PHYSICAL ACTIVITY CORRELATES IN PERSONS WITH SCI

Understanding and Changing Physical Activity Among People with Spinal Cord Injury: The Role of Psychosocial and Environmental Factors

By

KELLY PATRICIA ANN ARBOUR,

HONOURS. B.KIN, M.Sc.

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AUTHOR: Kelly Patricia Ann Arbour, Hons.B.Kin. (McMaster University), M.Sc. (McMaster University)

SUPERVISOR: Dr. Kathleen A. Martin Ginis

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Abstract

The purpose of this dissertation was to use an integrative theoretical framework to examine the individual and environmental factors associated with leisure-time physical activity (LTPA) for persons living with spinal cord injury (SCI). Using a systematic approach, three studies were conducted to: (1) survey the accessibility and availability of physical activity facilities for Canadians living with mobility disabilities, (2) test an integrative, theoretical framework for understanding LTPA among people with SCI, and (3) implement a theory-based intervention that focuses on helping beginner exercisers living with SCI cope with salient individual and environmental LTPA barriers.

Study 1 involved two sub-studies. Study 1A used a modified version of the AIMFREE instrument (Rimmer et al., 2004) and provided evidence of the limited accessibility of fitness and recreational facilities (n=44) for persons with mobility disabilities. Study 1B applied a geographical technique, Geographical Information Systems (GIS), to develop an objective proximity measure specific to persons with SCI. Results indicated a small, negative association between the objective presence of physical activity facilities and LTPA in a sample of persons with SCI (n=50), suggesting that living in close proximity to a facility which provides adaptive programming and equipment does not necessarily translate into greater LTPA for persons with SCI.

As an extension of Study 1, Study 2 used structural equation modeling to conduct a cross-sectional examination of whether an environmental factor --neighbourhood perceptions--could enhance the Theory of Planned Behaviour's (TPB; Ajzen, 1985) ability to explain LTPA intentions and behaviour in persons with SCI (n=246). Results indicated a small, negative association between perceived wheeling infrastructure and LTPA intentions. However, perceptions of neighbourhood aesthetics and wheeling infrastructure did not explain significant variance in either LTPA intentions or behaviour, beyond that accounted for by the TPB constructs, suggesting that these neighbourhood factors do not enhance the TPB's ability to explain LTPA behaviour.

Lastly, Study 3 used a randomized, controlled design to examine the effects of a 10-week action and coping planning intervention on enhancing LTPA and coping self-efficacy in exercise intenders living with SCI (n=47). Results indicated greater LTPA for participants who formed action plans and coping plans (A+C condition) than for the participants who only formed action plans (A condition). Furthermore, the A+C condition had greater confidence to schedule their LTPA and overcome LTPA-related barriers than the A condition. These findings provide evidence of the benefits of supplementing action plans with coping plans for enhancing LTPA and coping self-efficacy beliefs among exercise intenders living with SCI.

Together, these three studies provide a broader understanding of LTPA correlates and determinants in people with SCI, and provide evidence of the efficacy of multiple planning strategies for promoting LTPA in persons with SCI. The results provide an impetus for extending the scope of the research on the physical environment and LTPA towards persons with mobility disabilities. Moreover, the findings demonstrate the value of theory-based research for identifying the multidimensional correlates and determinants of LTPA, and for designing effective LTPA-enhancing interventions in persons with SCI.

List of Abbreviations

A condition	-action planning only condition
A-C condition	-action planning and coping planning condition
ADA	-American Disability Act
ADAAG	-Americans with Disabilities Act Accessibility Guidelines
ALACD	-Active Living Alliance for Canadians with Disabilities
AIMFREE	-Accessibility Instruments Measuring Fitness and Recreation Environments
ANCOVA	-analysis of covariance
ANOVA	-analysis of variance
AODA	-Accessibility for Ontarians with Disabilities Act
CFA	-confirmatory factor analysis
CFI	-comparative fit index
GIS	-geographical information systems
GLTEQ	-Godin Leisure-Time Exercise Questionnaire
HAPA	-health action process approach
IFI	-incremental fit index
K	-kappa statistic
LA	-lifestyle activity
LTPA	-leisure-time physical activity
ML	-maximum likelihood
NALP	-neighbourhood active living potential
NEWS	-Neighbourhood Environment Walkability Scale
OBG	-Ontario Building Code
PA	-physical activity
PARA-SCI	-Physical Activity Recall Assessment for People with Spinal Cord Injury
PBC	-perceived behavioural control
RMSEA	-root mean square error of approximation
SE	-self-efficacy
SEM	-structural equation modeling
SCI	-spinal cord injury
SHAPE SCI	-Study of Health and Physical Activity of People with Spinal Cord Injury
TPB	-Theory of Planned Behaviour
TTM	-Transtheoretical Model

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CHAPTER 1

Review of Literature

1.0 PHYSICAL ACTIVITY PARTICIPATION IN PERSONS WITH SCI

Physical activity is associated with many physical, psychological and social benefits for people with spinal cord injury (SCI). Examples of these benefits include improvements in aerobic fitness, muscular strength, and endurance (Heath & Fentem, 1997; Hicks et al., 2003), reductions in chronic pain (Hicks et al., 2003, 2005; Martin et al., 2002; Tasiemski, Bergstrom, Savic, & Gardner, 2000), depression, stress, and pressure sores (Heath & Fentem, 1997; Hicks et al., 2003; Martin Ginis et al., 2003), and increased social integration (Martin et al., 2002). Overall, findings from exercise training studies in persons with SCI indicate that physical activity is an important component of optimal health and well-being for persons living with SCI (Devillard, Rimaud, Roche, & Calmels, 2007; Martin Ginis & Hicks, 2005; Rimmer, Braddock, & Pitetti, 1996), and should be advocated as a health-promoting strategy within this population.

Despite the health benefits that are derived from physical activity participation, physical activity remains a national health concern for persons with SCI (Martin Ginis & Hicks, 2005, 2007; Rimmer et al., 1996). People with SCI are considered to be one of the most sedentary populations (Buchholz, McGillivray, & Pencharz, 2003; Dearwater, Laporte, Cauley, & Brenes, 1985; Martin Ginis & Hicks, 2007), with 53% of individuals being classified as inactive (Tasiemski et al., 2000). Moreover, people with SCI spend, on average, less than 1% of their daily routine in leisure-time physical activity (LTPA; physical activity one chooses to do during free time; Latimer, Martin Ginis, Craven, & Hicks, 2006; Martin Ginis, Latimer, Hicks, & Craven, 2005), which further attests to their sedentary lifestyle.

One explanation for such low physical activity levels may be the many secondary complications associated with sustaining an SCI (e.g., chronic pain, pressure sores, obesity, diabetes; Noreau, Proulx, Gagnon, Drolet, & Laramee, 2000). These conditions can interfere with a physical activity regimen, and may be even more detrimental to one's quality of life than the injury itself (Bauman, Kahn, Grimm, & Spungen, 1999; Johnson, Gerhart, McCray, Menconi, & Whiteneck, 1998). Furthermore, these complications are associated with an increased risk of cardiovascular and respiratory diseases, which are the leading causes of death among persons with SCI (Bauman et al., 1999; DeVivo, Krause, & Lammerts, 1999). For individuals without disabilities, physical activity is often endorsed for preventing disease and disability. Likewise, physical activity should be promoted in persons with SCI as a strategy to prevent and perhaps treat secondary conditions (Rimmer, 1999). This would be a more cost-effective strategy for improving health and well-being than other, more expensive methods such as medications or surgeries, which are often associated with adverse side-effects. As such, there is a need for determining how to get persons with SCI more physically active in order to accrue the health benefits of LTPA participation. Therefore, the purpose of this chapter is to provide an overview of the physical activity correlates and determinants that have been examined in individuals living with SCI, as well as to provide a foundation for the three dissertation studies further outlined in Chapters 2, 3 and 4.

2.0 SCI-SPECIFIC THEORY-BASED PHYSICAL ACTIVITY CORRELATES AND DETERMINANTS

2.1 Causation and Correlation

2.1.1 Defining Determinants and Correlates

Within the physical activity realm, researchers have identified factors that help to understand and predict physical activity in persons without disabilities, such as attitudes, self-efficacy, and social support (for a review see Bauman, Sallis, Dzewaltowski, & Owen, 2002; Buckworth, 2000; Trost, Owen, Bauman, Sallis, & Brown, 2002). Ultimately, these factors form the basis of interventions aimed at changing physical activity behaviour (Buckworth, 2000). In the behavioural sciences, research often begins with examining the correlational relationships between variables (termed "correlates"), which helps to generate hypotheses for further study. While a correlational relationship suggests an association exists between two variables, it does not imply causality. Rather, a causal relationship indicates that changes in one variable are systematically followed with changes in another variable (cf., Bauman et al., 2002). More importantly, a causal relationship is necessary for identifying the most important physical activity determinants to target in future interventions (Bauman et al., 2002). Within the physical activity domain, the terms "correlate" and "determinant" have often been used interchangeably (Bauman et al., 2002). However, a relationship between two variables can only be termed "causal" if it meets the following five criteria: (1) the variables are examined using an experimental design, with the greatest weight being given to randomized controlled trials; (2) there is a strong association between the two variables; (3) exposure to the determinant precedes the outcome; (4) a dose-response relationship exists; and (5) the causal model is conceptually plausible (Bauman et al., 2002; Dishman & Sallis, 1994). Since correlates do not meet the aforementioned criteria, labelling correlates as determinants may lead to inappropriate factors being targeted in future activity-enhancing interventions. Bearing in mind these issues, the following section highlights the correlates and determinants of physical activity that have been identified for individuals living with SCI.

2.1.2 The Influence of Research Design on Causality

As mentioned in the preceding section, study design is one factor that is used to determine whether a relationship is causal or correlational. The randomized controlled trial (RCT) is considered the "gold standard" design for determining causality because it allows researchers to randomly assign participants to conditions, thus reducing the influence of other, uncontrolled variables on the intervention (Bauman et al., 2002). However, many of the RCT principles, such as participant homogeneity, ethical issues surrounding a nonexercising control group, and study retention, are particularly problematic for conducting trials in persons with SCI (Martin Ginis & Hicks, 2005). Consequently, there have been a limited number of RCTs that have examined physical activity determinants in persons with SCI. Alternatively, a relatively large body of research has examined physical activity correlates and, in some studies, determinants through the use of other, less rigorous study designs, such as cross-sectional and, to a lesser extent, prospective research designs. Findings from these studies are discussed in the subsequent section.

2.2 Review of Physical Activity Correlates and Determinants Research in People with SCI

2.2.1 Cross-Sectional/Correlational studies

A variety of physical activity correlates have been examined in persons living with SCI. These correlates are presented in Table 1 under seven general categories: (1) demographic and biological factors, (2) secondary complications, (3) psychological, cognitive, and emotional factors, (4) behavioural attributes and skills, (5) social and cultural factors, (6) physical environment factors, and (7) physical activity characteristics. These seven categories were adapted from previous research in persons without disabilities (Bauman et al., 2002).

Table 1

Physical Activity Correlates Identified in Cross-Sectional Studies Among Persons with SCI and Other Types of Mobility Disabilities.

Correlate	*Relationship with overall physical activity*	*Reference*	*Correlate for persons without disabilities*
Demographic and biological factors			
Injury level (paraplegia)	+	Coyle et al., 1993	0
Age	-	Manns & Chad, 1999	✓
Disability/Impairment	-	Ellis et al., 2007; Hicks et al., 2003; Kinne et al., 1999; Martin et al., 2002; Rimmer et al., 1996; Scelza et al., 2005	✓
Physical independence	+	Manns & Chad, 1999 (T only); Noreau & Shephard, 1995	0
Mobility	+	Manns & Chad, 1999 (T only); Noreau & Shephard, 1995	0

Occupation	+	Manns & Chad, 1999 (T only)	✓
Income	-	Ellis et al., 2007; Kerstin et al., 2006; Kinne et al., 1999; Tasiemski et al., 2000, 2005; Putnam et al., 2003	✓
Preinjury PA status (active)	+	Wu & Williams, 2001	0
ADL dependence	-	Tasiemski et al., 2005	0
Self-care management	+	Tasiemski et al., 2005	0
Secondary Complications			
Pain (actual or fear of)	-	Martin et al., 2002; Martin Ginis & Latimer, 2007; Shifflett et al., 1994; Scelza et al., 2005	0
Belief that exercise will decrease pain	+	Tasiemski et al., 2000	0
Bowel/bladder problems	-	Coyle et al., 1993	0
Fractures	-	Scelza et al., 2005	0
Health problems	-	Scelza et al., 2005 (more associated with T)	✓
Functional ability	+	Noreau et al., 1993 (T only)	0
Psychological, cognitive, and emotional factors			
Lack of information (programs, PA prescription)	-	Coyle et al., 1993; Kinne et al., 1999; Martin et al. , 2002, Scelza et al., 2005; Rimmer et al., 2004	0
Lack of Knowledge (importance/benefits) of exercise	-	Hicks et al., 2003; Martin et al., 2002; Rimmer et al., 1996, Scelza et al., 2005	✓
Lack of activity skill	-	Coyle et al., 1993; Dattilo et al. 1998; Martin et al., 2002	✓
Self-efficacy	+	Greenwood et al., 1990; Kinne et al., 1999; Kosma et al., 2002, 2004; Martin et al., 2002	✓

Depression	-	Coyle et al., 1993; Martin et al., 2002; Martin Ginis & Latimer, 2007	✓
Life satisfaction	+	Coyle et al., 1993; Tasiemski et al., 2005	✓
Self-satisfaction	+	Noreau & Shephard, 1995	0
Intentions/Motivation	+	Latimer et al.,2004 (T only; strenuous and moderate PA only); Scelza et al., 2005	✓
Perceived behavioural control	+	Latimer et al., 2004 (T: mild PA only; P: strenuous PA only)	✓
Benefits (e.g., physical gains, improved QOL)	+	Martin et al., 2002; Shifflett et al., 1994	✓
Lack of time	-	Martin et al., 2002; Shifflett et al., 1994; Tasiemski et al., 2000, 2005	✓
Lack of energy/fatigue	-	Ellis et al., 2007; Scelza et al., 2005; Shifflett et al., 1994	✓
Exercise barriers and facilitators (total and motivational)	-	Kinne et al., 1999	✓
Self-determination (autonomy)	+	Kosma et al., 2002	✓
Lack of Interest/too lazy	-	Scelza et al., 2005	✓
Exercise will not improve/make condition worse	-	Scelza et al., 2005	0
Fun/Enjoyment	+	Kerstin et al., 2006; Tasiemski et al., 2000; Wu & Williams, 2001	✓
Outcome expectancies (e.g., strength, physical conditioning)	+	Putnam et al., 2003; Tasiemski et al., 2000, 2005; Wu & Williams, 2001	✓

Opportunity to be competitive	+	Kerstin et al., 2006; Tasiemski et al., 2000, 2005; Wu & Williams, 2001	0
Mastery experience	+	Kerstin et al., 2006	✓
Knowledge seeking	+	Kerstin et al., 2006; Rimmer et al., 2004	0
Willingness to try	+	Kerstin et al., 2006; Rimmer et al., 2004	✓
Body image improvements (physical appearance, weight control)	+	Kerstin et al., 2006; Tasiemski et al., 2000, 2005	✓
Self-schemata for exercise/ exerciser self-image	+	Kerstin et al., 2006; Noreau & Shephard, 1995	✓
Being a role model for others	+	Kerstin et al., 2006	✓
Opportunity to improve self-esteem	+	Tasiemski et al., 2000, 2005	✓
Perceived control over leisure, vocational status, and sexual life	+	Tasiemski et al., 2005	0
Exercise feeling states	+	Martin Ginis & Latimer, 2007	✓
Mood	+	Greenwood et al., 1990	✓
Need to maintain activity level	+	Tasiemski et al., 2000	✓
Fewer suicidal tendencies	+	Noreau & Shephard, 1995	0
Independent attitude	+	Noreau & Shephard, 1995	0
Behavioural attributes and skills			
Task (goal)-oriented	+	Kosma et al., 2002	✓
Fear of leaving the home	-	Scelza et al., 2005	0
Fear of further injury	-	Scelza et al., 2005; Tasiemski	0

		et al., 2000	
Education about adaptive sport/PA	+	Wu & Williams, 2001 (inactive preinjury only)	0
Learning new adaptive skills for the sport/physical activity	-	Wu & Williams, 2001	0
Planning	+	Kerstin et al., 2006	✓
Goal-setting	+	Kerstin et al., 2006; Putnam et al., 2003	✓
Self-monitoring	+	Kerstin et al., 2006	✓
Processes of changes	+	Kosma et al., 2004	✓
Decisional balance	+	Kosma et al., 2004	✓
Social and cultural factors			
Social support	+	Coyle et al., 1993; Dattilo et al. 1998; Ellis et al., 2007; Kerstin et al., 2006; Rimmer et al., 2004	✓
Lack of help from health professionals	-	Kinne et al., 1999	
Attitudes from others for being physically active	+	Kerstin et al., 2006; Kosma et al., 2002; Rimmer et al., 2004	✓
Social integration	+	Noreau & Shephard, 1995	✓
Physician influence	+	Scelza et al., 2005	✓
Fitness professionals unable to meet needs/Lack of staff knowledge	-	Rimmer et al., 2004; Scelza et al., 2005	0
Rehabilitation staff	+	Dattilo et al. 1998; Wu & Williams, 2001	0
Sport club for persons with disabilities (peers)	+	Putnam et al., 2003; Wu & Williams, 2001	0

Social reasons for exercise participation (socialize)	+	Tasiemski et al., 2000, 2005; Wu & Williams, 2001	✓
Belongingness (social network)	+	Kerstin et al., 2006; Putnam et al., 2003	✓
Ability to accept/ask for assistance	+	Kerstin et al., 2006; Rimmer et al., 2004	0
Having a PA role model	+	Kerstin et al., 2006	✓
Contacts with family and friends	+	Tasiemski et al., 2005	✓
Physician PA-related knowledge for persons with disabilities	+	Martin et al., 2002	0
Level of handicap	-	Manns & Chad, 1999	0
Physical environment factors			
Transportation difficulties	-	Dattilo et al. 1998; Hicks et al., 2003; Martin et al., 2002; Rimmer et al., 1996, 2004; Scelza et al., 2005; Tasiemski et al., 2005	0
Inaccessible facilities	-	Dattilo et al. 1998; Ellis et al., 2007; Hicks et al., 200; Kinne et al., 1999; Martin et al., 2002; Putnam et al., 2003; Rimmer et al., 1996, 2004; Scelza et al., 2005; Tasiemski et al., 2000, 2005	0
Inaccessible equipment	-	Ellis et al., 2007; Hicks et al., 2003; Kerstin et al., 2006; Martin et al., 2002; Rimmer et al., 1996, 2004	0
Being watched by others	-	Scelza et al., 2005	✓
Privacy at facilities	-	Scelza et al., 2005	0
Cost of program	-	Ellis et al., 2007; Martin et al., 2002; Rimmer et al., 2004;	✓

		Scelza et al., 2005	
Disability-specific policies available at facilities	+	Rimmer et al., 2004	0
Difficult to find adaptive sport equipment	-	Wu & Williams, 2001	0
Weather/Climate	-	Kerstin et al., 2006	✓
Geographical distance	-	Kerstin et al., 2006	✓
Physical Activity Characteristic			
Exercise perceived as boring	-	Scelza et al., 2005	✓
Exercise too difficult	-	Scelza et al., 2005 (more for T)	✓
Dislike of "traditional" disabled sports/activities	-	Tasiemski et al., 2000, 2005	0
Lack of opportunity to practise sport/participate in activity	-	Tasiemski et al., 2000, 2005	0

Note. (+) represents a positive relationship between the correlate and physical activity, while (-) indicates a negative relationship. (✓) indicates that the factor has been identified as a physical activity correlate in persons without disabilities, whereas (0) indicates that the factor has not been identified in persons without disabilities. Shaded check marks (✓) indicate correlates that may be more strongly associated with physical activity in persons with SCI than for persons without disabilities. P = paraplegia; PA = physical activity; T = tetraplegia; SE = self-efficacy.

Overall, 43 of the 84 physical activity correlates identified in the literature as important for activity participation in persons with SCI were similar to factors cited as important in research among individuals without disabilities (Bauman et al., 2002; Dishman & Sallis, 1994). For example, younger age, employment, and fewer financial difficulties were associated with greater physical activity participation in both people with and without SCI (Kerstein, Gabriele, & Richard, 2006; Kinne, Patrick, & Maher, 1999; Manns & Chad, 1999; Tasiemski et al., 2000; Tasiemski, Kennedy, Gardner, & Taylor, 2005). Interestingly, employment was only found to be a significant factor for individuals with tetraplegia (Manns & Chad, 1999). Furthermore, prominent psychological, social, and behavioural correlates of physical activity for persons without disabilities, such as self-efficacy, intentions, attitudes, mood disturbances, and social support were also shown to be associated with physical activity participation in persons with SCI (see Table 1 for a detailed list of common correlates). However, the plethora of health complications and costs associated with living with an SCI, suggest that some of the common factors listed in Table 1, such as the cost of programs, support from health and fitness professionals, and outcome expectancies may be more strongly associated with physical activity participation in persons with SCI than those individuals who do not have a disability.

Meanwhile, there were other factors listed in Table 1 that were unique to understanding physical activity in persons with SCI. These factors were most commonly found within the categories relating to demographics and biological factors, secondary complications, behavioural skills, and the social and physical environment. Examples of these SCI-specific correlates include: level of injury, physical activity status prior to having an SCI, physical independence and mobility, ability to perform activities of daily living, presence of secondary complications such as chronic pain, fear of further injury, affiliation with supportive rehabilitation staff or peers from a disability sports centre, ability to learn new adaptive skills, availability of transportation, and the accessibility of facilities and equipment. Together, these studies indicate that while there are many factors that are common to understanding physical activity in persons with and without SCI, there are also other characteristics that are unique to persons with SCI. As such, research efforts to increase physical activity levels among individuals with SCI population should consider these additional factors.

2.2.2 Prospective studies

To date, four prospective studies have examined determinants of physical activity specific to individuals with SCI (Ditor et al., 2003; Godin, Shephard, Davis, & Simard, 1989; Hicks et al., 2005; Latimer & Martin Ginis, 2005), while one study examined physical activity determinants in persons with disabilities, which included a subset of participants with SCI (Kosma, Ellis, Cardinal, Bauer, & McCubbin, 2007). Similar to findings in the cross-sectional research, these five studies identified determinants that were common to both individuals with and without SCI, such as education (Godin et al., 1989), past exercise (Godin et al., 1989), intentions (Godin et al., 1989; Kosma et al., 2007; Latimer & Martin Ginis, 2005), stages of change (Kosma et al., 2007), perceived behavioural control (PBC; Kosma et al., 2007); life satisfaction, and satisfaction with physical functioning (Hicks et al., 2005). However, there were also determinants identified that were unique to persons with SCI. For example, Ditor et al. demonstrated a significant, negative relationship between perceived pain at the end of a 9-month exercise trial and adherence during a 3-month follow-up for seven of the intervention participants. Moreover, the authors suggested that pain perceptions may be a potential predictor of exercise adherence in persons with SCI as it was shown to account for 83% of the variance in 3-month exercise adherence. Furthermore, the etiology of the disability (i.e., whether the disability resulted from a traumatic or atraumatic incident) was also found to influence physical activity in persons with SCI (Godin et al., 1989). Specifically, for males with paraplegia whose injuries were classified as traumatic (i.e., sudden SCI resulting from some type of trauma), past exercise behaviour, less education, and lower lesion level were the strongest predictors of LTPA performed over the preceding seven days. Meanwhile, intentions were the only significant predictor of LTPA in males who sustained an SCI as a result of a congenital or progressive illness. However, the restricted sample used in the study—young males with paraplegia—limits the generalizability of these findings to the larger SCI population.

In general, prospective research examining physical activity determinants in persons with SCI has been scarce. Many of the determinants have been previously shown to predict physical activity in persons without disabilities (e.g., intentions, and past exercise behaviour). However, there were also unique determinants for predicting physical activity in people with SCI, such as perceived pain, disease etiology, and injury level. Together, these determinants should be considered when developing LTPA-promoting interventions.

2.3 Limitations to Physical Activity Correlates and Determinants Research

One limitation to the current correlates and determinants research is the inconsistent operational definitions of physical activity. While some of the studies defined physical activity as "leisure-time" (e.g., neighbourhood wheeling, resistance training; Latimer & Martin Ginis, 2005), or "lifestyle" activities (e.g., a combination of leisure-time and household activities; Ellis, Kosma, Cardinal, Bauer, & McCubbin, 2007), other studies focused on specific types of activities (e.g., exercising at a fitness facility; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004). Meanwhile, an additional set of studies included sport participation in their definition of physical activity (e.g., Tasiemski et al., 2000, 2005). Clearly, little consensus exists regarding how physical activity should be defined in populations with disabilities. Hence, the physical activity correlates and determinants research in persons with SCI must be cautiously interpreted.

A second limitation is the limited focus on theory-driven research. Using theory to understand and promote physical activity among individuals with disabilities has been advocated by many researchers in the health promotion field (Crocker, 1993; Kosma et al., 2007; Latimer & Martin Ginis, 2005; Reid, 1989), and therefore, should be a priority when examining physical activity among individuals with SCI. However, of the studies reviewed, only seven utilized a theoretical framework to examine physical activity correlates or determinants (Cardinal, Kosma, & McCubbin, 2004; Ellis et al., 2007; Kosma, Cardinal, & McCubbin, 2004; Kosma, Cardinal, & Rintala, 2002; Kosma et al., 2007; Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Craven, 2004). Meanwhile, the remaining studies used a descriptive approach, without any particular theoretical rationale for why the variables were tested. While atheoretical approaches are useful for generating ideas and directing future research, they are limited in their ability to explain the multidimensional correlates and determinants of physically active (Biddle & Nigg, 2000; Symons Downs & Hausenblas, 2005). To better understand and promote physical activity in people living with SCI, there must be a shift from atheoretical approaches towards research that is grounded in theory.

3.0: USING THEORY TO IDENTIFY PHYSICAL ACTIVITY CORRELATES AND DETERMINANTS FOR PERSONS WITH SCI

The application of social psychological theory to the study of physical activity is widespread, with many researchers recognizing the usefulness of theory-based research for the promotion of regular physical activity participation (Baranowski, Anderson, & Carmack, 1998; Crocker, 1993; Godin, 1993; Godin & Kok, 1996; Symons Downs & Hausenblas, 2005). Many theoretical approaches have been used to understand and predict physical activity in persons without disabilities. These theoretical approaches include: belief-attitude theories (e.g., theory of planned behaviour), control-based theories (e.g., self-determination theory), decision-making theories (e.g., transtheoretical model), and competence-based theories (e.g., social cognitive theory; cf., Biddle & Nigg, 2000). According to Crocker (1993), theory-driven research is imperative for advancing the research on physical activity in persons with disabilities because of its ability to: (1) explain regularities and provide explanatory power, (2) act as a blueprint for developing research questions, and testable hypotheses, (3) provide a rationale for the inclusion/exclusion of particular variables, (4) allow for the study of complex relationships in a coherent, testable manner, and (5) extend the use of theories in the physical activity field (cf., Crocker, 1993; Rejeski, 1992). Most importantly, theory-based research can direct research efforts towards understanding and explaining the multiple correlates and determinants that have been examined in previous cross-sectional and prospective studies among individuals with SCI.

3.1 Overview of Theory-Based, Individual-Level Correlates and Determinants for People with SCI

A number of reviews and meta-analyses support the utility of theoretical frameworks for identifying correlates and determinants of physical activity among individuals without disabilities (Biddle & Nigg, 2000; Hagger, Chatzisarantis, & Biddle, 2002; Marshall & Biddle, 2001; McAuley & Blissmer, 2000; Symons-Downs & Hausenblas, 2005), with little consensus on the "best" approach for studying physical activity. Overall, these theoretical frameworks have been shown to be modestly predictive of physical activity for persons without disabilities (e.g., account for 21% to 25% of the variance in behaviour; Hagger et al., 2002; Symons Downs & Hausenblas, 2005), and therefore, provide researchers with a "blue print" for designing effective physical activity interventions (Rejeski, 1992).

When developing theory-driven approaches to promoting physical activity in persons with SCI, it is necessary for researchers to ensure that the guiding theory can adequately capture the variables that are the most important determinants of physical activity within the population (cf., Crocker, 1993). Given the relatively few studies that have focused exclusively on theory-driven research among people with SCI, this section will review the theoretical research that has been conducted in persons with SCI, as well as other types of mobility disabilities.

One theoretical approach that has been used is the Transtheoretical Model (TTM; Prochaska & DiClemente, 1983). The TTM is comprised of four constructs: *stages of change* (i.e., precontemplation, contemplation, preparation, action, and maintenance), *processes of change* (i.e., strategies used to initiate/maintain physical activity, such as social support or goal-setting), *self-efficacy*, and *decisional balance* (i.e., perceived pros and cons of physical activity; Kosma et al., 2004). According to the model, progression through the stages involves a positive decisional balance, increases in self-efficacy, and greater use of processes of change (Biddle & Nigg, 2000; Marshall & Biddle, 2001). Support for the utility of the TTM constructs for understanding stage classification in persons with disabilities has been found in both cross-sectional and intervention studies. In general, individuals in the lowest stages have shown lower scores on the dimensions of self-efficacy and processes of change, and have reported fewer pros of physical activity than those people in the higher stages (Cardinal et al., 2004; Kosma et al., 2004). Furthermore, behavioural processes of change and self-efficacy have shown the strongest associations with stages of change (Cardinal et al., 2004; Kosma et al., 2004). Overall, self-efficacy, decisional balance, and processes of change have accounted for 54.3% to 69.6% of the variance in stages of change (Cardinal et al., 2004; Kosma et al., 2004), with the greatest classification accuracy being shown for the stages of maintenance (Cardinal et al., 2004), precontemplation, and contemplation (Cardinal et al., 2004; Kosma et al., 2004). Interestingly, Cardinal et al. found that the classification accuracy increased to 70.8% when exercise barriers were added to the prediction model, suggesting that barriers may be an additional construct to include within the TTM for persons with disabilities.

Preliminary findings from a 4-week, web-based intervention further supports the use of TTM as a theoretical framework for promoting stages of change, and, to a lesser extent physical activity in persons with disabilities (33% of whom had an SCI; Kosma, Cardinal, & McCubbin, 2005). This program focused on enhancing the four TTM constructs through the use of weekly, stage-matched lesson plans. Meanwhile, participants in the control condition were exposed to weekly, motivational messages regarding aspects of life not related to physical activity (e.g., friendship, communication). Following the 4-week intervention, small-to-moderate changes in LTPA participation were associated with the TTM intervention. Furthermore, a larger proportion of participants in the intervention progressed to a higher behaviour stage in comparison to controls (52% vs. 28%, respectively).

Together, the aforementioned studies demonstrate preliminary support for the utility of the TTM for explaining and facilitating stages of change among persons with disabilities. However, limited support has been found for the TTM's ability to predict physical activity behaviour. Since none of the three studies were specific to persons with SCI, it remains unknown whether the results generalize to individuals with SCI. In an earlier study, Warms et al. (Warms, Belza, Whitney, Mitchell, & Stiens, 2004) demonstrated the efficacy of a 6-week, TTM-based lifestyle program on daily physical activity in 16 beginner exercisers with SCI. This lifestyle program was comprised of TTM-derived techniques to increase physical activity, such as stage-matched physical activity information, social support, goal-setting, and coping strategies. Among participants who did not report injury or illness, self-reported physical activity significantly improved over the study period. Although these results are encouraging, the small sample size, and the incomplete testing of the full TTM framework indicate that further study of the TTM in persons with SCI is warranted.

Another theory that has been identified as a viable theoretical framework for understanding physical activity in persons with disabilities is Ajzen's (1985) Theory of Planned Behaviour (TPB; Crocker, 1993). According to the tenets of the TPB (Ajzen, 1985), intentions are the most proximal determinant of behaviour. Furthermore, the theory posits that an individual's *intentions* are determined by three constructs: (a) *attitudes* (positive or negative evaluation of the behaviour), (b) *subjective norms* (social pressure to perform the behaviour), and (c) *perceived behavioural control* (PBC; the perceived ease or difficulty of performing the behaviour). Additionally, the theory stipulates that a particular behaviour will be performed when an individual exemplifies a *heightened sense of control* over his or her ability to perform the particular behaviour (i.e., heightened PBC).

Contrary to the TTM, the TPB has been fully tested for its ability to explain physical activity among individuals with SCI (Latimer & Martin Ginis, 2005; Latimer et al., 2004). In the first study, Latimer et al. (2004) found that the TPB had limited ability to explain moderate-intensity physical activity in persons with SCI, with PBC emerging as the sole physical activity correlate, but only for persons with tetraplegia. However, the use of indirect, belief-based TPB measures, a cross-sectional design, and the lack of a valid, and reliable physical activity measure for persons with SCI were proposed to limit the study's findings (Latimer & Martin Ginis, 2005). As such, a subsequent, prospective investigation (Latimer & Martin Ginis, 2005) was undertaken to rectify the previous limitations. Using direct belief-based measures, and a validated physical activity measure for persons with SCI (Martin Ginis et al., 2005), the authors were able to demonstrate the utility of the TPB for predicting intentions, and to a lesser extent behaviour, among 104 individuals with SCI. Together, attitudes, subjective norms, and PBC accounted for 60% of the variance in intentions, with each of the three constructs exhibiting a significant relationship with intentions. Meanwhile, intentions were shown to be the sole predictor of behaviour, accounting for 16% of the variance in LTPA. Consistent with the tenets of the TPB, intentions mediated the effects of the TPB constructs on behaviour. Overall, the results demonstrated the TPB to be a useful theory for predicting intentions, and, to a lesser extent, behaviour in persons with SCI. Moreover, these findings provide researchers with constructs to target in future LTPA-enhancing interventions in people living with SCI.

As an extension of these findings, Latimer and colleagues (Latimer, Martin Ginis, & Arbour, 2006) conducted one of the largest SCI interventions and demonstrated the merit of a planning intervention on increasing LTPA in 37 persons with SCI. Specifically, those who formed physical activity plans for three 30 minute bouts of moderate to heavy intensity physical activity per week increased their physical activity levels over an 8-week period, while participants in a control condition significantly decreased their physical activity over the same period. Furthermore, intentions were shown to explain a significant 23% of the variance in 8-week physical activity behaviour among the treatment condition versus a nonsignificant 1% in the controls. These findings support the use of theory-driven research, in particular the constructs captured by the TPB, for designing effective LTPA-enhancing interventions in persons with SCI.

3.2 Limitations of the Current Theoretical Research

Despite the evidence of the utility of the TPB for understanding physical activity in persons with SCI, there stills remains a significant amount of behavioural variance left unexplained when using this framework. Recent research has shown the benefits of integrating the TPB with the stage of change constructs for improving the prediction of physical activity in persons with disabilities (Kosma et al., 2007). Although this integrative approach was found to increase the amount of explained variance in physical activity from 16% to 28%, a significant amount of behavioural variance still remained to be explained. One reason for the relatively small explanatory power may be that the theoretical research conducted in persons with SCI has focused exclusively on the psychosocial determinants of LTPA, while completely disregarding other, environmental factors not captured by the TPB. According to Rimmer (1999), and also shown earlier in the physical activity correlates and determinants section, the demands of the environment, not the disability per se, may pose as a barrier to good health practices. As such, there may be core environmental factors that must also be considered when examining LTPA in persons with SCI. The following section reviews the research on physical activity and the environment for persons without disabilities and, where appropriate, those people with disabilities.

4.0 THE ENVIRONMENT AND PHYSICAL ACTIVITY IN PERSONS WITH SCI

4.1 Theoretical Underpinnings of Environmental Variables and Physical Activity

A growing interest has emerged regarding the importance of environmental factors to the promotion of physical activity. This interest, in part, developed from the recognition that changes in physical activity involve the complex interaction between individual-level factors and the surrounding environment (King, Stokols, Talen, Brassington, & Killingsworth, 2002; Sallis & Owen, 1997). As such, many researchers have advocated that an ecological approach be used to study the relationship between the environment and physical activity participation (Sallis & Owen; Spence & Lee, 2003). Contrary to the psychosocial theories that are used to study physical activity, an ecological framework allows researchers to examine the most relevant interpersonal, social, and environmental variables in order to provide a comprehensive understanding of physical activity (Bronfenbrenner, 1977; Sallis & Owen). Hence, ecological models are often divided into two broad levels of behavioural influence—*intraindividual* factors (e.g., personal beliefs), and (ii) *extraindividual* factors (e.g., the physical environment; Spence & Lee)—with the central focus of the model placed on the physical environment (Sallis & Owen). These ecological models posit that intra- and extraindividual factors can influence physical activity directly, as well as indirectly via their influence on each other (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Giles-Corti & Donovan, 2002; Owen, Humpel, Leslie, Bauman, & Sallis, 2004).

Despite the potential for ecological models to allow for the identification of many mediating factors occurring at multiple levels of influence (Sallis & Owen, 1997; Spence & Lee, 2003), most environmental studies have been exploratory, segmented, and lacking a coherent theoretical framework (King et al., 2002; Spence & Lee). The few cross-sectional studies that have used an ecological framework to examine the relative influence of intra- and extraindividual factors on physical activity have found the physical environment to exhibit the weakest relationship with physical activity (Ball et al., 2007; Giles-Corti & Donovan, 2002, 2003). While the relative influence of physical environmental factors may be second to intrapersonal and social factors, the collective influence of these three factors seems to show the strongest relationship with physical activity (Ball et al.; Giles-Corti & Donovan, 2002, 2003). However, more research is needed to better understand the contribution of intra- and extraindividual factors on physical activity promotion.

4.2 Review of the Environmental Correlates and Determinants of Physical Activity in Persons Without Disabilities

In the past, the physical environment has been the least studied correlate of physical activity (Dishman & Sallis, 1994; Sallis & Owen, 1997). Consequently, greater research investment towards measuring and identifying physical environmental correlates and determinants has occurred over the past decade (Ball, 2006; Giles-Corti, Timperio, Bull, & Pikora, 2005). The following section reviews the physical environmental correlates that have been identified for physical activity.

Most of the studies that have examined environmental correlates have been cross-sectional, with a limited number of prospective designs (e.g., Hovell, Hofstetter, Sallis, Rauh, & Barrington, 1992; Humpel, Marshall, Leslie, Bauman, & Owen, 2004; Sallis, Hovell, & Hofstetter, 1992; Sallis, King, Sirard, & Albright, 2007). Together, these studies have identified environmental attributes that warrant further investigation. In particular, three systematic reviews (Humpel, Owen, & Leslie, 2002; Owen et al., 2004; Wendel-Vos, Droomers, Kremers, Brug, & van Lenthe, 2007), and one meta-analysis (Duncan, Spence, & Mummery, 2005) identified the following physical environmental attributes as the most consistent, positive correlates of physical activity: access to (Duncan et al., 2005; Humpel et al., 2002; Owen et al., 2004; Wendel-Vos et al., 2007), and convenience of (Wendel-Vos et al., 2007) facilities that enable physical activity, availability of sidewalks (Owen et al., 2004; Wendel-Vos et al., 2007), trails (Wendel-Vos et al., 2007), and physical activity equipment (Humpel et al., 2002; Wendel-Vos et al., 2007), environmental aesthetics (Humpel et al., 2002; Owen et al., 2004), convenient shops and services (Duncan et al., 2005), and perceptions that traffic is not a problem (Duncan et al., 2005; Owen et al., 2004). While these correlates have generally shown small associations with physical activity (e.g., 4%-7% of the variance in physical activity; Duncan et al., 2005), many researchers have suggested that the overall contribution of small changes in physical environmental factors to physical activity at the population level may be substantial (Duncan et al., 2005; Giles-Corti et al., 2005; Sallis & Owen, 1997; Wendel-Vos et al., 2007). However, further prospective research is necessary for determining whether a causal relationship exists between the physical environmental factors identified and physical activity.

Many moderators have been suggested to influence the physical environment-physical activity relationship, including sex (Garcia Bengoechea, Spence, & McGannon, 2005; Wendel-Vos et al., 2007), type and intensity of physical activity (Owen et al., 2004; Wendol-Vos et al., 2007), age (Sallis et al., 2007), baseline perception scores (Humpel, Marshall, et al., 2004), and type of environmental measure (i.e., objective vs. subjective; Wendol-Vos et al., 2007). For example, some studies have shown certain attributes, such as neighbourhood aesthetics, to be positively related to physical activity among men, but not women (Garcia Bengoechea et al., 2005; Humpel, Owen, et al., 2004; Sallis et al., 1992). Meanwhile, other studies have found the same environmental attribute to be related to physical activity among both sexes, but in the opposite direction, such as traffic perceptions (Humpel, Marshall, et al., 2004). Likewise, different environmental correlates have been identified for different types and intensities of physical activities. In particular, leisure-time walking has been shown to be more strongly associated with neighbourhood aesthetics and availability of sidewalks, whereas participation in moderate-to-vigorous physical activity is more strongly related to the accessibility and convenience of recreational facilities, and the availability of trails (Wendel-Vos et al., 2007). Moreover, neighbourhood aesthetics and the availability of sidewalks have been found to be significantly related to leisure-time walking for men, but not women, suggesting an accumulative influence of different moderators on the physical environment-physical activity relationship. Taken together, these findings suggest that the relationship between the physical environment and physical activity is one that is complex, and interwoven with compounding influences of multiple factors.

According to Giles-Corti and colleagues (2005), one reason for the small relationships among environmental attributes and physical activity is a lack of measurement of behaviour-specific environmental factors. For example, when examining the relationship between walking and the physical environment, assessments of environmental attributes should be specific to the *type* of walking (e.g., leisure-time vs. transport), and *where* the walking will take place (e.g., neighbourhood, walking trail; Giles-Corti et al., 2005). Studies that have used these behaviour-specific environmental measures have often shown stronger associations between the physical environment and physical activity (Wendel-Vos et al., 2007). Hence, greater consideration of behaviour-specific measures should be given in future research.

In sum, findings from systematic reviews and meta-analyses have identified a variety of physical environmental correlates of physical activity for persons without disabilities. However, these environmental attributes often exhibit intricate relationships with physical activity, depending on a variety of factors, such as sex, and activity type. Despite the potential for environmental approaches to increase physical activity at the population-level (Giles-Corti et al., 2005), it may be premature to expect such large-scale changes by altering environmental variables that have been predominately identified using cross-sectional study designs among individuals without disabilities (cf., Giles-Corti et al., 2005; Sallis & Owen, 1997). To further the research on the physical environment and physical activity, more prospective studies should be conducted within a variety of populations.

4.3. Environmental Correlates of Physical Activity in Persons with Disabilities

Environmental factors that are important for understanding physical activity in persons with disabilities may not generalize to those who have a disability. This is particularly the case for the environmental factors associated with walking. Contrary to persons without disabilities, the majority of persons with SCI rely on a mobility-assistive device, such as a wheelchair, as their primary mode of mobility outside of the home (Canadian Paraplegic Association, 2000). This suggests that physical environmental attributes such as steep terrain and the presence of sidewalks, may play an even greater role on physical activity participation in persons with SCI than among people who do not have a disability, and therefore, warrant further study among individuals with SCI.

Currently, very little is known about the role of the physical environment on physical activity in persons with SCI, with most of the existing research directed towards the accessibility of fitness and recreational centres. Overall, findings suggest that these facilities do not meet the needs of individuals with disabilities (Cardinal & Spaziani, 2003; Nary, Froehlich, & White, 2000; Rimmer, Riley, Wang, & Rauworth, 2005; Rimmer et al., 2004; Thapar et al., 2004). Focus groups conducted among individuals with disabilities indicate that people with disabilities often perceive facilities, specifically fitness and recreational centres, to be "disability-unfriendly environments" because of such barriers as inaccessible access routes and amenities, lack of adaptive equipment, community programming, and transportation, and negative attitudes of staff towards accessibility-related issues (Rimmer, 2005; Rimmer et al., 2004). Furthermore, structural barriers, such as narrow doorways, and inaccessible pathways to and around equipment, represent the largest proportion of the total environmental barriers (Cardinal & Spaziani, 2003; Nary et al., 2000; Rimmer et al., 2005; Thapar et al., 2004). Among persons with SCI, Martin et al. (2002) identified the lack of accessible and affordable facilities or programs, transportation difficulties, and limited community awareness of adaptive services to be prominent environmental barriers to physical activity participation. For individuals with SCI, many of whom use a wheelchair as their primary mode of mobility, structural barriers may be even more problematic than for persons without disabilities (Thapar et al., 2004).

