

# Depression in Spinal Cord Injury: Assessing the Role of Psychological Resources

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**Purpose:** To test the spinal cord injury adjustment model (SCIAM) and to examine how psychological resources may influence depressive symptoms in persons with spinal cord injury (SCI). We expect that (a) higher general self-efficacy (GSE) and higher purpose in life (PIL) are associated with lower levels of depressive symptoms, and that (b) the effect of GSE and PIL on depressive symptoms is mediated by appraisals and coping strategies, as proposed by the SCIAM. **Method:** A nationwide cross-sectional survey (the Swiss Spinal Cord Injury Cohort Study) was conducted with individuals with SCI living in the Swiss community ( $N = 516$ ). Structural equation modeling was used to test relationships between variables as specified in the SCIAM. **Results:** Higher GSE ( $r = -.54$ ) and PIL ( $r = -.62$ ) were significantly associated with lower depressive symptoms. The initial model yielded poor model fit. However, the final modified model fitted well, with  $\chi^2(21) = 54.00$ ,  $p < .01$ , RMSEA = .055 (90% CI [.038, .073]), CFI = .98, explaining 62.9% of the variance of depressive symptoms. PIL had a direct large effect and an indirect effect on depressive symptoms via appraisals and coping strategies. The influence of GSE on depressive symptoms was fully mediated by appraisals and coping strategies. **Conclusions:** Psychological resources of individuals with SCI can have a direct effect on depressive symptoms. The mediated pathways are present, but not exclusive in our data, yielding only partial support for the mechanism proposed by the SCIAM.

**Keywords:** depression, spinal cord injuries, psychological adjustment (adaptation, psychological), purpose in life, structural models

### Impact and Implications

- This is the first study using structural equation modeling to test the spinal cord injury adjustment model (SCIAM) with depressive symptoms as adjustment outcome.
- The results are concordant with the conceptualization of adjustment to spinal cord injury (SCI) as a multifactorial process. Our findings provide partial support for the SCIAM, because the effect of the

psychological resources general self-efficacy and purpose in life on the level of depressive symptoms was only partially mediated by appraisals and coping.

- General self-efficacy and purpose in life, appraisals and coping strategies largely explained the level of depressive symptoms in persons with SCI, suggesting that they might be promising intervention targets to foster mental health.

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## Introduction

Spinal cord injury (SCI) is a neurological health condition that can result in permanent loss of motor and sensory function (Lin, 2010). The severe physical impairments also have considerable impact on everyday activities or social interactions of the individuals affected (Kirshblum, Campagnolo, & DeLisa, 2002). The experience of a disabling condition, such as SCI, can be a risk factor for the development of elevated levels of depressive symptoms: The risk for experiencing elevated levels of depressive symptoms is higher for individuals with SCI compared to the general population (Craig, Tran, & Middleton, 2009). Most recent prevalence estimates of elevated levels of depressive symptoms range between 20% and 40% in the first 6–8 months after injury (Craig et al., 2009).

The goal of reducing the negative effect of SCI in terms of elevated depressive symptoms has stimulated substantial research efforts aiming to identify predictors and hence potential intervention targets. For example, sociodemographic variables, such as age, gender, low education and income, as well as functional impairments or health status have been related to depressive symptoms (Arango-Lasprilla, Ketchum, Starkweather, Nicholls, & Wilk, 2011; Bombardier, Richards, Krause, Tulsy, & Tate, 2004; Fuhrer, Rintala, Hart, Clearman, & Young, 1993; Hoffman, Bombardier, Graves, Kalpakjian, & Krause, 2011; Krause, Kemp, & Coker, 2000; Saunders, Krause, & Focht, 2012).

The ways persons with SCI appraise their life situation and how they cope with the consequences of SCI have also been linked to depressive symptoms (Chevalier, Kennedy, & Sherlock, 2009; Galvin & Godfrey, 2001). Appraisals refer to how a person perceives and interprets a stressor. Life situations with a negative valence, such as SCI, can be appraised by the affected person as, for example, harming or challenging (primary appraisals). Secondary appraisals refer to the perception of an individual as to whether the demands imposed by SCI can be handled and whether the necessary resources are available to overcome these demands. Studies with individuals with SCI have repeatedly shown links between how SCI is appraised and the level of depressive symptoms (Galvin & Godfrey, 2001; Kennedy, Lude, Elfström, & Smithson, 2012; Post & van Leeuwen, 2012).

Coping strategies comprise the efforts that are used to manage the demands imposed by SCI. Common conceptualizations of coping strategies include, for example, problem-oriented, emotion-oriented, or avoidance-oriented coping strategies, although the conceptualization of the various coping strategies is subject to considerable debate and many other category systems exist (Skinner, Edge, Altman, & Sherwood, 2003). Problem-oriented coping refers to an active orientation toward the demanding situation, for example including planning and identification of necessary steps to solve a problem or improve a situation. Emotion-focused coping refers to strategies aiming to handle the emotions that were aroused by a stressful situation, such as venting of emotions. Avoidant coping strategies refer to strategies in which an individual avoids, withdraws or seeks distraction from the stressor and hence directs the attention away from the stressor. From a theoretical point of view, there are no good or bad coping strategies per se, as they have to fit the environmental demands of a specific situation. Further, coping can be assessed as general tendency, that is, coping strategies that are typically adopted in a wide array of

situations, or as situation-specific behavior, such as after SCI onset (Elfstrom, Ryden, Kreuter, Persson, & Sullivan, 2002). Nonetheless, problem-oriented coping strategies generally seem to be connected with better adjustment following SCI than avoidant-oriented strategies (Livneh & Martz, 2012).

Considerable interest has also been directed toward the link between psychological resources and depressive symptoms in individuals with SCI. Psychological resources of an individual are inner, health protecting or health promoting potentials of a person (Hobfoll, 2002; Luria & Torjman, 2009; Rowe, 1996). They may include abilities, skills and personal characteristics such as general self-efficacy (GSE), sense of coherence, optimism or purpose in life (PIL). Within the field of SCI, consistent associations between higher GSE, that is, a general belief in one's own capability to overcome demands from the environment (Schwarzer & Jerusalem, 1995), and lower depression has been observed. Knowledge regarding other psychological resources, such as PIL, that is, the extent to which a person discovers a sense of meaning in his or her own life (Frankl, 1959), is limited (Peter, Müller, Cieza, & Geyh, 2012; van Leeuwen, Kraaijeveld, Lindeman, & Post, 2012).

