RUNNING HEAD: PHYSICAL ACTIVITY AND SPINAL CORD INJURY

Developing Physical Activity Interventions for Adults with Spinal Cord Injury.

Part 1: A Comparison of Social Cognitions Across Actors, Intenders and Non-Intenders

Kathleen A. Martin Ginis and Jennifer R. Tomasone
McMaster University

Amy E. Latimer-Cheung
Queen's University

Kelly P. Arbour-Nicitopoulos and Rebecca L. Bassett-Gunter
McMaster University

Dalton L. Wolfe
University of Western Ontario

Abstract

Objective: This paper is the first in a three-part series focused on designing theory-based interventions to increase leisure time physical activity (LTPA) in persons with SCI. The purpose of this first study was to compare social cognitions for leisure time physical activity (LTPA) between people classified as LTPA actors, intenders, and non-intenders, as per Schwarzer's Health Action Process Approach (HAPA) model. **Method:** Participants were 238 men and women living with a spinal cord injury (M age = 44.14, SD = 12.74; 44.5% paraplegic) who were subsequently classified as LTPA actors (n = 105), intenders (n = 73), or non-intenders (n = 60). Participants completed a questionnaire that assessed the following HAPA constructs: LTPA outcome expectancies, self-efficacy, intentions, planning, and action control. **Results:** A MANCOVA revealed significant between-group differences for all variables ($ps < .001$). For all of the measures, actors scored significantly higher than intenders who, in turn, scored significantly higher than non-intenders. **Conclusion/Implications:** It is both theoretically and practically important to distinguish between LTPA non-intenders, intenders, and actors when developing LTPA-enhancing interventions for people with SCI. These distinctions inform the design and testing of the interventions reported in the two accompanying papers.

KEYWORDS: leisure time physical activity; exercise; paraplegia; tetraplegia; Health Action Process Approach

Developing Physical Activity Interventions for Adults with Spinal Cord Injury.

Part 1: A Comparison of Social Cognitions Across Actors, Intenders and Non-Intenders

Impact

- The strength of social cognitions for leisure time physical activity (LTPA) differs across individuals who do not intend to be active (i.e., non-intenders), who intend to be active but are not yet engaging in activity (i.e., intenders), and those are currently active (i.e., actors). While this relationship has been previously examined among orthopaedic outpatients, cardiac rehabilitation patients, and Chinese college students, this is the first study to explore whether social cognitions for LTPA vary systematically across actors, intenders, and non-intenders among individuals with spinal cord injury (SCI).
- The study confirms that among individuals with SCI, actors have stronger LTPA-related social cognitions than intenders and non-intenders, and intenders have stronger LTPA-related cognitions than non-intenders.
- It is theoretically and practically meaningful to target key social cognitions when developing LTPA-enhancing interventions for moving people with SCI through the behavior change process.

Among people with spinal cord injury (SCI), leisure-time physical activity (LTPA) has been associated with a wide range of physical and psychological health benefits (Jacobs & Nash, 2004; Martin Ginis, Jetha, Mack, & Hetz, 2009). Yet, in a recent study of nearly 700 men and women with SCI, 50% reported no LTPA whatsoever (Martin Ginis et al. 2010a). Of the 50% who reported at least some LTPA, the majority was insufficiently active to reap fitness benefits (Martin Ginis et al., 2010b). These data highlight a need for at least two different types of LTPA-enhancing interventions in the SCI community: interventions to help people *initiate* LTPA, and interventions to assist somewhat active people *increase and maintain* their LTPA.

The notion of developing different interventions for people at different points on the LTPA spectrum is consistent with a stage model approach to behavior change. Stage models propose that individuals can be classified into discrete stages of action readiness and that behavior change interventions are most effective when they target variables associated with a particular stage-defined group (Abraham, 2008). In contrast, continuum models (e.g., Social Cognitive Theory, Bandura, 1997; Theory of Planned Behavior, Ajzen, 1985) assume that behavior change occurs in a linear fashion, whereby individuals move along a range that reflects their likelihood of taking action. With this type of model, behavior change interventions target *all* variables that are known to predict action, without considering the needs of subgroups (cf. Schwarzer, Lippke, & Luszczynska, 2011).

The Transtheoretical Model (TTM; Prochaska, DiClemente, & Norcross, 1992) has been the most widely applied stage model, but it has also been widely criticized. One key criticism is that the five TTM stages are not qualitatively different, but rather arbitrary subdivisions of a continuous behavior change process (Weinstein, Rothman & Sutton, 1998; Sutton, 2001). Another recurring criticism is that stage categorization is based on the passage of time and

relatively arbitrary temporal benchmarks (Bandura, 1997). One moves from the action into the maintenance stage, for instance, after performing the target behavior at criterion levels for 6 months (Prochaska et al., 1992). It is not clear how someone who has been active for 5.5 months is qualitatively different from someone who has been active for 6.5 months. Furthermore, getting people to move from the action to the maintenance phase is more complicated than the simple passage of time, and the TTM cannot fully account for this transition (Bandura, 1997). As a result of these and other criticisms, some authors have recommended abandoning the model altogether (Sutton, 2001; West, 2005).

An alternative stage model--the Health Action Process Approach (HAPA; Luszczynska & Schwarzer, 2005; Schwarzer, 2008a)--has shown considerable promise for guiding the development of LTPA-enhancing interventions among people with SCI (Arbour-Nicitopoulos, Martin Ginis, & Latimer, 2009) and other types of disabilities and chronic health conditions (for a review, see Schwarzer et al., 2011). Unlike the TTM, the HAPA has both a continuum layer and a phase layer (note that Schwarzer [2008a; Schwarzer et al., 2011] uses “phase” and “stage” interchangeably). The continuum layer captures all of the HAPA variables simultaneously and is useful when designing studies to examine predictors of behavior change. The phase layer conceptualizes the behavior change process as consisting of motivational (goal-setting) and volitional (goal-pursuit) phases, and is useful for designing stage-matched interventions (Schwarzer et al., 2011).