With regards to the neighbourhood environment, even less is known about the neighbourhood correlates and determinants of physical activity for persons with disabilities. To date, only one study has examined this issue (Spivock, Gauvin, & Brodeur, 2007). Spivock et al. conducted neighbourhood audits to identify environmental "buoys" or facilitators that were associated with the likelihood of active living among individuals with disabilities (termed the *neighbourhood active living potential (NALP)*; Gauvin et al., 2005). Results indicated that the presence of accessible sidewalk surfaces, signage, and transport/destinations were associated with a greater NALP. Not surprisingly, the authors found that very few of the neighbourhoods contained these environmental facilitators. Since Spivock et al. only examined indicators of active living (defined as "a way of life that integrates physical activity into daily routines"; cf., Gauvin et al.), and not actual LTPA, it is unknown whether these findings generalize to physical activity behaviour of persons with disabilities.

5.0 CONCLUSION

The combination of sedentary lifestyles and increased risk of secondary complications have directed research efforts towards promoting healthy living, specifically physical activity, among persons with SCI. To date, most of the research that has examined the factors associated with physical activity in persons with SCI has primarily relied on cross-sectional study designs, with very few studies using a prospective design. Collectively, these studies have identified factors that are common to understanding physical activity in persons with and without SCI, as well as other characteristics that are unique to persons with SCI. However, the lack of clear operational definitions of physical activity, and the limited focus on theory-driven research preclude the ability to fully understand and predict physical activity in persons with SCI.

Studies that have applied theory to understanding physical activity in persons with disabilities have shown the TPB to be one of the most useful theories for predicting physical activity in persons with SCI. Even still, the relatively large amount of behavioural variance left unexplained when using the TPB framework suggests that other factors not captured by the TPB constructs, such as the physical environment, should be considered when examining physical activity among individuals with SCI. Within the physical activity realm, the primary focus of the environmental research has been conducted among individuals without disabilities. Results from these studies have generally found small associations between physical environmental attributes and physical activity. However, very little is known regarding the role of the physical environment on physical activity participation in persons with SCI. Of the existing research conducted, most studies have been directed towards examining the accessibility of fitness and recreational centres for various types of disabilities, with little regard to the neighbourhood environment. Hence, there is a limited understanding of the prominent environmental barriers to physical activity participation that are specific to persons with SCI. Taken together, this literature review indicates the need to identify both individual and environmental factors that are specific to predicting LTPA among individuals with SCI so that these variables can be targeted in activity-enhancing interventions.

6.0 GENERAL PURPOSE

The general purpose of the following three studies was to use an integrative theoretical framework to examine the individual and environmental physical activity correlates and determinants for persons with SCI. Study 1 adds to the physical environmental research by surveying the accessibility of fitness, recreational, and community swimming pool facilities for persons living with disabilities, and applying a geographical technique, Geographical Information Systems (GIS), to the physical activity domain in order to examine the relationship between proximity to physical activity facilities and LTPA in persons with SCI. As an extension of Study 1, Study 2 uses a cross-sectional design to test whether an environmental factor --neighbourhood perceptions--can enhance the Theory of Planned Behaviour's ability to explain LTPA intentions and behaviour in persons living with SCI. Lastly, Study 3 examines whether a theory-based intervention focused on teaching strategies for coping with salient individual and environmental physical activity barriers is effective for increasing LTPA among persons with SCI.

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CHAPTER 2

Examining the Accessibility and Availability of Physical Activity Facilities for Persons with Mobility Disabilities

Abstract

Purpose: To examine the accessibility and availability of physical activity facilities for persons living with mobility disabilities. **Methods:** Two studies were conducted. In Study 1A, the accessibility of 44 fitness, recreational, and community pool facilities in Hamilton, Ontario were assessed using a modified version of the AIMFREE (Rimmer et al., 2004). Study 1B used Geographical Information Systems (GIS) to examine the relationship between perceived and objective proximity to accessible physical activity facilities and LTPA among 50 Hamilton residents living with SCI. **Results**: None of the facilities were found to be fully accessible, with only three facility areas (i.e., parking, access routes, and programming) exhibiting above average (i.e., > 50%) mean accessibility scores. In general, recreational facilities had higher accessibility scores than fitness centres or community pools, with significant differences on the subscales of access routes, bathrooms, and swimming pools. Low agreement levels were found between the perceived and objective proximity measures. LTPA status was shown to moderate the relationship, with higher agreement levels found for participants who reported engaging in moderate or heavy LTPA versus their inactive counterparts, but only for the 30-minute wheeling boundary. Contrary to hypothesis, people living within a 30-minute wheel from an accessible facility were less likely to engage in either moderate or heavy LTPA than people who did not have an accessible facility located within a 30-minute wheel. No significant associations were found between LTPA and perceived proximity. **Conclusion:** These two studies provide evidence of the limited accessibility of Hamilton physical activity facilities for persons with mobility disabilities. Moreover, Study 1B indicates that living in close proximity to a facility which provides adaptive programming and equipment does not necessarily translate into greater LTPA.

Introduction

Physical inactivity is a national health concern, costing the Canadian health care system approximately $2.1 billion annually in direct health care costs (Katzmarzyk & Janssen, 2004). The combination of inactivity and poor dietary consumption has resulted in increased rates of chronic diseases and obesity. Consequently, a collaborative approach between the Federal, Provincial and Territorial Ministers of Health, the *Healthy Living Strategy* (2005), was developed to provide "a healthy nation in which Canadians experience the conditions that support the attainment of good health" (Secretariat for the Intersectoral Healthy Living Network, 2005, p. 9). While the *Healthy Living Strategy* provides targets for preventing disease and disability in healthy, able-bodied Canadians, less attention has been directed towards establishing health behaviour targets in populations who are underserved in terms of health promotion, such as persons with disabilities.

Among persons with disabilities, poor health status and chronic diseases are of an even greater concern than among individuals who do not have a disability (Martin Ginis & Hicks, 2007; Rimmer & Wang, 2005). For example, persons with disabilities are more likely to use health services and require prescription drugs than people without disabilities, and are more susceptible to chronic diseases such as heart disease, diabetes, and obesity (Canadian Council on Social Development, 2004; Martin Ginis & Hicks, 2007). Hence, there is a need to shift attention towards promoting healthy living in persons who already have disabilities, rather than focusing exclusively on preventing disabilities (Rimmer, 1999). Providing physical activity opportunities for persons with disabilities at recreational and fitness centres may be one option for curtailing these secondary health complications (Rimmer).

According to Rimmer's (1999) model of health promotion, physical activity facilities, such as recreational and fitness centres, are the future cornerstones of health promotion for people with disabilities. Specifically, these facilities are projected to become an extension of the rehabilitation process, with the focus shifting from rehabilitation towards community-based fitness programs. However, for this process to occur, greater emphasis is needed on recreational and fitness centre-based health promotion within persons with disabilities, with a particular focus on training fitness professionals in health promotion and disability, enhancing the relationship between rehabilitation and facility staff, and providing clients with assistance in overcoming physical activity barriers relating to use of recreational and fitness facilities.

To foster active living, recreational and fitness centres must provide programs that meet the needs of persons with disabilities. Without the existence of adapted programming, community-based health promotion may be substantially limited (Rimmer, 1999). Currently, little is known regarding the availability of programming for persons with disabilities at recreational and fitness centres and its relationship to leisure-time physical activity. The following two studies explored this issue.

In addition to programming, there are other social and physical environmental barriers to the use of recreational and fitness facilities. Lack of staff training and knowledge, lack of transportation to facilities, inaccessible building entrances and equipment, limited support from health professionals, and negative attitudes of staff and facility members have all been reported as barriers (Hawes, 2001; Rimmer, Braddock, & Pitetti, 1996; U.S. Department of Health and Human Services (USDHHS), 2000). While there have been a few initiatives aimed at reducing these environmental barriers (e.g., *Accessibility for Ontarians with Disabilities Act [AODA]; Active Living Alliance for Canadians with Disabilities (ALACD); Jasper Talk [1986] symposium on PA and disability; Sport Canada*), there has been only one study that has examined the presence of these environmental barriers within Canadian fitness and recreational centres (Hawes, 2001). Within this study, 38 recreational and fitness facilities were assessed across five Ontario cities using an unvalidated accessibility checklist which was based on the Ontario Building Code (OBC). Overall, the results revealed that none of the facilities were completely accessible, and compliance to the OBC was inconsistent.

The following two studies examined the accessibility and availability of physical activity facilities for Hamilton residents living with a disability. In Study 1A, the physical and social environments of fitness and recreational facilities in Hamilton, Ontario were surveyed. Meanwhile, Study 1B examined the relationship between proximity to accessible physical activity facilities and leisure-time physical activity among persons with a specific type of mobility disability – a spinal cord injury (SCI).

Study 1A

Active living and inclusion in all aspects of society are national priorities, particularly among persons with disabilities (Active Living Alliance for Canadians with a Disability [ALACD], 2008; USDHHS, 2000). As part of the active living movement, organizations such as the ALACD have been created to help Canadians with disabilities lead active, healthy lifestyles by providing equal access to physical activity opportunities for persons of all abilities (ALACD, 2008). The ultimate goal of these organizations is to create environments and opportunities that are designed in such a way that they not only meet the minimum accessibility standards (i.e., *Accessible Design*; Skulski, 2008), but they are also “approachable, functional, and usable by persons with disabilities, independently, safely, and with dignity” (termed *accessible*; Goldman, 1991). Within Ontario, building construction is regulated under the Ontario Building Code (OBC). One section of the Code, *Barrier-Free Design*, stipulates building conditions for persons with a disability. However, the OBC only applies to newly constructed or recently renovated commercial or public buildings (cf., Hawes, 2001). Recently, the Ontario government passed legislation, the Accessibility for Ontarians with Disabilities Act (AODA), which proposes that goods, services, and existing facilities be fully accessible to all Ontario citizens by 2025 (Ministry of Ontario, 2005).

Conversely, Title III of the American Disability Act (ADA) mandates that publicly and privately-owned facilities be architecturally accessible for persons with disabilities (Rauworth, 2006). Additional efforts have been made by the U.S. Access Board to create accessibility guidelines specific to recreational and fitness facilities (known as the *American with Disabilities Act Accessibility Guidelines* [ADAAG; U.S. Access Board, 2002]). These accessibility guidelines are important for facilitating physical activity opportunities for persons with disabilities by providing facility owners with accessibility standards to adhere to, as well as identifying barriers that may hinder the use of recreational and fitness facilities.

Within the physical activity and accessibility literature, adapted ADA and ADAAG checklists have been used to assess the accessibility of recreational and fitness centres. Earlier studies have used modified checklists that primarily focus on the structural environment of the facilities (e.g., widths of access aisles and doorways, spacing between equipment; Cardinal & Spaziani, 2003; Figoni et al., 1998; Nary, Froehlich, & White, 2000), with a limited emphasis on the social environment, such as staff training, programming, and policy. One Canadian study used a combination of an OBC accessibility checklist, and an attitudes survey to assess both the physical and social (e.g., staff knowledge, availability of programs and policies) environment of fitness and recreational facilities (Hawes, 2001). However, no information was provided on the measurement properties of these two instruments; hence it is unknown whether these instruments are valid and reliable measures for assessing the accessibility of facilities for persons with disabilities.

Recognizing the lack of valid accessibility instruments within the physical activity domain, Rimmer and colleagues (Rimmer, Riley, Wang, & Rauworth, 2004) recently developed the Accessibility Instruments Measuring Fitness and Recreation Environments (AIMFREE). The AIMFREE is a validated assessment tool that both researchers and consumers can use to examine the accessibility of the physical and social environment of fitness and recreational facilities for persons with mobility disabilities and visual impairments. For the current study, the AIMFREE was used to assess the accessibility of Hamilton fitness and recreational facilities.

To date, research suggests that recreational and fitness facilities are not fully compliant with ADAAG or OBC guidelines, with structural (e.g., uneven exterior surfaces, inaccessible pathways to and around fitness equipment and locker rooms, high service desks, lack of power-operated doors and hand-held shower units), and equipment (e.g., lack of adapted exercise equipment) barriers representing the largest proportion of the total environmental barriers (Cardinal & Spaziani, 2003; Hawes et al., 2001; Nary et al., 2000; Rimmer, Riley, Wang, & Rauworth, 2005). Additionally, there is reason to believe that a facility's social environment may influence physical activity participation for persons with disabilities, such as negative attitudes of staff members and other users of the facility, few opportunities for adapted programming and staff training in disability awareness and adapted physical activity (Hawes, 2001; Nary et al., 2000; Riley, Rimmer, Wang, & Schiller, 2008; Rimmer, 1999). However, findings from the few studies that have examined the social environment of fitness and recreational centres have been equivocal. While one study reported a lack of adapted fitness equipment, and minimal adaptive programming and staff training (Nary et al., 2000), another study reported some program opportunities (e.g., aquatics, wheelchair tennis; Hawes, 2001). An additional study found that the majority of recreational and fitness centre staff were trained on how to assist individuals with transferring to and from the equipment, and displayed positive attitudes and behaviours towards persons with disabilities (Rimmer et al., 2005). However, none of the studies used the same accessibility instrument (i.e., Hawes et al. and Nary et al. used non-validated questionnaires, while Rimmer et al. used the AIMFREE), which makes it difficult to compare the findings across studies. Overall, greater attention is warranted to assess accessibility (in terms of both the physical and social environment) of fitness and recreational facilities, especially given the projected importance of these establishments on the health and well-being of persons living with disabilities (Rimmer, 1999).

Thus, the primary purposes of Study 1A were to descriptively measure (a) the accessibility of the physical environment of established fitness and recreational facilities within the Hamilton-Wentworth area that provide physical activity programming and/or equipment for persons with disabilities; and (b) the knowledge and training of staff members at these facilities with regards to working with persons with a disability. Given the descriptive nature of these objectives, no hypotheses were proposed. A secondary purpose of Study 1A was to examine the relationship between facility accessibility, in particular areas of general accessibility (i.e., parking, access routes, bathrooms, and elevators) and fitness centre-specific accessibility areas (i.e., locker rooms, equipment, swimming pools, policies, and training), and the availability of programming for persons with disabilities. A positive relationship was hypothesized, such that fitness and recreational centres that exhibited higher accessibility ratings on the general accessibility and fitness centre-specific accessibility categories would have more accessible programs.

Method

Facilities

Fifty-six fitness centres (21 private for-profit health clubs, 5 public non-profit organizations such as YMCAs and YWCAs), recreational centres (16 publicly funded facilities), and community swimming pool facilities (i.e., 4 indoor and 10 outdoor swimming pools) within the Hamilton-Wentworth region were mailed a letter requesting permission for the investigators to perform one on-site facility assessment. These 56 facilities were selected because it was indicated, either through personal communication with the manager or web-based advertisements, that the facility provided physical activity programming and/or equipment for persons with disabilities.

Measures

Demographics. For descriptive purposes, information was collected on the type of facility (i.e., recreational centre, fitness centre, pool), date of establishment, type of area in which the facility was located (i.e., urban, suburban), target member (i.e., men and women, women only, family), number of staff, total memberships, and whether the facility had undergone any accessibility-related changes within the past 10 years.

Environmental Accessibility. The environmental accessibility of each facility was assessed using a modified version of the Accessibility Instruments Measuring Fitness and Recreational Environments (AIMFREE; Rimmer et al., 2004). The original AIMFREE instrument contains 401 items, which are divided into 6 accessibility subscales (built environment, information, equipment, policies, professional behaviour, and swimming pools). Given the length of the AIMFREE, the items pertaining to the accessibility of hot tubs/saunas, signage, and facility-related information were omitted for the present study in order to maintain the brevity of the assessments. Items pertaining to the accessibility of telephones were also omitted because these items were more appropriate for examining the accessibility needs of persons with visual impairments, than for persons with mobility disabilities, which was the primary population of interest. The 17 items on the professional behaviour subscale that pertained to monitoring staff behaviour towards persons with disabilities were also omitted since it was difficult to ensure that each facility would have at least one person with a disability using the facility during the assessment. Finally, no meaningful scoring system could be created by the original authors for the water fountain subscale (Rimmer et al., 2004); hence this subscale was excluded from the analyses. In sum, a total of 333 AIMFREE items were used in the present study, divided into five accessibility subscales (built environment, equipment, policies, professional behaviour, and swimming pools; see Table 1 for a description of each of the AIMFREE subscales and the corresponding number of items). Possible responses to each item were "Yes," "No" or "Not Applicable." The AIMFREE items were derived from focus groups discussions conducted with various individuals (e.g., persons with disabilities, architects, fitness professionals), as well as from the ADAAG. The AIMFREE instrument has demonstrated acceptable test-retest reliability ($\alpha s \geq 0.70$) and has shown to be a valid instrument to use to assess the accessibility of fitness and recreational facilities for persons with disabilities (Rimmer et al., 2004, 2005).

Accessibility Scoring

The AIMFREE scoring manual indicates the items for which a "Yes" (e.g., paths around equipment are free from obstacles) vs. a "No" (e.g., bathroom floors are slippery) response suggest greater accessibility. Each item is rated according to a Rasch measurement model which calibrates item difficulty and facility accessibility on an equal-interval logit (log odds ratio) scale (Rimmer et al., 2005). A composite raw score is then calculated for each area of a subscale by counting the number of items with responses indicative of greater accessibility. Within the AIMFREE manual, Rimmer and colleagues provide conversion charts, displaying the possible raw scores for each subscale along with a linearly transformed subscale, ranging from 0% (low accessibility) to 100% (high accessibility; see Appendix A.1). Converted accessibility scores > 50% indicate above-average levels of accessibility for the specific area or subscale.

Based on previous AIMFREE research (Rimmer et al., 2004), the ten subscales presented in Table 1 can be divided into two broad accessibility categories – *General Accessibility* and *Fitness Centre-Specific Accessibility*. The general accessibility category is a composite factor that encompasses the accessibility of the general layout of the building (e.g., parking, exterior access/entrance routes, bathrooms, and elevators). Meanwhile, the fitness centre-specific accessibility category considers the accessibility of the areas associated with the facility's fitness services (e.g., locker rooms, equipment, policies, programming, professional training and support, and swimming pools). For the present study, these two composite factors were used to determine the relationship between facility accessibility and the availability of fitness programs for persons with disabilities.

Evaluators

Raters (*n*=3) attended two, 3-hour training sessions (led by the principal investigator) to familiarize themselves with the AIMFREE items as well as to establish a specific protocol for measuring the direct observation items (e.g., slopes of access ramps, width of doorways, spacing between exercise equipment). Following these two sessions, the three raters and the principal investigator used the AIMFREE instrument to conduct practice assessments, in groups of two, on two designated fitness facilities. Responses of the two groups of raters were tabulated and percentage agreement was calculated on all applicable subscales except those requiring input from staff members (i.e., policies and professional behaviour; Rimmer et al., 2004; see Table 2). Item discrepancies were then discussed until all four raters reached a consensus for the particular item. Two-thirds into data collection, a second interrater agreement test was conducted on a different fitness facility to ensure that no rating drift had occurred (cf., Spivock, Gauvin & Brodeur, 2007).

Procedure

Informed consent was obtained from all participating facilities and the study was approved by the university's Research Ethics Board. The study consisted of three phases – screening, on-site assessment, and a follow-up debriefing. Below is a description of the procedure for each phase.

Screening

Eighty-eight fitness, recreational, and community swimming pool facilities within the Hamilton-Wentworth area were identified by the primary investigator through searches on the Internet, in the Yellow Pages, and the City of Hamilton Sports and

Recreation directory using keywords *fitness, health clubs, and recreational centres*. Follow-up phone calls were made by the investigator to determine whether the facility provided adaptive exercise equipment and/or programming for persons with disabilities. Of the 88 facilities, 56 were staff-acclaimed to provide adaptive exercise equipment and/or programming for persons with disabilities. These 56 facilities were then sent a letter (see Appendix A.2), which contained information regarding the study purpose and requested permission for the researchers to perform one on-site assessment of the facility. A follow-up phone call was made by the principal investigator to further explain the study purpose, and to obtain consent from the facility manager to participate in the study. At this time, the investigator scheduled the on-site assessment. Assessments were conducted during daylight hours (9:00am-7:00pm) from May to September 2007.

On-Site Assessment

The principal investigator and one of the three research assistants conducted on-site assessments of the facilities using the AIMFREE instrument. Direct observation and physical measurements were required for the three subscales pertaining to the built environment, exercise equipment, and swimming pool area (e.g., measuring ramp slopes, widths and heights of infrastructures). A steel measuring tape (Mastercraft Maximum; Canadian Tire, Aurora, ON) was used to measure distances, while a Smart Tool (Smart Tool™; House of Tools, Edmonton, AB) was used to measure slopes. The remaining two subscales –Policies and Professional behaviour—required an interview with a senior staff member. The total time to conduct each facility assessment was approximately 120 minutes (90 minutes for the direct observations, and 30 minutes for the interview).

Debriefing

At the end of the on-site assessment, staff members who assisted with the assessment were thanked and informed that they would be sent an electronic report of their facility's assessment results within two weeks (see Appendix A.3). A brochure containing background information on a specific type of mobility disability, a spinal cord injury, as well as the types of exercise programs/equipment that can be made available for this population was also given to the facility staff (see Appendix A.4).

Results

Facility Demographics

Of the 56 facilities that were contacted, 44 (14 private for-profit health clubs, 5 public non-profit organizations, 15 recreational centres, and 10 community swimming pools) were assessed, and their demographic information is displayed in Table 3. Overall, the facilities tended to be public, non-profit institutes, built prior to 1999, and located within urban areas. Most of the facilities (63.6%) targeted their services towards the family. Over half (59.1%) had undergone accessibility-related changes within the past 10 years, with 78% of these changes relating to locker rooms or bathrooms (e.g., addition of grab bars, and family change rooms).

A series of chi-square analyses and univariate ANOVAs were computed to test for differences on the demographic variables across the three facility types (Table 3). Results indicated a higher proportion of non-profit ($\chi^2(2)=27.02$, $p < .001$), and publicly-funded ($\chi^2(4)=29.95$, $p < .001$) recreational centres and pools (100%) in comparison to fitness centres (26.3% and 21.1%, respectively). Significant differences were also found for the facilities' target population ($\chi^2(6)=33.08$, $p < .001$), with recreational centres and pools providing services to all family members, while the majority of fitness centres (52.6%) endorsed an "adults only" environment. Between-group differences were found for membership ($F(2, 40)=10.18$, $p < .001$, $eta^2= 35$), full-time staff ($F(2, 40)=4.98$, $p < .02$, $eta^2=.21$), and part-time staff ($F(2, 40)=3.27$, $p < .05$, $eta^2=.15$). Tamhane's T2 post hoc tests revealed significantly more members at recreational centres versus fitness centres ($p=.001$), and more full-time staff employed at both recreational centres and fitness centres than pools ($ps < .02$). No other differences were significant.

Descriptive Statistics

Table 4 and Figure 1 provide the mean accessibility ratings for the five AIMFREE subscales. Overall, mean accessibility ratings ranged from 31.1% to 63.2%. Fitness programming was rated the highest (63.2%), with three of the facilities given an accessibility rating of 100%. Parking (54.8%) and exterior access/entrance routes (51.1%) received above-average ratings (i.e., > 50%; Rimmer et al., 2004), while the least accessible areas were locker/shower rooms (41.9%), swimming pools (37.0%), and bathrooms (31.1%).

Facility Type and the Accessibility Subscales

A series of univariate ANOVAs were computed to determine if AIMFREE scores differed across the three types of facilities. Results indicated significant main effects for facility type on exterior access/entrance routes ($F(2, 42)=4.78$, $p < .02$, $eta^2=.20$), locker/shower rooms ($F(2, 38)=3.91$, $p < .03$, $eta^2=.18$), bathroom ($F(2, 42)=5.30$, $p < .01$, $eta^2=.21$), training and support ($F(2, 34)=3.92$, $p=.03$, $eta^2=.20$), and swimming pools ($F(2, 29)=7.21$, $p < .01$, $eta^2=.36$; see Table 5). Follow-up pairwise comparisons, using the Bonferroni adjustment ($p < .03$), showed significantly higher accessibility scores for recreational centres on the exterior access/entrance routes subscale in comparison to the fitness centres ($p < .02$). In addition, recreational centres were found to have higher accessibility scores on the bathroom, and swimming pools subscales than the pools ($ps < .02$). Recreational centres also tended to exhibit higher bathroom ($p < .04$), and swimming pool accessibility scores ($p < .08$) than fitness centres, and higher scores on the locker/shower room than either the fitness centres ($p < .06$) or the pools ($p < .09$). Interestingly, there was a trend for fitness centres to score higher on the professional training and support subscale than recreational centres ($p < .12$), and pools ($p < .08$).

Relationship Between Fitness Programming and Facility Accessibility

Separate 1-tailed Spearman rank-order correlations were computed between accessibility scores of the AIMFREE subscales and the fitness programming subscale. Overall, correlations ranged from small to large (rs=.06-.80; see Table 6), with the strongest relationships emerging between the availability of fitness programs and the accessibility of elevators (r=.80, $p < .02$), swimming pools (r=.39, $p < .05$), and professional training and support (r=.33, $p < .03$). These findings indicate that facilities with more accessible elevators and swimming pools, and that had greater opportunities for staff training in areas related to working with persons with disabilities had more accessible fitness programs available to the disabled community. No other correlations were significant.

Separate 1-tailed Spearman correlations were computed to determine the relationship between fitness programming and the composite measures of general accessibility versus fitness-centre specific accessibility. For these analyses, the programming subscale was omitted from the composite fitness centre-specific accessibility category to reduce collinearity between the two measures. A significant, positive relationship emerged between the availability of fitness programs and fitness centre-specific accessibility (r=.35, p=.02). No significant relationship was found between the general accessibility measure and the availability of accessible fitness programs (see Table 6).

Discussion

The present study examined the accessibility of 44 Hamilton fitness and recreational facilities for people with disabilities. Overall, the mean accessibility ratings for the facilities were low, with only three categories (parking, access routes, and programming) exhibiting above- average accessibility (i.e., > 50% accessibility threshold). None of the facilities were found to be fully accessible, although three facilities received a 100% accessible rating on the programming subscale. Taken together, these results suggest that the fitness and recreational facilities assessed do not meet the physical activity needs of persons with disabilities.

In general, the recreational facilities were rated as more accessible than the fitness centres and community pools on the AIMFREE subscales, with significant differences shown for access routes, bathrooms, and swimming pools. While these findings are preliminary, the results suggest that the type of facility may influence overall accessibility for persons with disabilities. In particular, accessibility may be related to the facility's clientele and funding status. All recreational centres and pools were public, nonprofit organizations that provided services to families. Meanwhile, most fitness centres were private, for-profit organizations which targeted their services mainly towards adults who do not have a disability. Consequently, motivation to create an accessible environment would likely differ across facilities. In the present study, recreational facilities tended to score higher on structural (e.g., widths of doorways, availability of accessible parking), and policy-related aspects of accessibility, while fitness centres tended to be rated more favourably on professional behaviour-related aspects (e.g., disability-related training, accessible programs). Similar findings were shown in Hawes' (2001) study, where the municipal sector (i.e., public recreational centres) received higher accessibility scores than either the not-for-profit (i.e., YWCA-YMCAs or YMCAs) or commercial sectors on the majority of the measured items. Implications of these findings are to mandate equal physical activity opportunities for persons with disabilities across the different sectors.

While the overall findings indicate low accessibility ratings across the 44 facilities, there were areas where facility staff and managers succeeded on providing accessible environments for persons with disabilities. For example, many of the fitness facilities had equipment available that did not require transfers (e.g., free weights, cables), exercise machines that could be used by patrons of various abilities such as low-speed treadmills and recumbent bikes, and fitness instructors who were able to adapt existing fitness classes to meet the needs of persons with disabilities. Furthermore, all the facilities provided complimentary tours for persons to assess the accessibility of the facility prior to purchasing a membership, and staff members were trained in standard first aid and, in some cases, had other certifications (e.g., Kinesiologists, CanFitPro, adapted Physical Education programs). In terms of programming, over 80% of the facilities offered programs and/or services to persons of all abilities, such as water aerobics, private swimming classes, yoga, and personal training. With the exception of two facilities, staff members indicated that individuals were encouraged to participate in programs and services at their own pace. More importantly, all interviewed staff indicated that personal assistants (e.g., nurses) were allowed to accompany customers to the facility without incurring additional charges.

Although most facilities offered programs, there was only a very modest correlation between the accessibility of these programs and the overall accessibility of fitness-related areas of the facility. In particular, staff training and the accessibility of swimming pools exhibited modest positive relationships with programming. Meanwhile, none of the general accessibility measures, except elevators, were correlated with the availability of programming. However, given the small number of facilities assessed that had elevators (n=7), these results should be cautiously interpreted. Overall, these preliminary findings indicate that facilities which provide accessible fitness programs are not necessarily accessible. While there were a few accessible areas within the facilities that offered adapted programming, the majority of facility areas were below-average in accessibility (i.e., < the 50% threshold of acceptability). Intuitively, it would seem appropriate that facilities which have staff who are trained in working with persons with disabilities would be able to provide the optimal physical activity programs for this population, as they would be more aware of their specialized needs and capabilities. Likewise, facilities with accessible swimming pools may be more likely to accommodate the programming needs of persons with disabilities, such as providing a variety of means to access the pool, assistance from lifeguards, and designated areas to swim in the pool. However, the lack of concordance between accessibility and programming suggests that facilities need to work on creating environments that match their programming.

While the present study findings highlight important factors relating to the accessibility of fitness and recreational facilities, there are some study limitations that must be addressed. First, although the AIMFREE instrument is a validated tool for assessing the accessibility of fitness and recreational centres for persons with disabilities, there are some caveats researchers should keep in mind when using it. In particular, if there are items that do not apply to a given facility (e.g., the facility does not have lockers or showers), then these items are scored "No" (i.e., not accessible), and the facility ultimately receives a lower score for that subscale. The "not-applicable" issue was particularly a concern for the community pools and the older recreational centres, which did not always have lockers or showers for patrons to use. A secondary set of analyses, using a modified percentage score wherein facilities were only rated on applicable items (Appendix A.5) showed considerably higher accessibility ratings on several subscales, with most scales exhibiting scores that were above-average (i.e., > 50%). A second caveat concerns the nature of the AIMFREE items. Specifically, some of the items assess aspects of accessibility that may be less relevant to persons with mobility disabilities (e.g., questions pertaining to facility lighting, size of buttons on equipment). However, these items were retained in our study so that comparisons could be made with other studies that have used the AIMFREE. Lastly, the AIMFREE results are based on the ADAAG. Many of the facility owners were unaware of these guidelines, and were not legally required to meet these American standards.

The overall low accessibility ratings for the facilities in the current study indicate the need for changes to be made to improve the accessibility of fitness and recreational facilities for persons with disabilities. First, and foremost, accessibility guidelines should be established for Canadian facility owners to adhere to. One option may be to use the ADAAG. As previously mentioned, the ADAAG lists specific guidelines for recreational and fitness facility owners, such as dimensions for the wheelchair turning space around structures (i.e., 30-inch radius), and spacing between exercise machines (i.e., an adjacent clear space that is at least 36 inches wide and 48 inches long; Rimmer et al., 2004). Second, an annual monitoring system should be created which confirms whether or not facilities are following the accessibility guidelines. This system would not only monitor the physical environment of the facilities; it would also ensure staff members are receiving specific accessibility-related training. Likewise, input from members of the community should be obtained in order to facilitate and prioritize accessibility-related changes within facilities. Finally, at the policy level, laws need to be implemented to increase the number of accessible programs available at fitness and recreational facilities for persons with disabilities (Sallis, Bauman, & Pratt, 1998). Together, these recommendations may help to enhance the accessibility, and ultimately the use of facilities for persons with disabilities.

Overall, the findings from Study 1A indicate that the physical and social environments of Hamilton fitness and recreational facilities are not conducive to providing accessible physical activity opportunities for persons with disabilities. The following study further examines the issue of accessibility and the leisure-time physical activity (LTPA) of persons living with SCI.

Study 1B

Accumulating evidence suggests that the proximity of one's home to physical activity facilities is modestly associated with physical activity behaviour (Diez Roux et al., 2007; Dowda et al., 2007; Duncan, Spence, & Mummery, 2005; Giles-Corti & Donovan, 2002; Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Reed & Phillips, 2005; Roemmich et al., 2006; Sallis et al., 1990). In general, people who live in close proximity to fitness and recreational centres report greater physical activity than people who do not. However, most of these studies were conducted among individuals without disabilities. It is unknown whether proximity to physical activity facilities plays a significant role on LTPA for persons with SCI.

Proximity to physical activity facilities has generally been assessed using two types of measures: (1) subjective perceptions, and (2) quantitative instruments that are based on direct observation or existing Geographical Information Systems [GIS] databases (cf., Estabrooks, Lee, & Gyurcsik, 2003). Subjective perceptions of proximity are useful for providing information on people's awareness of existing physical activity facilities, and perceptions regarding barriers and facilitators to using these facilities (Jilcott, Evenson, Laraia, & Ammerman, 2007). Meanwhile, quantitative instruments provide researchers with objective data on the actual location of the facilities relative to people's residences. Given the reported difficulties of subjectively estimating distance (Golledge & Stimson, 1997; Kirtland et al., 2003; Lloyd, 1997), objective instruments are increasingly being used, in conjunction with subjective perceptions, to provide a better understanding of the importance of proximity to physical activity-related facilities (McCormack et al., 2004). Therefore, these two types of proximity measures were used in the present study.

Studies of the relationship between perceived and objective proximity have found overall low-to-fair levels of agreement between the two types of measures (kappas (K)= 0.00-0.30; Jilcott et al., 2007; Kirtland et al., 2003). However, poor measurement correspondence may be partly to blame for the low kappas. For example, in Sallis et al.'s (1990) study, perceived convenience (i.e., a composite factor of perceived accessibility [cost, social requirements], and perceived proximity) did not match the objective facility density measure (i.e., number of facilities within 5-km of participants' homes). In contrast, Jilcott et al. found a moderate correlation between perceived distance and objective GIS-determined distance, both of which were assessed using equivalent scale units (i.e., in miles). Additionally, Jilcott et al. found higher agreement for perceived existence of neighbourhood fitness facilities and GIS-measured existence of facilities within a 1-mile (K=0.14) versus a 2-mile (K=0.09) walk from one's home, suggesting a better match between perceptions and GIS-determined proximity measures for shorter versus longer distances from one's home (Golledge & Stimson, 1997; Kirtland et al., 2003; Lloyd, 1997). Consistent with this finding, a higher percentage of adolescent girls perceived access to recreational facilities that were located within a half mile of their homes than facilities situated greater than a one-mile walk from their homes (Scott, Evenson, Cohen, & Cox, 2007). Together, these findings suggest that the strength of agreement between perceived and objective proximity may depend on the measurement correspondence, and the defined neighbourhood area.

An additional factor that may influence the strength of agreement is physical activity status. People who are active may be more aware of the physical activity opportunities within their neighbourhood, and consequently, have more accurate perceptions of these environmental supports than their inactive counterparts (cf., McCormack et al., 2004). However, studies that have examined the relationship between physical activity status and the two types of proximity measures have shown mixed results. While Kirtland et al. (2003) found lower agreement among inactive (K=0.16) than active respondents (K=0.35), Jilcott et al. (2007) were unable to show consistently higher agreement levels among the more active women in their sample. However, Jilcott et al.'s sample were part of a larger physical activity intervention, and the agreement levels between the two proximity measures tended to be higher for the intervention group (ICC=.41) than the controls (ICC=.10), suggesting that level of physical activity may indeed moderate the relationship between perceived and objective proximity. As such, physical activity status was examined as a moderator in the present study.

We also investigated the relationship between facility proximity (perceived and objective) and LTPA. A number of studies have identified positive, albeit modest associations between physical activity and both perceived (Duncan et al, 2005; Jilcott et al., 2007; Mota, Almeida, Santos, & Ribeiro, 2005; Scott et al., 2007), and objective (Diez Roux et al., 2007; Dowda et al., 2007; Giles-Corti & Donovan, 2002; Hoehner et al., 2005; Powell, Chaloupka, Slater, Johnston, & O'Malley, 2007; Reed & Phillips, 2005; Roemmich et al., 2006) proximity to physical activity facilities. There is also indication that the association may be stronger when proximity is measured subjectively than objectively (Hoehner et al., 2005; Jilcott et al., 2007; Sallis et al., 1990; Scott et al., 2007). However, the strength of association tends to be small (e.g., γ=0.03; Hoehner et al.; β= -0.19, Jilcott et al.; ORs=1.3-1.6; Scott et al.). Moreover, all of these studies were conducted in persons without disabilities. To our knowledge, no study has examined whether perceived and objective proximity to an accessible physical activity facility is related to LTPA in persons with disabilities.

Given the lack of proximity-related research in persons with disabilities, the purposes of Study 1B were to: (1) examine the level of agreement between perceived and objective proximity to accessible neighbourhood physical activity facilities among persons with SCI; (2) determine whether the agreement level between the two proximity measures varies as a function of physical activity status; and (3) determine the relationship between facility proximity (perceived and objective) and LTPA for persons with SCI. In line with previous research in persons without disabilities (Jilcott et al., 2007, Kirtland et al., 2003; Sallis et al., 1990), it was hypothesized that perceived and objective proximity measures would exhibit a low level of agreement. Consistent with previous physical activity and proximity research (Kirtland et al.), our second hypothesis was that active participants would exhibit higher agreement levels between the perceived and objective proximity measures than inactive participants. Finally, given the small associations between perceived proximity and LTPA in people without disabilities (Hoehner et al., 2005; Jilcott et al., Scott et al., 2007), in combination with the novelty of physical activity and proximity research in persons with disabilities, our final hypothesis was that both types of proximity would be positively related to LTPA, although the strength of associations would be small.

Method

Participants

This cross-sectional study utilized data from an 18-month, prospective investigation of the physical activity patterns and predictors among individuals with SCI (Study of Health and Physical Activity of People with Spinal Cord Injury [SHAPE SCI]; Martin Ginis et al., 2008). Baseline LTPA and perceived proximity data from 50 SHAPE SCI participants who lived within the Hamilton-Wentworth region were used for the current investigation.

Physical Activity Facilities

Addresses of 90 fitness-only (26 privately and publicly operated fitness/health centres, 5 yoga/pilates studios, 3 martial arts studios, 1 dragon boat racing, and 1 tennis complex), and multipurpose (23 arenas, 16 publicly operated recreational centres, 15 indoor/outdoor community pools) facilities within the Hamilton-Wentworth region were geocoded. These 90 facilities were identified through an exhaustive search on the Internet, in the Yellow Pages, and the City of Hamilton Sports and Recreation directory using keywords *fitness, health clubs, recreational centres, yoga, pilates, martial arts*. Similar to Study 1A, the primary investigator telephoned each of the 90 facilities to obtain verbal confirmation from the staff that the facility had programming and/or equipment for persons with disabilities (see Appendix B.1 for details on the programming and/or equipment available).

Procedure

Participants' home addresses and the civic addresses of the physical activity facilities were geocoded using ArcGIS 9.1 (Environmental Systems Research Institute, Redlands, CA). All addresses were standardized so that they could be matched against a file containing both tabular and spatial data of all of the Ontario road networks, and were subsequently cross-checked with Google Map™ (Google Inc., Mountain View, CA).

To determine the total number of neighbourhood physical activity facilities surrounding each participant's residence, three network buffers were created using the Network Analyst extension of ArcGIS. In contrast to a straight-line buffer ("as the crow flies"), which does not consider the road networks, a network buffer establishes boundaries based on the existing street networks. Essentially, the network buffer is a more accurate representation of the area that people can access around their residence (Frank, Schmid, Sallis, Chapman, & Saelens, 2005). The three network buffers were labelled as follows: (1) a 15-minute drive, (2) a 30-minute manual wheel for persons with *tetraplegia*, and (3) a 30-minute manual wheel for persons with *paraplegia*. The 15-minute driving network boundary was determined by converting the city driving speed limit of 50km/h into an equivalent distance in metres/minute and then multiplying the value by 15. This distance was calculated as 12,495m. Given that manual wheeling distance traveled varies as a function of injury level (Beekman, Miller-Porter, & Schoneberger, 1999), one of two values was used to calculate the 30-minute manual wheeling neighbourhood network boundary. Based on the propulsion data from Beekman et al.'s study, 46.26m/min was used as the average manual wheeling distance traveled for persons with tetraplegia, while 72.86m/min was used for persons with paraplegia. These two manual wheeling distances were then multiplied by 30 to create the 30-minute manual wheeling network boundary for participants with tetraplegia (1387.80m), and paraplegia (2185.80m). Therefore, each participant had a total of two network buffers created around their residence –a 15-minute drive and a 30-minute wheel.

Measures

Perceived Proximity and Use of Accessible Neighbourhood Physical Activity Facilities. Participants were asked, "Does your neighbourhood (defined as either "places one could get to using one's wheelchair in 30 minutes OR places one could drive to in 15 minutes") include an accessible recreational facility?" Responses were recorded as either "Yes," "No" or "Don't Know." If participants answered "Yes" they were then asked to indicate whether or not they used the facility on a regular basis ("Yes" or "No").

Objective Proximity to Accessible Neighbourhood Physical Activity Facilities. Using ArcGIS, the total number of neighbourhood facilities was counted within each of the two network buffers (15-minute drive and 30-minute wheel) surrounding participants' residences. The counts were then used to classify participants' neighbourhoods as either having 0 (absent), or ≥ 1 (present) accessible physical activity facilities within the specified network buffer.

Leisure-Time Physical Activity (LTPA). LTPA was assessed using the Physical Activity Recall Assessment for People with SCI (PARA-SCI; Martin Ginis, Latimer, Hicks, & Craven, 2005). This instrument is an SCI-specific, 3-day activity recall measure that is administered over the telephone by a trained research assistant. Participants were mailed a printed chart prior to the interview, describing four physical activity intensity categories: (1) *nothing at all* (no physical effort), (2) *mild* (very light physical effort), (3) *moderate* (some physical effort), and (4) *heavy* (maximum physical effort; see Appendix B.2). During the telephone interview, participants were asked to use the chart to self-designate the intensity of each physical activity they recalled performing over the preceding 3 days. Next, the researcher coded the type of physical activity performed as either LTPA (i.e., physical activity that one chooses to do during free time; Martin Ginis et al., 2005; e.g., basketball, weight-training) or LA (lifestyle activity; e.g., household chores, computer work). This information was entered into a computer program to calculate the mean number of minutes spent in mild-, moderate- and heavy-intensity LTPA over the previous 3 days. Total LTPA was calculated by summing the mean number of minutes participants spent in LTPA at all three intensity levels. The PARA-SCI has shown acceptable test-retest reliability (*ICC*s=0.65-0.80), construct validity as well as concurrent validity with indirect calorimetry (Martin Ginis et al., 2005). This instrument has been previously used to examine predictors of physical activity behaviour among individuals with SCI (Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Arbour, 2006) with no interpretational problems reported in the target population. Although both LTPA and LA were assessed, only a dichotomized variable for LTPA was used in the present study's analyses for all intensity types (i.e., active: LTPA minutes > 0 vs. inactive: LTPA minutes = 0).

Demographics. For descriptive purposes, information was gathered regarding participants' age, sex, weight, height, marital status, education, ethnicity, primary mode of mobility outside of the home (e.g., manual wheelchair, electric wheelchair), injury level, and injury severity (i.e., complete/incomplete).

Statistical Analyses

Kappa statistics (*K*) were computed to examine the level of agreement between perceived and objective proximity to accessible physical activity facilities within a 30-minute wheel, and whether the level of agreement between the two proximity measures varied across physical activity status (no LTPA vs. some LTPA). Kappa coefficients that ranged from 0.41-0.60, 0.21–0.40, 0.01-0.20, and 0.00, were interpreted as moderate, fair, slight, or poor levels of agreement, respectively (Landis & Koch, 1977). *Z*-statistics were then computed to conduct between-groups comparisons of the kappa values.

