

**ORIGINAL RESEARCH**

# Profiles of Psychological Adaptation Outcomes at Discharge From Spinal Cord Injury Inpatient Rehabilitation



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## Abstract

**Objective:** To evaluate the effect of a newly acquired spinal cord injury (SCI) by identifying profiles of psychological adaptation outcomes at discharge from inpatient rehabilitation, using several outcome measures in parallel and to examine biopsychosocial factors associated with profile membership.

**Design:** Cross-sectional analysis of data from the Swiss Spinal Cord Injury inception cohort study.

**Setting:** Inpatient rehabilitation.

**Participants:** Individuals 16 years old or older with recently diagnosed SCI who finished clinical rehabilitation in 1 of the 4 major national rehabilitation centers (N=370).

**Interventions:** Not applicable.

**Main Outcome Measures:** Life satisfaction, general distress, and symptoms of depression and anxiety were assessed using a single item from the International SCI Quality of Life Basic Data Set, the Distress Thermometer, and the Hospital Anxiety and Depression Scale respectively.

**Results:** Using latent profile analysis, 4 profiles of psychological adaptation outcomes were identified displaying different levels of impact, ranging from Minimal to Severe. Regarding covariates associated with profile membership, higher optimism, purpose in life, and self-efficacy indicated a higher probability of having a Minimal impact profile. Additionally, males, individuals with better functional independence, and those with an absence of pain were more likely to show a Minimal impact profile.

**Conclusions:** Among the participants, 70% showed Minimal or Low impact profiles. Our findings support that individuals can show positive responses across several outcome measures even at an early time after the injury onset (eg, at discharge from inpatient rehabilitation). Moreover, our results indicate that beyond functional independence, improvement, and pain management, a rehabilitation process that strengthens psychological resources might contribute to better adaptation outcomes.

Archives of Physical Medicine and Rehabilitation 2020;101:401-11

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Presented to the European Health Psychology Society, August 23, 2018, Galway, Ireland, and the European Spinal Psychologists Association, March 21, 2019, Zürich, Switzerland.

Supported by the Swiss National Science Foundation (grant no. 100019\_165484).

Disclosures: none.

This study has been conducted in the framework of the Swiss Spinal Cord Injury Cohort Study (SwiSCI, [www.swisci.ch](http://www.swisci.ch)), supported by the Swiss Paraplegic Foundation. The members of the SwiSCI Steering Committee are Xavier Jordan, Bertrand Léger (Clinique Romande de Réadaptation, Sion); Michael Baumberger, Hans Peter Gmünder (Swiss Paraplegic Center, Nottwil); Armin Curt, Martin Schubert (University Clinic Balgrist, Zürich); Margret Hund-Georgiadis, Kerstin Hug (REHAB Basel, Basel); Thomas Troger (Swiss Paraplegic Association, Nottwil); Daniel Joggi (Swiss Paraplegic Foundation, Nottwil); Hardy Landolt (representative of persons with spinal cord injury, Glarus); Nadja Münzel (Parahelp, Nottwil); Mirjam Brach, Gerold Stucki (Swiss Paraplegic Research, Nottwil); Christine Fekete (SPF Coordination Group at Swiss Paraplegic Research, Nottwil).

Spinal cord injury (SCI) is a life-changing event that demands a multidisciplinary rehabilitation process. Besides regaining functioning and independence, rehabilitation goals are restoring the psychological state of the injured individuals and preparing them for reintegration into the community.<sup>1,2</sup> Thus, the discharge from inpatient rehabilitation constitutes a key time point to evaluate how individuals are adapting to the challenges posed by their SCI.

Psychological adaptation is a multidimensional and temporal process in response to adverse life events, which can lead to more or less positive outcomes.<sup>3</sup> These outcomes indicate the extent of

the impact of the stressful event on individuals' lives at a certain point in time. As posited in theoretical models such as Livneh and Antonak's Adaptation to Chronic Illnesses and Disabilities Model<sup>4</sup> or the SCI adjustment model,<sup>5,6</sup> psychological adaptation outcomes are influenced by multiple biopsychosocial covariates that can act as resources or as stressors.

Substantial individual differences exist in how individuals adapt to SCI.<sup>7</sup> Although it has been found that they are at higher risk for psychological disorders such as depression or post-traumatic stress disorder,<sup>7-9</sup> longitudinal studies indicate that they may actually follow different trajectories such as chronic distress or resilience.<sup>10-12</sup> Furthermore, sustaining an SCI does not preclude the experience of happiness and satisfaction with life,<sup>7,13-15</sup> nor the perception of growth in different domains (eg, perception of personal strengths).<sup>16,17</sup> To understand this diversity of responses to SCI requires a shift in focus from overall outcome mean scores, which may obscure individual differences, toward the application of person-centered analyses that enable the identification of heterogeneous patterns of response.<sup>18,19</sup> Moreover, it demands the analysis of multiple psychological adaptation outcomes,<sup>20</sup> including the presence or absence of psychiatric symptoms in addition to indicators of well-being.<sup>18,21</sup> Indeed, adapting to an SCI cannot be equated to the absence of mental health problems,<sup>22</sup> and the study of single outcomes disregards the multidimensionality of psychological adaptation because critical life events can have a differential impact on various well-being dimensions.<sup>20,23</sup> For instance, it has been found that after the loss of a loved one (eg, partner, child), individuals may not show symptoms of depression and still have a negative evaluation of their own life or experience low positive affectivity.<sup>20,24</sup>

Simultaneously studying several outcome measures of mental health and well-being with person-centered analytical techniques such as latent profile analysis (LPA) enables a multidimensional understanding of psychological adaptation, featuring the heterogeneity of SCI's psychological impact. These techniques can then be used to test the association between covariates and each profile to identify potential protective and aggravating factors.<sup>25,26</sup> Therefore, this study aimed at evaluating the impact of a newly acquired SCI by (1) identifying profiles of psychological adaptation outcomes across life satisfaction, distress, depressive symptoms, and anxiety symptoms at discharge from inpatient rehabilitation and (2) examining biopsychosocial factors associated with membership to the identified profiles.

