & Lepine, 1954). During the 19<sup>th</sup> century much of the work concerning psychological issues after the SCI was based on non-empirical studies that focused on the Stage Model of Adjustment (Elliott & Frank, 1996). Specifically, individuals who are adjusting to losses such as the SCI are expected to pass through several predetermined stages. These stages include 1) shock and denial, 2) depression, 3) anxiety, 4) anger, 5) bargaining and adaptation (Kubler-Ross, Wessler, & Avioli, 1972; Lindeman, 1944), with no strict sequence or duration for each stage (Morris, 1992; Wortman & Silver, 1989). Depression was considered a therapeutic prerequisite for optimal adjustment and absence of depression was indicative of an unhealthy denial of

injury acceptance (Nagler, 1950; Siller, 1969). Indeed, it was proposed that depression should be induced in non-depressed patients so that appropriate grieving can be initiated (Nemiah, 1957). Consequently, depression and anxiety were assumed to be an inevitable and normal reaction to the SCI. Thus, in the past there was less focus on treatment strategies for depression and anxiety following the SCI.

#### ***2.1.1.2 SCI is the only predictor of individual's behavior.***

A critical implication of the Stage Model of Adjustment is that the SCI is the only predictor of individual's behavior following the SCI; individual differences and post-injury situational differences were not considered, thus, reducing the perceived need for mental health promotion and interventions (Frank, Elliott, Corcoran, & Wonderlich, 1987). This implication is in contrast with Trieschmann's (1988) who conceptualises psychological adjustment following the SCI as an interaction of personal variables (personality style, preferred coping strategies), organic variables (medical) and environmental variables (family support, socioeconomic status). Supporting Trieschmann (1988), an individual who possesses an internal locus of control will adjust to the SCI more positively; and personality variables such as warmth and positive affect are important for adjusting to the SCI (Krause & Rohe, 1998; Frank & Elliott, 1989).

#### ***2.1.1.3 Depression is self-resolving.***

Another important feature of the Stage Model of Adjustment is decreases in psychological disruption over time. Another reason for previous lack of focus on mental health among people with the SCI was the assumption that psychological issues are temporary and that as the time since injury increases, depression and anxiety will be reduced (Mueller, 1962). Considering this implication of the Stage Model, most studies

were cross-sectional; longitudinal studies were not the focused. With further studies, it was found that the rate of anxiety and depression are highest immediately after injury and after discharge from the rehabilitation setting (Richards, 1986; Kennedy & Rogers, 2000).

Strong evidence against the self-resolving nature of mental health issues was gathered through longitudinal studies (Craig et al., 1994; Hoffman et al., 2011). It was suggested that lack of reduction in depression and anxiety could be related to daily frustrations associated with ongoing physical disabilities resulting from the SCI: “people with SCI wake up every morning to the injury, it does not go away” (Craig et al., 1994, p. 678). People with the SCI struggle every day to overcome structural barriers, financial and vocational limitations, and strains on family roles and relationships. Other longitudinal studies have explored the depression and anxiety over a period of 5 and 10 years (Hoffman et al., 2011; Pollard & Kennedy, 2007). Findings however still did not support the Stage Model of Adjustment; rates of depression and anxiety did not change significantly over these longer periods in the SCI population.

Considering the above discussion, it appears that the dominance of the Stage Model of Adjustment to the SCI created misconceptions regarding the nature of mental health issues among people with SCI; some misconceptions which are still prevalent. Such beliefs restricted research necessary to identify adequate treatment strategies to deal with mental health issues associated with the SCI (Elliott & Kennedy, 2004). The most prevalent beliefs were the disagreement regarding the prevalence of depression in the long term after the SCI, and that mental health issues were considered to be self-resolving. This may explain why only a few psychological interventions (antidepressant drugs and cognitive behavioural therapy) are available for mental health issues and are typically focused on the

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initial injury phase (Elliott & Kennedy, 2004; Fann et al., 2011). Special needs of the SCI population are not considered, as the guidelines for mental health treatment in the SCI are similar to that of the treatment guidelines for the general population (Consortium for Spinal Cord Medicine, 1998). Thus, it is important to consider interventions that can impact depression and anxiety levels, ultimately improving the mental health status of people living with the SCI in the community.

## **2.2 Level of Inactivity among People with the SCI, Consequences of Inactivity and Methodological Issues Identified in the Literature Related to Physical Activity**

### **2.2.1 Inactivity among people with SCI and its consequences.**

Sedentary lifestyles either imposed on or adopted by people with SCI have made them one of the most inactive groups in society (Dearwater et al., 1985). PA participation rates among people with the SCI are substantially lower compared to the able-bodied population (Buchholz, McGillivray, & Pencharz, 2003). It has been estimated that 50% of people with the SCI in Canada do not participate in any LTPA (Martin Ginis, Latimer, Arbour-Nicitopoulos, Buchholz, Bray, Craven, & Smith, 2010) compared to 38% of non-disabled Canadians (Craig & Cameron, 2004). Research among people with the SCI has reported an increase in inactivity levels over a period of 10 years, increasing from 76% to 84% from 2006 to 2016 (Latimer, Martin Ginis & Arbour-Nicitopoulos, 2006; Perrier & Martin Ginis, 2016). Inactivity has been associated with increased risk for secondary health problems, chronic diseases and physical deconditioning among people with the SCI (Noreau, Shephard, Simmard, Pare, & Pomerleau, 1993; Nash, 2005; Washburn & Figoni 1998). Physical inactivity is associated with mental health problems including depression and anxiety among people with the SCI (Anderson, Vogel, Chlan, Betz & McDonald 2007;

Whiteneck, Charlifue, Frankel, Fraser, Gardner, Gerhart, & Silver, 1992) and other disabilities including arthritis, heart disease, respiratory problems, spinal issues and Cerebral Palsy (Thierry, 1998; Turk, Geremski, Rosenbaum, & Weber 1997). Considering the potential negative health outcomes of a sedentary lifestyle among people with the SCI, PA is an important topic for research and intervention. Research in the field of the SCI and PA is not only needed to prevent the associated secondary complications, but also to overcome the methodological issues related to measurement of PA among people with SCI.

### **2.2.2 Overestimation of physical activity.**

Methodological issues identify an overestimation of PA participation among people with the SCI. Buchholz et al. (2003) reported that 56% of their sample was engaged in some sort of PA. Later, Carpenter, Forwell, Jongbloed, and Backman (2007) reported 75% of the sample population was physically active. Thus, these studies inaccurately reported the percentage of physically active individuals as higher among people with the SCI than the non-disabled population. This overestimation was due to the broad definition of how PA operationalized (any type of bodily movement produced by skeletal muscles which result in energy expenditure). Using this definition Carpenter et al. (2007) considered breathing exercises, relaxation exercise and one's personal routine as PA. In this study, 67% of the sample population was physically active because of participation in personal routine and breathing; and 49 % were considered physically active due to participation in relaxation exercises. Such findings give an inaccurate estimate of PA levels for individuals with the SCI.

### **2.2.3 Irrelevant comparison of interventions.**

The second methodological issue in the measurement of PA among the SCI population is the broad definition of PA used in the literature on psychological health. Researchers categorized a wide variety of interventions under the umbrella term of PA including functional electrical stimulation (FES), treadmill training, aerobic exercise, strength training, and supported standing activities. For example, Bradley (1994) studied the influence of FES on people with the SCI and Hick, Adams, Martin Ginis, Giangregorio, Latimer, Phillips, and McCartney (2005) focused on aerobic training and strength training exercises to improve subjective well-being. Both studies explored the influence of two technically distinct interventions (FES, aerobic exercise and strength training) on mental health dimensions. Martin Ginis, Jetha, Mack and Hetz (2010) conducted a meta-analysis using both the findings of Bradley (1994) and Hick et al. (2005) to see the influence of PA on subjective well-being. These two interventions are so distinct that it is not logical to categorize them under one heading of PA in a meta-analysis or empirical study. Lack of specificity of what is considered to be LTPA as discussed in Chapter 1 is also related to the methodological issue of conceptualizing PA in research. There has been lack of distinction in research between PA that is self-determined versus rehabilitative PA despite indications that PA which is enjoyable and leisure-like may have greater benefit to mental health (Asztalos et al., 2009; Rimmer, 1999; Stephens, 1988).

### **2.3 Importance of LTPA for People with the SCI**

LTPA is associated with many physical and psychological benefits for the SCI population. LTPA in the SCI population has been shown to reduce the risk of associated complications such as musculoskeletal, neuropathic pain, cardiovascular disease and type II diabetes (Buchholz et al., 2009; Norrbrink, Lindberg, Wahman, & Bjerkefors, 2012).

LTPA has been correlated with better body fat distribution (D'Oliveira et al., 2014), employment opportunities (Kim et al., 2011), optimization of ADLs performance such as ease to transfer and greater functional capacity and physical fitness among people with the SCI (Martin Ginis, Jorgensen, & Stapleton, 2012; Hetz, Latimer & Martin Ginis, 2009). In relation to psychological benefits of LTPA for the SCI, LTPA has been described as an important determinant of subjective and psychological well-being. For example, LTPA has impacted the self-esteem, self-confidence, psychological growth and a sense of purpose (Williams et al., 2014) and the overall quality of life of people with the SCI (Tomasone, Wesch, Martin Ginis, & Noreau, 2013). Also, in a study examining the perceived needs of the new SCI patients, it was identified that 23% of the new SCI patients expressed the need for LTPA (Cushman & Scherer, 2002). Such evidence clearly demonstrates the benefits of LTPA for people with the SCI.

### **2.3.1 Possible mechanisms through which LTPA can improve mental health in the SCI population.**

Psychological and physiological mechanisms have been suggested to explain the beneficial effects of PA/exercise on mental health. Postulated psychological mechanisms include: 1) Distraction Hypothesis (diversion from unpleasant somatic stimulus leads to improved affect; Morgan, 1985); 2) Self-efficacy Theory (successful completion of PA, where a challenging activity increases the self-confidence to deal with events that are challenging for one's mental health; Bodin & Martinsen, 2004; North, McCullagh, & Tran, 1990); 3) Mastery Hypothesis (mastery of physical skills brings sense of independence and success; Bodin & Martinsen, 2004); and 4) the Social Interaction Hypothesis (members of exercise group develop social relationships and provide support for each other; Ransford,

1981). Physiological mechanisms that explain the improvement in mental health due to physical activities/exercise are increased mono-aminergic synaptic transmission and activation of endorphin secretion (Morgan, 1985; Thoren, Floras, Hoffmann & Seals, 1990) that alters the mood state. Another explanation can be provided by the Thermo-genic Model (Yeung, 1996) which suggest that increased body temperature after PA /exercise is responsible for mood improvements.

LTPA is a category of PA, chosen by individuals to spend free time and for enjoyment (Bouchard & Shephard, 1994). Thus, all the mechanisms mentioned above to improve mental health are also applicable for LTPA, although there are few mechanisms specific to LTPA. These distinct mechanisms could be the reason for the higher positive association of LTPA with mental health. Orbaan (1986) stated individuals with the SCI develop fear and anxiety when they are not able to fulfil the demand of a PA. The phenomenon of exercise-induced depression has been not reported in the SCI population; however, Morgan, Costill, Flynn, Raglin and O’Conor (1988) reported exercise induced depression in athletes. This phenomenon can be explained by the theory of learned helplessness (Seligman, 1975). Considering the Theory of Learned Helplessness, it is possible that inability to achieve the goals set for exercises can lead to demotivation or depression among the SCI population, contrary to LTPA which encourage participation and provide enjoyment.

LTPA has many benefits over traditional exercise during the rehabilitation phase. Leisure activities provide an option-rich environment and encourage self-determined, autonomous behavior promoting intrinsic motivation and interest (Caldwell, 2005; Caltabiano, 1995). Leisure activities provide an opportunity to experience some level of

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control and choice. Freedom of choice in LTPA provides an experience of excitement, enjoyment and relaxation. Thus, leisure is said to be inherently meaningful and interesting. As leisure is meaningful, it promotes health by encouraging self-expression and social inclusion (Passmore, 2003). Due to intrinsic motivation and felt enjoyment, individuals push themselves to perform beyond their present ability and contribute to their functional development (Massimini, Csikszentmihalyi & Fave 1988). Considering the current perspective of post-traumatic growth few authors (Dattilo, & Caldwell, 1995; Dattilo et al. 1998; Kleiber et al., 1995) have specifically examined the relevance of leisure among people with the SCI. Results indicated that 1) leisure buffers the impact of negative life event (injury and disability) and provide continuity in life; thus, leisure is critically important to adjust to living with a disability; 2) leisure is a vehicle for personal transformation and life happiness; and 3) leisure develops social relationships – social interaction with people who have successfully accepted disability is critical for integration of individuals with the SCI into the community. Leisure generated social support has a stress reducing effect and is considered to be more meaningful (Coleman & Iso-Ahola, 1993).

### **2.3.2 Nature of association of LTPA and mental health.**

The relationship between LTPA and mental health has been explored with findings from both cross-sectional and longitudinal studies indicating a positive association between LTPA and mental health (Bernaards, Jans, Van den Heuvel, Hendriksen, Houtman, & Bongers, 2006; Galper, Trivedi, Barlow, Dunn, & Kampert 2006; Goodwin, 2003; Penedo & Dahn 2005; Schnohr, Kristensen, Prescott, & Scharling, 2005; Stephens, Jacobs & White, 1985; Strohle, 2009; Wang, Orpana, Morrison, Groh, Dai & Luo, 2012). The

relationship between LTPA and mental health is more complex than that between PA and physical health got several reasons. First, LTPA and mental health relationships vary considerably across activity domains and individual characteristics (Asztalos et al., 2009; Stephens et al., 1985). The association between LTPA and mental health does not apply equally to all the populations, as less active populations benefit more from engaging in LTPA (Stephens et al., 1985). All types of PA do not have psychological benefits, whereas LTPA has psychological benefits (Asztalos et al., 2009; Lahti, Lallukka, Lahelma & Rahkonen, 2013; Stephens, 1988). Second, the relationship between LTPA and mental health is complex as it varies with the intensity of LTPA and dimensions of mental health measured (Asztalos et al., 2009). Depression and anxiety were reduced more for those who participated in LTPA three times a week or more as compared to those who participated in LTPA two times a week or less (Muraki et al., 2000). The association between depression and LTPA is stronger compared to the relationship between anxiety and LTPA (Thorsen, Nystad, Stigum, Dahl, Klepp, Bremnes, & Fossa, 2005). The reason for this disparity could be that relationship between anxiety and LTPA is less explored.

The association of LTPA and mental health has not been studied in any disabled population including the SCI to best of my knowledge, but some related literature is available. The nature of this relationship in the SCI is assumed to be similar to other disabled populations, as some cross-disability research suggests generalizability of findings from one disabled population to other (Krause & Dawis, 1992; van Leeuwen, Post, Asbeck, Woude, Groot & Lindeman, 2010). Only a few studies (i.e., Gioia et al., 2006; Muraki et al., 2000) have explored the association of sports activity participation and mental health in the SCI population. These studies report a negative association between sports activities

and mental health; groups with a high frequency or duration of sport activity participation had low rates of depression and anxiety. Santiago and Coyle (2004) examined the relationship between secondary conditions associated with disability and LTPA participation in women with mobility impairments. It was observed that LTPA participation was inversely associated with activity limitations and positively associated with positive physical health and high energy levels. Greater participation in LTPA is associated with reduced risk of cardiovascular disease and type 2 diabetes among people with the SCI (Buchholz et al., 2009). SCI Action Canada group has gathered some information regarding LTPA among people with SCI such as demographics, injury related characteristics associated with LTPA and level of participation in LTPA. Only 50% of individuals with SCI participated in some LTPA (Ginis et al., 2010); most of the LTPA are performed at moderate intensity. Also, in a study examining the perceived needs of new SCI patients, it was identified that 23% of new SCI patients expressed the need for LTPA (Cushman & Scherer, 2002). Furthermore, studies working towards the promotion of LTPA among Canadians with SCI through behavioural strategies (counseling, peer mediated interventions) have strengthened the notion that LTPA is beneficial for people with SCI. To conclude, while there is not specific empirical evidence on the association among LTPA and mental health among the SCI population but the existing literature and broader disability studies field supports exploring a positive association between mental health and LTPA among the SCI population.

#### **2.4 Possible Mediators of the Association of LTPA and Mental Health among People with the SCI**

The complexity of the association of LTPA and mental health may be mediated by

various other factors. A mediator is described as a third variable that changes the relationship between an independent variable and an outcome variable (Baron & Kenny, 1986; Holmbeck, 1997). An independent variable predicts a mediator, which in turn, predicts an outcome. A mediator, therefore, can be described as a variable that explains how and why a relationship occurs between an independent variable and an outcome. According to Baron and Kenny (1986) three criteria are required to test for the effects of a mediator. First, there must be a relationship between the independent variable and outcome. Second, there must be a relationship between the independent variable and potential mediator. Third, there must be a relationship between the mediator and outcome. If a variable is a true mediator, then the effects of the independent variable must diminish or disappear between the independent variable and outcome after controlling for the mediator. There are various possible mediators that may help to explain the relationship between LTPA and mental health outcomes; the current study focused on self-esteem, coping self-efficacy, social support and perceived barriers as potential mediators as these were most prominent in the literature.

#### **2.4.1 Self-esteem.**

Self-esteem is one of the most popular psychological concepts and has been extensively studied. The concept of self-esteem was first introduced by William James (1890) as a result of splitting ourselves into a knower self (I-self) and a known self (me-self). Observations about the self and storage of those observations by I-self create three types of knowledge which collectively account for the me-self. The three types of knowledge are the material, social, and spiritual self. The social self is closest to self-esteem, comprising all characteristics recognised by others. Whereas, James' focus on

individual processes form self-esteem, later approaches stressed the social influence on self-esteem. For example, Cooley (1992), in his conception of the looking glass self, suggested that self-views are based on feedback from others. Self-esteem was usually confused with self-concept but, recent definitions emphasise that these two concepts should be distinguished (Leary & Baumeister, 2000). It was suggested that self-esteem represents the affective, or evaluative, component of self-concept; it specifically signifies how people feel about themselves, their attitude toward self, or an evaluation of self-worth (Coopersmith, 1967; Leary & Baumister, 2000; Rosenberg, 1965).

#### ***2.4.1.1 Functions of self-esteem.***

In general, a pervasive motive has been observed to increase self-esteem and maintain high self-esteem (Sedikides, 1993; Sedikides, Gaertner, & Toguchi, 2003). The most acknowledged explanation for this motive is the buffering role of self-esteem against stress and negative emotions by enhancing personal adjustment (Bartholomew, 1993; Greenberg, Solomon, Pyszczynski, Rosenblatt, Burling, Lyon & Pinel, 1992; Taylor & Brown 1988). The buffering role of self-esteem can be explained via socio-meter theory and terror management theory.

Socio-meter theory states that self-esteem is a socio-meter that serves as a subjective monitor of the extent to which a person is valued as a member of a desirable group and relationship (Leary, Tambor, Terdal & Downs, 1995). Social exclusion may make them feel less capable of personal adjustment because people feel devoid of the benefits of social support which enhance the feeling of loneliness, and risk of mental health issues (Nolan, Flynn & Garber, 2003; Stice, Ragan & Randall, 2004). Thus, with low social inclusion, people have low self-esteem and they strive to increase and maintain high self-

esteem. While socio-meter theory helps in psychological adjustment via benefits of social inclusion, Terror Management Theory (TMT; Greenberg, Pyszczynski, & Solomon, 1986) supports the anxiety buffering role of self-esteem. TMT states that people need self-esteem because self-esteem provides a shield against the fear of death, which is inevitable. TMT also supports that high self-esteem reduces the anxiety, help people to go about their daily activities effectively without being anxious, and low self-esteem initiates compensatory efforts to restore self-worth and self-esteem.

The concept of self-esteem is not widely studied in the SCI population, but evidence from other disability research shows that illness and disability can negatively impact self-esteem and that conversely, low self-esteem can exacerbate symptoms of illness, stress and negative mood. Related to the SCI, there is some evidence that self-esteem is positively associated with well-being, community participation, mental health, mastery, hope and effective coping (Peter, Muller, Cieza, & Geyh, 2012). The same review suggested that self-esteem is often compromised after the SCI.

#### ***2.4.1.2 Self-esteem and LTPA.***

Self-esteem has been widely studied in relation to PA. Most studies conclude that high self-esteem and PA are positively associated (Ekeland, Heian & Hagen, 2005; Schmalz, Deane, Birch & Davison 2007; Schneider, Dunton & Cooper, 2008; Spence, McGannon, & Poon, 2005) and propose improvements in self-esteem through PA interventions (Howells & Bowen, 2016; Li, Xu & Liu, 2014). However, the literature suggests that the relationship between PA and self-esteem is largely equivocal because of measurement issues and lack of conceptual clarity (Fox, 1999; McAuley & Rudolph, 1995). Therefore, this study considers the PA and self-esteem relationship in the context of the

Exercise and Self-Esteem Model (EXSEM; Sonstroem, Harlow, & Josephs, 1994; Sonstroem & Morgan, 1989). EXSEM is based upon hierarchical and multidimensional analysis of self-concept (Marsh & Shavelson, 1985). EXSEM proposes that an increase in PA leads to an increase in perceived physical competencies (e.g. physical endurance), which are assumed to generalise to an increase in physical self-esteem, which in turn, leads to an increase in global self-esteem. As a part of the EXSEM model, it was also assumed that PA indirectly influences self-esteem through its effect on self-efficacy specific to physical competencies. Extended EXSEM (Sonstroem et al., 1994) clarifies that self-efficacy acts in parallel to PA in its relationship with self-esteem. This model has been tested and approved by McAuley and colleagues over time (McAuley, Blissmer, Katula, Duncan & Mihalko, 2000; McAuley, Mihalko & Bane, 1997). The relationship between self-esteem and LTPA has never been explored in the SCI population; however, it has been studied in other populations and found to be positively correlated. For example, differences in self-esteem levels were found in male university students depending on their level of LTPA participation; students with high levels of LTPA participation reported high levels of self-esteem (Molina-Garcia, Castillo, & Queralt, 2011).