To examine the relationship between proximity to accessible physical activity facilities and the dichotomized LTPA variable, logistic regression was used. Four separate logistic regression analyses were performed, whereby LTPA (mild, moderate, heavy, total) was regressed on perceived and objective proximity to accessible neighbourhood physical activity facilities. Model fit was assessed using the Hosmer-Lemeshow statistic and the Omnibus test of model coefficients. Models with nonsignificant Hosmer-Lemeshow statistics, and significant Omnibus chi-squares were indicative of good fit (Tabachnick & Fidell, 2001).

A series of chi-square tests were conducted for each categorical demographic variable (e.g., sex, injury level, injury severity, mode of mobility) to examine any differences between active vs. inactive participants across the four LTPA intensity categories (e.g., mild, moderate, heavy, total). Spearman rho correlations were used to examine whether age, BMI or years postinjury were associated with LTPA status (active vs. inactive). No between-groups differences were found on any of the demographic categorical variables (*p*s > .05), nor were there any significant correlations between the continuous variables and LTPA status (*r*s < .18, *p*s > .20), thus no covariates were used in any of the regression analyses.

Results

Participant Descriptive Characteristics

Participant descriptive characteristics are presented in Table 7. Overall, the sample was predominately male (70%), single (56%), and manual wheelchair users (70%). Approximately half of the sample (52%) had tetraplegia, and 70% had an incomplete injury. Between-groups comparisons indicated no differences on any of the demographic variables across injury level (*p*s > .05).

Leisure-Time Physical Activity

LTPA data for the overall sample and as a function of injury level are shown in Table 8. Overall, participation rates were low, with only 47% of the sample engaging in LTPA at any intensity level. No between-groups differences in LTPA were found across injury level (*p*s > .05).

Level of Agreement Between Perceived and Objective Proximity

As shown in Table 9, almost half of the sample (46%) perceived their neighbourhood to have an accessible physical activity facility. Of those 46%, 13% indicated using the facility on a regular basis. There was a trend for perceived access to be greater among persons with paraplegia (63%) than persons with tetraplegia (32%; $p < .08$). No other between-groups differences were found for perceived access or reported use. Based on the GIS analyses, 82% of the sample lived within a 30-minute manual wheel from at least one accessible facility, while 100% lived within a 15-minute drive. On average, participants lived within a 15-minute drive and 30-minute manual wheel of 56.6 and 3.0 accessible physical activity facilities, respectively.

Kappa statistics are displayed overall and as a function of LTPA participation in Table 10. Overall, kappa statistics were low, ranging from .14 to .26. Slight agreement was found between the perceived and objective proximity measures for the 30-minute manual wheeling network buffer (K=.16, $p > .10$). Highest agreement was found for active participants who performed moderate (K=.22), or heavy (K=.26) LTPA. Pairwise comparisons using z-test statistics revealed significant between-groups differences for those who did some versus no moderate or heavy LTPA. As hypothesized, active participants reported higher agreement between the two proximity measures in comparison to their inactive counterparts. No other between-groups differences were found.

Given the lack of variability in the objective proximity measure using the 15-minute driving network buffer (i.e., all participants had ≥ 1 facility within a 15-minute drive from their residence), a kappa statistic could not be computed for this measure. Rather, a chi-square test was used, which tested the null hypothesis that all participants should *perceive* an accessible facility within a 15-minute drive. Results revealed the χ^2 statistic was significant for the overall sample, and across the four LTPA intensities (see Table 11). The significant χ^2 statistics indicate that, as hypothesized, there was low agreement between the perceived and actual existence of accessible physical activity facilities. Contrary to hypothesis, active participants had lower agreement levels than their inactive counterparts across all LTPA intensities.

A post-hoc univariate analysis of variance (ANOVA) was conducted to determine whether people who perceived their neighbourhood to include an accessible physical activity facility actually had more neighbourhood facilities. Results indicated no significant differences between the number of accessible physical activity facilities within a 30-minute manual wheel ($F(1,49)=2.42$, $eta^2=.04$, $p < .16$), or a 15-minute drive ($F(1,50)=2.05$, $eta^2=.05$, $p < .13$) for those who perceived (*M*s=3.6 and 60.1, respectively; $n=23$) versus did not perceive (*M*s=2.5 and 53.6, respectively; $n=27$) an accessible facility in their neighbourhood. Therefore, perceptions were not related to the actual number of facilities in one's neighbourhood.

Explaining LTPA: The Contribution of Perceived and Objective Proximity to Accessible Physical Activity Facilities

Results from the logistic regression analyses are displayed in Table 12. Nonsignificant Hosmer and Lemeshow goodness-of-fit statistics were found for all four regression models ($\chi^2(1)< .23$, $ps > .63$), indicating good model fit. For the models predicting moderate and heavy LTPA, the Omnibus test approached significance (moderate LTPA: $\chi^2(2)=5.78$, $p < .06$; heavy LTPA: $\chi^2(2)=5.89$, $p < .06$), indicating that the variables, as a set, reliably distinguished between active and inactive participants in comparison to the constant-only model (Tabachnick & Fidell, 2001). Strength of association was greatest for the moderate and heavy LTPA models (Nagelkerke $R^2=.16$), with smaller associations found for mild ($R^2=.05$) and total ($R^2=.06$) LTPA. The overall percent of cases correctly predicted by the models ranged from 58% to 81.6%, with the majority of cases overclassified into the inactive (88.5% to 100%) versus the active (0% to 38.5%) group.

Table 12 shows regression coefficients, Wald statistics, and odds ratios for the two predictors. Overall, moderate and heavy LTPA were related to the objective 30-minute wheeling proximity measure, however the direction of the relationship was contrary to expectation. People living within a 30-minute manual wheel were 90% *less* likely to engage in moderate LTPA, and 80% *less* likely to engage in heavy LTPA ($ps < .03$) than people who did not live within 30 minutes of a facility. Also contrary to hypothesis, the perceived proximity measure did not significantly contribute to explaining any of the four intensity levels of LTPA ($ps > .20$). Of note though, the results for perceived proximity were in the expected direction, with greater LTPA reported by participants who perceived an accessible physical activity facility in their neighbourhood than those who did not.

Discussion

The present study examined the relationships between perceived and objective proximity to accessible neighbourhood physical activity facilities and LTPA for persons with SCI. As hypothesized, low agreement was exhibited between the two proximity measures, using both the 30-minute wheeling and 15-minute driving network buffers. In partial support of our hypothesis, agreement levels were significantly higher for participants who reported engaging in moderate or heavy LTPA versus their inactive counterparts, but only for the 30-minute wheeling network buffer. Contrary to hypothesis, people living within a 30-minute manual wheel from an accessible facility were 90% less likely to engage in moderate LTPA, and 80% less likely to engage in heavy LTPA than people who did not have an accessible facility located within the specified network buffer. No significant associations were found between LTPA and perceived proximity. Each of these findings will be discussed in turn.

First, as hypothesized, low agreement was shown between perceived and objective proximity for both network buffers. This finding is similar to previous research in persons without disabilities (Jilcott et al., 2007; Kirtland et al., 2003), which indicates difficulties of subjectively estimating distances and the actual presence of physical activity facilities. Our findings suggest that these estimation difficulties exist for both shorter (i.e., 30-minute wheeling), and longer (i.e., 15-minute driving) distances. Consequently, we recommend that future physical activity and proximity research in persons with and without disabilities include both objective and subjective proximity measures in order to fully understand the relationship between proximity and LTPA participation.

Second, consistent with previous research in persons without disabilities (Kirtland et al., 2003), agreement levels for the two proximity measures were shown to be higher for those who engaged in moderate or heavy LTPA, although this was only the case for the 30-minute wheeling network buffer. Agreement may not have differed as a function of mild LTPA participation because low intensity activities may require fewer resources than higher intensity activities. For example, activities such as swimming and tennis are more likely to be performed in a fitness or recreational centre, whereas mild wheeling can be performed within the neighbourhood (e.g., on sidewalks). Therefore, people who engage in the higher intensity activities are more likely to be aware of the presence of physical activity facilities. Consistent with this reasoning, Kirtland et al. found that agreement levels were stronger for active people only for the perceived presence of recreational facilities; no between-groups differences were found for the perceived presence of sidewalks, neighbourhood safety or aesthetics.

As well, Kirtland et al. (2003) found that active participants had better agreement between the two proximity measures when using a neighbourhood (i.e., a 10-minute walk from one's home) versus a community (i.e., a 20-minute drive from one's home) boundary. This finding is similar to our findings that active participants had better agreement levels than their inactive counterparts for a 30-minute wheel than a 15-minute drive, suggesting that active people may only have more accurate perceptions of physical activity facilities that are close to their homes. Beyond a certain distance, physical activity status may have no influence.

Third, contrary to hypothesis, objective, but not perceived proximity was correlated with LTPA. However, the direction of association was opposite to our prediction –people living within a 30-minute wheel of an accessible facility were *less* likely to engage in moderate or heavy LTPA. For the present study, LTPA data were drawn from a larger epidemiological study, which did not ask participants to specify the location of their activities. As a result, participants may have been active in a location outside of the defined neighbourhood boundaries, or engaged in activities such as neighbourhood wheeling or home-based exercise, which do not require a facility. Indeed, Sallis et al. (1990) found that 25% of their sample exercised outside, but not at a facility, while 48% exercised at home, and 22% exercised at a facility. Posthoc analyses of our data showed that of the 23 participants who reported engaging in any intensity of LTPA, six exercised at home, seven exercised at a facility, and 14 exercised outside of the home, but not at a facility. Had the location of activity been considered in this study, a different pattern of relationships between proximity and LTPA may have emerged.

While the present study is one of the first to examine facility proximity and LTPA in persons living with a disability, there are some study limitations that must be addressed. First, given the small number of participants who engaged in moderate or heavy LTPA (n=13 and 14, respectively; see Table 10), the findings must be cautiously interpreted. The small sample is particularly problematic when examining non-parametric data, which relies on the distribution of cases relative to the independent variable (Tabachnick & Fidell, 2001). As shown in Appendix B.3, over 50% of the cell frequencies were less than five for all of the LTPA intensities. These low counts may have inflated the kappa statistics and the chi-square tests. Second, the accessibility of the facility was determined by the facility owner, not the participant. Consequently, some participants may not have perceived these facilities to meet their own accessibility standards. The results from Study 1A clearly show accessibility of the built environment for fitness and recreational centres tends to be quite low. Thus, our count of accessible facilities may have included facilities that participants did not consider accessible.

Likewise, the neighbourhood network buffers were "investigator-defined boundaries", and may not have corresponded with participants' perceptions of their neighbourhood boundaries (Jilcott et al., 2007). Among individuals without disabilities, neighbourhood definitions have varied, with some studies defining neighbourhood in terms of walking time (Hoehner et al., 2005; Kirtland et al., 2003; McGinn, Evenson, Herring, Huston, & Rodriguez, 2007; Wilson, Ainsworth, & Bowles, 2007). Unfortunately, a walking-based definition is inappropriate for persons with SCI, many of whom rely on mobility devices for ambulation. The "30-minute manual wheel" neighbourhood definition used in the present study was specific to persons with SCI. To accommodate participants who would be more likely to travel by car or bus, neighbourhood was also defined as "places one could drive to within 15 minutes." Despite our attempt to create a neighbourhood definition that was appropriate for persons with SCI, participants were not asked which one of the definitions they had in mind while responding to the perceived proximity measure. Consequently, some participants may have used the "15-minute drive" neighbourhood boundary, while others used the "30-minute wheel" boundary. Future research should examine the validity of these definitions in persons with SCI, as well as other types of disabilities.

Finally, the results do not reveal why people with SCI are not using the accessible facilities in their neighbourhoods. Overall, 46% of the sample reported an accessible physical activity facility in their neighbourhood, while only 13% indicated that they used the facility on a regular basis. This finding is similar to research in persons without disabilities, where 61% of participants perceived having access to fitness facilities, while 21% reported using the facility ten or more times in the past year (Kruger, Carlson, & Kohl, 2007). Contrary to Kruger et al.'s findings, our results do not support the claim that facility usage is higher among active versus inactive participants (see Table 9). For persons with disabilities, other factors may be related to the use of physical activity facilities, such as lack of transport, and cost of programming (French & Hainsworth, 2001). Future studies should examine other barriers or facilitators that contribute to the use of physical activity facilities.

In terms of contribution, the present investigation is the first to examine the relationship between LTPA and perceived and objective proximity to accessible physical activity facilities in persons with SCI. Furthermore, the findings are based on a GIS technique which included a network buffer that accounted for useable space (Frank et al., 2005; Jilcott et al., 2007). Overall, these preliminary findings indicate that proximity to an accessible facility does not seem to be related to LTPA in people living with SCI. However, further research is warranted to establish subjective and objective proximity measures with clearly defined neighbourhood boundaries for individuals with SCI.

General Discussion

The present studies examined the accessibility of physical activity facilities and whether their location is related to LTPA among persons with SCI. These studies showed that the accessibility of Hamilton fitness and recreational facilities is quite low. Moreover, living in close proximity to a facility which provides adaptive programming and equipment does not necessarily translate into greater LTPA. In Study 1A, none of the 44 facilities were found to be fully accessible, with only three accessibility-related areas (i.e., parking, access routes, and programming) exhibiting above average (i.e., > 50%) mean accessibility scores. Study 1B expanded on these findings by demonstrating a small, negative association between the objective presence of physical activity facilities and LTPA in a sample of persons with SCI. Overall, these two studies provide systematic assessments of the physical and social environments of physical activity facilities for persons with disabilities. This is an important contribution given that assessments are crucial for influencing accessibility-related changes (Iwarsson et al., 2004).

The findings also emphasize the importance of facility- and community-level approaches for improving the accessibility of fitness and recreational facilities. According to Riley et al.'s (2008) community-based accessibility improvement framework, achieving accessibility is a systematic process that involves collaboration at both the facility and community level. The ultimate goal is to obtain a match between a specific group's functional capacity, and the design and demands of the physical environment (*person-environment relationship*; Iwarsson & Stahl, 2003). The results from Study 1A are of particular interest because they highlight specific areas that are in need of improvement, such as bathrooms, locker rooms and swimming pools. These findings can be used to conduct future elicitation studies that involve members of the disability community and facility owners in order to identify feasible steps that can be taken to improve accessibility. This collaboration process is at the heart of Rimmer's (1999) model of health promotion, which suggests that fitness and recreational centres are the cornerstones for promoting active living among persons with disabilities.

There are several study strengths that should be highlighted. First, to the best of our knowledge, these are the first Canadian studies to systematically examine the accessibility of physical activity facilities for people living with SCI using a validated accessibility measure and an objective GIS-based technique. Second, a relatively large sample of facilities was used in Study 1A, and is comparable in size to earlier studies that have assessed the accessibility of fitness and recreational facilities (n=50, Cardinal & Spaziani, 2003; n=38, Hawes, 2001; n=37, Rimmer et al., 2005). Moreover, the current studies expand on the accessibility and physical activity literature by examining the physical and social environments of community swimming pools, in addition to fitness and recreational facilities. Third, and perhaps most importantly, the findings highlight the importance of examining environmental-level correlates of physical activity in persons with disabilities.

Despite the aforementioned contributions, the present studies are limited insofar as they only focused on the accessibility and availability of neighbourhood physical activity facilities in Hamilton, Ontario. Hence, the generalizability of these findings to facilities in other Canadian cities remains to be examined. Furthermore, given the absence of any standardized Canadian accessibility guidelines, future efforts should be directed at establishing guidelines for Canadian facility owners. Together, these steps could help to improve opportunities for persons with disabilities to become more physically active.

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Table 1

Description of the Five AIMFREE Subscales.

Subscale	Items	Description
Built Environment		
Parking	13	Accessibility of parking lot areas; access routes between parking lot and facility; dimensions of accessible parking spaces
Access Routes	44	Accessibility of access routes leading to the facility, entrance doorways, and front desk (e.g., width of doorways, slope of ramps)
Bathroom	32	Accessibility of bathroom doors, toilet stalls, and sink area
Lockers/Showers	39	Accessibility of doorways, locker room area (e.g., paths leading to lockers/benches), and shower area (e.g., presence of grab bars, height of showerheads)
Elevators	23	Accessibility of elevator entrance, controls, grab bars, audible/visual cues for floor direction and position
Equipment	56	Accessibility of doorways, pathways leading to/around exercise equipment; availability of accessible equipment
Professional Behaviour		
Training/Support	26	Resources and opportunities for training staff members in areas relating to working with persons with disabilities (e.g., training manual, attending conferences). Staff members' knowledge on disabilities and adaptive exercise
Programs	10	Accessibility of physical activity programs
Policy	53	Availability of policies (facility and swimming pool) that endorse the inclusion of persons with disabilities (e.g., marketing, mission statement)
Swimming Pool	37	Accessibility of pathways leading to/around the pool; availability of accessible means of pool entry/exit (e.g., pool lift, wet/dry ramp)

Note. For each of the five subscales, higher scores indicate a greater accessibility rating.

Table 2

Interrater Agreement Among Two Pairs of Raters Assessing the Environmental Accessibility of Three Fitness Facilities.

AIMFREE Subscales	Items	Percentage Agreement (%)			
		F1	F2	F3	Mean
Parking	13	92.3	100.0	76.9	89.7
Access Routes	44	77.3	84.1	88.6	83.3
Bathroom	32	78.1	93.8	87.5	86.5
Lockers/Showers	39	N/a	87.2	82.1	84.7
Equipment	56	83.9	83.9	83.9	83.9
Swimming Pools	37	N/a	91.9	N/a	91.9

Note. F1 and F2 = the two fitness facilities that were a part of the trial assessments; F3 = the facility used to conduct the second interrater agreement test.

Table 3

Demographic Characteristics of the Facilities (Overall) and of the Three Facility Types.

	Overall (n= 44)	Recreational Centres (n = 15)	Fitness Centres (n = 19)	Pools (n = 10)
Location				
Suburban	43.2%	40.0%	63.2%	40.0%
Urban	56.8%	60.0%	36.8%	60.0%
*Profit***				
For-Profit	31.8%	--	73.7%	--
Non-Profit	68.2%	100.0%	26.3%	100.0%
*Ownership***				
Franchise	9.1%	--	21.1%	--
Independent	25.0%	--	57.9%	--
Public	65.9%	100.0%	21.1%	100.0%
Date of Establishment				
≤ 1999[a]	75.0%	86.7%	53.3%	90.0%
≥ 2000	25.0%	13.3%	47.7%	10.0%
*Target Members***				
Men and Women	22.7%	--	52.6%	--
Women Only	11.4%	--	26.3%	--
Family	63.6%	100.0%	15.8%	100.0%

Health Promotion and Disability	2.3%	--	5.3%	--
Memberships (Total)[b] **	17,949(23,292)	34,293(26,453)	3,033(4,224)	17,298(21,255)
Full-time Staff [b] *	4 (5.42)	4 (2.72)	7 (7.37)	1 (1.16)
Part-time Staff [b] *	25 (26.78)	38 (33.50)	20 (22.90)	14 (10.02)
Accessibility-related changes < 10 years				
Yes	59.1%	73.3%	47.4%	60.0%
No	38.6%	26.7%	47.4%	40.0%
N/A	2.3%	--	5.3%	--

Note. Non-Profit = organization that engages in activities of public or private interest without any vested commercial/monetary profit; Franchise = facility which has corporate sponsorship; Independent = independently owned and operated facility (e.g., family business); Public = facility that is open for public use with a minimal fee.

[a] $n_{\text{fitness centres}} = 15$
[b] $n_{\text{overall}} = 41$; $n_{\text{fitness centres}} = 16$

$^{*}p < .05$, $^{**}p < .001$

Table 4

Mean Accessibility Ratings for the Five AIMFREE Subscales.

Subscale	*n*	Accessibility Score Range (%)	Accessibility Rating (%) (*M, SD*)
Built Environment			
Parking	35	16.20 - 73.00	54.81(12.77)
Access Routes	42	27.80 – 59.10	51.05 (6.47)
Bathroom	42	16.82 – 45.80	31.07 (5.49)
Lockers/Showers	38	19.60 – 56.30	41.89 (7.24)
Elevators	7	42.00 – 54.80	49.02 (4.85)
Equipment	19	40.10 – 57.90	47.69 (5.30)
Professional Behaviour			
Training/Support	34	26.80 – 85.80	47.93 (11.46)
Programs	35	28.80 – 100.00	63.15 (18.79)
Policy	38	36.29 – 57.91	47.07 (5.77)
Swimming Pool	29	16.90 – 51.40	36.96 (9.14)

Note. Accessibility scores are shown as percentages. Standard deviations are in parentheses. Higher ratings indicate a greater accessibility score for the respective subscale. Scoring is based on Rimmer et al.'s (2004) linear conversion accessibility scale (Rasch scoring).

Table 5

Mean Accessibility Ratings for the Three Types of Facilities on the Five AIMFREE Subscales.

Subscale	Recreational Centres	*n*	Fitness Centres	*n*	Community Pools	*n*
Built Environment						
Parking	58.72_x (7.80)	15	48.72_x (17.49)	13	57.71_x (6.48)	7
Access Routes	54.69_x (2.64)	15	48.23_y (8.41)	17	50.41_{xy} (4.04)	10
Bathroom	34.36_x (2.92)	15	29.74_x (6.03)	17	28.41_y (5.48)	10
Lockers/Showers	45.89_x (5.67)	14	39.67_x (6.72)	15	39.38_x (8.18)	9
Elevators	51.31_x (4.94)	2	48.10_x (5.05)	5	--	
Equipment	--		47.69 (5.30)		--	
Professional Behaviour						
Training/Support	43.78_x (8.25)	10	52.95_x (12.82)	17	41.66_x (6.03)	7
Programs	61.81_x (13.31)	12	67.00_x (19.24)	16	56.63_x (25.63)	7
Policy	49.21_x (6.13)	13	45.20_x (6.14)	17	47.57_x (2.81)	8
Swimming Pool	41.61_x (6.21)	13	38.98_{xy} (10.09)	6	29.69_y (7.68)	10

Note. Accessibility scores are shown as percentages. Standard deviations are in parentheses. Higher ratings indicate a greater accessibility score for the respective subscale. Scoring is based on Rimmer et al.'s (2004) linear conversion accessibility scale (Rasch scoring). Values in the same row that do not share a common subscript are significantly different, $p < .05$. The Bonferroni method was used to adjust the alpha for the pairwise comparisons ($p < .03$).

Table 6

Spearman Rank-Order Correlations Between Fitness Programming and Facility Accessibility Scores.

AIMFREE subscale	Spearman *r*
General Accessibility Measures	
Overall	-.01
Parking	.06
Access Routes	-.16
Bathrooms	-.24
Elevators	.80*
Fitness Centre-Specific Accessibility Measures	
Overall	.35*
Locker Rooms	-.23
Equipment	.11
Swimming Pools	.39*
Policies	.16
Training/Support	.33*

Note. Accessibility ratings for the Equipment subscale only available for the fitness centers (n = 19). The *General Accessibility Measure* is the mean accessibility rating for the subscales concerning parking, access routes, bathrooms, and elevators. The *Fitness Centre-Specific Accessibility Measure* is the mean accessibility rating for the subscales regarding locker rooms, equipment, swimming pools, policies, and professional training and support.

* $p < .05$

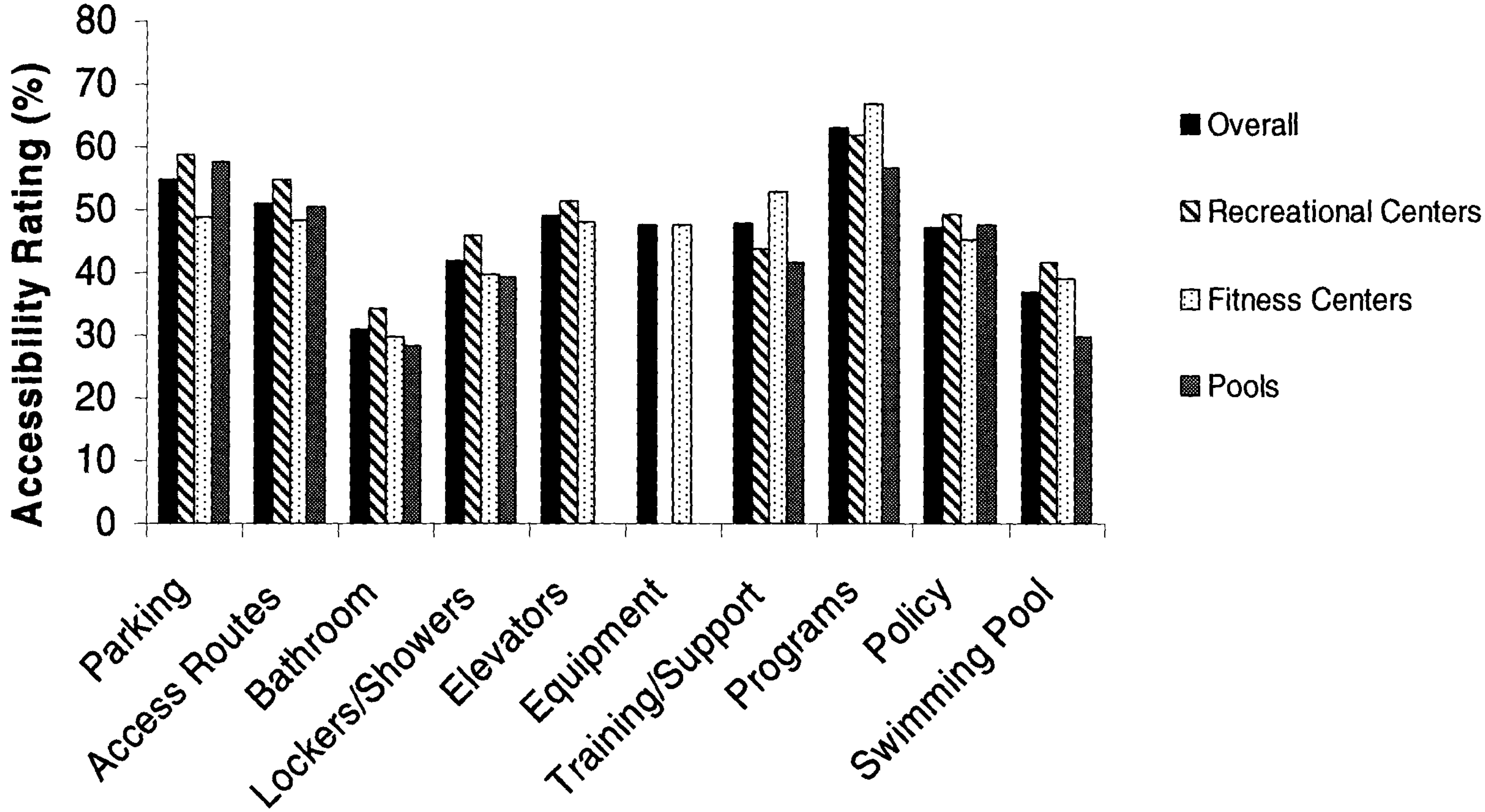

Figure 1. Mean accessibility ratings for the overall sample and stratified according to the three types of facilities. Ratings are based on Rimmer et al.'s (2004) linear conversion accessibility scale (Rasch scoring).

Table 7

Participant Demographic Characteristics.

Characteristic	Overall (n = 50)	Tetraplegia (n = 25)	Paraplegia (n = 24)
Age	43.52 (12.70)	41.64 (11.96)	45.36 (13.38)
BMI (kg/m^2)	25.86 (5.58) $_{(n = 49)}$	24.98 (4.61) $_{(n = 22)}$	26.65 (6.38) $_{(n = 23)}$
Years post injury	13.80 (10.44)	15.44 (10.95)	12.17 (10.07)
Total LTPA (M_{mins}/day)	17.41 (33.74)	22.64 (43.46)	12.69 (19.71)
Sex			
Male	70%	24%	36%
Female	30%	76%	64%
Injury Severity			
Complete	30%	44%	52%
Incomplete	70%	56%	48%
Marital Status			
Married	44%	28%	24%
Not married	56%	72%	76%
Ethnic Background			
White	96%	100%	92%
Black	2%	--	4%
Other	2%	--	4%
Education			
High school	40%	32%	44%
≥ College	60%	68%	56%
Mode of Mobility			
Manual chair	70%	60%	80%
Electric chair	24%	40%	8%
Other	6%	--	12%

Note. BMI = body mass index. Percentages are shown for categorical variables, while means and standard deviations are shown for all continuous variables. Missing injury level data from one participant. No differences across injury level on any of the demographic variables ($ps > .05$).

Table 8

Proportion of Participants Engaging in Leisure-Time Physical Activity (LTPA) for the Overall Sample and Across Injury Level.

Variables	*Overall (n=50)*	*Tetraplegia (n=25)*	*Paraplegia (n=24)*
Mild LTPA (%)[a]			
None	81.6	83.3	79.2
Some	18.4	16.7	20.8
Moderate LTPA (%)[a]			
None	73.5	70.8	75.0
Some	26.5	29.2	25.0
Heavy LTPA (%)[a]			
None	71.4	66.7	75.0
Some	28.6	33.3	25.0
Total LTPA (%)			
None	53.1	48.0	54.2
Some	46.9	52.0	45.8

[a] $n_{tetraplegia} = 24$

Table 9

Perceived and Objective Proximity of Accessible Physical Activity (PA) Facilities for the Overall Sample and Across Total Leisure-Time Physical Activity (LTPA) and Injury Level.

Variables	*Overall (n=50)*	*Tetraplegia (n=25)*	*Paraplegia (n=24)*	*Active (n=24)*	*Inactive (n=26)*
% reporting accessible neighbourhood PA facility (perceived)	46.0	32.0^{+}	62.5^{+}	50.0	42.3
% using accessible neighbourhood PA facility[a]	13.0	25.0	6.7	16.7	9.1
# of accessible PA facilities, *M*(SD)					
15-minute drive	56.6 (16.8)	55.5 (17.7)	57.8 (15.1)	53.4(18.0)	59.5(14.0)
30-minute wheel[b]	3.0 (2.5)	2.2 (2.1)	3.9 (2.7)	3.0 (2.3)	3.0 (2.8)
% with accessible neighbourhood PA facility (objective)					
15-minute drive	100.0	100.0	100.0	100.0	100.0
30-minute wheel	82.0	72.0	91.7	75.0	88.5

Note. Sample size for LTPA is based on total LTPA.

[a] Sample size based on those participants who indicated having an accessible neighbourhood physical activity facility ($n_{overall}$ = 23; $n_{tetraplegia}$ = 8; $n_{paraplegia}$ = 15; n_{active} = 12 ; $n_{inactive}$ = 11).

[b] Missing injury data for one participant ($n_{overall}$ = 49).

$^{+}p < .10$

Table 10

Kappa Statistics (K) Indicating the Level of Agreement Between the Perceived and Objective Proximity Measures of Accessible Neighborhood Physical Activity Facilities as a Function of Leisure-Time Physical Activity (LTPA) Participation.

Variable	*K*	*SE*	*t*	*n*	*p*	*z*
30-minute wheeling network buffer						
Overall	.16	.10	1.58	50	.11	
Mild LTPA						1.60
Some LTPA	.14	.30	0.47	9	.64	
No LTPA	.18	.11	1.64	40	.10	
Moderate LTPA						2.26^{*}
Some LTPA	.22	.27	0.79	13	.43	
No LTPA	.18	.09	1.90	36	<.06	
Heavy LTPA						2.08^{*}
Some LTPA	.26	.26	0.97	14	.33	
No LTPA	.18	.09	1.84	35	<.07	
Total LTPA						1.74
Some LTPA	.17	.17	0.94	24	.35	
No LTPA	.18	.10	1.58	26	.12	

Note. Kappa statistics ranging from 0.21–0.40, 0.01-0.20, and 0.00 correspond with fair, slight, and poor levels of agreement, respectively (Landis & Koch, 1977). *z*-statistic = $K_{(Mean)}/SE_{(Pooled)}$.

$^{*}p < .05$

Table 11

Chi-Square Statistics (χ^2) Testing the Null Hypothesis that Participants Perceived an Accessible Physical Activity Facility Within a 15-Minute Drive as a Function of Leisure-Time Physical Activity (LTPA) Participation.

Variable	% reporting accessible PA facility	χ^2	*df*	*p*
15-minute driving network buffer				
Overall	46.0	72860.58	1	<.001
Mild LTPA				
Some LTPA	44.4	55094.03	1	<.001
No LTPA	47.5	13881.67	1	<.001
Moderate LTPA				
Some LTPA	44.4	55526.67	1	<.001
No LTPA	53.8	13836.92	1	<.001
Heavy LTPA				
Some LTPA	42.9	57114.29	1	<.001
No LTPA	57.1	12847.72	1	<.001
Total LTPA				
Some LTPA	42.3	43247.89	1	<.001
No LTPA	50.0	29982.00	1	<.001

Note. PA = physical activity.

Table 12

Logistic Regression Analyses Predicting Leisure-Time Physical Activity with Perceptions and Objective Presence of Accessible Neighbourhood Physical Activity Facilities.

	R^2	*OR (95% CI)*	*β (SE)*	*z*	*p*
DV: Mild LTPA	.05				
Perceptions					
YES		1.1 (0.2-5.2)	.11 (.79)	0.21	.89
NO		1.0			
Facility Available (wheeling network buffer)					
YES		0.3 (0.1-1.9)	-1.08 (.87)	1.53	.22
NO		1.0			
DV: Moderate LTPA	.16				
Perceptions					
YES		2.5 (0.6-10.9)	.90 (.76)	1.39	.24
NO		1.0			
Facility Available (wheeling network buffer)					
YES		0.1 (0-0.8)	-1.95 (.87)	5.07	.02
NO		1.0			
DV: Heavy LTPA	.16				
Perceptions					
YES		3.0 (0.7-12.9)	1.09 (.75)	2.10	.15
NO		1.0			
Facility Available (wheeling network buffer)					
YES		0.2 (0-0.8)	-1.89 (.87)	4.71	.03
NO		1.0			
DV: Total LTPA	.06				
Perceptions					
YES		1.7 (0.5-5.4)	.51 (.60)	0.73	.39
NO		1.0			
Facility Available (wheeling network buffer)					
YES		0.3 (0.1-1.6)	-1.10 (.80)	1.87	.17
NO		1.0			

Note. CI = confidence interval, DV = dependent variable, OR = odds ratio. LTPA coded as 0 (no LTPA– referent) or 1 (some LTPA).

CHAPTER 3

Examining the Combined Role of Individual and Environmental Factors for Explaining Leisure-Time Physical Activity Behaviour in People with Spinal Cord Injury

Abstract

Purpose: To determine whether neighbourhood environmental perceptions enhance the Theory of Planned Behaviour's (TPB; Ajzen, 1985) ability to explain leisure-time physical activity (LTPA) intentions and behaviour in people living with SCI. **Methods:** Baseline cross-sectional data from 246 men and women with an SCI were used to test the study hypotheses. Structural equation modeling was used to test the hypotheses. Measures of the TPB constructs, perceptions of the neighbourhood aesthetics and wheeling infrastructure, and LTPA behaviour were administered over the phone by a trained research assistant. **Results:** In partial support of our first hypothesis, subjective norms and self-efficacy were significantly associated with LTPA intentions. Together, the TPB constructs explained a significant 59% of the variance in LTPA intentions. In partial support of our second hypothesis, intentions exhibited a significant, positive relationship with LTPA behaviour. However, neither of the two PBC constructs (i.e., self-efficacy and perceived controllability) was found to be significantly associated with LTPA behaviour. Overall, the TPB constructs accounted for 10% of the variance in LTPA behaviour. Contrary to hypothesis, the neighbourhood aesthetics and wheeling infrastructure were not found to explain significant variance in either LTPA intentions or behaviour, beyond that accounted for by the TPB constructs (i.e., 2% and 1%, respectively). Of interest though, was the significant, negative relationship exhibited between wheeling infrastructure and LTPA intentions. **Conclusion:** Overall, the most parsimonious model for understanding LTPA intentions and behaviour in persons with SCI was the TPB model that did not include the two neighbourhood factors. Further investigation is needed to determine specific external barriers that influence LTPA intentions and behaviour in people with SCI.

Introduction

Physical inactivity is an escalating, national health concern, with many research efforts being directed at developing strategies for increasing physical activity participation among the general population (Craig & Cameron, 2004). Even more alarming though, is the low physical activity rates for persons living with a disability. For example, while 36% of individuals without disabilities lead an inactive lifestyle, 56% of people living with a disability do not participate in any leisure-time physical activity (U.S. Department of Health and Human Services (USDHHS), 2000). One segment of the disability community whose physical activity participation rates are of great concern is people living with a spinal cord injury (SCI). Approximately 53% of persons with SCI are completely inactive (Tasiemski, Bergstrom, Savic, & Gardner, 2000). The secondary health complications associated with sustaining a SCI, (e.g., chronic pain, obesity, heart disease), in combination with such low physical activity rates, may have detrimental effects on quality of life (Bauman, Kahn, Grimm, & Spungen, 1999; Johnson, Gerhart, McCray, Menconi, & Whiteneck, 1998). Two fundamental aims of health promotion in persons with SCI are to reduce secondary complications, and maintain functional independence (Rimmer, 1999). One way to achieve these health promotion initiatives may be through regular and suitable physical activity participation.

A growing body of research from both correlational and experimental studies has demonstrated numerous benefits of physical activity participation for people with SCI. For example, significant improvements in upper body strength, psychological well-being, and overall quality of life have been reported following a 9-month, twice-weekly exercise program (Hicks et al., 2003). Similarly, reductions in disease risk factors (e.g., triglyceride levels, insulin resistance; Nash, Jacobs, Mendez, & Goldberg, 2001), and secondary impairments (e.g., pain, depression; Hicks et al., 2003; Martin Ginis et al., 2003), as well as increased confidence to overcome exercise-related barriers (Coyle, Shank, Kinney, & Hutchins, 1993; Latimer, Martin Ginis, & Arbour, 2006) have been related to regular exercise participation in persons with SCI. Yet, despite the health-related benefits associated with becoming more physically active, individuals with SCI remain the most inactive segment of society (Dearwater, Laporte, Cauley, & Brenes, 1985), with the most current research indicating that people with SCI are completely inactive for 76% of their waking day (Latimer, Martin Ginis, Craven, & Hicks, 2006). Accordingly, research has now been directed at identifying determinants of physical activity, in particular leisure-time physical activity (LTPA; activity done during one's free time; Martin Ginis, Latimer, Hicks, & Craven, 2005) that can be used as targets for interventions to increase physical activity participation in persons living with SCI (Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Arbour, 2006; Martin et al., 2002; Rimmer Braddock, & Pitetti, 1996).

One of the most widely supported social psychological theories for predicting physical activity intentions and behaviour in a variety of populations is Ajzen's (1985) Theory of Planned Behaviour (TPB; Biddle & Nigg, 2000; Hagger, Chatzisarantis, &

Biddle, 2002; Symons Downs & Hausenblas, 2005). The TPB is an expectancy-value theory (i.e., presumes individuals behave according to their values and expectations), which assumes *behavioural intentions* to be a function of one's *attitude* towards the behaviour (i.e., positive or negative evaluations of the behaviour), the social pressures, or *subjective norms*, one feels to perform the particular behaviour, as well as the individual's *perceptions of control over the behaviour* (PBC). Additionally, the theory stipulates that a particular behaviour will be performed when there is an *intention* to engage in the behaviour, and the individual exemplifies heightened PBC over his or her ability to perform the particular behaviour. Thus, the TPB is assumed to be a 'complete' theory in that all other factors will influence behaviour performance indirectly via the TPB constructs (Ajzen & Madden, 1986).

Preliminary research supports the utility of the TPB for predicting LTPA intentions and behaviour among individuals with SCI (Latimer & Martin Ginis, 2005). In this prospective, correlational study involving 104 individuals with SCI, attitudes, subjective norms, and PBC each significantly contributed to a total of 60% of the variance in LTPA intentions, while intentions accounted for 16% of the variance in LTPA behaviour. Taken together, these findings suggest that TPB constructs are useful targets to consider when designing interventions to increase LTPA intentions and, to a lesser extent, behaviour in persons with SCI. However, given the amount of variance left unexplained by theory-driven studies of LTPA, there may be other factors which are not captured by the TPB that are important predictors of LTPA intentions and behaviour in persons with SCI.

Among individuals without disabilities, four studies have integrated characteristics of the perceived environment with the TPB to predict physical activity behaviour (de Bruijn et al., 2006; Giles-Corti & Donovan, 2002; Rhodes, Brown, & McIntyre, 2006; Rhodes, Courneya, Blanchard, & Plotnikoff, 2007). Overall, the findings suggest that perceptions of the physical environment have less of a direct influence on physical activity behaviour than the TPB constructs. However, three of these studies (de Bruijn et al., 2006; Rhodes et al., 2006, 2007) found that physical environmental perceptions may be important factors to consider for increasing physical activity intentions. Further examination into the direct effects of the perceived physical environment on physical activity in persons with disabilities is warranted.

While many theories and models of motivated behaviour, such as the TPB, examine the interrelations between intrapersonal (e.g., beliefs, motivation), environmental, and behavioural factors, ecological models also consider the direct influence of the physical environment on behaviour (Sallis & Owen, 1997). The physical environment, such as the presence of sidewalks and recreational facilities, is one of the least studied correlates of physical activity in persons without disabilities (Sallis & Owen; Spence & Lee, 2003). Moreover, its relationship with physical activity participation in persons with SCI has not been empirically tested. For persons without disabilities, neighbourhoods that are perceived to be more aesthetically pleasing (i.e., contain attractive landscape and buildings), have more sidewalks, and to be in close proximity to recreational facilities, are associated with greater physical activity (Humpel, Owen, & Leslie, 2002; Owen, Humpel, Leslie, Bauman, & Sallis, 2004); however, the effects have been small (Duncan, Spence, & Mummery, 2005; Rhodes et al., 2006). Among persons living with a disability, the paucity of environmental research that has been conducted suggests that such physical environmental barriers as lack of curb cuts (i.e., a gradual ramp leading from the sidewalk to an intersecting street) and building ramps, steep ramps, and uneven travel surfaces, can all have a negative influence on physical activity participation (Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004; Spivock, Gauvin, & Brodeur, 2007). Given that 68% of persons with SCI rely on a manual chair as their primary mode of mobility outside of the home (Canadian Paraplegic Association, 2000), the physical environment may be an important factor to consider when examining LTPA intentions and behaviour within this group of individuals.

Both objective (e.g., neighbourhood audits, geographical information systems [GIS] data), and subjective (e.g., questionnaires) measurement techniques have been used to examine the relationship between the physical environment and LTPA in persons without disabilities (Cerin, Saelens, Sallis, & Frank, 2006; Frank, Schmid, Sallis, Chapman, & Saelens, 2005; Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Kirtland et al., 2003; Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003). In Study 1B, it was found that the objective presence of environmental supports for physical activity do not explain LTPA in persons with SCI. However, there was a non-significant trend shown for perceptions of the presence of environmental supports to correlate with LTPA. Therefore, Study 2 focused on neighbourhood perceptions. In particular, a subjective instrument, the Neighbourhood Environment Walkability Scale (NEWS; Saelens, Sallis, Black, & Chen, 2003) was used to assess people's perceptions of the neighbourhood's physical environmental attributes.

In short, the purpose of the present study was to determine whether neighbourhood environmental perceptions could enhance the TPB's ability to explain LTPA intentions and behaviour in people living with SCI. In accordance with the tenets of the TPB (Ajzen, 1985), it was hypothesized that (a) attitudes, subjective norms, and perceived behavioural control (PBC; perceived controllability and self-efficacy) would be significantly associated with LTPA intentions, and (b) intentions and PBC would be significantly related to LTPA behaviour (Ajzen, 1985; Hagger et al., 2002). In addition, perceptions of the neighbourhood environment, specifically neighbourhood aesthetics and wheeling infrastructure, were hypothesized to account for variance in both LTPA intentions and behaviour, beyond that attributable to the TPB variables (de Bruijn et al., 2006; Rhodes et al., 2006, 2007; Saelens et al., 2003).

Method

Participants

Recruitment of participants took place through existing research databases and physicians' records, advertising on the websites and magazines of national and provincial service organizations for people living with SCI (i.e., Canadian Paraplegic Association), and primary sports and recreational networks for people with disabilities (i.e., Active

Living Alliance for Canadians with a Disability, Canadian Paralympic Committee), as well as poster advertisements at community events, around rehabilitation centres, and within local newspapers. To be eligible, participants must have met the following criteria: (a) over 18 years of age, (b) neurological impairment secondary to SCI, (c) SCI must be a traumatic injury (e.g., motor vehicle accident, fall), (d) at least 1-year post-injury (YPI), (e) use an assistive device as the primary means for ambulation outside of the home, and (f) report no cognitive or memory deficits (see Martin Ginis et al., 2008). Informed consent was obtained from all participants, and the study was approved by the university's Research Ethics Board.