Previous studies on adverse life events (eg, chronic illnesses and disabilities, spousal bereavement, divorce) have identified at least 3 patterns of adaptation outcomes: one characterized by the best-identified outcomes, a second one showing poor outcomes, and a third one displaying outcomes in moderate levels.<sup>25-28</sup> Therefore, we expected to identify at least these 3 profiles among our study sample. Finally, based on studies analyzing the relationship between different

biopsychosocial factors and life satisfaction, depression, or anxiety, we expected profile membership to be associated with self-efficacy, purpose in life, and optimism,<sup>29-32</sup> as well as pain and functional independence,<sup>33-35</sup> but not with other biomedical (age, sex, injury characteristics) or social factors (partnership status).

## Methods

### Design and participants

A cross-sectional study was performed using rehabilitation discharge data from the ongoing Swiss Spinal Cord Injury inception cohort study (SwiSCI) conducted in the 4 major national rehabilitation centers.<sup>36</sup> SwiSCI was approved by the regional ethics committees and all participants gave written informed consent. Participants were assessed during clinical rehabilitation at 4 time points after diagnosis of SCI, including rehabilitation discharge. The present study considered 884 eligible individuals undergoing rehabilitation between May 2013 and April 2018. From those, 97 refused to any kind of data collection, 348 only consented the use of minimal data collected in the clinics (eg, basic sociodemographic, neurologic, and medical information, SCI etiology, and lesion characteristics), and 69 did not complete questionnaires regarding psychological adaptation outcomes at rehabilitation discharge. The final sample was composed of 370 participants (fig 1).

### Measures: Psychological adaptation outcomes

#### Life satisfaction

Participants rated their life satisfaction level in the past 4 weeks on a scale from 0 (completely dissatisfied) to 10 (completely satisfied), using 1 item from the International SCI Quality of Life Basic Data Set<sup>37</sup> which shows good convergent validity.<sup>38</sup>

#### Distress

Using the single item from the Distress Thermometer,<sup>39</sup> participants rated on a scale from 0 to 10 how much distress they were experiencing. Higher scores indicate higher distress, and a value of 4 indicates clinically relevant levels of general distress.<sup>40</sup> This item has acceptable levels of sensitivity to detect psychiatric morbidity.<sup>41</sup>

#### Symptoms of anxiety and depression

Anxiety and depression were assessed using the 2 subscales of the Hospital Anxiety and Depression Scale (HADS)<sup>42</sup> validated among individuals with SCI.<sup>43</sup> Values between 8 and 10 of each subscale sum scores are considered mild symptoms, 11-14 moderate, and 15-21 severe.<sup>44,45</sup>

### Measures: Biopsychosocial covariates

#### Demographics and injury characteristics

Information regarding sex, age, time since injury diagnosis, etiology of the SCI (traumatic vs nontraumatic), injury level (tetraplegia vs paraplegia [intact]), and injury completeness (complete vs incomplete) were retrieved from the patients' records.

#### Presence of pain

Using one self-reported item, participants indicated whether or not they experienced pain during the last week.

#### List of abbreviations:

|               |  |
|---------------|--|
| <b>BIC</b>    | <b>Bayesian information criterion</b>                  |
| <b>BLRT</b>   | <b>bootstrapped likelihood ratio test</b>              |
| <b>HADS</b>   | <b>Hospital Anxiety and Depression Scale</b>           |
| <b>LMR</b>    | <b>Lo-Mendell-Rubin likelihood ratio test</b>          |
| <b>LPA</b>    | <b>latent profile analysis</b>                         |
| <b>SwiSCI</b> | <b>Swiss Spinal Cord Injury inception cohort study</b> |
| <b>SCI</b>    | <b>spinal cord injury</b>                              |

### Functional independence

Functional independence was rated by health practitioners using the validated Spinal Cord Independence Measure III.<sup>46,47</sup> Total sum score ranges between 0 and 100. Higher scores represent better performance or independence.

### General self-efficacy

Self-efficacy was assessed with a modified 5-item version of the General Self-efficacy Scale,<sup>48</sup> which showed satisfactory reliability in an SCI sample.<sup>49</sup> It assesses the strength of the individual's belief in their own ability to respond to new difficult situations on a scale from 1 (not at all) to 4 (completely). Higher total sum scores indicate higher self-efficacy.

### Purpose in life

Life purpose was assessed with the Purpose in Life Test—Short Form,<sup>50</sup> which has shown strong reliability in an SCI sample.<sup>51</sup> It consists of 4 items rated on a scale from 1-7. Higher total sum scores indicate higher perceived purpose in life.

### Optimism

Level of optimism was assessed using a modified 6-item version of the Life Orientation Test-Revised.<sup>52</sup> This validated test<sup>53</sup> assesses general expectancies for positive outcomes. In this version, individuals rated statements regarding their current state of optimism on a scale from 0 (strongly disagree) to 4 (strongly agree).<sup>54</sup> Higher total sum scores indicate higher optimism.

### Partnership status

Participants reported whether they had a permanent partner at the onset of SCI or not.