Overall, considerable knowledge regarding potential correlates and determinants of depressive symptoms in individuals with SCI has been gathered. However, only a few studies have used or tested theoretical conceptualizations or models to shed light into the mechanism influencing the level of depressive symptoms observed in individuals with SCI. For example, Catalano, Chan, Wilson, Chiu, and Muller (2011) have used the framework of resilience model (Kumpfer, 1999) to describe the development of depressive symptoms in individuals with SCI. Another study used the theoretical quality-of-life model by Rapkin and Schwartz (2004) to investigate the mechanism underlying mental health, participation and life satisfaction to SCI (van Leeuwen, Post, et al., 2012). The interplay between sociodemographic and injury-related characteristics, motor function, participation and health-related factors and their impact on somatic and nonsomatic symptoms of depression was examined in a recent study (Hartoonian et al., 2014). However, specific disability-related adjustment models, which had been developed to depict the adjustment process following SCI, have not been investigated so far.

Based on the seminal work of Lazarus and Folkman (1984) and their transactional stress-coping model, and the health belief model (Janz & Becker, 1984), the spinal cord injury adjustment model (SCIAM) was developed to explain how persons with SCI adjust to SCI onset (Middleton & Craig, 2008). It has been used as a theoretical framework for the depiction of the adjustment process to SCI (Kennedy, Lude, Elfström, & Smithson, 2010a). The SCIAM proposes a multifactorial adjustment process. Biological factors, such as injury level, environmental factors, including social support, and psychological factors, including psychological resources such as GSE and PIL, constitute predisposing or modifying factors, stressors, or resources which interact and together influence how an individual with SCI appraises his or her injury. How the individual appraises SCI is supposed to have an effect on the coping strategies that are being adopted to handle the challenges of living with an SCI. Finally, how the individual copes with the challenges related to SCI affects the adjustment outcomes, such as depressive symptoms. To sum up, according to the SCIAM, the psychological resources (in our study: GSE and PIL) have an impact on depressive symptoms via appraisals and coping,

a process, which can be illustrated as GSE/PIL → appraisals → coping strategies → depressive symptoms.

The potential effect of GSE and PIL on various adjustment indicators has been examined in a large research program, where the SCIAM has been used as underlying, guiding model. Partial support for the SCIAM operationalizing adjustment outcomes with life satisfaction and participation has been found (Peter, Müller, Cieza, et al., 2014; Peter, Müller, Post, et al., 2014). The objective of this study is to examine whether, and if so, how GSE and PIL may influence depressive symptoms in persons with SCI. We expect that (a) higher GSE and PIL are associated with lower levels of depressive symptoms, and that (b) the effect of GSE and PIL on depressive symptoms is mediated by appraisals and coping strategies.

## Method

### Study Design

The Swiss Spinal Cord Injury Cohort Study (SwiSCI) is a population-based longitudinal cohort study that aims to enhance the understanding of how to support functioning, health maintenance, and quality of life of individuals with SCI (Post et al., 2011). SwiSCI consists of three pathways. Pathway 1 is a retrospective study of medical files of the persons with SCI. Pathway 2 is a community-based, cross-sectional survey including individuals living in the Swiss community. It is envisioned to repeat the community survey at a 5-year interval. Pathway 3, finally, is an inception cohort study including all Swiss persons with newly acquired SCI during their first rehabilitation program. Pathway 3 consists of four measurement time-points during first rehabilitation (1, 3, and 6 months after injury and at discharge of rehabilitation), while two further are envisioned at 1 and 2 years postinjury. A detailed description of the study design of SwiSCI can be found elsewhere (Post et al., 2011). The current study was nested within the community-based cross-sectional survey (Pathway 2) of SwiSCI.

### Procedures

Within Pathway 2 of SwiSCI, self-report questionnaires were sent in three waves to all eligible persons by postal mail. First, information about SwiSCI, the informed consent form, and a brief questionnaire about sociodemographic and injury-related variables were sent. Persons who gave consent and completed the first questionnaire received a second questionnaire on health, functioning, participation, and well-being. The third questionnaire wave consisted of three different modules, that is, the health services module, work and employment module, and the health behavior and personal factors module, which contained our questionnaires. To reduce the burden for the participants, respondents of the second questionnaire were randomly allocated to one of the three modules in the third questionnaire wave. Due to our need for a large sample size, a slightly higher percentage than one third, that is, 38%, was randomly allocated to the health behavior and personal factors module. The stratified randomized sample from the respondents of the second questionnaire was drawn controlling for gender, age, and level of injury (para- vs. tetraplegia).

### Participants

Eligible for study participation in Pathway 2 were individuals with a traumatic or nontraumatic SCI, age 16 years or older, living in the community in Switzerland. Neurodegenerative disorders such as multiple sclerosis, congenital conditions including spina bifida, or new SCI in the context of palliative care excluded participation. The recruitment of potential SwiSCI participants was based on screening of medical resources records of the four specialized Swiss SCI rehabilitation centers including the REHAB Basel, the Spinal Cord Injury Center of the Balgrist University Hospital, Zürich, the Clinique Romande de Réadaptation in Sion, and the Swiss Paraplegic Centre in Nottwil. Furthermore, member lists of two SCI associations (Swiss Paraplegic Association SPV, Parahelp) were additional sources for recruitment. All study participants signed an informed consent form. All local ethical committees (Zürich, Basel, Wallis, and Lucerne) approved the study. SwiSCI accords to the ethical standards of the Declaration of Helsinki (1964).

The return rates were 61.1% for the first SwiSCI Pathway 2 questionnaire wave, 82.6% for the second wave, and 87.6% for the present study, resulting in a cumulative response rate of 44.2%. Nonresponse analyses comparing characteristics of individuals initially invited to participate to the first wave to those participating to the present study indicated that members of the Swiss Spinal Association as well as individuals with shorter or longer time since injury than 13 years were more likely to return our questionnaire. However, age, gender, injury level, and language of the questionnaires were not associated with the nonresponse (M. W. G. Brinkhof, personal communication, June 12, 2014). A total of 516 individuals participated in our study. On average, the participants were mainly male (72.1%), 53.1 years old, paraplegic (67.5%), and lived more than 17 years with their injury (see Table 1).

### Measurement Instruments

Sociodemographic (age, gender, education and marital status) and injury-related variables (time since SCI, injury type, cause of SCI) were collected. Injury type comprises the injury level (para- vs. tetraplegia) and injury completeness (complete vs. incomplete injury). SCI can be caused by a traumatic (e.g., accident) or nontraumatic (e.g., internal bleeding) incident.

### Psychological Resources

**PIL.** The Purpose in Life Test–Short Form (PIL–SF; Schulenberg, Schnetzer, & Buchanan, 2011) was used to assess PIL. This measure is based on the original 20-item Purpose in Life Scale (Crumbaugh & Maholick, 1964). The PIL–SF consists of four 7-point items using different anchors for each item. An item example is “I have discovered: *no mission or purpose in life*” versus “*clear-cut goals and a satisfying life purpose*.” The total score ranges from 4 to 28, with higher scores standing for higher PIL. Good internal consistency estimates ranging between 0.84 and 0.86 have been reported (Schulenberg et al., 2011). Testing of convergent and divergent validity yielded correlational patterns with measures of well-being and distress which were consistent with the literature in terms of direction and magnitude (Schulenberg et al., 2011). Internal consistency in this study was good (Cronbach’s alpha: .89).



