

## REVIEW

# Psychological resources in spinal cord injury: a systematic literature review

C Peter<sup>1,2</sup>, R Müller<sup>1,2</sup>, A Cieza<sup>1,2</sup> and S Geyh<sup>1,3</sup>

**Study design:** Systematic literature review.

**Objectives:** The purpose of this study was to gain a systematic overview of the role of psychological resources in the adjustment to spinal cord injury (SCI).

**Methods:** A systematic literature review was performed. The literature search was conducted in the databases Pubmed, PsycINFO, the Social Sciences Citation Index, the Education Resources Information Center, Embase and the Citation Index of Nursing and Allied Health Literature. The assessed variables, measurement instruments, results and the methodological quality of the studies were extracted, summarized and evaluated.

**Results:** A total of 83 mainly cross-sectional studies were identified. Psychological resources were categorized into seven groups: self-efficacy (SE), self-esteem, sense of coherence (SOC), spirituality, optimism, intellect and other personality characteristics. SE and self-esteem were consistently associated with positive adjustment indicators such as high well-being and better mental health. Interrelations between psychological resources and key rehabilitation outcome variables such as participation were rarely studied. Only a few interventions, which were aimed at strengthening psychological resources were identified. Longitudinal studies suggested that SE, SOC, spirituality and purpose in life were potential determinants of adjustment outcomes in the long term.

**Conclusion:** Research on psychological resources in SCI is broad, but fragmented. Associations of psychological resources with mental health and well-being were frequently shown, while associations with participation were rarely studied. Further development of resource-based interventions to strengthen persons with SCI is indicated. This review can serve as guide for clinical practice and can add to the design of future SCI research.

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**Keywords:** psychological resource; spinal cord injuries; resilience; self-efficacy; quality of life; adjustment

## INTRODUCTION

Spinal cord injury (SCI) involves severe physical, social, but also psychological consequences.<sup>1</sup> The risk for major depression, anxiety disorder, post-traumatic stress disorder, substance abuse and suicide is elevated for people with SCI compared with the general population.<sup>2–7</sup> Activating their inherent psychological resources may protect people with SCI from negative secondary consequences of the injury.

Psychological resources are inner, health protecting and health promoting potentials of a person, which represent a source or means to deal with difficult situations or obtain valued ends.<sup>8–11</sup> They may include abilities, skills, knowledge, experiences, talents, strengths and behavioral patterns of the person. Strengthening psychological resources is an essential aim in clinical rehabilitation to support successful adjustment.<sup>12,13</sup>

Adjustment to disability is 'an evolving, dynamic, general process through which the individual gradually approaches an optimal state of person–environment congruence' (p. 8).<sup>14</sup> Prevailing models for the understanding of adjustment following SCI stress the role of psychological, biological and environmental factors in determining adjustment outcomes such as well-being, mental health or participation via appraisal and coping processes.<sup>6,15–17</sup> These models include psychological resources as determinants.

Current reviews in SCI have examined adjustment outcomes such as mental health and quality of life.<sup>5–7,18</sup> In addition, external resources such as social support,<sup>19</sup> and internal psychological resources such as locus of control<sup>20</sup> and coping style<sup>18</sup> have been implicated in adjustment outcomes but because of the unaccounted variance, there are perhaps a range of other psychological resources that could be contributing. A systematic overview of psychological resources in SCI does not exist yet. What is the current state of research on psychological resources, and what do we know about their relations to other factors and outcomes in the adjustment process following SCI? A summary of current findings on psychological resources could provide a basis for better understanding of adjustment, inform clinical practice, and could be used to develop and apply interventions tailored to strengthen people with SCI. To avoid redundancy with existing literature,<sup>5–7,18,20</sup> this review has explicitly excluded social skills, coping and locus of control as potential psychological resources. They are only mentioned and discussed if their relation to the included psychological resources has been examined.

Therefore, the objective of this study is to systematically inquire about the role of psychological resources after SCI and examine their relationship with other factors and outcomes of the adjustment process. Specific aims are (a) to identify the psychological resources

<sup>1</sup>Swiss Paraplegic Research, Nottwil, Switzerland; <sup>2</sup>Research Unit for Biopsychosocial Health, Institute for Health and Rehabilitation Sciences, Ludwig-Maximilians-University, Munich, Germany and <sup>3</sup>Department of Health Sciences and Health Policy, University of Lucerne and SPF, Nottwil, Switzerland  
Correspondence: C Peter, Guido A. Zäch-Strasse 4, CH-6207 Nottwil, Switzerland.  
E-mail: claudio.peter@paranet.ch

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studied in SCI research, and (b) to summarize the evidence about the relationship of psychological resources with other factors and outcomes of the adjustment process.