In each phase of the HAPA (and unlike the TTM), a different set of social cognitive predictors is important to the behavior change process (Schwarzer, 2008a). This principle has been empirically demonstrated and supports the existence of qualitatively different phases within the model (Schwarzer et al., 2011). In the motivational phase, risk perceptions, outcome

expectancies, and task self-efficacy are important cognitions to change because people in this phase do not yet have an intention to act (i.e., “non-intenders”), and these cognitions influence the formation of intentions. Consistent with the continuum approach, strengthening these cognitions increases the likelihood of intention formation. Once there is an intention to act, people move into the volitional phase. In this phase, the key determinants of behavior change are the cognitions and self-regulatory strategies necessary for translating intentions into action, specifically: action and coping planning, action control, and maintenance and recovery self-efficacy. Strengthening these variables increases the likelihood of action. Schwarzer (2008a) has noted that it is theoretically and practically meaningful to further subdivide the volitional phase into those who have an intention but are not acting on it (i.e., “intenders”) and those who are already performing the intended behavior (i.e., “actors”). Thus, the health behavior change process yields three groups – non-intenders, intenders, and actors. In contrast to the demarcation of the TTM stages, these HAPA groups are not distinguished by the simple passage of time, but rather the psychological variables of intention and behavior (Schwarzer, 2008).

It has been suggested that the strength of social cognitions for physical activity differ between these groups, and that stronger social cognitions correspond with progression through the phases (Schwarzer, 2008a). In the first study to examine this possibility, Lippke, Ziegelman and Schwarzer (2005) measured exercise-related social cognitions in a sample of orthopaedic outpatients. They predicted a pattern of between-groups differences based on the HAPA tenets. As hypothesized, they found that actors had significantly greater exercise self-efficacy (a combined measure of task and maintenance self-efficacy) and intentions than intenders who, in turn, had significantly greater exercise self-efficacy and intentions than non-intenders. Both actors and intenders scored similarly, and significantly higher than non-intenders, on a measure

of exercise planning. However, contrary to hypothesis, non-intenders did not have lower outcome expectations than actors and intenders.

Subsequent research involving cardiac rehabilitation patients (Dohnke, Nowossadeck, & Miller-Fahrnow, 2010) and Chinese college students (Duan, Lippke, Wagner, & Brehm, 2011) has replicated Lippke et al.'s (2005) findings of significantly greater exercise task and maintenance self-efficacy and intentions in intenders than non-intenders, and in actors versus intenders. However, conflicting results have emerged when comparing planning and outcome expectancies across the three groups. For instance, whereas Lippke et al. (2005) found no significant differences between actors and intenders for planning, Duan et al. (2011) found significant differences in planning across all three groups. Likewise, whereas Lippke et al. (2005) found no between-groups differences in outcome expectancies across the three groups, Dohnke et al. (2010) found that the strength of positive outcome expectancies increased significantly from non-intenders to intenders to actors. Given the inconsistent findings to date, further research is needed to determine which social cognitions differ reliably across the three HAPA groups.

Such knowledge would be valuable for developing LTPA-enhancing interventions for people with SCI. Fifty percent of the SCI population is at least somewhat active (Martin Ginis et al., 2010a), and could therefore be considered “actors.” It is not known whether subdividing the inactive 50% into “non-intenders” and “intenders” creates a theoretically and practically meaningful distinction within the SCI population. Furthermore, if the strength of LTPA social cognitions were shown to vary systematically across the three HAPA groups, then these differences would provide impetus for developing interventions to bolster the key cognitions that help people move through the motivational and volitional phases of behavior change.

As such, the purpose of the present study was to compare LTPA social cognitions between people with SCI who were classified as actors, intenders, and non-intenders. Based on previous research comparing physical activity social cognitions across these three HAPA groups (Duan et al., 2011; Dohnke et al., 2010; Lippke et al., 2005), and consistent with HAPA's explicit stage framework (Schwarzer, 2008a), we hypothesized that (1) actors and intenders would report stronger self-efficacy and intentions than non-intenders, and (2) actors would report greater intentions and self-efficacy than intenders. Given the mixed evidence for between-stage differences in planning and outcome expectancies, we reverted to Schwarzer's original, HAPA-driven hypotheses for these variables (Lippke et al., 2005; Schwarzer, 2008a) and hypothesized that: (3) actors and intenders would report greater planning and stronger outcome expectancies than non-intenders; (4) actors and intenders would not differ along measures of planning and outcome expectancies.

Method

Participants

Participants ($N = 242$) were recruited at two SCI research centers from databases of people who had been involved in previous studies. Eligibility criteria included the occurrence of a SCI at least 12 months prior resulting in paraplegia or tetraplegia, the use of a mobility aid outside of the home, and no reported cognitive impairment. The study was approved by the Research Ethics Boards at both institutions. Note that a subset of participants in this study ($n = 160$) are part of a longitudinal cohort study; some of their data were included in a study that used structural equation modeling to prospectively examine Social Cognitive Theory (Bandura, 1997) predictors of LTPA (Martin Ginis et al., 2011).