Table 1  
*Descriptive Characteristics of Study Participants*

	Participants <i>n</i> (%)
Gender	
Male	372 (72.1)
Female	144 (27.9)
Missing	0
Marital status	
Single (never married)	158 (30.5)
Married	258 (50.0)
Widowed	70 (13.6)
Divorced	23 (4.5)
Reg. Partnership	2 (0.4)
Missing	5 (1.0)
Age, mean ( <i>SD</i> ) in years	53.1 (14.6)
Missing	28 (5.4)
Education, mean ( <i>SD</i> ) in years	13.8 (3.3)
Missing	12 (2.3)
Time since injury, mean ( <i>SD</i> ) in years	17.6 (13.6)
Missing	44 (8.5)
Type of injury	
Complete paraplegia	166 (32.2)
Complete tetraplegia	57 (11.0)
Incomplete paraplegia	182 (35.3)
Incomplete tetraplegia	102 (19.8)
Missing	9 (1.7)
Cause of injury	
Traumatic	400 (77.5)
Nontraumatic	88 (17.1)
Unspecified	27 (5.2)
Missing	1 (0.2)
Language of questionnaire	
German	364 (70.5)
French	131 (25.4)
Italian	21 (4.1)
Missing	0

Note. *N* = 516.

**GSE.** The General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995) was used to assess GSE. This measure consists of 10 4-point Likert-type items yielding a total score range of 10–40. Higher scores indicate higher self-efficacy. An item example is “I am confident that I could deal efficiently with unexpected events.” Good internal consistencies ranging from .81 to .91 and unidimensionality have been reported for several language versions. The directions of the correlations with depression, anxiety, optimism, or physical symptoms support convergent and divergent validity (Schwarzer, Bäßler, Kwiatek, Schröder, & Zhang, 1997). The GSE Scale has been frequently used in SCI research (Kennedy, Taylor, & Hindson, 2006; Mortenson, Noreau, & Miller, 2010; Spungen, Libin, Ljungberg, & Groah, 2009). Internal consistency for this study was very good (Cronbach’s alpha: .91).

### Appraisals and Coping Strategies

**Appraisals.** The Appraisal of Life Events Scale (ALE; Ferguson, Matthews, & Cox, 1999) was used to assess primary appraisals. Using 16 adjectives, participants responded how they appraised difficult life-events in the past 3 months on a 6-point scale. The adjectives refer to three subscales: Threat (e.g., with the item “terrifying”), Challenge (e.g., “stimulating”), and Loss (e.g., “pitiful”). The total scores ranged from 0 to 30 for threat and

challenge and 0 to 20 for loss. Higher scores indicate higher appraisal levels. Good internal consistency ranging from .74 to .86 has been reported. The direction and magnitude of associations with measures of mental health and personality correlations supported convergent validity (Ferguson et al., 1999; Gourounti, Anagnostopoulos, & Vaslamatzis, 2010). The ALE has been applied in SCI research (Kennedy et al., 2010a, 2010b). The internal consistencies were good (threat: .86; challenge: .85; loss: .82).

**Coping strategies.** The Brief COPE was used to assess how participants were dealing with stressful life situations (Carver, 1997). Following SwiSCI-internal pretests, we assessed general coping strategies, because many persons with SCI living in the community did not perceive themselves as coping with SCI and, hence, criticized our original intention to capture how individuals cope with SCI. The Brief COPE consists of 28 items with a 4-point frequency scaling and encompasses 14 subscales. The total score range for each subscale was 2–8. Higher scores indicate more use of the specific coping strategy. Although consisting only of two items per scale, minimally acceptable reliability estimates have been reported (Carver, 1997). The measure has been frequently used in SCI research (e.g., Kennedy et al., 2000). Internal consistencies of the 14 subscales for the current study were Self-Distraction: .46; Active Coping: .71; Denial: .55; Substance Use: .92; Emotional Support: .77; Instrumental Support: .78; Behavioral Disengagement: .41; Venting: .60; Positive Reframing: .62; Planning: .47; Humor: .70; Acceptance: .70; Religion: .89; Self-Blame: .57.

### Adjustment Outcome

To measure depressive symptoms, the Depression subscale of the Hospital Anxiety and Depression Scale (HADS-D) was used (Zigmond & Snaith, 1983). The HADS focuses on affective and cognitive rather than somatic aspects of depression such as loss of appetite, fatigue, or sleep disturbance. The HADS can therefore be used in health conditions such as SCI that are accompanied by symptoms similar to the symptoms of depression. The Depression subscale consists of seven items. An example item is “I still enjoy the things I used to enjoy: *definitely as much, not quite so much, only a little, hardly at all.*” Responses are given on a 4-point frequency scale. The total score ranges from 0 to 21, with higher scores indicating more severe symptoms of depression. Total scores 8–10 are considered as mild cases, 11–15 as moderate cases, and 16 or above as severe cases (Zigmond & Snaith, 1983). Good reliability estimates of .82 and unidimensionality have been found for the Depression subscale in SCI populations using Rasch analyses (Müller, Cieza, & Geyh, 2012). Internal consistency for the present study was good (Cronbach’s alpha: .84).

We used validated German, French, and Italian versions of all measures. French and Italian versions of the PIL-SF and the ALE were not available and translated by the SwiSCI study team using a forward translation procedure. In a next step, all three language versions of all measurement instruments were harmonized in parallel in group sessions by bilingual persons. In this process, we also included the validated instruments because the different language versions were not necessarily consistent, even though based on the same, mostly English, original measurement instrument. Inconsistencies were, for example, items with additional subsets.

The original English language version was used as the gold standard and modifications were made, as appropriate, to ensure similarity in item phrasing and response options in all language versions.

## Analyses

In order to examine the first hypothesis, we calculated Pearson correlations in SPSS to identify the associations between GSE and PIL, appraisals, coping strategies, and depressive symptoms. With respect to Hypothesis 2, we performed structural equation modeling (SEM) using the free statistics environment “R” (R Core Team, 2012) and its “lavaan” package (Version 0.5–12; Rosseel, 2012). SEM combines path analysis with factor analysis. Factor analytic measurement models describe how unobservable latent variables (constructs) are measured by observed variables. The structural path model describes the interrelations among the latent variables (Schumacker & Lomax, 2010).