#### ***2.4.1.3 Self-esteem and mental health.***

The relationship between self-esteem and depression is undisputed. The relationship between these two constructs is so strong that some researchers have argued that low self-esteem and depression essentially be one construct and should be conceptualised as the opposite poles of a single dimension (Watson, Suls, & Haig, 2002). However, theoretical and empirical findings suggest that it is important to distinguish between self-esteem and depression because 1) self-esteem plays an important role in

several theories of depression that do not conceptualize low self-esteem and depression as synonyms; 2) self-esteem has been emphasized to play a major role in the aetiology of depressive disorders; and 3) low self-esteem is only a symptom of depression, not a necessary criterion.

There are two dominant models in the literature that define the relationship between self-esteem and depression: the Vulnerability Model and the Scar Model. The Vulnerability Model suggests that low self-esteem constitutes a causal risk factor for depression (Butler, Hokanson, & Flynn, 1994). Conversely, the Scar Model states that low self-esteem is a consequence of depression rather than a causal factor because episodes of depression may leave permanent scars in the self-concept of the individual (Rohde, Lewinsohn & Seeley, 1990; Zeiss & Lewinsohn, 1988). The relationship between self-esteem and anxiety has rarely been studied but, theories such as TMT have postulated that self-esteem serves as a buffer against anxiety. Two other theories in the literature (Tripartite Model and Cognitive Content Hypothesis) suggest that depression is more tightly linked to self-esteem than anxiety. Specificity of Scar and Vulnerability models for both anxiety and depression was tested in a meta-analysis of longitudinal studies, in relation to both depression and anxiety (Sowislo & Orth, 2013). Findings of meta-analysis support the Vulnerability Model for depression as the effect of self-esteem on depression was significantly stronger than the effect of depression on self-esteem (Sowislo & Orth, 2013; Orth, Robins & Roberts, 2008). In contrast, for anxiety it was found that the relationship between anxiety and self-esteem is relatively balanced in comparison to depression. Self-esteem predicting anxiety is equally true as anxiety predicting level of self-esteem (Sowislo & Orth, 2013).

Self-esteem is a potential mediator of psychological morbidity in the SCI (Craig et

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Craig, A. R., Hancock, K. M., & Dickson, H. G. (1994). A longitudinal investigation into anxiety and depression in the first 2 years following a spinal cord injury. *Spinal Cord*, 32(10), 675-679.

Craig, A., Tran, Y., & Middleton, J. (2009). Psychological morbidity and spinal cord injury: A systematic review. *Spinal Cord*, 47(2), 108-114.

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al., 2009). Also, high self-esteem is significantly correlated with high levels of life satisfaction and lower levels of loneliness in the SCI population (Tzonichaki, & Kleftras, 2002). No studies were found in the SCI population that have correlated self-esteem with depression or anxiety.

#### **2.4.1.4 Self-esteem as a mediator of LTPA and mental health.**

The interplay between self-esteem, PA and mental health has been examined in the literature in the general population (Herring, O'Connor & Dishman, 2014; Li et al., 2014; McPhie & Rawana 2012; Ryan, 2008; Van de Vliet, Knapen, Onghena, Fox, David, Morres & Pieters 2002; White, Kendrick & Yaedley, 2009). Overall, studies concluded that self-esteem mediates the PA and mental health relationship. For example, in a cross-sectional study Van de Vliet et al. (2002) report that among adult psychiatric patients a reduction in depressive symptoms was mediated by increased self-esteem, which had been promoted by increased perceptions of physical strength and attractiveness as a result of being physically active. Another study (Ryan, 2008) with non-clinical adults found that self-esteem explains the association between PA and mental health. Furthermore, changes in depressive symptoms occurred earlier than changes in self-esteem when participants increase their PA (White et al., 2009). It was concluded that self-esteem might not mediate initial improvements in depression, but perhaps mediates long-term effects. To date, self-esteem has not been explored as a mediator of LTPA and mental health among people with the SCI. This study will explore the mediating effect of CSE in the relationship between LTPA and mental health.

#### **2.4.2 Coping self-efficacy.**

The concept of coping self-efficacy (CSE) is based on the integration of two well

established theories within health research: the self-efficacy theory of Bandura (1997) and the stress and coping theory of Lazarus and Folkman (1984). Coping is viewed as the individual's cognitive and behavioural efforts to manage the stressful demands that are appraised as taxing and exceeding the individual's resources. Primary appraisal process determines the seriousness of the stressor and secondary appraisal determines what can be done about the stressor (Folkman, Lazarus, Gruen, & DeLongis, 1986). Self-efficacy is defined as the level of confidence people have in their ability to accomplish a specific action to achieve a particular outcome (Bandura, 1997). According to Bandura, self-efficacy depends on an individual's cognitive evaluation and processing of availability of social, physiological and other resources, as well as previous experiences of efficacy. In the framework of coping and self-efficacy theories, CSE addresses the second phase of coping, the secondary appraisal, which represents how individuals judge the stressful situations as controllable through specific coping strategies based on previous self-efficacy (Lazarus & Folkman, 1984). This belief in one's ability to perform a successful coping activity is referred to as CSE (Chesney, Neilands, Chambers, Taylor, & Folkman, 2006).

The concept of CSE is not new in the literature, it has been discussed before Chesney et al. (2006) proposed it (see, Benight, Ironson & Durham, 1999; Benight et al., 1999; Bandura, Taylor, Williams, Mefford & Barchas, 1985; Craft, 2005; Kent & Gibbons, 1987). It seems to be a new concept only because many authors use CSE interchangeably with the more popular terms of coping and self-efficacy (Benight & Bandura, 2004; McKnight, Afram, Kashdan, Kasle, Zautra 2009; Mikula et al., 2014, 2015; Yardi-Ravandi, Taslimi, Jamshidian, Saberi, Shams, & Haghparast, 2013). CSE has been well studied in cancer survivors, chronic pain, arthritis, and diverse traumatic events such as natural

disaster, terrorist attacks, motor vehicle accidents, and domestic violence (Luszczynska, Benight & Cieslak, 2009; Merluzzi & Nairn, 1999; Yardi-Ravandi et al., 2013). CSE is associated with health-related outcomes including better disease adjustment and management; improved quality of life; enhanced physical functioning; and reduced pain, fatigue and depression in clinical populations including cancer, obesity, multiple sclerosis, burns, rheumatoid arthritis, osteoarthritis and chronic pain (Arnstein, 2000; Giese-Davis, Koopman, Butler, Classen, Morrow & Spiegel, 1999; Linde, Rothman, Baldwin & Jeffery, 2006; Mikula et al., 2014, 2015; Merluzzi & Nairn 1999; Meredith, Strong, Feeney, 2006; Rhee, Parker, Smarr, 2000; Yardi-Ravandi et al., 2013).

#### ***2.4.2.1 Mechanisms of coping self-efficacy.***

CSE has a strong protective effect in stressful situations and positively influences both immediate and long-term stress levels (Luszczynska et al., 2009) in three ways. First, CSE perceptions create a balance between coping abilities, coping demands and the potential harmfulness of the event. Thus, CSE affects the degree to which an event is perceived as threatening (Bandura, 1997). Second, CSE perceptions influence the motivation to employ coping strategies, as well as the strategies that are considered because of its impact on the expected behavioural outcomes (Bandura et al., 1985). Third, CSE perceptions enhance the control over the disturbing thoughts and emotions related to the stressful event (Kent & Gibbons, 1987).

#### ***2.4.2.2 Coping self-efficacy and LTPA.***

Self-efficacy theory is a social cognitive approach to behavioural causation. According to Social Cognitive Theory, behavioural, physiological, cognitive factors and environmental influences all operate as interacting determinants of each other. The best

example of this reciprocal determinism is the relationship between PA and self-efficacy (McAuley & Blissmer, 2000). Self-efficacy can act as both a determinant and a consequence of PA participation. Research has shown self-efficacy is a predictor of PA adoption and maintenance (Oman & King, 1998; Sallis et al., 1986). At the same time, research shows an increase in self-efficacy with exposure to PA (Oman & King, 1998). However, sometimes growth in self-efficacy is demonstrated as curvilinear over the course of an exercise program (McAuley, Lox & Duncan, 1993). Generally, in the PA literature, self-efficacy has been operationalized in two ways: perceptions to overcome barriers related to PA (barrier self-efficacy) and the ability to schedule regular exercise sessions (scheduling self-efficacy; Ducharme & Brawley, 1995). Barrier and scheduling self-efficacy are types of CSE (Arbour-Nicitopoulos et al., 2009). Both types of coping self-efficacies are predictors of PA (Ducharme & Brawley, 1995). CSE has not been studied as a predictor of PA behavior in populations with disabilities, but recently two studies have explored CSE and LTPA in the SCI population (Arbour-Nictopoulos et al., 2009; Phang, Martin Ginis, Routhier, Lemay, 2012). Arbour-Nictopoulos et al. (2009) mentioned that both barrier and scheduling self-efficacy mediate the effect of planning intervention on LTPA. Phang et al. (2012) emphasised that barrier self-efficacy was enhanced by increased participation in LTPA.

#### ***2.4.2.3 Coping self-efficacy and mental health.***

The concept of CSE is not new. With the application of self-efficacy theory to the field of rehabilitation, CSE is an individual's belief regarding their abilities to cope with life pressures (Bandura, 1977), which is similar to Chesney et al.'s (2006) view of CSE. The relationship between self-efficacy and mental constructs are negatively associated

(Cutrona & Troutman, 1986; McFarlane, Bellissimo, & Norman, 1995) and individuals with high self-efficacy gain an increased sense of confidence in their ability to control and manage the symptoms associated with their chronic disease (rheumatologic disease; Daltroy, 1993). Individuals with high self-efficacy demonstrate long-term adherence in managing their illness, which enhances their QOL (Han, Lee, Lee & Park, 2003; Rosenstock, 1985). So far only a few studies have addressed the concept of CSE but, those that have, showed that CSE is associated with successful disease adjustment, few episodes of psychological distress, and improved mental complement of QOL in the context of aging and chronic diseases such as rheumatoid arthritis, cancer, multiple sclerosis, burn, and pain (Benka et al., 2014; Bosmans, Hofland, De Jong & Van Loey, 2015; Mikula et al., 2014; Maciejewski, Prigerson & Mazure, 2000; Philip, Merluzzi, Zhang & Heitzmann, 2013; Yardi-Ravandi et al., 2013). CSE has emerged as a focal mediator of post-traumatic recovery following traumatic events such as natural disaster (Benight & Harper, 2002). CSE has not been studied in relation to mental health in the SCI population, but a few have addressed self-efficacy in relation to mental health in the SCI (Hampton, 2004; Middleton, Tran, & Craig, 2007). The results indicate that self-efficacy beliefs accounted for substantial variance in the QOL and subjective well-being among people with the SCI. Also, self-efficacy was found to predict depression and psychological distress in the SCI population. Similarly, research has reported the importance of certain coping strategies in adjustment with the SCI and reducing the associated psychological distress and depression (Hanson, Buckelew, Hewett, & O'Neal, 1993; Kennedy, 1999). Self-efficacy and coping both have a positive effect on mental health. A combination of both coping and self-efficacy beliefs, CSE was able to account for a significant variance in psychological distress in

rheumatoid arthritis population even after controlling for the influence of disease, activity, functional status and personality traits (Benka et al., 2014). In conclusion, a combination of coping and self-efficacy beliefs, which is self-efficacy to cope, can be a valuable and modifiable factor which can enhance the engagement in LTPA and psychologically being; but it still needs to be studied in the SCI population.

#### ***2.4.2.4 Coping self-efficacy as a mediator of LTPA and mental health.***

This section will highlight the literature related to the role of CSE as a mediator of post-traumatic recovery and long-term psychological distress following traumatic events such as natural disaster. In relation to chronic diseases, CSE has been studied as a mediator between catastrophizing physical function and fatigue and mental health-related quality of life (McKnight et al., 2010). No study exploring the interaction of LTPA, CSE and mental health was found in the SCI research, but some associated literature was reviewed. A few studies have shown CSE to be a significant mediator of exercise and depression (Craft, 2005; Foley et al., 2008; White et al., 2009); though some disagreement exists (Pickett, Yardley & Kendrick, 2012). An important fact to notice in this contradiction is that the research supporting the mediational role of CSE has explored structured exercise and depression; whereas, Pickett et al. (2012) found that CSE is not a significant mediator of LTPA and depression. This contradiction encourages further exploration of the interaction of these variables. CSE (self-efficacy to cope, barrier-efficacy and scheduling-efficacy) has been suggested as a potential intervention to promote PA behavior and reduce psychological distress (Arbour-Nicotopoulos, Martin Ginis, & SHAPE SCI Research Team, 2008; Phang et al., 2012).

Bandura in 1977 suggested that mastery experience is the best source to enhance

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coping self-efficacy belief. In the same line of thought, Craft (2005) said that PA could provide a meaningful mastery experience which can promote coping self-efficacy beliefs. It has been already seen that high CSE can promote LTPA behavior in the SCI (e.g., Arbour-Nicotopoulos et al., 2009; Phang et al., 2012). Considering this link from existing research, the present study will explore the mediating effect of CSE in the relationship between LTPA and mental health.

#### **2.4.3 Social support.**

Social support is defined as an exchange of resources between individuals intended to enhance the well-being of the recipient (Shumaker & Brownell, 1984). Social support positively influences physical and mental health and quality of life (Berkman, Glass, Brissette, & Seeman, 2000; Grav, Hellzen, Romild, & Stordal, 2012; Helgeson, 2003; Uchino, 2006). Various aspects of social support (type, source and frequency of social support) have been addressed while exploring its association with health and well-being.

The conceptualization of social support varies widely; primarily it can be placed along two basic dimensions: quantitative/structural/objective (frequency of contact or number of people one interacts with) and qualitative/functional/subjective (perceptions about the adequacy of interpersonal contacts; Barrera & Ainlay, 1983). It has been an issue whether social support should be conceptualised regarding the structure or function of an interpersonal relationship. The quantitative perspective provides information about characteristics of a support network around the individual, independent of personal characteristics of the individual (Hammer, 1983). Qualitative, functional support helps to extract an individual's psychological representation of their support system; these representations are affected by personal and environmental characteristics (Cohen &

McKay, 1984). In comparison to quantitative measure of support, qualitative measures are more strongly associated with certain health outcomes and health behaviors (Schaefer, Coyne, & Lazarus, 1981). For instance, Porritt (1979), reported that quality, but not the quantity, of social support predicted health outcomes in men who incurred injuries in automobile accidents.

Social support is also conceptualized based on its multiple independent functions (i.e. instrumental/tangible, informational, emotional and appraisal support; House, 1981). The functions of social support which relate to health can be categorised as: 1) informational (Barrera, 1981; House, 1981; Mitchell & Trickett, 1980), provision of advice, information, or access to new sources of information; 2) instrumental, provision of material aid (House, 1981; Kahn & Antonucci, 1980); 3) social integration and a sense of reliable alliance, providing information that the person is a part of a network or support system of reciprocal help (Kahn & Antonucci, 1980; Walker, MacBride, & Vachon, 1977); 4) attachment or positive affect, provide information that a person is cared for, loved or esteemed (Cutrona & Russell, 1987); 5) reassurance of worth, agreement with the appropriateness of person's beliefs, interpretations or feelings (Kahn & Antonucci 1980; Walker et al., 1977); and 6) encouraging open expression of feelings and beliefs (Wortman & Dunkel-Schetter. Berkman (1995) illustrated categories of social support in terms of its relationship to PA behavior: instrumental (giving a friend a ride to PA class), informational (sharing information related to PA), emotional (talking to a friend regarding his/her PA schedule), and appraisal (encourage to perform well). Different types of social support may have different effects on health outcomes (Funch & Metlin, 1982; House 1981). For

example, Schaefer et al., (1981) found that instrumental support was more important than either informational or emotional support in predicting depression in elderly. These functions of social support are manifested through different social support processes.

#### ***2.4.3.1 Social support processes.***

These positive effects of social support can be explained through two distinct processes, the Buffering and Main Effect Models (Barrera, 1986; Cohen & Wills, 1985). The Buffering Model proposes that social support ‘buffers’ (protects) people from the potentially pathogenic influence of stressful events (Cohen & McKay, 1984; Gore, 1981); while the Main Effect Model supports an overall beneficial effect of social support in the absence of any stress. These two processes are not mutually exclusive; rather, they help to explain the influences of different aspects of social support on psychological health. It has been suggested that the quantitative aspects of social relationships (e.g., social networks, social integration) may operate via main effects, whereas the qualitative aspects of social relationships (e.g., perceived support) may operate through a stress-buffering mechanism. Evidence for the Buffering Model is found when the correlation between stressful events and poor health is weaker for people with high social support than for people with low social support (Cohen & Wills, 1985). The weak correlation between stress and poor health for people with high social support is often interpreted to mean that social support has protected people from stress. The Buffering hypothesis is likely to be observed more for perceived social support than for social integration (Uchino, 2009; Cohen & Wills, 1985). Evidence for the Main Effect Model is found when people with high social support are in better health than people with low social support, regardless of stress. The main effect of social support is likely to be observed when a person’s degree of integration in a large social

network is considered (Uchino, 2009), but perceived support had also shown some main effect for mental health outcomes (Barrera, 1986; Cohen & Wills, 1985; Uchino, 2009).

The stress Buffering Model has dominated the social support research and is well developed in comparison to the Main Effect Model. Most social support research is based on the assumption that social support is linked to mental health through stress buffering. To explain the Buffering Model, Cohen and Wills (1985) hypothesise that stress is related to illness through a causal chain. A person appraises any situation as stressful when a coping response is important, but is not immediately available (Lazarus & Launier, 1978). Accumulation of multiple, persisting stressful events place great demands on the coping abilities of most persons; referred as stress appraisal (Wills & Langer, 1980). At this point, individuals are predisposed to serious disorders through mechanisms such as 1) disruption of neuroendocrine or immune system functioning; 2) failure in self-care or negative affect; and 3) changes in health-related behaviours (e.g., alcohol abuse, poor diet or exercise patterns; Baum, Singer & Baum, 1981; Jemmott & Locke, 1984; Krantz, Grunberg, & Baum, 1985). In the Buffering Model, the causal chain linking stress to illness can be interrupted by social support at two different points (Cohen & McKay, 1984; Gore, 1981; House 1981). First, by intervening between the stressful event and stress reaction. Second, by intervening between stress and the onset of a pathological outcome.

In contrast to the Buffering Model, the Main Effect Model supports a generalised beneficial effect of social support. As per the Main Effect Model, large social networks provide persons with regular positive experiences, sense of predictability and stability in one's life situation and recognition of self-worth through socially rewarded roles in the community. Integration in a social network may also help one to avoid negative experiences

(e.g., economic or legal problems) that otherwise would increase the probability of psychological or physical disorder (Cohen & Wills, 1985; Moos & Mitchell, 1982).

#### **2.4.3.2 Social support and LTPA.**

There is extensive research on the positive relation between PA and social support demonstrates; this relation has also been found with LTPA but has not been as widely studied. Within the broader PA literature, higher levels of social support such as greater involvement in social organizations and more frequent contact with family and friends is associated with higher levels of PA (Eaton, Reynes, Assaf, Feldman, Lasater, Carleton, 1992; Gottlieb & Green, 1984; Krause, Goldenhar, Liang, Jay & Maeda, 1993; Osler, 1995). Recent researchers have also supported this positive relationship among cohorts across the lifespan from youth to older adults (Giles-Corti & Donovan, 2002; King, Tergerston, Wilson, 2008; Orsega-Smith, Payne, Mowen, Ho, & Godbey, 2007; Sharma, Sargent & Stacy, 2005; Spanier & Alison, 2001). The strength of the relationship between social support and PA can be explained by the fact that social support is a construct contained in some theories (e.g., Social Cognitive Theory and Planned Behavior Theory) and models (e.g., Health Belief and Social Ecological Model) used to explain PA behaviour. Unlike PA, the relationship of LTPA and social support is not well explored. Still, some literature is available. It was found that social support is influential in shaping the duration and pattern of LTPA among older adults (Orsega-Smith et al., 2007; Sharma et al., 2005; Wilcox, Castro, King, Housemann & Brownson, 2000). Also, Mannell and Loucks-Atkinson (2005) suggested enhancing social support resources as a way to mitigate leisure constraints and thereby facilitate participation in LTPA. Some evidence shows that the association of social support and LPTA applies to the SCI population as well (Martin

Ginis et al., 2012; Williams et al., 2014).

#### ***2.4.3.3 Social support and mental health.***

An ever-growing amount of research has documented the significance of social support for psychological well-being, and nearly all have reported an inverse association between social support and mental health variables (Cohen & Wills, 1985; Dean & Lin, 1977; Turner, 1983; Veiel & Baumann, 1992). It has been reported that the availability of social support reduces psychological distress, promotes psychological adjustment and provides an opportunity to utilise problem-focused and emotion-focused coping strategies (Lazarus & Folkman, 1984). An inverse relationship between social support and mental health has been observed in clinical populations such as stroke, rheumatoid arthritis, HIV, and SCI (Goodenow, Reisine, & Grady, 1990; Huang et al., 2015; Post, Ros, & Schrijvers, 1999; Robertson, & Suinn, 1968; Turner-Cobb et al., 2002). Several theories of stress, coping and social support have been proposed in the literature to explain the association between mental health and social support (e.g., the Lazarus Theory of Psychological Stress and an Optimal Matching Model of Stress and Social Support). All these theories suggest that social support works as a buffering agent to protect individuals from the adverse effects of stressful events. Also, stress and coping theories suggest that social support promotes adaptive appraisal and coping with stressful situations.