Measures

Participant Characteristics

The following demographic information was collected from participants: age, years post injury, sex, injury level (paraplegia or tetraplegia), injury severity (“complete” defined as “no motor or sensory function preserved in the sacral segment S4-S5” or “incomplete” defined as “some preservation of neurological function below level of injury”; Maynard et al., 1997), cause of injury, primary mode of mobility, ethnicity, marital status, and highest level of education completed. Leisure-time physical activity (LTPA) was assessed using the 3-day Physical Activity Recall Assessment for People with SCI (PARA-SCI; Martin Ginis, Latimer, Hicks, & Craven, 2005). Participants were asked to indicate the duration (minutes) and intensity of all activities performed in the morning, afternoon, and evening over the past three days. Intensity was self-rated as *heavy* (“activities that require a lot of physical effort that make you feel like you are working really hard, almost at your maximum, and you can only do the activity for a short period of time before getting tired”), *moderate* (“activities that require some physical effort that make you feel like you are working somewhat hard but you feel like you can keep going for a long time”), *mild* (“activities that require very light physical effort that make you feel like you are working a little bit, but you can keep doing them for a long time without getting tired”), or *nothing at all* using the PARA-SCI intensity classification chart (Martin Ginis et al., 2005). Recalled activities were coded by the interviewer as either LTPA (e.g., hand-cycling, swimming), or lifestyle activity (e.g., grooming, household chores). Mean number of minutes per day of moderate and heavy intensity LTPA were then calculated. We focused on moderate and heavy intensity LTPA as this intensity of activity is required for people with SCI to incur fitness benefits (Martin Ginis et al., 2011). The PARA-SCI has been shown to be a reliable and valid measure of LTPA among people with SCI (Latimer, Martin Ginis, Craven, & Hicks, 2006; Martin Ginis et al., 2005).

HAPA Group Classification

HAPA group was determined using a question (adapted from Marcus & Simkin, 1993) that assessed intentions for, and regular participation (i.e., ≥ 30 min/day, ≥ 3 days per week) in, moderate to heavy intensity LTPA, defined as "activities done during one's free time that required some physical effort (moderate) or maximum physical effort (heavy)." Respondents were asked to identify which of the following statements best described them: (A) Yes, I have been doing LTPA regularly for MORE than 6 months, (B) Yes, I have been doing LTPA regularly for LESS than 6 months, (C) No, but I intend to start doing LTPA regularly in the next 30 days, (D) No, but I intend to start doing LTPA regularly in the next 6 months, or (E) No, and I do NOT intend to start doing LTPA regularly in the next 6 months. Participants were classified as *actors* if they had been doing LTPA regularly (A or B), *intenders* if they did not regularly engage in moderate or heavy LTPA but intended to start (C or D), and *non-intenders* if they did not engage in moderate to heavy LTPA regularly and had no intentions of starting in the next 6 months (E).

Social Cognitive Variables: Motivational Phase Constructs

LTPA Outcome Expectancies were assessed using six adjective pairs (beneficial-harmful, valuable-worthless, good-bad, relaxing-stressful, enjoyable-unenjoyable, pleasant-unpleasant). Items were preceded by the statement "To what extent do you think that participating in moderate to heavy LTPA for 30 minutes, at least 3 days per week, over the next month would be..." The six pairs were rated on a 7-point scale with the verbal anchor "*extremely*" at points 1 and 7. Internal consistency of the scale was acceptable for the current study ($\alpha = .92$).

Task self-efficacy was measured using four separate scales (Bandura, 1997): self-efficacy for (a) moderate intensity aerobic activity, (b) heavy intensity aerobic activity, (c) moderate intensity strength training, and (d) heavy intensity strength training. Participants rated their confidence on a 7-point scale

(1=*not at all confident*; 7=*completely confident*) to engage in each type of LTPA for (a) 10 min, (b) 20 min, (c) 30 min, (d) 45 min, and (e) 60 min, without stopping. To help participants distinguish between task and maintenance self-efficacy, the task self-efficacy question stem included the statement “If you had all of the resources that you need, such as specialized equipment or an assistant, how confident are you that you could...” Alphas were acceptable for the aerobic self-efficacy scales ($\alpha_{\text{moderate}} = .94$; $\alpha_{\text{heavy}} = .93$) and for the strength self-efficacy scales ($\alpha_{\text{moderate}} = .94$; $\alpha_{\text{heavy}} = .93$).

Intentions were assessed by a two-item scale that has been shown to predict LTPA in people with SCI (Latimer, Martin Ginis, & Arbour, 2006; Arbour-Nicitopoulos et al., 2009). The two items were: (a) “I will try to do 30 min of moderate to heavy LTPA at least 3 days per week over the next month.” (1 = *definitely false*; 7 = *definitely true*) and, (b) “I intend to do 30 min of moderate to heavy LTPA at least 3 days per week over the next month.” (1 = *extremely unlikely*; 7 = *extremely likely*). The two intention items were highly correlated ($r = .95$, $p < 0.001$).

Social Cognitive Variables: Volitional Phase Constructs

Planning was assessed by four items that asked participants to indicate the extent to which they had made concrete plans for (a) what type of LTPA to do, and (b) when, (c) where, and (d) how often to do it. Ratings were made on a 7-point Likert scale (1 = *definitely false*; 7 = *definitely true*). This scale has been shown to predict exercise in cardiac patients (Scholz, Sniehotta, & Schwarzer, 2005), and had good internal consistency in the current study ($\alpha = .96$).