## MATERIALS AND METHODS

A systematic literature review was performed searching Pubmed, PsycINFO, the Citation Index of Nursing and Allied Health Literature, the Social Sciences Citation Index and the Education Resources Information Center. Search terms for psychological resources were combined with search terms for SCI ('parapleg\*', 'quadripleg\*', 'tetrapleg\*', 'spinal cord inj\*' or 'spinal cord\*'). Potential search terms for psychological resources were identified by consulting prominent health and health-related models and theories that address psychological resources, and by screening the psychological literature in PsycINFO for articles explicitly mentioning psychological resources in title or abstract. Potential search terms were checked for their correspondence with the definition of psychological resources to decide on their final use in the search strategy. (The list of all search terms is available as Supplementary Information on the webpage of the journal.)

Search results were screened for eligibility by two reviewers independently from each other, solving disagreement by consensus. Quantitative studies published in a scientific journal between 1990 and 2010 in English and mentioning psychological resources in the study aim, assessing psychological resources, or administering a psychological resource-based intervention were included for further analysis. Studies involving persons with SCI younger than 13 years, including non-human samples, and not generating first-hand data on psychological resources were excluded. Also, reviews, meta-analyses, dissertations, psychometric studies, case reports and qualitative studies were excluded.

Information about the study aims, design and population were extracted from the included studies. All variables assessed in the study and the corresponding assessment instruments were identified. Among the study variables, all psychological resources were marked and study results about psychological resources were documented. For quality assurance, data extraction and study quality rating (see below) was conducted by two reviewers independently from each other in one-third of the articles, solving disagreement by consensus. Data extraction was conducted using an MS-Access database.

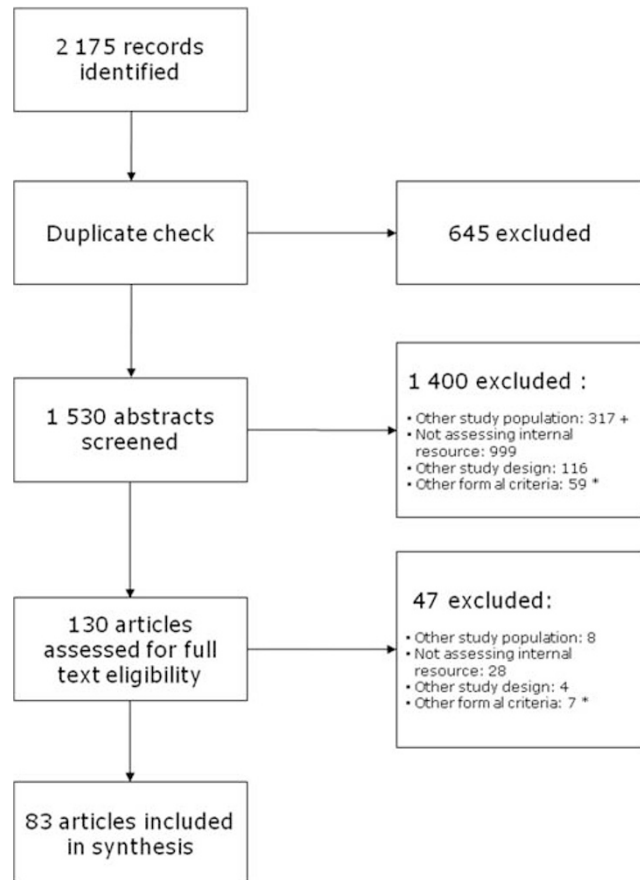
The identified psychological resources were listed and grouped. Research results were synthesized for each group thematically, subdivided by groups of associated variables representing outcomes and factors of the SCI adjustment process. Results were summarized considering the significance, direction, and the consistency of the associations, study methodology and strengths of evidence.

Study quality was rated using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement<sup>21</sup> or the Physiotherapy Evidence Database Scale (PEDro).<sup>22</sup> The STROBE represents a checklist of 22 criteria for case-control, cohort and cross-sectional studies. The PEDro scale consists of 11 items to be applied for randomized controlled trials. For both scales the number of fulfilled criteria per study was counted.

## RESULTS

The literature search led to the identification of 1530 articles, 83 were included (Figure 1). The agreement between the reviewers was 92% for the paper selection, 69.7% for variables, 76.4% for results and 91% for study quality in the data extraction.

