Evaluation of a Biopsychosocial Model of Life Satisfaction in Individuals with Spinal Cord Injuries

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Purpose: Biopsychosocial frameworks assist rehabilitation researchers in better understanding the subjective experiences of individuals with chronic illness and disability through the examination of biological, psychological and social dimensions of peoples' lives. Using a positive psychology lens, the biopsychosocial model may help researchers determine how variables contribute to positive outcomes for persons with disabilities. This study aims to utilize a biopsychosocial model to evaluate contributions of biological, psychological, and social variables to life satisfaction in persons with spinal cord injuries.

Method: Two hundred forty-seven adults with spinal cord injuries completed an online survey consisting of instruments measuring various biological, psychological and social variables, as well as perceived life satisfaction.

Results: Structural equation modeling was used to evaluate the hypothesized positive biopsychosocial model of life satisfaction. A re-specification of the model was necessary, and analysis of the re-specified model demonstrated adequate fit with the data. The final model explained 58% of the variance in life satisfaction.

Conclusions: The model demonstrated that pain and social factors indirectly impact life satisfaction through psychological well-being in persons with spinal cord injuries.

Effective rehabilitation services are best identified through empirically-supported interventions, in what is formally known as evidence-based practice (EBP; Bolton, 1979; Chan, Sasson, Dichman, Kim, & Chiu, 2009; Chan, Tarvydas, Blalack, Strauser, & Atkina, 2009b). EBP has been established by scholars in rehabilitation as the standard by which professionals should choose interventions that are effective, ethical, and theory- and model-driven (Chan et al., 2009b; Chan et al., 2009; Dumm & Elliott, 2008). EBP allows professionals to determine appropriate interventions for a particular population based on the body of research literature. Law (2002) explains that rehabilitation practitioners do not always follow an EBP approach, and tend to base interventions on intuition, anecdotal experiences, and habits. This may lead to poor outcomes for consumers. Rehabilitation researchers reiterate the call to use EBP in order to provide the most effective services to clients (Chan et al., 2010; Tucker & Reed, 2008). Chan et al. (2009b) suggests that implementing EBP interventions will prevent practitioners from making uninformed or habit-driven decisions.

To improve the effectiveness of rehabilitation services and outcomes, conducting theory- and model-driven research to inform best practices is vital (Chan et al., 2009b). Theory can be an instrumental component to inform EBP, providing practitioners with empirically supported interventions and techniques (Ingram, Hayes, & Scott, 2000). One important model, which is consistent with the prevailing philosophies of rehabilitation, and that continues to gain empirical support as...
an EBP in the rehabilitation literature is the biopsychosocial model.

Biopsychosocial Model

Early medical and rehabilitation practice used solely a biomedical approach, considering only the symptoms and functional limitations inherent to illness and disability. In recognizing the limits of this approach, Engel (1977) proposed the biopsychosocial model of patient care, which takes into consideration the interactions of the biological, psychological, and social dimensions of a person's life. The recognition of the benefit of an expanded understanding of medical pathology from different perspectives is consistent with the characteristics of rehabilitation. Rehabilitation, by nature, is diverse and interdisciplinary, drawing on knowledge and practice from many fields, including psychology, medicine, education, and neuroscience. These diverse perspectives suggest that the well-being and health of persons with disabilities are not exclusively determined by the physical characteristics of a disability or illness itself. As Wright (1983) explained, individuals' responses to the onset of disability should be considered in the context of individuals' lives, including the environments in which they live and the coping resources and appraisal processes inherent in their personalities.

Within rehabilitation, biopsychosocial models have been proposed for various conditions, such as neurological disorders (Fabry, 1998) chronic pain (Talo, Rytköowski, Hämäläinen, & Kallio, 1996), spinal cord injuries (Trieschmann, 1988), breast cancer (Hilton, 1989) and cardiovascular health (Waltz, Badura, Pfaff, & Schott, 1988; Wiklund, Sanne, Vedin & Wilhelmsson, 2001). More general models have been proposed as well (Post, de Witte, & Schrijvers, 1999; Scolfield, Pape, McCracken, & Maki, 1980). Currently, the most prominent biopsychosocial model in rehabilitation is the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF; WHO, 2001). The ICF model recognizes the interdependent nature of biological factors (e.g., physical pathology), psychological variables (e.g., emotional states), and social influences (e.g., social support), within three interactive components: (a) body functions and structures, (b) activities and participation, and (c) the context in which the individual functions.