Data were drawn from a larger, 18-month prospective study (SHAPE SCI; Martin Ginis et al., 2008). Baseline data from the first 246 participants (M_{age}=44.18 ± 12.17; M_{YPI}=15.92 ± 10.20) enrolled in SHAPE SCI who had complete data were used to test the study hypotheses. Participants were predominately male (75%), Caucasian (91%), and single (57%). Over half of the sample had tetraplegia (56%), with the majority of injuries being incomplete (i.e., partial or complete preservation of motor or sensory function below the injury level; 61%). The majority of participants (59%) were manual wheelchair users, while the remainder of the sample used either a power wheelchair (29%), a walking assistive device (e.g., cane or crutches; 10%), or a combination of their manual and power wheelchair (2%) as their primary mode of ambulation.

Measures

TPB measures

All TPB items were drawn from previous research on exercise behaviour in persons with SCI (Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Arbour, 2006; Martin et al., 2002). Given the length of the telephone interview for the larger, prospective study (i.e., 40 to 60 minutes/interview), a reduced set of items typically recommended for measuring TPB concepts was used.

Attitudes. Direct measures of attitudes toward participating in moderate to heavy LTPA were assessed using six pairs of adjectives, reflecting the affective (*unpleasant/pleasant, unenjoyable/enjoyable, stressful/relaxing*), and instrumental (*useless/useful, harmful/beneficial, bad/good*) components of attitude. Each item was framed by the following statement: "*I think that participating in moderate to heavy LTPA for at least 30 minutes on most days of week over the next 6 months would be ...*" All items were rated on a 7-point bipolar scale, and have been used in previous research examining the utility of the TPB as a framework for predicting physical activity among individuals with SCI (Latimer & Martin Ginis, 2005). Greater scores represented more positive attitudes towards moderate to heavy LTPA participation.

Subjective norms. Subjective norms were assessed by two items relating to the injunctive norm concept of subjective norm (Ajzen, 2002). The items were as follows:

"Most people who are important to me approve of me participating in moderate to heavy LTPA for at least 30 minutes on most days of the week over the next 6 months," and *"Most people who are important to me think I should participate in moderate to heavy LTPA for at least 30 minutes on most days of the week over the next 6 months."* Each item was rated on a 7-point bipolar scale, with the anchors 1 (*strongly disagree*) to 7 (*strongly agree*), and have been used in previous research examining the utility of the TPB as a framework for predicting physical activity among individuals with SCI (Latimer & Martin Ginis, 2005). Higher scores were indicative of greater perceived social pressures to participate in moderate to heavy LTPA.

PBC. Consistent with previous literature on the multidimensionality of the PBC construct (Armitage & Connor, 1999; Rhodes & Courneya; 2003; Terry & O'Leary, 1995; Trafimow, Sheeran, Conner, & Finlay, 2002), two aspects of PBC were examined – *perceived controllability* (beliefs about the extent to which performing the behaviour is completely up to the actor) and *self-efficacy* (perceived ease or difficulty of performing the behaviour). All items were rated on a 7-point bipolar scale, and have been used in previous research examining the utility of the TPB as a framework for predicting physical activity in people with SCI (Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Arbour, 2006). Three items were used to measure the perceived controllability concept of PBC: *"How much personal control do you feel you have over whether you participate in moderate to heavy LTPA for at least 30 minutes on most days of the week over the next 6 months?"* (1=*very little control*, 7=*complete control*), *"Whether or not I participate in moderate to heavy LTPA for at least 30 minutes on most days of the week, over the next 6 months is entirely up to me"* (1=*strongly disagree*, 7=*strongly agree*), and *"How much do you feel that whether you participate in moderate to heavy LTPA for at least 30 minutes on most days of the week over the next 6 months is out of your control?"* (1=*completely out of my control*, 7=*completely under my control*). The remaining two items assessed the self-efficacy aspect of PBC: *"How confident are you that you will be able to participate in moderate to heavy LTPA for at least 30 minutes on most days of the week over the next 6 months?"* (1=*very unconfident*, 7=*very confident*), and *"To what extent do you see yourself as capable of participating in moderate to heavy LTPA for at least 30 minutes on most days of the week over the next 6 months?"* (1=*very unlikely*, 7=*very likely*). Higher scores indicated greater perceptions of control or self-efficacy to participate in moderate to heavy LTPA.

Intentions. In line with previous TPB and physical activity research (Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Arbour, 2006; Latimer, Martin Ginis, & Craven, 2004), intentions were measured using two items, rated on a 7-point bipolar scale: (a) *"I will try to do at least 30 minutes of moderate to heavy LTPA on most days of the week over the next 6 months"* (1=*definitely false*, 7=*definitely true*), and (b) *"I intend to do at least 30 minutes of moderate to heavy LTPA on most days of the week over the next 6 months"* (1=*extremely unlikely*, 7=*extremely likely*). Higher scores represented greater intentions to participate in moderate to heavy LTPA.

Neighbourhood attributes. Perceptions of the neighbourhood environment were assessed using 2 subscales (*infrastructure for walking/cycling* and *aesthetics*) from Saelens et al.' (2003) Neighbourhood Environment Walkability Scale (NEWS). Previous research has demonstrated acceptable test-retest reliability (aesthetics: $ICC=.79$; infrastructure for walking/cycling: $ICC=.58$), and construct validity of these NEWS subscales among residents living in high- vs. low-walkability neighbourhoods (Cerin et al., 2006; Saelens et al., 2003), accelerometer (Atkinson, Sallis, Saelens, Cain, & Black, 2005), and self-reported physical activity (De Bourdeaudhuij, Sallis, & Saelens, 2003). For the present study, each item was modified such that the statement pertained to wheeling (i.e., self-propelling one's wheelchair) as opposed to walking around one's neighbourhood. Accordingly, for the present study, the walking/cycling facilities subscale was referred to as the "*wheeling infrastructure*" subscale. Neighbourhood was defined as "places one could get to using one's wheelchair in 30 minutes." This definition is consistent with the wording of the TPB and LTPA items (i.e., at least 30 minutes of LTPA), as well as Health Canada's (2007) recommendations of at least 30 minutes of moderate-intensity physical activity. For those participants who did not use a wheelchair outside of the home (i.e., relied on other assistive devices such as a cane or braces), neighbourhood was also defined as "places one could drive to within 15 minutes."

The *wheeling infrastructure* subscale contained five items that focused on specific places or physical structures within the neighbourhood that may facilitate or hinder wheeling (*"There are sidewalks on most of the streets in my neighbourhood," "The sidewalks in my neighbourhood are well maintained (paved, even, and not a lot of cracks)," "There are paved pathways or trails in or near my neighbourhood that are easy to get to," "Sidewalks are separated by the road/traffic by parked cars,"* and *"There is a grass/dirt strip that separates the streets from the sidewalks in my neighbourhood"*). Another aspect of the neighbourhood environment that may influence wheeling, but is not included in the infrastructure for walking/cycling subscale, is whether the sidewalks contain ramps or curb cuts to allow people to transverse from one section of sidewalks to the next. Hence, a sixth item was developed and included in the subscale to determine the availability of sidewalk ramps/curb cuts within the neighbourhood ("*Most of the sidewalks in my neighbourhood have ramps/curb cuts*"). The *aesthetics* subscale was composed of six items which tapped into the pleasurable aspects of the neighbourhood surroundings (*"There are trees along the streets in my neighbourhood," "Trees give shade for the sidewalks in my neighbourhood," "There are many interesting things to look at while wheeling/pushing in my neighbourhood," "My neighbourhood is generally litter-free," "There are many attractive natural sights in my neighbourhood,"* and *"There are attractive buildings/homes in my neighbourhood"*). All items were rated on a 4-point Likert scale (1=*strongly disagree*, 2=*somewhat disagree*, 3=*somewhat agree*, and 4=*strongly agree*), with higher scores representing more positive perceptions of neighbourhood aesthetics or places for wheeling within the neighbourhood. Those participants who indicated their neighbourhood did not have any sidewalks (e.g., lived in the countryside) were given the option of responding *"N/a"* to the item, *"There are sidewalks on most of the streets in my neighbourhood."*

Leisure-Time Physical Activity (LTPA). LTPA was assessed using the Physical Activity Recall Assessment for People with SCI (PARA-SCI; Martin Ginis et al., 2005). This instrument is an SCI-specific, 3-day activity recall measure that is administered over the telephone by a trained research assistant. Participants were mailed a printed chart prior to the interview, outlining four physical activity intensity categories: (1) *nothing at all* (no physical effort), (2) *mild* (very light physical effort), (3) *moderate* (some physical effort), and (4) *heavy* (maximum physical effort). During the telephone interview, participants were asked to use the chart to self-designate the intensity of each physical activity they recalled performing over the preceding 3 days. Next, the researcher coded the type of physical activity performed as either LTPA (i.e., physical activity done during free time; e.g., basketball, weight-training) or LA (lifestyle activity; e.g., household chores, computer work). This information was entered into a computer program to calculate the mean number of minutes spent in mild-, moderate- and heavy-intensity LTPA over the previous 3 days. The PARA-SCI has shown acceptable test-retest reliability (*ICC*s=0.65-0.80), construct validity, and concurrent validity with indirect calorimetry (Martin Ginis et al.). This instrument has been previously used to examine predictors of physical activity in people with SCI (Latimer & Martin Ginis, 2005; Latimer, Martin Ginis, & Arbour, 2006) with no interpretational problems reported in the target group.

LTPA was represented by a latent factor, which was a composite of the following two items: (1) the mean number of *minutes* participants reported performing moderate and heavy LTPA, and (2) the number of *days* participants engaged in at least 30 minutes of moderate and heavy LTPA. This latent LTPA variable corresponds with the wording of the TPB items, which focus on participating in at least 30 minutes of moderate to heavy LTPA on most days of the week. The correlation between the two observed LTPA variables was .79.

Procedure

All participants were recruited for the SHAPE SCI study (Martin Ginis et al., 2008). A trained research assistant contacted the participant via telephone, email or in person to determine eligibility and to schedule a baseline interview during a subsequent phone call. During the interview, a research assistant administered the TPB measures, neighbourhood attributes items, and PARA-SCI in a quasi-random order. All responses were recorded by the research assistant. Participants were required to have the PARA-SCI intensity chart in front of them before the PARA-SCI was administered. The duration of the interviews ranged from 45 to 60 minutes.

Data Analysis

Prior to analyses, the data were screened for missing values, out-of-range values and outliers. Descriptive outputs were examined to ensure normality assumptions were met (i.e., ± 2 *SDs* for skewness and kurtosis; Tabachnick & Fidell, 2001). Bivariate correlations among the TPB and neighbourhood variables were also examined to test for multicollinearity. All *r* values were < 0.90, indicating that none of the constructs were highly correlated (cf., Tabachnick & Fidell; see Table 3).

Model Specification. A factor analytic-structural equation modeling approach (SEM; Hoyle, 1995; Jöreskog, 1973) was used to test whether neighbourhood environmental attributes would enhance the TPB's ability to explain LTPA intentions and behaviour. Data analyses proceeded in a two-step process (Anderson & Gerbing, 1988), using AMOS 7.0. The first step involved using confirmatory factor analysis (CFA) to test a series of measurement models to determine a composite latent measurement model. The second step involved using SEM to test the hypothesized structural relationships among the latent variables outlined in the composite measurement model. Model integrity during both the CFA and SEM steps was determined by examining the solution estimates of the observed and latent variables (e.g., standardized factor loadings, factor correlations), and the model fit indices. The pattern of the standardized residual covariance matrix was also examined, with values ≤ 2 *SDs* indicating minimal error variance, and therefore, a better fit of the correlation estimates to the implied model (Anderson & Gerbing).

Model Fit Indices. Several fit indices were used to examine the discrepancy between the sample and fitted covariance matrices in the CFA and SEM analyses. The conventional chi-square statistic (χ^2) was used to examine the absolute fit of the model to the sample data, with a nonsignificant χ^2 ($p > .05$) indicating good model fit (Marsh, Wen, & Hau, 2004). However, the sensitivity of the χ^2 test to sample size and trivial differences in the sample and implied covariance matrices limits its practical utility for model evaluation (Hu & Bentler, 1999; Tabachnick & Fidell, 2001). Accordingly, three additional fit indices (Comparative Fit Index [CFI], Incremental Fit Index [IFI], and Root Mean Square Error of Approximation [RMSEA ±90% confidence interval]) were used to further evaluate model fit. The CFI and IFI assess model fit along a continuum (ranging from 0 to 1), with one end of the continuum being the independence (uncorrelated) model, and the other end containing the saturated (perfect-fitting) model (Hu & Bentler; Tabachnick & Fidell). Models exhibiting CFI and IFI values > 0.90 and 0.95 are indicative of acceptable and excellent fit, respectively (Bentler & Bonett, 1980). The RMSEA is an estimation of lack of fit of the model to a saturated model (Tabachnick & Fidell). RMSEA values < 0.05 are indicative of close fit, while values between 0.05 to 0.08 or > 0.10 indicate either an acceptable model fit or a poor-fitting model, respectively (Browne & Cudeck, 1993). The 90% confidence interval around the RMSEA point estimate should contain 0.08 to confirm that the model is a close fit to the sample data (Hu & Bentler; Marsh et al.).

Results

Data Screening

Examination of the univariate distribution characteristics indicated minimal departure from normality (overall skewness: -.16 to 2.68; overall kurtosis: -.26 to 8.64), with four variables ("participating in LTPA would be harmful/beneficial," "participating in LTPA would be worthless/valuable," "Most people who are important to me think I should participate in moderate to heavy LTPA," and the mean number of LTPA minutes) exhibiting kurtosis values that deviated from univariate normality (3.09, 3.78, 3.85, and 8.64, respectively). However, inspection of the multivariate normality statistics suggested departure from normality for the TPB and environment items (Multivariate kurtosis=120.23 for TPB measurement model and 11.37 for the neighbourhood measurement model). Therefore, the Maximum Likelihood (ML) estimation procedure was used to estimate the parameters in both the measurement and structural model analyses. The robustness of the ML method to deviations from normality in small samples (West, Finch, & Curran, 1995) suggests this procedure to be an appropriate estimation method for the current data analyses.

Confirmatory Factor Analyses of the Measurement Models

Theory of Planned Behaviour (TPB) Measurement Model

The six-factor TPB measurement model is presented in Figure 1. Results of the CFA testing the fit of the model to the sample data indicated good fit (χ^2=234.29; df =104; $p < 0.01$; *CFI*=0.95; *IFI*=0.95; *RMSEA*=0.07 [90% CI=0.06-0.08]). Moderate-to-strong standardized factor loadings were found for all individual items and their respective latent factor (attitude: βs=.70-.82, $ps < .01$; subjective norms: βs=.78-.85, $ps < .01$; perceived controllability: βs=.80-.86, $ps < .01$; self-efficacy: βs=.85-.88, $ps < .01$; intention: βs=.90-.94, $ps < .01$; LTPA: βs=.88-.90, $ps < .01$). Further inspection of the pattern of the standardized residual covariances suggested a symmetrical residual distribution (12.50% $z \geq |1.0|$; 0.07% $z \geq |2.0|$; 0% $z \geq |3.0|$), thus indicating that the fitted correlations were adequately estimated. The correlations between the latent factors ranged from small to moderate in magnitude (i.e., *r*s =.26 to .68). Based on the pattern of model fit indices, as well as the magnitude of the standardized factor loadings, residual covariances, and interfactor correlations, no modifications were made to the TPB measurement model.

The Neighbourhood Measurement Model

Prior to examining the integrity of the composite measurement model, a series of CFAs were run to test whether the 12 neighbourhood items could be collapsed into one or two latent factors. Results of the CFA testing are presented in Table 1. Based on the fit indices, the two-latent factor (6 items/factor) neighbourhood measurement model was a better fit than the one-latent factor (12 manifest items) measurement model (two-factor: χ^2=120.20, *CFI* and *IFI*=0.83, *RMSEA*=0.07; one-factor: χ^2=284.42, *CFI*=0.41, *IFI*=0.43, *RMSEA*=0.13). Further inspection of the standardized factor loadings and residual covariance matrices revealed less estimation error with the two- versus one-latent factor neighbourhood model (one-factor: βs=.10-.63; 48.48% $z \geq |1.0|$; 19.70% $z \geq |2.0|$; 10.61% $z \geq |3.0|$; two-factor: wheeling infrastructure [βs=.14-.62], aesthetics [βs=.23-.73]; 28.79%

$z \geq |1.0|$; 12.12% $z \geq |2.0|$; 0.03% $z \geq |3.0|$). These findings indicate that the neighbourhood measurement model is best represented as a two-latent factor model with the factors termed *wheeling infrastructure* and *neighbourhood aesthetics*. This is consistent with previous work on the NEWS among individuals without disabilities, which demonstrates separate scale items for neighbourhood aesthetics and infrastructure for walking/cycling (Cerin et al., 2006; Saelens et al., 2003).

Given the less-than-optimal *CFI* and *IFI* model fit indices for the two-latent factor neighbourhood measurement model (i.e., < .90), a series of CFAs were run to further test the model's integrity. An item deletion approach was used, where one neighbourhood item was sequentially removed from the two-latent factor neighbourhood measurement model. This process was performed 7 times, until each of the two latent factors was comprised of three manifest items, which is the minimal number of items for measuring a latent variable (Bollen, 1989). Items were deleted based on the magnitude of the factor loadings and the pattern of the standardized residual covariance matrices. Specifically, items with small factor loadings (i.e., < |0.30|; Bryant & Yarnold, 1994), and which consistently exhibited standardized residual variance values greater than 2 *SD*s, were removed from the model. Fit indices for the seven, two-latent factor neighbourhood measurement models are given in Table 1. Satisfactory *CFI* and *IFI* values (i.e., > 0.95) were exhibited by five of the seven specified measurement models. Furthermore, *RMSEA* point estimates fell within tolerable ranges (i.e., upper boundary of the 90% confidence interval $\leq$ 0.10) for the majority of the models. Overall, Model 6 (i.e., 4 manifest items per latent factor) was found to account for more of the sample data than any of the other specified two-factor latent neighbourhood measurement models (see Table 1). Further evidence of model integrity was demonstrated by the standardized factor loading estimates for the items on the two subscales (wheeling infrastructure: βs =.36-.73, *p*s < .01; neighbourhood aesthetics: βs=.34-75, *p*s < .01; see Figure 2), and the symmetrical distribution of the standardized residual covariance matrix (10.71% $z \geq |1.0|$; 3.57% $z \geq |2.0|$; 0.00% $z \geq |3.0|$). Taking into consideration the findings from the CFA, Model 6 (i.e., 4 manifest items per latent factor) was deemed the best-fitting two-factor neighbourhood measurement model. Therefore, this model was used in all further measurement and structural analyses.

Full Measurement Model: Combining the TPB and Neighbourhood Measurement Models

Results of the CFA testing the fit of the composite, eight-factor measurement model are presented in line 1 of Table 2. Overall, the model exhibited good fit to the sample data, with satisfactory *CFI* and *IFI* values (all $\geq$ 0.95), and *RMSEA* point estimates that were well within the upper boundary of the 90% confidence interval (i.e., 0.06-0.10). Inspection of the distribution of the standardized residual covariance matrix suggested that the fitted correlations were adequately estimated (14.33% $z \geq |1.0|$; 0.01% $z \geq |2.0|$; 0% $z \geq |3.0|$). Bivariate correlations between the latent factors ranged from .00 to .68 (see Table 3). Based on the pattern of model fit indices, as well as the magnitude of the solution estimates, the composite, eight-factor measurement model was deemed feasible to use during the structural analyses.

Descriptive Statistics

The descriptive statistics, internal consistency reliability estimates, and bivariate correlations for the latent factors in the eight-factor composite measurement model are provided in Table 3. Reliability estimates ranged from 0.64 to 0.89. In general, participants indicated having positive attitudes towards, and perceptions of control over participating in at least 30 minutes of moderate to heavy LTPA, greater social pressure and confidence to engage in LTPA, and perceived their neighbourhoods to have many places for wheeling and aesthetically-pleasing surroundings. Overall, participants reported performing a mean of 20.50 minutes (*SD*=36.40) of moderate or heavy LTPA per day over the previous 3 days, and engaged in at least 30 minutes of moderate and heavy LTPA on less than 1 of the 3 recalled days (i.e., *M*=0.61, *SD*=0.90).

As predicted by the TPB, LTPA intentions were significantly and positively correlated with attitudes, subjective norms, perceived controllability, and self-efficacy (*r*s=.43-.68, *p*s $< .05$; see Table 3). Correlations between intentions and the neighbourhood factors were small, albeit statistically significant (aesthetics: r=.18; wheeling infrastructure: r= -.14). As shown in Table 3, correlations between the composite LTPA behaviour latent factor and all other latent factors were small to moderate (*r*s=.03 to .32), with intentions exhibiting the strongest relationship.

Structural Model Analyses

Relationship with Intentions: Does the neighbourhood environment explain variance in intentions beyond that accounted for by the TPB variables?

The structural model for explaining intentions is shown in Figure 3. Based on the fit indices (see Table 2, line 2), the structural model represented an acceptable fit to the data (*CFI* and *IFI*=0.94, *RMSEA*=0.08). In partial support of our hypothesis, self-efficacy and subjective norms exhibited significant positive relationships with intentions (βs=0.53 and 0.28, respectively), indicating that greater confidence to engage in moderate to heavy LTPA and greater perceptions of social pressure for LTPA were associated with greater intentions to engage in at least 30 minutes of moderate to heavy LTPA on most days of the week over the next 6 months. Additionally, there was a trend towards a positive relationship between attitudes and intentions (β=0.17, $p < .10$), suggesting that more positive attitudes towards participating in at least 30 minutes of moderate to heavy LTPA were associated with greater intentions to engage in at least 30 minutes of moderate to heavy LTPA on most days of the week over the next 6 months. Contrary to hypothesis, no significant relationship was found between perceived controllability and intentions. Together, the TPB variables accounted for 59% of the variance in intentions to engage in at least 30 minutes of moderate to heavy LTPA on most days of the week over the next 6 months.

To test whether the neighbourhood environment factors explained further variance in intentions, above and beyond the 59% attributed to the TPB variables, a second structural model was tested. This model included all of the TPB variables as well as the two neighbourhood factors – wheeling infrastructure and neighbourhood aesthetics (see Figure 4). The structural model represented a good fit to the data (*CFI* and *IFI*=0.95, *RMSEA*=0.05; see Table 2, line 3). In addition to the significant relationships demonstrated between intentions and self-efficacy, and intentions and subjective norms, the neighbourhood factor 'wheeling infrastructure' was found to exhibit a significant, negative relationship with intentions (β= -0.13), such that perceptions of more places for wheeling were related to lower intentions to engage in at least 30 minutes of moderate to heavy LTPA on most days of the week over the next 6 months. However, neighbourhood aesthetics was not found to be significantly associated with intentions. An additional 2% of the variance in intentions was explained by the two neighbourhood environment factors, thus resulting in a total explained variance of 61% in LTPA intentions by the TPB and neighbourhood environment variables.[1]

To determine the most parsimonious model for explaining LTPA intentions, the $\Delta \chi^2$ statistic was calculated between the two models (i.e., TPB only vs. TPB and neighbourhood). Based on the results ($\Delta \chi^2$ (129, N=246) =129.11, $p > .05$), the TPB only model is the most parsimonious of the two models for explaining LTPA intentions.

Relationship with LTPA Behaviour: Do Perceptions of the neighbourhood environment explain variance in behaviour beyond that accounted for by the TPB variables?

The structural model for explaining LTPA behaviour is shown in Figure 5. Examination of the fit indices indicated a good model fit to the sample data (*CFI* and *IFI*=0.95, *RMSEA*=0.07; see Table 2, line 4). In partial support of our hypothesis, intentions were significantly related to LTPA behaviour (β=0.21, $p < .05$), with greater intentions to engage in moderate to heavy LTPA associated with greater LTPA behaviour. However, no significant relationships were found between LTPA behaviour and perceived controllability or self-efficacy. Overall, 10% of the variance in moderate to heavy LTPA was explained by the TPB constructs.

To determine whether the neighbourhood environment factors explain further variance in LTPA behaviour, above and beyond the 10% accounted for by the TPB variables, a second structural model, consisting of the TPB variables and the two neighbourhood factors, was examined (see Figure 6). Overall, this second structural model represented a good fit to the data (*CFI* and *IFI*=0.95, *RMSEA*=0.05; see Table 2, line 5). However, contrary to hypothesis, no significant relationships were exhibited between LTPA behaviour and any of the model constructs. An additional 1% of the variance in LTPA behaviour was explained by the neighbourhood environment factors, thus resulting in a total explained variance of 11% in LTPA by the TPB and neighbourhood environment variables.[2]

To determine the most parsimonious model for explaining LTPA behaviour, the $\Delta \chi^2$ statistic was calculated between the two models (i.e., TPB only vs. TPB and neighbourhood). Based on the results ($\Delta \chi^2$ (143, N=246) =145.84, $p > .05$), the TPB only model is the most parsimonious of the two models for explaining LTPA behaviour.

Discussion

This cross-sectional study used structural equation modeling to examine whether neighbourhood environmental perceptions enhance the TPB's ability to explain LTPA intentions and behaviour in people living with SCI. In partial support of our first hypothesis, and consistent with the tenets of the TPB, subjective norms and self-efficacy were significantly associated with LTPA intentions. Additionally, there was a trend for a positive relationship between attitudes and LTPA intentions. Together, the TPB constructs explained 59% of the variance in LTPA intentions, indicating a large effect (Cohen, 1992). In partial support of our second hypothesis, intentions emerged as a significant, positive correlate of LTPA behaviour. However, contrary to theory, neither of the two PBC constructs was found to be significantly associated with LTPA behaviour. Overall, the TPB constructs accounted for 10% of the variance in LTPA, suggesting a small effect (Cohen, 1992). Contrary to hypothesis, the two neighbourhood factors, aesthetics and wheeling infrastructure, were not found to explain significant variance in either LTPA intentions or behaviour, beyond that accounted for by the TPB constructs. Of interest though, was the significant, negative relationship exhibited between wheeling infrastructure and LTPA intentions. Overall, results indicate that the most parsimonious model for understanding LTPA intentions and behaviour in persons with SCI was the TPB model that did not include the two perceived neighbourhood factors.

Consistent with previous TPB research in people with SCI (Latimer & Martin Ginis, 2005), our findings support the utility of the TPB for explaining LTPA intentions. Interestingly, the 59% of variance in LTPA intentions that was accounted for by the TPB constructs is virtually identical to the 60% that was demonstrated in Latimer and Martin Ginis' study. However, contrary to Latimer and Martin Ginis' findings, attitudes were not significantly associated with LTPA intentions. One possible explanation is that other, personal factors may exert a stronger influence on people with SCI's motivation for engaging in LTPA than attitudes. Persons with SCI are more likely to experience chronic conditions such as pain, bladder infections, and joint overuse (Noreau, Proulx, Gagnon, Drolet, & Laramee, 2000), all of which could have a negative impact on LTPA intentions. Based on the present results, it would seem that the most effective way to bolster LTPA intentions in persons with SCI would be to focus on strategies and interventions that aim to increase people's self-efficacy and perceptions of social pressure for participating in specific LTPA behaviours.

Similar to other TPB studies (Armitage & Conner, 1999; Terry & O'Leary, 1995; Trafimow et al., 2002), the two PBC constructs, self-efficacy and perceived controllability, were shown to be differentially related to LTPA intentions. Specifically, self-efficacy was found to exhibit a stronger relationship with intentions than perceived controllability. Future research should examine these two PBC components separately to fully understand the role of control beliefs on LTPA intentions in people with SCI.

Contrary to the tenets of the TPB, intentions, but not the two PBC constructs, were significantly associated with LTPA behaviour. This finding is consistent with Latimer and Martin Ginis' (2005) research, which found intentions to be the stronger predictor of LTPA behaviour. Hence, the utility of PBC constructs for explaining LTPA behaviour in persons with SCI appears to be limited. As previously suggested (Latimer & Martin Ginis), the current PBC measures may not fully capture control over/self-efficacy to deal with the health conditions that people with SCI regularly encounter. These health conditions tend to be unexpected and can have devastating effects on LTPA participation. Alternatively, the PBC items may not have captured other environmental barriers that can influence LTPA in persons with SCI, such as accessibility of an exercise facility.

Contrary to hypothesis, perceptions of the neighbourhood aesthetics and wheeling infrastructure did not significantly enhance variance explained in LTPA intentions and behaviour. Interestingly, perceptions of the neighbourhood wheeling infrastructure were found to exhibit a significant, albeit small, negative relationship with intentions. This counter-intuitive finding (i.e., more positive perceptions of the neighbourhood wheeling infrastructure relates to less intentions for LTPA), may indicate poor validity of the NEWS instrument for persons with SCI. Given that the NEWS items were developed and tested in persons without disabilities (Saelans et al., 2003), it is likely that there are additional neighbourhood environmental perceptions that are of particular importance to people living with SCI, that are not captured by the NEWS (e.g., presence of curb cuts). Development of instruments to measure the presence of salient neighbourhood environmental factors that are related to LTPA in people with SCI would be an important step for future research.

Our study is one of the first to attempt to use an ecological framework for understanding LTPA behaviour in people living with SCI. Despite this strength, there are some study limitations to consider. First, the cross-sectional study design precludes us from determining causality. However, there is some indication that current physical activity levels tend to be a reasonable proxy measure of future physical activity, which suggests that for correlational analyses, similar findings can be expected between cross-sectional and prospective designs (Rhodes & Plotnikoff, 2005). Second, although adequate fit indices and solution estimates were demonstrated for the final two latent-factor perceived neighbourhood model, there may be other, competing models that were not considered. Thus, the generalizability of the results is limited to the model that was selected. Moreover, the findings can only generalize to people who live within neighbourhoods that include sidewalks, as participants who lived within neighbourhoods that did not include sidewalks were excluded from the analyses. Third, perceived, as oppose to objective neighbourhood environmental factors were integrated within the TPB. While the subjective nature of the NEWS items corresponds with the self-report TPB and LTPA behaviour instruments, it remains unclear whether the results would differ if a more objective neighbourhood environmental instrument was included. Similarly, there are other social environmental factors that were not examined, yet may have an important influence on LTPA in persons with SCI, such as socioeconomic status or the presence of active neighbours. Fourth, it is possible that participants may have had difficulty with perceiving the specified neighbourhood distances (i.e., a 30-minute wheel or 15-minute drive), which is a common problem reported in many geographic studies (Kirtland et al., 2003). Thus, we cannot be certain of the specific areas participants thought of while responding to the neighbourhood items. Lastly, the LTPA behaviour variable did not control for whether or not activities were performed in the person's defined neighbourhood. Hence, people may have participated in activities that were outside of the defined neighbourhood (e.g., swimming at a recreational centre in a different city) and, therefore, the reported neighbourhood perceptions may not be important correlates of their overall LTPA behaviour. To enhance the measurement correspondence between neighbourhood factors and LTPA, researchers should ensure that the location of activities fits within the defined neighbourhood (Giles-Corti, Timperio, Bull & Pikora, 2005).

Overall, results from the present study suggest that perceived neighbourhood aesthetics and wheeling infrastructure do not enhance the TPB's ability to explain LTPA intentions and behaviour among persons with SCI. Further investigation is needed to determine the specific environmental barriers that influence LTPA intentions and behaviour in people with SCI and to develop a universal neighbourhood definition that can be applied to people of all abilities.

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Footnotes

[1]A third structural model was tested to examine the influence of the presence of neighbourhood sidewalks on LTPA intentions. For this model, the 'wheeling infrastructure' latent variable was replaced with an observed 'sidewalk presence' variable, which permitted the inclusion of the 19 participants who indicated they did not have sidewalks ($n_{total} = 265$). Results indicated a good model fit to the data ($\chi^2 = 310.84$; $df = 155$; $p < 0.01$; $CFI = 0.94$; $IFI = 0.94$; $RMSEA = 0.06$ (90% CI = 0.05-0.07). However, contrary to the significant, negative relationship between 'wheeling infrastructure' and intentions that was demonstrated in the earlier intentions model ($\beta = -.13$; Figure 4), sidewalk presence did not exhibit a significant relationship with intentions ($\beta = .01$). Similar to the intentions model in Figure 4, an additional 2% of the variance in intentions was explained by aesthetics and sidewalk presence, thus resulting in a total explained variance of 61% in LTPA intentions by the TPB, neighbourhood aesthetics, and sidewalk presence variables.

[2] A third structural model was tested to determine the influence of the presence of neighbourhood sidewalks on LTPA behaviour. Consistent with the intentions model, the 'wheeling infrastructure' latent variable was replaced with an observed 'sidewalk presence' variable, resulting in the inclusion of the 19 participants who reported having no neighbourhood sidewalks ($n_{total} = 265$). Results indicated a good model fit to the data ($\chi^2 = 338.10$; $df = 189$; $p < 0.01$; CFI and $IFI = 0.95$; $RMSEA = 0.05$ (90% CI = 0.05-0.06). Contrary to the LTPA behaviour prediction model in Figure 6, intentions exhibited a significant, positive relationship with LTPA behaviour ($\beta = .22$), indicating greater intentions to participate in LTPA is associated with greater LTPA behaviour. However, aesthetics and sidewalk presence did not explain any additional variance in LTPA behaviour, beyond the 10% explained by the TPB variables.

Table 1

Model Testing of the Neighbourhood Attribute Items.

Model	χ^2	*Df*	*P*	*CFI*	*IFI*	*RMSEA (90% CI)*
1	284.42	54	< .01	0.41	0.43	0.13 (0.12-0.15)
2	120.20	53	< .01	0.83	0.83	0.07 (0.06-0.09)
3	108.10	43	< .01	0.83	0.84	0.08 (0.06-0.10)
4	50.57	34	.03	0.95	0.95	0.05 (0.01-0.07)
5	27.95	26	.36	0.99	0.99	0.02 (0.00-0.06)
6	20.16	19	.39	0.996	0.996	0.02 (0.00-0.06)
7	18.00	13	.16	0.98	0.98	0.04 (0.00-0.08)
8	16.92	8	.03	0.97	0.97	0.07 (0.02-0.11)

Note. CFI = Comparative Fit Index; IFI = Incremental Fit Index; RMSEA = Root Mean Square Error of Approximation; CI = Confidence Interval for relevant point estimates. Model 1 = One-factor Neighbourhood Model (12 manifest items loading on 1 latent factor). Model 2 = Two-factor Neighbourhood Model (12 item parcels (6 per latent factor) loading on 2 correlated latent factors representing "infrastructure" and "aesthetics). Model 3 = Two-factor Neighbourhood Model (11 manifest items (5 items for "infrastructure", 6 items for "aesthetics"). Model 4 = Two-factor Neighbourhood Model (10 manifest items (5 per latent factor) loading on 2 correlated latent factors). Model 5 = Two-factor Neighbourhood Model (9 manifest items (5 items for "infrastructure", 4 items for "aesthetics"). Model 6 = Two-factor Neighbourhood Model (8 manifest items (4 per latent factor) loading on 2 correlated factors). Model 7 = Two-factor Neighbourhood Model (7 manifest items (4 for "infrastructure", 3 for "aesthetics"). Model 8 = Two-factor Neighbourhood Model (6 manifest items (3 per latent factor) loading on 2 correlated factors).

Table 2

Model Fit Indices for the Composite Measurement and Structural Models.

Model	χ^2	*Df*	*p*	*CFI*	*IFI*	*RMSEA (90% CI)*
1. Composite Measurement Model	380.12	247	< .01	0.95	0.96	0.05 (0.04-0.06)
2. Intentions Structural Model – TPB only	216.60	80	< .01	0.94	0.94	0.08 (0.07-0.10)
3. Intentions Structural Model – TPB and neighbourhood	345.71	209	< .01	0.95	0.95	0.05 (0.04-0.06)
4. LTPA Structural Model – TPB only	239.35	106	< .01	0.95	0.95	0.07 (0.06-0.08)
5. LTPA Structural Model – TPB and neighbourhood	385.19	249	< .01	0.95	0.95	0.05 (0.04-0.06)

Note. CFI = Comparative Fit Index; IFI = Incremental Fit Index; RMSEA = Root Mean Square Error of Approximation; CI = Confidence Interval for relevant point estimates. Composite measurement model comprised of 23 manifest items loading on 7 correlated latent factors representing attitude (6 manifest items), subjective norms (2 manifest items), perceived control (3 manifest items), self-efficacy (2 manifest items), neighbourhood wheeling infrastructure (4 manifest items), neighbourhood aesthetics (4 manifest items), and intentions (2 manifest items).

Table 3

Descriptive Statistics and phi-Coefficients for the Eight Latent Variables in the Composite Measurement Model.

Latent Variables	*M*	*SD*	Range	Skew.	Kurt.	1	2	3	4	5	6	7	8
1. Attitude	33.99	7.04	8-42	-1.39	2.14	(0.89)							
2. Subjective Norm	11.94	2.68	2-14	-1.62	2.39	.64	(--)						
3. Perceived Control	16.63	4.70	3-21	-0.93	-0.04	.27	.26	(0.87)					
4. Self-Efficacy	10.46	3.49	2-14	0.21	-1.25	.58	.33	.68	(--)				
5. Aesthetics[a]	12.73	2.71	4-16	-0.70	-0.17	.31	.30	.16	.18	(0.64)			
6. Infrastructure[b]	12.49	2.95	4-16	-0.99	0.64	.00	.01	-.01	-.03	.04	(0.68)		
7. Intentions	10.32	3.88	2-14	-0.89	-0.45	.63	.55	.43	.68	.18	-.14	(--)	
8. LTPA (composite)						.19	.03	.21	.27	.08	-.12	.32	(--)
no. of days	0.61	0.90	0-3	1.42	0.88								
mean mins.	20.50	36.40	0-240	2.68	8.64								

Note. Higher scores denote a more positive response. Internal consistency reliability estimates (Cronbach's Coefficient α) are placed along the principal diagonal for all subscale item scores. Correlation matrix is based upon pairwise comparisons in the full measurement model analyses with equivalent sample sizes across each element in the matrix. All phi-coefficients > |.30| are significant at $p < .05$ (two-tailed; Bryant & Yarnold, 1994). $n = 246$ for all study measures.

[a] Score based on the final 4-item "neighbourhood aesthetic" latent variable.

[b] Score based on the final 4-item "wheeling infrastructure" latent variable.

Figure 1. Factor loadings and correlations of the TPB Measurement Model

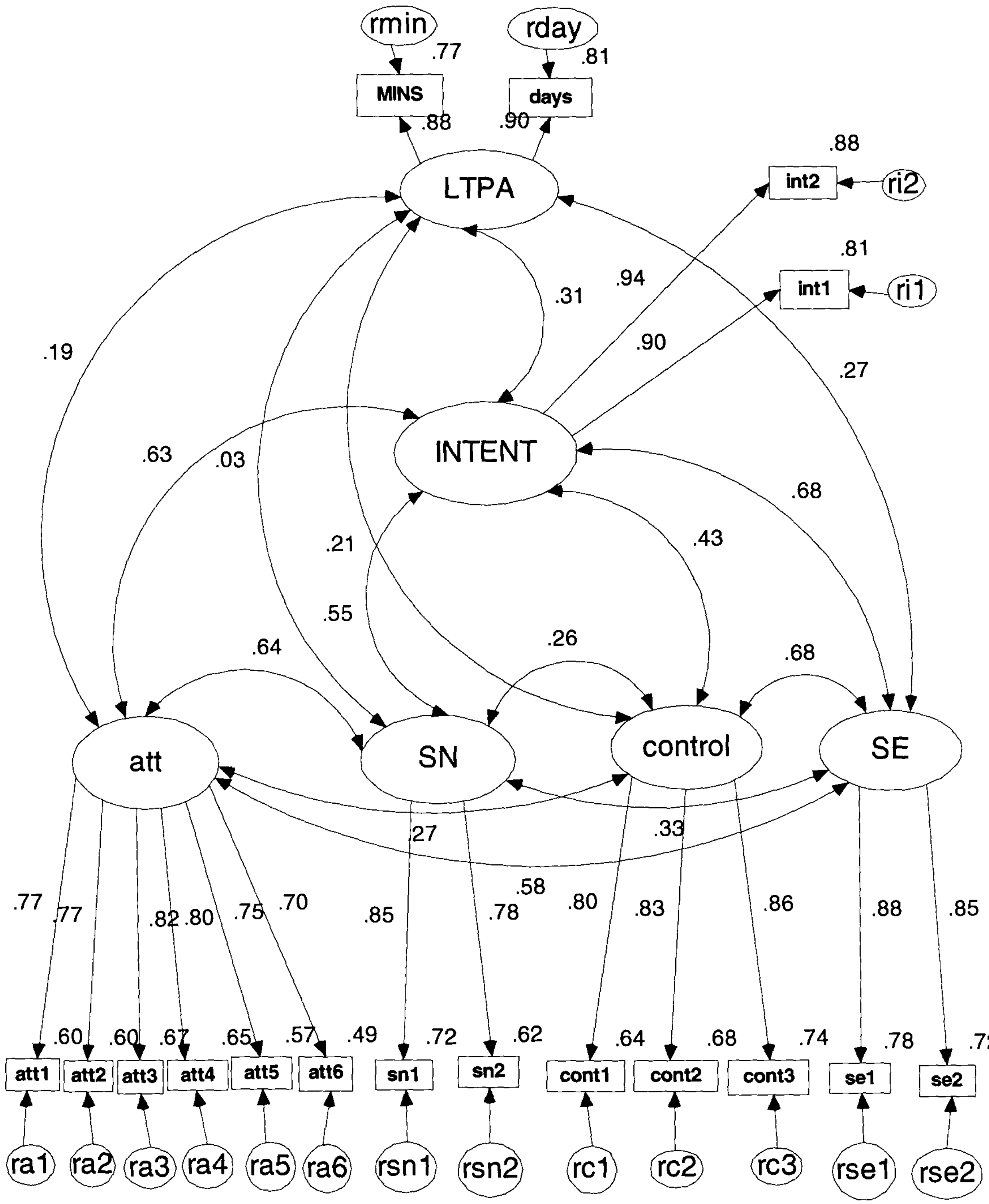
Figure 2. Factor loadings and correlations of the two-factor neighbourhood measurement model (8 latent variables)

Figure 3. Structural model predicting LTPA intentions using the TPB constructs. Solid lines represent significant beta weights, while dashed lines indicate non-significant beta weights. Ellipses represent latent variables.

Figure 4. Structural model predicting LTPA intentions using the TPB constructs and neighbourhood (aesthetics and wheeling infrastructure) attributes. Solid lines represent significant beta weights, while dashed lines indicate non-significant beta weights. Ellipses represent latent variables.

Figure 5. Structural model predicting LTPA intentions and behaviour using the TPB constructs. Solid lines represent significant beta weights, while dashed lines indicate non-significant beta weights. Ellipses represent latent variables.

