Development of a Conceptual Model to Predict Physical Activity Participation in Adults With Brain Injuries

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The purpose was to examine psychosocial factors that influence the physical activity behaviors of adults with brain injuries. Two differing models, based on Harter’s model of self-worth, were proposed to examine the relationship between perceived competence, social support, physical self-worth, affect, and motivation. Adults numbering 384 with brain injuries completed a series of questionnaires measuring each psychosocial variable. The structural analysis indicated a nonsignificant chi squared value and good fit indices for model two which included affect as the mediating variable. Findings indicate that affect is critical in shaping the physical activity cognitions and behaviors of adults with brain injuries. Suggestions are made on practical ways to enhance affect and subsequently physical activity participation.

Of the estimated 1.5 million United States citizens that sustain a traumatic brain injury (TBI) every year, an estimated 80–90,000 experience long-term disability (Langlois, Rutland-Brown, & Thomas, 2004), emphasizing that this acquired disability is a serious public health issue (National Institute of Health, 1998). The etiology of TBI is extremely diverse across all age groups and includes motor vehicle accidents, falls from heights, sports injuries, industrial accidents, assaults, and neglect (National Institute of Health, 1998). The complexity of the disability is exacerbated by the diversity of the problems that result from the insult to the brain, including physical, cognitive, and psychosocial impairments (Kersel, Marsh, Havill, & Sleigh, 2001). Thus, a challenge is presented to specialists involved in the rehabilitation of people with TBI to provide meaningful rehabilitation programs (Driver, Harmon, & Block, 2003a).

One area of the rehabilitation process that specialists repeatedly indicate to be the most difficult to successfully influence are psychosocial impairments (Driver, 2005; Driver, 2006a; Kwan & Sulzberger, 1995), which occur as individuals adjust to living and coping with the significant physical (e.g., spasticity, ataxia), cognitive (e.g., awareness, aphasia), and life changes experienced post injury (e.g., loss of employment, ability to drive). Research post injury indicates that individuals experience a disruption in negative affect (Armstrong, 1991; Brown &
Vandergoot, 1998; Kreutzer, Seel, & Gourley, 2001; Levin, Goldstein, & MacKenzie, 1997), self-esteem (Baker-Roth, McLaughlin, Weitzenkamp, & Womeldorff, 1995; Howard & Claiman, 1994), and social support (Fazio & Fralish, 1988; Potter, Smith, & Finegan, 1994). Negative changes in these variables have been related to decreased (a) life satisfaction (Holosko & Huege, 1989), (b) likelihood of returning to work (Kaplan, 1990), (c) quality of life (Steadman-Pare, Colantonio, Ratcliff, Chase, & Vernich, 2001), and (d) compliance to a rehabilitation program (Marsh, Kersel, Havill, & Sleigh, 1998). Consequently, a primary purpose of rehabilitation is to positively influence psychosocial functioning (Driver, 2006a).

One mode of rehabilitation that has been shown to successfully impact psychosocial functioning in individuals post TBI is physical activity (PA; Baker-Roth et al., 1995; Driver & O’Connor, 2003; Driver, O’Connor, Lox, & Rees, 2003b; Driver, Rees, O’Connor, & Lox, 2006; Finset & Andersson, 2000). Despite the documented benefits of participation, PA is not typically prescribed to people post TBI as part of their rehabilitation program and participation rates are considered low (National Institute of Health, 1998). Consequently, there is a need for research that examines how psychosocial variables (e.g., self-esteem, affect, social support) influence PA participation post injury in an attempt to increase participation (Driver, 2006a). Within general psychology and sport/exercise psychology, a variety of theoretical perspectives have evolved to explain motivation and behavior. Examples include cognitive evaluation theory (Deci & Ryan, 1985), expectancy value theory (Eccles et al., 1983), achievement goal theory (Nicholls, 1984), social cognitive theory (Bandura, 1986), and competence motivation theory (CMT; Harter, 1978). While each theory is unique and provides a slightly different viewpoint for explaining motivation, there are similarities that can be drawn between each conceptualization. For example, belief in ability, social support, and enjoyment are recognized as being critical to explaining motivation (Driver, 2006a; Horn, 2003). One model of motivation that includes each critical component is Harter’s (1987) model of self-worth, which stemmed from CMT (Harter, 1978). Thus, Harter’s model was selected as the framework for the study as it (a) contains factors central to explaining motivation, (b) has been used to understand PA participation in youth participants, and (c) offers potential as a framework for adults post TBI (Driver, 2006a).