Practitioners in rehabilitation settings who use a biopsychosocial approach will consider biological, psychological, and social factors in the development of rehabilitation goals and in choosing interventions (Gracey, Evans, & Malley, 2009). The biopsychosocial approach to rehabilitation is gaining traction as an important EBP. For example, a recent Cochrane review (Kamper et al., 2014) found that people with chronic low back pain whose rehabilitation programs were multidisciplinary and targeted factors from multiple life domains, rather than receiving solely a physical treatment regimen, not only experienced less pain and disability, but also had better employment outcomes.

Biopsychosocial Model within a Well-Being Framework

Although the biopsychosocial model represents a vast improvement over purely biomedical approaches to medicine and rehabilitation, it has primarily been used as a framework for discussing pain (e.g., Gatchel, 2004; Mariano, 1992; Osborn, Jensen, Ehde, Hanley, & Kraft, 2007; Raichle, Hanley, Jensen, & Cardenas, 2007; Saarijärvi, Saarijärvi, Karja, & loukamaa, 2012) and depression (e.g., Covie, Adamson, Spencer, & Howe, 2003; Lee, Chan, & Berven, 2007; Seel et al., 2003; O'Shea & Smedema, 2014) in persons with disabilities and chronic illnesses. Despite the more holistic approach to investigating rehabilitation outcomes, the focus on outcomes such as pain and depression is not fully compatible with rehabilitation's increasing emphasis on a “positive psychology” approach (Dunn & Dougherty, 2005; Seligman & Csikszentmihalyi, 2000). As opposed to the traditional emphasis on ameliorating deficits or improving functional limitations within rehabilitation, positive psychology highlights positive aspects of individuals' lives, such as their personal assets and strengths, and focuses much less on negative characteristics (Dunn & Dougherty, 2005). As a result of this philosophical evolution, more attention is now paid to subjective well-being and quality of life as the preferred outcomes in rehabilitation settings. For example, Schultz et al. (2002) argued that an adaptation-oriented rather than a pathology-oriented approach to treatment is preferable in helping persons with disabilities achieve the best outcomes.

In response to this shift, Hoffman and Driscoll (2000) proposed an alternative to Engel's (1977) biopsychosocial model of illness, which is based upon wellness and health. According to Hoffman and Driscoll (2000), a health promotion model emphasizing adaptation and proactive responding is preferred in the prevention and reduction of costs associated with disability and disease. In their concentric biopsychosocial model of health, health status is located in the center of a series of concentric circles, and each circle outward contains psychosocial (e.g., affect, social support), biosocial (e.g., culture), and biomedical (e.g., disease characteristics) factors respectively. Such a focus on the biological, psychological, and social contributors to positive outcomes such as life satisfaction in persons with disabilities is more consistent with the movement toward positive psychology in rehabilitation research and clinical settings (Dunn & Dougherty, 2005; Seligman & Csikszentmihalyi, 2000).

Biopsychosocial Variables and Well-Being in Persons with Spinal Cord Injuries

As one of the primary goals of rehabilitation is to help people with disabilities achieve the highest level of subjective well-being possible, a major emphasis of research in rehabilitation is to identify predictors of positive outcomes in persons with disabilities. This allows for the design of evidence-based rehabilitation services to maximize positive outcomes including life satisfaction. Considering well-being from a positive biopsychosocial perspective will allow a more complete, holistic, and asset-oriented view of the impact of disability on individuals' lives. The following biopsychosocial variables have been studied in relation to positive outcomes such as subjective well-being in persons with spinal cord injuries:

**Biological variables.** Two biological variables frequently
studied in individuals with spinal cord injuries are injury severity/level of impairment and pain. Although some research has demonstrated that higher injury levels are related to lower well-being (Clayton & Chubon, 1994), several studies have concluded that injury level, degree of impairment, and severity are weakly or unrelated to well-being (Craig, Tran, Lovas, & Middleton, 2008; Martz, Livneh, Priebe, Wuermser, & Ottomanelli, 2005; Migliorini & Tonge, 2009). Despite this, disability severity is very commonly considered in research related to well-being in persons with spinal cord injuries. In addition, within research including biological variables, pain and well-being are consistently shown to be negatively correlated (Raichle et al., 2007; Craig et al., 2008; Ravenscroft, Ahmed, & Burnside, 2000).

Psychological variables. Psychological variables commonly addressed related to well-being in individuals with spinal cord injuries include mental health, hope, and more recently core self-evaluations (CSE). Regarding mental health, Martz et al. (2005) found that negative emotional responses such as depression and anxiety were related to lower levels of psychosocial adaptation in persons with spinal cord injuries. As for hope, Migliorini and Tonge (2009) found that lack of hope was negatively associated with subjective well-being in persons with spinal cord injuries. Hope also has been found to relate to life satisfaction in individuals with spinal cord injuries (Smedema, Chan, & Phillips, 2014; Smedema & Tansey, 2015). CSE is a newer psychological variable that describes individuals' global evaluations of themselves as good, competent, and worthy people, and is a higher-order predictor of well-being that consists of self-esteem, self-efficacy, locus of control, and emotional stability (Judge, Erez, & Bono, 1998). CSE has been found to be associated with life satisfaction in individuals with spinal cord injuries (Smedema et al., 2014; Smedema & Tansey, 2015).

Social variables. Social variables frequently studied in individuals with spinal cord injuries include social support, social stigma, and social functioning. Li and Moore (1998) focused on perceived social support and stigma, and found that these constructs are associated with the acceptance of disability in individuals with spinal cord injuries. Social support has also been shown to impact the outcome of life satisfaction for individuals with spinal cord injuries (Smedema & Tansey, 2015; Hampton, 2008). Migliorini and Tonge (2009) found that feeling a sense of intimacy with others was related to subjective well-being in Australians with spinal cord injuries. Veterans with spinal cord injuries who have greater social integration have been found to have higher levels of life satisfaction (Fortmann et al., 2013).

Aims of the Present Study
Given the need for research supporting EBP in rehabilitation settings, as well as the promise of the biopsychosocial model as an EBP to influence positive well-being outcomes, the purpose of this study is to evaluate a positive biopsychosocial model of life satisfaction, which is consistent with rehabilitation's increasing emphasis on positive psychology. A structural equation model will be tested with biological, psychological, and social latent variables predicting overall life satisfaction. Observed biological variables, identified through previous research, include injury level and pain. Observed psychological variables include mental health, hope, and CSE. Observed social variables include social support, social stigma, and social functioning. It is hypothesized that the model will exhibit a good fit with the data, and will support the biopsychosocial model of life satisfaction in persons with spinal cord injuries.