Figure 6. Structural model predicting LTPA intentions and behaviour using the TPB constructs and neighbourhood (aesthetics and wheeling infrastructure) attributes. Solid lines represent significant beta weights, while dashed lines indicate non-significant beta weights. Ellipses represent latent variables.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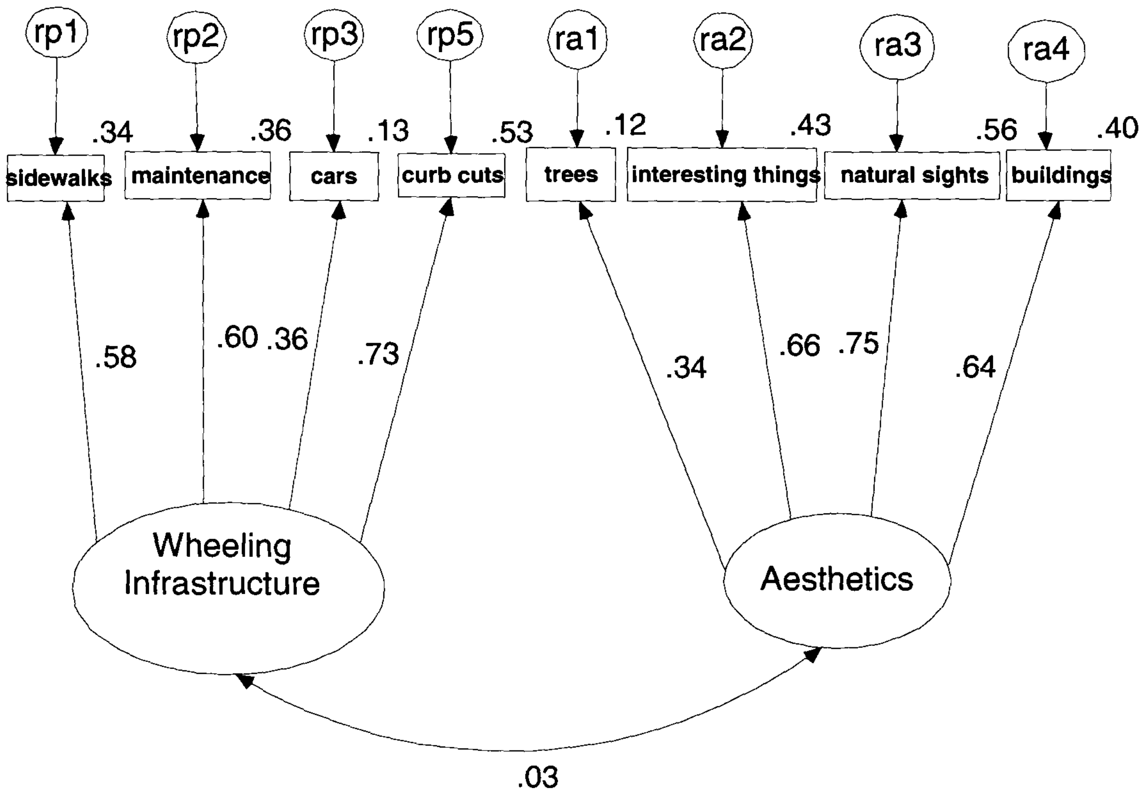
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Wheeling Infrastructure
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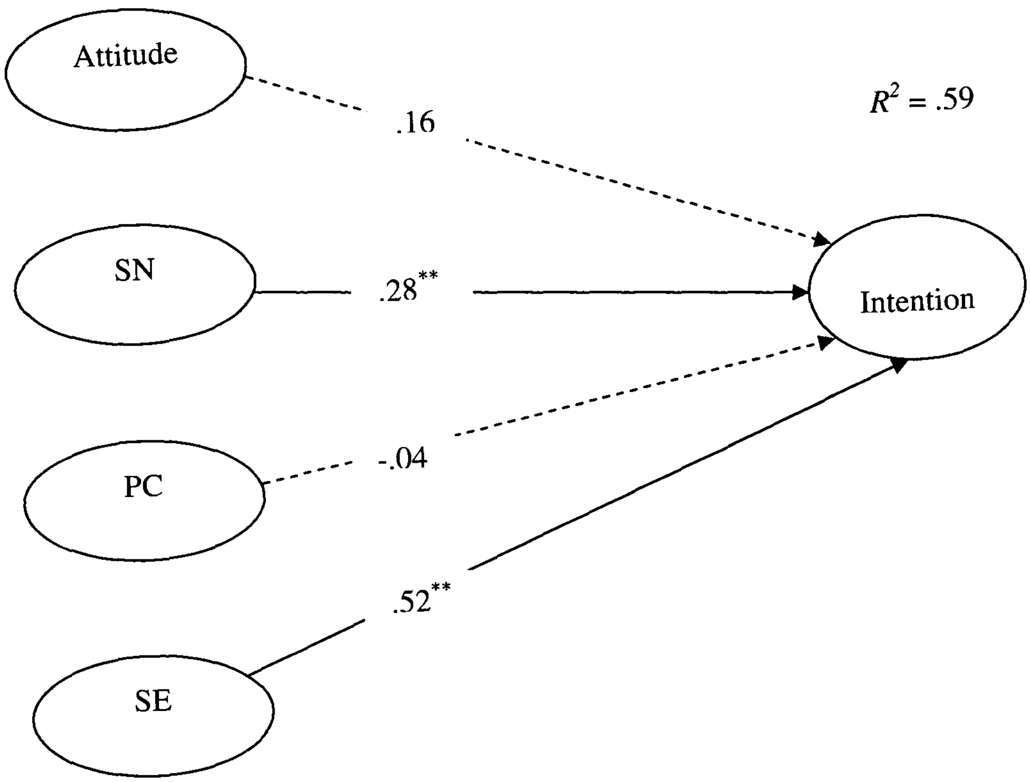

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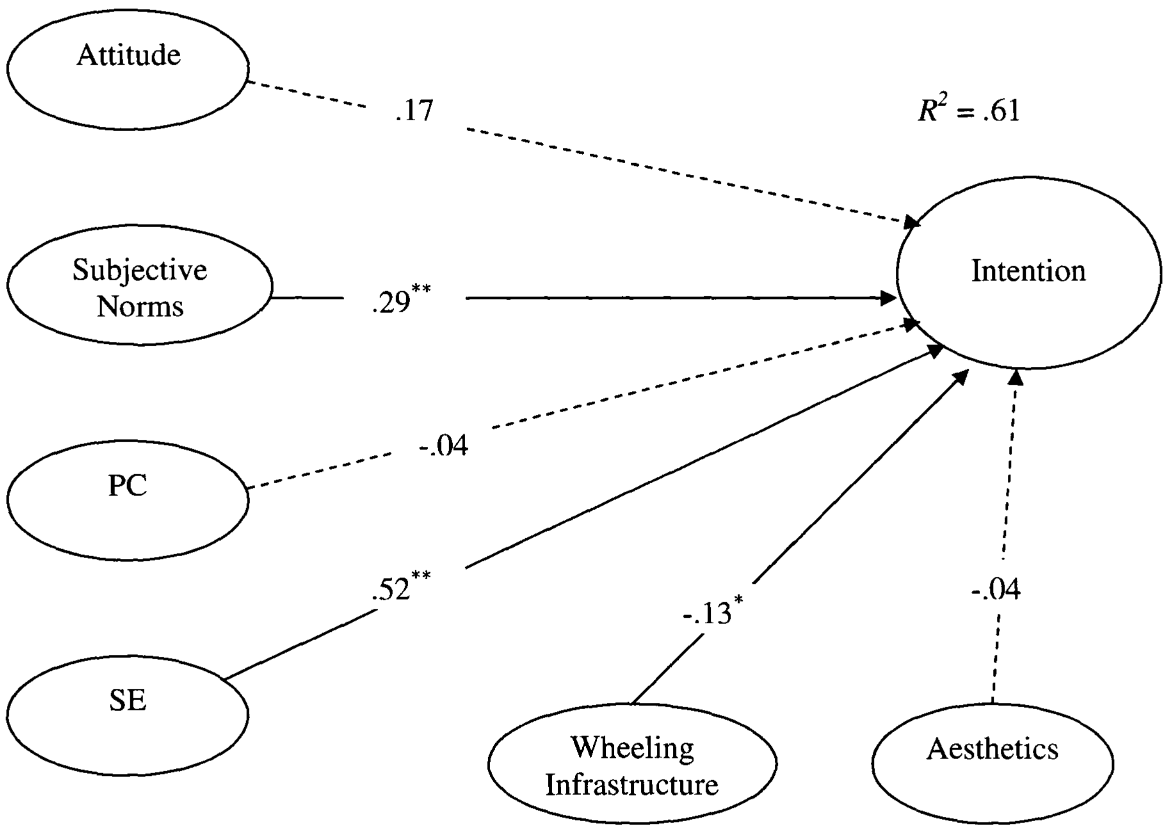
Attitude
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Subjective Norms
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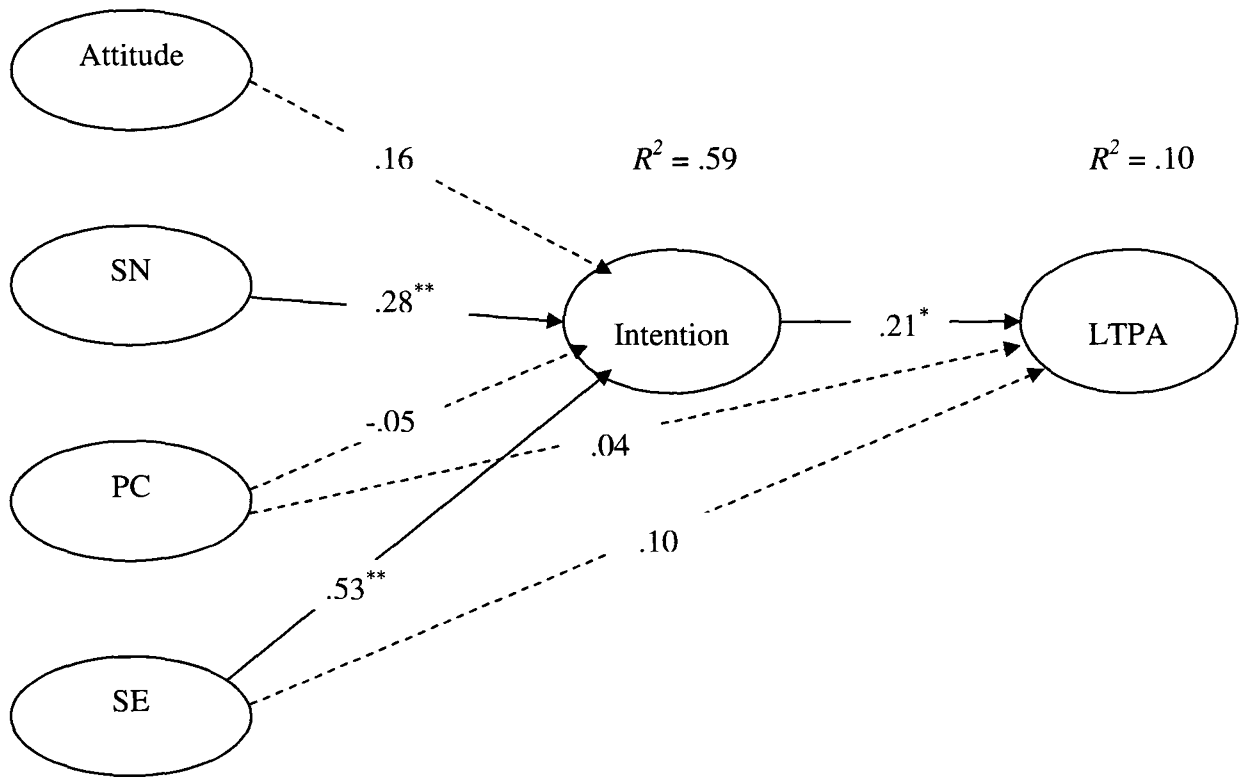
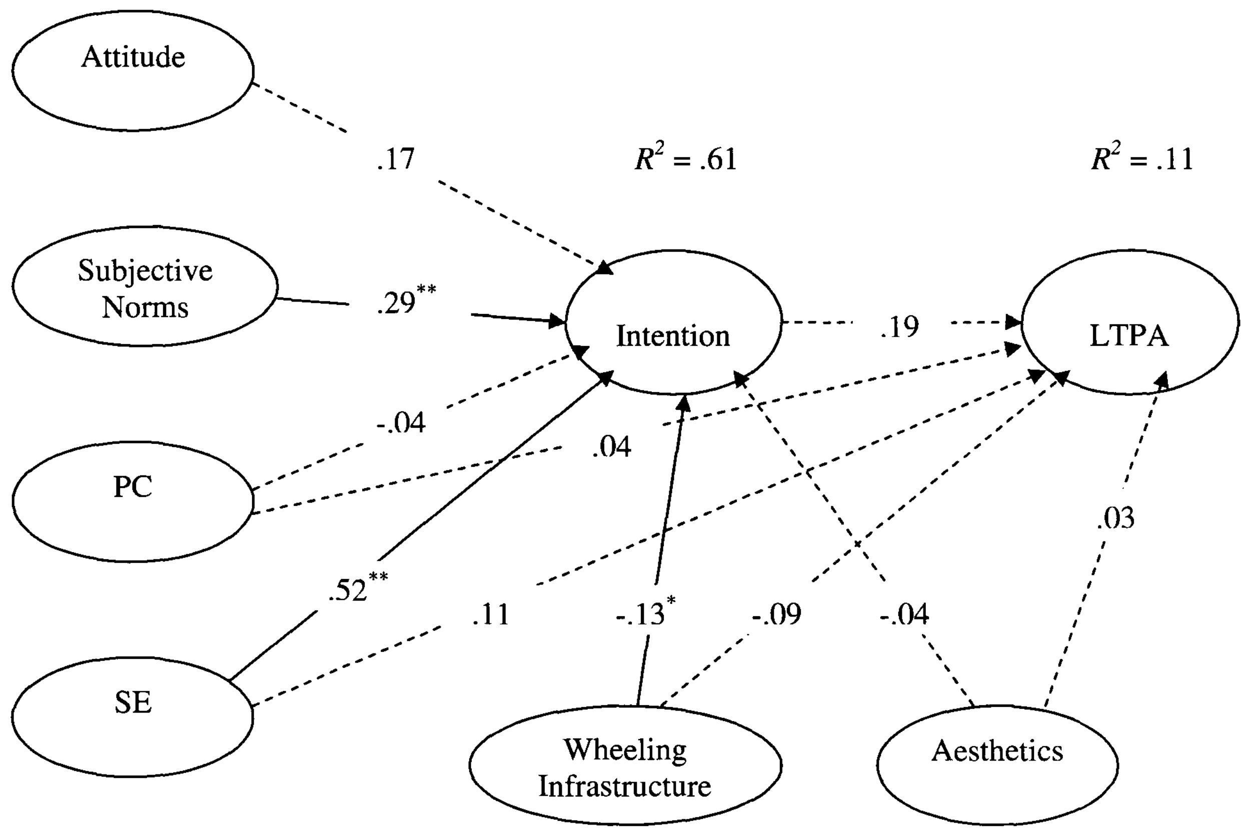
*p < .05, **p < .01



*$p < .05$, **$p < .01$


Attitude
Subjective Norms
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LTPA
Wheeling Infrastructure
Aesthetics
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*$p < .05$, **$p < .01$

CHAPTER 4

Turning intentions into action: The combined effects of action planning and coping planning on leisure-time physical activity and coping self-efficacy in exercise intenders living with spinal cord injury

Abstract

Purpose: To examine the effects of action and coping planning (A+C) on LTPA, coping self-efficacy and action control in beginner exercisers living with SCI. Additionally, this study tested whether the tenets of the Health Action Process Approach (HAPA; Schwarzer, 1992) extend to explaining LTPA performed in a community setting. **Method:** Forty-seven beginner exercisers living with SCI were randomly assigned to either an action planning only (A) or an A+C condition. The A condition formed action plans for LTPA every 5 weeks and self-monitored their LTPA behaviour. The A+C condition formed coping plans for self-identified LTPA-related barriers, in addition to forming action plans and self-monitoring. Data were collected at weeks 1, 5, and 10, and included measures of intentions, coping self-efficacy, action control, and LTPA. **Results:** At week 5, the A+C condition reported significantly greater LTPA, general barriers and scheduling self-efficacy, and intentions than the A condition. However, facility barriers self-efficacy was greater in the A condition. Scheduling self-efficacy partially mediated the effects of the intervention on LTPA, accounting for 34% of the total effect of the intervention on week 5 LTPA. At week 10, general barriers self-efficacy was significantly greater in the A+C condition. A trend was also shown for the A+C condition to report greater LTPA and scheduling self-efficacy than the A condition. Contrary to the HAPA tenets, none of the post-intentional HAPA constructs significantly predicted LTPA. **Conclusion:** Findings from Study 3 illustrate the benefits of supplementing action plans with coping plans for enhancing LTPA and coping self-efficacy beliefs among beginner exercisers living with SCI.

Introduction

Many social cognitive theories have been developed to understand why people engage in health behaviours such as leisure-time physical activity (LTPA). In most of these models, intentions are regarded as the most proximal determinant of behaviour change. However, findings from a variety of meta-analyses support the existence of an "intention-behaviour gap" (Hagger, Chatzisarantis, & Biddle, 2002; Orbell & Sheeran, 1998; Sheeran, 2002), suggesting that motivation may be a necessary, yet insufficient antecedent of LTPA (cf., Sheeran, 2002). In line with this reasoning, Sheeran found that 47% of individuals who intended to perform a health-related behaviour failed to translate their intentions into action (termed *abstained intenders*). In order to design effective LTPA-enhancing interventions, a greater understanding of the post-intentional predictors of behaviour is warranted (Lippke, Ziegelmann, & Schwarzer, 2004).

Post-Intentional Processes: The Health Action Process Approach (HAPA)

One model that has been increasingly used to examine post-intentional processes is the Health Action Process Approach (HAPA; Schwarzer, 1992, 2008). The HAPA distinguishes between two phases of behaviour change. In the first phase (*motivation*), people focus on their desires and wishes associated with performing the behaviour. It is at this point where individuals form an intention to adopt the behaviour. Thus, similar to other theories and models of motivated behaviour (e.g., Theory of Planned Behaviour; Ajzen, 1985; Self-Efficacy Theory; Bandura, 1986; Transtheoretical Model; Prochaska & DeClemente, 1983), the motivational phase of the HAPA captures a set of beliefs that are predictive of one's intention to perform a behaviour (i.e., outcome expectancy, self-efficacy, risk perceptions). However, contrary to the other theories and models of motivated behaviour which focus almost exclusively on behavioural adoption (Rothman, Baldwin, & Hertel, 2004), the HAPA also includes a second, post-intentional phase (*volition*). During the volitional phase, people use a series of self-regulatory strategies to plan, initiate and maintain the behaviour (Sniehotta, Scholz, & Schwarzer, 2006). Thus, the HAPA not only includes factors that influence behavioural adoption, it also accounts for other, post-intentional factors that may help to strengthen the intention-behaviour gap (Schwarzer, 2008). For this reason, the HAPA may be a superior model for understanding behaviour change (Lippke et al., 2004; Schwarzer, 2008).

According to the HAPA, movement between the motivational and volitional phases requires a series of mindset changes. The first mindset shift, termed *intentional mindset*, occurs when a nonintender forms an intention to perform the specified behaviour. Within the context of understanding LTPA, individuals who exhibit intentional mindsets are labelled "*intenders*" because they have formed an intention to perform LTPA, but they are not yet physically active at the recommended level (Lippke et al., 2004; Schwarzer, 1992). Upon entering the subsequent volitional phase, the intender must focus attention towards cognitions and behaviours that relate to behavioural initiation (Schwarzer & Fuchs, 1995). Some intenders may undergo a second shift towards an *actional mindset*, wherein they are regularly active and are utilizing self-regulatory strategies, such as planning, to maintain the behaviour (labelled *actors*; Lippke et al., 2004). For actors, the goal is to maintain regular performance of LTPA. Given that the intention-behaviour gap has mainly been attributed to abstained intenders (Orbell & Sheeran, 1998; Sheeran, 2002), the present study focused on increasing LTPA in a sample of people with SCI who intended to increase their behaviour.

The Role of Planning on LTPA: Action Planning and Coping Planning

A common barrier for intenders is not knowing how to adopt a regular regime of LTPA. In particular, intenders often lack the appropriate skills necessary to plan for LTPA (Orbell & Sheeran, 1998; Schwarzer, 1992; Sheeran, 2002). Two subconstructs of planning have been shown to influence LTPA –action planning and coping planning (Sniehotta et al., 2006). *Action planning* entails forming concrete action plans which specify when, where, and how the intention will be translated into action. Action plans are similar to implementation intentions (Gollwitzer, 1999), both of which link goal-directed behaviour to situational cues (Gollwitzer, 1999; Sniehotta et al., 2006; Schwarzer, 2008). However, implementation intentions are often written in "if-then" statements, while action plans are written in the context of situational parameters (e.g., where, when, and how). Meta-analytical data confirm the benefit of implementation intentions and action plans on goal pursuit in a variety of domains, with an overall moderate-to-large effect on behaviour (d = .65; Gollwitzer & Sheeran, 2006).

Accumulating experimental evidence suggests that action plans may be useful for increasing physical activity in a variety of populations (Arbour & Martin Ginis, in press; Kwak, Kremers, van Baak, & Brug, 2007; Latimer, Martin Ginis, & Arbour, 2006; Lippke et al., 2004; Luszczynska, 2006; Milne, Orbell, & Sheeran, 2002; Prestwich, Lawton, & Connor, 2003; Sniehotta et al., 2006). In the only published study to examine the use of action plans for promoting LTPA in persons with SCI, Latimer et al. (2006) found that those who formed action plans for three 30 minute bouts of moderate to heavy intensity physical activity per week increased their physical activity levels over an 8-week period in comparison to the control condition who significantly decreased their physical activity over the same period. Furthermore, Latimer et al. demonstrated a stronger relationship between baseline intentions and 8-week physical activity behaviour, and greater motivation, barrier self-efficacy, and perceived control among the action planning condition than the controls. These findings suggest that forming action plans may help to enhance LTPA, motivation, and control beliefs among people with SCI who intend to increase their physical activity. Moreover, action plans may strengthen the intention-behaviour relationship, with recent evidence indicating that more frequent use of action planning is associated with a stronger relationship (Luszczynska, 2006). Together, these findings support the utility of action planning for enhancing LTPA.

Meanwhile, *coping planning* involves the pairing of anticipated barriers with strategies that people can use to regulate their behaviour when these barriers arise.

Examples of the self-regulatory strategies that are often used for health behaviours are self-talk, cognitive restructuring, emotion control, and self-monitoring (cf., Baumeister, Heatherton, & Tice, 1994; Sniehotta et al., 2006). In essence, forming coping plans allows people to anticipate potential barriers that may interfere with LTPA, and perhaps increase the likelihood of participating in LTPA under these threatening situations. Preliminary research has shown that intenders who supplement action plans with coping plans report greater exercise behaviour than controls (Lippke et al., 2004; Sniehotta et al., 2006). In one of the only studies to compare the effects of coping plans and action plans on exercise behaviour, Sniehotta et al. (2006) found that cardiac rehabilitation patients who formed both action plans and coping plans for exercise after discharge reported greater strenuous physical exercise two months after discharge from the cardiac rehabilitation program than patients who either formed only action plans or who received the standard-care treatment. To our knowledge, there are no studies which have experimentally examined the combined effects of action and coping planning on physical activity outside of the context of rehabilitation. Hence, the present investigation examined the effects of these planning subconstructs on LTPA in a community-based sample of intenders living with SCI.

The Additional Influence of Action Control and Coping Self-Efficacy on LTPA

In addition to planning, the HAPA captures other, post-intentional processes that are important to predicting and understanding LTPA. One such construct is action control. *Action control* is conceptualized as three distinct self-regulatory actions – comparative self-monitoring, awareness of standards, and effort (Sniehotta, Scholz, & Schwarzer, 2005). While planning provides people with action goals and cues for self-monitoring, which makes it central to behavioural initiation, action control is important for behavioural regulation (Sniehotta et al., 2005). Based on the work of Baumeister and colleagues, self-monitoring, awareness of standards, and effort are the three "ingredients" to self-regulation; failure in any one of these three actions, such as inconsistent monitoring of one's behaviour, inappropriate goals or ideals, or lack of persistence in facilitating situations, can impede one's ability to regulate, and ultimately, maintain the behaviour (Baumeister & Heatherton, 1996; Sniehotta et al., 2005). Previous research has shown action control to be the most proximal volitional predictor of exercise behaviour among cardiac rehabilitation patients (Sniehotta et al., 2005), suggesting that active self-regulation is a key component to the behaviour change process.

In addition to planning and action control, progression through the volitional phase is also influenced by self-efficacy beliefs (Schwarzer & Fuchs, 1995). Self-efficacy is a robust predictor of exercise behaviour among a variety of populations (Bandura, 1997; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002). However, the strength of association between self-efficacy and exercise behaviour has been shown to vary as a function of the type of self-efficacy (Maddux, 1995; Rodgers & Sullivan, 2001; Rodgers et al., 2002; Scholz, Sniehotta, & Schwarzer, 2005), with some research indicating a stronger relationship between exercise behaviour and coping self-efficacy (i.e., beliefs in one's ability to perform exercise under challenging situations) than task self-efficacy (i.e., beliefs in one's ability to perform the specific behavioural components; Maddux, 1995; Rodgers & Sullivan, 2001). Accordingly, the HAPA includes phase-specific self-efficacy beliefs, each of which is reflective of different tasks that must be mastered at each stage of the behaviour change process (Renner & Schwarzer, 2005; Scholz et al., 2005; Schwarzer, 2008). For example, while task self-efficacy is crucial for behavioural adoption, coping self-efficacy is required for continued participation (Rodgers et al., 2002). Two subtypes of coping self-efficacy that have been shown to be important predictors of exercise maintenance among beginner exercisers are *scheduling self-efficacy* (DuCharme & Brawley, 1995), and *barrier self-efficacy* (Schwarzer, 1992, 2008). Specifically, beginner exercisers' confidence to overcome scheduling demands and exercise-related barriers may gradually decrease over time as they become more familiar with and realize the difficulty of managing the scheduling difficulties and obstacles that are associated with regular exercise participation (DuCharme & Brawley). Hence, the current study examined whether barrier and scheduling self-efficacy predict LTPA in beginner exercisers with SCI.

The Relationship Between Planning and Coping Self-Efficacy Beliefs

Recently, there has been some indication that action plans alter exercise-related coping self-efficacy beliefs (Arbour & Martin Ginis, 2004, in press; Latimer et al., 2006). For example, studies have shown higher scheduling self-efficacy (Arbour & Martin Ginis, 2004, in press), and barrier self-efficacy (Arbour & Martin Ginis, in press; Latimer et al.) among people who form action plans. Overall, these findings suggest that in addition to Gollwitzer's (1999) postulated automaticity mechanisms, action plans may also help to bolster control beliefs. According to social cognitive theories of motivated behavior (Ajzen, 1985; Bandura, 1997), these greater control beliefs are associated with a greater likelihood of behavioral enactment. Currently though, no study has examined the effects of combined planning (i.e., action planning and coping planning) on coping self-efficacy beliefs. Therefore, the present study further examined the concept of planning and its relationship with exercise-related coping self-efficacy beliefs in beginner exercisers.

In sum, the current study is an extension of previous action planning research conducted among individuals with SCI (Latimer et al., 2006). Within the original study, it was found that an 8-week action planning intervention helped to increase control beliefs and physical activity (Latimer et al.). The purpose of this 10-week study was to extend these findings by examining whether a combined action and coping planning intervention (A+C condition) would result in higher LTPA levels and greater self-regulatory skills --in particular coping self-efficacy and action control-- than an intervention focused on action planning alone (A condition). Based on previous action planning and physical activity research, the following hypotheses were tested:

1. Participants assigned to the A+C condition would exhibit greater LTPA than participants in the A condition (Latimer et al., 2006; Sniehotta et al., 2006).
2. Participants in the A+C condition would report greater coping self-efficacy (i.e., general barriers, facility barriers, and scheduling), and greater action control than the A condition (Latimer et al.).
3. Given that intentions are precursors to motivation (Gollwitzer & Sheeran, 2006; Lippke et al., 2004; Schwarzer, 1992), no between-groups differences on intentions were expected to occur.

A second purpose was to examine the tenets of the HAPA. In particular, we investigated whether (1) the volitional processes outlined in the HAPA (i.e., planning, coping self-efficacy, and action control) were predictors of LTPA among people with SCI, and (2) changes in these volitional processes would mediate the effects of the intervention on LTPA. Based on findings from previous HAPA research, the following three hypotheses were tested:

4. Action planning, coping self-efficacy, and action control would each predict LTPA (Sniehotta et al., 2005).
5. Action planning would mediate the effects of intentions on LTPA (Luszczynska, 2006).
6. Coping self-efficacy and action control would mediate the effects of the intervention on LTPA.

Method

Participants

Based on previous action planning and exercise research, a large-sized effect was expected for the physical activity behaviour outcome (Gollwitzer & Sheeran, 2006; Latimer et al., 2006; Milne et al., 2002). Cohen's (1992) power calculation methods indicated a sample of 52 participants was required to detect a large-sized effect at $p < .05$.

Participants were 47 individuals with SCI (M_{age}=49.28, SD=12.82; 63.8% male; 51.1% with tetraplegia; see Table 1) who were all sedentary (i.e., participated in ≤ 2 days per week of LTPA over the past 6 months; Latimer et al., 2006; Rodgers & Gauvin, 1998), yet who intended to participate in 3 days per week of LTPA over the next 10 weeks. Recruitment of participants took place through existing research databases, and advertising on the websites and magazines of national and provincial service organizations for people living with SCI (i.e., Canadian Paraplegic Association, SCI Solutions Alliance, Care Cure Community). Participants met the following inclusion criteria: (a) over 18 years of age, (b) neurological impairment secondary to SCI, (c) exercised ≤ 2 times per week over the past 6 months (Latimer et al.; Rodgers & Gauvin), and (d) intended to exercise 3 days per week over the next 10 weeks. These criteria were put in place because we were interested in targeting individuals with SCI who were not currently physically active, but who had intentions to start exercising over the intervention time period. Informed consent was obtained from all participants prior to each telephone interview, and the study was approved by the university's Research Ethics Board

Randomization and Design

A 10-week, single-blind randomized controlled trial design was used. Random numbers were used to allocate participants to the study conditions. Measures of intentions and LTPA were administered at baseline, weeks 1, 5 and 10. Coping self-efficacy was measured at weeks 1, 5 and 10, while frequency of action planning, action control and health-related LTPA breaks were assessed at weeks 5 and 10 (see Figure 1). All measures were administered over the phone by the primary investigator or a trained research assistant.

Measures

Intentions. Two items were used to measure intentions for participating in LTPA: *"I will try to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next 4 weeks,"* and *"I intend to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next 4 weeks."* Responses were made on a 7-point scale ranging from 1 (*definitely false/extremely unlikely*) to 7 (*definitely true/extremely likely*). Items were summed, with higher scores indicating stronger intentions. These items have been used in previous physical activity research in persons with SCI (Latimer & Martin Ginis, 2005; Latimer et al., 2006).

Prior to assessing intentions, participants were read a script (referred to as a "corrective entreaty"; Ajzen, Brown, & Rosenthal, 1996), which encouraged them to form their intentions while considering possible barriers to performing LTPA. Specifically, participants were told how intentions formed in a hypothetical situation differ from those intentions formed in a real situation, and were provided with possible barriers that may interfere with implementing their intentions (e.g., getting sick, feeling tired; see Appendix D.2 for script). At the end of the script, participants were asked to consider what the next 4 weeks "are really going to be like..." before responding to the intentions items (Ajzen et al., 1996). The purpose of the corrective entreaty statement was to reduce the tendency to overestimate one's subsequent performance of LTPA (Ajzen, Brown, & Carvajal, 2004).

Coping Self-Efficacy

Three types of coping self-efficacy items were used to assess participants' confidence to overcome psychosocial and environmental barriers to LTPA. All items were rated on a 7-point scale from 1 (*not at all confident*) to 7 (*completely confident*).

General Barriers Self-Efficacy. A 6-item questionnaire assessed participants' confidence in their ability to overcome salient barriers to physical activity. The six salient barriers (e.g., having pain or soreness, bad weather) were previously identified from focus groups conducted with individuals with SCI (Martin et al., 2002). Preliminary testing among eight active individuals with SCI found the instrument to exhibit acceptable reliability (α=0.75). Each item was preceded by the statement: "Assuming you were very motivated, how confident are you that you will participate in moderate to heavy LTPA for at least 30 minutes on 3 days per week over the next 4 weeks even if…" (Blanchard et al., 2003). This instruction set was used to control for the influence of lack of motivation on participants' confidence levels. A mean general barriers self-efficacy score was calculated, with higher scores representing greater confidence to overcome salient barriers to physical activity. Internal consistency was acceptable at all three time measurements (αs > .80).

Facility Barriers Self-Efficacy. A 6-item questionnaire was used to measure participants' confidence to overcome social and physical environmental barriers at fitness centres. The six facility barriers (e.g., limited spacing between equipment, lack of staff knowledge, being watched by others) were identified from Study 1A findings as well as from a recent study examining perceived barriers to exercise in people with SCI (Scelza, Kalpakjian, Zemper, & Tate, 2005). Preliminary testing among eight active individuals with SCI found the instrument to exhibit excellent reliability (α=0.93). A mean facility barriers self-efficacy score was calculated, with higher scores indicating greater confidence to overcome social and physical environmental barriers at fitness centres. Acceptable reliability was demonstrated at all three time measurements (αs > .80).

Scheduling Self-Efficacy. Scheduling self-efficacy was measured by having participants rate their confidence in their ability to arrange their weekly schedule to fit 30 minutes of moderate to heavy LTPA once, twice, and three times times per week over the next 4 weeks (Arbour & Martin Ginis, 2004). This measure has shown excellent reliability in previous action planning and SCI research (α > .85; Latimer et al., 2006). A mean scheduling self-efficacy score was calculated, with higher scores representing greater confidence to schedule moderate to heavy LTPA over the next 5 weeks. Internal consistency was acceptable at all three time measurements (αs > .88).

Action Control. Three self-regulatory processes were measured to determine participants' active mastery over their LTPA– comparative self-monitoring, awareness of standards, and self-regulatory effort (Sniehotta et al., 2005). A total of six items (two per process) comprised the action control questionnaire (Sniehotta et al., 2005). Each item was preceded by the statement, "During the past 4 weeks, I have…" Examples of the items are as follows: "…constantly monitor whether I engage in LTPA often enough," "…I am careful to ensure that I am active for at least 30 minutes at a moderate to heavy intensity, each time I engage in LTPA," and "…try my best to meet my own standards for being physically active." Items were rated on a 7-point scale ranging from 1 (*definitely false*) to 7 (*definitely true*). The six items were summed, with higher scores indicative of greater action control (i.e., greater self-monitoring, goal-setting, and effort spent in goal attainment). Previous research has found this measure to have adequate internal consistency among a sample of cardiac patients (α=.91; Sniehotta et al., 2005). Internal consistency was acceptable at both time points (αs > .90).

Health-Related Break from LTPA. To control for any health-related problems that may have influenced LTPA over the study period, participants were asked to indicate whether they experienced any breaks from LTPA due to a health-related problem (cf., Scholz et al., 2005). Participants who experienced a health-related break were asked to indicate (a) the specific problem, and (b) the number of days their LTPA was affected by the particular health problem.

Weekly Leisure-Time Physical Activity (LTPA). A short version of the Physical Activity Recall Assessment for People with SCI (PARA-SCI; Martin Ginis, Latimer, Hicks, & Craven, 2005) was administered to measure weekly LTPA. This instrument is an SCI-specific, 7-day activity recall measure that is administered over the telephone by a trained research assistant. Participants were asked to indicate the number of days and minutes they engaged in mild, moderate, and heavy LTPA over the previous 7 days. This instrument is similar in structure to the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003), an activity recall measure that is commonly used for people without disabilities. However, the three intensity descriptions are based on those used in the original PARA-SCI intensity guidelines (Martin Ginis et al., 2005). Consistent with Latimer et al. (2006), the moderate and heavy intensity categories were used to calculate weekly LTPA. Separate weekly LTPA scores were calculated for baseline, weeks 1, 5 and 10 by multiplying the respective number of days and minutes. A moderate correlation (r =. 50, p <.01) was found between this weekly LTPA measure and the original PARA SCI measure in a pilot test involving 51 participants with SCI.

Manipulation Checks

Frequency of Action Planning. A 4-item instrument was administered to determine any between-groups differences on the frequency with which participants altered the details of their action plans (Luszczynska & Schwarzer, 2003). Participants were asked to rate the extent to which they changed the details of their action plans regarding (a) when (i.e., day and/or time), (b) where, (c) what types of activities, and (d) how often they would engage in LTPA. This measure has demonstrated acceptable reliability within a sample of cardiac patients (α=.94; Scholz et al., 2005). Items were rated on a 7-point scale from 1 (*not at all*) to 7 (*very often*). Internal consistency for the current study was .64 (week 5), and .76 (week 10).

Coping Planning. A manipulation check was administered to the action planning only condition to determine whether they spontaneously developed coping plans. This questionnaire asked participants (a) whether or not they created any plans for dealing with anticipated barriers to their LTPA participation, (b) to list the anticipated barrier(s), and (c) to provide an example of the plan(s) they made to cope with each of the identified barriers.

Procedure

Interested participants were screened over the phone for eligibility by the primary investigator using the demographics and LTPA recall measures. Eligible participants were read an information letter, and verbal consent was obtained. Participants were then scheduled for their week 1 telephone interview, and were mailed a consent form as well as a physical activity tool kit, which included a rubber resistance band (Thera-Band™, Hadamar, Germany), an exercise instruction guide, and exercise safety tips (Latimer et al., 2006; see Appendix D.7). As in Latimer et al.'s study, participants were sent the tool kit to ensure they all had basic knowledge of physical activity, as well as access to basic exercise equipment. A physical activity pamphlet was also included. This pamphlet was specifically designed for the study to provide participants with helpful tips on getting started with a physical activity program (e.g., how to locate a fitness centre, how to plan for physical activity, activities that can be done at home or at a fitness centre). Prior to disseminating the pamphlet, a pilot test was conducted to determine the appropriateness and relevance of the pamphlet. Eight individuals with SCI who were members of a community-based exercise program were asked to rate the pamphlet on six dimensions (i.e., usefulness of information, similarity of target audience, credibility, comprehension, readability, and accuracy; see Appendix D.11), on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Overall, the pamphlet was shown to be appropriate for beginner exercisers (M=6.25, SD=1.15), with participants indicating that the pamphlet was useful (M=5.88, SD=1.36), and appealing to the SCI community (M=6.00, SD=1.60). Furthermore, the information presented in the pamphlet was rated as credible (M=6.25, SD=1.39), easy to read (M=6.50, SD=0.93), and understand (M=6.63, SD=0.74), and accurate (M=6.25, SD=1.16).

Immediately prior to the Week 1 telephone interview, participants were randomized by the primary investigator, using a random numbers table, to either the combined action and coping planning (A+C) condition or the action planning only (A) condition. The interview began with the researcher reviewing the consent form and the physical activity tool kit, and then administering the LTPA recall and intentions measures. Immediately following the delivery of these two measures, the researcher administered the randomly allocated planning intervention.

Planning Interventions

Action Planning Only (A) Condition. Participants assigned to the A condition were asked to form action plans for participating in 3 days per week of at least 30 minutes of LTPA over the next 4 weeks. For each of the 3 days, they were asked to specify the time, place, the number of minutes, and the intensity at which they intended to exercise. The researcher recorded the details of the action plans on a calendar that was subsequently sent to the participant. Participants were instructed to familarize themselves with their action plans, and to post the plans in a place where they would be able to refer to them regularly. To foster action control skills (i.e., self-monitoring and awareness of standards), participants were also given a log book so they could monitor their actual LTPA behaviour. At the end of each day, participants were instructed to record the type of activity they performed, the number of minutes they exercised, and the intensity level they were working at (i.e., mild, moderate, or heavy), using the PARA-SCI (Martin Ginis et al., 2005) intensity classification guidelines. On the days they did not do LTPA, they were instructed to place an "X" in the box that said "none" (see Appendix D.10).

Action and Coping Planning (A+C) Condition. Following the action planning intervention, participants in the A+C condition were also asked to form coping plans for overcoming three self-identified barriers to their LTPA participation. The following script was used by the researcher to administer the coping planning intervention (Sniehotta et al., 2006):

> "To begin, I would like you to think about any obstacles or barriers which may interfere with the implementation of your exercise plans. Can you identify three obstacles for me?" [Participants then described three obstacles/barriers which the researcher recorded on the coping planning sheet.]

> "Now I would like you to think about *how* you could successfully cope with such problems. Specifically, I would like you to make a plan about how you would deal with these situations. Remember that the more precise, concrete and personal you formulate your plans, the more they will help you."

Similar to the action planning intervention, participants were instructed to familarize themselves with their coping plans, and to post the plans in a place where they would be able to refer to them regularly. Also, participants were given a log book so they could monitor their actual LTPA behaviour.

Immediately following the planning interventions, the three coping self-efficacy measures (general barriers, facility barriers, and scheduling) were administered. Participants were then scheduled for their Week 5 interview and were emailed the appropriate intervention plans and log book.

At week 5, all participants completed the LTPA recall, as well as the intention measures during a telephone interview. Next, all participants were asked to form action plans for participating in 3 days per week of LTPA over the next 5 weeks. These action plans were recorded by the researcher on a new calendar and mailed to the participant along with a new 5-week log book. Participants in the A+C condition were also asked to create new coping plans for LTPA barriers that they may encounter over the next 5 weeks. These coping plans were also mailed to participants. Following the administration of the three coping self-efficacy measures, participants were asked to complete the measures of action control, action planning frequency, and health-related LTPA break.

During the week 10 phone interview, participants were asked to complete the same instruments that were administered during the week 5 interview (i.e., LTPA recall, intentions, coping self-efficacy, action control, action planning frequency, and health-related LTPA break). In addition, participants in the A condition were administered the coping planning manipulation check. Participants were then debriefed and thanked for their participation.

Statistical Analyses

Data were screened for missing values and outliers. For each of the four weeks (i.e., baseline, weeks 1, 5, and 10), LTPA outliers (values > 3 *SD*s above the mean) were identified and were adjusted to a value that was 3 *SD*s above the mean for the active sample. Two outliers (values > 3 *SD*s below the mean) were detected for the scheduling self-efficacy variable. These scores were replaced with a value that was 3 *SD*s below the mean (Tabachnick & Fidell, 2001).

A series of repeated measures ANOVAs were used to examine between-groups differences on LTPA, intentions, coping self-efficacy, and action control. All ANOVA assumptions were tested and confirmed using Tabachnick and Fidell's (2001) recommendations. In line with Baron and Kenny's (1986) guidelines, prospective hierarchical regressional analyses were conducted to test the hypotheses concering mediation.

Results

Participant Flow

Figure 2 displays a flow chart of participants from recruitment to the end of the 10 weeks. The final sample was 40 participants for weeks 1 to 5 (A+C condition: n=19; A condition: n=21), and 35 participants for weeks 6 to 10 (A+C condition: n=18; A condition: n=17; see Figure 2 for attrition details).

Given the number of dropouts between weeks 5 to 10 (n=5), separate analyses were conducted for weeks 1 to 5, and weeks 6 to 10. Analyzing the data across two separate time points allowed us to maximize power for detecting between-groups differences.

Separate chi-square analyses and ANOVAs revealed no group differences on the baseline demographic characteristics or LTPA participation between those who withdrew or who were excluded from the analyses (n=11) and the remaining participants in the weeks 1 to 5 or weeks 6 to 10 analyses (ps > .05; see Table 1).

Participant Characteristics and Randomization Check

Baseline demographics and LTPA data are shown in Table 1. For the week 1 to 5 analyses, participants were 28 men and 12 women with paraplegia (50.0%), and tetraplegia (50.0%) with predominately incomplete injuries (60.0%). Meanwhile, participants included in the week 6 to 10 analyses were 25 men and 10 women with paraplegia (48.6%), and tetraplegia (51.4%) who also had predominately incomplete injuries (57.1%). No between-groups differences were found on any of the demographic characteristics or baseline LTPA (ps > .05), indicating that the participants were successfully randomized.

A chi-square test was conducted to determine whether the proportion of participants who experienced any health-related breaks from LTPA over weeks 1 to 5 or weeks 6 to 10 varied across the two conditions. As shown in Table 1, no group differences were found on the number of *participants* who reported taking a health-related LTPA break over weeks 1 to 5 ($n_{control}=6$ and $n_{treatment}=10$, $\chi^2(1)=2.41$, $p > .10$), or weeks 6 to 10 ($n_{control}=8$ and $n_{treatment}=11$, $\chi^2(1)=0.70$, $p > .40$). However, between-groups differences were found for the number of *days* participants reported taking an LTPA-related health break, but only across weeks 1 to 5. Results indicated that the A+C condition reported more LTPA-related health breaks than those in the A condition, $F(1,39)=4.62$, $p < .04$. To control for this difference, all week 1 to 5 analyses used the number of LTPA-related health break days as a covariate.