Four types of self-efficacy for various aspects of exercise self-regulation were measured using 7-point response scales (1 = *not at all confident*; 7 = *completely confident*). To account for participants’ level of motivation, all items were preceded by the statement “*Assuming you were very motivated, how confident are you that...*” (Blanchard et al., 2003). *Maintenance self-efficacy* was measured with four items that assessed participants’ confidence to overcome obstacles (fatigue, time constraints,

transportation problems, pain, bad weather, lack of support) that may prevent them from engaging in 30 min of moderate to heavy LTPA three days per week in the next month. This measure has demonstrated predictive validity in the SCI population (Arbour-Nicitopoulos et al., 2009; Latimer et al., 2006), and showed good internal consistency in the current study ($\alpha = .85$). *Recovery self-efficacy* was assessed using a 7-item scale that asked participants to rate their confidence to manage lapses in their LTPA program over the next month (translated and modified from measures recommended by Schwarzer; c.f. Sniehotta, Scholz, Lippke & Ziegelmann, 2002; Sniehotta, Scholz, Lippke, Ziegelmann, & Luszczynska, 2003). This scale demonstrated adequate internal consistency in the current study ($\alpha = .79$). *Scheduling self-efficacy* was also measured because it has been shown to mediate the effects of planning on LTPA in people with SCI (Arbour-Nicitopoulos et al., 2009). The four scheduling self-efficacy items measured participants' confidence to fit (a) one, (b) two, (c) three, and (d) four or more bouts of 30 min of moderate to heavy intensity LTPA into their weekly schedule over the next month. This measure has demonstrated predictive validity in people with SCI (Arbour-Nicitopoulos et al., 2009; Latimer et al., 2006) and had good internal consistency in the current study ($\alpha = .92$). Finally, *goal-setting efficacy* was measured because of the relevance of goal-setting to exercise motivation and self-regulation (Shields & Brawley, 2007). Two items assessed confidence to (a) set realistic goals for increasing LTPA, and (b) develop realistic plans to reach LTPA goals over the next month (Shields & Brawley, 2007), and were highly correlated in the present study ($r = .82, p < 0.001$).

Action control was assessed with six items that asked participants to indicate the extent to which LTPA is salient as well as their use of self-regulation strategies (1 = *definitely false*; 7 = *definitely true*; Sniehotta, Scholz, & Schwarzer, 2005). Example items are: "I constantly monitor whether I engage in LTPA often enough," and "I try my best to meet my own standards for being physically active." This scale showed adequate internal consistency in the current study ($\alpha = .84$).

Procedure

All questionnaires were administered over the telephone by a research assistant. After the demographic information was collected, participants were read SCI-specific definitions of moderate and heavy intensity LTPA (Martin Ginis et al., 2005). They then completed the HAPA group classification item. Based on their HAPA group, participants completed a group-relevant questionnaire package. Actors completed a package that included measures of all of the social cognitive variables. Intenders and non-intenders completed all measures except action control and recovery self-efficacy because pilot testing indicated that these questionnaire items were meaningless to inactive people. To minimize respondent burden and frustration, we did not administer these items to intenders and non-intenders. Finally, the PARA-SCI measure of LTPA was administered.

Statistical Analysis

Data were screened for missing values. If a participant was missing a score for one item on a particular scale, the participant's mean score for the completed scale items was calculated and entered as the overall scale score ($n = 3$; two actors and one intender). If a participant was missing all the items on one scale, the participant was given the mean scale score of all participants in the same HAPA group ($n = 16$; six actors, five intenders, and five non-intenders). Four participants (two actors and two non-intenders) were excluded because they were missing all of the items on $\geq$ two scales.

Age and number of years post-injury were compared across the three groups using a one-way ANOVA, followed by Tamhane T2 post-hoc tests. All other demographic variables were compared using a chi-square analysis. A MANCOVA was conducted to test the study hypotheses regarding between-groups differences on the social cognitive variables between actors, intenders and non-intenders controlling for any between-group differences in demographic characteristics. Because Box's

M test indicated significant differences in covariance matrices among the three groups ($p < 0.01$), Pillai's trace was used as the criterion for testing significant multivariate effects. Pillai's criterion is considered robust when the assumption of homogeneity of variance matrices is violated (Tabachnick & Fidell, 1996). Significant multivariate effects were followed up with univariate ANCOVAs, for which alpha was adjusted using the Bonferroni method. Significant univariate ANCOVAs ($p < 0.005$) were followed by pairwise comparisons. Because action control and recovery self-efficacy were measured only in the actor group, analysis of these variables consisted of calculation and interpretation of descriptive statistics.

Results

Participant Characteristics

After excluding four participants due to missing data, 238 participants were included in the analyses and classified as follows: $n = 60$ non-intenders (25%); $n = 73$ intenders (31%); $n = 105$ actors (44%). Characteristics of participants in each group are presented in Table 1.

Overall, participant characteristics were consistent with the Canadian SCI population, indicating a representative sample in terms of age, paraplegia to tetraplegia ratio, and primary mode of mobility (Canadian Paraplegic Association, 2000). Similar to findings from previous LTPA research in the SCI population (Martin Ginis et al., 2010a), a significant between-groups difference was found for the number of years post-injury ($F(2,232) = 8.10, p < .001$). Both intenders and non-intenders were injured longer ago than actors ($ps \leq .01$; Table 1). Highest level of education obtained ($\chi^2(2) = 10.90, p = .004$) also differed significantly, with a greater percentage of actors having completed a post-secondary education (i.e., college, university, or post-graduate) as compared to intenders and non-intenders (see Table 1). As expected, there were significant differences in LTPA across the three groups, $F(2,228) = 47.47, p < .001$. Actors

reported more min/day of moderate and heavy intensity LTPA than intenders and non-intenders ($ps < 0.001$; Table 1). Intenders and non-intenders did not differ on min/day of LTPA.