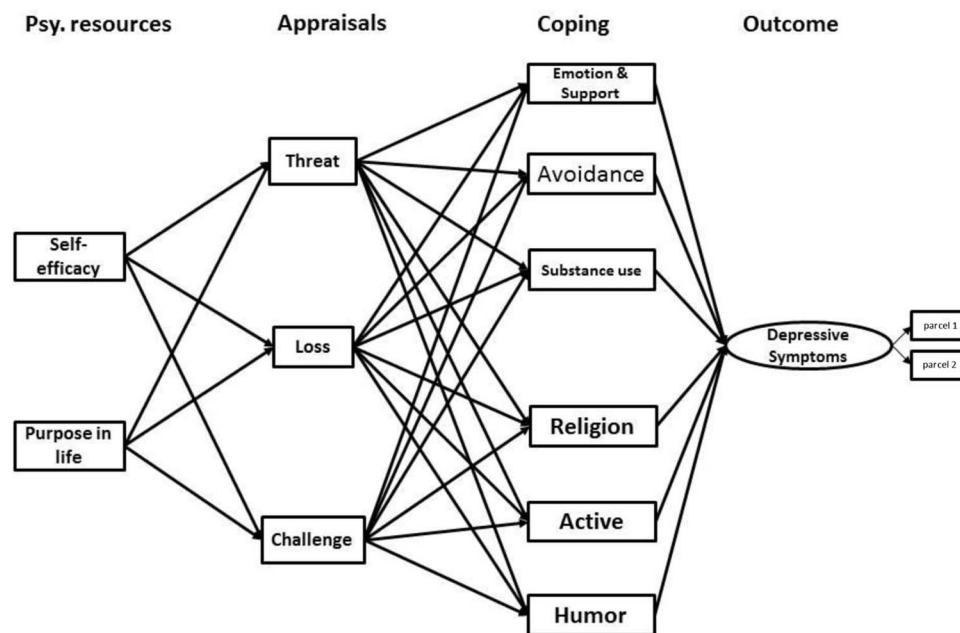
A ratio of 10–20 participants per observed variable or a sample of at least 200 persons are considered adequate for SEM (Weston, Gore, Chan, & Catalano, 2008). To attain an adequate ratio, we defined all variables as observed variables and not as latent variables (with the exception of depressive symptoms, see Figure 1).

Higher-order factor structures of the Brief COPE have been reported (Kapsou, Panayiotou, Kokkinos, & Demetriou, 2010; Sica et al., 2008). Hence, we examined the factorial structure of the measure in a first step. By means of the “R” package “psych” (Version 1.2.8; Revelle, 2012), a parallel exploratory factor analysis (principal axis factoring based on squared multiple correlations as communality estimates) using an oblique rotation (pro-

max) was performed with the 28 items. We decided on the number of factors by integrating information from a graphical scree plot of the eigenvalues, from parallel analysis, and from communalities and interpretability of loading patterns. This yielded 6 factors (45.2% explained variance). We labeled the six factors: (a) emotional coping and support (consisting of the three original subscales: Emotional Support, Instrumental Support, Venting), (b) avoidance (subscales: Denial, Self-Blame, Acceptance–Reversed; single items of Behavioral Disengagement and Self-Distraction subscales), (c) substance use (subscale: Substance Use), (d) religious coping (subscale: Religious Coping), (e) active coping (subscales: Active Coping, Planning; one item of Positive Reframing) and (f) humor (subscale: Humor Coping; one item of Positive Reframing). The items of the six factors were summed up and treated as observed variables.

Using the item parceling procedure, we modeled depressive symptoms as a latent variable (Coffman & MacCallum, 2005). This procedure reduces the potential bias of the estimated parameters directly connected to depressive symptoms, as its measurement error is incorporated (Coffman & MacCallum, 2005). The first four items of the HADS-D constituted the first parcel; the sum of the other three items, the second parcel.

A structural equation model was specified based on the SCIAM (Middleton & Craig, 2008). We defined a double-mediation model that can be depicted as PIL/GSE → appraisals → coping strategies → depressive symptoms (see Figure 1). In the initial model, the intercorrelations with  $r > .20$  among appraisals, and among the coping strategies, respectively, were also included, because appraisals and coping strategies are associated and



Initial model is based on the Spinal Cord Injury Adjustment Model (SCIAM). Adjustment is operationalized with depressive symptoms. For clarity of graph, the following correlations are not depicted: Self-efficacy - Purpose in life; Threat - Loss; Loss - Challenge; Emotion & support - Active; Emotion & support - Avoidance; Active - Humor; Humor - Avoidance; Avoidance - Substance use.

Figure 1. Initial structural equation model based on the spinal cord injury adjustment model consisting of psychological resources, appraisals, coping strategies, and depressive symptoms. Psy. = psychological.

might have some degree of conceptual overlap. Standardized path coefficients with values  $>0.1$  represent a small effect,  $>0.3$  medium effect, and  $>0.5$  large effect (Cohen, 1992). We used full information maximum likelihood (FIML) for model estimation, based on raw data. FIML analyses partially missing data without imputing missing values (Enders & Bandalos, 2001). Chi-square ( $\chi^2$ ) and root-mean-square error of approximation (RMSEA), including the 90% confidence interval (CI), were used to evaluate how well the data fit the theorized model. A nonsignificant chi-square and a RMSEA  $< 0.05$  indicate good fit (Schumacker & Lomax, 2010). For further model assessment, we used the Comparative Fit Index (CFI), with values  $>0.95$  indicating good fit. To consider necessity of model modification, standardized residuals were examined, which represent the differences between empirical and model-implied covariances of variables. Standardized residuals  $>2$  indicate significant differences between model and data.

In terms of power, two aspects can be distinguished (Hancock, 2006): The power to detect model misspecification (MacCallum, Browne, & Sugawara, 1996), and the power to test effects. A post hoc Monte Carlo power analysis was carried out with the “sim-

sem” package in “R” (Pornprasertmanit, Miller, & Schoemann, 2013) to test the power for the effects.

## Results

The score range, mean and the number of missing values for each measure are shown in Table 2. Overall, 105 individuals (20.9%) had elevated levels of depressive symptoms of which 65 (12.9%) reached mild depressive symptoms, 33 (6.6%) moderate, and 7 (1.4%) severe levels of depressive symptoms.

Regarding Hypothesis 1, correlations between the assessed variables can be found in Tables 3 and 4. Higher GSE ( $r = -.54$ ) and PIL ( $r = -.62$ ) were associated with lower symptoms of depression, which corresponds with our hypothesis.