Harter’s model predicts that perceived competence and social support influence an individual’s self-worth (see Figure 1). This linear relationship continues as self-worth predicts an individual’s affect and then motivation. Conceptually, the model of self-worth suggests that individuals make judgments about their perceived competence or social support, which shapes their self-worth. This feeling of self-worth then leads to an emotional (affective) reaction, which influences the individual’s motivation. For example, individuals experiencing increased perceived competence and social support will have greater self-worth, which then leads to more positive affective feelings (e.g., happiness) and increased motivation. Conversely, individuals who have low perceived competence and social support will have low self-worth, more negative affect (e.g., anger, frustration), and decreased motivation. Research using Harter’s framework within a PA context with youth participants (8–15 years old) has consistently shown that individuals’ motivation is determined by their perceived competence, social support, self-worth,
Figure 1 — Harter’s (1987) model of global self-worth.
and affect (Babkes & Weiss, 1999; Harter, 1978; Smith, 1999; Weiss, Ebbeck, & Horn, 1997; Weiss & Ferrer-Caja, 2002; for a detailed review and application of the model to people with TBI see Driver, 2006a).

Some research, however, has also indicated an alternative relationship between these psychosocial variables (Ebbeck & Weiss, 1998; Smith, 1999) whereby affect serves as the mediating variable between perceived competence and social support and self-worth and motivation. This alternative relationship was based on Harter’s (1978) original conceptualization of CMT, which posits that positive affect mediates the influence of perceived competence and social support on intrinsic motivation. Conceptually, this relationship varies from the model of self-worth as individuals experience an emotional (affective) reaction to their perceived competence or social support, rather than making a judgment of self-worth. This emotional reaction then influences the individual’s self-worth, motivation, and behavior. For example, individuals who have increased perceived competence and social support will have greater positive affective feelings (e.g., relaxation, contentment), which then results in higher self-worth, motivation, and actual participation. Thus, an individual’s affective experience (e.g., happy or sad, anxious or relaxed) that is generated in response to feelings of competence and social support is critical in determining self-worth and motivation. Direct and indirect relationships are also included between self-worth and motivation and PA participation in the affective model. These relationships are again consistent with Harter’s CMT, which posits that self-worth influences cognitive motivation and participation. Thus, individuals with greater self-worth will demonstrate increased motivation and actual participation. Using affect as the mediating variable, as opposed to an outcome, was based on Harter’s recommendation to “restore affect and emotion to its rightful place, as central to an understanding of behavior” (Harter, 1981, p. 4). If support for the affective model was found for individuals with a TBI, then rehabilitation programs would need to emphasize and foster positive affective experiences in an attempt to enhance self-worth and motivation.

Based on the conceptualization of affect being the mediating variable in Harter’s CMT, Ebbeck and Weiss (1998) examined the relationship between perceived physical competence, affect, and self-worth in 8–13-year-old children attending an instructional sports camp. Results indicated that positive affect (e.g., enjoyment, excitement) mediated the influence of perceived physical competence on self-worth, so higher perceived competence and positive affect were associated with higher self-esteem. Thus, results indicate that judgments of self-worth were mediated by participants affective feelings, reinforcing Harter’s conceptualization that affect could be placed as the mediating variable, as opposed to self-worth that drives intrinsic motivation. Smith (1999) extended the work by Ebbeck and Weiss by investigating the relationship among perceptions of peer and friend relationships, affect, physical self-worth, and PA motivation. Participants included 418 middle school students who ranged in age from 12 to 15 years old. Results supported the alternative affective model as perceptions of peer acceptance and friendship were positively related to adolescent’s affect. Affect was then seen to influence self-worth and motivation independently rather than linearly. However, results did not support the direct and indirect relationship between self-worth, motivation, and participation reported by Harter (1987). The relationship between self-worth, motivation, and behavior, however, is considered important to examine with
individuals post TBI due to the disruption in self-worth and impact previous research has shown this to have on behavioral components of rehabilitation (e.g., adherence to rehabilitation services, return to work). Findings again reinforce an alternative relationship, whereby affect plays a mediational role in the model.

In summary, based on Harter’s original conceptualization of CMT (Harter, 1978; 1981) and empirical support from previous literature with youth participants (Ebbeck & Weiss, 1998; Smith, 1999), an alternative to Harter’s (1987) original model of self-worth was proposed. The alternative relationship places affect as the central variable that mediates the relationship between perceived competence and social support and self-worth and motivation. Therefore, the purpose of this study was to examine two different models of PA participation including (a) Harter’s original model of self-worth (Figure 1), and (b) an alternative model with affect as the central mediating variable (Figure 2). It is hypothesized that the data will fit both models.