Group Differences on Social Cognitive Variables

Given the between-groups differences in years post-injury and education, these variables were treated as covariates in the MANCOVA. Education was converted to a binary variable (0 = no post-secondary education; 1 = post-secondary education, i.e., completed college, university, or post-graduate education). There was a significant multivariate effect (Pillai's Trace = .76, $F(20,440) = 13.44$, $p < 0.001$) for HAPA group across the 10 social cognitive variables. However, neither covariate was statistically significant in the MANCOVA (years post injury: Pillai's Trace = .07, $F(10,219) = 1.69$, $p = .08$; highest level of education completed: Pillai's Trace = .07, $F(10,219) = 1.65$, $p = .09$). Covariate-adjusted means and standard errors for the social cognitive variables are presented in Table 2. Follow-up univariate ANCOVAs with alpha adjusted for multiple comparisons ($p < 0.005$) indicated that there were significant between-groups differences on all measured social cognitive variables ($ps < 0.001$). Pairwise comparisons of the significant univariate effects revealed that actors scored significantly higher than both intenders and non-intenders, and intenders scored significantly higher than non-intenders on all measured social cognitive variables (all $ps \leq 0.01$, see Table 2).

Inspection of the means for recovery self-efficacy ($M = 5.92$ out of 7, $SE = 0.08$) and action control ($M = 5.48$ out of 7, $SE = 0.13$) indicated that actors scored high on both measures. Interpretation of these values suggests actors had high confidence in their ability to manage lapses in their LTPA program. They also frequently used self-regulatory strategies to manage their LTPA.

Discussion

Using the Health Action Process Approach (HAPA) framework (Schwarzer, 2008a), the purpose of this study was to examine differences in social cognitions among people with SCI categorized as LTPA non-intenders, intenders, and actors. As predicted, actors had significantly greater intentions and self-efficacy than intenders; intenders, in turn, had significantly greater intentions and self-efficacy than non-intenders. The same pattern of differences also emerged for outcome expectancies and planning. Actors scored higher than intenders on these variables and, unexpectedly, intenders also scored higher than non-intenders.

Finding differences in LTPA self-efficacy and intentions across all three HAPA groups is consistent with the HAPA tenets (Schwarzer, 2008a) and studies of various populations including cardiac rehabilitation patients (Dohnke et al., 2010), orthopaedic patients, (Lippke et al., 2005), and university students (Duan et al., 2011). Our results extend these findings to people with SCI. Our results also indicate that between-groups differences in self-efficacy extend beyond task, maintenance and recovery self-efficacy, to two types of self-regulatory efficacy that had not been previously compared across HAPA groups: scheduling and goal-setting. Differences in these self-efficacy measures are not surprising, given that scheduling and other forms of self-regulatory efficacy have been linked to greater LTPA intentions and behavior in people with SCI (Arbour-Nicitopoulos et al., 2009; Latimer et al., 2006). Based on the present findings, it seems that there is a strengthening of various types of task and self-regulatory efficacy beliefs, as well as motivation (i.e., intentions), as people with SCI move through the LTPA behavior change process.

Outcome expectancies and planning also increased significantly from non-intenders to intenders to actors. These results partially support the original HAPA-driven hypotheses, which

predict differences between non-intenders and the other two groups for these variables. However, the original hypotheses predict only minor differences between intenders and actors (Lippke et al., 2005; Schwarzer, 2008a). The observed significant differences between intenders and actors are consistent with recent work (Dohnke et al., 2010; Duan et al., 2011), indicating that outcome expectancies and planning strengthen within the volitional phase. Presumably, as they accumulate experience with LTPA, actors become more aware of the benefits of being physically active, and thus score higher on measures of outcome expectancies than (inactive) intenders. Furthermore, given that planning interventions have been shown to help people with SCI move through the volitional phase (Arbour-Nicitopoulos et al., 2009; Latimer et al., 2006), it is not particularly surprising that actors would make greater use of planning than intenders. Given the multitude of LTPA barriers faced by the SCI population (Scelza, Kalpakjian, Zemper, & Tate, 2005), consistently high levels of planning are likely vital to sustained participation. The relatively high scores for action control further reinforce the notion that being active requires ongoing acts of self-regulation including planning and self-monitoring.

Taken together, the consistent between-groups differences on the social cognitive variables suggest an underlying continuum of LTPA action-readiness among people with SCI (Schwarzer 2008b). The between-groups differences also bolster Schwarzer's (2008a) contention that people pass through different "mindsets" on their way to behavior change, reflecting increasingly stronger, more positive social cognitions. Accordingly, we conclude that it is both theoretically and practically important to distinguish between non-intenders, intenders, and actors within the context of LTPA behavior change in the SCI population. These findings have important implications for developing LTPA-enhancing interventions.

In particular, when developing interventions, we cannot treat the inactive half of the SCI population (Martin Ginis et al., 2010a) as a homogeneous group. Non-intenders have significantly poorer LTPA social cognitions than intenders and have not yet formulated an intention to be active. From a practical perspective, different LTPA interventions must be tailored to effectively transition these two groups of inactive individuals through the motivational and volitional phases of behavior change. Based on HAPA (Schwarzer, 2008a), non-intenders would benefit from interventions that target the development of task self-efficacy and positive outcome expectancies in order to help them formulate LTPA intentions (Latimer et al., 2006). Intenders would benefit from interventions that target planning and self-regulatory forms of self-efficacy (e.g., scheduling, goal-setting; Arbour-Nicitopoulos et al., 2009) that facilitate the translation of intentions to action. Finally, given the relatively high scores for actors on all of the study variables, actors might benefit most from interventions that sustain the social cognitions that are key to long-term LTPA participation, particularly those that pertain to self-regulation (i.e., action control, maintenance self-efficacy, recovery self-efficacy; Bandura, 2005).