Regarding Hypothesis 2, the initial model corresponding to the SCIAM (see Figure 1) yielded a poor model fit with  $\chi^2(38) = 434.58$ ,  $p < .01$ , RMSEA = 0.143 (90% CI [0.132, 0.155]), CFI = 0.76. Considering the standardized residuals, the model was modified by adding the paths (a) from GSE and PIL to active coping, (b) from PIL to depressive symptoms, (c) from GSE to humor, (d) threat to depressive symptoms, (e) from PIL to religious coping, (f)

Table 2

*Descriptive Characteristics of Psychological Resources, Appraisals, Coping, and Depressive Symptoms*

Variable (measure)	Range	Mean (SD)	Missing <i>n</i> (%) <sup>a</sup>	Cronbach's $\alpha$
Psychological resources				
General self-efficacy (GSES)	10–40	30.4 (5.6)	28 (5.4)	.91
Purpose in life (PIL-SF)	4–28	21.3 (4.6)	17 (3.3)	.89
Mediating variables				
Appraisals (ALE)				
Challenge	0–30	12.9 (7)	50 (9.7)	.85
Loss	0–20	6.9 (4.9)	47 (9.1)	.82
Threat	0–30	9.5 (6.7)	47 (9.1)	.86
Coping (Brief COPE, original subscales)				
Self-Distraction	2–8	5.0 (1.6)	15 (2.9)	.46
Active Coping	2–8	6.1 (1.5)	13 (2.5)	.71
Denial	2–8	3.3 (1.5)	22 (4.3)	.55
Substance Use	2–8	2.6 (1.2)	10 (1.9)	.92
Emotional Support	2–8	4.0 (1.6)	12 (2.3)	.77
Instrumental Support	2–8	4.4 (1.5)	16 (3.1)	.78
Behavioral Disengagement	2–8	3.1 (1.3)	13 (2.5)	.41
Venting	2–8	3.9 (1.4)	17 (3.3)	.60
Positive Reframing	2–8	5.6 (1.6)	15 (2.9)	.62
Planning	2–8	5.4 (1.5)	22 (4.3)	.47
Humor	2–8	4.1 (1.7)	17 (3.3)	.70
Acceptance	2–8	6.4 (1.5)	18 (3.5)	.70
Religion	2–8	3.8 (2.0)	17 (3.3)	.89
Self-Blame	2–8	3.7 (1.5)	18 (3.5)	.57
Coping (Brief COPE, EFA-based subscales)				
Emotion and Support	6–24	12.3 (3.7)	20 (3.9)	.83
Avoidance	8–32	14.3 (3.7)	35 (6.8)	.67
Substance Use	2–8	2.6 (1.2)	10 (1.9)	.92
Religion	2–8	3.8 (2.0)	17 (3.3)	.89
Active	5–20	14.4 (3.0)	29 (5.6)	.71
Humor	3–12	6.8 (2.2)	17 (3.3)	.67
Adjustment outcome				
Depressive symptoms (HADS, subscale)	0–21	4.6 (3.9)	14 (2.7)	0.84

*Note.*  $N = 516$ . GSES = General Self-Efficacy Scale; PIL-SF = Purpose in Life Test–Short Form; ALE = Appraisal of Life Events Scale; EFA = exploratory factor analysis; HADS = Hospital Anxiety and Depression Scale. Little's missing-completely-at-random test was significant ( $p < .001$ ), indicating that data was not missing completely at random. After additional analyses of the pattern of missing data, the data was treated as missing at random.

<sup>a</sup> Missing refers to missing total scores.

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Table 3  
*Pearson Correlations Between Psychological Resources, Appraisals, Coping (14 Original Subscales), and Depressive Symptoms*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Depressive symptoms	1.00																				
2. Self-efficacy	-0.54**	1.00																			
3. Purpose in life	-0.62**	0.55**	1.00																		
4. Challenge	-0.30**	0.32**	0.35**	1.00																	
5. Loss	0.45**	-0.40**	-0.31**	-0.22**	1.00																
6. Threat	0.42**	-0.34**	-0.24**	-0.08	0.71**	1.00															
7. Self-distraction	0.06	-0.01	0.05	0.02	0.24**	0.19**	1.00														
8. Active coping	-0.31**	0.39**	0.46**	0.17**	-0.13**	-0.09	0.22**	1.00													
9. Denial	0.30**	-0.16**	-0.15**	-0.06	0.25**	0.20**	0.26**	-0.09*	1.00												
10. Substance use	0.14**	-0.13**	-0.14**	0.01	0.15**	0.11*	0.11*	-0.16**	0.13**	1.00											
11. Emotional support	0.07	-0.06	0.00	0.07	0.27**	0.26**	0.21**	0.14**	0.14**	0.13**	1.00										
12. Instrumental support	-0.01	-0.03	0.09	0.07	0.25**	0.23**	0.24**	0.22**	0.03	0.02	0.64**	1.00									
13. Behavior disengagement	0.32**	-0.17**	-0.28**	-0.12**	0.16**	0.12**	0.14**	-0.16**	0.29**	0.10*	0.03	-0.03	1.00								
14. Venting	0.12**	-0.02	-0.03	0.05	0.20**	0.20**	0.12**	0.02	0.07	0.10*	0.50**	0.42**	0.04	1.00							
15. Positive reframing	-0.41**	0.46**	0.42**	0.35**	-0.19**	-0.17**	0.05	0.36**	-0.15**	-0.12**	0.00	0.12**	-0.10*	-0.01	1.00						
16. Planning	-0.09	0.26**	0.27**	0.15**	0.11*	0.11*	0.26**	0.47**	0.00	-0.05	0.23**	0.33**	-0.10*	0.18**	0.38**	1.00					
17. Humor	-0.32**	0.34**	0.24**	0.28**	-0.16**	-0.13	0.04	0.16**	-0.12	0.11*	0.00	0.01	-0.10*	0.13**	0.35**	0.18**	1.00				
18. Acceptance	-0.45**	0.45**	0.37**	0.20**	-0.35**	-0.28**	-0.10*	0.35**	-0.39**	-0.12**	-0.15**	-0.06	-0.13**	-0.08	0.45**	0.16**	0.33**	1.00			
19. Religion	0.02	-0.11*	0.11*	0.08	0.27**	0.26**	0.19**	0.13**	0.10*	-0.08	0.16**	0.22**	0.10*	0.10*	0.16**	0.16**	-0.07	0.03	1.00		
20. Self-blame	0.20**	-0.08	-0.04	0.11*	0.19**	0.27**	0.22**	0.06	0.24**	0.19**	0.25**	0.16**	0.04	0.18**	-0.06	0.26**	0.02	-0.16**	0.07	1.00	
21. Time since injury	-0.21**	0.03	0.16**	0.17**	-0.13**	-0.08	-0.05	0.02	-0.12	0.01	-0.03	-0.03	-0.06	-0.07	0.10	0.05	0.02	0.09	0.00	-0.05	1.00

Note. *N* = 516.  
 \*\* *p* < .05. \*\*\* *p* < .01.