Method

Participants

Purposive sampling was used to include participants based on specific criteria. First, participants were all adults with a TBI (i.e., aged > 18 years old). Second, participants were all outpatients at a rehabilitation center who lived in the community. Third, based on an evaluation by a psychologist, participants all functioned at level VII (automatic-appropriate) or VIII (purposeful-appropriate) on the Ranchos Los Amigos Scale (RLAS) of cognitive functioning (Hagan, Malkmus, & Durham, 1979). The scale is completed by a psychologist intermittently throughout rehabilitation to determine an individual’s level of cognitive functioning. Scores range between I (unresponsive to any stimuli) to VIII (purposeful-appropriate). Participants who function at level VII and VIII are able to complete activities independently, problem solve, and recall relevant information. This criterion increased the likelihood that participants could “recall appropriate information,” compared with individuals at level VI or below who require “cueing” to follow directions and have “memory problems” (Hagan et al., 1979). Finally, participants experienced the TBI at least one year before the study. Participants were informed about the selection criteria before the distribution of the questionnaires. The final sample consisted of 384 adults (female = 144, male = 240) with TBI ($M_{\text{age}} = 35.81, SD = 8.66$). Mean time since injury was 57.31 months ($M = 4.77$ years).

Procedure

Before the study began, approval from an Institutional Review Board to complete research with human participants was received and the treatment of participants was in accordance with the ethical standards of American Psychological Association (APA). Four local rehabilitation centers were then contacted regarding the nature of the study and the need for participants. During the initial contact, the researcher spoke with the Clinical Rehabilitation Coordinators at each center and informed them of the purpose of the research and the protocol required. Once the
Figure 2 — Standardized estimates for the structural component of the affective model.
centers granted permission, the researcher scheduled times to attend multiple therapy sessions at the center. Outpatients attended sessions on a voluntary basis to discuss issues related to their rehabilitation (e.g., vocational, physical, occupational). The researcher attended these meetings and informed attendees about the aim of the project, the requirements (e.g., completing questionnaires), the selection criteria, and then invited people to participate. If individuals met the selection criteria and agreed to participate, then they completed the questionnaires immediately; however, as some participants could not complete the questionnaires after the meeting, alternative times were arranged when convenient to be completed at the respective rehabilitation centers.

The procedure for participants lasted about 30 min and included time for (a) reading the informed consent form, (b) reading the instructions to the questionnaires, and (c) completing the questionnaires. The researcher was available to all participants during this time. Once individuals finished, the researcher collected the questionnaires and participants left the room.

**Measures**

First, participants completed a short demographic questionnaire, which consisted of questions on age, gender, time since injury, level of cognitive functioning, physical ability (e.g., walker, cane, wheelchair), and amount of PA typically completed post injury. A modified version of the Leisure Time Exercise Questionnaire (LTEQ; Godin & Shephard, 1985) was used to measure frequency of PA during a typical week and reliability and validity estimates have been reported with adult samples (Godin, Jobin, & Bouilon, 1986; Jacobs, Ainsworth, Hartman, & Leon, 1993). The LTEQ requires individuals to report the amount of times they participate in mild, moderate, and strenuous PA every week for more than 15 min. Scores were then summed to determine the frequency of PA participation (e.g., 5 checks = 5, 15min bouts/week). Frequency scores were used in the current study rather than MET values, thus results do not represent intensity of activity level. The LTEQ was adapted based on feedback received from a panel of four specialists (e.g., two clinical psychologists, two exercise psychologists) who had expertise with the population and content. Modifications were made if the majority of experts suggested a specific change and included (a) providing an example of how to complete the measure, and (b) changing the examples of activity so that they were relevant for individuals with TBI (e.g., Mild exercise = minimal effort—chair yoga, easy walking; Moderate exercise = not exhausting—fast walking, cycling; Strenuous exercise = heart beats rapidly—swimming, jogging).