Method
Participants
In this study, 247 adults with spinal cord injuries completed an online survey. 123 (49.8%) of the participants were female and 124 (50.2%) were male. Their ages ranged from 20 to 72 (M = 41.6, SD = 12.4). The average age of injury onset was 27.4 (SD = 12.9, Range 0-64). The average time since participants' injury occurred was 14.2 years (SD = 12.5, Range 1-60). Participants' self-identified racial/ethnic identities were as follows: 206 (83.4%) White, 12 (4.9%) Black, 20 (8.1%) Hispanic/Latino, 3 (1.2%) Asian, 4 (1.6%) Native American and 2 (0.8%) who selected "other". Regarding spinal cord injury severity, 109 (44.1%) participants indicated their spinal cord injury affected the cervical spine, 111 (44.9%) indicated their injury affected the thoracic spine, 25 (10.1%) indicated their injury affected the lumbar spine, and 2 (0.8%) indicated their injury affected the sacral spine. Education level of the participants varied: 7 (2.8%) participants did not have a high school diploma, 1 (0.4%) participant earned a special education certificate of completion/attendance, 39 (15.8%) participants received a high school or high school equivalent diploma, 59 (23.9%) participants received some post-secondary education, 43 (17.4%) participants earned an associate's degree or vocational/technical school certificate, 65 (26.3%) participants earned a bachelor's degree, and 32 (13.0%) participants earned a master's degree or higher. In terms of employment status, 57 (23.1%) participants specified being full-time employees, 33 (13.4%) participants specified being part-time employees, 25 (10.1%) participants specified being retired, 28 (11.3%) participants were involved in volunteering activities, 16 (6.5%) participants were currently students, 28 (11.3%) participants were actively looking for a job, but were not employed, and 60 (24.3%) participants specified that they were not employed and were not actively looking for a job. Among participants employed part-time, the average hours of paid work each week was 14.6 (SD = 7.5). Among participants employed full-time, the average hours of paid work each week was 40.5 (SD = 7.1).

Instruments
A variety of instruments were used to measure the variables in this study. In addition to a demographic questionnaire, biological measures included self-reported injury level and the Pain subscale of the Medical Outcomes Study 20-Item Short Form Health Survey (SF-20); psychological measures included the Core Self-Evaluations Scale, the Trait Hope Scale, and the Mental Health subscale of the SF-20; and social measures included the Social Functioning subscale of the
SF-20, the Personal Resources Questionnaire-2000, and an adapted version of the Stig-9.

**Demographic questionnaire.** The demographic questionnaire was developed by the researchers to gather pertinent demographics specific to this study. The information acquired included gender, age, race/ethnicity, education, employment, and injury characteristics.

**Injury level.** Each participant's self-reported location of spinal cord injury was assigned a value from 1 to 30, with C1 cervical injuries being assigned 1, and S5 sacral injuries being assigned a 30. Thus, higher scores reflect lower levels of injury (i.e., higher physical functioning).

**Medical Outcomes Study 20-Item Short-Form Health Survey.** The Medical Outcomes Study 20-Item Short-Form Health Survey (SF-20), developed by Ware, Sherbourne, and Davies (1992) was used to measure components in the biological (Pain subscale), psychological (Mental Health subscale), and social (Social Functioning subscale) latent variables, as these subscales were developed to measure health concepts related to pain, mental health, and social functioning. The pain subscale consists of one item (e.g., "How much bodily pain have you had during the past 4 weeks?") measured on a six-point Likert scale (1=none to 6=very severe). The mental health subscale includes five items (e.g., "How much of the time, during the past month, have you been a very nervous person?") measured on a six-point Likert scale (1=all the time to 6=none of the time). The social functioning subscale consists of one item (e.g., "How much of the time, during the past month, has your health limited your social activities (like visiting with friends or close relatives)?") measured on a six-point Likert scale (1=all the time to 6=none of the time). Calculated scores on each subscale range from 0 to 100, with higher scores indicating better biological, psychological, and social functioning. The SF-20 demonstrates strong psychometric properties, exhibiting high correlations with other physical and mental health measures (Davis & Ware, 1981) and internal consistency reliability coefficients ranging from .87 to .92 (Stewart, Hays, & Ware, 1988). The Cronbach's alpha coefficient for the mental health subscale was $\alpha=.79$. As both the pain and the social functioning subscales consisted of one item each, alpha coefficients could not be determined.