Study characteristics as well as demographic and lesion-related data of the study populations are depicted in Table 1. Overall, 92 different constructs representing psychological resources were captured in these studies (Table 2). Forty-eight of the search terms used were not identified in the literature search (for example, curiosity, humor or creativity). (See Supplementary Information on the webpage of the journal). Psychological resources were structured into seven overarching groups and both statistically significant and not significant results considered. Statistically significant results are presented in



**Figure 1** Flow diagram of the systematic literature review. + Numbers do not add up because several criteria can be applied to one article. \*Other formal criteria: No abstract, not in English, other publication type, published before 1990.

Tables 3–6, while findings of this review are graphically summarized in Figure 2.

### Self-efficacy and perceived control

Self-efficacy (SE) and perceived control (PC) are defined as the person's beliefs or general perceptions to direct or perform a behavior.<sup>23,24</sup> Overall, 7 studies assessed general self-efficacy (GSE), 12 studies self-efficacy related to health conditions or -management (HSE) and 6 studies SE related to other specific contents (for example, exercise). PC was assessed in 17 studies. Measurement instruments used are shown in Table 2.

*Quality of life, well-being and life satisfaction.* The evidence for the relation of SE with well-being seemed fairly strong. Persons with high GSE, social SE or PC reported higher well-being<sup>25–27</sup> and life-satisfaction.<sup>25,28,29</sup> The results regarding perceived health were inconclusive.<sup>25,26,29</sup> HSE, but not GSE predicted quality of life in a multivariate longitudinal study.<sup>30</sup> However, HSE's association with quality of life<sup>30–32</sup> and perceived health was inconsistent<sup>32,33</sup> and may be explained by differences in the study populations.

*Physical health.* Only a few studies addressed the relation between SE and physical health, and the evidence appeared to be weak. People with higher HSE had less physical impairment<sup>34</sup> and less secondary physical conditions<sup>35,36</sup>. PC over pressure relief did not predict health behavior for pressure sore prevention or pressure sore occurrence.

**Table 1** Characteristics of the 83 papers included in the systematic literature review

	(n=83)	%
<i>Country</i>		
USA	44	52
Canada	10	12
Australia	7	8
United Kingdom	6	7
Taiwan	3	4
China	2	3
Norway	2	3
Sweden	2	3
Switzerland	1	1
Brazil	1	1
Finland	1	1
France	1	1
Greece	1	1
Italy	1	1
Portugal	1	1
South Korea	1	1
<i>Study design</i>		
Observational cross-sectional without control group	28	33.5
Observational cross-sectional with control group	28	33.5
Observational longitudinal without control group	11	13
Intervention randomized controlled trial	5	6
Intervention other	4	5
Intervention controlled clinical trial	4	5
Observational longitudinal with control group	3	4
<i>Sample size—mean (range)</i>	127 (9–1361)	
<i>Age—mean (range)</i>	39.8 (25–55.9)	
Not specified (n)	12	
<i>Gender</i>		
Male		70.4
Female		29.6
Not specified (n)	8	
<i>Marital status</i>		
Married (n)		43.2
Not specified (n)	45	
<i>Age at injury—mean (range)</i>	28.1 (12.2–42.2)	
Not specified (n)	62	
<i>Severity of injury</i>		
Paraplegia		50.5
Tetraplegia		48.2
Complete injury		45.1
Incomplete injury		53.1
Traumatic injury		91.1
Non-traumatic injury		7.1
<i>Time since injury in months—mean (range)</i>	132 (1.5–300)	
Not specified (n)	29	
<i>Setting</i>		
Community based	53	64
Mixed	15	18
Inpatient	9	11
Outpatient	6	7

However, sample size of this longitudinal study was low ( $n=17$ ).<sup>37</sup> An inverse relation of exercise SE and breathing problems was reported.<sup>38</sup>

Pain may affect SE, however, evidence seems weak and is based on few studies. Pain SE was higher for persons with SCI than for pain patients without SCI.<sup>32</sup> Persons with SCI and pain experienced lower HSE and exercise SE than persons without pain.<sup>33,38</sup> High pain control was associated with less pain interference<sup>39,40</sup> and lower pain intensity,<sup>40</sup> while inconsistent relationships of SE with these variables were found.<sup>32,33,38,41</sup>

**Mental health.** The associations of SE with mental health are the most consistent identified in this review. Persons with high GSE, HSE or pain control were consistently less anxious or depressed,<sup>32–34,38,41,42</sup> and reported better mental health.<sup>39,40</sup> However, these studies were cross-sectional and statements about the direction of relationships or causality cannot be made.