The social influences scale (SIS) was used to assess perceptions of family, friend, and caregiver influence (Chogahara, 1999). The SIS was originally designed for use with older adults within a PA context. The scale is multidimensional as it assesses types (e.g., positive and negative) and sources (e.g., family, friends) of support and has been recommended for use with people with TBI (Driver, 2005). Evidence of the factorial validity and test retest reliability of the SIS has been provided for people with TBI (Driver, 2007). The questionnaire consists of six subscales and 27 questions with scores recorded on a Likert scale ranging from 0 (never) to 4 (very often). The stem of each question begins with “During the past few months, how often have your friends, family, or caregivers”
which is followed by a positive support question, “Promised that they would participate in physical activity with you?” or a negative influence question, “Criticized your low skill level in physical activity?” Higher mean scores for each subscale indicate increased positive support or negative influences. In the current study alpha coefficients were reported for each subscale including informational (.74), companionship (.78), justifying (.83), esteem (.83), criticizing (.86), and inhibitive (.87). Intraclass correlations 3:1 (Shrout & Fleiss, 1979) were computed to determine the stability of the measure over a two-week period by administering the questionnaires to 50 participants. Estimating the stability of each measure was considered important to increase the likelihood that participant responses (with a RLAS classification of VII or VIII) could be considered reliable, even though individuals may have experienced some degree of cognitive impairment. A two-week test-retest was used as participants typically attended the outpatient program bimonthly. Correlation’s for the SIS were significant for each subscale, ranging from .64 (criticizing) to .85 (emotional).

The physical appearance and athletic ability subscales of the adult self-perception profile were used to assess perceived physical competence in PA (Messer & Harter, 1986). Content validity of items for both subscales has been provided for adults and children and both subscales have been used in a PA context independently from the complete measure (Babkes & Weiss, 1999; Messer & Harter, 1986; Smith, 1999; Weiss, Ebbeck, & Horn, 1997). Each subscale consists of four items whereby individuals choose between opposing statements. For example, individuals are presented with two statements: “Some adults are happy with the way they look BUT other adults are not happy with the way they look” and then have to choose if the statement is “Sort of true” or “Really true” of them. Responses are scored between one and four with subscale scores ranging from 4 to 16 with higher scores representing increased perceived competence. Within the current study, alpha coefficients were reported for the physical appearance (.82) and athletic ability (.88) subscales. The intraclass correlation 3:1 for physical appearance (.64) and athletic ability (.79) were also significant. Evidence of face validity was provided as four experts reviewed the measure for use with adults with TBI. Changes were made to the measure if a majority made a suggestion and included (a) providing an example of how to respond to the question and (b) changing font size from 14pt to 18pt.

A modified version of the global self-worth subscale of the adult self-perception profile was used to measure physical self-worth (Messer & Harter, 1986). The original global self-worth subscale was created with a sample of healthy adults, and results provided evidence for the validity and reliability of subscale items. The subscale consists of six items and for each item, individuals chose between opposing statements. Scores range from 6 to 24 with higher scores representing increased global self-worth. However, several studies have changed the wording of the original questions so that they measure physical self-worth (“I am happy with my physical abilities”) rather than global self-worth (“I am happy with myself as a person”; e.g., Ebbeck & Weiss, 1998; Rose & Larkin, 2002; Smith, 1999). Consequently, based on previous literature, the wording of each question was modified to reflect physical self-worth (Ebbeck & Weiss, 1998; Rose & Larkin, 2002; Smith, 1999). Results from the reliability analysis indicated an alpha coefficient of .78 and intraclass correlation 3:1 of .75. Four experts reviewed
the measure and modifications were the same as those made for the athletic ability/physical appearance subscales.

The Physical Activity Affect Scale (PAAS; Lox, Jackson, Tuholski, Wasley, & Treasure, 2000) was used to measure affective feeling states. The original scale was developed using college aged females and males and is based on Russell’s (1980) multidimensional conceptualization of affect. The scale consists of four subscales and 12 items that are descriptors of a particular affective state (e.g., enthusiastic, calm, awful, etc.) that require responses on a Likert scale ranging from 0 (do not feel) to 4 (feel very strongly). Evidence of the validity and reliability of the PAAS as an acute (Driver, 2006b) and chronic (Driver & Lox, 2007) measure of affect for people with TBI has been provided. The internal consistency of each subscale within the current study was confirmed with alpha coefficients for positive affect (.96), negative affect (.88), fatigue (.87), and tranquility (.91). Intraclass correlations 3:1 were significant for each subscale of the PAAS (ranging from .69–.84).

Intraclass correlations 3:1 were significant for each subscale of the PAAS (ranging from .69–.84).