Table 4

*Pearson Correlations Between Psychological Resources, Appraisals, Coping (6 EFA-Based Factors), and Depressive Symptoms*

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Depressive symptoms	1.00												
2. Self-efficacy	-0.54**	1.00											
3. Purpose in life	-0.62**	0.55**	1.00										
4. Challenge	-0.30**	0.32**	0.35**	1.00									
5. Loss	0.45**	-0.40**	-0.31**	-0.22**	1.00								
6. Threat	0.42**	-0.34**	-0.24**	-0.08	0.71**	1.00							
7. Support	0.08	-0.04	0.03	0.08	0.30**	0.28**	1.00						
8. Active coping	-0.30**	0.45**	0.48**	0.24**	-0.04	-0.02	0.23**	1.00					
9. Avoidance	0.45**	-0.32**	-0.28**	-0.08	0.42**	0.38**	0.27**	-0.11*	1.00				
10. Humor	-0.39**	0.42**	0.32**	0.35**	-0.19**	-0.17**	0.06	0.35**	-0.23**	1.00			
11. Religion	-0.02	-0.11*	0.11*	0.08	0.27**	0.26**	0.19**	0.19**	0.10*	0.01	1.00		
12. Substance use	0.14**	-0.13**	-0.14**	0.01	0.15**	0.11 <sup>+</sup>	0.10 <sup>+</sup>	-0.14**	0.24**	0.04	-0.08	1.00	
13. Time since injury	-0.21**	0.03	0.16**	0.17**	-0.13**	-0.08	-0.05	0.06	-0.12*	0.04	0.00	0.01	1.00

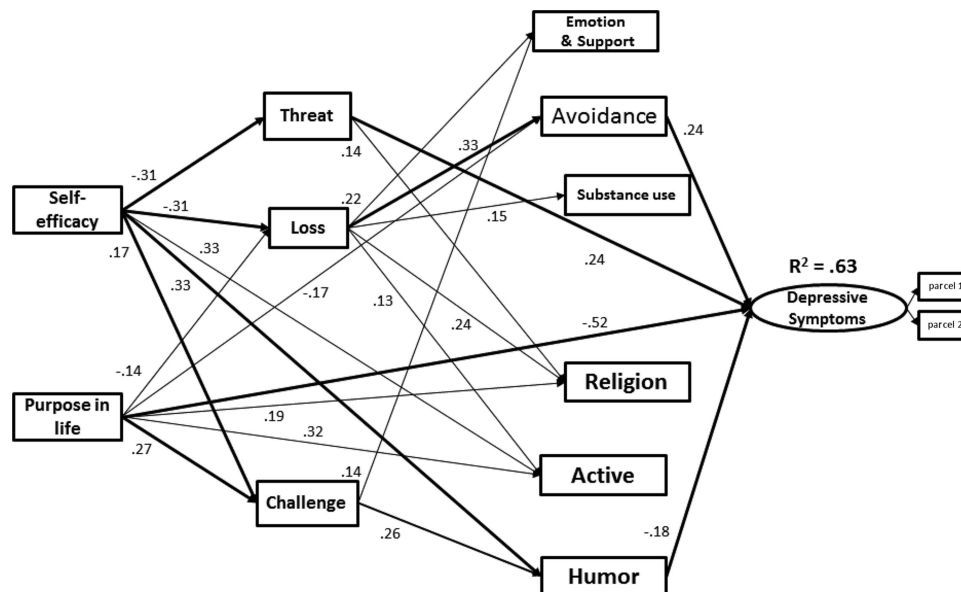
Note.  $N = 516$ .

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

from PIL to avoidance, and (g) intercorrelations between all six coping factors. No paths were deleted. The final model had a good model fit with  $\chi^2(21) = 54.0$ ,  $p < .01$ , RMSEA = .055 (90% CI [.038, .073]), CFI = .98, explaining 62.9% of variance of depressive symptoms.

As shown in Figure 2, PIL had a large direct effect on depressive symptoms ( $\beta = -.52$ ). PIL was also indirectly related to depressive symptoms via three pathways: First, via avoidance (PIL-avoidance:  $\beta = -.17$ ; avoidance-depressive symptoms:  $\beta = .24$ ), second, via loss and avoidance (PIL-loss:  $\beta = -.14$ , loss-avoidance:  $\beta = .33$ , avoidance-depressive symptoms:  $\beta = .24$ ), and third, via challenge and humor (PIL-challenge:  $\beta = .27$ ; chal-

lenge-humor:  $\beta = .26$ ; humor-depressive symptoms:  $\beta = -.18$ ). GSE had an indirect relationship to depressive symptoms via four pathways: first, via threat (GSE-threat:  $\beta = -.31$ ; threat-depression:  $\beta = .24$ ), second, via loss and avoidance (GSE-loss:  $\beta = -.31$ ; loss-avoidance:  $\beta = .33$ ; avoidance-depressive symptoms:  $\beta = .24$ ), third, via challenge and humor (GSE-challenge:  $\beta = .17$ ; challenge-humor:  $\beta = .26$ ; humor-depressive symptoms:  $\beta = -.18$ ), and fourth, via humor (GSE-humor:  $\beta = .33$ ). Threat appraisals had a direct effect on depressive symptoms ( $\beta = .24$ ), the relationships of the other appraisals were mediated by coping strategies. Avoidance ( $\beta = .24$ ) and humor ( $\beta = -.18$ ) significantly related to depressive symptoms, with weak to moderate effects.



$\chi^2(21) = 54.00$ ,  $p < .01$ , CFI = .98, RMSEA = .055 (90% CI [.038, .073]).  
 $R^2$  = proportion of explained variance.

All depicted paths are significant. Bold lines highlight the paths of the determinants of depressive symptoms. The following non-significant paths are not shown: Purpose in life  $\rightarrow$  Threat; Threat  $\rightarrow$  Emotion/Avoidance/Substance use/Active/Humor; Loss  $\rightarrow$  Humor; Challenge  $\rightarrow$  Avoidance/Substance use/Religion/Active; Emotion  $\rightarrow$  Depressive Symptoms; Substance use  $\rightarrow$  Depressive Symptoms; Religion  $\rightarrow$  Depressive Symptoms; Active  $\rightarrow$  Depressive Symptoms. The correlations between Self-efficacy and purpose in life, between all 6 coping subscales, as well as between Threat and Loss, and Loss and Challenge are not depicted.

Figure 2. Final structural equation model with depressive symptoms as adjustment outcome variable.



The power for detecting model misspecification was very good, achieving a level of .91 (MacCallum et al., 1996). The test of the effects yielded an average effect power of 0.77.