**Core Self-Evaluation Scale.** The Core Self- Evaluation Scale (CSES; Judge, Erez, Bono, & Thoresen, 2003) was used to measure CSE in this study. The CSES includes 12 items (e.g., "I am confident I get the success I deserve in life") rated on a five-point Likert scale (1=strongly disagree to 5=strongly agree). Higher scores on the CSES indicate greater levels of CSE. Consistent with CSE theory, the CSES presents a one-factor measurement structure (Judge et al., 2003; Smidemama, Morrison, Yaghaian, Deangelas, & Aldrich, 2016). Measures of job satisfaction, job performance, and life satisfaction have been found to be significantly correlated with the CSES (Judge et al., 2003). The CSES demonstrates a one-month test-retest reliability of .81. Internal consistency reliability estimates (Cronbach's alpha) range from .81 to .87 (Judge et al., 2003). Smedema et al. (2016) validated the CSES specifically for individuals with spinal cord injuries. The Cronbach's alpha coefficient for the CSES in the present study was $\alpha=.88$.

**Trait Hope Scale.** The Trait Hope Scale (THS; Snyder et al., 1991) was used to measure hope in this study. The THS includes eight items focusing on agency (e.g., "I energetically pursue my goals") and pathways thinking (e.g., "There are lots of ways around any problem") rated on a four-point Likert scale (1=definitely false to 4=definitely true). The total score from the THS was used in this study. Higher scores in the THS indicate greater levels of hope. Optimism, self-esteem, and goal expectancies have all been found to be related to the THS (Snyder et al., 1991). The internal consistency reliability estimates (Cronbach’s alpha) across several studies averaged to .80 (Snyder et al., 1991). The Cronbach's alpha coefficient for the THS in the present study was $\alpha=.88$.

**Personal Resources Scale-2000.** The Personal Resources Scale-2000 (PRQ-2000; Weinert, 2003) was used to measure perceived social support in this study. The PRQ-2000 includes 15 items (e.g., "There is someone I feel close to who makes me feel secure") rated on a seven-point Likert scale (1=strongly disagree to 7=strongly agree). Higher scores indicate greater levels of social support. The PRQ-2000 has been found to be associated with measures of mental health outcomes, such as the Center for Epidemiologic Studies Short Depression Scale-10 Item Version (Weinert, 2003). Internal consistency reliability estimates (Cronbach’s alpha) range from .89 to .95 (Weinert, 2003). The Cronbach's alpha coefficient for the PRQ-2000 in the present study was $\alpha=.93$.

**Adapted Stig-9.** An adapted version of the Stig-9 (B. Gierk, personal communication, November 25, 2015) was used to measure spinal cord injury stigma in this study. The Stig-9 was originally developed to measure perceived social stigma toward individuals with mental illness. In this study, the words "mental illness" were replaced with the words "spinal cord injury" to reflect social stigma toward individuals with spinal cord injury. The adapted Stig-9 includes nine items (e.g., "I think that most people think badly of someone with a spinal cord injury") rated on a four-point Likert scale (0=disagree to 3=agree). Higher scores on the adapted Stig-9 indicate greater levels of perceived social stigma. However, in order to keep the signs consistent (i.e., greater functioning equals higher scores), the Stig-9 was reverse scored in this study. While the Stig-9 is a relatively new measure of perceived social stigma in persons with mental illness, initial psychometric information on 919 outpatients support its factor and divergent validity (B. Gierk, personal communication, November 25, 2015). Gierk’s initial study demonstrated an internal consistency reliability estimate (Cronbach’s alpha) of $\alpha=.88$. The Cronbach’s alpha coefficient for the adapted Stig-9 in the present study was $\alpha=.88$.

**Satisfaction with Life Scale.** The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) was used to measure satisfaction with life in this study. The SWLS includes five items (e.g., "In most ways my life is close to my
ideal") rated on a seven-point Likert scale (1=strongly disagree to 7=strongly agree). Higher scores on the SWLS indicate greater levels of life satisfaction. Measures of subjective well-being, such as the Affect Balance Scale and the Rosenberg Self-Esteem Scale, have been found to be correlated with the SWLS (Diener et al., 1985). The SWLS demonstrates a test-retest reliability coefficient of .82 over a 2-month period. The Cronbach’s alpha coefficient for the SWLS in the present study was α=.90.