High HSE was associated with lower helplessness,<sup>34</sup> but not related with feeling worn out,<sup>36</sup> psychiatric history<sup>34</sup> or number of medications<sup>34</sup> in cross-sectional studies. High exercise SE was related with higher alcohol consumption.<sup>38</sup>

**Activity and participation.** The evidence on the relation of SE with participation is fragmented, as different activity-types were examined. Persons with high GSE, HSE, exercise SE/mastery or PC performed more school,<sup>43</sup> recreation<sup>25</sup> or exercise activities<sup>44,45</sup> prior or post-injury. They performed better health behavior and used less health-care services,<sup>36</sup> experienced more functional independence and less mobility restrictions.<sup>29</sup> These belief-related resources were related with a higher amount of work activity prior injury<sup>43</sup> and with more time spent on work post-injury.<sup>25</sup> Associations with employment status were inconsistent,<sup>26,34,36</sup> while the relationship with work impairment was not significant.<sup>29</sup> Social integration,<sup>29</sup> participation in SCI-adapted activities<sup>36</sup> and physical activity were not consistently higher for persons with high PC or HSE in cross-sectional and longitudinal studies.<sup>46,47</sup>

**Sociodemographic and lesion-related variables.** Evidence is fairly strong that SE and PC are not related with sociodemographic and lesion-related variables. Associations of belief-related resources with sociodemographic variables such as education,<sup>25,26,31,34,36,41</sup> gender,<sup>25,26,31,36</sup> age,<sup>25,26,29,31,36,41,46,48</sup> marital status,<sup>25,26,36,49</sup> income<sup>25,26</sup> and ethnicity<sup>26,28,36</sup> were largely not significant.

The relationship of SE with lesion-related variables including level and completeness of injury, age at injury and time since injury were mostly not statistically significant.<sup>25,26,29,31,41,45,46</sup> High HSE appears to be associated with greater time since injury.<sup>31,41</sup> PC was predicted by neurologic impairment one year post-injury in a multivariate analysis.<sup>43</sup>

Compared with general populations, persons with SCI reported lower social SE but equal GSE and PC,<sup>27,50</sup> and higher HSE than persons with multiple sclerosis.<sup>34</sup> Decreases in control and self-reliance because of SCI were retrospectively reported,<sup>51,52</sup> but also increases in SE.<sup>53</sup>

**Interrelations of psychological resources, appraisal and coping.** Many different personal and environmental factors have been examined, but results are not comparable across studies and evidence remains weak. Persons with high control or mastery had more knowledge<sup>43</sup> and higher self-esteem.<sup>54</sup> Higher HSE was associated with acceptance<sup>32,33</sup> and fewer cognitive distortions.<sup>34</sup> GSE positively correlated with perceived manageability. This might be explained by the conceptual similarity of these two variables.<sup>42</sup> A person's PC at rehabilitation admission predicted PC 1-year post-injury.<sup>43</sup>