Despite the predominance of the stress buffering approach in social support research, the approach has some practical limitations. First, the stress buffering role of social support has been observed inconsistently compared to the main effect role of social support. For example, in a comprehensive review of studies of social support and major depressive disorder (see Lakey & Cronin, 2008), nearly all studies supported the main

effect except one study (Brown, Andrews, Harris Adler, & Bridge, 1978) that reported a buffering effect. Second, the stress buffering approach suggests coping and appraisal as the link between perceived support and mental health but it has no empirical support. In 1986, Baron and Kenny argued that if coping and appraisal account for perceived support's link to mental health, controlling for coping and appraisal will substantially reduce this link. Only a few studies were able to demonstrate this pattern to support the buffering effect of social support (Holahan, Moos, Holahan & Brennan, 1995). In contrast, many studies found no evidence that coping and appraisal can explain the perceived support's link to mental health. To overcome these limitations, the Relational Regulation Theory (RRT; Lakey, & Orehek, 2011) was adopted which explains the main effect between perceived support and mental health. RRT is based on the belief that social support is a relational construct and individuals develop their ideas of what is supportive via conversation, interaction, shared activities and relationships (Lakey, & Orehek, 2011). Also, people regulate their affect through involvement in a diversity of relationships (and quasi-relationships) to improve mental health. This concept was supported by Marroquin (2011) in an extensive review research on social support and health.

#### ***2.4.3.4 Social support as a mediator of LTPA and mental health.***

The mediator is a third variable that comes between the independent and dependent variable and represents the generative mechanisms through which the independent variable influences the dependent variable. Baron & Kenny (1986), said that mediators may explain how external physical events take on internal psychological significance (p.1176), whereas, a moderator affects the direction or strength of the causal relationship between the independent and dependent variables. Mediating and moderating effects of social support

have been interchangeably studied. At times statistical analysis suggested that researchers were examining the data for a mediating rather than a moderating effect of social support because the relationship between the independent and dependent variables remained unchanged when social support was controlled (Wu & Lam, 1993). A clear distinction between the mediating and moderating role of social support has encouraged researchers to study the mediational perspective of social support. Social support has been widely studied as a third variable in the relationship of variety of variables such as mood state, stress, depression, hope, self-esteem, functional status, quality of life, PA and functional impairments in general population as well as in the disabled population (Multiple Sclerosis and SCI) but, most commonly social support has been operationalized as mediator of stress and adjustment relationship (Bruhn & Philips, 1987; Huang et al., 2015; Kaniasty & Norris, 1993; Phillips, Smedema, Fleming, Sung, & Allen, 2016; Quittner, Glueckauf & Jackson, 1990; Wu, Ge, Sun, Wang, & Wang, 2011). LTPA, social support and mental health have not been studied together in the past except in one study. Elliott and Shewchuk (1995) investigated depression as a mediator of LTPA and social support. Therefore, the mediating role of social support in the relationship between LTPA and mental health needs further exploration. In the present study, social support is investigated as a mediator because it holds a relationship with LTPA and mental health; also LTPA and mental health are related to each other. Thus, these three variables fulfil the criteria of mediation relationship.

#### **2.4.4 Perceived barriers.**

Perceived barriers to PA refers to reasons why people do not participate in PA, discontinue PA or the negative experiences of participants within PA participation (Williams et al., 2014). The importance of perceived barriers to PA has been considered in

numerous studies for the general population (e.g., Dishman, Sallis, Orenstein, 1985; Giles-Corti & Donovan, 2002; Gordon-Larsen, McMurray, Popkin, 2000; Seefeldt, Malina & Clark 2002). Despite the highlighted need of PA promotion among people with disability, little is known about the perceived barriers that can influence their level of PA (Mulligan, Hale, Whitehead, Baxter, 2012; Rimmer, Rubin, Braddock, 2000; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004; van der Ploeg, Van der Beek, Van der Woude, & Van Mechelen, 2004) and even less is known about these barriers in the SCI population (Keegan, Brooks, Blake, Muller, Fitzgerald & Chan, 2014; Kerstin, Gabriele, Richard, 2006; Levins, Redenbach, & Dyck, 2004; Vissers et al., 2008). Recently, considering the importance of LTPA and knowledge of barriers to LTPA, few authors have studied barriers to participation in LTPA among people with SCI (Martin Ginis et al., 2012; Williams et al., 2014).

Perceived barriers arise as a function of external and internal factors (Scelza, Kalpakjian, Zemper, & Tate, 2005). External factors include public attitudes, policies, procedures, inaccessible facilities, and insufficient resources; whereas internal factors are subjectively experienced as limited motivation, health concerns, and psychological barriers (Rimmer et al., 2004). Literature suggests that individuals with the SCI experience more external barriers than internal barriers (Vissers et al., 2008) and people with tetraplegia experience more perceived barriers to LTPA than people with paraplegia (Scelza et al., 2005). The severity of the SCI was not significantly associated with PA participation, but types of perceived barriers did vary according to the severity of impairment. Individuals with more significant mobility impairments endorsed higher rates of external barriers (Robertson, Bucks, Skinner, Allison & Dunlop, 2011).

#### ***2.4.4.1 Perceived barriers as a mediator of LTPA and mental health.***

While exploring the literature to understand the path of mediation between LTPA, perceived barriers to LTPA and mental health, it was found that literature on perceived barriers to LTPA is based on an unstated assumption: a direct causal link has been assumed between perceived barriers to LTPA and level of participation in LTPA (Shaw, Bonen, McCabe, 1991). As an interpretation of this assumption, it was believed that as the number of perceived barriers to LTPA increases the level of participation decreases. Establishing a causal link was problematic because perceived barriers to LTPA were not only reported by non-participants, but also by participants (Kay & Jackson, 1991). Possibly, people who participate in LTPA may report more perceived barriers because participation exposes the individual to barriers. As a result of indirect prediction, it was assumed that LTPA participation and perceived barriers are negatively associated. On exploring this relationship, it was found that a negative correlation does not exist. On the contrary, evidence suggests that more frequent reporting of at least some perceived barriers is associated with higher rather than lower PA participation (Kay & Jackson, 1991; Reichert, Barros, Domingues, & Hallal, 2007). It was further suggested that higher perceived barriers might not necessarily lead to lower participation and alleviation of such barriers may not necessarily result in higher participation. Recently, the relationship between LTPA participation and perceived barriers to LTPA was discussed as a part of the Attitude, Social Influence and Self-Efficacy (ASE) model (De Vries, Dijkstra, & Kuhlman, 1988). This model states that attitude, social influence, and self-efficacy collectively determine PA behavior through a person's intention towards PA. However, intention toward PA depends on the individual's skills and perceived barriers. The nature of this relationship also

Comment [AL10]:

depends on the population studied as not all barriers are not applicable to all populations (Parks, Housemann, & Brownson, 2003; Rimmer et al., 2004; Zunft et al., 1999). When the association between LTPA and perceived barriers was explored in the SCI population, it was found that as a result of being engaged in regular LTPA, perceived barriers to LTPA reduce (Williams et al., 2014).

Limited literature is available to understand the association between perceived barriers to LTPA and mental health. In a recent study, Chick, Hsu, Yeh, and Hsieh (2015) found that perceived barriers have a negative influence on leisure satisfaction which is positively related to self-reported health. Only one study was found to explore the effects of perceived barriers to LTPA on mental health among university students (Oh, Oh, & Caldwell, 2002). Results indicated that students who experienced higher barriers tended to rate themselves lower on mental health outcomes. The association between perceived barriers to LTPA and mental health can be hypothesised based on the Theory of Learned Helplessness (Seligman, 1975). Accordingly, repeated exposure to an aversive, unavoidable stimulus can result in depression or some other mental illness. It is possible that due to perceived barriers to LTPA, lack of engagement in LTPA is experienced as a failure by an individual with the SCI and it can predispose the individual to mental health issues. The interplay between LTPA, perceived barriers to LTPA and mental health cannot be discussed due to lack of literature, but still, a mediation relationship can be expected because all three variables are associated with each other.

### **Chapter 3: Methodology**

The purpose of this chapter is to provide a methodological overview of procedures used in this study. A self-reported survey method approach is used in this descriptive study. The rationale for this approach is its descriptive nature, potential for generalizability and ability to target a larger sample size. The following research questions are addressed in this study: 1) What is the level of participation in leisure time physical activity (LTPA) among people with the Spinal Cord Injury (SCI) in Canada? 2) What is the association of mental health (depression and anxiety) and LTPA among people with the SCI? and 3) How do self-esteem, coping self-efficacy, social support and perceived barriers to LTPA mediate the relationship between LTPA and mental health? This chapter provides a description of the sample, research design and recruitment, variables and measures, the procedures, dependent-independent variables, and description of data analysis are included. The proposal of this research was been reviewed by the Health Research Ethics Board (HREB) and found to be in compliance with Memorial University's ethics policy (see Appendix A: Ethics Proposal).

#### **3.1 Sample**

A purposeful sampling technique was used. Individuals were invited to participate in this study if they had the SCI (traumatic or non-traumatic, complete or incomplete injury, level of injury at or below C<sub>5</sub>), at or above the age of consent in respective provinces, and were living in the Canadian community with wheelchair as their primary mode of mobility. Individuals who were in institutionalized care facilities or had some other neurological conditions (Brain injury) along with the SCI were excluded.

### **3.2 Research Design and Recruitment**

Data for the present study was collected using a self-administered cross-sectional survey (see Appendix B: Survey). Data collection for this study lasted from November, 2016 to March, 2017. Two different methods of data collection were employed: online web-survey via SurveyMonkey.com and mail-return paper copy. All the provincial SCI organizations in Canada were contacted through e-mails to request that advertising the survey to their clients. The SCI associations of Newfoundland (NL), Nova Scotia (NS), Manitoba, and Saskatchewan put the advertisement for the present study in their newsletter and official website. Saskatchewan and NL associations also posted the advertisement for recruitment on their Facebook page. The NS association mailed 200 paper copies of the survey to their clients. Participants were also invited to participate in the study through social networking sites (Facebook and Twitter). Advertisement for recruitment in this study was posted on the following social media groups: The Rick Hansen Foundation, the SCI Ontario Thunder-Bay, the Synaptic SCI & Neuro-rehabilitation Centre, the ISABLED, and the SCI Treatment Centre Society.

### **3.3 Variables and Measures**

Leisure time physical activity, pre-post spinal cord injury depression and anxiety, social support, coping self-efficacy, self-esteem and perceived barriers were the variables of interest in the present study. LTPA and mental health (depression and anxiety after the SCI) were the independent and dependent variables respectively. Other variables were chosen on the basis of their theoretical importance as the possible mediators of LTPA and mental health.

### **3.3.1 LTPA participation.**

Leisure time physical activity is the predictor/independent variable, defined as a subtype of physical activities (PA), one chooses to do during free time such as walking, wheeling, playing sports or exercising at the gym and is distinguished from other types of PA such as paid work and activities of daily living (Bouchard & Shephard, 1994). Leisure time physical activities was measured using Physical Activity Scale for Individuals with Physical Disabilities (PASIPD; Washburn, McAuley, Frogley & Figoni, 2002). PASIPD has yielded tenuous evidence of validity in the SCI population but, was the only suitable tool available to address the research questions of this study. The other tools explored to measure LTPA among people with the SCI included the, Leisure Time Physical Activity Questionnaire for Spinal Cord Injury (LTPAQ-SCI; Martin Ginis, Phang, Latimer, & Arbour-Nicitopoulos, 2012), the Physical Activity Recall Assessment Tool for Spinal Cord Injury (PARA-SCI; Latimer, Martin Ginis, Craven & Hicks, 2006), and the Physical Activity and Disability Scale (PADS; Washburn, Zhu, McAuley, Frogley & Figoni, 2002). Both the LTPAQ-SCI and PARA-SCI are administered via structured interviews. While the PARA-SCI needs to be administered by a trained interviewer, the LTPAQ-SCI can be self administered but, it assesses only minutes of mild, moderate and heavy intensity LTPA. The PADS assesses only overall intensity of structured exercise activities. Given these restrictions the PASIPD was deemed the most appropriate tool available.

PASIPD is a 7-day physical activity recall questionnaire which asks respondents to report the number of days and the average hours per day spent in the different physically active leisure and household activities. From a total of 13 items of PASIPD, only 2 – 13 items were scored to calculate the total PA score. The first question of the scale asks

participants the amount of time spent in stationary activities such as watching television. In the remaining 12 items, six items address leisure activities (e.g., “During the past 7 days, how often did you walk, wheel, push outside your home other than specifically for exercise”) and the other six items address household activities (e.g., “During the past 7 days, how often have you done any light housework, such as dusting, sweeping floors or washing dishes”). Each item of PASIPD has 2 or 3 sub-items, regarding frequency per week, hours of participation per day and an open ended question asking participants to report what these activities are. Also, one dichotomous question was added to at the end of the LTPA sub-scale to know the individual’s perspective about their involvement in LTPA after the SCI. Frequency responses range from 0 (never) to 3 (often), and duration responses range from 0 (never) to 4 (more than 1 hours). Score for each item was multiplied by the given metabolic equivalent value and a total PA score was calculated by summing these values. Score for PASIPD range from 0 – 178; higher scores indicating higher PA. To calculate the total LTPA score, only 5 (outdoor wheeling; light, moderate and strenuous recreational sports; strengthening exercise) of the 17 items were multiplied to their metabolic equivalents and were summed. Total LTPA scores range from 0 – 92. For the total score of household activities, 7 (light or heavy intensity house-work; volunteer; caring for others) of the 14 items were multiplied to their metabolic equivalents and were summed. Total household activity score range from 0 – 86. Pearson correlations between the items of original PASIPD and total PASIPD score at the time of development range from 0.20 to 0.67 (Washburn et al., 2002). Cronbach alpha coefficients (0.37 to 0.65) indicated low to moderate internal consistency. Moderate correlations between PASIPD score and Utrecht Activity List (0.36 – 0.51,  $p < 0.01$ ) were reported in a sample of 139 ambulatory and wheel

chair dependent persons with the SCI (De Groot, Van der Woude, Niezen, Smit & Post, 2010).

### **3.3.2 Mental Health (Pre-morbid / Post-morbid Depression and Anxiety).**

Mental health is the outcome variable. Although not specifically defined in the literature, researchers have measured a large number of variables under the umbrella term of mental health. In the present study depression (e.g. Elliott & Frank, 1996; Craig et al., 2009) and anxiety (e.g. Kennedy & Rogers, 2000; Harper et al., 2014) were the chosen variables. Rates of depression and anxiety are higher in individuals with the SCI in comparison to the general population (Craig et al., 1994; Hancock et al., 1993; Post & van Leeuwen, 2012; Harper et al., 2014) and both have a large financial burden (O'Connor et al., 2000; O'Neal et al., 2000; Harper et al., 2014). Also, depression in the SCI is associated with poor subjective health, lower life satisfaction and difficulty with activities of daily living (ADLs; Bombardier et al., 2004). Depression was not considered as mere sadness of mood, rather a state characterized by loss of self-esteem and incentive, and is associated with a very low perceived probability of attaining personal life goals of significance to the individual (Lovibond, 1995). Mental health was assessed using self-reported short version of Depression Anxiety and Stress Scale (DASS- 21; Lovibond, 1995). Jacob, Zachariah and Bhattacharji (1995) recommended the that tool to measure depression should exclude reference to any somatic symptoms. Two tools fit this criterion are the Hospital Anxiety and Depression Scale (HADS; Jacob et al., 1995) and DASS-21 (Sakakibara, Miller, Orenczuk, & Wolfe, 2009). Both tools have excellent reliability (HADS, 0.79 – 0.84; Woolrich, Kennedy, & Tasiemski, 2006; DASS-21, 0.74- 0.90; Migliorini et al., 2008) but, the validity of the DASS-21 (0.61 – 0.70) is better than the HADS (0.38 – 0.58; Berry &

Kennedy, 2003). Considering the validity, the DASS-21 appears to be better but it has a lower sensitivity for depression (57%; Mitchell, Burns, & Dorstyn, 2008). Further exploration found that HADS has some issues with licensing; mental health was assessed using the self-reported short version of the DASS-21.

DASS-21 has 3 subscales (depression, anxiety and stress) with 7 items in each. Only the depression and anxiety sub-scales were used in this study. Respondents were asked to indicate how much each statement applied to them over the previous week related to depression (e.g., “I felt that I had nothing to look forward to”) and anxiety (e.g., “I felt scared without any good reason”). Scoring for each response was done using a 4 point Likert scale (1 = “did not apply to me at all”, 4 = “applied to me very much or most of the item”). Scores for each subscale can range from 7 – 28, with higher scores indicating greater severity or frequency of negative emotional symptoms. Previous research using this scale report excellent internal consistency and reliability; Cronbach alpha for the overall DASS – 21 is very good (.927) and alpha coefficients for depression and anxiety sub-scales have also found to be reliable (.902 and .748 for depression and anxiety respectively; Migliorini et al., 2008).

Exploring the relation between pre-morbid and post morbid mental health status is not a research question of the present study but, it was a limitation identified in the literature. An attempt was made to know the pre-morbid mental health status of people with the SCI. Pre-morbid depression and anxiety (i.e., prior to SCI) was assessed using the Ruff Neuro-behavioural Inventory (RNBI; Ruff & Hibbard, 2003). Items from pre-morbid depression (e.g. “I suffered from periods of deep sadness in my life”) and pre-morbid anxiety (e.g. “I received treatment for anxiety”) sub-scales were only used to screen for

presence or absence of pre-morbid depression and anxiety. Pre-morbid depression and anxiety were not explored in any studies on mental health in the SCI population but, it is possible that pre-morbid mental health status has some influence over the mental health status after the SCI. Thus, the items of RNBI were not scored using original scoring but, were changed into dichotomous items to be used as sample descriptors.

### **3.3.3 Self-esteem.**

Self-esteem is a general evaluation of self-concept and sense of personal worth. It was measured using the 10 item Rosenberg Self-Esteem scale (RSE; Rosenberg, 1965). No SCI specific measures were available to measure self-esteem other than the 23-item SCI-QOL Self-Esteem Item Bank (Kalpakjian, Tate, Kisala, & Tulsy, 2015). RSE is a commonly used scale in the SCI population to measure self-esteem (Tzonichaki, & Kleftaras, 2002; Geyh et al., 2012) and has only 10 items. Thus to reduce participant burden RSE was chosen to measure self-esteem. Respondents were asked to report their level of agreement or disagreement with the list of provided statement (e.g. “I feel I do not have much to be proud of”, “All in all, I am inclined to feel that I am a failure”) on a 4 point Likert scale (4 = “strongly agree”, 1 = “strongly disagree”). Five out of the 10 items are reversed score. Total score range from 4 – 40, with higher scores indicating higher self-esteem. Internal consistency reliability and test retest reliability of scale was reported to range from 0.77 to 0.88 and 0.82 to 0.85 (Rosenberg, 1965) respectively. Reliability and validity specific to the SCI population are not available.

### **3.3.4 Coping self-efficacy.**

Coping self-efficacy (CSE) is conceptualized as a combination of coping behavior and self-efficacy beliefs (Chesney et al., 2006). It is defined as individual’s confidence or

perceived self-efficacy in performing coping behaviors in the face of life challenges or threats. As CSE is not much explored no other tools were available, other than CSE scale. CSE scale consist of 26 items. Respondents were asked to rate their level of confidence or certainty on how they are going to act if things are not going well for them (e.g. “Sort out what can be changed, and what cannot be changed”, “Get friends to help you with the things you need”). Anchors for the 11-point response scale were 0 (‘cannot do at all’), 5 (‘moderately certain can do’) and 10 (‘certain can do’). An overall CSE scale score is calculated by summing the item ratings. Total scores range from 0 – 260 with higher score indicating higher CSE. Van Wyk (2011) reported excellent reliability indices (Cronbach alphas of .86, .87, and .87) for the English version of the 26-item CSE scale.

### **3.3.5 Social support.**

Social support is defined as an exchange of resources between individuals intended to enhance the well-being of the recipient. It conveys the information of being loved, cared for, esteemed, valued and bestows a sense of belonging (Shumaker & Brownell, 1984). Social support can be instrumental (such as tangible assistance), emotional (such as exchange with a close friend) or informational (such as advice from a peer). Social support was measured using a 6-item version of the interpersonal support evaluation list (ISEL; Cohen & Hoberman, 1983). ISEL was chosen because SCI specific tools were not available and ISEL is the most widely used tool to measure social support in the SCI population (Peter et al., 2012). Respondents were asked to rate the statements (e.g. “When I need suggestions on how to deal with a personal problem, I know someone I can turn to”, “I often meet or talk with family or friends”) on a scale of 1 = “definitely false” to 4 = “definitely true”. Total scores range from 6 – 24, with higher scores indicating higher levels

of perceived social support. The original scale has higher scores of ISEL indicating lower perceived social support. For the sake of convenience to understand and go along with other variables, items were reversed scored (with exception of “Not be able to find someone to take care of their house”) so that higher scores indicated higher perceived social support. Previous research using this scale has reported Cronbach alpha ranging from .73 to .82 (Williamson, 2000; Williamson & Schulz, 1992).