The challenge subscale of the motivational orientation in sport scale was used to measure participants’ cognitive motivation (Weiss, Bredemeier, & Shewchuk, 1985), as the scale reflects individuals’ tendency to seek tasks that are optimally challenging (Smith, 1999). The scale is a PA specific version of Harter’s (1981) measure of intrinsic versus extrinsic motivation that was developed for the classroom setting. The original scale was developed using 11–13 year-old participants, but evidence of the validity and reliability has been provided among 8–15 year olds (Theeboom, De Knop, & Weiss, 1995; Smith, 1999). The scale uses a structured-alternative format as individuals choose between opposing statements (e.g., “Some adults like hard physical activity skills BUT other adults prefer easy physical activity skills”). The five items are scored from one to four with higher scores representing increased intrinsic motivation and lower scores a greater extrinsic orientation. For the current study an alpha coefficient of .79 was reported, and the intraclass correlation 3:1 was significant (.81). The measure was reviewed by four experts and changes included (a) font size from 14pt to 18pt and (b) providing an example of an answer.

It is important to note that as the perceived competence, physical self-worth, and motivation questionnaires all used the same structured alternative format, they were all placed within the same instrument. Thus, the items from each subscale appeared within one measure, in a random order. This step was taken to reduce the number of instructions and total pages.

Data Analysis

The data analyses consisted of two components including (a) descriptive analyses and (b) structural equation modeling (SEM). Descriptive analyses were completed using PRELIS and SEM using LISREL (Joreskog & Sorbom, 2002). First, descriptive statistics and homogeneity of variance tests were computed. As SEM assumes multivariate normality, it is important to screen for outliers as well as test the skewness and kurtosis of the distribution. After the initial analyses were completed, SEM was employed using the covariance matrix to test the fit of the data to each of the proposed models. The measurement model was measured first, followed by an estimation of the full structural model. Full variable latent
measurement models were used whereby all items loaded exclusively on their respective latent factors and all factors were free to correlate with one another. Subscales served as indicators of the latent variables perceived competence, social support, and affect. Subscale items represented the latent physical self-worth and motivation variables. A total frequency score was used for the PA latent variable and was estimated using an error variance of zero.

A chi-squared test was calculated to compare the underlying covariance structure generated by LISREL estimates with the covariance structure of the empirical data; however, as chi square values can be influenced by sample size (Bollen & Long, 1994), several other fit indices were calculated (e.g., Comparative, Goodness, Normed, Adjusted, and Non NFI). Values range between 0–1 with values less than .90 suggesting a poor fit of the model (Loehlin, 1998). Steiger’s (1990) Root Mean Square Error of Approximation (RMSEA) was also calculated with values of .05 or less indicating a close fit, .08 a reasonable fit, and >.10 an unacceptable fit.

Results

Questionnaires were collected from 402 adults with TBI. Due to missing data points and response errors (e.g., multiple responses to items), however, the final sample consisted of 384 adults (female = 144, male = 240). Preliminary data analyses revealed the data met the assumption of normality as the values for skewness and kurtosis were not significantly different from zero ($p < .05$). This included the measures of social support, perceived competence, affect, physical self-worth, motivation, and PA behavior. Skewness values ranged from -0.33–0.79 ($M = 0.38$), and kurtosis from -0.78–0.89 ($M = -0.19$). The sample data were considered appropriate for further analyses as the results of SEM are not impacted when the majority of skewness and kurtosis values are less than an absolute value of one (Schutz & Gessaroli, 1993). The correlation matrix is available upon request from the author.

Results from the Ranchos Los Amigos Scale indicated that 227 individuals were classified as level VII cognitive functioning (59%) and 157 as level VIII (31%). Forty-two (11%) participants reported their mobility as being independent, 73 (19%) used a walker, 146 (38%) used a cane, and 123 (32%) were in a wheelchair. The sample reported participating in a mean of 3.24 15-min bouts of PA per week, which is the equivalent of 48.6-min of PA. 70% of these bouts were reported as being mild activity, 28% moderate, and 2% strenuous. There was not a significant difference between amount of PA and level of cognitive functioning but there was between amount of PA and level of mobility. Specifically, individuals who reported being independent participated in more PA than individuals in a wheelchair ($p < .05$).

Model Testing Results for Harter’s Model of Self-Worth

First, the measurement model was assessed and the chi squared value reported for model one $\chi^2 (df = 84, N = 384) = 756.14, p = .00$ indicated that there was a statistical difference ($p > .05$) between the two covariance matrices. Therefore, the null hypothesis was rejected because there was a significant difference between
conceptual model one and the data collected for adults with TBI. Thus, the data from this sample of adults with TBI did not fit Harter’s (1987) model of self-worth. This finding is reinforced by the different fit indices (e.g., CFI = .65, GFI = .76, NFI = .70, AGFI = .65, NNFI = .62), as values less than .90 indicate a poor fit of the model. The RMSEA (.11) also suggests an insufficient fit of the data to the proposed model, with values greater than .10 indicating a poor fit. Collectively, these indices indicated that model one (see Figure 1) was a poor fit for the data.