### Data analysis

All analysis were conducted using Mplus 8<sup>a</sup> and the reporting of this study is based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.<sup>55</sup> To identify the profiles of psychological adaptation outcomes, exploratory LPA was conducted. LPA is a person-centered analytic technique, used to identify relatively homogeneous subgroups of individuals within a larger heterogeneous sample, based on their answers to observed continuous variables.<sup>56</sup> Several models with an increasing number of profiles were tested and compared. A maximum likelihood estimator with robust SE was used to adjust for the slight nonnormal distribution of the outcome measures<sup>57</sup> (table 1). The means and variances of the adaptation outcomes were freely estimated to account for potentially unequal variances across profiles, and all models were implemented using different sets of starting values to avoid local maxima solutions.<sup>58-60</sup> Three goodness-of-fit indices were used to select the model with the best-fitting number of profiles: the Bayesian information criterion (BIC, lower values indicate better model fit), the Lo-Mendell-Rubin likelihood ratio test (LMR), and the bootstrapped likelihood ratio test (BLRT); significant *P* values indicate that the model is preferred over a model with one less profile.<sup>61</sup> Besides fit indices, the profiles' interpretability and theoretical relevance, the entropy indicator (higher entropy indicates higher classification accuracy), and the profiles' proportion were considered (fewer profiles with at least 5% of the sample were preferred over many profiles with fewer individuals).<sup>60</sup>

Covariates associated with profile membership were tested using the 3-step approach proposed by Vermunt.<sup>62</sup> This procedure performs a multinomial logistic regression after identifying the best-fitting number of profiles to avoid the effects of covariate misspecification and to control for individual's misclassification rates.<sup>63,64</sup>

The rate of missing data varied between 0.81% and 18.92% (see table 1). Missing in the adaptation outcomes was addressed using full information maximum likelihood, whereas missing in the covariates were imputed using multiple imputation in Mplus (20 imputed datasets). Data were imputed at the sum score level, but the items of each scale were included in the imputation model to reduce information loss.<sup>65</sup> Profile membership probabilities were also included to account for the fact that LPA assumes the existence of unobserved subpopulations.<sup>65-67</sup>

## Results

### Sample characteristics

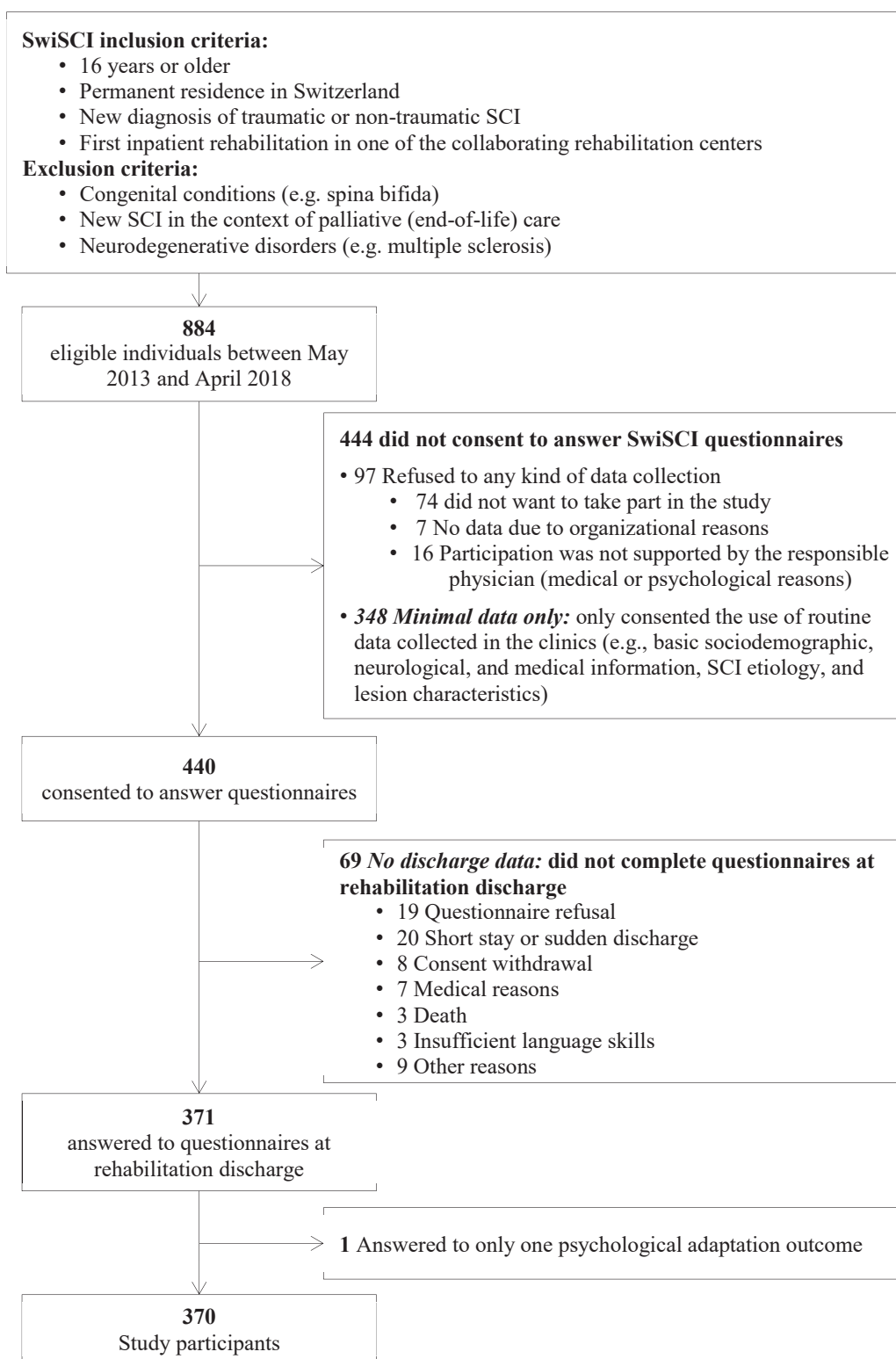
Table 1 depicts the descriptive characteristics of the study participants. Comparative analysis indicates that participants had better functional independence than all nonparticipants, had longer time since injury than individuals who did not complete questionnaires at rehabilitation discharge, and were slightly younger and reported incomplete injuries more often than those who only consented the use of minimal data collected in the clinics (table 2).