Manipulation Checks

Separate 2 (condition) x 2 (time) ANOVAs were conducted to test for any group differences on frequency of action planning over weeks 1 to 5 and weeks 6 to 10. Results revealed no main effect for condition or time (ps >.40), suggesting that the frequency with which participants altered their original action plans over the 10-week period was similar between the two conditions.

In terms of coping planning, none of the participants in the A condition reported forming detailed plans for anticipated LTPA-related barriers, suggesting that participants in the A condition did not spontaneously form coping plans over the 10 weeks.

Changes in LTPA

Separate 2 (condition) x 2 (time) ANCOVAs were conducted to test for any between-groups differences on LTPA at weeks 1 to 5 (controlling for baseline LTPA scores and LTPA-related health break days), and weeks 6 to 10 (controlling for week 1 LTPA scores). For weeks 1 to 5, the main effect for time approached significance, $F(1,36)=3.41$, $p=.06$, indicating that minutes of moderate to heavy LTPA increased from week 1 to week 5. While there was no main effect for condition ($p > .70$), there was a significant Time x Condition interaction, $F(1,36)=3.87$, $p=.05$. Post-hoc pairwise t-tests revealed a significant increase in the number of minutes of moderate to heavy LTPA from week 1 to week 5 for participants in the A+C condition, $t(18)=-3.70$, $p=.002$, *Cohen's d*=0.69, while no change in LTPA was found for the A condition ($p > .90$, *Cohen's d*= -0.01; see Table 2 for raw *M*s and *SD*s). Thus, in support of our hypothesis, moderate to heavy LTPA over weeks 1 to 5 was greater for the A+C condition than the A condition.

For weeks 6 to 10, a trend was shown for condition, $F(1,32)=3.02$, $p=.09$, *Cohen's d*=0.59, indicating that participants in the A+C condition reported more minutes of LTPA over the last 5 weeks of the study in comparison to those participants in the A condition (see Table 2 for raw *M*s and *SD*s). No other significant main effects or interactions were found (*p*s > .50).

Changes in Intentions, Coping Self-Efficacy, and Action Control

For intentions, the week 1 to week 5, 2 (condition) x 2 (time) ANCOVA revealed a significant main effect for condition, $F(1,36)=5.99$, $p < .02$, *Cohen's d*=0.82. Contrary to hypothesis, the A+C condition reported greater intentions to engage in at least 30 minutes of moderate to heavy LTPA over weeks 1 to 5 in comparison to participants in the A condition. However, results from the week 6 to 10 analyses indicated no main effects or interaction (*p*s > .10). As hypothesized, no between-groups differences were shown for intentions over the last 5 weeks (see Table 2).

In terms of coping self-efficacy beliefs, results from the week 1 to 5 analyses indicated a main effect for time for scheduling self-efficacy, $F(1,37)=5.10$, $p=.03$, *Cohen's d*= 0.35. Overall, confidence to schedule moderate to heavy LTPA decreased for both groups from week 1 to week 5. However, significant main effects for condition were found for all three types of coping self-efficacy (facility barriers: $F(1,37)=6.05$, $p < .02$, *Cohen's d*= -0.80; general barriers: $F(1,37)=7.75$, $p < .01$, *Cohen's d*= 0.91; scheduling: $F(1,37)=8.81$, $p < .01$, *Cohen's d*= 0.97). Inspection of the means indicated that, as hypothesized, the A+C condition had greater confidence to schedule and overcome LTPA-related barriers at the end of week 5 in comparison to the A condition. However, contrary to hypothesis, the A condition had greater confidence to overcome facility-related barriers in comparison to the A+C condition. For general barriers self-efficacy, the Condition x Time interaction approached significance, $F(1, 37)=3.52$, $p=.07$. Post-hoc pairwise *t*-tests indicated a significant decrease in general barriers self-efficacy for the A condition from week 1 to week 5, $t(20)=2.08$, $p=.05$, *Cohen's d*= 0.49. A subsequent independent *t*-test revealed that the A+C condition had significantly greater general barriers self-efficacy at week 5 than the A condition, $t(38)=2.88$, $p < .01$. No other significant interactions were found (*p*s > .10).

Meanwhile, results from the week 6 to 10 analyses indicated a main effect for condition for general barriers self-efficacy, $F(1,32)=5.72$, $p < .03$, *Cohen's d*= 0.81, and a trend for scheduling self-efficacy, $F(1,32)=3.25$, $p=.08$, *Cohen's d*=0.57. As hypothesized, the A+C condition had greater confidence to overcome moderate to heavy LTPA-related barriers and scheduling demands over weeks 6 to 10 in comparison to the A condition. No other main effects or interactions were found (*p*s > .20; see Table 2 for raw *M*s and *SD*s).

With respect to action control, results from the ANCOVA for both the week 1 to 5 and week 6 to 10 analyses indicated no main effect for condition (*p*s > .30). Contrary to hypothesis, the A+C condition did not exhibit greater action control over the 10 weeks than the A condition.

Testing the Tenets of the HAPA Model

The following analyses tested the hypotheses concerning the HAPA model. For descriptive purposes, bivariate correlations among the HAPA variables are presented in Table 3.

Post-Intentional Predictors of LTPA

Two hierarchical regression analyses were conducted to examine the post-intentional determinants of LTPA at week 5 and week 10. A mean coping self-efficacy score was calculated across the three types of coping self-efficacy (i.e., scheduling, general barriers, and facility barriers). This mean was then used as the coping self-efficacy variable in the subsequent regression analyses. Order of variable entry was based on the tenets of the HAPA model (Schwarzer, 1992; Sniehotta et al., 2005; see Figure 3). Specifically, to predict week 5 LTPA, week 1 LTPA was entered first (Step 1), followed by week 1 intentions (Step 2), and then coping self-efficacy (Step 3). Similarly, week 10 LTPA was regressed on week 5 LTPA (Step 1), followed by week 5 intentions (Step 2), action planning and coping self-efficacy (Step 3), and week 5 action control (Step 4).

As shown in Table 4, neither of the two prediction models was significant (*p*s > .05). Overall, past LTPA behaviour, intentions and coping self-efficacy accounted for a nonsignificant 21% of the variance in week 5 LTPA, $\Delta F(1,36)=0.49$, $p=.49$. Contrary to hypothesis, only past LTPA behaviour was a significant predictor of moderate to heavy LTPA at week 5 ($\beta=.41$, p .01).

In terms of predicting LTPA at week 10, the four HAPA constructs and past LTPA accounted for a non-significant 10% of the variance in behaviour, $\Delta F(1,29)=1.49$, $p=.23$. Contrary to hypothesis, none of these variables significantly predicted moderate to heavy LTPA at week 10 (*p*s > 05; see Table 4).

Mediating Role of Action Planning

Two prospective temporal designs were used to test whether action planning mediated the effects of intentions on moderate to heavy intensity LTPA (Baron & Kenny, 1986; Frazier, Barron, & Tix, 2004). In the first mediation analyses, action planning over weeks 1 to 5 was tested as a mediator of the effects of week 1 intentions on week 5 LTPA, whereas the second set of analyses tested whether action planning over weeks 6 to 10 mediated the effects of week 5 intentions on LTPA at week 10 (see Figure 4a). As demonstrated in Table 4, intentions were not a significant predictor of LTPA at week 5 (β=.14, p=.40) or week 10 (β=.21, $p > .20$). Bivariate correlations indicated that action planning was not significantly related to intentions or LTPA ($ps > 10$; see Table 3 for r-values). Contrary to hypothesis, action planning was not found to mediate the effects of intentions on LTPA at either week 5 or week 10.

Mediating Role of Coping Self-Efficacy and Action Control

Based on the between-groups differences found for the coping self-efficacy variables, but not action control, prospective meditational analyses were only used to examine the mediating role of coping self-efficacy on the intervention-LTPA relationship. Similar to the previous meditational analyses for action planning, two meditational analyses were conducted for coping self-efficacy. In the first analyses, week 1 coping self-efficacy (i.e., general barriers, facility barriers, or scheduling) was tested as a mediator of the effects of the intervention on total minutes of moderate or heavy LTPA at week 5. Meanwhile, a second set of analyses tested whether week 5 coping self-efficacy mediated the effects of the intervention on total minutes of moderate to heavy LTPA at week 10 (Baron & Kenny, 1986; Frazier et al., 2004). In accordance with Baron and Kenny's recommendations, prospective hierarchical regression analyses were used to examine the four conditions outlined in Figure 4b. To control for any between-groups differences, week 1 LTPA was used as a covariate for both sets of analyses, while number of LTPA-related health break days was used as a covariate for the week 5 LTPA analyses.

As shown in Table 5, the intervention-LTPA relationship (i.e., Path A) was significant for the analyses predicting week 5 LTPA (β=.30, p=.05), but not for the prediction of week 10 LTPA (β=.15, p=.39). Thus, the A+C intervention was associated with greater minutes of moderate to heavy LTPA at week 5, but not week 10. Hence, the mediational analyses were only continued for LTPA at week 5.

The intervention-coping self-efficacy relationship (i.e, Path B) was significant for scheduling self-efficacy (β=.41, $p < .02$), and facility barriers self-efficacy (β= -.39, p=.02), with the A+C condition reporting greater confidence to schedule moderate to heavy LTPA, and less confidence to overcome facility-related barriers than the A condition. No significant relationship was found between the intervention and general barriers self-efficacy ($p > .10$).

Examination of the coping self-efficacy-LTPA relationship showed a trend for scheduling self-efficacy (β=.25, $p < .10$), but not facility barriers self-efficacy ($p > .80$).

Therefore, greater minutes of moderate to heavy LTPA at week 5 was associated with greater scheduling self-efficacy at week 1.

Given that the three mediational conditions were only met for scheduling self-efficacy, the strength of the intervention-LTPA relationship when the mediator was added to the model (i.e., Path D) was only examined for scheduling self-efficacy. If Path D was reduced to zero, then this would indicate that scheduling self-efficacy fully mediated the relationship. However, if Path D was significantly smaller than Path A, but greater than zero, then this would indicate partial mediation (Baron & Kenny, 1986; Frazier et al., 2004). As shown in Table 5, once controlling for scheduling self-efficacy, Path D was reduced (β=.23, p=.17), although not to zero, indicating that scheduling self-efficacy partially mediated the relationship between the planning intervention and total minutes of moderate to heavy LTPA at week 5.

To test the significance of the mediated effect, a Sobel test (Frazier et al., 2004) was conducted whereby the products of the unstandardized regression coefficients of Paths B and C in Figure 4b were divided by a standard error term[1] (i.e., z score). The difference between Paths A (β=.30) and D (β=.23) was not significant at the .05 level (z score=1.42, p=.16). However, given that the Sobel test is a very conservative test that lacks power when $n < 400$ (Dearing & Hamilton, 2006), we also calculated the magnitude of the mediating effect. Analyses indicated that 34% of the total effect of the intervention on week 5 LTPA was mediated by scheduling self-efficacy at week 1.[2]

Discussion

The Effects of Action Planning and Coping Planning

The present study extends the findings from Latimer et al.'s (2006) study by demonstrating the usefulness of a combined action and coping planning intervention for increasing LTPA, intentions, and coping self-efficacy in people with SCI. Only participants in the A+C condition significantly increased their LTPA over weeks 1 to 5, and there was a trend for the A+C condition to report greater LTPA than the A condition over weeks 6 to 10. The A+C condition also reported stronger intentions at week 5, and greater general barriers and scheduling self-efficacy over the 10 weeks. Scheduling self-efficacy was shown to partially mediate the effects of the intervention on week 5 LTPA. Each of these findings will be discussed in turn.

As hypothesized, the A+C intervention resulted in greater LTPA. During weeks 1 to 5, participants in the A+C condition significantly increased their participation in moderate to heavy LTPA, while LTPA remained unchanged for those in the A condition. Further support of the benefits of the intervention on LTPA was shown with the trend towards higher LTPA in the A+C condition over the remaining 5 weeks. Our findings for greater LTPA in the A+C condition are consistent with the observed effects of Sniehotta et al.'s (2006) 8-week planning intervention in cardiac patients. Taken together, these findings suggest that action plans that are supplemented with coping strategies are more effective for sustaining longer-term LTPA than action plans alone. These coping strategies provide people with a "plan of attack" for the barriers that may potentially affect their ability to implement action plans. Given the many challenges that persons with SCI must confront, such as unexpected health complications or visits to specialists, these coping plans may act as useful alternative action plans. Thus, coping plans should be considered as a key component to LTPA interventions for persons with SCI.

In addition to the benefits of the intervention on LTPA, the results further support the notion that planning affects exercise-related self-efficacy (Arbour & Martin Ginis, 2004, in press; Latimer et al., 2006). In particular, scheduling and general barriers self-efficacy were shown to be significantly greater for the A+C condition than the A condition at the end of week 5. In Latimer et al.'s study, action planning was associated with greater confidence to schedule and overcome general LTPA-related barriers. The present study expands on Latimer et al.'s findings by demonstrating additional improvements in scheduling and barrier self-efficacy that may occur when action plans are supplemented with coping plans. This is an important finding for people with SCI, many of whom must deal with countless barriers and scheduling demands on a daily basis (Martin et al., 2002).

For general barriers self-efficacy, the between-groups difference persisted over weeks 6 to 10. One reason why general barriers self-efficacy, but not scheduling, continued to be significantly greater in the A+C condition is the presence of a ceiling effect. While participants started off with relatively high scheduling self-efficacy (M=5.97 on a 7-point scale), scores for general barriers self-efficacy were lower (M=4.91). Hence, participants had more opportunity to improve their scores on the general barriers measure over the 10 weeks. This finding also suggests that the items on the general barriers self-efficacy measure may be more reflective of the coping planning intervention than the scheduling self-efficacy items.

Contrary to our prediction, facility barriers self-efficacy was greater in the A condition at week 5 than for participants in the A+C condition. Post-hoc chi-square analyses of the proportion of participants who reported action plans that involved exercising at a fitness facility revealed no differences between the two conditions (A+C: n=4; A: n=8). Further examination of the barriers discussed with the A+C condition indicated that only two participants mentioned facility-related barriers (i.e., lack of access to equipment). One explanation for our counter-intuitive findings may be that when it came time for the A+C participants to indicate their confidence to overcome the facility-related barriers, they felt low efficacy because they did not have a plan to manage them, whereas they had plans for scheduling and the other types of barriers captured by the general barriers self-efficacy scale. That is, our A+C intervention may have inadvertently decreased self-efficacy for managing barriers that were not discussed during the coping planning.

While the intervention affected coping self-efficacy beliefs, no significant effect was found for action control. In hindsight, it may not be surprising that there were no between-groups differences on this variable. Recall that both conditions were asked to record their LTPA in log books. Thus, regular use of the log book would have increased self-monitoring and awareness of standards in both conditions. These are two of the self-regulatory strategies that comprise the action control construct.

According to the tenets of the HAPA, planning does not increase intentions (Schwarzer, 1992; Sniehotta et al., 2006). While the A+C intervention did not increase intentions, it did help to sustain intentions over weeks 1 to 5 in the A+C condition. Although this finding is inconsistent with Sniehotta et al.'s (2006) study involving cardiac patients, it parallels the results revealed in Latimer et al.'s (2006) study among persons with SCI. LTPA programs have been reported to be the most desirable, but least available service for people living with SCI (Martin et al., 2002). Having the opportunity to discuss physical activity plans, and, for our participants in the A+C condition, strategies to cope with potential barriers with a trained researcher, could be considered a type of LTPA "service." Moreover, obtaining advice from a trained researcher on how to cope with LTPA-related barriers could have enhanced perceptions of social support. This service, in combination with the social support, may have helped to sustain the A+C participants' motivation during the early weeks of the study. However, no between-groups differences were found after week 5, suggesting that the differential effects of the intervention on sustaining intentions are short-term.

Testing the Tenets of the HAPA

In terms of the hypotheses testing the HAPA model, the regression analyses indicated that none of the HAPA constructs (i.e., action planning, coping self-efficacy, and action control), were significant predictors of LTPA. One reason for these null findings may be that the time-lag between the assessments of the predictors and LTPA was too distal (cf., Sutton, 1998). However, previous HAPA research has found the HAPA constructs to significantly predict LTPA, regardless of whether the time-lag was shorter (i.e., 8 weeks; Lippke et al., 2004; Sniehotta et al., 2005) or longer (i.e., 10 months; Scholz et al., 2005). Thus, the 5-week interval between the assessments of the predictors and LTPA should have been an appropriate period. A second explanation relates to the target group. Within the previous HAPA research, most of the studies have been conducted in a rehabilitation setting, such as cardiac rehabilitation (Lippke et al., 2004; Scholz et al., 2005; Sniehotta et al., 2005, 2006), where the focus is helping patients adhere to exercises prescribed during *rehabilitation*. Meanwhile, our study focused on persons with SCI who were living in the community, and who wanted to increase their physical activity during their *leisure-time*. Hence, given the different nature of the two activities (i.e., rehabilitation exercises are done to improve functional ability, while LTPA may be done for enjoyment and to maintain one's physical functioning), factors that predict adherence to rehabilitation exercises may be different from those that predict LTPA.

One question that remains is why did intentions not predict LTPA? According to the HAPA model, once the post-intentional constructs are added to the prediction model, the effects of intentions are significantly reduced (Lippke et al., 2004), in some cases almost to zero (Scholz et al., 2005; Sniehotta et al., 2005). However, when examined on their own, intentions have been found to be a modest, albeit significant predictor of LTPA in persons with SCI (Latimer & Martin Ginis, 2005; Latimer et al., 2006; Study 2). One reason for the discrepancy in findings may be the use of an entreaty statement prior to the assessment of the intention items. Our participants were asked to think about all the possible barriers they might encounter when they formed their intentions. None of the other SCI studies used this entreaty protocol. Given the unpredictable nature of SCI, the entreaty statement may have made participants' intentions less reliable by asking them to think about things that may or may not happen in the future. Less reliable intentions have been shown to be poor predictors of behaviour (Connor, Sheeran, Norman, & Armitage, 2000). The small correlation that was found between intentions at weeks 1 and 5 (r=.31, p=.07; Table 3), suggests that intentions were not stable over the study period. Hence, future research should examine the effects of entreaty statements on the intention-LTPA relationship in special populations, and whether they affect the reliability of intention measures.

An additional purpose of the study was to test for the mediating effects of coping self-efficacy and action control on the intervention-LTPA relationship. Based on the results from the meditational analyses, scheduling self-efficacy was the only self-regulatory process that was found to mediate this relationship. However, mediation was only found for weeks 1 to 5, with scheduling self-efficacy at week 1 accounting for 34% of the total effect of the intervention on LTPA at week 5. This finding suggests that scheduling self-efficacy may be important for initiating LTPA in persons with SCI, and therefore should be targeted in future interventions.

Despite the effects of the intervention on general barriers and facility barriers self-efficacy, we did not find these two coping self-efficacy beliefs mediated the intervention-LTPA relationship. Given that we examined the mediating effects of coping self-efficacy at week 1, it may be that participants simply did not have a chance to experience some of the barriers listed on the general barriers and facility barriers self-efficacy scales in relation to LTPA (e.g., lack of transportation, accessible equipment). Their lack of experience could have compromised the relationship between their efficacy beliefs and behaviour.

Limitations and Conclusions

While the present study has shown many benefits of action and coping planning on LTPA among people with SCI, there are some study limitations that warrant mention. First, the absence of a 'coping planning only' condition precludes our ability to determine whether the greater LTPA and coping self-efficacy for A+C participants was the result of the coping planning alone, or a combination of the action and coping planning. Future research should compare the effects of a 'coping planning only' intervention versus an A+C intervention on LTPA and coping self-efficacy. Second, while this study is one of the largest RCTs to examine LTPA promotion in persons with SCI, the relatively small sample size rendered it difficult to detect significant between-groups differences over the last 5 weeks. Recall that our initial sample size calculation was based on previous studies that have found a large-effect for action planning on LTPA (Latimer et al., 2006). We found a medium-sized effect of condition on LTPA at week 10. However, given the potent effect of action plans on LTPA, it may not have been appropriate to expect a large between-group difference in a study where both conditions formed action plans.

Despite these limitations, this study makes an important contribution as it is the first to illustrate the benefits of action and coping plans for enhancing LTPA and coping self-efficacy beliefs among beginner exercisers living with SCI. Future interventions that focus on teaching beginner exercisers how to create LTPA plans, as well as how to identify and cope with self-identified barriers are recommended as a strategy to enhance LTPA in persons with SCI. Furthermore, our study is the first to empirically examine the utility of the HAPA framework for predicting LTPA in persons with disabilities. While previous HAPA research has focused on cardiac and orthopaedic patients enrolled in rehabilitation programs, this study tested the model in a community-based sample of persons with SCI. Taken together, our findings speak to the importance of planning and self-efficacy for increasing physical activity in people with SCI.

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Footnotes

[1] z score = $ab / \sqrt{(b^2 sa^2 + a^2 sb^2 + sa^2\, sb^2)}$, where '*a*' and '*b*' are unstandardized regression coefficients for the regression of the mediator on the predictor, and the outcome on the mediator, respectively, while '*sa*' and '*sb*' are their respective standard errors.

[2] The following equation was used to calculate the amount of mediation: ab/c, where '*a*', '*b*', and '*c*' are unstandardized regression coefficients for the regression of the mediator on the predictor, the outcome on the mediator, and the total effect of the predictor on the outcome, respectively.

Table 1

Baseline Participant Leisure-Time Physical Activity and Demographic Characteristics.

			Week 1 to 5 Analyses (*n* = 40)				Week 6 to 10 Analyses (*n* = 35)			
Variable	All participants recruited (*n* = 47)		A+C Condition (*n* = 19)		A Condition (*n* = 21)		A+C Condition (*n* = 18)		A Condition (*n* = 17)	
Baseline LTPA (min/week)	49.20	96.81	63.95	104.26	45.83	104.23	67.50	106.09	56.62	113.71
Age	49.28	12.82	48.79	13.20	49.62	12.51	47.61	12.51	50.47	13.67
Years post injury[a]	14.81	12.18	15.90	13.19	12.11	9.93	16.48	13.32	12.40	10.40
≥ College Education	51%		63%		43%		67%		47%	
Caucasian	89%		95%		81%		94%		82%	
Health-Related LTPA Break[b]	--		53%		29%		61%		47%	
No. of days[c]	--		4.74	6.83	1.33	2.35	4.36	6.54	5.76	11.54
Incomplete Injury	60%		63%		57%		61%		53%	
Male	64%		74%		67%		78%		65%	
Married/Common Law	53%		53%		62%		56%		71%	
Mode of Mobility										
Manual Chair	49%		47%		57%		44%		53%	
Power Chair	32%		37%		29%		39%		29%	
Tetraplegia	51%		53%		48%		50%		53%	

Note. LTPA: leisure-time physical activity. A: action planning only; A+C: action planning and coping planning. No significant between-groups differences were found on any of the demographics and baseline LTPA data for participants included in the week 1 to 5 analyses but excluded from the week 5 to 10 analyses (*n*=5), and the remaining participants (*n*=35).

[a] Data missing for one participant in the control group.

[b] Frequencies are based on number of participants who responded "Yes" to taking an LTPA-related health break over the two time points.

[c] Main effect for condition, $F(1,39)=4.62$, $p < .04$, indicating A+C condition reported significantly more LTPA-related health break days over weeks 1 to 5.

Table 2

Raw Means for Intentions, Post-Intentional Volitional Processes, and LTPA Scales.

Scale	Observed Score Range	Week 1 *M (SD)*	Week 5 *M (SD)*	d_1	Week 10 *M (SD)*	d_2
Intentions	2 – 14			0.94		0.15
A Condition		9.67 (2.37)	9.00 (2.90)		9.82 (2.70)	
A+C Condition		11.53 (1.98)	11.21 (1.65)		10.28 (3.32)	
Facility Barriers SE	1.80 – 7			-0.82		-0.87
A Condition		5.81 (1.27)	5.99 (0.88)		5.92 (0.87)	
A+C Condition		4.92 (1.60)	5.05 (1.36)		4.74 (1.70)	
General Barriers SE	1 – 6.67			0.92		0.63
A Condition		4.71 (1.07)	4.06 (1.52)		3.98 (0.98)	
A+C Condition		5.14 (0.79)	5.22 (0.94)		4.69 (1.26)	
Scheduling SE	1 .67– 7			0.95		0.33
A Condition		5.59 (1.05)	5.01 (1.51)		5.25 (1.27)	
A+C Condition		6.30 (0.59)	6.12 (0.66)		5.69 (1.36)	
Action Planning	4 – 25			0.26		0.29
A Condition		--	11.10 (4.38)		11.24 (4.87)	
A+C Condition		--	12.21 (4.22)		12.78 (5.63)	
Action Control	9 – 42			0.30		0.12
A Condition		--	26.81 (8.87)		29.41 (8.37)	
A+C Condition		--	29.58 (9.34)		30.39 (8.47)	
LTPA (min/week)	0 – 505.80			0.45		0.30
A Condition		58.00 (124.11)	56.90 (66.96)		58.83 (68.18)	
A+C Condition		40.13 (58.60)	92.20 (88.38)		78.48 (64.98)	

Note. SE: self-efficacy. $n = 40$ at weeks 1 and 5, and $n = 35$ at week 10. *Cohen's d* is defined as the magnitude of the difference, in standard deviations, between the A+C condition and the A condition. Effect sizes that are .20, .50, or .80 represent small, medium, and large effect sizes, respectively (Cohen, 1992). Values for *Cohen's d* represent between-groups differences based on the *raw* means at week 5 (d_1) and week 10 (d_2).

Table 3

Bivariate Correlations Between the Health Action Process Approach Constructs.

Variable	1	2	3	4	5	6	7	8	9
1. Week 1 Intentions	--								
2. Week 5 Intentions	$.31^{+}$	--							
3. Week 1 Coping SE	<.01	.22	--						
4. Week 5 Coping SE	.06	$.59^{**}$	$.55^{**}$	--					
5. Week 5 Action Planning	.17	.25	-.12	-.14	--				
6. Week 5 Action Control	.21	$.46^{**}$	$.43^{**}$	$.54^{**}$	-.10	--			
7. Week 1 LTPA	.07	.14	.18	.24	.02	$.42^{*}$	--		
8. Week 5 LTPA	.14	$.35^{*}$	.18	$.43^{**}$	-.04	$.51^{**}$	$.44^{**}$	--	
9. Week 10 LTPA	-.10	.21	.26	.11	-.05	.26	.01	.05	--

Note. r-values between week 1 intentions, week 1 coping SE, and week 5 LTPA are based on $n = 40$. The remaining r-values are based on $n = 35$. LTPA: leisure-time physical activity; SE: self-efficacy. Coping self-efficacy represents a composite measure of the means of facility barriers self-efficacy, general barriers self-efficacy, and scheduling self-efficacy.

$^{+}p < .10$, $^{*}p < .05$, $^{**}p \leq .01$

Table 4

Regression Analysis Testing the Prediction of Moderate to Heavy LTPA from the Post-Intentional Determinants Outlined in the Health Action Process Approach.

Predictor	R^2	ΔR^2	β	t	p
Outcome: Week 5 LTPA					
Step 1	.19	.19			<.01
Week 1 LTPA			.43	2.95	
Step 2	.20	.01			.48
Week 1 LTPA			.42	2.87	<.01
Week 1 Intentions			.11	.72	.48
Step 3	.21	.01			.49
Week 1 LTPA			.41	2.68	.01
Week 1 Intentions			.11	.72	.48
Week 1 Coping SE			.10	.69	.49
Outcome: Week 10 LTPA					
Step 1	<.01	<.01			.76
Week 5 LTPA			.05	.31	
Step 2	.04	.04			.25
Week 5 LTPA			-.02	-.11	.91
Week 5 Intentions			.21	1.16	.25
Step 3	.06	.02			.79
Week 5 LTPA			-.02	-.10	.92
Week 5 Intentions			.29	1.20	.24
Week 5 Action Planning			-.13	-.68	.50
Week 5 Coping SE			-.08	-.31	.76

Step 4	.10	.05			.23
Week 5 LTPA			-.11	-.52	.61
Week 5 Intentions			.23	.93	.36
Week 5 Action Planning			-.10	-.52	.61
Week 5 Coping SE			-.15	-.58	.57
Week 5 Action Control			.28	1.22	.23

Note. LTPA: leisure-time physical activity; SE: self-efficacy. Coping self-efficacy represents a composite measure of the means of facility barriers self-efficacy, general barriers self-efficacy, and scheduling self-efficacy.

Table 5

Regression Analyses Testing Week 1 Coping Self-Efficacy as a Mediator of the Planning Intervention –Leisure-Time Physical Activity Relationship.

Mediational Path	$R^2_{adjusted}$	ΔR^2	β	T
Path A: Predictor – Outcome				
Intervention → Week 5 LTPA	.20	.08*	.30	1.97*
Path B: Predictor - Mediator				
Intervention → Facility Barriers SE	.09	.14*	-.39	-2.41*
Intervention → General Barriers SE	.01	.06	.27	1.58
Intervention → Scheduling SE	.11	.15*	.41	2.53*
Path C: Mediator - Outcome				
Facility Barriers SE → Week 5 LTPA	.12	.001	-.03	-0.19
Scheduling SE → Week 5 LTPA	.18	.06$^+$	.25	1.71$^+$
Path D: Mediation				
Intervention → Week 5 LTPA (controlling for scheduling SE)	.21	.04	.23	1.41

Note. LTPA: leisure-time physical activity; SE: self-efficacy. Standardized regression coefficients (β) are shown. Number of LTPA-related health break days used as a covariate in all analyses, while week 1 LTPA used as a covariate in Paths A, C, and D. Path analysis based on Baron and Kenny's (1986) recommendations.

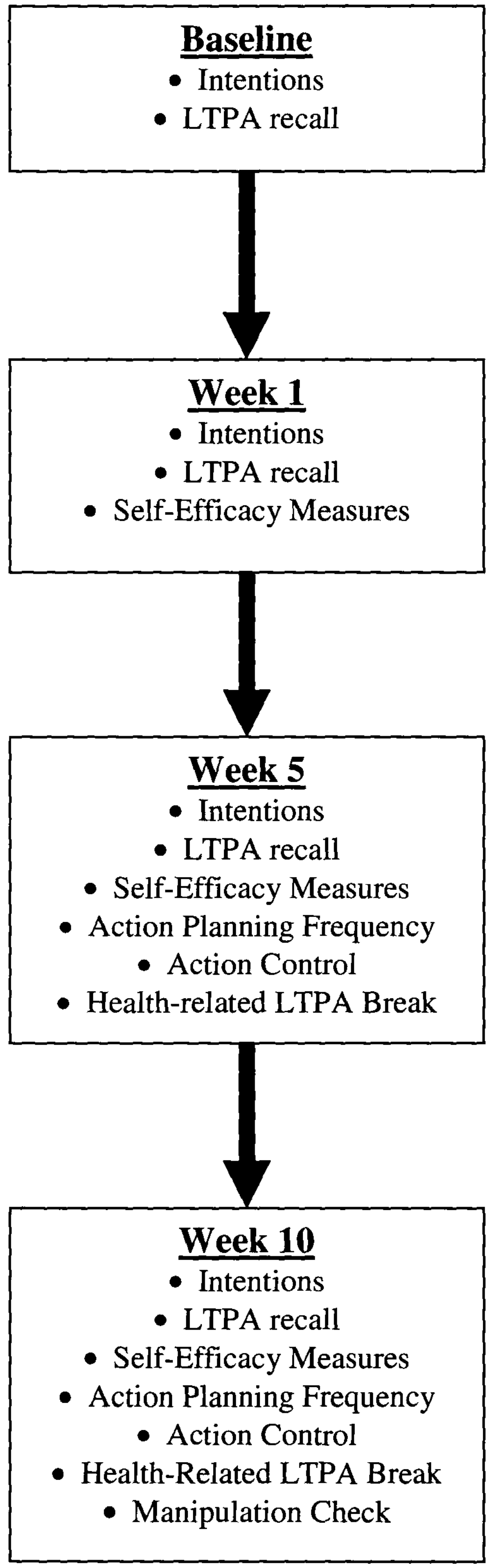
$^+p < .10$, $^*p < .05$

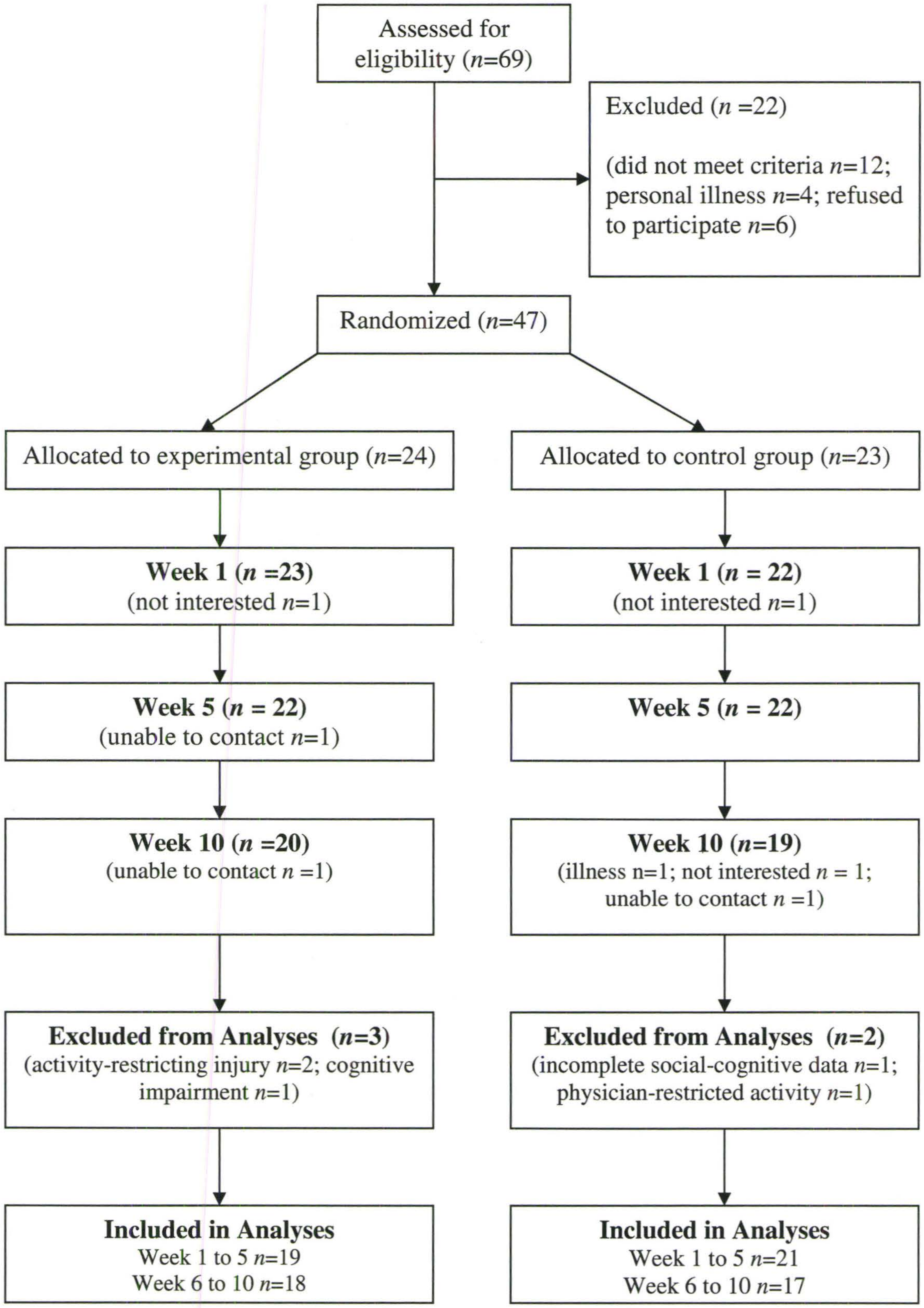
Figure 1. Diagram of the measurement time points over the course of the 10-week study and the corresponding measures administered to participants.

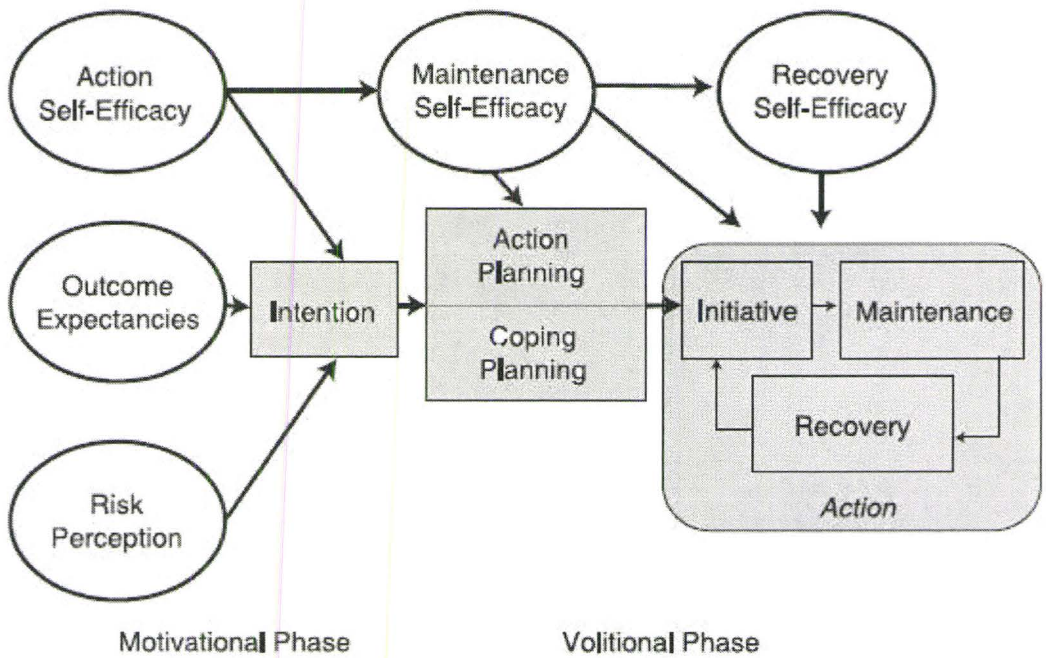
Figure 2. Flow chart of participants from recruitment to the end of the 10-week randomized controlled trial.

Figure 3. Diagram of the Health Action Process Approach (HAPA; cf., Schwarzer, 2008). Shaded variables represent the HAPA constructs that were examined in the present study.

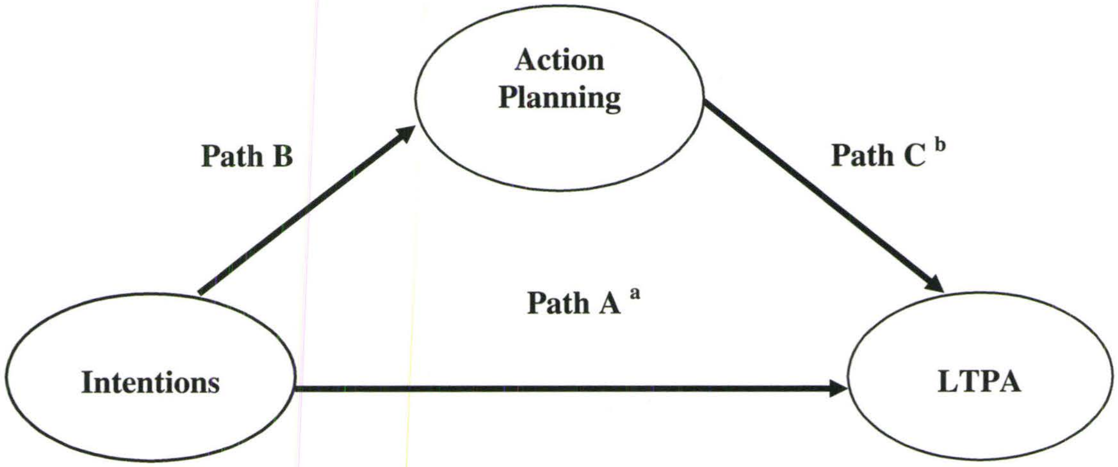
Figure 4. Baron and Kenny's (1986) hierarchical regression model used to test whether (a) action planning mediated the intention-LTPA relationship, and (b) coping self-efficacy mediated the intervention-LTPA relationship. Dashed line denotes a non-significant relationship after controlling for Path C.


Baseline
• Intentions
• LTPA recall
Week 1
• Intentions
• LTPA recall
• Self-Efficacy Measures
Week 5
• Intentions
• LTPA recall
• Self-Efficacy Measures
• Action Planning Frequency
• Action Control
• Health-related LTPA Break
Week 10
• Intentions
• LTPA recall
• Self-Efficacy Measures
• Action Planning Frequency
• Action Control
• Health-Related LTPA Break
• Manipulation Check


Assessed for eligibility (n=69)
Excluded (n =22)
(did not meet criteria n=12; personal illness n=4; refused to participate n=6)
Randomized (n=47)
Allocated to experimental group (n=24)
Allocated to control group (n=23)
Week 1 (n =23)
(not interested n=1)
Week 1 (n = 22)
(not interested n=1)
Week 5 (n = 22)
(unable to contact n=1)
Week 5 (n = 22)
Week 10 (n =20)
(unable to contact n =1)
Week 10 (n=19)
(illness n=1; not interested n = 1; unable to contact n =1)
Excluded from Analyses (n=3)
(activity-restricting injury n=2; cognitive impairment n=1)
Excluded from Analyses (n=2)
(incomplete social-cognitive data n=1; physician-restricted activity n=1)
Included in Analyses
Week 1 to 5 n=19
Week 6 to 10 n=18
Included in Analyses
Week 1 to 5 n=21
Week 6 to 10 n=17

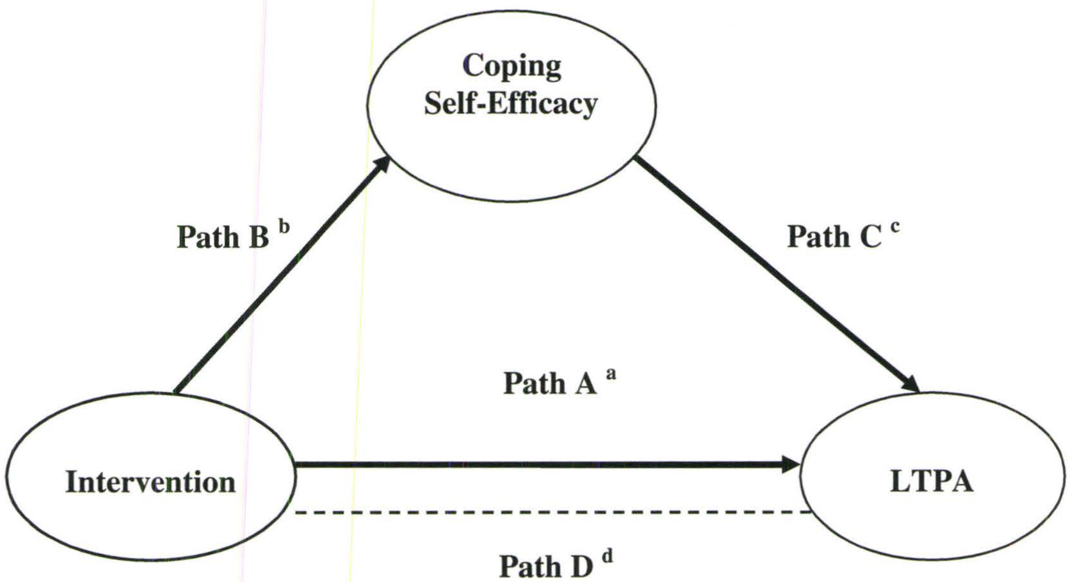

Action
Self-Efficacy
Maintenance
Self-Efficacy
Recovery
Self-Efficacy
Outcome
Expectancies
Intention
Action
Planning
Coping
Planning
Initiative
Maintenance
Recovery
Action
Risk
Perception
Motivational Phase
Volitional Phase

(a)



[a] Controlling for week 1 LTPA minutes.
[b] Controlling for week 1 LTPA minutes.

(b)



[a] Controlling for week 1 LTPA minutes, and # of LTPA-related health break days.
[b] Controlling for # of LTPA-related health break days.
[c] Controlling for week 1 LTPA minutes, and # of LTPA-related health break days.
[d] Controlling for week 1 LTPA minutes, # of LTPA-related health break days, and week 1 coping self-efficacy scores.