The above recommendations provide the basis for developing the interventions reported in our two companion brief reports. The first report (*Latimer et al., 2011*) is a pilot study of two interventions for initiating and increasing LTPA among intenders living with SCI. Both interventions focus on the social cognitive factors that are pertinent to transitioning people from the motivational to volitional phases of behavior change (i.e., self-efficacy, intentions, and planning). The second paper (*Brawley et al., 2011*) is a feasibility study of a group-mediated intervention designed to teach the self-regulatory strategies needed to increase self-directed LTPA among actors with SCI. The intervention focuses on strengthening the social cognitive factors within the volitional phase of the behavior change process (i.e., planning, scheduling and

goal-setting self-efficacy, action control, and recovery self-efficacy). These studies demonstrate the utility of designing LTPA-enhancing interventions that target the different LTPA mindsets of people with SCI. Importantly, these studies also answer Schwarzer and colleagues' (2011) call in *Rehabilitation Psychology* for further development and testing of interventions specifically for intenders and maintainers with different chronic illnesses and disabilities.

Although the present study has yielded important results that inform the design of our interventions, a couple of limitations warrant mention. First, given the cross-sectional study design, we were unable to determine whether an increase in scores on the social cognitive measures are an antecedent or consequence of movement through the behavior change process. Likewise, we could not test whether different social cognitive variables differentially influence LTPA across the three groups (Schwarzer, 2008a, 2008b). Such tests are important for determining whether the HAPA phases represent qualitatively different stages (with certain variables emerging as more relevant LTPA determinants in some stages than others), or simply points on a continuum of behavior change, with the variables having consistent predictive powers across phases (Weinstein, Rothman, & Sutton, 1998). Second, given concerns about participant burden, coupled with our desire to measure multiple aspects of task and self-regulatory efficacy, the complete HAPA model was not tested. This is a limitation of virtually all of the studies to date comparing social cognitions across the three HAPA groups.

Despite these limitations, our study provides impetus for using the HAPA model to develop LTPA interventions for initiating, increasing, and maintaining community-based LTPA among people with SCI. Persons with SCI are considered to be at the lowest end of the LTPA participation spectrum (Dearwater, Laporte, Cauley & Brenes, 1985), with 50% of the population engaging in no LTPA whatsoever (Martin Ginis et al., 2010a). Developing LTPA interventions

that target specific social cognitions is an essential step towards moving people with SCI through the motivational and volitional phases of behavior change.

References

- Abraham, C. (2008). Beyond stages of change: Multi-determinant continuum models of action readiness and menu-based interventions. *Applied Psychology: An International Review*, 57, 30-41. doi: 10.1111/j.1464-0597.2007.00320.x
- Ajzen, I. (1985). From intentions to action a theory of planned behaviour. In: J. Kuhl & J. Beckmann (Eds.), *Action Control: From Cognition to Behaviour* (pp. 11–39). Heidelberg: Springer-Verlag.
- Arbour-Nicitopoulos, K. P., Martin Ginis, K. A., & Latimer, A. E. (2009). Planning, leisure-time physical activity, and coping self-efficacy in persons with spinal cord injury: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, 90, 2003-2011. doi:10.1016/j.apmr.2009.06.019
- Bandura A. (1997). *Self-efficacy: The exercise of control*. (pp. 24; 415-420). New York: Freeman.
- Bandura, A. (2005). The primacy of self-regulation in health promotion. *Applied Psychology: An International Review*, 54, 245-254.
- Blanchard, C. M., Courneya, K. S., Rodgers, W. M., Fraser, S. N., Murray, T. C., Daub, B., & Black, B. (2003). Is the theory of planned behavior a useful framework for understanding exercise adherence during phase II cardiac rehabilitation? *Journal of Cardiopulmonary Rehabilitation*, 23, 29-39.
- Brawley et al. (2011, current issue)

- Canadian Paraplegic Association. (2000). The Workforce Participation Survey of Canadians with Spinal Cord Injury. Ottawa: Canadian Paraplegic Association.
- Dearwater, S. R., Laporte, R. E., Cauley, J. A., & Brenes, G. (1985). Assessment of physical activity in inactive populations. *Medicine & Science in Sports & Exercise*, 17, 651-655.
- Dohnke, B., Nowossadeck, E., & Miller-Fahrnow, W. (2010). Motivation and participation in a phase III cardiac rehabilitation programme: An application of the health action process approach. *Research in Sports Medicine*, 18, 219-235. doi: 10.1080/15438627.2010.510032
- Duan, Y., Lippke, S., Wagner, P., & Brehm, W. (2011). Testing two stage assessments in a Chinese college student sample: Correspondences and discontinuity patterns across stages. *Psychology of Sport and Exercise*, 12, 306-313. doi:10.1016/j.psycsport.2010.12.002
- Jacobs, P. L., & Nash, M. S. (2004). Exercise recommendations for individuals with spinal cord injury. *Sports Medicine*, 34, 727-751. doi: 0112-1642/04/0011-0727
- Latimer et al. (2011, current issue)
- Latimer, A. E., Martin Ginis, K. A., & Arbour, K. P. (2006). The efficacy of an implementation intention intervention for promoting physical activity among individuals with spinal cord injury: A randomized controlled trial. *Rehabilitation Psychology*, 51, 273-280. doi:10.1037/0090-5550.51.4.273
- Latimer, A. E., Martin Ginis, K. A., Craven, B. C., & Hicks, A. L. (2006). The physical activity recall assessment for people with spinal cord injury: Validity. *Medicine & Science in Sports & Exercise*, 38, 208-216. doi:10.1249/01.mss.0000183851.94261.d2

- Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2005). Stage-specific adoption and maintenance of physical activity: Testing a three-stage model. *Psychology of Sport and Exercise*, 6, 585-603. doi:10.1016/j.psychsport.2004.11.002
- Luszczynska, A., & Schwarzer, R. (2005). Social-cognitive theory. In M. Conner & P. Norman (Eds.), *Predicting Health Behavior* (2nd ed., pp. 127–169). Buckingham: Open University Press.
- Marcus, B. H., & Simkin, L. R. (1993). The stages of exercise behavior. *Journal of Sports Medicine and Physical Fitness*, 33, 83-88.
- Martin Ginis, K. A., Latimer, A. E., Arbour-Nicitopoulos, K. P., Bassett, R. L., Wolfe, D. L., & Hanna, S. E. (2011). Determinants of physical activity among people with spinal cord injury: A test of social cognitive theory. *Annals of Behavioral Medicine*. Published online 05 May 2011. doi:10.1007/s12160-011-9278-9
- Martin Ginis, K. A., Arbour-Nicitopoulos, K. P., Latimer, A. E., Buchholz, A. C., Bray, S. R., Craven, B. C.,... Wolfe, D. L. (2010b). Leisure time physical activity in a population-based sample of people with spinal cord injury part II: Activity types, intensities, and durations. *Archives of Physical Medicine and Rehabilitation*, 91, 729-33. doi:10.1016/j.apmr.2009.12.028
- Martin Ginis, K. A., Jetha, A., Mack, D. E., & Hetz, S. (2010). Physical activity and subjective well-being among people with spinal cord injury: A meta-analysis. *Spinal Cord*, 48, 65-72. doi:10.1038/sc.2009.87

- Martin Ginis, K. A., Latimer, A. E., Arbour-Nicitopoulos, K. P., Buchholz, A. C., Bray, S. R., Craven, B. C.,... Wolfe, D. L. (2010a). Leisure time physical activity in a population-based sample of people with spinal cord injury part I: Demographic and injury- related correlates. *Archives of Physical Medicine and Rehabilitation*, 91, 722-728. doi: 10.1016/j.apmr.2009.12.027
- Martin Ginis, K. A., Latimer, A. E., Hicks, A. L., & Craven, B. C. (2005). Development and preliminary evaluation of an activity measure for people with spinal cord injury. *Medicine & Science in Sports & Exercise*, 37, 1099-1111. doi: 10.1249/01.mss.0000170127.54394.eb
- Maynard, F. M., Bracken, M. B., Creasey, G., Ditunno, J. F., Donovan, W. H., Ducker, T. B.,... Young, W. (1997). Intervention standards for neurological and functional classification of spinal cord injury: American Spinal Injury Association. *Spinal Cord*, 35, 266-274
- Prochaska, J. O., DiClemente, C. C., & Norcross, J. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, 47, 1102-1114.
- Scelza, W. M., Kalpakjian, C. Z., Zemper, E. D., & Tate, D. G. (2005). Perceived barriers to exercise in people with spinal cord injury. *American Journal of Physical Medicine & Rehabilitation*, 84, 576-583. doi:10.1097/01.phm.0000171172.96290.67
- Schwarzer, R. (2008a). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviours. *Applied Psychology*, 57, 1-29. doi:10.1111/j.1464-0597.2007.00325.x

- Schwarzer, R. (2008b). Some burning issues in research on health behaviour change. *Applied Psychology: An International Review*, 57, 84-93. doi: 10.1111/j.1464-0597.2007.00324.x
- Schwarzer, R., Lippke, S., & Luszczynska, A. (2011). Mechanisms of health behavior change in persons with chronic illness or disability: The Health Action Process Approach (HAPA). *Rehabilitation Psychology*, 56, 161-170. doi: 10.1037/a0024509
- Scholz, U., Sniehotta, F. F., & Schwarzer, R. (2005). Predicting physical exercise in cardiac rehabilitation: The role of phase-specific self-efficacy beliefs. *Journal of Sport & Exercise Psychology*, 27, 135-151.
- Shields, C.A., & Brawley, L. R. (2007). Limiting exercise options: Depending on a proxy may inhibit exercise self-management. *Journal of Health Psychology*, 12, 663-671. doi: 10.1177/1359105307078173
- Sniehotta, F. F., Scholz, U., Lippke, S., & Ziegelmann, J. (2002). Scale for the assessment of phase-specific self-efficacy of physical activity. Retrieved 25 February 2011, from <http://userpage.fu-berlin.de/~falko/scales/heartdocu.html>
- Sniehotta, F. F., Scholz, U., Lippke, S., Ziegelmann, J., & Luszczynska, A. (2003) Phase-specific self-efficacy in health behavior change. Unpublished manuscript, Free University, Berlin.
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2005). Bridging the intention-behavior gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology and Health*, 20, 143-160. doi: 10.1080/08870440512331317670
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2006). Action plans and coping plans for physical

exercise: A longitudinal intervention study in cardiac rehabilitation. *British Journal of Health Psychology*, *11*, 23-37. doi: 10.1348/135910705X43804

Sutton, S. (2001). Back to the drawing board? A review of applications of the transtheoretical model to substance use. *Addiction*, *96*, 175-186.