### Latent profile analysis

Models with 2-6 profiles were estimated and compared. The 4-profile model was selected as the best-fitting solution because it showed the lowest BIC and significant LMR and BLRT (table 3). Moreover, its entropy and proportion of individuals per profile were satisfactory.

Potentially, influential outliers were investigated using scatter plots of Cook distance against each psychological adaptation outcome. Two potentially influential outliers with Cook distance values higher than 1 were identified. These 2 outliers showed "inconsistent" patterns of response (eg, high scores in life satisfaction and high scores in depressive symptoms). Models excluding these 2 outliers were implemented and indicated that the 4-profile solution remained the best-fitting one. Further analyses were conducted without these outliers.

Figure 2 depicts the estimated means and 95% confidence interval for the 4 identified profiles of psychological adaptation outcomes. The profiles were characterized by different levels of impact and labeled as Minimal impact (32.6%), Low impact (37.3%), Mild impact (23%), and Severe impact (7.1%). Minimal impact displayed the lowest scores in depressive symptoms, anxiety symptoms, and distress as well as the highest scores in life satisfaction. Low impact showed high life satisfaction, depressive symptoms, and anxiety symptoms below the cutoff scores of the HADS, and clinically relevant levels of distress according to the distress thermometer. Mild impact displayed mild symptomatology of depression and anxiety as well as high distress and low life satisfaction. Severe impact showed clinically relevant symptoms of depression and anxiety, the highest level of distress, and



**Fig 1** Participation flowchart.

the lowest level of life satisfaction. Plots of the mean and observed individual values for each profile (fig 3) show fairly distinctive individual patterns of response. (Estimated means and 95% confidence interval for each profile can also be found in supplemental

table S1, available online only at <http://www.archives-pmr.org/>. The correlation between the study variables are displayed in supplemental table S2, available online only at <http://www.archives-pmr.org/>).

**Table 1** Descriptive characteristics of the study participants at rehabilitation discharge (N=370)

| Variable                                 | Mean ± SD    | Range  | n (%)       | Missing n (%) | α   | Skewness | Kurtosis |
|--|--------------|--------|-------------|---------------|-----|----------|----------|
| <b>Psychological adaptation outcomes</b> |              |        |             |               |     |          |          |
| Depressive symptoms                      | 4.84±3.87    | 0-19   | -           | 10 (2.70)     | .82 | 0.93     | 3.43     |
| Anxiety symptoms                         | 4.87±3.93    | 0-19   | -           | 3 (0.81)      | .84 | 0.99     | 3.80     |
| Life satisfaction                        | 6.51±2.25    | 0-10   | -           | 3 (0.81)      | -   | -0.61    | 3.04     |
| Distress                                 | 4.69±2.61    | 0-10   | -           | 6 (1.62)      | -   | 0.07     | 2.20     |
| <b>Covariates</b>                        |              |        |             |               |     |          |          |
| Sex (male)                               | -            | -      | 264 (68.65) | 0 (0.00)      | -   | -        | -        |
| Age (y)                                  | 53.79±16.54  | 16-87  | -           | 0 (0.00)      | -   | -        | -        |
| Time since injury (d)                    | 158.18±83.71 | 25-485 | -           | 0 (0.00)      | -   | -        | -        |
| Length of stay in rehabilitation (d)     | 137.90±78.38 | 4-425  | -           | 0 (0.00)      | -   | -        | -        |
| SCI etiology (traumatic)                 | -            | -      | 218 (58.92) | 0 (0.00)      | -   | -        | -        |
| Injury level (tetraplegia)               | -            | -      | 133 (36.74) | 8 (2.20)*     | -   | -        | -        |
| Injury level (paraplegia)                | -            | -      | 217 (59.94) | 8 (2.20)*     | -   | -        | -        |
| Injury level (intact)                    | -            | -      | 12 (3.31)   | 8 (2.20)*     | -   | -        | -        |
| Injury completeness (incomplete)         | -            | -      | 306 (84.53) | 8 (2.20)*     | -   | -        | -        |
| Pain (presence of)                       | -            | -      | 241 (65.31) | 1 (0.27)      | -   | -        | -        |
| Functional independence                  | 73.05±23.33  | 5-100  | -           | 8 (2.16)      | -   | -        | -        |
| General self-efficacy                    | 15.92±2.68   | 5-20   | -           | 21 (5.68)     | .84 | -        | -        |
| Purpose in life                          | 22.23±4.18   | 5-28   | -           | 16 (4.32)     | .85 | -        | -        |
| Optimism                                 | 17.01±4.57   | 5-24   | -           | 26 (7.03)     | .76 | -        | -        |
| Partner at onset of SCI (yes)            | -            | -      | 215 (71.66) | 70 (18.92)    | -   | -        | -        |

\* Indicates rate of missing data after completion with the latest assessment available in the medical records.

**Covariates associated with profile membership**

Table 4 presents the results of the multinomial logistic regression using profile membership as a dependent variable. Male individuals and higher scores in purpose in life or optimism increased the likelihood to be part of the Minimal impact profile compared to any other profile. Additionally, individuals with better functional independence had higher chances to display a Minimal impact profile compared to Low or Severe impact, and those with paraplegia or intact injury, absence of pain, or higher self-efficacy were more likely in Minimal impact than in Mild impact. However, the effect of injury level was only marginally significant. Age, time since injury, etiology of the SCI, injury completeness, and having a partner at SCI onset were not significantly associated with profile membership.

**Sensitivity analysis**

To check the robustness of the results, the multinomial logistic regression analysis was repeated with complete cases only (n=255) instead of imputed data. Results using Minimal impact as comparison group remained fairly the same, except that the effect of functional independence and self-efficacy became nonsignificant (when compared to Low and Mild impact, respectively) and the effect of tetraplegia became significant (when compared to Low impact). Such minor changes in the results can be expected as the size of each profile was reduced by nearly 30% due to missing data.