Model Testing Results for the Affective Model

Second, the measurement component of the affective model was assessed and the chi squared value, $\chi^2 (df = 84, N = 384) = 108.78, p = .08$ indicated that there was not a statistical difference ($p > .05$) between the two covariance matrices. Therefore, the null hypothesis was accepted as there was no difference between the affective model and sample data. This finding was supported by the various fit indices (e.g., CFI = .93, GFI = .96, NFI = .94, AGFI = .95, NNFI = .92, RMSEA = .03). The next step involved examining the structural model and estimating the factor loadings for the components of the affective model. The means, standard deviations, factor loadings, $t$ values, and percentage variance squared are displayed in Table 1. These standardized coefficient estimates ranged between -.57 and .91 and each item/subscale loaded significantly ($t > 1.96$) with the appropriate latent variable. The percentage of variance that each latent variable accounted for in the respective items/subscales ranged between 32% and 83%. The final step involved estimating the factor loadings between the structural components of the affective model. Standardized estimates between the structural components ranged between 0.15 (physical self-worth and behavior) to 0.88 (affect and physical self-worth), and only one structural relationship was nonsignificant ($t < 1.96$). The direct relationships between the structural variables are displayed graphically in Figure 2. The indirect effects of the different structural components in the affective model were also assessed due to the mediational nature of the model. For variables with multiple indirect links, the set of products was summed. Standardized estimates of the indirect effects between the structural components of the model are presented in Table 2. Perceived competence and social support had a significant indirect effect on an individual’s motivation, self-worth, and PA behaviors.

Discussion

The purpose of this exploratory study was to examine the relationship between several key psychosocial variables that previous research had shown to predict PA participation. Results from the model testing indicated that affect was the key mediating variable in predicting PA participation in adults with TBI. The mediational role of affect, instead of physical self-worth (Harter, 1987), is conceptually based on CMT (Harter, 1978, 1981) and is supported empirically by research with youth samples (Ebbeck & Weiss, 1998; Smith, 1999). Results from the current study reinforce this affective conceptualization and previous research with youth samples.
The relationship between perceived competence and affect was supported by previous research findings in youth athletes as increased perceived competence has been associated with enhanced enjoyment (Scanlan & Simons, 1992; Ebbeck & Weiss, 1998). The notion of using affect as a mediator in the model is further supported by the fact that CMT stipulates that perceived competence is a precur-
sor to affect (Harter, 1978).

### Table 1  Means, Standard Deviations, Loadings, t-values, and Variance Explained for the Affective Model

<table>
<thead>
<tr>
<th>Subscales and Observed Variables</th>
<th>$M$</th>
<th>$SD$</th>
<th>Loadings</th>
<th>$t$ values</th>
<th>Variance</th>
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<td>0.83</td>
<td>7.45*</td>
<td>69</td>
</tr>
<tr>
<td>Physical Self-Worth 2</td>
<td>2.05</td>
<td>0.78</td>
<td>0.87</td>
<td>8.79*</td>
<td>77</td>
</tr>
<tr>
<td>Physical Self-Worth 3</td>
<td>1.97</td>
<td>0.85</td>
<td>0.81</td>
<td>6.98*</td>
<td>65</td>
</tr>
<tr>
<td>Physical Self-Worth 4</td>
<td>2.03</td>
<td>0.91</td>
<td>0.77</td>
<td>5.25*</td>
<td>59</td>
</tr>
<tr>
<td>Physical Self-Worth 5</td>
<td>2.10</td>
<td>0.77</td>
<td>0.82</td>
<td>7.16*</td>
<td>67</td>
</tr>
<tr>
<td>Physical Self-Worth 6</td>
<td>2.19</td>
<td>0.88</td>
<td>0.87</td>
<td>8.79*</td>
<td>77</td>
</tr>
</tbody>
</table>

* =$t > 1.96
The link between social support and affect is supported by past research as Smith (1999) found that youth participants with greater friendship and peer support reported greater feelings of positive affect and enjoyment. Conversely, individuals with decreased perceptions of friendship and peer support had less positive affect. Similar findings have been reported for older adults (McAuley et al., 2000) as greater support was associated with increased positive affect, well-being, and PA adherence and decreased negative affect and loneliness. Specific to adults with TBI, changes in social support and affect have been demonstrated in response to exercise participation (Driver et al., 2006). Studies have also found that decreased support and negative influences result in negative emotional and behavioral consequences (Chogahara, 1999). Results from the current study reinforce the relationship between social support and affect and demonstrate the important indirect role that significant others can play in promoting or discouraging PA participation.