### **3.3.6 Perceived barriers.**

Perceived barriers are defined as factors hampering the participation in physical activity and exercise; these factors can be external (public attitude, policies, procedures, inaccessible facilities or insufficient resources) or internal (subjectively experienced as barriers, can be motivation, health concerns). Perceived barriers were evaluated using Barriers to Health Promoting Activities for Disabled Persons Scale (BHADP; Becker, Stuijbergen & Sands, 1991). Perceived barriers is not a well explored area of study in the SCI population (Cowan, Nash & Anderson, 2013) and most of the available literature is from qualitative studies (Williams et al., 2014; Vissers et al., 2008; Levins et al., 2004) so, not many quantitative tools were available. Two tools were considered to measure perceived barriers: Barriers to Physical Exercise and Disability Scale (BPED; Rimmer et al., 2000) and Exercise Barriers and Benefits Scale (EBBS; Sechrist, Walker & Pender, 1987). Items of BPED scale were rated as “yes”, “no” and “don’t know”, no numeric score was available for statistical analysis. EBBS was able to provide total numeric score but is very long (43 items) and has not used in the SCI population. BHADP was chosen as it has been used in the SCI population (Keegan et al., 2014; Warmes, Belza & Whitney, 2007). Measurement characteristics of the BHADP have been examined by using factor analysis

and they found Cronbach's alphas for external barriers subscale and the motivation subscale were 0.81 and 0.83, respectively (Keegan et al., 2014). BHADP is comprised of 18 items and 2 subscales: 7 items external barrier subscale ("Lack of help from health care professionals") and 11 items motivation subscale ("Feeling I can't do things correctly"). Both subscales were incorporated in the survey for the present study. Respondents were asked to rate the items using a 4 point Likert scale (1 = "never" to 4 = "routinely"). Total score range from 18 - 72, with higher scores indicating greater perceived barriers.

### **3.3.7 Socio-demographics**

Socio-demographic variables were also collected including age (year of birth), sex (female, male, or other), education (highest level obtained), martial/partnership status (before and after the SCI), annual household income and employment status (before and after the SCI). Respondents were also asked several SCI specific demographics including date of injury (duration since injury), level of injury (Tetraplegia or Paraplegia), and completeness of injury (complete or incomplete).

### **3.4 Data Analyses**

Data was screened for missing values and outliers prior to running analyses. Following the initial data screening, descriptive statistics were analysed and bi-variate correlations were done to check how the variables of interest were related with each other and with the socio-demographic variables. Spearman's rho test was done as assumptions of parametric data such as normality and interval level data were violated. Assumptions of multiple regression were explored including, normality (Kolomogorov-Smirnov test), multi-collinearity (variance inflation factor (VIF) and tolerance) and homoscedasticity (regression plots; Field, 2013). Finally, mediation analysis was conducted to determine how

CSE, social support, self-esteem, and perceived barriers to LTPA mediate the association of LTPA and mental health among people with the SCI.

#### 3.4.1 Mediation analysis.

Multiple mediation analysis was conducted using Process for SPSS version 23, which use bootstrapping to test mediation. To check mediation, six different models were considered based on the possible permutations and combinations of variables of interest. All six models are explained in the Table 3.1 and are illustrated in Figures 3.1 to 3.6. Mediation analysis was conducted using bootstrapping method outlined by Hayes (2009). Bootstrapping resampling was repeated for a total of 5000 times (Hayes, 2009). Analyses provided coefficients and percentile confidence intervals of path a, b, direct ( $c'$ ), indirect and total effect (c) for all six models of mediation.

Different approaches had been used in the past to test mediation. The most popular method to test mediation is the *causal steps approach* popularized by Baron and Kenny (1986). This approach estimates each path between the independent, mediator and outcome variable. The effect of the independent variable on the proposed mediator and effect of the mediator on dependent variables is represented by path 'a' and 'b' respectively. The Direct effect ' $c'$ ' is the measure of influence of independent variable on outcome variable. Indirect effects (product of a and b) are the measure of influence of independent variable in the presence of proposed mediators. Total effects (c) of the independent variable on outcome variable is quantified as the sum of direct and indirect effects. Once each path is estimated, to ascertain whether the proposed mediator is functioning as a mediator or not, it is checked if  $c'$  is different from zero by a statistical significance criterion. If  $c'$  is significantly reduced

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in comparison to  $c$ , mediation is present. The causal steps approach has been criticized for 1) lowest in power and high type I error (Fritz & Mackinnon, 2007; Mackinnon, Lockwood, Hoffman, West & Sheets, 2002); and 2) does not quantify the specific effect of mediation rather infer it by the outcomes of a set of hypothesis tests (Hayes, 2009).

Another popular method to test mediation is *product of coefficient approach* (Sobel test). This test is frequently used as a supplement to the causal approach. The Sobel test does not provide any additional information regarding size or significance of the indirect effect. In the Sobel test standard error of  $a*b$  is used as a test statistic for testing the null hypothesis that the indirect effect is zero. The major flaw of Sobel test is that it is based on the assumption that the sampling distribution of the indirect effect is normal; whereas, the sampling distribution of  $ab$  tends to be asymmetric (Bollen & Stine, 1990; Stone & Sobel, 1990).

The distribution of products approach (Empirical M-test) is the third commonly used method to test mediation. This approach requires assistance to tables which makes it cumbersome (Hayes, 2009; Mackinnon et al., 2007). In Empirical M-test delta values are computed from sample values and these are then used to find the critical values of the product distribution in delta tables. These delta tables are available in increments of .4 and .2 for most delta values. Thus there is lack of exact critical value for any pair of delta values. Hayes (2009), advocated the use of bootstrapping as it generates a distribution of the indirect effect by treating the obtained sample of size as a representation of the population in miniature and requires no assumptions (Hayes, 2009). Bootstrapping measures the specific effect of mediation i.e. indirect effect of the independent variable on the outcome variable. Significant mediation is considered if the 95% confidence intervals for indirect

effects contain no zero. Bootstrapping is a popular method for mediation analysis thus, programs are available for data analysis software such as SPSS, SAS and R. In the current study data was analysed using bootstrapping approach and inferences about existence of mediation were made based on both causal approach (old school) and specific indirect effects (new school).

Table 3.1 Models of mediation.

	<b>Outcome (Y)</b>	<b>Predictor (X)</b>
Model A.1	Depression	Total physical activity
Model A.2	Depression	Leisure time physical activity
Model A.3	Depression	Household activity
Model B.1	Anxiety	Total physical activity
Model B.2	Anxiety	Leisure time physical activity
Model B.3	Anxiety	Household activity

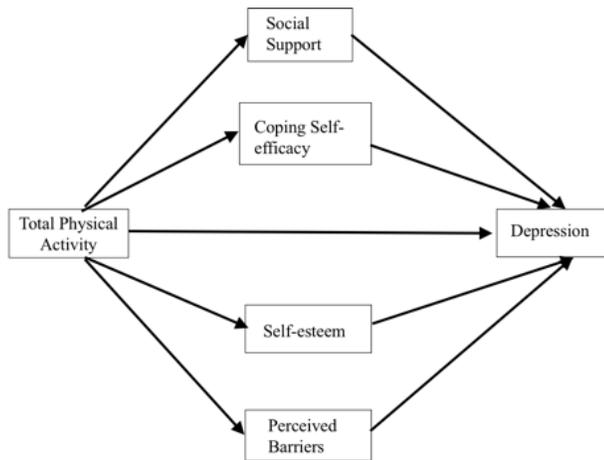


Figure 3.1 Model A.1

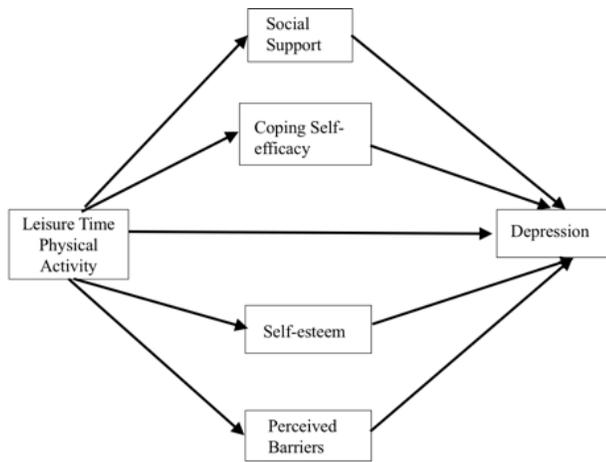


Figure 3.2 Model A.2.

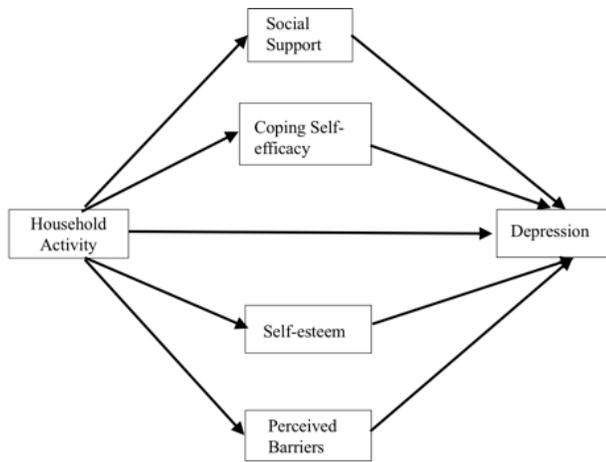


Figure 3.3 Model A.3.

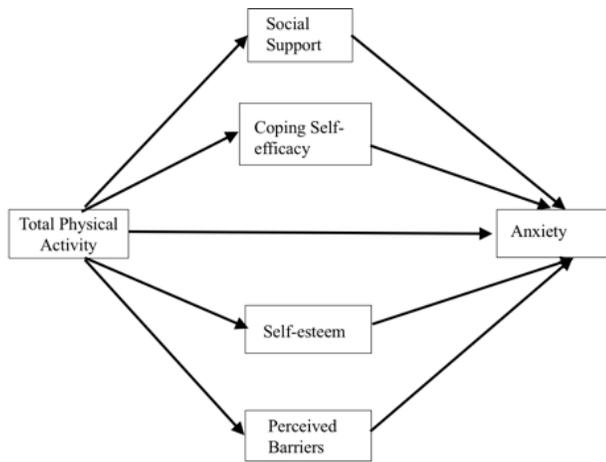


Figure 3.4 Model B.1.

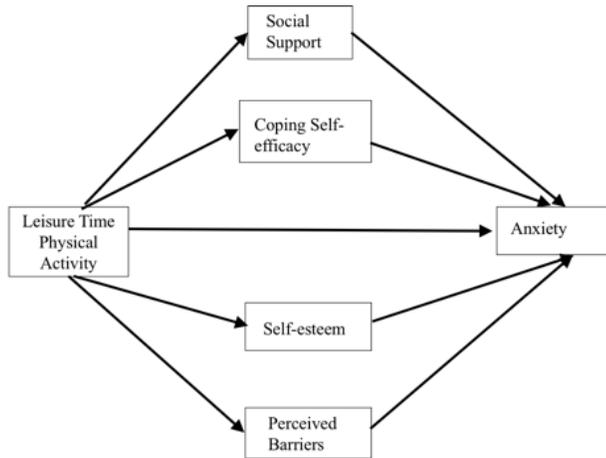


Figure 3.5 Model B.2

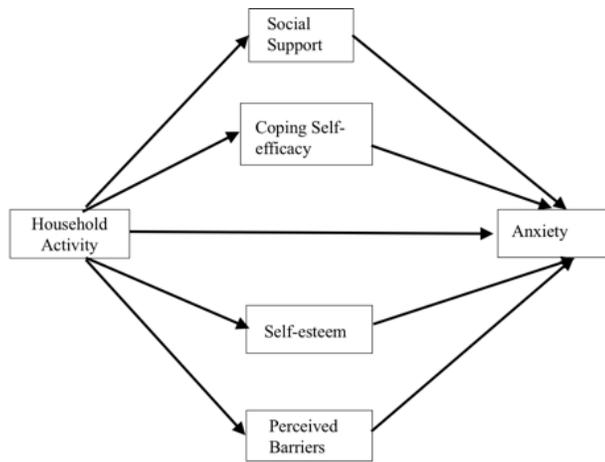


Figure 3.6 Model B.3

## **Chapter 4: Results**

The following chapter presents the results compiled for this study. First the descriptive analyses are discussed: socio-demographics, leisure time physical activity (LTPA), mental health (depression and anxiety), coping self-efficacy (CSE), social support, self-esteem and perceived barriers to LTPA. The results of the mediation analysis are presented to explore if the relationship of LTPA and mental health is mediated through CSE, social support, self-esteem and perceived barriers.

### **4.1 Descriptive Analysis**

#### **4.1.1 Response rate and missing data.**

Between November 2016 and March 2017, a total of 49 people participated in the study (28 online responses and 21 paper responses). Out of 200 paper copy surveys, 40 surveys were returned due to incorrect postal addresses and only 21 surveys were answered. The response rate for the paper copy of the questionnaire mailed by the NS SPI association to their clients was 10.5%. Data was screened for missing values and outliers. Nearly all the variables had some missing data (25% cases), but perceived barriers (i.e. Barriers to Health Promoting Activities for Disabled Persons Scale (BHADP) and social support (i.e. Interpersonal Support Evaluation List (ISEL) scales had 19 (45.2%) and 16 (38.1%) cases missing data, respectively. Where a respondent had completed 80 % or more of the scale items, the sum of the completed items was computed as the total score for that particular variable. Nine cases had more than 20 % missing data and were deleted. Thus, only 37 provided complete data on main variables, reducing the sample size to 37. No outliers were found.

#### 4.1.2 Sample description.

Descriptive statistics were performed to obtain sample characteristics for socio-demographic variables (see Table 4.1). One third of the sample population was male (75% male and 25% female). Mean age for the sample population was 55.7 years ( $SD = 14.49$ ;  $SE = 2.41$ ) and 18.9 years ( $SD = 13.47$ ;  $SE = 2.24$ ) was the average duration since injury. More than half of the sample population was tetraplegic (60% tetraplegic and 40% paraplegic). In this sample, 47.2% of the people with the SCI had some post-secondary education, 13.9 % had a university degree and 11.1 % had graduate degree which is higher than the average Canadian population (Statistics Canada, 2006). The majority of individuals with the SCI were married or had common-law partners (55.6%) prior to their injury and (50 %) after the SCI. It was interesting that number of people who were single / never married before the SCI (27.8%) reduced to half (13.9%) following the SCI, while at the same time there was a three times increase in the number of divorces reported following the SCI (5.6% before the SCI and 19.4% after the SCI). Employment statistics reveals that number of people who were working full time before the SCI (72.2%) reduced to less than one third after the SCI (22.2%). At the same time there was an increase in the number of people who reported being retired (16.7% before the SCI and 36.1% after the SCI) and unemployed (2.8 % before the SCI and 36.1% after the SCI) following injury. In terms of annual household income, over half of the sample received less than \$50,000 per year with the mode (25.7) being \$20,000 to \$29,999 annual household income per year.

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#### 4.1.3 Leisure time physical activity.

Participants were asked to report the number of days and the average hours per day spent in the different activities of leisure and household in the past 7 days. PASIPD scale items were scored on the 4-point Likert-scales (frequency: 0 = “never”, 1 = “seldom”, 2 = “sometimes”, 3 = “often”; duration: 0 = “never”, 1 = “less than 1 hour”, 2 = “1-2 hours”, 3 = “2-4 hours”, 4 = “more than 4 hours”). One item in the LTPA sub-scale (impact of the SCI on leisure participation) was dichotomous. Total PA score, LTPA score and household activity score range from 0 – 178, 0 – 92 and 0 – 86 respectively.

Overall, total physical activity score was closer to the lower end of the continuum ( $M = 36.4$ ;  $SD = 20.77$ ;  $SE = 3.46$ ; Table 4.2). On average, participation in household activities ( $M = 16.0$ ;  $SD = 11.78$ ;  $SE = 1.96$ ) was slightly lower than the LTPA ( $M = 20.3$ ;  $SD = 13.79$ ;  $SE = 2.29$ ). Predominance of sedentary behavior (static activities) was observed. For instance, per week frequency of participation static activities such as watching T.V ( $M = 3.8$ ;  $SD = 0.39$ ;  $SE = 0.06$ ) and hours spent per day in those static activities ( $M = 3.4$ ;  $SD = 0.65$ ;  $SE = 0.11$ ) had the highest mean scores among activities of leisure and household. Also, per week frequency of participation in activities of leisure and household is higher in comparison to the duration of participation in those activities per day. For example, frequency of lawn work in a week ( $M = 1.3$ ;  $SD = 0.71$ ;  $SE = 0.12$ ) was higher than the hours spend per day during lawn work ( $M = 0.6$ ;  $SD = 0.89$ ;  $SE = 0.15$ ). Also, 51.4% of sample population felt that SCI has reduced their frequency of participation in the leisure time activities.

#### 4.1.4 Mental health (depression and anxiety).

Pre-morbid depression and anxiety (i.e., prior to SCI) was assessed using the Ruff Neuro-behavioural Inventory (RUFF; Ruff & Hibbard, 2003) in order to screen for presence or absence of pre-morbid depression and anxiety. More than half of the sample had some anxiety and depression symptoms before they had SCI. Descriptive statistics revealed that 56.8 % and 54.1 % of the sample had taken treatment for anxiety and depression respectively. Over half of the respondent (59.5%) revealed that they had considered harming themselves during premorbid life. Other descriptive for pre-morbid depression and anxiety can be found in the Table 4.3.

To know their current mental health status respondents were asked to indicate how much the statements of DASS – 21 applied to them over the previous week related to depression and anxiety. Each response was scored using a 4-point Likert scale (1 = “did not apply to me at all”, 2 = “applied to me some degree for some of the time”, 3 = “applied to me to a considerable degree for good part of time”, 4 = “applied to me very much or most of the time”). Scores range from 7-28 for each subscale with greater scores indicating greater depression and anxiety. Participants on average reported a moderate level of depression ( $M = 14.2$ ;  $SD = 6.53$ ;  $SE = 1.07$ ; Table 4.4) and anxiety ( $M = 11.2$ ;  $SD = 4.16$ ;  $SE = 0.69$ ; Table 4.5). Depression is more severe in comparison to anxiety. At the same time depression and anxiety were found to be significantly, positively and highly correlated with each other ( $\rho = .666$ ;  $p = .001$ , Table 4.6). No significant correlation was found between mental health and LTPA (Depression:  $\rho = .185$ ;  $p = .273$ ; Anxiety:  $\rho = .246$ ;  $p = .148$ ), household work (Depression:  $\rho = .063$ ;  $p = .711$ ; Anxiety:  $\rho = .132$ ;  $p = .442$ ) or

total PA (Depression:  $\rho = .167$ ;  $p = .324$ ; Anxiety:  $\rho = .271$ ;  $p = .110$ ). Correlations for all variables can be found in the Table 4.6.

#### **4.1.5 Self-esteem.**

Respondents were asked to report their level of agreement or disagreement with the list of provided statement on a 4-point Likert scale (4 = “strongly agree”, 3 = “agree”, 2 = “disagree”, 1 = “strongly disagree”). Five out of the 10 items were reversed score. Total score range from 4 – 40, with higher scores indicating higher self-esteem. Overall, high self-esteem ( $M = 26.4$ ;  $SD = 5.09$ ;  $SE = 0.84$ ; Table 4.7) was reported by the sample population. Two items, “I have a number of good qualities” ( $M = 3.2$ ;  $SD = 0.77$ ;  $SE = 0.13$ ) and “I am a person of worth, at least on equal plane with others” ( $M = 2.9$ ;  $SD = 0.90$ ;  $SE = 0.15$ ) of the self-esteem scale were rated high in agreement in comparison to the other items. Self-esteem was significantly, negatively and moderately correlated to the depression ( $\rho = -.356$ ;  $p = .030$ ) and anxiety ( $\rho = -.429$ ;  $p = .009$ ). Self-esteem was not significantly correlated with LTPA ( $\rho = .055$ ;  $p = .975$ ), household work ( $\rho = .037$ ;  $p = .827$ ) or total PA ( $\rho = -.044$ ;  $p = .795$ ).

#### **4.1.6 Coping self-efficacy.**

Coping Self-Efficacy (CSE) was measured using a 26 item scale. Respondents were asked to rate their level of confidence or certainty on how they are going to act if things are not going well for them on an 11-point Likert type scale. Anchors for the 11-point response scale were 0 (‘cannot do at all’), 5 (‘moderately certain can do’) and 10 (‘certain can do’). CSE scores range from 0- 260, with higher scores indicating higher CSE. Participants reported moderate level of CSE ( $M = 156.5$ ;  $SD = 66.01$ ;  $SE = 10.85$ ; Table 4.8). CSE was

significantly, negatively and highly correlated with depression ( $\rho = -.722$ ;  $p = .001$ ) and anxiety ( $\rho = -.619$ ;  $p = .001$ ). CSE was not significantly correlated with LTPA ( $\rho = -.186$ ;  $p = .270$ ), household work ( $\rho = -.166$ ;  $p = .333$ ) or total PA ( $\rho = -.208$ ;  $p = .217$ ).

#### **4.1.7 Social support.**

Participants were asked to rate the statements of Interpersonal Support Evaluation List (ISEL) on a 4-point Likert scale (1 = “definitely false”, 2 = “probably false”, 3 = “probably true”, 4 = “definitely true”). One of the six items (finding someone to take care of their house) was reverse scored. Total scores range from 6 – 24, with higher scores indicating higher levels of perceived social support. Participants with the SCI reported low social support ( $M = 17.9$ ;  $SD = 4.81$ ;  $SE = 0.79$ ; Table 4.9). Social support scores indicate that participants were really confident about finding someone whose advice they can trust ( $M = 3.3$ ;  $SD = 0.92$ ;  $SE = 0.15$ ) but, they were not confident for having someone to take care of their house when they are not at home ( $M = 2.7$ ;  $SD = 1.08$ ;  $SE = 0.18$ ). Social support was found to be significantly, negatively and highly correlated to depression ( $\rho = -.575$ ;  $p = .001$ ) and moderately to anxiety ( $\rho = -.365$ ;  $p = .02$ ). No significant correlations were found between social support and any type of PA (LTPA:  $\rho = .028$ ;  $p = .670$ ; Household work  $\rho = -.239$ ;  $p = .155$ ; Total PA:  $\rho = -.098$ ;  $p = .563$ ).