In regard to the Severe impact profile, results were less robust (ie, significant effects appeared for purpose in life, age, functional

**Table 2** Comparison between participants and nonparticipants of the study

| Variable                          | Participants (N=370)<br>n (%) | Nonparticipants           |       |     |                |                          |       |     |                |
|-----------------------------------|-------------------------------|---------------------------|-------|-----|----------------|--------------------------|-------|-----|----------------|
|                                   |                               | Minimal Data Only (n=348) |       |     |                | No Discharge Data (n=70) |       |     |                |
|                                   |                               | n (%)                     | t     | df  | χ <sup>2</sup> | n (%)                    | t     | df  | χ <sup>2</sup> |
| Sex (male)                        | 254 (68.65)                   | 232 (66.67)               | -     | -   | 0.32           | 48 (68.57)               | -     | -   | 0              |
| Mean age (y) ± SD                 | 53.79±16.54                   | 58.11±19.65               | 3.20* | 716 | -              | 51.67±19.11              | 0.95  | 438 | -              |
| Mean time since injury (d) ± SD   | 158.18±83.71                  | 160.58±89.70              | 0.37  | 716 | -              | 125.48±88.63             | 2.97* | 438 | -              |
| SCI etiology (traumatic)          | 218 (58.92)                   | 195 (56.93)               | -     | -   | 0.61           | 38 (54.29)               | -     | -   | 0.52           |
| Injury level (tetraplegia)        | 133 (36.74)                   | 93 (33.57)                | -     | -   | 0.99           | 18 (37.50)               | -     | -   | 0.11           |
| Injury level (paraplegia)         | 217 (59.94)                   | 172 (62.09)               | -     | -   | -              | 28 (58.33)               | -     | -   | -              |
| Injury level (intact)             | 12 (3.31)                     | 12 (4.33)                 | -     | -   | -              | 2 (4.17)                 | -     | -   | -              |
| Incomplete injury                 | 306 (84.53)                   | 215 (78.18)               | -     | -   | 4.23†          | 38 (82.61)               | -     | -   | 0.11           |
| Mean functional independence ± SD | 73.05±23.33                   | 61.00±28.55               | 5.34* | 552 | -              | 67.36±27.64              | 1.68† | 418 | -              |

NOTE. All values are written in n (%) unless otherwise specified.

\* Indicates P < .05.

† Indicates P < .01.

**Table 3** Goodness-of-fit indices

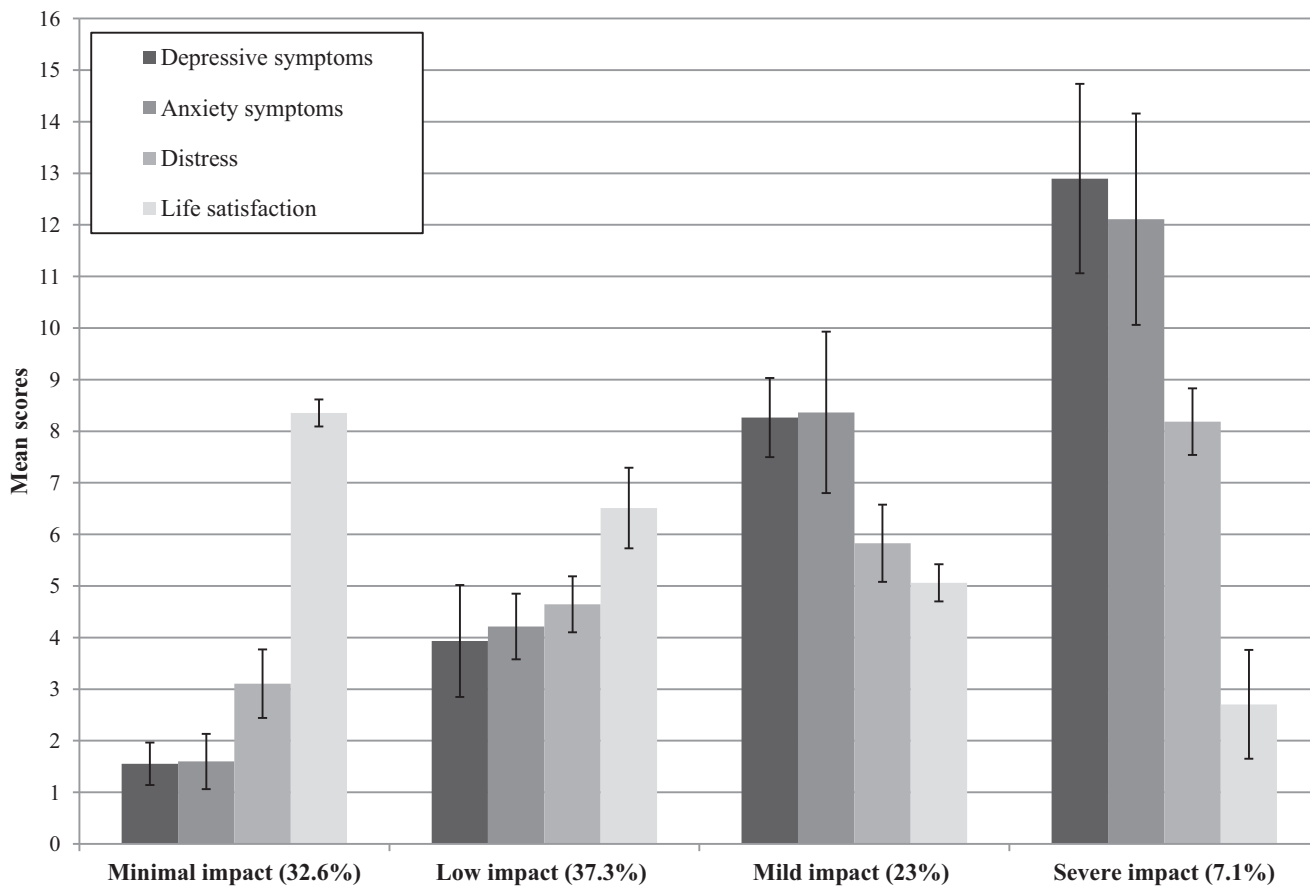
| No. of Profiles                                     | Bayesian Information Criterion | Lo-Mendell-Rubin Likelihood Ratio Test ( <i>P</i> Value) | Bootstrapped Likelihood Ratio Test ( <i>P</i> Value) | Entropy | No. Per Profile     |
|---|--------------------------------|--|--|---------|---------------------|
| N = 370   |                                |  |  |         |                     |
| 2   | 6899.01                        | <.001  | <.001  | .84     | 200/170             |
| 3   | 6817.12                        | .186   | <.001  | .79     | 150/146/74          |
| 4   | 6801.20                        | .004   | <.001  | .78     | 133/122/85/30       |
| 5   | 6804.62                        | .045   | <.001  | .78     | 130/108/64/37/31    |
| 6   | 6831.66                        | .594   | .428   | .81     | 121/100/54/38/34/23 |
| n = 368 (potentially influential outliers excluded) |                                |  |  |         |                     |
| 2   | 6841.04                        | <.001  | <.001  | .84     | 201/167             |
| 3   | 6758.90                        | .118   | <.001  | .79     | 150/145/73          |
| 4*  | 6743.62                        | .006   | <.001  | .79     | 133/125/86/24       |
| 5   | 6746.70                        | .030   | .020   | .79     | 128/108/71/37/24    |
| 6   | 6780.63                        | .738   | 1.000  | .81     | 114/106/78/37/24/9  |