The strong relationship between physical self-worth and affect is supported by previous research findings, which have shown that positive affect plays an important role in developing self-worth in youth samples (Brustad, 1988; Ebbeck & Weiss, 1998). For example, Ebbeck and Weiss examined the relationship between positive affect and physical self-worth in a sample of 265 youth participants (age 8–13) enrolled in a sport skill program. Results from the structural analyses indicated a strong correlation between positive affect and self-esteem (.65). Findings from the Ebbeck and Weiss study are reinforced by results from the current investigation as both samples had a judgment about their appearance or ability, which was correlated to their affective reaction. This affective feeling was then related to participants’ overall judgment of self-worth.

Previous research supports the relationship between affect and motivation (Carpenter, Scanlan, Simons, & Lobel, 1993; Duncan, 1993; Harter, 1987, 1999; Smith, 1999). For example, Smith (1999) found a large positive correlation (.90) between affect and motivation among youth sports participants. Findings from Harter’s (1987, 1999) model testing have consistently shown motivation to be influenced by affect. Results from the sport commitment literature have also shown enjoyment (positive affect) to be the strongest predictor of commitment.

Table 2  Indirect Effect Between the Structural Components of the Affective Model

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Estimate</th>
<th>t value</th>
<th>% Variance Explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Competence → Self-Worth</td>
<td>0.41</td>
<td>8.87*</td>
<td>13</td>
</tr>
<tr>
<td>Perceived Competence → Motivation</td>
<td>0.33</td>
<td>6.76*</td>
<td>11</td>
</tr>
<tr>
<td>Perceived Competence → PA Behavior</td>
<td>0.16</td>
<td>2.17*</td>
<td>3</td>
</tr>
<tr>
<td>Social Support → Self-worth</td>
<td>0.26</td>
<td>4.84*</td>
<td>8</td>
</tr>
<tr>
<td>Social Support → Motivation</td>
<td>0.19</td>
<td>2.73*</td>
<td>5</td>
</tr>
<tr>
<td>Social Support → PA Behavior</td>
<td>0.13</td>
<td>2.10*</td>
<td>4</td>
</tr>
<tr>
<td>Self-Worth → Physical Activity</td>
<td>0.30</td>
<td>6.32*</td>
<td>10</td>
</tr>
</tbody>
</table>

\*t > 1.96
(Carpenter et al., 1993; Carpenter & Coleman, 1998; Scanlan, Simons, Carpenter, Schmidt, & Keeler, 1993). Previous research also supports the link between self-worth and motivation (Harter, 1978, 1987; Wong & Bridges, 1995). Findings from youth participants indicated that feelings of self-worth were related to an individual’s motivation level. Specifically, individuals with greater feelings of self-worth experienced increased motivation to participate in soccer (Wong & Bridges, 1995).

Results also indicated that increased cognitive motivation was associated with an increase in reported PA participation. For example, individuals who reported increased motivation also indicated that they were more physically active. Conversely, individuals who stated they had low motivation reported lower activity levels. This result establishes an association between cognitions (e.g., intrinsic motivation) and actual behavior (e.g., level of participation) for adults with TBI. This connection has been reported in youth participants (Smith, 1999) and has important implications for practitioners due to the beneficial health outcomes associated with PA participation (Bateman, Culpan, Pickering, Powell, Scott, & Greenwood, 2001; Driver, O’Connor, Lox, & Rees, 2004; Driver et al., 2006). For example, if PA practitioners can increase participant’s intrinsic motivation, then actual activity levels may also increase causing individuals to gain the health benefits associated with PA (e.g., avoidance of obesity and heart disease).