## Discussion

This study investigated the effect of the psychological resources GSE and PIL, appraisals, and coping strategies on depressive symptoms in individuals with SCI. A high amount of variance of depressive symptoms was explained through modeling the interrelations between psychological factors. In line with our first hypothesis, higher PIL and higher GSE were associated with lower levels of depressive symptoms. The second hypothesis was only partially supported. PIL showed a strong direct effect on depressive symptoms. The relationship of GSE, however, was mediated by appraisals and coping strategies, which corresponds with the SCIAM.

Our study showed that individuals with SCI who have a purpose in their life (PIL) and who believe to possess the ability to handle difficult life demands (GSE) have lower depressive symptoms. These bivariate relationships are strong and correspond with previous SCI research (Peter et al., 2012) and studies in other populations (Chow & Ho, 2012; Davison, McCabe, Knight, & Mellor, 2012; Johnson et al., 2011; Pinquart, 2002). Similar results have also been found for other psychological resources in individuals with SCI, such as optimism, hope, sense of coherence, or self-esteem (Peter et al., 2012; van Leeuwen, Kraaijeveld, et al., 2012). The consistency of these positive bivariate associations could partially result from their shared salutogenetic perspective and conceptual overlap. For example, the subscale Meaningfulness of the multiple-component resource (Hobfoll, 2002) sense of coherence does have close ties to PIL, in a sense that both assess individually perceived meaning in life (Antonovsky, 1993).

The direction and strength of the bivariate associations between appraisals and depressive symptoms are in line with a recent SCI study (Kennedy et al., 2010a). The bivariate associations of coping strategies with depressive symptoms are weaker than previously reported (Kennedy, Lowe, Grey, & Short, 1995), but they reflect that avoidance-oriented coping is associated with unfavorable outcomes (Livneh & Martz, 2012; van Leeuwen, Kraaijeveld, et al., 2012). Our results further support the findings that accepting an SCI is linked to lower depressive symptoms (Kennedy et al., 1995; Kennedy et al., 2010a). In this sense, acceptance represents a problem-confronting, typically future-oriented coping strategy, in contrast to an avoidance, passive strategy. Correspondingly, reversed scores of the Acceptance subscale were incorporated in the exploratory factor analysis (EFA)-based coping factor avoidance.

PIL was the strongest determinant of lower depressive symptoms in our final structural equation model. Similarly, the beneficial effect of PIL has been observed across a wide range of populations, but not solely in terms of mental health. For example, cross-sectional research has identified PIL as determinant of better adjustment to SCI onset (deRoos-Cassini, de St. Aubin, Valvano, Hastings, & Horn, 2009; Mona et al., 2000; Thompson, Coker, Krause, & Henry, 2003). A multivariate longitudinal study identified the absence of PIL as a risk factor for the development of depression in a 10-year cohort of high-school absolvents (Wood & Joseph, 2010). PIL also explained depressive symptoms over and

above other psychological, social, and environmental factors in aged care residents (Davison et al., 2012).

The effect of GSE on depressive symptoms was indirect and mediated by appraisals and coping strategies. Past research not only has found consistent correlations of GSE with depressive symptoms but also identified GSE as determinant of depressive symptoms in multivariate regression analyses (Shnek et al., 1997). Our study confirms the relevance of GSE, but indicates that the effect of GSE on depressive symptoms might rather be mediated by reducing threat and loss appraisals and in combination with humor coping, but not direct. However, longitudinal research is needed to support our findings.

Low PIL and GSE can be interpreted as symptoms of depression, rather than distinct concepts that determine the level of depression. For example, the International Classification of Diseases (ICD-10) enumerates low self-confidence and negative thinking of the future as symptoms of depression, which are conceptually similar to low GSE (World Health Organization, 2008). However, a close inspection of the phrasing of the GSE, PIL, and depressive symptom items used in our study shows no conceptual similarity, as the items do not use identical words, subsets, or key concepts, such as "meaning." In addition, the bivariate associations between GSE, PIL, and depressive symptoms did not indicate extreme multicollinearity.

We found strong support for appraisals as determinants of depressive symptoms: All 3 appraisals, that is, loss, threat, and challenge, were significantly involved, with threat appraisals even having a direct effect on higher levels of depressive symptoms in the final structural equation model. The fact that appraisals influence mental health of individuals with SCI has been observed (Kennedy et al., 2010a; van Leeuwen, Post, et al., 2012). However, while in our study threat appraisals seem to inhere a dominant role among the measured appraisals due to their direct influence, other studies have identified loss (Kennedy et al., 2010a) or challenge appraisals measured 6 or 12 weeks postinjury as determining depressive symptoms in multivariate analyses (Bonanno, Kennedy, Galatzer-Levy, Lude, & Elfstrom, 2012; Kennedy et al., 2010a). Overall, it seems that appraisals with a positive outlook, such as challenge, have an effect leading to lower depressive symptoms, while appraisals with a negative connotation, such as threat and loss, are connected with higher levels of depressive symptoms.

The overall impact of coping strategies on depressive symptoms in our multivariate SEM analyses was weak, with only avoidance and humor coping having significant effects. The EFA-based Avoidance Coping subscale used in our SEM analyses consists of the original COPE subscales Denial, Self-Blame, Acceptance (negative loading, hence items were reversed), as well as single items of the Behavioral Disengagement and Self-Distraction subscales. Our findings correspond with past research insofar as behavioral disengagement, and especially acceptance have been connected with the level of depressive symptoms in individuals with SCI (Kennedy et al., 1995; Kennedy et al., 2010a, 2010b; Kennedy et al., 2000).

In contrast, the significant effect of humor coping was unexpected, because previous research has not identified humor as a predictor of depressive symptoms in multivariate analyses. Rather, it was found as a commonly adopted coping strategy following SCI onset (Kennedy et al., 2000). Our finding might be due to the

additional item from the Positive Reframing subscale, which together with the two original humor items composed the EFA-based humor coping factor used in our SEM analyses. Positive reframing has been identified as a determinant of depressive symptoms in clinical SCI rehabilitation and the community settings (Kennedy et al., 1995; Kennedy et al., 2000). Overall, because humor has been linked to better health and life satisfaction, further research seems warranted (McCreaddie & Wiggins, 2008; Proyer, Ruch, & Buschor, 2013).

Our findings apply to individuals with long-term SCI and the comparatively weak effect of coping strategies on depressive symptoms might be explained by the lack of a specific stressor and the overall low depression scores in our study sample. SwiSCI-internal pretests indicated that persons living with SCI for many years, as in our study sample, do not necessarily perceive the injury as a stressor, which is why we refrained from assessing SCI-specific stressors or coping behavior. The reaction of the participants might be explained by the distinction individuals with SCI may make between the injury itself, its direct consequences (e.g., neuropathic pain), and indirect consequences (e.g., urinary tract infections, inaccessible environments). Nonetheless, SCI-specific or general coping strategies might have a more immediate impact on mental health shortly after the injury, hence in a time when the individuals have to dedicate substantial efforts to handle the consequences of their injury (e.g., Kennedy et al., 2010a). However, the findings of a recent systematic literature review do not support this assumption, identifying inconsistent, and frequently weak, associations between coping strategies and depression even in the first months following SCI (van Leeuwen, Kraaijeveld, et al., 2012). Overall, a clear pattern regarding the role of coping strategies and the time that has passed since SCI seems lacking, but based on our findings it would be misleading to conclude that coping strategies are weakly related to depressive symptoms per se.