\* Indicates final selected model.

independence, pain, and partnership status when compared to Low and Mild impact). This profile was the smallest and had the highest reduction due to missing data (n=15). Thus, results regarding the Severe impact profile should be interpreted cautiously.

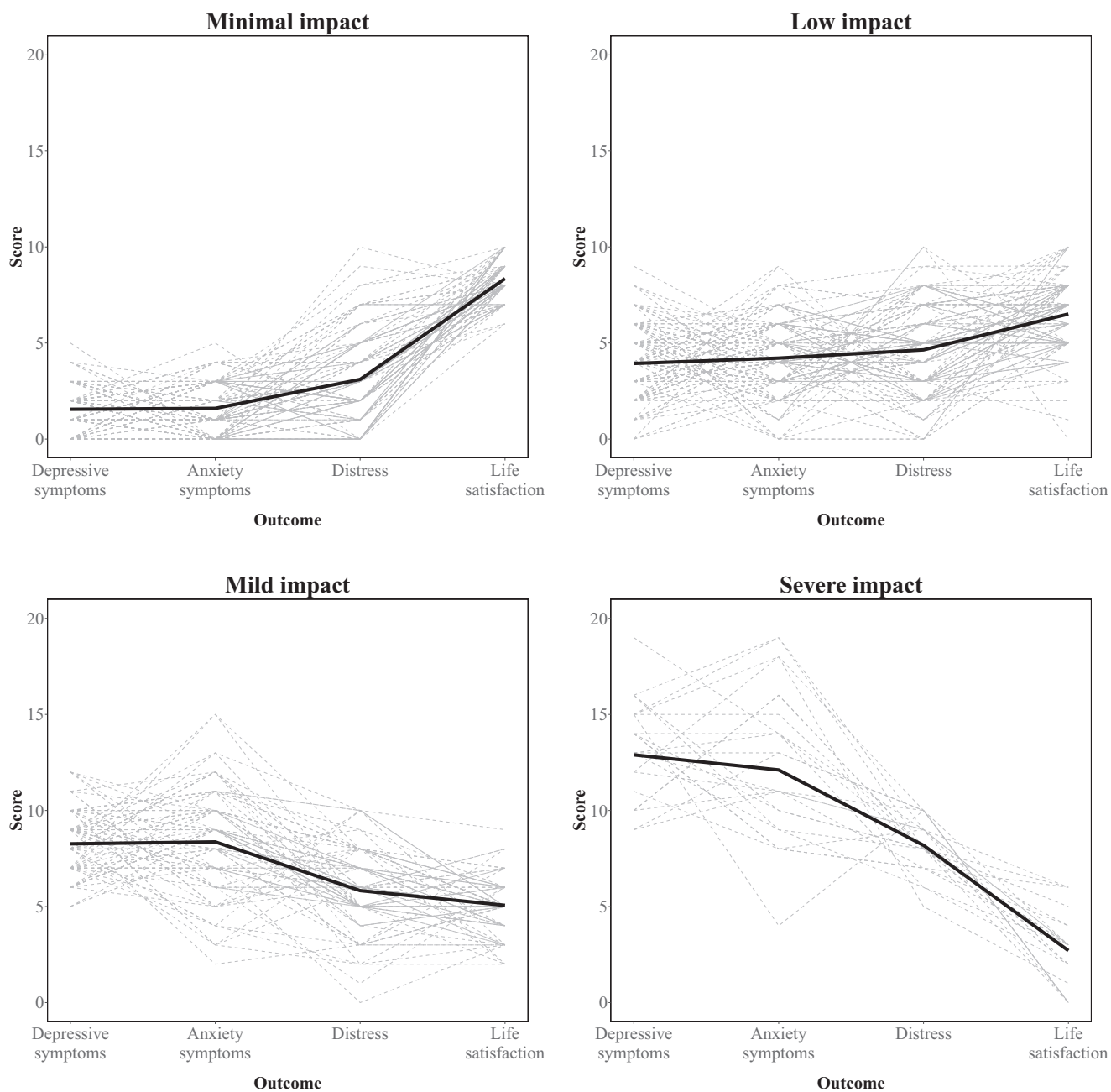
### Discussion

As hypothesized, we identified several profiles of psychological adaptation outcomes displaying different levels of impact, ranging from Minimal to Severe. These findings coincide with studies



**Fig 2** Estimated mean scores and 95% confidence interval of the identified profiles (n=368).





**Fig 3** Profiles' estimated mean scores and observed individual values ( $n=368$ ). NOTE. Solid lines represent profiles' means.

suggesting a varying degree of adaptation outcomes among individuals with chronic illnesses and disabilities.<sup>10,12,13,28,68</sup> Such heterogeneity is not identifiable when studying overall mean scores and support that individuals can show positive responses across several outcome measures early after injury onset. Still, outcomes observed at rehabilitation discharge may improve or decline as individuals face the new challenges of reintegrating into the community. Therefore, longitudinal studies are needed to understand what contributes to maintaining positive adaptation outcomes beyond the clinical setting.