**Table 2** Selected overarching groups of psychological resources, corresponding variables and measurement instruments

<i>Overarching group of psychological resource (total number of studies), specific resource</i>	<i>Measurement instrument</i>	<i>Study reference</i>
<i>Self-efficacy (23)</i>		
GSE	The General Self-Efficacy Scale <sup>141</sup>	25–28
	General Self-Efficacy Scale <sup>142</sup>	30, 38, 42
	Perceived Benefit Scale <sup>143</sup>	53
<i>HSE</i>		
Disease-management self-efficacy	Self-Efficacy for Managing Chronic Disease <sup>144</sup>	41
Health-related self-efficacy	Self-rated Abilities for Health Practices Scale <sup>145</sup>	60
	The Perceived Health Competence Scale <sup>146</sup>	30
Pain self-efficacy	Pain Self-Efficacy Questionnaire <sup>147</sup>	32, 59
SCI self-efficacy	Moorong Self-Efficacy Scale <sup>148</sup>	31–33, 59
	The Beliefs Scale <sup>149</sup>	34
	Items constructed/adapted by authors	49
Self-efficacy for managing health condition	Stanford Self-efficacy for Managing Chronic Disease Scale <sup>144</sup>	150
	Items constructed/adapted by authors	36
Self-efficacy for urinary tract infection prevention	Items constructed/adapted by authors	35
<i>Self-efficacy related to other context</i>		
Barrier self-efficacy	Items constructed/adapted by authors	47, 58
Exercise self-efficacy	SCI Exercise Self-Efficacy Scale <sup>151</sup>	38
	Items constructed/adapted by authors	44
Scheduling self-efficacy	Items constructed/adapted by authors	47, 58
Self-efficacy for active living	Self-Efficacy in Active Living <sup>57</sup>	56, 57
Self-efficacy for task persistence	Items constructed/adapted by authors	44
Social self-Efficacy	The Self-Efficacy Scale <sup>141</sup>	27
<i>Control (17)</i>		
Control (personality)	Multi-dimensional Personality Questionnaire <sup>152</sup>	153
In-control	Self-Perception Scale <sup>51</sup>	51
Independent	Self-Perception Scale <sup>51</sup>	51
Mastery	Mastery Scale <sup>154</sup>	54
Pain control	Survey of Pain Attitudes <sup>155</sup>	40
	Survey of Pain Attitudes—Short form <sup>156</sup>	39
PC	Personal Independence Profile <sup>157</sup>	43, 50, 55
	Perceived Stress Scale <sup>158</sup>	29
Perceived behavioral control	Seven-item measure of control-related constructs <sup>159</sup>	46, 47
Perceived exercise mastery	Self-Perception in Exercise Questionnaire <sup>160</sup>	45, 161
Perceived leisure control	Leisure Diagnostic Battery <sup>162</sup>	163
Personal control	Internal-External Locus of Control Scale <sup>164</sup>	63
Perceived behavioral control of skin checking	Items constructed/adapted by authors	37
Perceived behavioral control of pressure sore	Items constructed/adapted by authors	37
<i>Self-esteem (20)</i>		
Self-esteem	Rosenberg Self-Esteem Scale <sup>61</sup>	50, 54, 62–64, 66–68, 71, 72, 75, 165
	Culture-Free Self-Esteem Inventory <sup>166</sup>	51, 65, 70
	Index of Self-Esteem <sup>167</sup>	73
Personal self-esteem	Culture-Free Self-Esteem Inventory <sup>166</sup>	70
Social self-esteem	Culture-Free Self-Esteem Inventory <sup>166</sup>	70
Sexual self-esteem	Sexuality Scale <sup>168</sup>	63
Confident	Self-Perception Scale <sup>51</sup>	51
Self-affirmation	No information in article	56
Self-reliance	Individualism-Collectivism scale <sup>169</sup>	28
Self-worth	Self-Perception Profile <sup>170</sup>	74
Sexual self-confidence	SCI Women Questionnaire <sup>69</sup>	69
<i>Sense of coherence (5)</i>	Sense of Coherence Scale <sup>76</sup>	77–81
<i>Purpose in life (5)</i>		
Purpose in life	Purpose in Life Scale <sup>171</sup>	86, 87, 90
Meaning making	Purpose in Life Scale <sup>171</sup>	85
Life regard (meaning)	Life regard Scale <sup>172</sup>	63

**Table 2 (Continued)**

Overarching group of psychological resource (total number of studies), specific resource	Measurement instrument	Study reference
Spirituality (4)	Brief Multidimensional Measure of Religiousness/Spirituality	88, 89
	Intrinsic Spirituality Scale <sup>173</sup>	84
	Perceived Benefit Scale <sup>143</sup>	53
Hope (3)	Miller Hope Scale <sup>174</sup>	68
	Mental Adjustment to Cancer Scale <sup>175</sup>	71, 72
	State Hope Scale <sup>176</sup>	93
	The Hope Scale <sup>177</sup>	92
Optimism (4)	Life Orientation Test <sup>178</sup>	30, 63
	Adjective checklist <sup>179</sup>	52
	Self-Perception Scale <sup>51</sup>	51

Abbreviations: GSE, general self-efficacy; HSE, health-related self-efficacy; PC, perceived control; SCI, spinal cord injury.

**Environmental factors.** Interpersonal support was unrelated to PC<sup>29</sup> and inconsistently associated with HSE.<sup>36,41</sup> HSE was unrelated to environmental adaptations, facility accessibility and denied/unrequested health-care services.<sup>36</sup> In-patients needing independent living services reported lower control than others.<sup>55</sup>

**Interventions strengthening SE and PC.** Evidence regarding SE enhancement is fairly consistent. Multidisciplinary, multimodal interventions with different topics such as lifestyle or self-relaxation targeting specific SE were successful. GSE and specific SE, for example, for active living, were enhanced by active/independent living programs,<sup>56,57</sup> or physical activity or sports programs.<sup>42,47,58</sup> HSE was not increased by a cognitive-behavioral pain management program,<sup>59</sup> but enhanced in a wellness workshop intervention. However, in the latter study, the enhanced HSE levels of persons in the intervention group did not differ from the HSE levels of the control group.<sup>60</sup> PC was not improved in the identified intervention studies.<sup>43,47,55</sup> Overall, sample sizes for SE-intervention studies were small ( $27 < n < 44$ ), but larger for PC-intervention studies ( $37 < n < 234$ ).