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York: Harper Collins.

Weinstein, N. D., Rothman, A. J., & Sutton, S. R. (1998). Stage theories of health behavior: Conceptual and methodological issues. *Health Psychology*, *17*, 290-299.
doi:10.1037/0278-6133.17.3.290

West, R. (2005). Time for a change: Putting the transtheoretical (stages of change) model to rest. *Addiction*, *100*, 1036-1039. doi:10.1111/j.1360-0443.2005.01139.x

Table 1.

Participant demographics and injury-related characteristics for actors, intenders, and non-intenders.

Variable	Actors <i>n</i> = 105	Intenders <i>n</i> = 73	Non-intenders <i>n</i> = 58
Age (years)	42.41±13.59	45.07±11.69	46.18±12.15
Years post injury*	11.29±8.60	15.84±11.16	17.02±9.75
Moderate and heavy intensity LTPA (mins/wk)**	34.68±35.17 ^a	3.79±12.01	2.32±6.23
Sex			
Male	80 (76.2)	57 (78.1)	42 (72.4)
Female	25 (23.8)	16 (21.9)	16 (27.6)
Level of injury			
Paraplegia	53 (50.5)	32 (43.8)	20 (34.5)
Tetraplegia	50 (47.6)	41 (56.2)	38 (65.5)
Lesion			
Complete	34 (32.4)	19 (26.0)	13 (22.4)
Incomplete	42 (40.0)	32 (43.8)	22 (37.9)
Cause of injury			
Vehicular	60 (57.2)	34 (46.6)	33 (56.9)
Sports/recreation	18 (17.1)	14 (19.1)	15 (25.8)
Falls	15 (14.3)	13 (17.8)	4 (6.9)
Medical/surgical complications	4 (3.9)	5 (6.8)	3 (5.1)
Other	7 (6.8)	5 (6.8)	3 (5.1)
Primary mode of mobility			
Manual chair	78 (74.3)	45 (61.6)	36 (62.1)
Power chair	21 (20.0)	20 (27.4)	18 (31.0)
Gait aid	6 (5.7)	8 (11.0)	4 (6.9)
Ethnicity			
White	101 (96.2)	68 (93.2)	54 (93.1)
Other	4 (3.8)	5 (6.8)	4 (6.9)
Marital status			
Single	43 (41.0)	27 (37.0)	21 (36.2)
Common law	7 (6.7)	5 (6.8)	4 (6.9)
Married	44 (41.9)	30 (41.1)	24 (41.4)
Divorced	9 (8.6)	8 (11.0)	7 (12.1)
Widowed	2 (1.9)	3 (4.1)	2 (3.4)
Highest level of education***			
High school	31 (29.5)	33 (45.2)	26 (44.8)
College	25 (23.8)	17 (23.3)	10 (17.2)
University	29 (27.6)	7 (9.6)	8 (13.8)
Post-graduate	8 (7.6)	8 (11.0)	1 (1.7)
Other	12 (11.4)	8 (11.0)	13 (22.4)

Note. LTPA, leisure-time physical activity. Some participants declined to respond to certain questions. Hence, $n < 105$ for some variables in the actor group, $n < 73$ for some variables in the intender group, and $n < 58$ for some variables in the non-intender group. Demographic information was not available for two participants in the non-intender group (hence $n = 58$). All values are n (%) except for age and years post injury, which are $M \pm SD$.

* F -value significant at $p < .001$ indicating significant between-group differences for years post-injury. Bonferroni post-hoc analysis revealed that there were significant differences between all three groups ($ps \leq .007$).

** F -value significant at $p < .001$ indicating significant between-group differences for weekly minutes of moderate and heavy intensity of LTPA. ^aBonferroni post-hoc analysis revealed that actors reported more min/day of moderate and heavy intensity LTPA than intenders and non-intenders ($ps < 0.001$). Intenders and non-intenders did not differ on min/day of LTPA.

*** χ^2 value significant at $p = .004$ indicating significant between-group differences.

Table 2.

Descriptive statistics for the measured social cognitive variables ($M \pm SE$) as a function of group.

Variable	Actors ($n = 105$)	Intenders ($n = 73$)	Non-intenders ($n = 60$)	Univariate $F(2,228)$
Motivational phase constructs				
Outcome expectancies	6.02±0.12	5.60±0.14	4.43±0.16	29.91
Task self-efficacy				
Moderate aerobic activity	4.92±0.17	3.77±0.20	2.66±0.23	30.33
Heavy aerobic activity	3.89±0.16	2.79±0.19	1.75±0.21	30.85
Moderate strength activity	5.13±0.16	4.03±0.19	2.91±0.22	32.81
Heavy strength activity	3.85±0.16	2.84±0.19	1.90±0.21	26.09
Intentions	6.63±0.15	3.87±0.17	1.73±0.20	199.28
Volitional phase constructs				
Planning	5.43±0.19	3.43±0.22	1.59±0.25	73.49
Maintenance self-efficacy	5.04±0.14	3.78±0.16	3.03±0.18	38.86
Recovery self-efficacy	5.92±0.08			
Scheduling self-efficacy	6.06±0.16	4.75±0.19	3.90±0.21	33.44
Goal setting	5.98±0.16	5.21±0.18	3.71±0.21	36.07
Action control	5.48±0.13			

Note. Multivariate F -value significant at $p < .001$ for all 10 variables. All univariate F -values were significant at $p < 0.001$. Actors scored significantly higher than both intenders and non-intenders, and intenders scored significantly higher than non-intenders on all 10 social cognitive variables (all $ps < .01$).