CHAPTER 5

General Discussion

Many health benefits are associated with physical activity participation for people living with SCI (Devillard, Rimaud, Roche, & Calmels, 2007; Hicks et al., 2003; Rimaud, Calmels, & Devillard, 2005). Despite these benefits, persons with SCI are one of the most sedentary groups in all of society (Dearwater, Laporte, Cauley, & Brenes, 1985). Thus, research is needed to identify factors that explain physical activity in persons with SCI so that these variables can be targeted in activity-enhancing interventions. Using a systematic approach, this dissertation examined individual and environmental factors associated with LTPA in persons with SCI. Together, this series of studies has contributed to the advancement of knowledge regarding the physical activity environment, physical activity correlates and determinants, and theory-based interventions. Each of these contributions will be discussed in turn.

7.0: CONTRIBUTIONS TO ADVANCING ENVIRONMENTAL RESEARCH IN THE PHYSICAL ACTIVITY DOMAIN

Within the physical activity domain, the physical environment has been the least studied variable, particularly among individuals with disabilities (Giles-Corti, Timperio, Bull, & Pikora, 2005). This dissertation has made significant contributions to the advancement of knowledge regarding the influence of the environment on LTPA in persons with SCI, particularly in the areas of facility accessibility, the neighbourhood environment, and environmental measures for persons with mobility disabilities.

7.1: Research on accessibility of fitness and recreational centres

To date, Study 1A is the first Canadian study to examine the accessibility of fitness and recreational facilities, as well as community pools, using a validated accessibility instrument. The results from Study 1A extend the earlier research using the AIMFREE by demonstrating that the instrument can also be used to assess the accessibility of Canadian facilities. Furthermore, the findings from Study 1A have practical implications for stakeholders such as facility owners or municipal recreational departments. Specifically, these preliminary results can be used by stakeholders to establish feasible, accessibility plans. For example, for the facility areas that received the lowest accessibility ratings, such as bathrooms and locker rooms, more investment and long-range accessibility plans would be needed to make these areas "disability-friendly" environments (Rimmer, 2005). Meanwhile, other areas that were given higher accessibility ratings, such as programming, may require less investment, and more short-term accessibility plans. Considering the interconnectedness between the physical and social environments, Study 1A also highlights that stakeholders need to ensure that the physical environments of facilities correspond with the available programming. It is unacceptable for facilities to offer adapted programs, but not provide accessible physical environments for persons of all abilities. These programs are futile if patrons cannot access the facility.

7.2: Research on the neighbourhood environment

The dissertation studies also extend the research on physical activity and the neighbourhood environment. In particular, Study 1B and Study 2 are the first to examine the relationship between neighbourhood environmental factors and LTPA in persons with SCI. Study 2 is also the first study to use an ecological framework to examine the additional contribution of environmental perceptions in explaining LTPA in persons with mobility disabilities. Examining the relative influence of psychosocial and environmental factors on physical activity in persons without disabilities has been advocated by many researchers (Giles-Corti et al., 2005; Sallis & Owen, 1997). The findings from Study 2 are important insofar as they indicate that, similar to the research conducted in persons without disabilities, psychosocial factors have a stronger relationship with LTPA intentions and behaviour than perceptions of neighbourhood aesthetics and wheeling infrastructure. Moreover, these findings can be used to direct future intervention research towards the most effective strategy for increasing LTPA in persons with SCI (i.e., at the individual level).

7.3: Research on objective and subjective environmental variables

A final contribution to the physical activity environment research is the testing and application of environmental variables and measurement approaches for persons with mobility disabilities. Most physical environment research has focused on physical activity modes that are inappropriate for many persons with mobility disabilities, such as walking and upright cycling. This focus becomes problematic because the environmental instruments used in these studies may not be applicable to persons with limited lower-limb mobility. As such, Study 1B and Study 2 modified existing environmental instruments so that they pertained to wheeling – an activity that is commonly performed in persons with SCI (Canadian Paraplegic Association, 2000). Contrary to previous environmental research, which has defined neighbourhood boundaries in terms of walking (Kirtland et al., 2003), Study 1B defined the neighbourhood in terms of the average manual wheeling distance covered in 30 minutes by persons with tetraplegia, and a separate boundary for those with paraplegia. Specifically, geographical information systems (GIS), was used to create this 30-minute wheeling boundary. Using a neighbourhood boundary that was specific to wheeling was essential for determining the relationship between objective facility proximity and LTPA among persons with SCI. This same neighbourhood definition was also used in Study 2 to assess neighbourhood perceptions of aesthetics and wheeling infrastructure. Furthermore, Study 2 modified the NEWS instrument (Saelens, Sallis, Black, & Chen, 2003) so that the items pertained to wheeling as opposed to walking around one's neighbourhood. While the two modified variables (i.e., the 30-minute wheeling boundary and the wheeling-based NEWS subscales) require further refinement and validation in persons with SCI, these studies demonstrate the importance of using environmental instruments that are specific to both the activities and demographic characteristics of the target population.

8.0: CONTRIBUTIONS TO ADVANCING PHYSICAL ACTIVITY CORRELATES AND DETERMINANTS RESEARCH IN PERSONS WITH SCI

A major limitation of the SCI and physical activity literature has been the lack of clear, consistent operational definitions of physical activity. Operational definitions are useful for providing researchers with a basis for classifying different categories of physical activity (e.g., leisure-time, sports, activities of daily living), and consequently, the ability to examine category-specific predictors. The dissertation studies have made a significant contribution to the correlates and determinants research by using a concise definition of physical activity, specifically LTPA, for identifying correlates and determinants that can be targeted in future LTPA-enhancing interventions. Furthermore, our studies used a validated SCI-specific instrument of LTPA (i.e., PARA-SCI; Martin Ginis, Latimer, Hicks, & Craven, 2005). Given the many functional limitations that are associated with living with an SCI, it is important that physical activity instruments, such as the PARA-SCI, can reliably capture the distinct activities of this population. As a result, the dissertation studies have identified correlates (Study 1B and Study 2), and determinants (Study 3) that pertain specifically to LTPA in persons with SCI. Thus, our findings will be particularly useful for designing LTPA-enhancing interventions.

A second contribution is the use of a theoretical framework. As mentioned in the General Introduction section, most of the studies that have examined physical activity correlates and determinants in people with mobility disabilities have been atheoretical, and are therefore limited in their ability to explain multidimensional determinants of physical activity (Symons Downs & Hausenblas, 2005). Our studies, in particular Study 2 and Study 3, add to the research by examining theory-based constructs in a coherent, testable manner (cf., Crocker, 1993). Consistent with Latimer and Martin Ginis' (2005) findings, Study 2 demonstrated the utility of the Theory of Planned Behaviour (TPB) for understanding LTPA intentions, and to a lesser extent, LTPA behaviour. However, the relatively large intention-behaviour gap that was found (i.e., intentions explained ~4% of variance in LTPA) indicates that there may be other factors that moderate and/or mediate the intention-behaviour relationship in persons with SCI.

Although action planning frequency has been identified as a potential intention-behaviour mediator (Luszczynska, 2006), Study 3 did not find support for this relationship. As discussed in Study 3, the use of an entreaty statement prior to asking the intention items may have caused participants' intentions to be unstable over the 10-week study, thus alternating the relationships between intentions, action planning frequency and behaviour. Stability of intentions may be an important factor to consider when examining influences on the intention-behaviour relationship (cf., Connor, Sheeran, Norman, & Armitage, 2000).

Given that the TPB does not capture the volitional processes of motivated behaviour, Study 3 utilized the Health Action Process Approach (HAPA; Schwarzer, 1992) as a framework to examine the post-intentional predictors of LTPA. Using a prospective study design, Study 3 showed that the self-regulatory processes that predict physical activity in a rehabilitation setting (e.g., coping self-efficacy, action control) do not predict LTPA in a community setting. This finding suggests that the HAPA model may be limited to predicting exercise in a rehabilitation setting. Further examination of the HAPA model for predicting LTPA in non-rehabilitation settings is warranted.

9.0: CONTRIBUTIONS TO ADVANCING THEORY-BASED INTERVENTIONS

In addition to using theories for understanding and predicting LTPA, theoretical frameworks are integral to the development of LTPA-enhancing interventions (Baranowski, Anderson, & Carmack, 1998). Despite the descriptive nature of Study 1A, the findings indicate a potential role for social ecological frameworks in future intervention-based research in persons with disabilities. Using a social ecological framework would require that physical activity interventions be developed such that they focus on various levels of behaviour change. For instance, at the individual level, educational interventions can be developed which focus on enhancing persons with disabilities' confidence to participate in community-based physical activity programs, such as teaching individuals how to find information on the programs available within their municipality. At the environmental level, training programs can be developed to enhance staff members' knowledge on disability and physical activity. Meanwhile, at the policy level, laws can be implemented to increase the number of accessible programs available at fitness and recreational facilities for persons with disabilities (Sallis, Bauman, & Pratt, 1998). In essence, taking a social ecological approach may help to understand physical activity participation at the various levels, and provide information on how to improve behaviour change strategies at the respective levels (Sallis & Owen, 1997).

Another example of the importance of theory for designing effective LTPA-enhancing interventions was illustrated in Study 3. In particular, the HAPA constructs of action planning and coping planning were found to be effective constructs to target in order to increase LTPA in persons with SCI. It was shown that during weeks 1 to 5, participants in the combined action and coping planning (A+C) condition significantly increased their participation in moderate to heavy LTPA, while no change in LTPA was shown for the A condition over the same period. Furthermore, there was a trend for the A+C condition to report greater LTPA than the A condition over weeks 6 to 10, indicating that the A+C intervention had a continued benefit on LTPA over the remaining 5 weeks. The A+C intervention was associated with greater confidence to schedule and overcome LTPA-related barriers in comparison to an action planning only condition. Together, these findings contribute to the HAPA research by demonstrating that in addition to greater LTPA, an A+C intervention is effective for sustaining coping self-efficacy beliefs in a group who encounters many LTPA-related barriers. When one considers the large-sized effects that have been shown for action planning alone on control beliefs and LTPA (Latimer, Martin Ginis, & Arbour, 2006), these results become more impressive as they indicate the additional benefits of coping plans on LTPA for persons with SCI.

Demonstrating that an intervention is effective for increasing LTPA is a preliminary step for advancing physical activity research. Once an effect has been shown, the next step is to determine *how* or *why* the intervention affects LTPA. Testing for mechanisms is a priority in the physical activity domain (Baranowski et al., 1998). Study 3 contributes to the mechanistic research by using the HAPA model to strategically examine *how* the A+C intervention increased LTPA. Of the self-regulatory processes assessed, scheduling self-efficacy at week 1 was found to partially mediate the effects of the intervention on week 5 LTPA. Implications of these findings are that future LTPA-enhancing interventions that focus on increasing beginner exercisers' confidence to schedule LTPA will be most effective for exercise intenders living with SCI.

10.0 DIRECTIONS FOR FUTURE RESEARCH

The findings from this dissertation provide many directions for future research. One such direction would be to examine specific types of LTPA, such as neighbourhood wheeling, in relation to specific environmental factors (cf., Giles-Corti et al., 2005). Studies that identify behaviour-specific environmental influences will help to further our understanding of the role of the physical environment on LTPA in persons living with SCI. Additionally, more prospective, theory-based research should be conducted, which focuses on the relative influence of both individual and environmental factors for predicting LTPA in people with SCI. These studies should also examine whether additional, relevant types of coping self-efficacy, such as recovery self-efficacy, enhance the prediction of LTPA in people with SCI. Finally, as a practical recommendation, greater collaboration between stakeholders and researchers should be considered. Such partnerships may help in facilitating improvements in the accessibility of physical activity facilities, as well as other resources, for persons with mobility disabilities.

11.0 CONCLUSION

Overall, this series of studies has provided a broader understanding of the correlates and determinants of LTPA in persons with SCI, and has shown the efficacy of supplementing action plans with coping plans for increasing LTPA participation. The studies demonstrate the importance of using behaviour- and population-specific instruments of physical activity for examining LTPA correlates and determinants. The findings also illustrate the value of theory-based research for identifying the multidimensional correlates and determinants of LTPA and for designing effective LTPA-enhancing interventions among persons with SCI. Finally, the dissertation provides an impetus for extending the scope of the research on the physical environment and physical activity towards persons with mobility disabilities. The advancements in knowledge that stem from this dissertation regarding the environment, LTPA correlates and determinants, and theory-based interventions will certainly be of value for determining the most effective, evidence-based strategies for promoting LTPA in persons with SCI.

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Appendix A

Study 1A Materials

Appendix A.1	AIMFREE Items
Appendix A.2	Recruitment Letter
Appendix A.3	Facility Summary Report
Appendix A.4	Physical Activity Brochure
Appendix A.5	Modified Percentage Scores

Appendix A.1 – AIMFREE Items

Section A: Parking

Item	YES	NO	N/A
1. Does the facility have its own parking lot, structure, or area? *If NO or N/A, go to Section B.*	1	2	3
(a) Do parking spaces that are designated as accessible have a clear width of at least 8 feet?	**1**	2	3
(b) Do parking spaces that are designated as accessible have an access aisle adjacent to the parking space?	**1**	2	3
(c) If parking spaces marked as accessible have access aisles, do they have a clear width of at least 60 inches?	**1**	2	3
(d) Are spaces that have a clear width of 16 feet available for lift-equipped vans?	**1**	2	3
(e) Are parking spaces designated as accessible at least 20 feet long?	**1**	2	3
(f) Do parking spaces that are designated as accessible have a vertical clearing of at least 98 inches?	**1**	2	3
(g) Is the maximum distance between the entrance to the facility and a parking space 150 feet or less?	**1**	2	3
(h) According to your own assessment, are accessible parking spaces as close as possible to facility entrances?	**1**	2	3
(i) Are drains and catch basins located outside the path leading from accessible parking spaces to the building entrance?	**1**	2	3
(j) Are accessible parking spaces kept free from obstacles?	**1**	2	3
(k) Does the facility have a ticket machine for parking lot access?	1	**2**	3
(l) If the facility parking lot(s) use ticket machines, can the driver obtain the ticket while remaining seated on the driver's side of the car? **Score 1 point for either (k) or (l)	**1**	2	3

Section B: Access Routes and Walkways

Item	YES	NO	N/A
1. Is the **running slope** of **access routes** greater than 5% (1-foot rise in 20 feet)?	1	**2**	3
2. Is the **cross or side-to-side slope** of **access routes** greater than 2% (1-foot rise in 50 feet)?	1	**2**	3
3. Are access routes, particularly those marked as accessible, free from obstacles?	**1**	2	3
4. Are accessible routes clearly marked by signage?	**1**	2	3
5. Are access routes at least 60 inches wide? *If Yes, score 2 more points and go to question 6*	**1**	2	3
(a) Do they have passing spaces at intervals of 200 feet or	**1**	2	3

less? (b) Do they have passing spaces that are at least 60 inches wide AND 60 inches long/deep?	**1**	2	3
6. Does an accessible path of travel lead from the street or sidewalk to a facility entrance?	**1**	2	3
7. Can doors, particularly those marked as accessible, be opened without knobs, handles or locks that require grasping or twisting?	**1**	2	3
8. Do entrance doors open ***automatically***?	1	2	3
9. Is a ***push button*** available to open entrance doors?	**1**	2	3
10. Do entrance doors have ***power assist***?	**1**	2	3
11. Do entrance door thresholds have a lip at the bottom of the threshold that is a ¾-inch or less?	**1**	2	3
12. Do entrance doors have a clear width greater than 32 inches when open?	**1**	2	3
13. Is there at least one accessible entrance on the ground floor of the facility?	**1**	2	3
14. Are facility entrances that are connected to an accessible route also accessible?	**1**	2	3
15. Do entrances have a front approach, in which the access route brings individuals directly in front of the entrance? ***If NO or N/A, score 1 point and go to question 16.*** (a) Is the space in front of doors level?	1 **1**	2 2	3 3
16. Is there a series of doors required to enter the building? ***If NO or N/A, go to question 17.*** (a) Do the doors swing in the same direction?	1 **1**	**2** 2	3 3
CURB CUTS			
17. Do curb cuts have a detectable warning texture? ***If NO or N/A, go to question 18.*** (a) Does the warning texture extend the full *width* of the ramp? (b) Does the warning texture extend the full *length* of the ramp?	**1** **1** **1**	2 2 2	3 3 3
18. Is the lip at the base of the curb ramp ¼-inch or less?	**1**	2	3
19. Is the *slope of curb cuts* greater than 8.33% (1-foot rise in 12 feet)?	1	**2**	3
20. Is the *slope* of the *flared sides* of curb cuts greater than 10% (1-inch rise in 10 inches)?	1	**2**	3
PEDESTERIAN RAMPS			
21. Do access routes include steps? ***If NO or N/A, score 6 points and go to question 22.***	1	2	3

(a) Are step edges marked with a bright colour and/or tactile surface?	**1**	2	3
(b) Is there a pedestrian ramp adjacent to the steps?	**1**	2	3
If NO or N/A, go to question 22.			
(i) Is the cross (side-to-side) slope of ramp runs 2% (1-inch rise in 50 inches) or less?	**1**	2	3
(ii) Does the ramp change directions?	1	**2**	3
(iii) If the ramp changes directions, are landings placed along the ramp where direction changes occur?	**1**	2	3
Score 1 point for a highlighted answer to either ii or iii.			
(c) Do pedestrian ramps that are *longer than 6 feet* have handrails on both sides of the ramp?	**1**	2	3
(d) Are pedestrian ramps made from a non-slip material?	**1**	2	3
22. Does the service desk/counter have a section that is 36 inches high or less AND a clear width of at least 36 inches?	**1**	2	3
23. Does the facility have adequate lighting?	**1**	2	3
24. Can users adjust light levels or can users request lighting-level adjustments in different areas?	**1**	2	3
25. Does the facility have carpeted floors in main areas?	1	2	3
If NO, score 2 points and go to question 26.			
(a) In your judgment, if the facility has carpeting, does the carpeting make wheelchair travel difficult?	1	2	3
(b) Are area carpets/pads fastened to the floor?	**1**	2	3
26. Is the flooring slip-resistant?	**1**	2	3
27. Is there at least 72 inches of clear width in facility corridors, allowing two persons who use wheelchairs to pass?	**1**	2	3
28. Are there changes in elevations in the facility that require steps?	1	**2**	3
29. If there are changes in elevation inside the facility that require steps, is there a wheelchair-accessible ramp adjacent to the steps? *Score 1 point for a highlighted answer to either 28 or 29.*	**1**	2	3
30. If the facility has a snack or juice bar, does the counter at the snack/juice bar have a portion that is 36 inches high or less AND a clear width of at least 36 inches?	**1**	2	3

Section C: Equipment

Item	YES	NO	N/A
1. Are there doors leading to the exercise equipment room?	1	2	3
If NO or N/A, score 3 more points and go to question 2.			
(a) Do the doors open automatically?	**1**	2	3
(b) Do the doors have a clear width greater than 32 inches?	**1**	2	3
(c) Do the doors have a threshold that is ½-inch high or less?	**1**	2	3

<table>
<tr><td>2. For <u>each type</u> of exercise equipment in the facility, is there at least one machine that has an adjacent clear space that is at least 30 inches wide AND 48 inches long?

<table>
<tr><th>Equipment Type</th><th>Clear Space (Y or N)</th></tr>
<tr><td>Chest</td><td></td></tr>
<tr><td>Back</td><td></td></tr>
<tr><td>Quadriceps</td><td></td></tr>
<tr><td>Hamstrings</td><td></td></tr>
<tr><td>Biceps</td><td></td></tr>
<tr><td>Triceps</td><td></td></tr>
<tr><td>Shoulders</td><td></td></tr>
<tr><td>Calf</td><td></td></tr>
<tr><td>Abdominals</td><td></td></tr>
<tr><td>Treadmill</td><td></td></tr>
<tr><td>Recumbent bike</td><td></td></tr>
<tr><td>Elliptical</td><td></td></tr>
</table></td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>3. Is there at least one mode or path of access to <u>each type</u> of exercise equipment for persons using wheelchairs?

<table>
<tr><th>Equipment Type</th><th>Access Path (Y or N)</th></tr>
<tr><td>Chest</td><td></td></tr>
<tr><td>Back</td><td></td></tr>
<tr><td>Quadriceps</td><td></td></tr>
<tr><td>Hamstrings</td><td></td></tr>
<tr><td>Biceps</td><td></td></tr>
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<tr><td>Abdominals</td><td></td></tr>
<tr><td>Treadmill</td><td></td></tr>
<tr><td>Recumbent bike</td><td></td></tr>
<tr><td>Elliptical</td><td></td></tr>
</table></td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>4. Are the paths around exercise equipment free from obstacles?</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>5. Are the routes to exercise equipment made from non-slip surface?</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>6. Is exercise equipment arranged in rows?
If NO or N/A score 2 more points and go to question 7.
(a) Is there an area between <u>each row</u> that has a 30-inch clear turning radius?
Is there an unobstructed path between and around the rows?</td><td>1

1
1</td><td>2

2
2</td><td>3

3
3</td></tr>
<tr><td>8. Are seats on exercise equipment at least 18 inches wide?</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>9. Can the seat height of equipment be adjusted?</td><td>1</td><td>2</td><td>3</td></tr>
</table>

10. Do any of the machines that have seats provide back support?	**1**	2	3
11. Are there pieces of exercise equipment in which the following elements can be reached from a seated position?			
(a) Grab bars	**1**	2	3
(b) Grips	**1**	2	3
(c) Controls	**1**	2	3
12. If exercise equipment has handgrips or handles, can they be moved out of the way in order for persons to transfer onto the equipment?	**1**	2	3
13. Does the facility provide exercise equipment that does not require transfer from wheelchair to machine?	**1**	2	3
14. Are there machines allowing an individual to change settings, (e.g., weight settings) without transferring off of the machine?	**1**	2	3
15. Is the lightest setting on weight machines suitable for persons who are not used to exercising or may have low strength levels? *(e.g., lowest setting on weight machine is 5 lbs, with weight added in 2-to 5-lb increments)*	**1**	2	3
16. Are the following pieces of exercise equipment/assistive devices available in the facility?			
(a) Accessible resistance machines	**1**	2	3
(b) Arm-crank ergometer	**1**	2	3
(c) Progressive resistive upper and lower body wheelchair-accessible exercise machine	**1**	2	3
(d) Combined arm-leg ergometer	**1**	2	3
(e) Multi-station wheelchair-accessible exercise equipment	**1**	2	3
(f) Swing-away seats	**1**	2	3
(g) Recumbent bikes	**1**	2	3
(h) Other exercise equipment with swivel chair	**1**	2	3
(i) Wheelchair accessible ergometer	**1**	2	3
(j) Wheelchair rollers	**1**	2	3
(k) Low MPH treadmill	**1**	2	3
(l) Parallel bars	**1**	2	3
(m) Drop rings	**1**	2	3
(n) Light hand weights	**1**	2	3
(o) Wrist weights	**1**	2	3
(p) Medicine balls	**1**	2	3
(q) Padded mats	**1**	2	3
(r) Standing frame	**1**	2	3
(s) Gloves or equipment handles with Velcro or similar assistive devices for gripping	**1**	2	3
(t) Straps and padding	**1**	2	3
(u) Transfer board	**1**	2	3
(v) Wrist cuffs/holding gloves	**1**	2	3
CARDIO EQUIPMENT			

17. Does the facility have cardio exercise equipment?	**1**	2	3
18. On exercise machines requiring pedaling, are there mechanisms readily available to fasten feet to the pedals?	**1**	2	3
19. On exercise machines requiring gripping onto handlebars, are there mechanisms available such as gloves with Velcro or handlebars with rubber to make gripping easier?	1	2	3
20. Are alternative formats used for descriptions of controls on exercise equipment? (Indicate specific alternative formats below) ***If NO or N/A, go to question 20.*** (a) Braille (b) Large print (c) Raised lettering (d) Pictograms (e) Audio (f) Other Specify: ________________	**1** **1** **1** **1** **1** **1** **1**	2 2 2 2 2 2 2	3 3 3 3 3 3 3
21. In your judgment, are buttons and displays on exercise equipment easily readable?	**1**	2	3
22. Are buttons on equipment raised from the panel surface?	**1**	2	3
23. Does exercise equipment provide audible cues? (e.g., cues signaling changes in speed or grade on treadmill)	**1**	2	3

Section D: Locker Rooms and Showers
Locker Rooms

Item	YES	NO	N/A
1. Does the facility have a locker room? *If NO or N/A, go to question 23.*	1	2	3
2. Are there doors leading to the locker room? *If NO or N/A, score 4 points and go to question 3.* (a) Do the doors open automatically? (b) Is a pushbutton available to open the doors? (c) Do the doors have a **clear width** *greater than 32 inches*? (d) Do the doors have a **threshold** that is *½-inch high or less?*	1 **1** **1** **1** **1**	2 2 2 2 2	3 3 3 3 3
3. Is there **a clear path** leading from the locker room entrance to the *lockers* that is *at least 36 inches wide*?	**1**	2	3
4. If there is a path from the locker room to the *bathroom*, does the path have a **clear width** of *at least 36 inches*?	**1**	2	3
5. If there is a path from the locker room to the *showers*, does the path have a **clear width** of at *least 36 inches*?	**1**	2	3

6. If there is a path from the locker room to *one or more facility use area*, does the path have a **clear width** of *at least 36 inches*?	**1**	2	3
7. Are paths leading from the locker room to other areas of the facility free from obstacles?	**1**	2	3
8. Is there a path with a **clear width** of *at least 36 inches* between the lockers and benches?	**1**	2	3
9. Are paths leading directly to lockers free from obstacles?	**1**	2	3
10. Are there lockers in which the **distance** from the *middle of locker door handles* to the floor is *24 inches or less*?	**1**	2	3
11. Can the highest lockers be opened from the position of a wheelchair user?	**1**	2	3
12. Is the lowest locker at a **height** of *36 inches or less*?	**1**	2	3
13. Do locker door handles require grasping, pinching, twisting, or pulling with the fingers to open?	1	**2**	3
14. Are dressing benches at least 24 inches *deep*?	**1**	2	3
15. Are dressing benches at least 48 inches *wide*?	**1**	2	3
16. Are dressing benches between *17 and 19 inches* from the floor to the top of the bench?	**1**	2	3
17. Is there *at least 36 inches* of **clear space** between benches and other obstacles?	**1**	2	3
18. Is companion seating available adjacent to wheelchair spaces in front of accessible lockers?	**1**	2	3
19. Is there an accessible scale for weighing a client seated in a wheelchair?	**1**	2	3
20. Are wheelchair spaces in front of accessible lockers connected to an accessible route?	**1**	2	3
21. Does the facility have private family changing rooms?	**1**	2	3
22. Does the locker room have private changing rooms?	**1**	2	3
SHOWERS			
23. Does the facility have showers? ***If NO or N/A, go to Section G.*** (a) Do shower stall entrances have a **clear width** of *at least 36 inches*? (b) Does the shower spray unit have a **hose** *at least 60 inches long?* (c) Can the shower spray unit be used as a hand-held device? (d) When used as a fixed showerhead, is the shower spray unit *48 inches or less* from the floor?	1 **1** **1** **1** **1** **1** **1**	2 2 2 2 2 2 2	3 3 3 3 3 3 3

(e) Can shower water temperature be adjusted prior to getting into the shower? (f) Are the shower controls operable with one closed fist? (g) Is there at least one shower stall in which a wheelchair user can roll into the shower? (h) Does the shower stall have grab bars on the wall opposite the showerhead? (i) Are grab bars placed on the sidewall(s)? (j) Are grab bars *33 to 36 inches* from the floor? (k) Are grab bars *at least 36 inches* long? (l) Is a fold seat or free shower bench available?	**1** **1** **1** **1** **1** **1**	2 2 2 2 2 2	3 3 3 3 3 3

Section E: Elevators

Item	YES	NO	N/A
1. Are there elevators in the facility? ***If NO or N/A, got to Section H.***	1	2	3
2. Are elevators located on an accessible path of travel?	**1**	2	3
3. Are floor numbers clearly marked by the elevators?	**1**	2	3
4. Is there a visual signal on each floor indicating which elevator is approaching?	**1**	2	3
Do visual signals indicate the direction of the approaching elevator?	**1**	2	3
6. Are visual signals in hallways 72 inches or higher from the floor or ground?	**1**	2	3
7. Is there an audible signal on each floor indicating that an elevator is approaching?	**1**	2	3
8. Do audible signals provide verbal information as to the direction of the approaching elevator, OR is one sound made for up direction and two sounds for down direction?	**1**	2	3
Do floor buttons inside the elevator have visual indicators to show each floor destination?	**1**	2	3
9. Are floor button visual indicators extinguished when the elevator reaches each selected floor?	**1**	2	3
11. Do elevator cars have audible signals indicating the floor number at each stop?	**1**	2	3
12. Do elevator buttons have raised characters?	**1**	2	3
13. Are raised button characters in the elevator *at least ¾-inch* high?	**1**	2	3
14. Are raised and Braille characters on elevator hoist way jambs *at least 2 inches* high?	**1**	2	3
are raised designations for control buttons placed immediately to the left of the button to which they apply?	**1**	2	3
16. Is the centerline of the highest raised button characters *60*	**1**	2	3

inches or less from the floor?			
17. Are control buttons in elevators designated by Braille?	**1**	2	3
18. When elevator doors are closing, do the doors reopen when someone crosses the elevator threshold?	**1**	2	3
19. Are elevator emergency communication buttons *35 to 48 inches* from the floor?	**1**	2	3
20. Are grab bars provided on each sidewall of elevator cabs?	**1**	2	3
21. Are grab bars mounted *32 to 36 inches above* the floor?	**1**	2	3
22. When the elevator is open, is the **clear width** of the elevator door *at least 36 inches*?	**1**	2	3
23. Is the **width** of the elevator car *at least 80 inches*?	1	2	3

Section F: Bathrooms

Item	YES	NO	N/A
1. Do the bathroom doors have *power assist*?	**1**	2	3
2. Is a *pushbutton* available to open the doors?	**1**	2	3
3. Do the bathroom doors open *automatically*?	**1**	2	3
4. Do bathroom doors have a **clear width** *greater than 32 inches?*	**1**	2	3
5. Is there an **unobstructed turning radius** of *at least 60 inches* in front of restroom doors?	**1**	2	3
6. Do *toilet stall doors* have a **clear width** of *at least 36 inches?*	**1**	2	3
7. Do toilet stall doors swing towards the area outside of the stall?	**1**	2	3
8. Are accessible toilet stalls *at least 60 inches wide* AND at least 60 inches long/deep?	**1**	2	3
9. Is the distance from the ***center*** of the toilet to the stall wall at least 18 inches?	**1**	2	3
10. Are flush controls mounted 44 inches or less above the floor?	**1**	2	3
11. Is the toilet seat 17 to 19 inches high from the floor?	**1**	2	3
12. Is the ***center*** of toilet paper dispensers 19 inches or less from the floor?	**1**	2	3
13. Does the toilet paper dispenser provide a continuous paper flow?	**1**	2	3
14. Does the toilet stall door have a latch or handle near the doorjamb to aid in closing the door from the inside?	1	2	3
15. Are grab bars installed within the accessible stall(s)?	1	2	3
If NO or N/A, go to question 16.			
(a) Is a grab bar mounted on the wall behind the toilet?	**1**	2	3
(b) Are grab bars mounted on the stall sidewalls?	**1**	2	3
(c) Are grab bars 1-1/2 inches from the stall wall to which they are mounted?	**1**	2	3
(d) Are sidewall grab bars *between* 40 and 42 inches long?	**1**	2	3
(e) Is the distance from the back of the stall to the far end			

(**when facing the toilet**) of sidewall grab bars 12 inches or less? (*f*) Are grab bars mounted 33 to 36 inches *from the floor to the bottom of the bar (closest to the toilet)?*	**1** **1**	2 2	3 3
16. Is the bathroom floor slippery?	1	**2**	3
17. Are hot water pipes and abrasive surfaces below the sink insulated?	**1**	2	3
18. Are towel dispensers and/or hand dryers easy for a wheelchair user to reach?	**1**	2	3
19. Is the bottom edge of mirrors 40 inches or less from the floor?	**1**	2	3
20. Is there a clear floor space that is at least 30 inches wide AND at least 48 inches long/deep for front approach to sinks?	**1**	2	3
21. Is there a clear floor space that is at least 30 inches wide AND at least 48 inches long for front approach to paper dispensers and/or hand dryers?	**1**	2	3
22. Is there a clear floor space that is at least 30 inches wide AND 48 inches long/deep for front approach to mirrors?	**1**	2	3
23. Is the sink counter 34 inches or less above the floor?	**1**	2	3
24. Is the knee space below the sink at least 30 inches wide?	**1**	2	3
25. Is the knee space below the sink at least 19 inches deep (from the front surface of the sink/counter to the pipes under the sink)?	**1**	2	3
26. Is the sink depth 6.5 inches or less?	**1**	2	3

Section G: Professional Support/Training

Item	YES	NO	N/A
1. Have staff members encountered difficulties in helping individuals with disabilities in the facility?	1	**2**	3
2. If difficulties are encountered in helping individuals with disabilities, are staff members able to receive emotional and/or instructional support? *Score 1 point for a highlighted answer to either 1 or 2.*	**1**	2	3
3. Does your facility have a medical reference book on disability and associated conditions?	**1**	2	3
4. Is staff trained in the performance of wheelchair transfers?	**1**	2	3
5. Does your facility have a training manual or textbook regarding working with individuals with disabilities?	**1**	2	3
6. Do staff members receive training (e.g., workshops, in-services) on communicating with people with disabilities?	**1**	2	3
7. Do staff members receive training on providing accommodations to persons with disabilities?	**1**	2	3
8. When a person with a disability requests directions to the facility, are staff familiar with public transportation routes, including nearest	**1**	2	3

bus or train stops near the facility?			
9. Do staff members attend conferences or continuing education classes regarding accessibility of fitness facilities?	**1**	2	3
10. Do staff members receive basic information on medications and their effect during exercise?	1	2	3
11. Are staff members knowledgeable about medical conditions and medications such as:			
(a) Autonomic dysreflexia	1	2	3
(b) Beta blockers	1	2	3
(c) Diabetes	1	2	3
(d) Behavioural problems	1	2	3
(e) Seizures	1	2	3
(f) Sodium retention	1	2	3
(g) High blood pressure	1	2	3
(h) Common secondary conditions associated with disability	1	2	3
12. Is there a staff member on site that has training or certification in the following areas:			
(a) CANFIT-PRO	**1**	2	3
(b) Adaptive physical education	**1**	2	3
(c) Clinical exercise physiology	**1**	2	3
(d) Kinesiology	**1**	2	3
(e) Occupational therapy	**1**	2	3
(f) Personal training for persons with disabilities	**1**	2	3
(g) Physical therapy	**1**	2	3
(h) Therapeutic recreation	**1**	2	3

Section H: Policies

Item	YES	NO	N/A
1. Are service animals allowed in your facility?	**1**	2	3
2. Is information in an alternative format available upon request? (Indicate specific alternative formats below) ***If NO or N/A, go to question 3.***	**1**	2	3
(a) Braille	**1**	2	3
(b) Large print	**1**	2	3
(c) Raised lettering	**1**	2	3
(d) Pictograms	**1**	2	3
(e) Audio	**1**	2	3
(f) Other Specify: ________________	**1**	2	3
3. When your facility is about to undergo structural modifications, are individuals with disabilities invited to provide input?	**1**	2	3
4. Does your facility have a mission statement indicating that the	**1**	2	3

inclusion of persons with disabilities is a facility goal?			
5. Will you allow a consumer's personal assistant to enter the facility without incurring additional charges?	**1**	2	3
6. Can a consumer's personal assistant be allowed to attend facility programs without incurring additional charges?	**1**	2	3
7. Can membership fees be pro-rated based upon how much of the facility is accessible or equipment is usable by persons with disabilities?	**1**	2	3
8. With the exception of item 7 above, does a person's disability determine membership fees?	1	**2**	3
9. Is the accessibility of the facility periodically reviewed?	**1**	2	3
10. Does the facility require staff to be trained in basic first aid?	**1**	2	3
11. Does your facility advertise its accessible services?	**1**	2	3
12. Are tours of the facility regarding its accessibility features provided to persons with disabilities?	**1**	2	3
13. Does your facility refer individuals to healthcare specialists such as dieticians and therapists upon request?	**1**	2	3
14. Does your facility keep a list of assistive device manufacturers that it can provide upon request?	**1**	2	3
15. Can a consumer receive a complete list of the accessible exercise equipment available at your facility?	**1**	2	3
16. Are complimentary visits allowed in order for persons with disabilities to assess whether your facility meets their needs?	1	2	3
17. Does at least one person with a disability serve on your facility's advisory board or committee?	**1**	2	3
18. Has your facility ever received a complaint regarding its accessibility?	1	**2**	3
19. If your facility receives a complaint regarding its accessibility, is there a formal process for handling the complaint?	**1**	2	3
(a) Are complaints regarding accessibility reviewed in a timely manner?	**1**	2	3
(b) After a complaint regarding accessibility is reviewed, is a summary of the review given to the person who filed the complaint?	**1**	2	3
20. Does your facility actively seek input from persons with disabilities with regard to the creation of new programs?	**1**	2	3
21. When determining where to host a recreation program, are accessible sites always chosen?	**1**	2	3
22. Would the management allocate additional staff if a number of persons with disabilities expressed interest in their fitness services?	**1**	2	3
23. Would management pay or provide release time for staff to attend continuing education activities related to working with persons with disabilities?	**1**	2	3

24. Does you facility's marketing plan include persons with disabilities as a targeted population?	**1**	2	3
25. If your facility is not accessible for a particular consumer, is information readily available concerning the location of accessible facilities in the near area?	**1**	2	3
26. Has your facility designated an employee to oversee the facility's accessibility?	**1**	2	3
27. If your facility has adaptive equipment, is it readily available in the area where it is used?	**1**	2	3
28. Is the number of paid staff adequate to meet the needs of persons with disabilities who use your facility?	**1**	2	3
29. When the number of paid staff is not adequate to meet the needs of consumers with disabilities, does your facility recruit more volunteers or staff? *Score 1 point for a highlighted answer to either 28 or 29.*	**1**	2	3
30. Does exercise equipment receive timely preventive maintenance?	**1**	2	3
31. Is information available to consumers about making the transition from rehabilitation to community-based fitness activities or programs?	**1**	2	3
32. Is staff kept up to date on the latest adapted equipment by attending conferences and workshops?	**1**	2	3
33. Is instruction provided to new employees regarding assisting with the transfer of people with mobility impairments in and out of the pool?	**1**	2	3
SWIMMING POOL POLICIES			
34. Is the pool's water temperature kept between 84 and 92 degrees Fahrenheit (33-37 degrees Celsius) when it is in use?	**1**	2	3
35. If the pool is wheelchair-accessible, is adaptive equipment available, such as aquatic chairs, to facilitate entering and exiting the pool?	**1**	2	3
36. Does the facility allow persons who use wheelchairs to enter swimming pools using their own wheelchairs?	**1**	2	3
37. Are lifeguards available to provide assistance and training?	**1**	2	3
38. Does the facility have an Aquatics Facility Operator (AFO)?	**1**	2	3
39. Do any staff members in the facility have training in adapted aquatics?	**1**	2	3
40. Does the facility provide water joggers?	**1**	2	3
41. Does the facility provide shortee-vests that help to keep swimmers warm?	**1**	2	3
42. Does the facility provide swim rings for chest or torso support?	**1**	2	3
43. Are floatation devices allowed during swimming programs and	**1**	2	3

lessons?			
44. If applicable, is a buddy system used during swimming programs and lessons?	**1**	2	3
45. Does the swim program cover the use of nontraditional swim strokes (e.g., dog paddle)?	**1**	2	3
46. If applicable, is enough time given for program participants with disabilities to change and enter the pool prior to the start of the class/program?	**1**	2	3

Section I: Programs (Group Activities)

Item	YES	NO	N/A
1. When a person enrolls in a program, is the person asked if he/she requires any accommodations?	**1**	2	3
2. Are registrants with disabilities contacted prior to the start of the program to discuss any accommodations or adaptations that are necessary for their participation?	**1**	2	3
3. Are programs that allow persons with disabilities to participate provided in your facility?	**1**	2	3
4. If your facility offers programs specifically for persons with disabilities, are they similar in content to programs offered to persons who do not have disabilities?	**1**	2	3
5. Do exercise classes and programs (e.g., aerobic classes) include activities that can be performed from a seated position?	**1**	2	3
6. Are chairs available in exercise classes?	**1**	2	3
7. Are rails available to hold onto during standing exercises?	**1**	2	3
8. Can individuals with disabilities participate in fitness/ recreation programs at their own pace?	**1**	2	3
9. Does your facility provide enough time for persons with disabilities to prepare (i.e., use locker room, shower) prior to the start of a program?	1	2	3
10. After a fitness or recreation program has been completed, are participants with disabilities asked to evaluate the program with respect to its accessibility?	**1**	2	3

Section J: Swimming Pool

Item	YES	NO	N/A
1. Are there doors leading to the swimming pool? ***If No or N/A, score 2 points and go to question*** (a) Do the doors have *power assist*? (b) Do the doors have a threshold that is ½ inch high or less?	1 **1** **1**	2 2 2	3 3 3
2. Does the pool have a ledge to hold onto when entering the water?	**1**	2	3
3. Does the surface immediately around the pool have a *detectible*	**1**	2	3

warning texture?			
4. Do paths leading to and around the pool have a clear width of at least 36 inches?	**1**	2	3
5. Please indicate the availability of the following means of entering and exiting the pool: (a) Lift or hoist (b) Wet/dry ramp (c) Zero-depth entry (similar to the beach) (d) Transfer wall (e) Stairs with handrails	 **1** **1** **1** **1** **1**	 2 2 2 2 2	 3 3 3 3 3
6. If there is only one accessible means of pool entry and exit, is this accessible means a *pool lift, zero-depth entry, or wet/dry ramp*?	1	2	3
7. If there are two or more accessible means of entering and exiting the pool, is at least one of these means a *movable floor, transfer steps, transfer wall, or stairs with handrails?*	**1**	2	3
8. Is each accessible means of pool entry connected to an accessible route?	**1**	2	3
9. Does the pool have a lift for entering and exiting? ***If NO or N/A, go to question 10.*** (a) Does the pool lift descend 18 to 20 inches below the water surface? (b) Does the pool lift seat have armrests on both sides? (c) Is a footrest attached to the pool lift? (d) Are pool lift controls accessible from the deck level? (e) Can the pool lift controls be operated without the need for grasping, pinching or twisting of the wrist?	**1** **1** **1** **1** **1** **1**	2 2 2 2 2 2	3 3 3 3 3 3
10. Does the pool have at least one ramp for entry/exit? a) Is the width of the ramp at least 36 inches? b) Is the slope of the ramp greater than 8.3% (equivalent to1-foot rise in ramp height for every 12 feet of ramp length)? c) Are ramp landings level? d) Are ramp *landings* at least as wide as the ramp run? e) Are ramp landings at least 60 inches long? f) Does the ramp have handrails?	**1** **1** 1 **1** **1** **1** **1**	2 2 **2** 2 2 2 2	3 3 3 3 3 3 3
11. If the total linear length of the pool wall (measured on all four sides) is less than 300 feet, does the pool have at least one accessible means of entry and exit?	**1**	2	3
12. If the total linear length of the pool wall (measured on all four sides) is 300 feet or more, does the pool have at least two accessible means of entry and exit? *Score 1 point for a highlighted answer to either question 11 or 12.*	**1**	2	3
13. Does the pool have a transfer wall?	**1**	2	3

If NO or N/A, go to question 14. (a) Is it 12 to 16 inches wide? (b) Is the transfer wall top 16 to 18 inches above the floor? (c) Is the surface of the transfer wall non-abrasive?	 **1** **1** **1**	 2 2 2	 3 3 3
14. Is the clear space adjacent to each point of pool entry at least 60 inches wide AND 60 inches long/deep?	**1**	2	3
15. Is there an area in the pool where persons who move slowly can swim without interfering with other swimmers?	**1**	2	3
16. In your judgment, are pool depth markers clearly visible from outside the pool?	**1**	2	3
17. Are lifeguards available to provide assistance?	**1**	2	3

Appendix A.2 – Recruitment Letter

Dear Sir/Madam,

As a member of the fitness industry, it may be of no surprise that many Canadian adults lead inactive lifestyles. Even more alarming though, is the low physical activity rates among people with disabilities. For example, while 35% of the general population is considered inactive, ***53% of people living with a spinal cord injury (SCI) do not participate in ANY physical activity.*** In a recent Ontario study, it was found that ***only 17% of people with SCI who report living in close proximity to a wheelchair-accessible fitness facility actually use the facility***. Together, these findings suggest that we need to better understand the accessibility of established fitness and recreational facilities for people with a SCI.