#### **4.1.8 Perceived barriers.**

*Participants were asked how often they experience given items as barriers to their LTPA on a 4-point Likert scale (1 = “never”, 2 = “sometimes”, 3 = “often”, 4 = “routinely”).* Total scores range from 18 - 72, with higher scores indicating greater perceived barriers to LTPA. Overall scores reveal that sample perceived less barriers to LTPA ( $M = 36.1$ ;  $SD =$

8.14;  $SE = 1.30$ ; Table 4.10). Impairment ( $M = 2.8$ ;  $SD = 1.05$ ;  $SE = 0.17$ ) was reported as the most common barrier to participation in LTPA and difficulty with communication ( $M = 1.4$ ;  $SD = .60$ ;  $SE = 0.10$ ) as the least common. Perceived barriers to LTPA was significantly, positively and moderately correlated to the depression ( $\rho = .559$ ;  $p = .001$ ) and small-moderately positively correlated with anxiety ( $\rho = .319$ ;  $p = .056$ ), but this relation was not statistically significant. Perceived barriers to LTPA were not significantly correlated with LTPA ( $\rho = .306$ ;  $p = .065$ ), household work ( $\rho = .162$ ;  $p = .337$ ) or total PA ( $\rho = .272$ ;  $p = .103$ ).

## **4.2 Mediation Analysis**

### **4.2.1 Assumptions of mediation.**

To perform mediation analysis some statistical assumptions, need to be met. First, all the variables need to be normally distributed. To check this assumption Kolomogorov-Smirnov test was performed on all key variables. Kolomogorov-Smirnov test revealed that scores for depression (Table 4.4), total physical activity (Table 4.2), LTPA score (Table 4.2), PA in household activities (Table 4.2), CSE (Table 4.8), social support (Table 4.9), and perceived barriers (Table 4.10) were normally distributed for the sample. Self-esteem (Table 4.7) and anxiety scores (Table 4.5) were not normally distributed. A second assumption is that there should be little or no multi-collinearity between predictor variables (no perfect relationship between predictors). To check this assumption variance inflation factor (VIF) and tolerance ( $1/VIF$ ) were examined. VIF values greater than 10 (Myers, 1990) and tolerance values less than 0.2 (Menard, 1995) indicate multi-collinearity. No multi-collinearity was seen in sample (Table 4.11). Third, homoscedasticity (residuals at

each level of the predictors should have equal variances). To check this assumption, ZRESID (regression standardized residual value) was plotted against ZPRED (regression standardized predicted value). Graphs showed randomly dispersed points, which means assumption of homoscedasticity is met (Field, 2013).

#### **4.2.2 Inference of mediation analysis.**

In this study, mediation analysis was conducted using bootstrapping method outlined by Hayes (2009). Analyses provided coefficients and percentile confidence intervals of path a, b, direct, indirect and total effect for all six models of mediation analyzed in this study (Table 4.12). To determine mediation, two schools of thoughts exist: causal approach (old school) and indirect effects approach (new school). The old school of thought uses direct effect and total effect; for mediation to exist direct effect should reduce to zero and should be statistically significant (Baron & Kenny, 1986). The new school of thought on mediation analyses uses indirect effects; for mediation to exist these indirect effects should be significant (Hayes, 2009; Preacher & Hayes, 2008). Bootstrapping was used to conduct mediation analyses which is advocated by new school of thought; however, inferences regarding presences of mediation were made using both the new and old school approaches.

##### **4.2.2.1 Causal approach to mediation analysis (old school of thought).**

###### *Influence of independent variable on proposed mediators (path a).*

Path 'a' is the estimate of change in the proposed mediator when there is a unit change in the independent variable. In all six models of mediation, any of the physical activity score (total PA, LTPA or household activities) was not able to significantly predict any mediator (Table 4.12).

*Influence of proposed variable on the outcome variable (path b).*

Path 'b' is the estimate of change in the outcome variable when there is a unit change in the mediator. A common trend was observed in the models of mediation explored in this study. CSE was a significant predictor of anxiety, but not for depression. In all three models of mediation with anxiety as an outcome variable, a unit increase in CSE decreased the anxiety by 0.03 units (Model B.1:  $B = -0.03$ ,  $SE = 0.01$ ,  $t = -2.12$ ,  $p = .04$ ; Model B.2:  $B = -0.03$ ,  $SE = 0.01$ ,  $t = -2.23$ ,  $p = .03$ ; Model B.3:  $B = -0.03$ ,  $SE = 0.01$ ,  $t = -2.62$ ,  $p = .01$ ; Table 4.12). On the other hand, models of mediation with depression as the outcome variable, a unit increase in perceived barriers increased depression by 0.23 units on average (Model B.1:  $B = 0.24$ ,  $SE = 0.11$ ,  $t = 2.06$ ,  $p = .04$ ; Model B.2:  $B = 0.22$ ,  $SE = 0.11$ ,  $t = 2.02$ ,  $p = .05$ ; Model B.3:  $B = 0.24$ ,  $SE = 0.11$ ,  $t = 2.13$ ,  $p = .04$ ; Table 4.12).

*Influence of independent variable on outcome variable (Total effect – path c).*

Path c is the estimate of change in the outcome variable with a unit change in the independent variable. In all six models of mediation, any of the physical activity score (total PA, LTPA or household activities) was not able to significantly predict any mental health (depression or anxiety) variable (Table 4.12).

*Influence of independent variable on outcome variable (direct effect - path c').*

Path c' is the estimate of change in the outcome variable with a unit change in the independent variable when proposed mediators are controlled. So, path c' is same as path c but in c' the influence of mediators is controlled. In this study, in all six models of mediation none of the physical activity variables (total PA, LTPA or house-hold) were able to significantly predict mental health (depression or anxiety) variables (Table 4.12).

*Inferences from old school of thought.*

The first condition for mediation is that path a, b and c should be statistically significant. Second, when path a and b are controlled the previously significant path c should no longer be significant (path c'). Ideally path c' should be equal to zero to demonstrate strongest mediation but, in cases of multiple mediators a significant reduction in path c' is expected in comparison to path c (Baron & Kenny, 1986). In the present study path a and path c were not significant at all. Only path b for CSE and anxiety, and perceived barriers and depression was significant. Thus, in this study the first condition of mediation was not met. Path c' was small in comparison to path c (Table 4.12), but was not significant. Thus, according to old school of thought present study was not able to demonstrate any statistically significant mediation.

**4.2.2.2 Indirect approach to mediation analysis (new school of thought).**

*Indirect effect of independent variable on outcome variable.*

Indirect effect is the estimate of influence of the independent variable on the dependent variable through the mediators. It is expected that the independent variable remains constant and the proposed mediators vary to bring a unit change in the independent variable which in turn alters the outcome variable. In the present study, the indirect effects (Table 4.13) for any of the explored model of mediation were not significant.

*Inferences from new school of thought.*

Bootstrapped confidence intervals were used to check the significance of path a and b, but to determine mediation only the indirect effect of the independent variable on the outcome variable was examined. Significant mediation is considered if the 95% confidence

intervals for indirect effects contain no zero. All the explored models of mediation had zero in the confidence intervals for indirect effects (Table 4.13). Thus, according to new school of thought present study was not able to demonstrate any statistically significant mediation.

Table 4. 1 Socio-demographics of Sample.

Socio-Demographic Variables	% (n)	Socio-Demographic Variables	% (n)
<b>Gender</b>		<b>Household Income</b>	
Male	75 (27)	\$10,000 to \$ 19,999	22.9 (8)
Female	25 (9)	\$20,000 to \$ 29,999	25.7 (9)
<b>Level of Injury</b>		\$30,000 to \$39,999	2.9 (1)
Paraplegia	40 (12)	\$40,000 to \$ 49,999	17.1 (6)
Tetraplegia	60 (18)	\$50,000 to \$ 59,999	8.6 (3)
<b>Extent of Injury</b>		\$60,000 to \$79,000	11.4 (4)
Complete	35.3 (12)	\$80,000 to 99,999	5.7 (2)
Incomplete	64.7 (22)	More than 1,00,000	5.7 (2)
<b>Employment Status before injury</b>		<b>Current Employment Status</b>	
Full time	72.2 (26)	Full time	22.2 (8)
Part time	8.3 (3)	Part time	5.6 (2)
retired	16.7 (6)	Retired	36.1 (13)
unemployed	2.8 (1)	Unemployed	36.1 (13)
<b>Marital Status Before Injury</b>		<b>Current Marital Status</b>	
Single, never married	27.8 (10)	Single, never married	13.9(5)
Married or common law	55.6 (20)	Married or common law	50 (18)
Separated	5.6 (2)	Separated	2.8 (1)
Divorced	5.6 (2)	Divorced	19.4(7)
Widowed & currently single	5.6 (2)	Widowed & currently single	13.9(5)
<b>Level of Education</b>			
Elementary school	2.8 (1)		
High school certificate or equivalent	25 (9)		
Some postsecondary education	47.2(17)		
University degree	13.9 (5)		
Graduate degree	11.1 (4)		

Table 4. 2 Descriptive Statistics of Total Physical Activity, Leisure Time Physical Activity, and Household Activities.

Variables	M	SD	SE	Z <sub>skewness</sub>	Z <sub>kurtosis</sub>	K-S test <sup>a</sup>
<b>Total PA Score <sup>d</sup></b>	36.4	20.77	3.46	0.87	-0.46	D <sub>(36)</sub> = .077
<b>Leisure Time Physical Activity (LTPA)</b>						
Frequency of static activities <sup>b</sup>	3.8	0.39	0.06	-4.27	1.03	D <sub>(35)</sub> = .502
Duration of static activities <sup>c</sup>	3.4	0.65	0.11	-1.95	-0.05	D <sub>(35)</sub> = .323
Frequency of wheeling and walking outside <sup>b</sup>	2.8	0.89	0.15	-0.39	-1.18	D <sub>(35)</sub> = .213
Duration of wheeling and walking outside <sup>c</sup>	2.0	1.18	0.19	0.12	-1.17	D <sub>(35)</sub> = .178
Frequency of light sport or recreational activities <sup>b</sup>	1.6	0.99	0.16	3.48	0.83	D <sub>(35)</sub> = .388
Duration of light sport or recreational activities <sup>c</sup>	0.9	0.91	0.14	1.48	-0.75	D <sub>(35)</sub> = .230
Frequency of moderate sport or recreational activities <sup>b</sup>	1.1	0.31	0.05	6.58	6.44	D <sub>(35)</sub> = .524
Duration of moderate sport or recreational activities <sup>c</sup>	0.5	0.86	0.13	4.85	4.20	D <sub>(35)</sub> = .378
Frequency of strenuous sport or recreational activities <sup>b</sup>	1.5	1.00	0.17	4.65	2.65	D <sub>(35)</sub> = .419
Duration of strenuous sport or recreational activities <sup>c</sup>	0.7	0.84	0.14	2.37	-0.11	D <sub>(35)</sub> = .311
Frequency of strengthening and endurance exercises <sup>b</sup>	1.5	0.93	0.16	4.47	2.68	D <sub>(35)</sub> = .384
Duration of strengthening and endurance exercises <sup>c</sup>	0.7	0.76	0.13	1.33	-1.45	D <sub>(35)</sub> = .270
<b>Total LTPA Score <sup>e</sup></b>	20.38	13.79	2.29	1.31	-0.61	D <sub>(36)</sub> = .113
<b>Household Activities (HHA)</b>						
Frequency of light housework <sup>b</sup>	2.8	1.16	0.19	-1.14	-1.72	D <sub>(34)</sub> = .247
Duration of light housework <sup>c</sup>	1.7	1.07	0.18	1.12	-0.05	D <sub>(34)</sub> = .224
Frequency of heavy housework <sup>b</sup>	1.6	0.90	0.15	3.18	0.95	D <sub>(34)</sub> = .345
Duration of heavy housework <sup>c</sup>	0.9	1.10	0.19	3.32	1.86	D <sub>(34)</sub> = .244
Frequency of home repairs <sup>b</sup>	1.1	0.44	0.07	7.17	10.36	D <sub>(34)</sub> = .514
Duration of home repairs <sup>c</sup>	0.3	0.53	0.09	3.11	0.70	D <sub>(34)</sub> = .403
Frequency of lawn work <sup>b</sup>	1.3	0.71	0.12	5.98	6.98	D <sub>(34)</sub> = .449
Duration of lawn work <sup>c</sup>	0.6	0.89	0.15	3.46	1.27	D <sub>(34)</sub> = .348
Frequency of outdoor gardening <sup>b</sup>	1.1	0.40	0.07	9.31	18.45	D <sub>(34)</sub> = .525
Duration of outdoor gardening <sup>c</sup>	0.3	0.62	0.11	4.63	2.79	D <sub>(34)</sub> = .443
Frequency of caring for another person <sup>b</sup>	1.8	1.17	0.19	2.96	-0.39	D <sub>(34)</sub> = .344
Duration of caring for another person <sup>c</sup>	1.3	1.46	0.24	1.97	-0.98	D <sub>(34)</sub> = .224
Frequency of paid or volunteer work <sup>b</sup>	1.5	1.04	0.18	4.13	1.40	D <sub>(34)</sub> = .438
Duration of paid or volunteer work <sup>c</sup>	0.9	1.32	0.23	3.36	0.61	D <sub>(34)</sub> = .337
<b>Total HHA Score <sup>f</sup></b>	16.0	11.78	1.96	2.53	1.68	D <sub>(36)</sub> = .124

\*  $p < .05$

<sup>a</sup> Kolomogorov-Smirnov test; <sup>b</sup> 0 = “never”, 1 = “seldom”, 2 = “sometimes”, 3 = “often”; <sup>c</sup> 0 = “never”, 1 = “less than 1 hour”, 2 = “1-2 hours”, 3 = “2-4 hours”, 4 = “more than 4 hours”; <sup>d</sup> score range from 0 – 178, higher scores indicating higher physical activity.; <sup>e</sup> score range from 0 – 92, higher scores indicating higher LTPA.; <sup>f</sup> score range from 0 – 86, higher scores indicating higher physical activity.

Table 4. 3 Descriptive Statistics of Pre-injury Depression and Anxiety.

<b>Pre-injury Depression</b>	<b>Yes</b>	<b>No</b>	<b>Pre-injury Anxiety</b>	<b>Yes</b>	<b>No</b>
Lost interest in sexual activity	56.8	43.2	I received treatment for anxiety	56.8	43.2
Slept most of the day	62.2	37.8	Worried excessively	56.8	43.2
Never suffered from periods of depression	43.2	54.1	Panic in situations where others do not	54.1	45.9
Never considered harming myself	40.5	59.5	Worried uncontrollably	59.5	40.5
Received treatment for depression	54.1	45.9	Would get so nervous that I felt frozen	45.9	54.1
Suffered from periods of deep sadness	59.5	40.5	I was told I could be easily stressed	59.5	40.1

Table 4. 4 Descriptive Statistics of Depression.

<b>Depression</b>	<b>M</b>	<b>SD</b>	<b>SE</b>	<b>Z<sub>skewness</sub></b>	<b>Z<sub>kurtosis</sub></b>	<b>K-S test <sup>a</sup></b>
Felt downhearted and blue <sup>b</sup>	2.3	1.05	0.17	1.08	-1.25	D <sub>(36)</sub> = .252
Nothing to look forward <sup>b</sup>	2.1	1.09	0.18	1.21	-1.40	D <sub>(36)</sub> = .217
Felt that life was meaningless <sup>b</sup>	1.7	1.03	0.17	2.84	0.01	D <sub>(36)</sub> = .327
Felt I wasn't worth much as a person <sup>b</sup>	1.9	1.14	0.18	2.27	-0.85	D <sub>(36)</sub> = .253
Unable to be enthusiastic <sup>b</sup>	2.0	1.02	0.16	1.39	-1.14	D <sub>(36)</sub> = .216
No positive feeling at all <sup>b</sup>	1.8	.980	0.16	2.52	-0.08	D <sub>(36)</sub> = .294
Difficult to take initiatives <sup>b</sup>	2.2	1.09	0.18	0.92	-1.51	D <sub>(36)</sub> = .221
<b>Total Depression Score <sup>c</sup></b>	<b>14.2</b>	<b>6.53</b>	<b>1.07</b>	<b>1.54</b>	<b>-1.00</b>	<b>D<sub>(36)</sub> = .077</b>

\*  $p < .05$

<sup>a</sup> Kolmogorov-Smirnov test

<sup>b</sup> 1 = "did not apply to me at all", 2 = "applied to me some degree for some of the time", 3 = "applied to me to a considerable degree for good part of time", 4 = "applied to me very much or most of the time".

<sup>c</sup> score range from 7 – 28, higher score indicating higher depression.

Table 4. 5 Descriptive Statistics of Anxiety.

Anxiety	M	SD	SE	Z <sub>skewness</sub>	Z <sub>kurtosis</sub>	K-S test <sup>a</sup>
Aware of increased heart rate <sup>b</sup>	1.6	0.89	0.15	3.95	2.50	D <sub>(36)</sub> = .317
Aware of dryness of mouth <sup>b</sup>	2.0	1.24	0.20	1.60	-1.75	D <sub>(36)</sub> = .322
Experience difficulty in breathing <sup>b</sup>	1.4	0.84	0.14	5.09	4.35	D <sub>(36)</sub> = .423
Experienced trembling <sup>b</sup>	1.6	0.90	0.15	3.49	1.26	D <sub>(36)</sub> = .362
Worried about situations <sup>b</sup>	1.5	0.87	0.14	4.21	2.50	D <sub>(36)</sub> = .393
Close to panic <sup>b</sup>	1.4	0.65	0.10	3.05	0.47	D <sub>(36)</sub> = .391
Scared without any good reason <sup>b</sup>	1.5	0.81	0.13	3.67	1.71	D <sub>(36)</sub> = .382
<b>Total Anxiety Score <sup>c</sup></b>	11.2	4.16	0.69	1.76	-0.77	D <sub>(36)</sub> = .176*

\*  $p < .007$

<sup>a</sup> Kolomogorov-Smirnov test

<sup>b</sup> 1 = “did not apply to me at all”, 2 = “applied to me some degree for some of the time”, 3 = “applied to me to a considerable degree for good part of time”, 4 = “applied to me very much or most of the time”.

<sup>c</sup> score range from 7 – 28, higher score indicating higher anxiety

Table 4. 6Bivariate Correlations

Variables	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Age	.06	-.30	.34	.11	-.17	-.37*	.48**	.50**	-.02	.18	-.25	-.37*	-.32	-.01	-.17	.08	-.26	-.17	-.11
2. Gender		-.19	.17	.12	.30	.31	-.10	-.12	.13	.08	.26	.00	.22	-.10	-.03	.00	-.20	.08	-.03
3. Level of Injury			-.32	-.18	.00	.16	-.21	-.32	-.18	.03	-.04	.50**	.19	.03	.09	-.15	.31	-.12	.14
4. Extent of Injury				-.10	-.08	.15	.40*	.18	.07	.08	.04	-.20	-.05	.15	.34	-.29	.19	.30	-.02
5. Duration of Injury					-.24	-.38*	-.42*	-.02	-.07	.01	.03	-.19	-.06	-.17	-.06	.25	-.22	-.03	.18
6. Annual Income						.56**	-.13	-.23	.11	-.10	.26	-.07	.14	.06	.00	.12	-.29	.10	-.12
7. Educational Status							-.22	-.35*	.27	-.20	.28	.24	.32	-.01	.26	-.09	.11	.05	-.20
8. Partnership Status Before Injury								.61**	-.20	.26	.00	-.05	-.04	.17	.03	-.24	.14	-.08	.00
9. Current Partnership Status									-.19	-.03	.09	-.15	-.00	.10	.04	.01	-.05	.00	.05
10. Employment Status Before Injury										-.27	.02	.04	.08	-.10	.17	.09	-.07	.09	-.22
11. Current Employment Status											.00	-.04	-.05	.22	.17	-.06	.05	.01	.25
12. LTPA												.38*	.87**	.19	.25	-.19	.06	.05	.31
13. Housework													.76**	.06	.13	-.16	.28	.01	.16
14. Total Physical Activity														.17	.27	-.21	.17	.06	.27
15. Depression															.67**	-.72**	.48**	.37*	.56**
16. Anxiety																-.62**	.36*	.36*	.32
17. Coping Self-Efficacy																	-.64**	-.39*	-.54**
18. Social Support																		.28	.29
19. Self-Esteem																			
20. Perceived Barriers																			.13

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Table 4. 7 Descriptive Statistics of Self-Esteem.

Self-Esteem	M	SD	SE	Z <sub>skewness</sub>	Z <sub>kurtosis</sub>	K-S test <sup>a</sup>
I am satisfied with myself <sup>d</sup>	2.2	0.80	0.13	1.22	0.09	D <sub>(35)</sub> = .293
I think I am not good at all <sup>b, d</sup>	2.5	1.02	0.17	-0.18	-1.40	D <sub>(35)</sub> = .193
I have a number of good qualities <sup>d</sup>	1.8	0.83	0.13	3.18	2.30	D <sub>(35)</sub> = .310
Able to do things like others <sup>d</sup>	2.5	0.94	0.15	0.28	-1.04	D <sub>(35)</sub> = .238
Have not too much to be proud of <sup>b, d</sup>	2.5	1.01	0.16	-0.27	-1.36	D <sub>(35)</sub> = .193
Feel useless at times <sup>b, d</sup>	2.5	1.07	0.17	-0.10	-1.59	D <sub>(35)</sub> = .205
I am a person of worth <sup>d</sup>	1.9	0.89	0.14	2.03	0.17	D <sub>(35)</sub> = .271
Wish to have respect for myself <sup>b, d</sup>	2.5	0.98	0.16	-0.75	-1.17	D <sub>(35)</sub> = .279
I feel I am a failure <sup>b, d</sup>	2.5	1.11	0.18	0.14	-1.77	D <sub>(35)</sub> = .185
Positive attitude toward myself <sup>d</sup>	2.2	1.00	0.16	1.05	-1.09	D <sub>(35)</sub> = .229
<b>Total Self-esteem Score</b> <sup>c</sup>	23.4	5.15	0.84	-1.37	1.58	D <sub>(36)</sub> = .174*

\*  $p < .007$

<sup>a</sup> Kolomogorov-Smirnov test

<sup>b</sup> reversed score

<sup>c</sup> score range from 0 – 30, with higher scores indicating higher self-esteem

<sup>d</sup> 3 = strongly agree, 2 = agree, 1 = disagree, 0 = strongly disagree

Table 4. 8 Descriptive Statistics of Coping Self-Efficacy.