Around 20% of the study participants reported elevated depressive symptoms ranging between mild and severe levels. This proportion is somewhat lower than recent mean estimations of 27% of persons with SCI living in the community, ranging from 11% to 60% (Craig et al., 2009). Although our estimations lie within this range, we cannot exclude the possibility of an underestimation caused by selective nonresponse. However, the observed mean level of depressive symptoms of the current study ( $M = 4.6$ ) corresponds with a nonrepresentative Swiss sample of a European Study 12 weeks postinjury ( $M = 4.3$ ; Kennedy et al., 2010a).

### Clinical Implications

The current study adopted a cross-sectional design assessing individuals with SCI living in the community for many years, which is why our findings cannot be directly translated to the clinical rehabilitation setting. However, our findings may give indications as to which variables might be potentially successful targets for intervention in the community setting. They partly represent concepts targeted in past SCI interventions (Post & van Leeuwen, 2012). PIL, GSE, appraisals, and humor might be promising intervention targets to reduce depressive symptoms in persons with SCI. Although coping strategies had a weak effect on depressive symptoms in our study, they should not be disregarded

as potential intervention target per se. However, the weak effect might suggest that a main focus on coping as intervention target may not be efficient to improve the level of depressive symptoms. Rather, the direct and indirect mechanism identified in the current study might indicate that several factors need to be considered together to most efficiently support individuals with SCI.

Regarding PIL, several interventions aim to foster PIL to enhance well-being. However, these interventions were not always successful and have, up till now, not been conducted with individuals with SCI. For example, relying on the conceptual well-being model by Ryff (1989), well-being therapy aims to identify, strengthen, and focus on the moments in life, in which well-being is experienced. Well-being therapy reduced vulnerability for depression in high-risk populations (Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998; Fava & Tomba, 2009). Beneficial effects have also been reported for the acceptance and commitment therapy across a wide range of populations, such as persons dealing with anxiety, depression, stress, or stigma (Ruiz, 2010, 2012; Sharp, 2012). In contrast, no effect on PIL has been found for a psychosocial counseling intervention or purposeful reminiscences, consisting for example of going through personal documents from the past (De Vries et al., 1997; Vaughan & Kinnier, 1996). Overall, the efficacy of such programs for individuals with SCI has yet to be investigated.

In contrast to PIL, several intervention programs targeted GSE, appraisals or coping in individuals with SCI. Several interventions targeting self-efficacy of individuals with SCI have been successfully conducted. For example, an intervention program aiming to help increase active living across the life span enhanced self-efficacy of the participants (Rose, Piatt, Zahl, & Kim, 2008; Zahl, Compton, Kim, & Rosenbluth, 2008). Other effective programs consist of physical activity or sports (e.g., Kennedy et al., 2006). Appraisals are a primary target in cognitive behavior therapy. Positive short-term impact on psychological outcomes, such as better quality of life and acceptance or lower depressive symptoms, have been revealed in individuals with SCI (Dorstyn, Mathias, & Denson, 2011). Coping and appraisals were major targets in coping effectiveness training, in which appraisal skills and a range of standard cognitive-behavioral coping skills are taught to individuals with SCI. Preliminary results supported its effectiveness (King & Kennedy, 1999). In the larger follow-up study, however, the treatment effect barely missed statistical significance ( $p = .058$ ; Kennedy, Duff, Evans, & Beedie, 2003).

Humor can be fostered and thus potentially used in stressful life situations. For example, strengthening humor in an Internet-based intervention was linked to an increase in well-being in adults (Proyer et al., 2013). We identified one humor pilot intervention study with individuals with SCI, where the exposure to humorous videos on individuals with SCI was examined in a pilot study. Due to the small sample size ( $N = 8$ ), no clear conclusion could be drawn regarding the potential effectiveness of the intervention (Kennedy & Marsh, 1993).

### Study Limitations

Partial support for the SCIAM has been found in studies where adjustment outcomes were operationalized with life satisfaction and participation (Peter, Müller, Cieza, et al., 2014; Peter, Müller, Post, et al., 2014). The findings of the current study also only

partially support the mechanism proposed by the SCIAM: The initial model representing a pure, double-mediating mechanism yielded an insufficient fit. Model fit improved, in part, due to the direct paths from PIL or appraisals to depressive symptoms. These results indicate that the mediated pathways assumed by the SCIAM are present, but not exclusive in our data. Direct effects of psychological resources and appraisals on adjustment outcomes, such as depression, have been suggested by another SCI adjustment model, the stress appraisal and coping model (Galvin & Godfrey, 2001). The direct effect of PIL on lower depressive symptoms also corresponds to the notion of PIL acting as a key domain or resource preserving psychological well-being, independent of the situational demands (Frankl, 1959; Hobfoll, 2002; Ryff, 1989). Nonetheless, study limitations need close consideration when interpreting our results.

First, the SCIAM can be differently operationalized. To attain an adequate sample size/variable ratio, we did not include biological factors, such as the injury-level, and environmental factors, such as social support, which are also assumed to influence adjustment following SCI. The psychological component could be represented by other variables, such as optimism or extraversion. Other appraisals connected to the injury could be assessed, such as perceptions of helplessness due to SCI. We further conceptualized GSE as a stable trait-like characteristic and not as a proxy for SCI-related appraisals belonging to the appraisal component in the SCIAM (Middleton & Craig, 2008). Also, due to SwiSCI-internal pretests, we refrained from assessing SCI-specific stressors or coping strategies because persons living in the community for many years, as in our study sample, did not necessarily perceive SCI as a stressor. Second, due to the cross-sectional study design, causality cannot be concluded. Third, study participants were living in a Swiss community setting, and therefore findings cannot be generalized to the entire SCI community. Fourth, model modifications are based on the data and involve a risk of capitalizing on sample artifacts. Hence, the final model is data-driven and needs cross-validation. Future studies should comprehensively test the SCIAM under consideration of SCI-specific stressors, all model components and by using different operationalizations.

## Conclusions

Psychological resources, such as PIL, of individuals with SCI can have a direct effect on depressive symptoms. Their influence, however, is also partially mediated by appraisal and coping processes, which supports the mechanism proposed by the SCIAM. Studies with a longitudinal design considering persons with recent SCI onset need to be conducted to support our findings.

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