Results from the current study indicate that affect plays a central role in predicting cognitions (e.g., motivation) and behaviors (e.g., PA participation) among adults with TBI. Thus, judgments about appearance, ability, and social support were associated with the intrinsic motivation and activity level of the sample. While results did not confirm Harter’s model of self-worth, findings are conceptually supported by CMT as affect mediates the relationship between perceived competence, social support, and motivation. Consequently, affect is placed as the central and driving variable as opposed to self-worth. It is hypothesized that affect adopts a central mediating role due to the strong disturbance in affect experienced after an injury (Armstrong, 1991; Baker-Roth et al., 1995; Brown & Vandergoot, 1998) in response to the physical, psychosocial, cognitive, and lifestyle changes caused by the injury (Driver et al., 2003a). Consequently, feelings become increasingly profound, perhaps especially so when induced by contemplating appearance, ability, or social support. The connection between affect and perceived competence, social support, and self-worth is emphasized as each variable has been shown to be negatively influenced (e.g., decrease type/source of support, belief in ability) post injury. Perhaps then, when evaluating their ability, appearance, and/ or social support, individuals were forced to think about the negative changes that had occurred because of the injury. Consequently, individuals’ perceptions of competence and social support had a strong relationship with feelings (e.g., affect), which in turn were associated with individuals’ overall judgments (e.g., physical self-worth, motivation) and behaviors (e.g., level of activity). Thus, results were different from Harter’s (1987) model because of the central role that affect played in shaping both cognitions and behaviors.

Implications

The affective model has potential to aid specialists in structuring PA interventions, which is important due to the physical (Bateman et al., 2001; Driver et al., 2004)
and psychosocial benefits of participation (Driver & O’Connor, 2003; Driver et al., 2006). Rehabilitation specialists must create activity programs and environments that facilitate the development and fostering of positive affect. Specific to physical activity, Weiss (1991) recommends that interventions be based on facilitating mastery experiences, increasing social support, and enhancing positive affective experiences. For example, affect could be increased by participating in a fun environment and setting achievement oriented goals (see Driver, 2006a for a detailed review of interventions). While these suggestions are not a “revolutionary” concept, rehabilitation typically occurs in a therapeutic environment (e.g., clinical, methodical, one-on-one) rather than an environment where individuals participate in groups, make choices, or have fun.

Limitations

There are several limitations with the current study including the (a) use of the self-report measures in SEM as common methods variance can overly inflate the relationship between latent variables, (b) selection of the “best” measures for a sample of individuals with some degree of cognitive impairments, and (c) possible bias of responses as participants were all outpatients attending a rehabilitation program. Consequently, the group does not represent outpatients who do not attend rehabilitation (e.g., positive/maladaptive rehabilitation, too great a cost involved). There were also several other limitations with the measures used. For example, the challenge subscale is not an encompassing measure of intrinsic motivation as it does not assess the enjoyment component. In addition, even though estimates of the subscales reliability and validity were provided, the measure had not previously been used with adults. Therefore, current results should be interpreted with caution, in particular the finding that the sample reported high (above the midpoint) intrinsic motivation to participate in PA but low (below the midpoint) perceived competence, social support, and physical self-worth. This discrepancy may have occurred because (a) the subscale does not measure the enjoyment component of intrinsic motivation, and/ or (b) insufficient estimates of reliability and validity were presented. Ideally, additional estimates of reliability and validity are provided when using questionnaires that were created with a different sample (e.g., concurrent, discriminant validity; Yun & Ulrich, 2002).

Future Research

There are several areas for future investigation. For example, while results from the current sample indicate a good fit of the data to the affective model, research efforts should continue to examine the relationship between each variable in the model. Future studies should aim to substantiate the tentative relationships determined between variables as well as confirm the central role of affect. This is particularly important due to the exploratory nature of the current investigation and concerns regarding the appropriateness of measures for the population based on the research question (e.g., challenge subscale—see comment above). Consequently, it is critical that complementary work is conducted that further examines and establishes the relationships outlined in the current study. Another interesting area of research would involve examining other individual factors that influence the perceived competence and social support of individuals with TBI.
For example, the impact of individual variables such as time since injury, level of physical and cognitive ability, gender, social network size, marital status, and age could be examined. Future efforts could also examine the applicability of the model to adults with different levels of cognitive functioning; however, this line of research could prove to be challenging due to the potential problems associated with collecting reliable and valid responses with individuals who have cognitive impairments (e.g., memory, attention).

In summary, results highlight the important role that affect may play in determining an individual’s PA behaviors. It is important, however, to continue examining the relationships established within the model in an attempt to improve our understanding of the PA behaviors of adults with TBI. Due to the diverse range of impairments that result from the injury, PA may play an important role in the rehabilitation of individuals with TBI as well as providing opportunities for people to recreate in community settings. Future studies examining the cause-and-effect relations between the psychosocial variables in the model and PA should be tested through experimental designs to determine the unique, and perhaps reciprocal, contribution of the constructs on each other. This will allow researchers to identify how to modify the rehabilitation program of individuals with a TBI to enhance PA participation.

References