Coping Self-efficacy (CSE)	M	SD	SE	Z <sub>skewness</sub>	Z <sub>kurtosis</sub>	K-S test <sup>a</sup>
Keep from getting in dumps <sup>b</sup>	5.8	2.60	0.42	-0.05	-0.61	D <sub>(35)</sub> = .141
Talk positively to yourself <sup>b</sup>	6.2	2.73	0.44	-0.21	-1.78	D <sub>(35)</sub> = .137
Sort out things <sup>b</sup>	6.3	2.77	0.45	-0.77	-1.28	D <sub>(35)</sub> = .166
Get emotional support <sup>b</sup>	6.5	3.35	0.55	-1.02	-1.76	D <sub>(35)</sub> = .216
Find solutions for problems <sup>b</sup>	6.8	2.65	0.44	-1.95	-0.27	D <sub>(35)</sub> = .159
Break problems into parts <sup>b</sup>	6.3	2.96	0.48	-1.46	-0.99	D <sub>(35)</sub> = .173
Consider options during stress	6.4	2.95	0.48	-1.28	-1.15	D <sub>(35)</sub> = .144
Make a plan of action <sup>b</sup>	6.2	2.88	0.48	-0.36	-1.74	D <sub>(35)</sub> = .145
Develop new hobbies <sup>b</sup>	5.4	3.48	0.57	-0.27	-2.02	D <sub>(35)</sub> = .175
Mind off unpleasant thoughts <sup>b</sup>	5.8	3.07	0.50	-0.72	-1.45	D <sub>(35)</sub> = .150
Look for positivity <sup>b</sup>	6.3	2.86	0.47	-1.43	-0.92	D <sub>(35)</sub> = .168
Keep from feeling sad <sup>b</sup>	5.7	3.11	0.51	-0.36	-1.57	D <sub>(35)</sub> = .155
Consider other's view point <sup>b</sup>	6.5	2.36	0.38	-1.05	-0.86	D <sub>(35)</sub> = .194
Try multiple solutions <sup>b</sup>	6.7	2.66	0.43	-1.93	-0.01	D <sub>(35)</sub> = .180
Keep yourself from being upset <sup>b</sup>	5.6	2.99	0.49	-0.23	-1.68	D <sub>(35)</sub> = .165
Make new friends <sup>b</sup>	6.5	3.20	0.52	-1.28	-1.32	D <sub>(35)</sub> = .206
Get friends to help <sup>b</sup>	6.3	3.35	0.55	-1.59	-1.26	D <sub>(35)</sub> = .190
Do something positive <sup>b</sup>	5.7	3.19	0.52	-0.54	-1.63	D <sub>(35)</sub> = .180
Make unpleasant thoughts go away <sup>b</sup>	5.4	2.83	0.46	0.09	-1.52	D <sub>(35)</sub> = .154
Think about part of problem <sup>b</sup>	5.4	3.18	0.52	-0.59	-1.32	D <sub>(35)</sub> = .134
Visualize pleasant things <sup>b</sup>	6.1	3.23	0.53	-1.18	-1.44	D <sub>(35)</sub> = .170
Keep yourself from feeling lonely <sup>b</sup>	5.5	3.47	0.57	-0.01	-2.02	D <sub>(35)</sub> = .198
Pray or meditate <sup>b</sup>	5.3	3.53	0.58	0.03	-1.86	D <sub>(35)</sub> = .162
Get emotional support <sup>b</sup>	4.3	3.10	0.51	1.35	-1.03	D <sub>(35)</sub> = .134
Fight for what you want <sup>b</sup>	6.3	3.17	0.52	-0.99	-1.56	D <sub>(35)</sub> = .153
Resist the impulse to act hastily <sup>b</sup>	6.3	2.85	0.46	-0.64	-1.82	D <sub>(35)</sub> = .230
<b>Total CSE Score<sup>c</sup></b>	156.5	66.01	10.85	-0.69	-1.33	D <sub>(36)</sub> = .105

\*  $p < .05$

<sup>a</sup> Kolmogorov-Smirnov test

<sup>b</sup> 0 = cannot do at all, 5 = moderately certain can do, 10 = certain can do

<sup>c</sup> score range from 0 – 260, higher score indicating higher coping self-efficacy

Table 4. 9 Descriptive Statistics of Social Support.

<b>Interpersonal Support Evaluation List (ISEL)</b>	<b>M</b>	<b>SD</b>	<b>SE</b>	<b>Z<sub>skewness</sub></b>	<b>Z<sub>kurtosis</sub></b>	<b>K-S test <sup>a</sup></b>
Several people to talk <sup>b</sup>	2.1	1.16	0.19	1.43	-1.53	D <sub>(36)</sub> = .233
Meet or talk with others <sup>b</sup>	1.9	1.16	0.19	1.86	-1.38	D <sub>(36)</sub> = .303
Someone to help <sup>b</sup>	2.1	1.17	0.19	0.99	-1.86	D <sub>(36)</sub> = .278
Take suggestion for problems <sup>b</sup>	2.0	1.08	0.17	1.80	-1.06	D <sub>(36)</sub> = .264
Someone to take care of my house <sup>b</sup>	2.7	1.10	0.18	-0.74	-1.61	D <sub>(36)</sub> = .191
Have someone to trust <sup>b</sup>	1.5	0.89	0.14	3.64	1.43	D <sub>(36)</sub> = .362
<b>Total ISEL Score <sup>c</sup></b>	12.5	4.84	0.79	1.78	-0.42	D <sub>(36)</sub> = .146*

\*  $p < .051$

<sup>a</sup> Kolomogorov-Smirnov test

<sup>b</sup> 1 = definitely false, 2 = probably false, 3 = probably true, 4 = definitely true

<sup>c</sup> scores range from 6 – 24, with higher scores indicating higher levels of perceived social support

Table 4. 10 Descriptive Statistics of Perceived Barriers to LTPA.

Perceived Barriers	M	SD	SE	Z <sub>skewness</sub>	Z <sub>kurtosis</sub>	K-S test <sup>a</sup>
Lack of convenient facilities <sup>b</sup>	2.3	.93	.15	0.81	-0.82	D <sub>(29)</sub> = .268
Too tired <sup>b</sup>	2.3	.70	.11	1.09	0.40	D <sub>(29)</sub> = .358
Lack of transportation <sup>b</sup>	2.0	1.27	.21	1.64	-1.80	D <sub>(29)</sub> = .400
Feeling what I do doesn't help <sup>b</sup>	2.0	.90	.15	0.97	-0.91	D <sub>(29)</sub> = .219
Lack of money <sup>b</sup>	2.2	1.03	.17	1.34	-0.98	D <sub>(29)</sub> = .290
Impairment <sup>b</sup>	2.8	1.05	.17	-0.55	-1.59	D <sub>(29)</sub> = .223
No one to help me <sup>b</sup>	2.0	.92	.15	1.29	-0.67	D <sub>(29)</sub> = .229
Not interested <sup>b</sup>	2.1	.81	.13	1.61	0.43	D <sub>(29)</sub> = .299
Lack of information <sup>b</sup>	1.8	.80	.13	2.24	1.06	D <sub>(29)</sub> = .295
Embarrassed with appearance <sup>b</sup>	2.1	1.03	.17	1.75	-0.75	D <sub>(29)</sub> = .286
Concern about safety <sup>b</sup>	1.9	.68	.11	1.65	1.82	D <sub>(29)</sub> = .367
Lack of support <sup>b</sup>	1.6	.85	.14	2.53	-0.04	D <sub>(29)</sub> = .321
Interferes with responsibilities <sup>b</sup>	1.8	.96	.15	2.10	-0.40	D <sub>(29)</sub> = .262
Lack of time <sup>b</sup>	1.5	.80	.13	3.82	1.91	D <sub>(29)</sub> = .368
Can't do things correctly <sup>b</sup>	1.9	.98	.16	2.52	0.20	D <sub>(29)</sub> = .287
Difficulty with communication <sup>b</sup>	1.4	.60	.10	2.47	0	D <sub>(29)</sub> = .382
Bad weather <sup>b</sup>	2.3	1.03	.17	1.30	-1.14	D <sub>(29)</sub> = .321
Help from health professionals <sup>b</sup>	1.8	.82	.13	1.49	-0.49	D <sub>(29)</sub> = .261
<b>Total Perceived Barriers Score<sup>c</sup></b>	<b>36.1</b>	<b>8.14</b>	<b>1.3</b>	<b>0.44</b>	<b>-0.77</b>	<b>D<sub>(36)</sub> = .088</b>

\*  $p < .05$

<sup>a</sup> Kolomogorov-Smirnov test

<sup>b</sup> 1 = never, 2 = sometimes, 3 = often, 4 = routinely

<sup>c</sup> score range from 18 - 72, with higher scores indicating greater perceived barriers

Table 4. 11 Collinearity Statistics.

<b>Variable</b>	<b>Tolerance</b>	<b>VIF<sup>a</sup></b>
Leisure Time Physical Activity	.883	1.133
Household Activities	.868	1.151
Total Physical Activity	.862	1.161
Coping Self-Efficacy	.389	2.573
Social Support	.625	1.600
Self-Esteem	.674	1.484
Perceived Barriers	.742	1.347

<sup>a</sup> = Variance inflation factor

Table 4. 12 Path coefficients for multiple mediation analysis.

Path and Model	B	SE B	t	p	B	SE B	t	p
<b>Model A.1</b>				<b>Model B.1</b>				
Total PA to mediators (path a)								
CSE	-0.80	0.54	-1.47	.14	-0.93	0.53	-1.75	.08
SS	-0.02	0.04	-0.53	.59	-0.03	0.04	-0.88	.38
SE	0.02	0.04	0.51	.61	0.01	0.04	0.38	.70
PB	0.12	0.06	1.94	.06	0.13	0.06	1.90	.06
Mediators to depression / anxiety (path b)								
CSE	-0.03	0.02	-1.57	.12	-0.03	0.01	-2.12*	.04
SS	-0.16	0.24	-0.66	.51	0.13	0.17	0.75	.45
SE	-0.29	0.20	-1.46	.15	-0.18	0.12	-1.15	.13
PB	0.24	0.11	2.06*	.04	-0.01	0.07	-0.13	.89
Total effect of PA on depression / anxiety (path c)	.05	0.05	0.97	0.33	0.04	0.03	1.20	.21
Direct effect of PA on depression / anxiety (path c')	-.00	0.04	-0.09	0.92	0.02	0.04	0.61	.54
<b>Model A.2</b>				<b>Model B.2</b>				
LTPA to mediators (path a)								
CSE	-0.73	0.81	-0.91	.36	-0.98	0.80	-1.22	.22
SS	0.01	0.05	0.26	.79	-0.01	0.04	-0.22	.81
SE	0.01	0.06	0.13	.89	-0.00	0.07	-0.07	.99
PB	0.18	0.12	1.51	.12	0.19	0.12	1.50	.12
Mediators to depression / anxiety (path b)								
CSE	-0.03	0.02	-1.46	.15	-0.03	0.01	-2.23*	.03
SS	-0.18	0.23	-0.76	.45	0.11	0.19	0.59	.55
SE	-0.30	0.20	-1.50	.14	-0.17	0.11	-1.50	.14
PB	0.22	0.11	2.02*	.05	-0.01	0.08	-0.20	.83
Total effect of LTPA on depression / anxiety (path c)	0.08	0.07	1.15	.25	0.07	0.06	1.20	.23
Direct effect of LTPA on depression / anxiety (path c')	0.02	0.04	0.58	.56	0.04	0.08	0.55	.58
<b>Model A.3</b>				<b>Model B.3</b>				
Household activities to mediators (path a)								
CSE	-1.51	0.92	-1.62	.11	-1.56	0.93	-1.68	.10
SS	-0.09	0.10	-0.91	.36	-0.10	0.10	-0.98	.33
SE	0.05	0.07	0.74	.46	0.05	0.07	0.70	.48
PB	0.13	0.11	1.22	.23	0.13	0.11	1.21	.23
Mediators to depression / anxiety (path b)								
CSE	-0.03	0.02	-1.69	.10	-0.03	0.01	-2.62*	.01
SS	-0.16	0.26	-0.65	.51	0.14	0.15	0.94	.35
SE	-0.27	0.20	-1.30	.18	-0.17	0.17	-1.56	.12
PB	0.24	0.11	2.13*	.04	0.01	0.01	0.07	.94
Total effect of household activities on depression / anxiety (path c)	0.04	0.09	0.44	.66	0.05	0.05	0.81	.42
Direct effect of household activities on depression / anxiety (path c')	-0.04	0.08	-0.52	.60	0.01	0.01	0.38	.70

\*  $p < .05$ ; CSE = coping self-efficacy; SS = social support; SE = self-esteem; PB = perceived barriers

Table 4. 13 Bootstrap results for indirect effects in the multiple mediation analyses.

Mediator	Depression (N = 37)				Anxiety (N = 36)			
	Point Coefficient	Standard Error	Confidence Interval		Point Estimate	Standard Error	Confidence Interval	
			Lower	Upper			Lower	Upper
<b>Model A.1 (Total physical activity)</b>				<b>Model B.1 (Total physical activity)</b>				
CSE	0.028	0.0272	-.0135	.0957	0.0310	0.0219	-.0091	.0770
SS	0.003	0.0114	-.0219	.0270	-0.005	0.0117	-.0328	.0139
SE	-0.006	0.0143	-.0433	.0148	-0.0031	0.0094	-.0265	.0125
PB	0.030	0.247	-.0070	.0928	-0.0012	0.0103	-.0216	.0227
<b>Total</b>	<b>0.056</b>	<b>0.0454</b>	<b>-.0338</b>	<b>.1485</b>	<b>0.0218</b>	<b>0.0264</b>	<b>-.0136</b>	<b>.0732</b>
<b>Model A.2 (LTPA)</b>				<b>Model B.2 (LTPA)</b>				
CSE	0.0246	0.0336	-.0283	.1065	0.0334	0.0323	-.0155	.1071
SS	-0.0027	0.0159	-.0425	.0245	-0.0013	0.0117	-.0306	.0192
SE	-0.0029	0.0238	-.606	.0422	0.0000	0.0133	-.0350	.0214
PB	-0.0430	0.0385	-.0039	.1417	-0.0035	0.0176	-.0378	.0386
<b>Total</b>	<b>0.0620</b>	<b>0.0687</b>	<b>-.0662</b>	<b>.2053</b>	<b>-0.0286</b>	<b>0.0397</b>	<b>-.0413</b>	<b>.1160</b>
<b>Model A.3 (Household activities)</b>				<b>Model B.3 (Household activities)</b>				
CSE	0.0562	0.0548	-.0341	.1855	0.0544	0.0397	-.0229	.1339
SS	0.0163	0.0323	-.0659	.0700	-0.0148	0.0289	-.0813	.0338
SE	-0.0145	0.0268	-.0855	.1293	-0.0090	0.0162	-.0460	.0195
PB	0.0328	0.0382	-.0196	.0218	0.0006	0.0116	-.0199	.0294
<b>Total</b>	<b>0.0908</b>	<b>0.0914</b>	<b>-.1161</b>	<b>.2566</b>	<b>0.0312</b>	<b>0.0471</b>	<b>-.0762</b>	<b>.1155</b>

CSE = coping self-efficacy; SS = social support; SE = self-esteem; PB = perceived barriers

## **Chapter 5: Discussion**

The purpose of this survey based study was to explore the level of participation in leisure time physical activity (LTPA) among people with the Spinal Cord Injury (SCI), explore LTPA's association with mental health, and to know how this relationship is mediated through coping self-efficacy, social support, self-esteem and perceived barriers. In this chapter results addressing the research questions are discussed. The strengths and limitations of the present study, future recommendations and implications for researchers and practitioners are also discussed.

### **5.1 Level of LTPA Participation**

In the present study both LTPA and participation in household activities were measured. Overall, in this sample participation in any type of physical activity (PA) was low. More than half of the sample was not participating at all in any kind of LTPA or household PA. Lack of participation in LTPA is consistent with the findings of Martin Ginis et al. (2010) who reported 50.1% of people with the SCI do not participate in any kind of LTPA. Sedentary behavior was predominant in the sample: more than 80% of the sample was engaged in sedentary activities (reading, watching T.V, computer games) for at least 3-4 days in a week for more than 4 hours per day. Similar trends had been reported regarding sedentary behavior in the SCI population. Findings from the present study were comparable to Perrier & Martin Ginis (2016) and Latimer et al. (2006) who respectively reported 84% and 76% of their sample was inactive.

## **5.2 Mental Health (Depression and Anxiety)**

The sample in this study reported moderate to severe levels of depression and anxiety. Both mental health variables were found to be highly correlated with each other, but depression was more common and severe in the sample. Prevalence of depression (60%) and anxiety (53%) in the present sample was higher than that found in previous studies exploring depression and anxiety (18-25%) after the SCI (Fann et al., 2011; Fullerton, Harvey, Klein & Howell, 1981; Hancock et al., 1993; Hoffman et al., 2011). These studies explored depression within one year of the SCI or a maximum up to 5 years post SCI. Findings of the present study were somewhat comparable to those who studied depression and anxiety among community living people with the SCI and found a prevalence of 30-60% (MacDonald, Nielson & Cameron, 1987; Krause et al., 2000; Migliorini et al., 2008). Findings may suggest higher mental health issues among community dwelling persons with the SCI.

## **5.3 Relationship of Mental Health and LTPA**

The purpose of this study was to explore the relationship between mental health variables and LTPA. To know if the relationship to mental health is different with PA in household activities, data was also analyzed to determine the association of mental health with household activities and total PA. No significant association between mental health variables and PA (LTPA, household activities or total PA) was found. Findings from the present study were not consistent with those who studied the relationship of LTPA and mental health in the able-bodied populations, the SCI population, or other disabilities including Multiple Sclerosis, Muscular Dystrophy and Post-Polio Syndrome (Stephens, 1988; Muraki et al., 2000; Gioia et al., 2006; Asztalos et al., 2009; Rosenberg, Bombardier, Artherholt, Jensen, & Motl, 2013). These studies reported a negative

association between LTPA and mental health; higher involvement in LTPA was associated with low rates of depression and anxiety. Reasons for the inconsistency in the findings could be small sample size of the present study or lack of sensitive tools to measure LTPA. Almost all of the studies measured LTPA/PA levels by asking open ended questions regarding the frequency or duration of participation. Only one study (Rosenberg et al., 2013) used standardized tools to measure LTPA/PA levels: International Physical Activity Questionnaire (IPAQ) and Godin Leisure Time Exercise Questionnaire (GLTEQ). Both these questionnaires are not valid for the SCI population and are focused on exercise behavior rather than LTPA and thus were not considered for the present study. As suggested by White et al (2009), another possible reason for the discrepancy in findings could be people's responses to LTPA depend on benefits experienced from LTPA. Also, energy expenditure does not necessarily lead to improved psychological outcomes, but the psychosocial experience of LTPA is important. Findings regarding lack of association of household activities with improved mental health are in line with findings of Pickett et al. (2012) and Stephens (1988) who found non-leisure activities are not associated with a reduction in depression in clinically depressed individuals and able bodied individuals respectively. Overall, findings of the present study regarding association of LTPA and mental health were not consistent with existing evidence. Future research with a more sensitive tool to measure LTPA in the SCI population and a LTPA based intervention might be able to support the association of LTPA and mental health in the SCI population.

#### **5.4 Self-esteem**

##### **5.4.1 Self-esteem and mental health.**

An overall high level of self-esteem was reported by the SCI sample in the present study. This is consistent with previous studies that have reported high self-esteem as time since injury increases (Cook, 1979; Craig, Hancock, Chang, 1994; Hancock, Craig, Tennant, Chang, 1993; Nelson, 1987; Piazza, Holcombe, Foote, Paul, Love, & Daffin, 1991). In the present study, self-esteem was negatively associated with depression and anxiety. This association had been supported in the past in the SCI population (Coyle, Lesnik-Emas, Kinney, 1994; Gorman, Kennedy, Hamilton, 1998). In the present sample self-esteem was not a predictor of mental health which is contradictory to the findings of Coyle et al. (1994) who found that self-esteem predicted 16% of variance in depression among people with the SCI. Self-esteem has also been reported as a predictor of psychological adjustment following the SCI (Alfano, Neilson, Fink, 1993; Frank & Elliott, 1987).

#### **5.4.2 Self-esteem and LTPA.**

There was no significant association found between self-esteem and LTPA. Also, self-esteem was not predicted by LTPA. The association between LTPA and self-esteem has not really been explored among people with the SCI, but a few studies have explored self-esteem as a predictor of participation in the SCI, based on ICF model (Geyh et al., 2012). Self-esteem has been found to be a significant predictor of participation in the SCI population (Geyh et al., 2012; Peter et al., 2012), but an inverse relationship between these two variables had never been explored among the SCI or any other population. Although one study reported high self-esteem levels in male university students who participated in LTPA more than others (Molina-Garcia et al., 2011).

### **5.4.3 Self-esteem as a mediator of LTPA and mental health.**

Self-esteem did not present as a potential mediator of LTPA and mental health association in the current sample. There was no study available to compare the findings in the SCI population. It is possible that the present sample was not able to detect mediation as self-esteem has been reported to mediate the long-term effects of PA participation on depression (White et al., 2009). Maybe a longitudinal, intervention based study will be able to show this mediating effect of self-esteem rather than a cross-sectional study.