### Self-esteem

Self-esteem refers to a person's positive evaluation of one's self<sup>61</sup> and was assessed in 20 studies (Table 4). Results are fragmented, but suggested relationships of self-esteem with well-being, mental health and participation. Persons with high self-esteem showed higher life satisfaction,<sup>54,62</sup> better sexual adjustment,<sup>63</sup> were less depressed,<sup>51,54</sup> less stressed<sup>64</sup> and felt less lonely.<sup>62</sup> Self-esteem was inconsistently related to functional independence<sup>54,64,65</sup> and not associated with scoliosis,<sup>65</sup> or pressure sore occurrence.<sup>66</sup> High self-esteem was associated with better social integration<sup>64</sup> and related to physical, but not work- or school-related activities.<sup>67</sup> Persons with high self-esteem experienced higher mastery<sup>54</sup> and hope<sup>68</sup> and showed more emotional- and problem-focused coping.<sup>64</sup>

Persons with SCI frequently perceived self-esteem as compromised by SCI.<sup>51,69,70</sup> However, their self-esteem did not consistently differ from general<sup>50,54,71–73</sup> or other clinical populations ( $n=16$ ).<sup>74</sup> Cross-sectional studies indicated that self-esteem could be restored.<sup>68,70</sup> Longitudinal research reported reduced self-esteem 1 and 2 years post-injury.<sup>71,72</sup> Self-esteem's association with gender was inconsistent,<sup>62,65,68</sup> relations with other sociodemographic<sup>62,68,70</sup> and lesion-related variables.<sup>67,70</sup> were not significant.

It was also inconsistently related with social support,<sup>62,64,65,68</sup> unrelated to social barriers,<sup>64</sup> but negatively connected to amount, origin and type of received insurance benefits.<sup>66,67</sup>

Self-esteem and self-affirmation were not enhanced by cognitive behavioral therapy<sup>75</sup> or an educational active living-workshop.<sup>56</sup> However, sample sizes were small in the treatment groups ( $n=27$ ;  $n=28$ , respectively) and only few persons with low self-esteem participated.<sup>75</sup>

### Sense of coherence

Sense of coherence (SOC), defined as global orientation to view the world as comprehensible, manageable and meaningful,<sup>76</sup> was measured in five studies (Table 4). SOC was associated with better psychosocial adjustment,<sup>77,78</sup> and predicted better mental health<sup>78</sup> and quality of life<sup>79</sup> in longitudinal studies.

Persons with SCI reported changes in SOC after SCI,<sup>78</sup> but higher SOC than able-bodied.<sup>80</sup> High SOC was related to the coping strategies acceptance,<sup>78,79</sup> fighting spirit<sup>79</sup> and less social reliance, as well as to loss- and threat-appraisals.<sup>79</sup>

SOC of participants of a comprehensive pain management program ( $n=27$ ) remained stable over 12 months. In contrast, SOC of persons with SCI in the control group without treatment decreased over time.<sup>81</sup>

### Spirituality and purpose in life

Spirituality, which refers to searching for or personal attitude toward transcendence, was assessed in four studies.<sup>82</sup> Purpose in life (PIL) is the degree to which an individual finds meaning in life<sup>83</sup> and was examined in five studies (Table 5).

Associations of PIL and spirituality with well-being and mental health appear significant. However, evidence is weak and based on single studies. High spirituality and PIL were associated with higher life satisfaction and well-being,<sup>63,84,85</sup> better mental health<sup>84</sup> and adjustment<sup>86</sup> and, as shown in longitudinal research, reduced mortality.<sup>87</sup> Spirituality was not associated with functional independence.<sup>84</sup>

Both, cross-sectional and longitudinal studies indicated changes in spirituality after SCI,<sup>53,84</sup> and similar spirituality levels to persons with other health conditions.<sup>88,89</sup> One large study reported significant but low correlations of PIL with health locus of control and various personality attributes.<sup>86</sup>

Higher PIL was found for men than women.<sup>90</sup> Associations with other sociodemographic or lesion-related variables were statistically not significant.<sup>85,86</sup>

### Hope and optimism

Hope and optimism conceptualized as positive orientation toward the future<sup>91</sup> were assessed in five cross-sectional and two longitudinal