We did not identify any profile characterized by a differential impact of SCI on the adaptation outcomes (eg, high life satisfaction and elevated symptoms of depression or anxiety). Although such pattern of response could be noted for some

participants (see [fig 3](#)), these individuals were not representative enough to form a profile. However, with a larger sample, a profile with such characteristics could have emerged. Future studies analyzing longitudinally and simultaneously several adaptation outcome measures could reveal such heterogeneity because the effects of SCI could be longer-lasting for some indicators than for others.<sup>23,24</sup>

We identified 32.6% of the participants displaying a profile characterized by Minimal psychological impact of SCI at rehabilitation discharge. In fact, the Minimal impact profile showed rates of life satisfaction comparable to the national general population (mean = 8.34 and 8.00, respectively).<sup>69</sup> This type of profile characterized by the best-identified outcomes has been usually labeled as "resilient" and has been reported as the most prevalent

**Table 4** Covariates associated with profile membership

| Covariates              | Minimal Impact vs |      |                    |      |                    |      | Low Impact vs     |      |               |      | Mild Impact vs     |      |
|-------------------------|-------------------|------|--------------------|------|--------------------|------|-------------------|------|---------------|------|--------------------|------|
|                         | Low Impact        |      | Mild Impact        |      | Severe Impact      |      | Mild Impact       |      | Severe Impact |      | Severe Impact      |      |
|                         | Estimate          | SE   | Estimate           | SE   | Estimate           | SE   | Estimate          | SE   | Estimate      | SE   | Estimate           | SE   |
| Sex (male)              | -1.99*            | 0.60 | -2.13*             | 0.66 | -2.71*             | 0.91 | -0.15             | 0.45 | -0.73         | 0.75 | -0.58              | 0.77 |
| Age                     | 0.01              | 0.02 | 0.02               | 0.02 | -0.03              | 0.04 | 0.01              | 0.02 | -0.04         | 0.04 | -0.05              | 0.04 |
| Time since injury       | 0.00              | 0.00 | 0.00               | 0.00 | -0.01              | 0.01 | 0.00              | 0.00 | -0.01         | 0.01 | -0.01              | 0.01 |
| Etiology (traumatic)    | -0.03             | 0.52 | -0.05              | 0.65 | -1.90              | 1.28 | -0.02             | 0.54 | -1.86         | 1.21 | -1.84              | 1.30 |
| Tetraplegia             | 0.91              | 0.58 | 1.11 <sup>†</sup>  | 0.64 | -0.17              | 1.95 | 0.20              | 0.50 | -1.07         | 1.86 | -1.28              | 1.92 |
| Complete SCI            | -0.72             | 0.90 | -0.42              | 1.14 | -0.93              | 1.45 | 0.30              | 0.81 | -0.21         | 1.20 | -0.51              | 1.40 |
| Pain                    | 0.11              | 0.52 | 1.95 <sup>‡</sup>  | 0.86 | -0.35              | 1.58 | 1.84 <sup>‡</sup> | 0.82 | -0.46         | 1.50 | -2.30              | 1.72 |
| Functional independence | -0.05*            | 0.02 | -0.03              | 0.02 | -0.09 <sup>‡</sup> | 0.05 | 0.02 <sup>‡</sup> | 0.01 | -0.04         | 0.04 | -0.07              | 0.04 |
| Self-efficacy           | -0.09             | 0.14 | -0.34 <sup>‡</sup> | 0.15 | -0.05              | 0.19 | -0.25*            | 0.10 | 0.04          | 0.15 | 0.29 <sup>‡</sup>  | 0.15 |
| Purpose in life         | -0.29*            | 0.09 | -0.37*             | 0.10 | -0.66*             | 0.25 | -0.07             | 0.07 | -0.37         | 0.23 | -0.30              | 0.23 |
| Optimism                | -0.22*            | 0.08 | -0.51*             | 0.11 | -0.75*             | 0.17 | -0.29*            | 0.08 | -0.53*        | 0.16 | -0.24 <sup>‡</sup> | 0.13 |
| Partner (yes)           | -0.72             | 0.70 | -0.80              | 0.75 | 0.88               | 1.60 | -0.08             | 0.54 | 1.60          | 1.51 | 1.68               | 1.55 |

NOTE. N=359: 9 cases were not included in the multinomial logistic regression, because data regarding injury level and completeness could not be recovered from previous assessment times. Minimal impact n=125; Low impact n=133; Mild impact n=86; Severe impact n=24.

\* Indicates  $P < .01$ .

<sup>†</sup> Indicates  $P < .10$ .

<sup>‡</sup> Indicates  $P < .05$ .

in studies on psychological adaptation to spousal bereavement or divorce.<sup>25,26</sup> Similarly, studies on the longitudinal development of depression or anxiety following SCI have identified resilient trajectories (ie, stable low depression) as being the most prevalent among individuals with SCI.<sup>10,11,68</sup> In contrast, our most prevalent profile was Low impact (37.3%, significant distress and lower life satisfaction than Minimal impact). This result might be due to methodological choices of previous studies using mixture modeling, which set the outcomes' variances to be equal across classes. This has been criticized because it seems to cause an overestimation of resilient responses after potentially traumatic events.<sup>70</sup> Minimal impact following SCI might thus be less common than previously reported.