## **5.5 Coping Self-efficacy**

### **5.5.1 Coping self-efficacy and mental health.**

Coping self-efficacy (CSE) is not a well explored area of research in the SCI population and this section needs to be considered in light of limited literature. In the present study CSE was a significant predictor of anxiety but not of depression. CSE has never been explored in relation to anxiety and depression in people with the SCI and thus the findings of this study were compared to available studies with able-bodied individuals and people with chronic illnesses or mobility impairment. Findings related to anxiety were consistent with the previous research on athletes and individuals with rheumatoid arthritis which suggest that CSE is negatively related to anxiety (Benka et al., 2014; Nicholls, Polman & Levy, 2010). The findings related to CSE and depression were contrary to the findings of previous studies in individuals with cancer and rheumatic disease (Garnefski, Kraaij, Benoist, Bout, Karels & Smit, 2013; Philip et al., 2013; these studies indicated a negative association between depression and CSE. A possible explanation for this contradiction could be that in the present study depressive symptoms were measured outside of an intervention context; whereas, other studies

explored the relationships between CSE and depression in a sample participating in some sort of exercise intervention. Another reason could be the sensitivity of the CSE scale used in the present study to depressive symptoms. Most of the items of the CSE scale are focused on the ability to deal with stressful situations where there is high possibility that a person would be anxious, but not depressed.

#### **5.5.2 Coping self-efficacy and LTPA.**

The present study found that LTPA was not a significant predictor of CSE. This specific relationship (i.e. between LTPA and CSE) has not been previously explored; however, Phang et al. (2012) found a modest positive relationship between barrier self-efficacy (type of CSE) and wheelchair maneuvering skills (type of PA). The really low level of engagement in leisure activities, which was not able to target CSE beliefs in the current sample is a possible reason for the lack of association between CSE and LTPA. Another possibility is that the items of CSE scale are not sensitive to changes that can arise due to participation in LTPA; the CSE scale was focused on the ability to deal with the stressful situations.

#### **5.5.3 Coping self-efficacy as a mediator of LTPA and mental health.**

The results of the present study showed that CSE was not a significant mediator of LTPA and mental health (anxiety and depression) in the SCI. There was a difference between direct and indirect paths, but this was not statistically significant. These findings are similar to Pickett et al. (2012) who found CSE was not a potential mediator of LTPA and mental health in an able-bodied population, but contrary to Craft, (2005) who suggested CSE as a mediator in a clinically depressed group. Few possible reasons of agreement and disagreement could be following. First, in Craft's study sample was participating in an exercise intervention; in Pickett et al.'s and the present studies, LTPA

was measured out of an intervention context. Second, Craft et al. (2005) used a different measure of CSE focused on examining people's perceptions of their abilities to perform a particular coping behavior. The present study and Pickett et al.'s study was focused on one's ability to deal with stressful situations. This difference in the conceptualization and operationalization of CSE may explain the difference in findings. Third, CSE may not be related to the total energy expenditure; instead it may be related to how regularly people engage in LTPA. In the present study PASIPD score was based on energy expenditure not on frequency of participation.

## **5.6 Social support**

### **5.6.1 Social support and mental health.**

In the present sample social support was significantly and negatively correlated with both depression and anxiety but was not a significant predictor of these mental health variables. The negative association between social support and mental health is a well-supported finding among the SCI population (Huang et al., 2014; Peter et al., 2012; Pollard & Kennedy, 2007; Post et al., 1999). Findings also exist for social support as an insignificant predictor of mental health. For example, Huang et al. (2014) reported that the effect of social support on depressive symptoms was entirely operated through self-concept among people with the SCI.

### **5.6.2 Social support and LTPA.**

Similar to Martin Ginis et al. (2012) no significant association was found between social support and LTPA. Also, the present study found that LTPA was not a significant predictor of social support. This direction of social support and LTPA relationship has not explored in the past. However, social support was considered as a potential facilitator of LTPA in a qualitative study among people with the SCI (Williams et al.,

2014) but a quantitative study with the SCI population (Martin Ginis et al., 2012) found social support is not a predictor of LTPA. While there is some literature supporting the positive impact of social support on LTPA among older adults (Orsega-Smith et al., 2007; Sharma et al., 2005; Wilcox et al., 2000) and in the SCI (Williams et al., 2014), future research needs to explore whether LTPA can predict social support or not.

### **5.6.3 Social support as a mediator of LTPA and mental health.**

Social support failed to emerge as a mediator of LTPA and mental health. Social support has never been explored as a mediator of LTPA and mental health association in any population (able-bodied or disabled), but these three variables were studied together in the past with mental health as a mediator of LTPA and social support, in males with the SCI (Elliott & Shewchuk 1995) and significant mediation was reported. The present study predicted social support to be a mediator of LTPA and mental health in the SCI population because social support had been reported as a mediator of functional disability and hope in the SCI population (Phillips et al., 2016). From the findings of previous studies, it can be inferred that LTPA was predicting mental health, which was further predicting social support (Elliott & Shewchuk 1995). In the present study LTPA was expected to predict social support, which was expected to predict mental health. The present study sample was not very active in terms of LTPA and was depressed and anxious. It is possible that lack of engagement in LTPA is responsible for low levels of social support and poor mental health in the present sample, which is further responsible for lack of successful mediation between LTPA, social support and mental health. Future research in the SCI population with high levels of LTPA participation is required to understand the relationship of these three variables.

### **5.7 Perceived Barriers**

The present sample reported low levels of perceived barriers to LTPA participation. A significant positive association was found between perceived barriers and mental health. Also, perceived barriers was a significant predictor of depression in the explored models of mediation. Vissers et al. (2008) reported poor mental health as a perceived barrier to PA participation among people with the SCI. In Vissers et al.'s study it is possible that perceived barriers to PA were very strong predictor of depression, because depression was recognized as the barrier itself.

### **5.8 Limitations**

The results of this study need to be interpreted in light of its limitations. A cross-sectional, self-report survey based research design was used. Being cross-sectional this study can only provide associations, not causation. There may have been some sample biases in the study as individuals who do not speak English may not have responded to the survey. Also, only one province (Nova Scotia) administered the paper survey; in all other recruiting provinces participants were invited through online advertisement. It is possible that people with the SCI who did not have access to the internet were unaware of the study. A web based survey method was chosen because an earlier United States study showed that people with the SCI preferred receiving information through the internet (Matter et al., 2009). The Nova Scotia association mentioned that internet access would be a barrier to their clients' participation in the study. Later, it was found that almost half (45.9 %) of all study participants were residents of Nova Scotia; this is likely due to the recruitment through the paper copy survey. An indirect interpretation of limited response rate of web-based survey is poor access to internet facility among people with the SCI. Researchers who have adopted web-based survey methods collaborated with some of the SCI organizations for recruitment (e.g., Noreau, Noonan,

Cobb, Leblond, & Dumont, 2014; Martin Ginis et al., 2010). Future research examining the internet accessibility of people with the SCI in Canada is required. Also, alternative methods to conduct the SCI based research such as face-to-face interviews need to be considered.

Another bias was from the predominance of a large percentage (45.9 %) of the sample population coming from the province of Nova Scotia, limits the generalizability of findings to other provinces. A minimum sample size determined for the present study was 50 (10 observations for each independent variable; Halinski & Feldt, 1970; Miller & Kuncze, 1973). Only 37 participants provided complete data. Small sample size can be viewed as a limitation of the present study. As a small sample size can increase the chance of type II errors (chance of assuming true as a false premise; Faber & Fonseca, 2014) and it is thus unable to detect significance.

An important caveat to acknowledge is the low sensitivity of the measurement tools. Best efforts were made to select the most appropriate tools among those available. Still it is recognized that measurement tools need to be more sensitive and specific to the SCI population. For example, level of LTPA participation was measured using the PASIPD. Total scores were based on the average hours of participation in any PA. Frequency of participation did not influence the LTPA score at all; thus a person who participated two hours per day, five times a week would have the same score as another person who was active for two hours once a week. Another issue with PASIPD was use of metabolic equivalents (MET). These MET values may not be applicable to people with the SCI due to differences in energy consumption. Also, literature on LTPA in the able-bodied and in the SCI population is diverse (activities inside or outside the home and social or solitary) and extensive (e.g., walking, wheeling and fishing), but it is

questionable in the SCI population if strength training, physical therapy (PT) or occupational therapy (OT) can be categorized as LTPA. People with the SCI participate in strength training or PT/OT interventions as a part of their rehabilitation, which is structured and goal oriented. Whereas LTPA should be non-structured with no set goals, should be chosen by the individual, and consist of activities other than their routine work or health maintenance activities. Previous studies have considered rehabilitation based PA interventions as LTPA, but in the present study rehabilitation exercises were not considered as LTPA. It is possible that due to the fact that rehabilitation PA was not considered as LTPA, the present study was not able to demonstrate significant associations between LTPA and any other variables of interest.

One of the strengths of the present study is differentiating between PA/ exercises and LTPA among people with the SCI. Knowledge of pre-morbid psychological status of participants is a study strength; however, it was measured as a dichotomous variable so it was not possible to demonstrate its association with other variables. A major strength of the study design was the consideration of a number of potential mediators. However, there are other factors that were not included in this study which could also mediate the relationship between LTPA and mental health such as distraction, enjoyment, motivation, self-determination and affect. Another strength of this study is exploring and highlighting the need for mental health research in a community based SCI sample. Most of the SCI based studies are focused on the initial rehabilitation phase and issues that arise while integrating into community remains unaddressed (Santos et al., 2013; Wurmser, Ho, Chiodo, Priebe, Kirshblum, & Scelza, 2007).

#### **5.9 Future Directions and Recommendations**

There are several suggestions for future research in the area of LTPA and mental health among the SCI population. First, more research is needed on the association of LTPA and mental health in the SCI population. This study was not able to demonstrate any association between LTPA and mental health. More appropriate tools to measure LTPA might have changed the findings of the present study. A second recommendation is to design a self-reported tool to measure different kinds of PA (leisure and non-leisure) specific to the SCI population. The tool should consider the total duration of PA, including frequency and duration of participation. An important aspect to be work on would be to establish MET guidelines for different activities for people with the SCI. Using the specific MET guidelines, existing tools based on MET such as PASIPD will be more relevant to the SCI population. Also, to make the items of the new tool more relevant to the SCI population, a qualitative research should be done to investigate the other accessible LTPA for the SCI population.

A significant percentage of sample revealed the presence of pre-morbid anxiety and depression. A retrospective study exploring the association of the pre-morbid mental health and the incidence of the SCI is required. The association between the pre-morbid mental health and the incidence of the traumatic SCI requires further research.

The present study was not intended to evaluate the effect of any exercise intervention on mental health of the SCI population. However, it will be a good idea to explore the association of LTPA and mental health in an intervention based study in the SCI population. An experimental design would help to clarify if there is an association between LTPA and mental health or not. Research also needs to be focused on the long-term and short-term effects of LTPA participation and what factors are responsible for the mediation at both time periods. It is possible that one factor is an important mediator

of the LTPA and mental health relationship at the beginning of participation in LTPA, and another factor is important to maintain this association in the long-term. For example, CSE was suggested as a valuable factor for any engagement in LTPA (Arbour-Nicitopoulos et al., 2009) and self-esteem was reported to mediate the long term effect of PA on depression (White et al., 2009).

Finally, the small sample size of this study could explain several of the non-significant findings. Therefore, disregarding the theories explored here, it is important to replicate this research with a larger sample. While the analysis provided mixed support for potential mediators, each of these mediators needs to be further tested using a larger sample. Recruitment of people with the SCI was the biggest challenge in this study. Best efforts were made to advertise the study, but recruitment may have been limited due to reduced internet access among people with the SCI. Therefore, future researcher should focus on paper surveys and when possible use telephone based or face-to-face structured interview formats. Web survey should not be obsolete; but more effort should be made to reach the population with non-web-based survey formats. Recruiting participants from a SCI participant's pool will be a good option. Also, data collection at the present study lasted for five months, future researcher should continue data collection for a longer period.

#### **5.10 Recommendations for Practitioners**

The following are the recommendations for health practitioners, government agencies and the SCI organizations to improve mental health and LTPA participation of people with the SCI. Results of this study indicated high rates of the pre-morbid depression and anxiety; there could be a connection between high rates of poor mental health and the increasing incidence of the SCI. As recommended above this connection

needs to be explored and mental health organizations should emphasize on the need for empirical research in this area. The present sample also reported high rates of post-injury depression and anxiety. With the intent to provide participants with the information regarding available mental health services to deal with any mental health crisis, efforts were made to find mental health services available for the SCI population. No special services were found; serious efforts are required in this direction to establish mental health services specifically for people with the SCI or other forms of disability.

Level of LTPA participation and over all PA were very low in the present sample. Previous studies have reported low level of activity in the SCI population (Perrier et al., 2016; Martin Ginis et al., 2010; Latimer et al., 2006). One of the modifiable predictors of LTPA participation is perceived barriers. In the present study the most common perceived barrier to LTPA was impairment, followed by lack of facilities and bad weather. This indicates that people with the SCI have intention to participate in LTPA, but available facilities are not able to meet their needs. To accommodate for incremental weather, particularly the Canadian climate, indoor facilities and better transportation needs to be considered. Lack of help from professionals and knowledge was also highlighted as a perceived barrier. Rehabilitative healthcare professionals should be advocating participation in LTPA for maintenance of physical health and to promote positive mental health. Healthcare professionals working in close association with people with the SCI should be made aware of the LTPA facilities available in the vicinity so that the information can be provided to people with the SCI. Also, LTPA should be encouraged as a part of rehabilitation program so that people with the SCI can themselves realize the impact of LTPA participation on their lives.

Another issue that needs attention is how to effectively communicate with people with the SCI. Twenty-eight percent of the paper copy surveys circulated from Nova Scotia were returned because of an incorrect address. This indicates that organizations working with the SCI may not have updated contact information of their clients. Online connectivity can be a solution, but poor web-based response rate of present study indicates poor internet accessibility. In such a situation people with the SCI are devoid of help which can make adjustments with the SCI a less difficult process. People with the SCI may have less access to current information on coping with the SCI and research advancements. Internet accessibility and needs of the SCI to communicate were studied in the USA, but such a study is missing in the Canadian SCI population. This will help future researchers to effectively communicate with people with the SCI and better understand their needs. Internet accessibility offers an opportunity of inclusiveness for people with disability – to live on a more equitable basis within the global community. A number of countries have created or modified general communications legislation to include clauses on accessibility. For example, the USA has passed the 21st Century Communications and Video Accessibility Act of 2010.

CSE, a relatively new variable of interest in this general field, was explored in relation to LTPA and mental health; it was found to be a significant predictor of anxiety. Previous work has reported that participation in LTPA can promote CSE in the SCI population (Phang et al., 2012). Thus, it is important to consider how the experience of LTPA can be structured to promote CSE in the SCI population. For example, LTPA experiences can be facilitated to ensure enjoyment, positive affect and self-determination which may increase participants' self-efficacy and positive coping

behaviors. Overall, initiatives targeted at improving mental health through LTPA participation should be taken into consideration for people with the SCI.

### **5.11 Conclusion**

This area of research is valuable because of a continuous increase in the prevalence of the SCI along with high prevalence of inactivity and mental health issues. These areas of research had been explored individually in the SCI population, but the relation between LTPA and mental health requires further investigation. This was one of the first studies to specifically study mental health and LTPA in the community dwelling SCI population. In the present study, not only was the association of LTPA and mental health studied, but mediators of this relationship were examined. The present study also explored the pre-injury mental health of people with the SCI. Future studies need to relate pre-injury mental health with mode of injury, post-injury mental health status and long term adjustment with the SCI. The most important gap addressed, the present study looked at the LTPA experience of people with the SCI out of the context of rehabilitation interventions. Regarding the gaps related to PA literature, the present study highlighted the need of a new self-reported tool to measure physical activity (leisure and non-leisure) in the SCI population. Overall, the present study was able to highlight the need of specialized mental health services for people with the SCI living in the community and enhancing their LTPA experience. Also, the present study strongly recommends the research to explore the influence of LTPA participation on mental health issues in the SCI as well as in other populations prone to have a sedentary life style.

The results of present study were not able to demonstrate any significant models of mediation, but indicated that there are factors that can successfully mediate the

relationship of LTPA and mental health in the SCI. Promoting LTPA and interventions focused on these mediators could improve the mental health of the SCI. Overall, there is need of interdisciplinary research, services and policy development to identify, develop and enhance resources and services that are needed to promote LTPA participation among people with the SCI. The long term goal is to encourage good mental health in the community dwelling SCI by promoting LTPA.

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**Comment [AL14]:** This is an presentation abstract. Here is how to cite:

Giese-Davis, J., Koopman, C., Butler, L. D., Classen, C., Morrow, G. R., & Spiegel, D. (1999). Self-efficacy with emotions predicts high quality of life in primary breast cancer patients. *Self-efficacy and Cancer: Theory, Assessment, and Treatment*.

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Greenberg, J., Pyszczynski, T., & Solomon, S. ( 1986). The causes and consequences of a need for self-esteem: A terror management theory. In R. F. Baumeister (Ed.), *Public self and private self* (pp. 189-212). New York: Springer-Verlag.

**Comment [MA17]:** This is the MAPS reference (see below under "m" – MAPS).  
[Paraplegia](#). 1993 Jun;31(6):349-57.  
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**Comment [MA23]:** Not cited in text.

**Comment [ag24R23]:** This one has more than 6 authors so I have written martin ginis et al., 2012 but there is another ref as well .... How to differ between 2

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Comment [ag27]: Please look

Comment [ag28R27]: Good. Just should be in sentence case. Here is general template for online source: Author, A. A., & Author, B. B. (Date of publication). *Title of document*. Retrieved from <http://Web address>

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## **Appendix A: Ethics Proposal**

### **Statement of ethical issues**

#### **Recruitment and first contact**

A letter of invitation will be sent to all the organisations working with Spinal Cord Injury in Canada. Interested organisations will screen their databases based on the inclusion and exclusion criterion of the present study. The organizations will not provide direct names or contact information of their constituents to the researchers but rather will be communicated to directly by the organizations. Potential participants will be contacted through webmail by the organization; this communication would include a brief description of the study, a link to the on-line survey, and contact information for participants to contact the investigators if they would like a paper copy. Also, an invitation for participation in the study is expected in the monthly newsletters of these organisations. Interested participants can respond by filling the electronic copy of the survey or they can request a paper copy of the survey from investigators. Participant names and contact information received in emails requesting a paper copy will be not being retained (emails will be deleted).

#### **Consent process**

To recruit participants for this study, Canadian Paraplegic organizations will be contacted through telephone or emails. After the agreement to help with recruitment of participants, on behalf of the investigators' participants with spinal cord injury who are living in the community will be contacted via by the organizations working with spinal cord injury. In this webmail, there will be a link for an electronic copy of survey on survey monkey (information letter being the first part of the survey). Participants who request a paper copy of the survey will receive a package with an information sheet about the survey, and the survey itself. Answering the survey questions will be considered as a consent for participation.

#### **Potential risks, discomforts and inconveniences**

There are no foreseeable risks associated with this survey. Participants may feel emotionally overwhelmed while answering the questions in terms of reflecting on their current physical activity and quality of life. To address this potential risk, participants are provided with the contact details of mental health services in their province. This information is present in the letter of information for the participants. There can be some sort of physical discomfort (tiredness) as participant will be spending 30 to 40 minutes to complete the survey. Potential inconveniences can be time devoted to completing the survey.

#### **Confidentiality**

All members of the research team will be briefed on their responsibility for privacy protection. All members of the research team will sign an oath of confidentiality. As a general principle, no names, addresses, telephone numbers will be recorded on paper or requested in data files. Any data-sharing agreements between the researcher and other researchers and/or institutions will be signed prior to providing or obtaining access to data. Consequences for breach of confidentiality will be clearly stipulated to the

research team. All computer files pertaining to the study will be password protected. All paper abstract forms and printouts of electronic files will be kept in secure storage – limited number of storage areas, limited access rooms, locked filing cabinets.

**Deception:** No deception will occur.

**Retention of Data**

Paper copies of the survey will be stored in the locked cabinets. Paper consent forms will be stored in a separate cabinet. Electronic data from the survey will be stored on a secure and encrypted computer in PE 2006. Electronic data will be discarded and paper copies will be shredded in 5 years.

**Dissemination of Research Results**

Collective/ aggregate results will be shared with organizations participating in this study. Individual results will not be shared with anyone other than the participants through e-mail or postal mail on request. For publications only aggregate results will be used.

## Appendix B: Survey



### Association and Mediators of Leisure Time Physical Activity and Mental Health Among People with Spinal Cord Injury in Canada

Thank you for your interest in this study. I appreciate you taking time to complete this survey. I am interested in knowing the association of leisure time physical activity and mental health among people with spinal cord injury in Canada. There are no correct or incorrect answers to any of the following questions. You can refuse to answer any questions without giving any reason and without ramifications. Please respond to the best of your ability, indicating how you feel about particular topic. Please be open and honest in your responses.

**Leisure Time Physical Activity:** This section of questions is about your current level of leisure time physical activity participation. Leisure time is the time when you are not working or doing necessary daily life activities or any kind of paid work. I would like to know your level of participation in physically active leisure activities in the past week (i.e., number of hours) and what are your activities of interest. Please mention the activities in which you have participated in the last 7 days in the space provided.