**Table 3** Associations of self-efficacy with variables, type of analysis and corresponding coefficient

Psychological resource	Associated variable	Type of analysis	Coefficient	Study reference
<i>Self-efficacy</i>				
<i>Mental health</i>				
GSE, HSE	Anxiety	Corr	$r=-0.45$ to $-0.515$	33, 42
GSE, HSE, exercise SE	Depression	Corr	$r=-0.43$ to $-0.611$ , +	32–34, 38, 41–42
HSE, exercise SE	Depression	Regr	$\beta=-0.28$ to $-0.35$ , +	34, 38
HSE <sup>a</sup>	Depression	Regr	$\beta=-0.263$	41
PC (pain control)	Mental health	Corr	$r=0.46$ to $0.55$	39, 40
	Mental health	Regr	$\beta=0.42$	40
HSE	Helplessness	Corr	$r=-0.47$	34
GSE, exercise SE	Alcohol consumption	Corr	+	38
Exercise SE <sup>a</sup>	Alcohol consumption	Regr	+	38
<i>Well-being and perceived health</i>				
GSE, PC	Life satisfaction	Corr	$r=.050$ to $0.52$ ,	25, 29
GSE, PC	Life satisfaction	Regr	$\beta=0.36$ to $0.40$ , +	25, 28, 29
GSE, PC	Perceived health	Corr	$r=-0.216$ to $0.45$	25, 26, 29
HSE	Quality of life	Corr	$r=0.38$ to $0.73$	30, 31
	Quality of life	Regr	$\beta=0.265$ to $0.312$	30
	Quality of life	(M)ANOVA	$F(8, 97)=10.7$ , $p<0.001$	31
GSE, social SE, PC	Well-being	Corr	$r=0.30$ to $0.43$ , +	25–27
Social SE	Well-being	Regr	$\beta=0.21$	27
<i>Sociodemographic and lesion-related variables</i>				
HSE	Time since injury	Corr	$r=0.18$ to $0.367$	36, 41
HSE <sup>a</sup>	Time since injury	Regr	$\beta=0.205$	41
PC <sup>a</sup>	Neurological impairment	Regr	+	43
Social SE	SCI vs general population	Diff	$t=-2.34$ , $p<0.05$	27
HSE	SCI vs Multiple Sclerosis	Diff	$t=-2.46$ (158), $p<0.05$	34
SE	Change (increase after SCI)	Desc	26% Of participants	53
PC	Change (before SCI vs after SCI)	Diff	+	51
Self-reliance	Change (before SCI vs after SCI)	Diff	+	52
PC (1-year post-injury) <sup>a</sup>	PC	Regr	$\beta=0.20$	43
<i>Physical health</i>				
HSE	Physical impairment	Corr	$r=-0.27$	34
HSE	Secondary phys. conditions	Corr	$r=-0.52$ to $-0.13$	35, 36
		Path	$\beta=-0.12$	36
Exercise SE <sup>a</sup>	Breathing problems	Regr	+	38
<i>Pain</i>				
Pain SE	SCI vs pain-patients	Diff	$t(45)=-5.29$ , $p<0.05$	32
Pain control	Pain intensity	Corr	$r=-0.38$	40
HSE	Pain intensity	Diff	OR=2.7	31
Pain control	Pain interference	Corr	$r=-0.46$ to $-0.53$	39, 40
	Pain interference	Regr	$\beta=-0.34$	40
HSE <sup>a</sup>	Pain interference	Regr	$\beta=-0.427$	41
<i>Activity and Participation</i>				
GSE	Recreation activity	Corr	$r=0.24$	25
PC <sup>a</sup>	School activity	Regr	+	43
SE, exercise mastery <sup>a</sup>	Exercise activity	Regr	$\beta=0.23$ to $0.41$ , +	44, 45
HSE	Health behavior	Corr	$r=0.19$	36
	Health behavior	Regr	$\beta=0.20$	36
HSE	Health-care use	Corr	$r=-0.16$	36
	Health-care use	Regr	$\beta=-0.20$	36
PC	Functional independence	Corr	$r=0.178$	29
PC	Mobility restrictions	Corr	$r=0.175$	29
GSE	Work activity	Corr	$r=0.35$	25
PC <sup>a</sup>	Work activity	Regr	+	43



**Table 3 (Continued)**

<i>Psychological resource</i>	<i>Associated variable</i>	<i>Type of analysis</i>	<i>Coefficient</i>	<i>Study reference</i>
<i>Personal and environmental factors</i>				
HSE	Cognitive distortions	Corr	$r=-0.37$	34
PC	Knowledge	Corr	$r=0.34$ to $0.38$	43
GSE	Perceived manageability	Corr	$r=0.64$ to $0.77$	42
PC (1-year post-injury) <sup>a</sup>	PC	Regr	$\beta=0.20$	43
Mastery	Self-esteem	Corr	$r=0.51$	54
HSE	Denied health-care services	Corr	$r=-0.02$ to $0.10$	36
HSE	Environmental adaptations	Corr	$r=0.18$ to $0.22$	36
PC <sup>a</sup>	Need of independent living service	Diff	+	55
<i>Intervention</i>				
SE	Intervention (pre- vs post-intervention)	Diff	$t(16)=2.67$ , $p<0.05$ , Cohen's $d=0.86$ ; $P<0.05$ , Cohen's $d=1.05$ ; $Z=2.5$ , $p<0.05$	42, 56, 57
	Intervention (pre- vs post-intervention)	(M)ANOVA	$F(2, 84)=6$ , $p<0.01$ , Cohen's $d=0.60$	58
	Intervention (treatment vs control)	ANCOVA	$F(1, 32)=4.76$ , $p<0.05$ , Cohen's $d=0.52$	47