Previous studies have estimated the prevalence of clinically relevant levels of depression and anxiety among individuals with SCI to be 22 and 27% respectively.<sup>9,71</sup> In our sample, around 30% of the individuals showed elevated symptoms of either depression, anxiety, or both (Mild and Severe impact profiles). These individuals would particularly benefit from interventions targeting factors related to better psychological adaptation profiles following SCI.

### Covariates associated with profile membership

As hypothesized, self-efficacy, purpose in life, and optimism were associated with more positive adaptation outcomes at rehabilitation discharge (ie, Minimal or Low impact profiles). Previous studies have consistently found that self-efficacy and purpose in life contributed to better mental health and well-being after SCI.<sup>29,30,32,72,73</sup> Optimism has also been found to contribute to better psychological outcomes.<sup>29,32,68,74</sup> This highlights the need for fostering psychological resources during the clinical rehabilitation, a setting that has been described as overly focused on physical issues and less attentive to individuals' emotional needs.<sup>75-77</sup> Indeed, reports of interventions fostering optimism or purpose in life during inpatient rehabilitation are scarce. However, self-efficacy has been effectively increased by cognitive-behavioral techniques, peer mentoring, or multimedia resources,

which can reduce levels of depressive mood, and anxiety, and improve medical outcomes (eg, decubitus prevention).<sup>77-79</sup>

Better functional independence and absence of pain were also associated with displaying a Minimal impact profile. While some studies reported no associations between functional limitations and psychological adaptation to SCI,<sup>10,80,81</sup> others coincide with our findings and identified positive effects of functioning on life satisfaction.<sup>13,34</sup> However, individuals that experience pain have been consistently found to be at a greater risk for having poor adaptation outcomes.<sup>11-13</sup> These results underline the negative impact of pain, providing basis to argue that it should be a priority intervention target. Note that absence of pain, like higher self-efficacy, was not significantly associated with membership to Minimal impact compared to Severe impact profile. These surprising results might be due to the higher variation and the smaller sample size of the Severe impact profile. Additionally, measures such as pain intensity could have been more informative regarding profile differences than the dichotomous item used in this study.

Unexpectedly, our results indicate that males are more likely to show a Minimal impact profile than any other identified profile. Previous findings regarding sex seem contradictory; whereas some indicate a higher risk of mental health disorders among women compared to men,<sup>82,83</sup> others indicate that males have a higher likelihood of depression or anxiety after rehabilitation discharge.<sup>84</sup> Thus, further studies are needed to confirm whether or not sex should be considered in the interventions to enhance psychological adaptation to SCI.

As hypothesized, we did not identify significant effects of age or injury-related characteristics on profile membership. However, our study participants were slightly younger and reported more often incomplete injuries than nonparticipants who only consented the use of minimal data. This reduced the variability of our sample regarding age and lesion completeness; thus, the effect of these variables might have been more difficult to identify. Still, our findings coincide with past studies indicating no effect of age or injury characteristics on psychological adaptation.<sup>11-13,85</sup> Finally, we did not find significant associations between partnership status



and profile membership. Former studies have also not identified associations between partnership status and life satisfaction or depression,<sup>11,86,87</sup> or suggested that marriage does not necessarily enhance well-being.<sup>88</sup> Other factors such as social support or relationship satisfaction could be more relevant to explain adaptation outcomes following SCI.<sup>89,90</sup>

### Study limitations

The present study is subject to several limitations. First, the pre-SCI level of individuals' life satisfaction, distress, depression, and anxiety was not considered. Clearly, this information is not easily available, but individuals' mental health history would contribute to discrimination between psychological disturbances due to the injury and those that participants already experienced before SCI. Second, psychological adaptation is a process and its outcomes may change with time. Due to the cross-sectional character of our study, we do not know how the psychological adaptation outcomes developed during the inpatient rehabilitation (eg, following a trajectory of resilience, recovery, or worsening), nor how they will change after discharge. Thus, the longitudinal and simultaneous analysis of several adaptation outcome measures during and after inpatient rehabilitation is needed since psychological adaptation should be considered in its multidimensional as well as in its temporal character.<sup>3</sup> This could be complemented with qualitative methods to broaden the understanding of the development of the psychological adaptation process following the onset of an SCI. Furthermore, the proportion of individuals in the Severe impact profile was small ( $n=24$ ) and could have obscured differences regarding covariates such as pain and self-efficacy. Moreover, some vulnerable individuals may have been excluded, because our sample was composed of individuals that were in better physical conditions than nonparticipants and disregarded individuals whose participation was not supported by the physicians (due to physical or psychological condition;  $n=16$ ). Thus, our findings may not be generalizable for the most functionally impaired individuals with SCI. Finally, other factors such as spirituality or appraisals, which have been associated with adaptation outcomes after SCI<sup>10,31</sup> were not included in this study. Thus, potential predictors of profile membership may be missing.

### Conclusions

Using data from a population-based cohort study and adopting a comprehensive approach to the investigation of psychological adaptation outcomes following SCI, we identified that the majority of individuals showed positive outcomes at the end of SCI rehabilitation, displaying Minimal or Low impact profiles. However, results from this study also indicate that a large portion of individuals (30%) likely require tailored interventions to facilitate their psychological adaptation process. Intervention planning to facilitate psychological adaptation to SCI should acknowledge the complexity of this process by considering biological, psychological, and social factors. Indeed, the present study identified several potentially modifiable covariates which constitute avenues for interventions during rehabilitation. Beyond functional independence improvement and pain management, strengthening psychological factors might contribute to better adaptation outcomes and in turn facilitate the return to the community for individuals with a recently acquired SCI.

### Supplier

a. Mplus, version 8; Muthén and Muthén.

### Keywords

Optimism; Emotional adjustment; Rehabilitation; Spinal cord injuries

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