In an effort to promote physical activity among people with a SCI living in the Hamilton-Wentworth area, Dr. Kathleen Martin Ginis and Kelly Arbour, a Ph.D. student, from the Department of Kinesiology at McMaster University are conducting a research project to examine the accessibility of fitness and recreational facilities in Hamilton. If you volunteer to participate in this research project, the following would occur. First, the student investigator (Ms. Arbour) and a trained research assistant would perform ONE on-site research evaluation of your facility. Specifically, we would be making physical measurements of the structures surrounding your facility (i.e., width of sidewalks, parking spaces, doorways, ramp slopes), as well as examining the presence and quality of the fitness equipment, locker rooms, and washrooms within the facility. Second, we would ask that you spend 30 minutes with us so we could ask you some questions pertaining to the training, policies and fitness programs that exist at your establishment. We expect the entire process to take approximately 2 hours (i.e., 90 minutes to complete the physical assessment of the facility and 30 minutes to conduct the interview).

We hope that the knowledge gained from this research project will allow other researchers to identify areas of greatest need for improving the accessibility of facilities. Furthermore, this research project will offer facility owners, such as yourself, a chance to understand the strengths and weaknesses of your facility in terms of its accessibility for people who have mobility disabilities.

Please note that the results obtained from this research will **remain confidential** and **will NOT be connected with your facility**. While you will be provided with a written report of the findings for the physical measurements section, you are **by no means obligated to alter your facility**. Rather, the findings will be used to direct future research efforts towards making fitness and recreational facilities more accessible to the needs of people with SCI.

If you are interested in participating in this research project, please contact Kelly Arbour at (905) 525-9140, ext. 27937. We look forward to speaking with you in the near future.

Sincerely,

Dr. Kathleen A Martin Ginis, Ph.D.
Associate Professor
McMaster University
(905)525-9140 ext. 23574
martink@mcmaster.ca

Kelly Arbour, M.Sc.
Ph.D. candidate
McMaster University
(905)525-9140 ext. 27937
arbourkp@mcmaster.ca

Appendix A.3 – Facility Summary Report

Below is a summary of the results of the research project you participated in. For each section, you will find the following information: (1) a total score out of 100; (2) a percentile rank that indicates how accessible your facility is relative to a standardized sample; (3) specific areas that were found to be highly accessible; and (4) suggestions on how to improve items that were found to be less accessible.

Category	*Score (/100)*	*Strengths*	*Suggestion(s) for Improvements*
Built Environment			
Parking	N/a		
Access Routes/Entrance Areas	49.70	-the access route leading to the building was well maintained (i.e., free from obstacles)	- may be a good idea to fasten all mats to the floor in front of door entrances (they create an irregular floor surface which makes it difficult to maneuver over in a wheelchair)
Locker Rooms and Showers	43.20	-locker rooms were spacious, which permits room for wheelchair users to maneuver around lockers (i.e., ample clear space/ paths)	- entrance door to the locker room difficult to open for people who have poor hand dexterity (i.e., unable to grasp doorknob) – consider replacing the knob with a lever-shaped handle
Bathrooms	31.54	-great to see grab bars installed behind the toilet as well as on the stall sidewall (useful for transfers on/off toilet)	-Ensure that all hot water pipes and abrasive surfaces under the sink are well-insulated (this is a concern for many wheelchair users –increased risk of burns when left exposed)
Elevators	N/a		
Equipment (e.g., availability of accessible equipment, pathways between and around equipment)	53.80	- equipment arranged in rows – easier to access -great variety of equipment (i.e., cables, free weights, arm ergometer)	-May consider removing the rubber mats on the ground (create problems for accessing machines
Swimming Pool (e.g., availability of accessible equipment, accessible pathways to and from the pool)	36.10	-stairs with handrails were available to assist with pool entry/exiting for people who use such assistive devices as braces, canes -perimeter of the pool had a clear width of at least 36"	-Make sure that there are no obstacles (i.e., chairs, tables, pool toys) blocking the clear space around the pool (i.e., at least 36" of clear space)

Once again, thank you very much for your dedication to this research project. Please feel free to e-mail me any questions you may still have or concerns regarding the study.

Sincerely,
Kelly Arbour, M.Sc.
Ph.D. candidate – Health and Exercise Psychology
McMaster University, (905) 525-9140 ext. 27937, arbourkp@mcmaster.ca

What Types of Equipment Should Be Provided?

Strength-Training

Equipment with **small weight increments** (i.e., 1- to 2-lbs increments), **wider seats and benches,** and a **swing away seat** is preferable. If space is limited in your facility, recommend having **multi-station equipment** that is accessible for someone who uses a wheelchair. These stations faciltate a wide range of resistance exercises in a small space.

Another space-saving and accessible device is the **wall pulley.** This type of equipment is particularly handy when you are working with someone who is unable to transfer onto the traditional exercise equipment.

Free Weights/Stretching Area

Make sure to offer **different types of free weights** (e.g., weights less than 5 pounds, cuff weights). If feasible, provide a **raised "treatment table" or elevated mat** for stretching.

Cardiovascular Equipment

Having **different types of exercise bikes** (i.e., recumbent bikes with wider seats) is essential. Suggest having at least one **arm ergometer** (they provide a great upper body workout for everyone!). When working with someone who is able to walk, make sure treadmills have a **low MPH setting** and **start very slowly**!

Did You Know...

- 36,000 Canadians have an SCI

  ~900 new injuries/yr

- 90% of injuries result from traumatic causes

  e.g., motor vehicle accidents (35%), falls (16.5%), medical conditions (10.8%), sports (6.7%), diving (5.3%) and industrial accidents (5.3%)

- Only 17% of people with SCI who report living in close proximity to a wheelchair-accessible fitness facility report using the facility on a regular basis
- **Autonomic dysreflexia (AD)** is a condition that can occur in someone with an injury at T6 or above. With AD, **blood pressure can rise to a potentially dangerous level** and, therefore warrants fitness professionals' immediate attention.

Here are some useful resources to check out:

Canadian Paraplegic Association
www.canparaplegic.org/en/

Active Living Alliance for Canadians with a Disability
www.ala.ca/content/home.asp

Canadian Wheelchair Sports Association
www.cwsa.ca/home.html

Canadian Paralympic Association
www.paralympic.ca/

Rick Hansen Foundation
www.rickhansen.com/

Promoting Physical Activity within the Spinal Cord Injury Population

A Guide for Fitness and Health Professionals

Prepared By:
Kelly Arbour, M.Sc.
McMaster University

Email:
arbourkp@mcmaster.ca

What is a Spinal Cord Injury (SCI)?

A SCI is an injury or disease to the spinal cord, causing paralysis in two or more of the limbs. The degree of paralysis depends on two factors:

(1) **Injury Level**

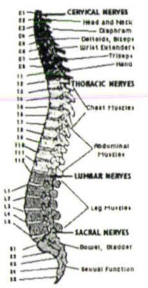


Fig. 1: A map of the spinal cord segments and respective functions.

A high-level injury is a result of damage to the neck (i.e., segments C1-C7) and is termed *quadriplegia*. Consequently, those persons with quadriplegia may be unable to move their arms and legs. Meanwhile, people who incur a lower-level injury to the spinal cord (i.e., segments T1-S5) are said to have *paraplegia*. While they can move their arms, trunk stability and lower limb movement are compromised.

(2) **Lesion Severity**

The severity of the lesion is determined by the extent to which the spinal cord has been damaged. An injury is termed *complete* when the spinal cord has been completely severed, resulting in no sensation or voluntary movement below the site of damage. In contrast, an *incomplete* injury occurs from a partial tear to the spinal cord, resulting in partial or complete preservation of sensory or **motor function below the injury site.**

Important Issues to Consider

Secondary Health Complications

While there are many physical and psychological consequences that are a direct result of a SCI, the secondary health complications associated with the injury may be even *more detrimental to one's quality of life.* Some of the most common health complications reported are: **bladder infections, pressure sores, chronic pain, spasticity, shoulder injuries, autonomic dysreflexia, and osteoporosis.**

Benefits of Physical Activity

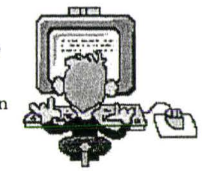
- Increased performance of activities of daily living
- Greater physical independence
- Greater chance of returning to work
- Increased social support and life satisfaction
- Decreased reports of depression and chronic pain
- Enhanced perceptions of health status and muscle strength

Barriers to Physical Activity

Despite the aforementioned benefits of physical activity, **53% of individuals with SCI do not participate in ANY physical activity.** Some of the most common physical activity barriers reported by people with SCI are: **lack of transportation, limited space between equipment, lack of elevators, fear of limitations, lack of information, high equipment cost, negative social environment**

How Can You Promote Physical Activity?

Enhance Your SCI Knowledge



- Visit the on-line resources listed in the back of this pamphlet
- Sign-up for a disability awareness course

Get to Know Your Client's Abilities and Limitations

Make sure to discuss with the person their abilities and level of functioning. Examples of some questions that you could ask are:

- "How well does each muscle function?"
- "What activities/movements cause pain, spasticity, or fatigue?
- "What types of activities do you enjoy?"

Provide a Friendly, Inclusive Environment

Create space between exercise equipment so that wheelchair users can maneuver throughout the facility (e.g., provide extra space at the end of a row of exercise equipment). This increased space will provide an opportunity for all members to interact and may even lessen potential fears of not being able to move around the equipment.

Appendix A.5 - Modified Percentage Score

For the Study 1A, we supplemented Rimmer et al.'s Rasch transformation scoring with a simplified percentage score (termed a *modified percentage score*). Specifically, scores for each area and/or subscale were calculated by dividing the total number of items with responses indicative of greater accessibility by the total number of applicable items on the scale. For example, if a facility had 16 items on the locker/shower subscale which were indicative of greater accessibility, and the total number of items on the locker/shower scale that applied to the facility was 36, then the locker/shower accessibility score for the facility would be 44%.

Mean accessibility ratings for the five AIMFREE subscales.

Subscale	*n*	Modified Percentage Score *M (SD)*
Built Environment		
Parking	31	66.28 (11.26)
Access Routes	42	52.99 (10.34)
Bathroom	42	56.43 (13.59)
Lockers/Showers	38	52.71 (13.11)
Elevators	7	69.83 (6.27)
Equipment	19	44.70 (9.37)
Professional Behaviour		
Training/Support	34	41.31 (18.35)
Programs	35	71.82 (19.61)
Policy	38	61.07 (10.05)
Swimming Pool	29	46.11 (16.74)

Note. Higher scores denote greater accessibility for the respective category. Given that some subscale items are allocated more than one point for a particular response (e.g., a "No" response for items 1 and 6 on the Equipment subscale are given a score of 3 and 2, respectively, using the Rasch scoring procedure), accessibility ratings for some scales (e.g. Equipment and Training/Support) were lower using the modified percentage score than when using the Rasch score (see Table 4, p. 91).

Mean accessibility ratings for the five AIMFREE subscales (scoring based on the modified percentage score).

Subscale	Recreational Centres	*n*	Fitness Centres	*n*	Pools	*n*
Built Environment						
Parking	67.64 (11.84)	15	66.57 (10.30)	9	62.99 (12.14)	7
Access Routes	57.83 (6.24)	15	47.76 (12.62)	17	54.61 (7.03)	10
Bathroom	65.09 (8.31)	15	52.76 (13.28)	17	49.70 (14.82)	10
Lockers/Showers	60.87 (9.60)	14	47.54 (14.23)	15	48.63 (10.26)	9
Elevators	73.69 (7.45)	2	68.29 (5.90)	5	--	
Equipment	--		44.70 (9.37)	19	--	
Professional Behaviour						
Training/Support	34.38 (12.93)	10	49.90 (20.09)	17	30.36 (9.83)	7
Programs	72.44 (18.34)	12	73.60 (20.39)	16	66.71 (21.96)	3
Policy	63.18 (10.28)	15	61.52 (11.15)	19	56.68 (6.15)	10
Swimming Pool	55.11 (11.67)	13	50.01 (17.83)	6	32.08 (12.97)	10

Note. Given that some subscale items are allocated more than one point for a particular response (e.g., a "No" response for items 1 and 6 on the Equipment subscale are given a score of 3 and 2, respectively, using the Rasch scoring procedure), accessibility ratings for some scales (e.g. Equipment and Training/Support) were lower using the modified percentage score than when using the Rasch score (see Table 5, p. 92).

Appendix B

Study 1B Materials

Appendix B.1	Programming and Equipment Descriptions
Appendix B.2	PARA-SCI Intensity Classification Sheet
Appendix B.3	Cross Tabulation of Physical Activity Status and Perceived and Objective Proximity

Appendix B.1 – Programming and Equipment Description

Description of Programming and Equipment Available at the Physical Activity Facilities.

Programs/Equipment	Examples
Individual classes	yoga, pilates, personal training, swimming, wheelchair tennis*
Group-based classes	martial arts, tai chi, yoga, pilates, dragon boat racing*, aerobics
Resistance exercises	Free weights, cable weights, accessible universal weight machines, tubing, therabands, medicine balls
Cardio exercises	recumbent bikes, arm ergometers, track, combined arm/leg ergometer
General Recreational Programs	skating, swimming, basketball, Wheelchair tennis*, squash

* Denotes a seasonal activity

Appendix B.2 - PARA-SCI Intensity Classification Sheet

	NOTHING AT ALL	MILD	MODERATE	HEAVY
How hard are you working?	• Includes activities that even when you are doing them, you do not feel like you are working at all.	• Includes physical activities that require you to do very light work. You should feel like you are working a little bit but overall you shouldn't find yourself working too hard.	• Includes physical activities that require some physical effort. You should feel like you are working somewhat hard but you should feel like you can keep going for a long time.	• Includes physical activities that require a lot of physical effort. You should feel like you are working really hard (almost at your maximum) and can only do the activity for a short time before getting tired. These activities can be exhausting.

How Does Your Body Feel?

	NOTHING AT ALL	MILD	MODERATE	HEAVY
Breathing & Heart Rate	Everything is normal	• Stays normal or is only a little bit harder and/or faster than normal.	• Noticeably harder and faster than normal but NOT extremely hard or fast.	• Fairly hard and much faster than normal.
Muscles		• Feel loose, warmed-up and relaxed. Feel normal temperature or a little bit warmer and not tired at all	• Feel pumped and worked. Feel warmer than normal and starting to get tired after awhile.	• Burn and feel tight and tense. Feel a lot warmer than normal and feel tired.
Skin		• Normal temperature or is only a little bit warmer and not sweaty.	• A little bit warmer than normal and might be a little sweaty.	• Much warmer than normal and might be sweaty.
Mind		• You might feel very alert. Has no effect on concentration.	• Require some concentration to complete.	• Requires a lot of concentration (almost full) to complete.

Appendix B.3 – Cross Tabulation of Physical Activity Status and Perceived and Objective Proximity to Physical Activity Facility (30-minute wheel)

Mild LTPA

Mild LTPA		Perceived Proximity	Objective Proximity		Total
			No	Yes	
Inactive		No	5	16	21
		Yes	1	18	19
	Total		**6**	**34**	**40**
Active		No	2	3	5
		Yes	1	3	4
	Total		**3**	**6**	**9**

Moderate LTPA

Moderate LTPA		Perceived Proximity	Objective Proximity		Total
			No	Yes	.00
Inactive		No	4	16	20
		Yes	0	16	16
	Total		**4**	**32**	**36**
Active		No	3	3	6
		Yes	2	5	7
	Total		**5**	**8**	**13**

Heavy LTPA

Heavy LTPA		Perceived Proximity	Objective Proximity		Total
			No	Yes	
Inactive		No	4	16	20
		Yes	0	15	15
	Total		4	31	35
Active		No	3	3	6
		Yes	2	6	8
	Total		5	9	14

Total LTPA

Total LTPA	Perceived Proximity	Objective Proximity		Total
		No	Yes	
Inactive	No	3	12	15
	Yes	0	11	11
	Total	**3**	**23**	**26**
Active	No	4	8	12
	Yes	2	10	12
	Total	**6**	**18**	**24**

Appendix C

Study 2 Materials

Appendix C.1 TPB Questionnaire

Appendix C.2 Modified Neighbourhood Environment Walkability Scale

Appendix C.1 – TPB Questionnaire

Attitudes:

To what extent do you think that participating in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next month would be:

Extremely Unenjoyable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Enjoyable
Extremely Harmful	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Beneficial
Extremely Unpleaseant	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Pleasant
Extremely Bad	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Good
Extremely Stressful	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Relaxing
Extremely Worthless	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Valuable

Subjective Norms:

1. To what extent do you agree with the following statement?:
   Most people who are important to me think I should participate in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next month.

Strongly Disagree	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Strongly Agree

2. To what extent do you agree with the following statement?:
   Most people who are important to me approve of me participating in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next month.

Strongly Disagree	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Strongly Agree

Perceived Behavioural Control:

1. How much personal control do you feel you have over whether you participate in moderate to heavy LTPA for at least 30 minutes on 3 days of the week, over the next month?

Very Little Control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Complete Control

2. To what extent do you agree with the following statement?:
   Whether or not I participate in moderate to heavy LTPA for at least 30 minutes on 3 days of the week, over the next month is entirely up to me.

Strongly Disagree	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Strongly Agree

3. How much do you feel that whether you participate in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next month is out of your control?

Completely Out of My Control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Completely Under My Control

4. How confident are you that you will be able to participate in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next month?

Very Unconfident	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very Confident

5. To what extent do you see yourself as being capable of participating in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next month?

Very Unlikely	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very Likely

Intentions:

1. To what extent is the following statement true for you?:
   I will try to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next month.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

2. To what extent is the following statement likely?:
   I intend to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next month.

Extremely Unlikely	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Likely

Appendix C.2 - Modified Neighbourhood Environment Walkability Scale

"For the purpose of this questionnaire, please consider your neighbourhood to mean:

- places you could get to using your wheelchair in 30 minutes
- places you could drive to in 15 minutes

"For each question, tell me if you agree or disagree. I will then follow up by asking if you strongly or somewhat agree/disagree."

(a) **There are sidewalks on most of the streets.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree ☐* N/a

(b) **The sidewalks are well maintained (paved, even, few cracks).**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(c) **The sidewalks are separated from the road/traffic by parked cars.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(d) **There is a grass/dirt strip that separates the streets from the sidewalks.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(e) **Most of the sidewalks have ramps.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(f) **Trees give shade for the sidewalks.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(g) **There are paved pathways or trails that are easy to get to.** *

☐ ☐ ☐ ☐

Strongly Disagree Somewhat Disagree Somewhat Agree Strongly Agree

(h) **There are trees along the streets.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(i) **There are many interesting things to look at while wheeling/pushing.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(j) **My neighbourhood is generally litter free.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(k) **There are many attractive natural sights.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

(l) **There are attractive buildings/homes in my neighbourhood.**

☐ Strongly Disagree ☐ Somewhat Disagree ☐ Somewhat Agree ☐ Strongly Agree

Appendix D

Study 3 Materials

Appendix D.1	Leisure-Time Physical Activity Recall
Appendix D.2	Intentions and Entreaty Statement
Appendix D.3	Coping Self-Efficacy Measures
Appendix D.4	Action Control Measure
Appendix D.5	Manipulation Checks
Appendix D.6	Intervention Scripts
Appendix D.7	Physical Activity Tool kit Materials
Appendix D.8	Sample Action Planning Calendar
Appendix D.9	Sample Coping Planning
Appendix D.10	Sample Log book
Appendix D.11	Pilot Study Materials

Appendix D.1 -Leisure-Time Physical Activity Recall

I am going to ask you about the time you spent engaging in mild, moderate, and heavy intensity LTPA in the last **7 days**. Recall that Leisure Time Physical Activity (LTPA) is physical activity that you **choose** to do during your **free time**, such as exercising, playing sports, gardening, and taking the dog for a walk (necessary physical activities such as physiotherapy, grocery shopping, pushing/wheeling for transportation are not considered LTPA).

1. Keeping in mind that **mild intensity LTPA** requires very light physical effort. Mild intensity activities make you feel like you are working a little bit, but you can keep doing them for a long time without getting tired.

   During the last 7 days, on **how many days** did you do mild intensity LTPA? _______

   On those days, **how many minutes** did you usually spend doing mild intensity LTPA? ______

2. Recalling that **moderate intensity LTPA** requires some physical effort. Moderate intensity activities make you feel like you are working somewhat hard, but you can keep doing them for a while without getting tired.

   During the last 7 days, on **how many days** did you do moderate intensity LTPA? _______

   On those days, **how many minutes** did you usually spend doing moderate intensity LTPA? ______

3. As you know, **heavy intensity LTPA** requires a lot of physical effort. Heavy intensity activities make you feel like you are working really hard, almost at your maximum. You cannot do these activities for very long without getting tired. These activities may be exhausting.

   During the last 7 days, on **how many days** did you do heavy intensity LTPA? _______

On those days, **how many minutes** did you usually spend doing heavy intensity LTPA? ______

Appendix D.2 - Intentions and Entreaty Statement

Often when we indicate intentions for future behaviour, we have in mind optimal or ideal circumstances that may not adequately consider the many barriers to activity that we often encounter every week. Examples may include: having no one to help you exercise, unexpected social opportunities, getting sick or just feeling tired.

Please take a few minutes to consider what your upcoming 5 weeks are really going to be like and answer the following questions….. "

1. To what extent is the following statement true for you?:
   I will try to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next 5 weeks.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

2. To what extent is the following statement likely?:
   I intend to do at least 30 minutes of moderate to heavy LTPA on 3 days of the week over the next 5 weeks.

Extremely Unlikely	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Extremely Likely

Appendix D.3 - Coping Self-Efficacy Measures

"Now I am going to ask you some questions about your confidence to participate in LTPA under various conditions. For these questions, I'd like you to rate your confidence on a scale of 1-7 where:

1 = not at all confident
4 = moderately confident
7 = completely confident

General Barriers Self-Efficacy:

Assuming you were very motivated, how confident are you that you will participate in moderate to heavy LTPA for at least 30 minutes on 3 days of the week over the next 5 weeks if:

	Not at all Confident 1	2	3	Moderately Confident 4	5	Completely Confident 6	7
(a) you feel tired or fatigued	☐	☐	☐	☐	☐	☐	☐
(b) you get busy or have limited time	☐	☐	☐	☐	☐	☐	☐
(c) you have transportation problems	☐	☐	☐	☐	☐	☐	☐
(d) you have pain or soreness	☐	☐	☐	☐	☐	☐	☐
(e) the weather is very bad	☐	☐	☐	☐	☐	☐	☐
(f) you do not have someone to help you exercise	☐	☐	☐	☐	☐	☐	☐

Facility Barriers Self-Efficacy

Assuming you were very motivated and were going to exercise at a fitness center, how confident are you that you can do the following:

	Not at all Confident 1	2	3	Moderately Confident 4	5	Completely Confident 6	7
(a) transfer on/off narrow equipment benches	☐	☐	☐	☐	☐	☐	☐
(b) maneouver your wheelchair around equipment	☐	☐	☐	☐	☐	☐	☐
(c) find someone knowledgeable to help you	☐	☐	☐	☐	☐	☐	☐
(d) not worry about other people watching you	☐	☐	☐	☐	☐	☐	☐
(e) find equipment that you can use	☐	☐	☐	☐	☐	☐	☐
(f) find an exercise program that meets your needs	☐	☐	☐	☐	☐	☐	☐

<u>Scheduling Self-Efficacy</u>

Assuming that you were very motivated, over the next 5 weeks, how confident are you that you can fit 30 minutes of moderate to heavy LTPA in your weekly schedule:

	Not at all Confident 1	2	3	Moderately Confident 4	5	Completely Confident 6	7
(a) Once per week	☐	☐	☐	☐	☐	☐	☐
(b) Twice per week	☐	☐	☐	☐	☐	☐	☐
(c) Three times per week	☐	☐	☐	☐	☐	☐	☐
(d) More than three times per week	☐	☐	☐	☐	☐	☐	☐

Appendix D.4 - Action Control Measure

"To what extent are the following statements true for you?"

1. I constantly monitor whether I engage in LTPA often enough.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

2. I am careful to ensure that I am active for at least 30 minutes at a moderate to heavy intensity, each time I engage in LTPA.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

3. My physical activity program is often on my mind.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

4. I am constantly aware of my physical activity program.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

5. I really try to engage in LTPA regularly.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

6. I try my best to meet my own standards for being physical active.

Definitely False	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Definitely True

Appendix D.5-Manipulation Checks

Action Planning Frequency:

The following questions refer to the last 5 weeks and the LTPA plans that you have made within this period.

1. Within the last 5 weeks, how often have you changed the details of your LTPA plans regarding **when** to participate in LTPA?

Not at all	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very often

2. Within the last 5 weeks, how often have you changed the details of your LTPA plans regarding **where** to participate in LTPA?

Not at all	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very often

3. Within the last 5 weeks, how often have you changed the details of your LTPA plans regarding **what types of activities to do?**

Not at all	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very often

4. Within the last 5 weeks, how often have you changed the details of your LTPA plans regarding **how often** to participate in LTPA?

Not at all	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	Very often

Health-Related Break from LTPA:

1. Over the past 5 weeks, did you have to take a break from your LTPA due to any health-related problems?

   O YES O No

2. Can you tell me the specific health-related problem(s)?

   ____

3. How long did each health problem affect your LTPA?

Health Problem	*# of Days LTPA affected*

Coping Planning Manipulation:

Please answer the following questions:

1. Over the past 10 weeks, I made a detailed plan for dealing with any anticipated barriers that I felt would interfere with my exercise plans?

   O YES O No

2. Can you list for me the specific barriers you had anticipated would interfere with your LTPA?

   ____

   ____

   ____

   ____

3. For each barrier you listed in the previous question, can you tell me what your coping plan was?

Barrier	***Coping Plan***

Appendix D.6 - Intervention Scripts

Action Planning Script

The following script will be used for both the action planning only and combined groups:

Over the next four weeks I would like you to try to do 30 minutes of leisure-time physical activity 3 times a week. Let's create a plan to help you reach this goal. I will write down the plan and send you a copy by e-mail.

I would like you to really think about the next 4 weeks. For each week, I would like you to choose 3 days when you think you would be able to engage in 30 minutes of LTPA. Remember that you can break up the 30 minutes throughout the day.

Starting with today, what 3-days in the next week do you think you will be able to do 30-minutes of LTPA? Keep in mind all 30-minutes do not have to be done at one time. **Also, to avoid injuries, we strongly recommend gradually increasing your exercise frequency and duration to a maximum of 3 days for 30 minutes each day.**

Starting with Day 1, can you tell me the activity you plan on doing, as well as where the activity will take place, what time you plan on exercising, and at what intensity? Remember that the more precise, concrete and personal you formulate your plans, the more they will help you.

For each day participants should specify

What:
Where:
When:
Duration:
Intensity:

Great, now let's do the same thing for the next two days. Over the remaining 3 weeks, do you plan on keeping the same weekly fitness routine?

If YES:
"Great! I will be sure to send this information to you so you can refer to your exercise plans."

If NO:
"Okay. Let's make your exercise plans for the following 3 weeks."

****Action Planning Only Group:**

"Great! I will be sure to send this information to you so you can refer to your exercise plans."

"I would like you to try to memorize your plans carefully. Visualize the situations and your planned actions and make a firm commitment to act as planned."

Coping Planning Script

****For the combined group, the following script will be used to deliver the coping planning intervention:**
"To begin, I would like you to think about any obstacles or barriers which may interfere with the implementation of your exercise plans. Can you identify three obstacles for me?"

[Participant will describe three obstacles/barriers which the researcher will record on the coping planning sheet.]

"Now I would like you to think about *how* you could successfully cope with such problems. Specifically, I would like you to make a plan about how you would deal with these situations. Remember that the more precise, concrete and personal you formulate your plans, the more they will help you."

Example of Some Possible Barriers and Suggested Coping Plans:

BARRIER	***COPING PLAN***
No accessible facility nearby	- I will use the equipment I have at home (e.g., theraband, arm weights) - I will go for a wheel outside. If it is snowy or too cold, I will wheel in the mall in the morning
Pain	- I will keep in mind that if I exercise safely it will not make may pain worse. It might even lessen the negative effects associated with pain such as feeling anxious and depressed
Lack of Transportation	- I will keep in mind that I don't have to go to a gym to do exercise. I can find ways to get active in my home (i.e., put on an exercise video, wheel up and down the hallways of my apartment building) - I will use the equipment I have at home
No exercise buddy	- I will purchase an exercise video that is suitable for people with SCI
Do not have anyone to help me exercise	- I will contact a local school or university to see if there are student volunteers that will help me.

[Researcher will record a coping plan for each barrier that the participant identifies (Please refer to the "Suggested Coping Plan" example for some ideas to give to the participant).]

Following the coping planning intervention:

“Great! I will be sure to send this information to you so you can refer to your exercise plans.”

“I would like you to try to memorize both your action plans and coping plans carefully. Visualize the situations and your planned actions and make a firm commitment to act as planned.”

Appendix D.7 – Physical Activity Toolkit Materials

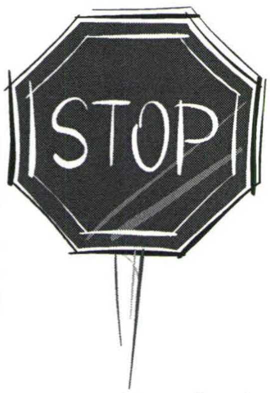
Safety First

When participating in any type of physical activity, it is important to remember some basic safety techniques:

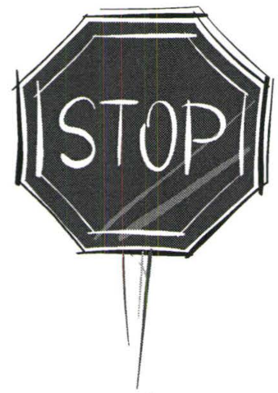
- **Get the OK from you doctor**.
  Inform your Family Physician about your plans for a home exercise program. Your doctor may have some precautions or recommendations for you to consider.
- **Dress the part.**
  Wear comfortable, loose-fitting clothing and shoes.
- **Check your environment.**
  Choose a spot in your home that is spacious and clear of obstacles.
- **Monitor yourself.**
  Exercising alone means being responsible for yourself. Use the talk test throughout your workout - can you talk without gasping for air? If not, it's time to take a break.
- **Pace yourself.**
  Start your program off slowly and progress at an even rate during each workout and between workouts.
- **Warm-Up.**
  Remember to do light endurance work before your strength or flexibility exercises to ensure your muscles are warm.
- **Cool-Down.**
  Complete some gentle stretching and ensure your breathing has returned to normal before you stop.
- **Keep hydrated.**
  Be sure to drink lots of fluids while partaking in activities and after you are done.

When participating in physical activity, it is important to listen to your body. If you experience prolonged muscle and/or joint soreness, stop doing the activity that is causing the pain and consult your physician.

If you feel sign or symptoms of autonomic dysreflexia stop doing the activity immediately and determine the cause of the reaction.



Signs and Symptoms of Autonomic Dysreflexia



- Pounding headache (caused by the elevation in blood pressure)
- Goose Pimples
- Sweating above the level of injury
- Nasal Congestion
- Slow Pulse
- Blotching of the Skin
- Restlessness

- Hypertension (blood pressure greater than 200/100)
- Flushed (reddened) face – not resulting from participating in physical activity
- Red blotches on the skin above level of spinal injury
- Sweating above level of spinal injury
- Nausea
- Slow pulse (< 60 beats per minute)
- Cold, clammy skin below level of spinal injury

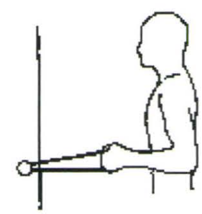
What to do if you think you are experiencing autonomic dysreflexia

- Initiate treatment quickly to prevent complications
- Remain in a sitting position, but do a pressure release immediately. You may transfer yourself to bed, but always keep your head elevated.
- Identify and remove the cause
    - Since a full bladder is the most common cause, check the urinary drainage system.
    - Bowel and skin might also be a cause.
- If the symptoms do not go away, consult a physician immediately

Some exercises for you to try

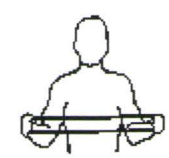
Using the large yellow rubber strip included in your Physical Activity Toolkit, tie the ends of the strip in a knot to form a large circular band. Then try the following exercises:

A. Sit in front of a secured door and place one end of the rubber band around the doorknob. Hold the other end of the rubber band in your hand or loop it around your wrist. Keeping your elbow flexed at a 90-degree angle, pull your arm back away from the door against the resistance of the band. Release the tension of the band slowly as you return to the starting position. Repeat this exercise 20 times. DO NOT CAUSE PAIN. DO NOT HOLD YOUR BREATH.

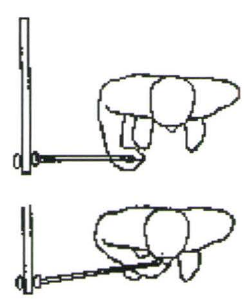


B. Sit with your side next to a secured door. Place one end of the rubber band around a doorknob. Hold the other end of the band in your hand or loop it around your wrist. Push the band forward until you encounter resistance from the band. Slowly release the tension until your arm is in the starting position. This exercise should be repeated 20 times. DO NOT CAUSE PAIN. DO NOT HOLD BREATH.

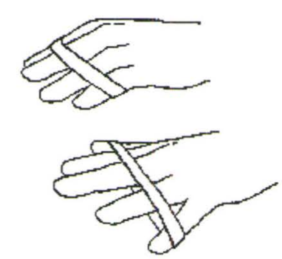
C. Keeping your elbows by your sides, bent to a 90-degree angle, place the rubber around your hands in front of your body. Try to pull your hands away from each other thereby placing resistance on the band. Slowly release the tension on the band, allowing your hands to resume their starting position. DO NOT CAUSE PAIN. DO NOT HOLD BREATH.



D. Sit with your right side by a securely closed door. You should be approximately 18" away from the door. Place one end of the rubber band around the doorknob and hold the other end in your hand or loop it around your wrist. Keeping your elbow by your side, pull the band toward your stomach. Slowly release the band, allowing your arm to return to the starting position. The elbow must stay on the waist at all times. DO NOT CAUSE PAIN. DO NOT HOLD YOUR BREATH.



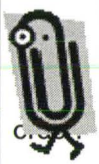
E. Place a wide office rubber band around the tips of all five fingers. Spread the fingers apart from each other as far as you can. Slowly release the tension of the rubber band, returning your hand to its starting position. You should do this at least 50 times a day. Very gradually, work up to 200 finger extensions per day. DO NOT CAUSE PAIN.



Appendix D.8 - Sample Action Planning Calendar

Initials: **email:**

ACTION PLAN
NOVEMBER 2007



SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Remember, the details for your exercise plan are presented in the following Where (P) When (T) # of Minutes (M) Activity (A) Intensity (I)				1 P:YMCA T: 3:00pm M: 30 A: Swimming I: moderate	2 P: T: M: A: I:	3 P: YMCA T: 12:00pm M: 45 A: weights I: ½ moderate, ½ heavy
4 P: T: M: A: I:	5 P: YMCA T: 12:00pm M: 45 A: weights I: ½ moderate, ½ heavy	6 P: T: M: A: I:	7 P: T: M: A: I:	8 P:YMCA T: 3:00pm M: 30 A: Swimming I: moderate	9 P: YMCA T: 12:00pm M: 45 A: weights I: ½ moderate, ½ heavy	10 P: T: M: A: I:

Appendix D.9 - Sample Coping Planning

Below you will find three barriers and/or obstacles which you thought may potentially interfere with the implementation of your exercise plans. For each barrier, you have outlined a plan which could be used to help you cope with such a problem. Please take a moment to read over these coping plans. Try to visualize the situations and your planned actions and make a firm commitment to act as planned!

BARRIER/OBSTACLE	***COPING PLAN***
Unforeseen appointments (e.g., business, doctor appointments)	If this barrier tempts me to not exercise, I plan to… ***reschedule the exercise to a different day***.
Muscle soreness/Pain	If this barrier tempts me to not exercise, I plan to… ***avoid activities that cause pain and/or modify the exercises so they don't cause any further soreness or pain.***
Feeling Tired	If this barrier tempts me to not exercise, I plan to… ***remind myself that the best medicine for fatigue is fresh air and that I will feel rejuvenated with a wheel outside.***

Appendix D.10 - Sample Log book

LOGBOOK INSTRUCTIONS

Tracking Your Progress

***LEISURE-TIME PHYSICAL ACTIVITY* includes all of the activities that you choose to do during your free time that require physical exertion. Leisure-time physical activity does not include activities such as physio, shopping, stretching, cleaning and other activities of daily living**

Instructions

At the end of each day please record a few details about the leisure-time physical activities you did over the course of the day. Did you choose to do several short bouts or one long bout? Whatever it may be, please keep track of it in the logbook included below. If you are not active on a particular day simply place an X in the box that says "*none.*"

For each activity please provide the following information:

- What – what type of activity did you did (e.g., wheeling, theraband exercises)?
- When – what time did you do the activity at?
- Duration – how many minutes did you do the activity for?
- Intensity – based on the colourful intensity definition sheet, how hard were you working? If the intensity changed during the activity please indicate how many minutes you spent at each intensity.

At the end of the 5 weeks you will be asked to return your logbook to Kelly via e-mail.

If you have any questions please contact

Kelly Arbour
(905)525-9140 ext. 27624
arbourkp@mcmaster.ca

Sample Logbook Page

Mary's Daily Activity Log - Week 1

Friday December 19, 2003 None ∋

Details	Activity 1	Activity 2	Activity 3	Notes
What				
Duration	Minutes	minutes	minutes	
Intensity				
Other:				

Saturday December 20, 2003 None ∋

Details	Activity 1	Activity 2	Activity 3	Notes
What				
Duration	Minutes	minutes	minutes	
Intensity				
Other:				

Sunday December 21, 2003 None ∋

Details	Activity 1	Activity 2	Activity 3	Notes
What				
Duration	Minutes	minutes	minutes	
Intensity				
Other:				

Monday December 22, 2003 None ∋

Details	Activity 1	Activity 2	Activity 3	Notes
What				
Duration	Minutes	minutes	minutes	
Intensity				
Other:				

Appendix D.11 - Pilot Study Materials

MESSAGE QUALITY QUESTIONNAIRE

INSTRUCTIONS: Please keep in mind the pamphlet "Physical Activity for Persons with a SCI" you just read when answering the following questions.

Please CIRCLE the number that best describes your answer.

1. The pamphlet was informative.

1	2	3	4	5	6	7
Strongly DISAGREE						**Strongly AGREE**

2. The information in the pamphlet was aimed at people like me.

1	2	3	4	5	6	7
Strongly DISAGREE						**Strongly AGREE**

3. The information in the pamphlet was believable.

1	2	3	4	5	6	7
Strongly DISAGREE						**Strongly AGREE**

4. The pamphlet was easy to read.

1	2	3	4	5	6	7
Strongly DISAGREE						**Strongly AGREE**

5. The pamphlet was easy to understand.

1	2	3	4	5	6	7
Strongly DISAGREE						**Strongly AGREE**

6. The information in the pamphlet was accurate.

1	2	3	4	5	6	7
Strongly DISAGREE						**Strongly AGREE**

Physical Activity for Persons with a SCI Pamphlet

Getting Started

One of the most challenging tasks of becoming more active is getting started. Here are some tips to help you along the path to a physically active lifestyle:

Start with a plan

- Create *a weekly* exercise plan. Make sure to include *as much detail as possible* (e.g., the activity, where you will do the activity, what time, what day)

Monday	Tuesday	Wednesday
8:00– 8:15am: Moderate wheeling around the neighbourhood with the dog 4:00– 4:15am: Heavy arm lifts using wrist weights in the living room	Rest	12:00–12:30pm Moderate swimming with Sandy at the YMCA

Know your limits

- Ease into your exercise program to avoid injuries and minimize pain
- Know that some initial discomfort is normal
- Avoid exercising 3 days in a row
- Beginners should avoid exercising > 3 days/week or over 30 minutes at a time
- Break up your fitness routine throughout the day (e.g., 15 minutes in the morning, 15 minutes in the evening)

"Recently, I followed the advice of my doctor and family to join the local YMCA. Although I was a little nervous at first that other members would be watching me, I quickly got over my fear. In fact, I have met so many wonderful people. The staff are always willing to help me with any of the machines, and to give me advice on how I can achieve my fitness goals. Not to mention I have also been able to provide them with some feedback about fitness programs that would be of interest to the larger disability community." (N.K. L1 injury)

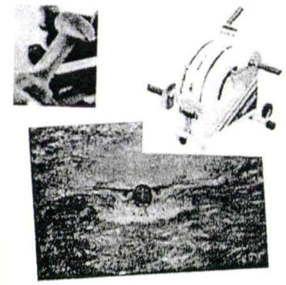
Here are some groups who encourage physical activity among people with SCI:

National Center for Physical Activity and Disability (NCPAD)
www.ncpad.org/ **Check out their exercise videos

Canadian Paraplegic Association
www.canparaplegic.org/en/

Active Living Alliance for Canadians with a Disability
www.ala.ca/content/home.asp

Canadian Wheelchair Sports Association
www.cwsa.ca/home.html



Physical Activity for Persons with a Spinal Cord Injury

Tips and Strategies for Meeting Your Physical Activity Goals

McMaster University

Inspiring Innovation and Discovery

Key Factors to Consider When Choosing the "Right" Fitness Center

While it may seem at first to be a hard task, finding the fitness center that meets your needs and interests is possible. Here are some key factors that you should consider when choosing a fitness center:

1. Location

Generally, the easier it is for you to get to the facility, the more often you will use it. Try looking for a facility that is close to your home or workplace.

2. Type

A variety of fitness centers are available. Multipurpose facilities (e.g., YMCA) often include swimming pools, squash/racquetball courts, exercise equipment, and other amenities (e.g., juice bars, daycare). Gyms tend to focus more on strength-training and aerobic exercises, and usually include equipment and offer fitness classes.

3. Cost

Most facilities require you to pay a fixed amount to join. This membership fee can be paid either in full or in (monthly) installments. Make sure you understand what is included in the fee, and don't be afraid to ask questions!

4. Equipment/Classes

Most fitness centers provide a variety of equipment, such as free weights, strength-training machines, treadmills, seated bikes, resistance balls, and padded mats.

If a facility doesn't provide the services you want, contact other facilities until you find the one that's right for you!

Benefits of Exercise

- Increased muscle strength
- Greater physical independence
- Decreased reports of chronic pain
- Greater chance of returning to work
- Increased perceptions of social support
- Enhanced health perceptions

What Activities Can I Do?

Whether you plan on exercising at home or at a facility, there are many suitable activities that you can do. Here are a few suggestions:

Activities that Can be Done at Home:

ACTIVITY	***WHAT DO I NEED?***
Wheeling or Walking	• Wheelchair/walker/cane • A safe place (e.g., neighbourhood, park, hallway)
Arm or Leg Lifts	• Free weights/wrist or ankle weights • Water bottles
Stomach crunches	• Chair/wheelchair
Aerobics/Yoga	• Exercise videos specific for people with SCI (see NCPAD website on the back)

"I used to think that exercise was too difficult, especially given the pain with my SCI. About 6 months ago though, I started to include physical activity into my daily routine. Every Monday is "manual Monday" which means I use my manual chair to get around. I have started to gradually include other activities, like 30 minutes of seated stomach crunches and arm lifts (using wrist weights) for 3 days per week. Now, wheeling and transfers are definitely easier to do. My arms are much more toned, and I have so much energy to do the things I really enjoy." (K.L. C4/C5 injury)

Activities that Can be Done at an Exercise Facility:

ACTIVITY	***WHAT DO I NEED?***
Swimming	• Pool • Assistant or volunteer
Aerobic Exercises	• Arm-crank ergometer • Recumbent bike • Fitness classes (speak with the fitness coordinator to discuss the classes that would be most appropriate and of interest to you)
Strength Training	• Free weights • Multi-station cable equipment • Medicine balls

Be sure to inform your doctor about your plans for an exercise program as he or she may have some cautions for you to consider.