**Procedures**

This study’s procedures were approved by the Education and Social/Behavioral Science Institutional Review Board Office at the authors’ institution. An advertisement was placed in the membership magazine of the National Spinal Cord Injury Association (NSCIA), Life in Action, to recruit members to participate. In addition, a link to the online survey was posted on the NSCIA website and several other spinal cord injury support group websites (e.g., inspiredsciforum.com). To ensure eligibility, at the beginning of the online survey individuals were asked eligibility questions (e.g., What is your age? Do you have a spinal cord injury?) before completing the online informed consent process. No prospective participants failed to qualify based upon these eligibility questions. Participants were sent a $15 gift card after completion of the survey.

**Data Analysis**

All model estimations and effects analyses were conducted using maximum-likelihood estimation in AMOS 22.0. Several indices were used to evaluate model fit as recommended by Weston, Gore, Chan, and Catalano (2008). These include (a) the chi-square goodness-of-fit test, with a non-significant chi-square indicating good model fit; (b) the χ²/df ratio, with values between 1 and 3 indicating good fit; (c) the comparative fit index (CFI), with values of .95 or higher indicating good fit; and (d) the goodness-of-fit index (GFI), with values of .95 or greater indicating good fit. Additionally, Root Mean Square Error of Approximation (RMSEA) with a value less than .05 indicating close fit and a value up to .08 indicating reasonable fit (Byrne, 2001), was used to evaluate the fit of the model.

**Results**

Means, standard deviations, and intercorrelations among the variables in the proposed model, which were calculated using SPSS 22.0, are shown in Table 1. The hypothesized biopsychosocial model of life satisfaction (as shown in Figure 1) was evaluated using structural equation modeling. The model revealed a significant chi-square, χ²(26, N = 247) = 283.71, p =.000; χ²/df = 10.91; GFI = .82; CFI = .68; and RMSEA = .20. These indices taken together indicate an inadequate fit with the data. As a result, re-specification of the model was necessary.

In order to determine necessary modifications to the original model, the researchers determined the critical ratios for eliminating paths and modification indices for adding paths. Consequently, the latent variable “bio” and the observed variable “injury level” were eliminated, while retaining the observed variable “pain.” The path between the latent variable “social” and “life satisfaction” was also eliminated. Several direct paths were added to the model, including (a) a path between the latent variable “social” and the latent variable “psycho”; (b) a path between “pain” and “mental health”; (c) a path between “pain” and “social function”; and (d) a path between “mental health” and “social function”. Finally, a covariance was added in between the error terms for “CSE” and “mental health”.

Analysis of the re-specified model (shown in Figure 2) still revealed a significant chi-square, χ²(16, N = 247) = 38.50, p <.001. However, the remaining fit indexes were considered to be acceptable: χ²/df = 2.41; GFI = .96; CFI = .97; and RMSEA = .08. The results taken together demonstrated adequate fit of the re-specified model to the data.

The model explained 58% of the variance in life satisfaction. Effects analysis indicated that the latent variable “psycho” had a direct effect on life satisfaction (β = .76, p <.01). The latent variable “social” had a direct effect on the latent variable “psycho” (β = .83, p <.05). Pain had direct effects on mental health (β = .58, p <.05) and social function (β = .27, p <.01). Mental health had a direct effect on social function (β = .27, p <.01). The latent variable “social” had indirect effects on life satisfaction (β = .64, p <.01), mental health (β

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<thead>
<tr>
<th>Table 1. Means, Standard Deviations, and Correlations for all Variables in Proposed Model (N=247)</th>
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<td><strong>M(SD)</strong> 1. 2. 3. 4. 5. 6. 7. 8. 9.</td>
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<td>---------------------------------------------</td>
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<tr>
<td>1. Life Satisfaction 19.5(8.2) .</td>
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<tr>
<td>2. Injury Level 19.5(6.5) .15* .</td>
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<tr>
<td>3. Pain 45.1(25.3) .19** .02 .</td>
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<tr>
<td>4. Core Self-Evaluation 39.3(8.6) .63*** .09 .12 .</td>
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<td>5. Hope 48.4(9.7) .66*** .18** .06 .70*** .</td>
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<td>6. Mental Health 57.5(20.4) .43*** .18** .20** .64** .52**</td>
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<td>7. Social Function 58.7(31.1) .36*** .04 .37*** .46*** .40*** .47***</td>
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<td>8. Social Support 79.6(17.9) .58*** .20** .18** .58*** .67*** .44*** .42***</td>
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<td>9. Social Stigma 20.1(6.5) .19** .09 .13* .33*** .24*** .32*** .24*** .38***</td>
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**Note.** *p<.05, **p<.01, *** p<.001
Discussion