- |    |   |                           |               |                   |              |            |
|----|---|---------------------------|---------------|-------------------|--------------|------------|
| 1. | During the past 7 days how often did you engage in static activities such as reading, watching TV, computer games, or doing handcrafts? What were these activities?<br>On average, how many hours per day did you spend in these static activities? | Never (Go to question #2) | Seldom (1-2d) | Sometime s (3-4d) | Often (5-7d) | Don't know |
| 2. | During the past 7 days, how often did you walk, wheel, push outside your home other than specifically for exercise. For example, getting to work or class, walking the dog shopping, or other errands? On average, how many hours per day did you   | Never (Go to question #3) | Seldom (1-2d) | Sometime s (3-4d) | Often (5-7d) | Don't know |

- spend wheeling or pushing outside your home?
3. During the past 7 days, how often did you engage in light sport or recreational activities such as bowling, golf with a cart, hunting or fishing, darts, billiards or pool, therapeutic exercise (physical or occupational therapy, stretching, use of a standing frame) or other similar activities? What were these activities?  
On average, how many hours per day did you spend in these light sport or recreational activities?
- |                           |               |                  |               |            |
|---------------------------|---------------|------------------|---------------|------------|
| Never (Go to question #4) | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d)  | Don't know |
| Less than 1hr             | 1-2hr         | 2-4hr            | More than 4hr | Don't know |
4. During the past 7 days, how often did you engage in moderate sport and recreational activities such as doubles tennis, softball, golfing, ballroom dancing, wheeling or pushing for pleasure or other similar activities? What were these activities?  
On average, how many hours per day did you spend in these moderate sport and recreational activities?
- |                           |               |                  |               |            |
|---------------------------|---------------|------------------|---------------|------------|
| Never (Go to question #5) | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d)  | Don't know |
| Less than 1hr             | 1-2hr         | 2-4hr            | More than 4hr | Don't know |
5. During the past 7 days, how often did you engage in strenuous sport and recreational activities such as, wheelchair racing (training), off-road
- |                           |               |                  |              |            |
|---------------------------|---------------|------------------|--------------|------------|
| Never (Go to question #6) | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
|---------------------------|---------------|------------------|--------------|------------|

pushing, swimming, aerobic dance, arm cranking, cycling (hand or leg), singles tennis, rugby, basketball, walking with crutches and braces, or other similar activities?

What were these activities?

On average, how many hours per day did you spend in these strenuous sport or recreational activities?

Less than 1hr	1 - 2hr	2-4hr	More than 4hr	Don't know
---------------	---------	-------	---------------	------------

6. During the past 7 days, how often did you do any exercise specifically, to increase muscle strength and endurance such as lifting weights, push-ups, pull-ups, dips, or wheel-chair push-ups, etc?
- |                           |               |                  |              |            |
|---------------------------|---------------|------------------|--------------|------------|
| Never (Go to question #7) | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
|---------------------------|---------------|------------------|--------------|------------|

On average, how many hours per day did you spend in these exercises to increase muscle strength and endurance?

Less than 1hr	1 but less than 2hr	2-4hr	More than 4hr	Don't know
---------------	---------------------	-------	---------------	------------

7. Do you feel your leisure time physical activity has reduced after spinal cord injury
- |     |    |
|-----|----|
| Yes | No |
|-----|----|

Household activities: The following questions are about your current level of routine household activities. I would like to know your level of participation in household activities (number of hours) and the type of activities in which you have engaged in.

8. During the past 7 days, how often have you done any light housework, such as dusting, sweeping floors or washing dishes?
- |                           |               |                  |              |            |
|---------------------------|---------------|------------------|--------------|------------|
| Never (Go to question #8) | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
|---------------------------|---------------|------------------|--------------|------------|

On average, how many hours per day did you spend doing light housework?

Less than 1hr	1 - 2hr	2-4hr	More than 4hr	Don't know
---------------	---------	-------	---------------	------------

- |     |   |   |               |                  |              |            |
|-----|---|---|---------------|------------------|--------------|------------|
| 9.  | During the past 7 days, how often have you done any heavy housework or chores such as vacuuming, scrubbing floors, washing windows, or walls, etc?<br>On average, how many hours per day did you spend doing heavy housework or chores? | Never (Go to question #9)<br>Less than 1hr  | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
| 10. | During the past 7 days, how often you done home repairs like carpentry, painting, furniture refinishing, electrical work, etc?<br>On average, how many hours per day did you spend doing home repairs?                                  | Never (Go to question #10)<br>Less than 1hr | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
| 11. | During the past 7 days, how often have you done lawn work or yard care including mowing, leaf or snow removal, tree or bush trimming, or wood chopping, etc?<br>On average, how many hours per day did you spend doing lawn work?       | Never (Go to question #11)<br>Less than 1hr | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
| 12. | During the past 7 days, how often have you done outdoor gardening?<br>On average, how many hours per day did you spend doing outdoor gardening?   | Never (Go to question #12)<br>Less than 1hr | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |
| 13. | During the past 7 days, how often did you care for another person, such as children, a dependent spouse, or another adult?  | Never (Go to question #13)                  | Seldom (1-2d) | Sometimes (3-4d) | Often (5-7d) | Don't know |

	On average, how many hours per day did you spend caring for another person?	Less than 1hr	1 - 2hr	2-4hr	More than 4hr	Don't know
14.	During the past 7 days, how often did you work for pay or as a volunteer? (Exclude work that mainly involved sitting with slight arm movement such as light office work, computer work, light assembly line work, driving bus or van, etc.)	Never (Go to end)	Seldom (1-2d)	Sometimes (3-4d)	Often (5-7d)	Don't know
	On average, how many hours per day did you spend working for pay or as a volunteer?	Less than 1hr	1 - 4hr	5 but less than 8hr	8hr or more	Don't know

Depression: Through the questions below I am interested in knowing about your feelings and thoughts during past week (i.e., past 7 days). For each statement, please circle one response describing how often you felt or thought in a certain way in the past one week.

	Did not apply to me at all	Applied to me to some degree or for some of the time	Applied to me to a considerable degree or for a good part of time	Applied to me very much or most of the time	Don't know
1. I felt downhearted and blue	0	1	2	3	Don't know
2. I felt that I had nothing to look forward to	0	1	2	3	Don't know
3. I felt that life was meaningless	0	1	2	3	Don't know
4. I felt I wasn't worth much as a person	0	1	2	3	Don't know
5. I was unable to become enthusiastic about anything	0	1	2	3	Don't know
6. I couldn't seem to experience any positive feeling at all	0	1	2	3	Don't know
7. I found it difficult to work up the initiative to do things	0	1	2	3	Don't know

Anxiety: Through the questions below I am interested in knowing how anxious you were in the past one week (i.e., last 7 days). In each case, please circle one response describing how often you felt in a certain way in past one week.

- |    |  |   |   |   |   |            |
|----|--|---|---|---|---|------------|
| 1. | I was aware of changes in my heart rate in absence of any exertion   | 0 | 1 | 2 | 3 | Don't know |
| 2. | I was aware of dryness of my mouth   | 0 | 1 | 2 | 3 | Don't know |
| 3. | I experienced difficulty breathing other than complication of my injury (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion) | 0 | 1 | 2 | 3 | Don't know |
| 4. | I experienced trembling (e.g. in the hands)  | 0 | 1 | 2 | 3 | Don't know |
| 5. | I was worried about situations in which I might panic and make a fool of myself  | 0 | 1 | 2 | 3 | Don't know |
| 6. | I felt I was close to panic  | 0 | 1 | 2 | 3 | Don't know |
| 7. | I felt scared without any good reason  | 0 | 1 | 2 | 3 | Don't know |

Pre-injury anxiety and depression: These questions ask you about your depression and anxiety BEFORE you had spinal cord injury.

- |    | Yes                      | No                       |  | Yes                      | No                       |
|----|--------------------------|--------------------------|--|--------------------------|--------------------------|
| 1. | <input type="checkbox"/> | <input type="checkbox"/> | I received treatment for anxiety.  | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. | <input type="checkbox"/> | <input type="checkbox"/> | There were periods when I worried excessively.                           | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. | <input type="checkbox"/> | <input type="checkbox"/> | I had feelings of panic in situations where others do not panic.         | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. | <input type="checkbox"/> | <input type="checkbox"/> | I worried uncontrollably   | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. | <input type="checkbox"/> | <input type="checkbox"/> | I would get so nervous that I felt frozen.                               | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. | <input type="checkbox"/> | <input type="checkbox"/> | I was told I could be easily stressed                                    | <input type="checkbox"/> | <input type="checkbox"/> |
|    |                          |                          | My depression made me lose interest in sexual activity.                  |                          |                          |
|    |                          |                          | There were times when I slept most of the day to avoid facing the world. |                          |                          |
|    |                          |                          | I never suffered from periods of depression.                             |                          |                          |
|    |                          |                          | I would never have considered harming myself.                            |                          |                          |
|    |                          |                          | I received treatment for depression.                                     |                          |                          |
|    |                          |                          | I suffered from periods of deep sadness in my life.                      |                          |                          |



4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I am a person of worth, at least on an equal plane with others.
8. I wish I could have more respect for myself.
9. All in all, I am inclined to feel that I am a failure.
10. I take a positive attitude toward myself.

Interpersonal support: Items listed below are to know how you feel about personal support system. Please indicate how strongly you feel that any particular statement is true or false.

- |  | Definitely true | Probably true | Probably false | Definitely false |
|--|-----------------|---------------|----------------|------------------|
| 1. When I feel lonely there are several people I can talk to.  | 1               | 2             | 3              | 4                |
| 2. I often meet or talk with family or friends.  | 1               | 2             | 3              | 4                |
| 3. If I were sick, I could easily find someone to help me with my daily chores.  | 1               | 2             | 3              | 4                |
| 4. When I need suggestions on how to deal with a personal problem, I know someone I can turn to.   | 1               | 2             | 3              | 4                |
| 5. If I had to go out of the town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc.) | 1               | 2             | 3              | 4                |
| 6. There is at least one person I know whose advice I really trust.  | 1               | 2             | 3              | 4                |

Barriers to leisure time physical Activities: Items listed below are designated to know the factors that restrict your participation in leisure time physical activities. Please circle the

number that best indicates how much each of these problems keeps you from participating in physically active leisure.

	Never	Sometimes	Often	Routinely
1. Lack of convenient facilities	1	2	3	4
2. Too tired	1	2	3	4
3. Lack of transportation	1	2	3	4
4. Feeling what I do doesn't help	1	2	3	4
5. Lack of money	1	2	3	4
6. Impairment	1	2	3	4
7. No one to help me	1	2	3	4
8. Not interested	1	2	3	4
9. Lack of information	1	2	3	4
10. Embarrassment about my appearance	1	2	3	4
11. Concern about safety	1	2	3	4
12. Lack of support from family/friends	1	2	3	4
13. Interferes with other responsibilities	1	2	3	4
14. Lack of time	1	2	3	4
15. Feeling I can't do things correctly	1	2	3	4
16. Difficulty with communication	1	2	3	4
17. Bad weather	1	2	3	4
18. Lack of help from health care professionals	1	2	3	4

#### BACKGROUND INFORMATION

Please fill in the blank or mark ✓ for following questions.

Are you:  Female  Male  Other

What is your **Year of birth**? \_\_\_\_\_

Date of your injury? Month \_\_\_\_\_ Year \_\_\_\_\_

What is your level of injury?

Tetraplegia Please specify \_\_\_\_\_ (example: C5 etc.)

Paraplegia. Please specify \_\_\_\_\_ (example: D11 etc.)

What is the extent of your spinal cord injury?  Complete  Incomplete

What is the **highest level of education** you have achieved? (please check ONE)

- Elementary school
- High school certificate or equivalent
- Some postsecondary education (post secondary not completed)
- Certificate or diploma from a community college or trade school
- University degree
- Graduate Degree
- Other, please specify \_\_\_\_\_

What was your marital/**partnership status before injury**? (please check ONE)

- Single, never married
- Married or common-law
- Separated
- Divorced
- Widowed and currently single
- Widowed and now re-married or common-law

What is your **present/current** marital/**partnership status**? (please check ONE)

- Single, never married
- Married or common-law
- Separated
- Divorced
- Widowed and currently single
- Widowed and now re-married or common-law

Please check the category into which your **annual household income** falls: (please check ONE)

- Less than \$10,000
- \$10,000 to \$19,999
- \$20,000 to \$29,999
- \$30,000 to \$39,999
- \$40,000 to \$49,999
- \$50,000 to \$59,999
- \$60,000 to \$79,999
- \$80,000 to \$99,999
- over \$100,000

What was your **employment status before injury**? (please check ONE)

- Full-time
- Part-time
- Unemployed
- Retired

What is your **present/current employment status**? (please check ONE)

- Full-time
- Part-time

Unemployed

Retired

## Appendix C: Letter of Information for participants



School of Human Kinetics and Recreation  
St. John's, NL, Canada A1C 5S7

Dear \_\_\_\_\_

Thank you for your interest in my study “Association and Mediators of Leisure Time Physical Activity (LTPA) and Mental Health among People with Spinal Cord Injury (SCI) in Canada.” This survey study has been undertaken to understand the association of LTPA and mental health among people with SCI.

### **Overview of procedures:**

This is a survey based study, if you agree to participate in this study I would like you to answer the questions in the survey. Through these questions I am interested in knowing your physical activity schedule and any emotional symptoms you experienced in past one week. Also, I would like to know about your support system (emotional, physical, financial) and the factors that promote or restrict your participation in leisure activities.

### **Benefits, Risks & Confidentiality:**

There are minimal risks associated with this study such as you might feel emotionally overwhelmed while answering the survey, and it will take only 30 – 40 minutes to complete the survey. The purpose of this study is not to be critical of or evaluate you as a person. The information collected for this study will only be used in relation to this research project. All the information about you will be kept confidential and limited to Dr. Linda Rohr and Dr. Angela Loucks-Atkinson, research supervisors and me. This information will not be shared with any other person. Collective results will be shared with the organizations helping in the data collection of this study. The following steps will be taken to reduce issues of privacy and confidentiality:

- All surveys will be provided with an identification code (i.e. no identifying information will be entered into the database);
- Data will only be reported in aggregate form (overall Canada), with no individual results available;
- All data will be kept in a secure location at Memorial University (Physical Education Building) and access to the data will only be given to me and my thesis supervisor (Dr. Angela Loucks-Atkinson). All data will be destroyed after five years; and
- Data collected will only be used in relation to this research project;

- Organizations helping in recruitment will be provided the opportunity to know the collective results.

Survey Monkey is a web-based survey site and tool that employs multiple layers of security to make sure that the survey account and data remains private and secure. Survey monkey employs a third-party firm to conduct daily audits of their security, and the survey data resides behind the latest in firewall and intrusion prevention technology. However, since Survey Monkey is owned by an American company, guarantees of confidentiality and anonymity provided must be tempered by the acknowledgement that all data collected and maintained by the company is subject to the US Patriot Act and has the potential of being appropriated by a designated government agency without any notification to the researcher or participants. Therefore, anonymity and confidentiality cannot be guaranteed. While it is highly unlikely that United States Homeland Security would demand the data and scrutinize any of the participants entering the United States, the possibility does exist. The web-survey data will be accessible to the researcher and her supervisor who have the password for the site.

Your participation in this study is voluntary, and you can refuse to answer any questions without giving any reason and without ramifications. By completing the survey, you are providing consent to participate.

The proposal of this research has been reviewed by the Health Research Ethics Authority (HREA) and found to be in compliance with the standards of the Canadian Tri-Council Research Ethics guidelines. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the HREA ethics office at [info@hrea.ca](mailto:info@hrea.ca) or by telephone at (709) 777-6974.

If you have any further questions or concerns, please feel free to contact me. I am best reached by email at [ag6858@mun.ca](mailto:ag6858@mun.ca) or by phone at (709) 986-5135.

If you would like a copy of the report of this study please contact me, Amita Goyal, via email: [ag6858@mun.ca](mailto:ag6858@mun.ca)

**\*NOTE – Though this study has minimum risks, in case you feel emotionally overwhelmed and feel the need to seek some professional mental health services you can contact your local Canadian Mental Health Association branch below. **If you are having a mental health crisis or require professional mental services after hours call 911.****

British Columbia Division  
E  
P (604) 688-3234

[info@cmha.bc.ca](mailto:info@cmha.bc.ca)

Alberta Division  
E [alberta@cmha.ab.ca](mailto:alberta@cmha.ab.ca)  
P (780) 482-6576

Saskatchewan Division

E P (306) 525-5601	<a href="mailto:contactus@cmhask.com">contactus@cmhask.com</a>
Manitoba and Winnipeg E P (204) 982-6100	<a href="mailto:office@cmhawpg.mb.ca">office@cmhawpg.mb.ca</a>
Ontario Division E P (416) 977-5580	<a href="mailto:info@ontario.cmha.ca">info@ontario.cmha.ca</a>
Quebec Division E P (514) 521-4993	<a href="mailto:acsmtl@cooptel.qc.ca">acsmtl@cooptel.qc.ca</a>
New Brunswick E P (506) 455-5231	<a href="mailto:info.cmhanb@rogers.com">info.cmhanb@rogers.com</a>
Nova Scotia Division E P 902.466.6600 Toll Free: 1.877.466.6606	<a href="mailto:pamela@novascotia.cmha.ca">pamela@novascotia.cmha.ca</a>
Prince Edward Island Division E P (902) 566-3034	<a href="mailto:division@cmha.pe.ca">division@cmha.pe.ca</a>
Newfoundland and Labrador Division E P (709) 753-8550	<a href="mailto:office@cmhanl.ca">office@cmhanl.ca</a>

## Appendix D: Organizational recruitment letter



School of Human Kinetics and Recreation  
St. John's, NL, Canada A1C 5S7.

Dear \_\_\_\_\_,

My name is Amita Goyal, I am a graduate student at Memorial University of Newfoundland in the School of Human Kinetics and Recreation. I am contacting you regarding my Master's research study on "Association and Mediators of Leisure Time Physical Activity and Mental Health among People with Spinal Cord Injury (SCI) in Canada." The purpose of this study is to explore the association between leisure time physical activity (LTPA) and mental health (depression and anxiety) in (SCI). An understanding of this relationship and its predictors will be helpful for organizations working for health promotion for people with SCI or other mobility impairments. It will also be beneficial for people with SCI to know the benefits of getting engaged in physical activities during their free time. As LTPA has a preventive role, an early introduction of LTPA in people with SCI may prevent them from developing mental health issues. An important implication of this study will be to develop a better understanding of predictors (e.g., coping styles and social support) of the relationship between LTPA and mental health in order to develop strategies to prevent mental health issues and promote LTPA.

This is an online/paper based survey and I am seeking involvement of organizations working with people with SCI in Canada to help recruit participants for the study. I am requesting that that your organization to be the first contact with potential participants by advertising and informing people with SCI about the study in an email (including the web link to the survey). Also, an invitation for participation in the study could be promoted in monthly organizational newsletters or other constituent communications. Interested participants can respond by completing the the electronic copy of survey or they can request a paper copy of survey from investigators. Informed consent from participants will be obtained by providing detailed information about the study and having participants sign a consent form. Responses will be anonymous and collective findings will be shared with all contributing organizations to help initiate required actions for improving mental health of people with SCI in Canada. Data collection for this study would take place in Fall 2016 and Winter 2017.

If your organization wants to learn more about this study or is interested in helping with participant recruitment, please contact me and I will send you a formal information letter about the study, survey and consent form for the participants. The proposal of this research has been reviewed by the Health Research Ethics Board (HREB) and found to be in compliance with the standards of the Canadian Tri-Council Research Ethics guidelines. If you have ethical concerns about the research (such as

the way you have been treated or your rights as a participant), you may contact the HREA office at [info@hrea.ca](mailto:info@hrea.ca) or by telephone at (709) 777-6974. If you have any further questions or concerns, please feel free to contact me. I am best reached by email at [ag6858@mun.ca](mailto:ag6858@mun.ca) or by phone at (709) 986-5135.

Sincerely,  
Amita Goyal.

## Appendix E: Recruitment advertisement



Do you have spinal cord injury?  
Has spinal cord injury restricted your participation in physical activities during your leisure time?  
What are the factors that restrict your participation?  
**PARTICIPANTS NEEDED FOR SPINAL CORD INJURY RESEARCH**



I am looking for volunteers with Spinal Cord Injury (wheelchair as primary mode of mobility) to complete an online survey to explore the association of leisure time physical activities and mental health. You can complete the survey at <https://www.surveymonkey.com/r/RN9T29V> or contact Amita Goyal to request a paper copy of the survey.

For any further information please contact Amita Goyal at [ag6858@mun.ca](mailto:ag6858@mun.ca) or call at 709-986-5135. Memorial University of Newfoundland & Labrador. School of Human Kinetics and Recreation

## Appendix F: Webmail for participants

Dear Member,

We would like to inform you about the study “Association and Mediators of Leisure Time Physical Activity and Mental Health among People with Spinal Cord Injury (SCI) in Canada.” This study is the Master’s thesis of Amita Goyal (graduate student MSc. Kinesiology, Memorial University, Newfoundland), under the supervision of Dr. Linda Rohr (Associate Dean of Undergraduate Studies and Associate Professor, School of Human Kinetics and Recreation, Memorial University) and Dr. Angela Loucks-Atkinson (Associate Professor, School of Human Kinetics and Recreation, Memorial University). Amita is exploring how participation in leisure time physical activities can influence mental health (anxiety and depression) among people with spinal cord injury. If you are willing to participate in this study, please complete the survey through the provided web link below or you can request the paper copy from the investigators:

<https://www.surveymonkey.com/r/RN9T29V>

Further information about the study is presented on the first page of the survey. Information provided by you will be kept confidential and will be used only for research purposes.

If you need any further information about the study you can contact the following:

**Amita Goyal,** [ag5868@mun.ca](mailto:ag5868@mun.ca)/ 709-986-5135

**Linda Rohr,** [lerohr@mun.ca](mailto:lerohr@mun.ca)

**Angela Loucks-  
Atkinson,** [aloucksa@mun.ca](mailto:aloucksa@mun.ca)