This study provides important information about biopsychosocial contributors of life satisfaction in individuals with spinal cord injuries. In the re-specification of the model, the injury level component of the biological latent variable was dropped, leaving pain as the only biological indicator in the final model. While some prior research has shown higher injury levels to be associated with lower well-being in individuals with spinal cord injuries (e.g., Clayton & Chubon, 1994), this result is consistent with the majority of prior research, which shows minimal contribution of injury level to well-being in persons with spinal cord injuries (Craig et al., 2008; Martz et al., 2004; Migliorini & Tonge, 2009). In addition, in the re-specified model, pain influenced life satisfaction indirectly through its effects on mental health and social functioning. Prior research has shown that higher levels of pain are associated with decreased psychological well-being in persons with spinal cord injuries (Craig et al., 2008; Raichle et al., 2007; Ravenscroft et al., 2000). Furthermore, experiencing pain has a synergistic relationship with poor mental health, and both pain and mental illness are related to the ability to successfully function in a social environment (Gatchel, 2004).

Another notable characteristic of the re-specified model is that the social latent variable (i.e., social well-being) did not affect life satisfaction directly, but via an indirect effect through the psychological latent variable (i.e., psychological well-being). These findings help to elucidate the mechanisms through which the categories of variables in the biopsychosocial model influence overall subjective well-being (e.g., life satisfaction). Consistent with Hoffman and Driscoll’s (2000) concentric theoretical model, psychological well-being served as a mediator between biological (i.e., pain) and social well-being and life satisfaction in this study. The observed social variables, social support and social functioning, and social stigma have been found to be related to well-being in persons with spinal cord injuries (Smedema & Tansey, 2015; Li & Moore, 1998; Hampton, 2008). The results of this study suggest that the variables in these prior studies may, in fact, have affected overall subjective well-being by first improving participants’ psychological health, which in this study was operationalized by CSE, hope, and mental health. Future longitudinal research will help determine the causal nature of these relationships.

Clinical and Research Implications

The results of this study suggest that, within a biopsychosocial framework, biological and social factors do not directly affect overall life satisfaction in persons with spinal cord injuries, but they do so indirectly through increased psychological well-being. Therefore, rehabilitation interventions should be designed in such a way that psychological well-being is a primary consideration. In this particular study, psychological well-being was comprised of hope, CSE, and mental health. Interventions aimed at increasing hope include helping clients to develop the agency (i.e., motivation) and pathways (e.g., routes, processes) to achieve desired life goals (Snyder, Rand, & Sigmon, 2002). Such methods might include education regarding effective decision-making, motivational interviewing, and techniques aimed at the development of self-regulation strategies (Schrank, Bird, Rudnick, & Slade, 2012). Although no interventions yet exist to directly affect CSE, practitioners focusing on CSE often target the four low-order CSE traits (self-esteem, self-efficacy, locus of control, and emotional stability). For example, the pursuit of self-esteem may have either positive or negative consequences for the client (Crocker & Park, 2004). If an individual fails to achieve desired goals in the pursuit of self-esteem, feelings of shame, worthlessness, and sadness may result. Pyszczynski and Cox (2004) suggest that assisting individuals to develop a positive sense of self-worth through helping others, and based on their inner identities and values, may be preferable alternatives to
seeking self-esteem based on individuals' achievements. In addition, mental health in persons with spinal cord injuries can be addressed through the provision of appropriate mental health counseling services, including cognitive and cognitive behavioral therapy. It is important to note that these are just three of the multitude of factors that constitute psychological well-being, and future research should focus on identifying other variables which are important within a biopsychosocial perspective.

Although it is important to address psychological well-being directly in persons with spinal cord injuries, practitioners should design comprehensive and holistic intervention programs that consider biological and social factors which affect psychological well-being and overall life satisfaction. For example, pain may be addressed through the provision of appropriate medical care and counseling interventions aimed at helping the individual to develop effective coping strategies. In addition, the impact of relevant biological vulnerabilities may be minimized through cognitive and cognitive behavioral therapy addressing maladaptive pain- and health-related appraisals, beliefs, and catastrophizing thoughts (Raichle et al., 2007).

In addition, social well-being plays a key role in the psychological well-being of individuals with spinal cord injuries. In clinical settings, clients' perceptions of their social roles and relationships should be explored in order to determine their feelings of social connectedness. Social stigma and social role functioning should also be discussed with clients to understand individuals' lived social experiences. When social well-being is not at optimal levels, opportunities for increasing connections with others may be explored. For example, gaining control of one's immediate environment and regulating stressful emotions and other life stressors may help positively increase an individual's ability to cope (Moos & Schaeffer, 1984). Learning to effectively cope in situations where an individual feels uncomfortable or unsupported may help with social well-being. From a research perspective, future studies may want to look at other positive psychology constructs that could help define social well-being. Constructs such as perceived social self-efficacy and social problem solving may be two concepts to consider.

The psychological and social variables that are operationalized in this model come from a positive psychology framework. Such a positive approach mirrors the rehabilitation field's strengths-based philosophy that is applied in both research and practice. From a clinical perspective, individual strengths should be emphasized and areas of weakness should receive accommodation (Dunn & Dougherty, 2005). Focusing on the strengths of individuals with spinal cord injuries in a clinical setting does not mean the negative aspects of life should be disregarded; rather a more positive approach is suggested (Smedema, 2014). In a research context, future studies should look at other positive psychological variables that may impact life satisfaction. Seligman (2011) suggests that using the PERMA model, which focuses on positive, emotions, engagement, relationships, meaning/purpose, and accomplishments increases happiness and well-being. The PERMA model may help expand the conceptualization and understanding of psychological well-being for individuals with spinal cord injuries.

Limitations
This study provides novel information about the biopsychosocial model in conceptualizing well-being in persons with spinal cord injuries; however, it has several limitations. First, this study focused only on persons with spinal cord injuries, and therefore the results may not generalize to the larger population of individuals with disabilities. In addition, this study may not generalize to the entire population of persons with spinal cord injuries, outside of those who have computers, are willing to complete surveys online, and/or who participate in online support groups. Next, data were collected through the use self-report measures, and this may affect the validity of the results. The instruments used in this study have been found to be valid and reliable in previous research, but as with any self-report measure, there are several factors that limit interpretation. By collecting sensitive, disability-related information, participant responses may be influenced by the social desirability bias (Antonak & Livneh, 1995; Kreuter, Predden, & Tourangeau, 2008). In addition, the participants completed the survey online, and this may have led to a larger proportion of persons who were higher functioning, younger, and/or more comfortable using the Internet to complete the survey.

Conclusion
The purpose of this study was to evaluate a biopsychosocial framework for individuals with spinal cord injuries. The results showed that pain was the only observed biological variable to be included in the re-specified model, and it directly affected the observed variables of mental health and social role functioning. The results also indicate that social well-being affected life satisfaction indirectly through psychological well-being in individuals with spinal cord injuries. This re-specified model shines light on the emphasis that should be placed on psychological and social well-being indicators in individuals with spinal cord injuries. It also supports a positive psychology framework in clinical and research settings, as all the psychological and social variables used were positive in nature. Future research directions may look at additional positive psychological constructs in various populations of individuals with disabilities, in order to ensure they are able to achieve the highest level of life satisfaction possible.

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