Abbreviations: ANCOVA, analysis of covariance; Cohen's  $d$ , measure of effect size; Corr, bivariate correlation; Desc, descriptive data analysis; Diff, bivariate difference test; GSE, general self-efficacy; HSE, health-related self-efficacy; (M)ANOVA, (multivariate) analysis of variance; OR, odds ratio; PC, perceived control; Regr, regression analysis; SCI, spinal cord injury; SE, self-efficacy;  $r$ , correlation coefficient;  $\beta$ , standardized beta-coefficient; +, result-coefficient(s) not described in the article. <sup>a</sup>Psychological resource is the dependent variable. Only statistically significant and consistent results are shown.

**Table 4 Associations of self-esteem and sense of coherence with variables, type of analysis and corresponding coefficient**

<i>Psychological resource</i>	<i>Associated variable</i>	<i>Type of analysis</i>	<i>Coefficient</i>	<i>Study reference</i>
<i>Self-esteem</i>				
Self-esteem	Life satisfaction	Corr	$r=0.43$ to $0.65$	54, 62
Self-esteem	Sexual adjustment	Regr	$\beta=0.49$	63
Sexual self-esteem	Sexual adjustment	Regr	$\beta=0.58$ to $0.68$	63
Self-esteem	Depression	Corr	$r=-0.56$ to $-0.74$	51, 54
Self-esteem	Stress	Corr	$r=-0.49$	64
	Stress	Path	$\beta=-0.61$	64
Self-esteem	Loneliness	Corr	$r=-0.45$	62
Self-esteem	Mastery	Corr	$r=0.51$	54
Self-esteem	Hope	Corr	$r=0.91$	68
	Hope	Regr	$\beta=0.53$	68
Self-esteem	Coping (emotion and problem-focused)	Corr	$r=0.34$ to $0.37$	64
	Coping—emotion-focused	Path	$\beta=0.76$	64
Self-esteem	Social integration	Corr	$r=0.54$	64
Self-esteem	Activities physical	Regr	$\beta=0.24$ to $27$	67
Confidence <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	51
Self-esteem <sup>a</sup>	Change (before SCI vs after SCI)	Diff	$t(60)=4.58$ , $p<0.01$	70
	1-year post-injury vs 2-year post-injury vs 5-year post-injury	(M)ANOVA	$p<0.01$	70
Self-esteem	Received insurance benefits	Regr	$\beta=-0.16$ to $-0.38$	67
<i>Sense of coherence</i>				
Sense of coherence	Psychosocial adjustment	Corr	$r=0.31$ to $55$ ,	78
	Psychosocial adjustment	(M)ANOVA	+	77
Sense of coherence	Mental health	Corr	$r=0.47$ to $63$	78
Sense of coherence	Quality of life	Corr	$r=0.554$	79
Sense of coherence	Coping—acceptance	Corr	$r=0.59$ to $0.647$	78, 79
Sense of coherence	Coping—fighting spirit	Corr	$r=0.397$	79
Sense of coherence	Coping—social reliance	Corr	$r=-0.493$	79
Sense of coherence	Appraisal—loss	Corr	$r=-0.542$	79
Sense of coherence	Appraisal—threat	Corr	$r=-0.488$	79
Sense of coherence	Appraisal—challenge	Corr	$r=0.283$	79
Sense of coherence <sup>a</sup>	Change (before SCI vs after SCI)	Desc	+	78
Sense of coherence <sup>a</sup>	SCI vs general population	Diff	$t(140)=2.92$ , $p<0.05$	80
Sense of coherence <sup>a</sup>	Intervention	Diff	+	81

Abbreviations: ANCOVA, analysis of covariance; Corr, bivariate correlation; Diff, bivariate difference test; Desc, descriptive data analysis; (M)ANOVA, (multivariate) analysis of variance; Path, path analysis; Regr, regression analysis; SCI, spinal cord injury;  $r$ , corr coefficient;  $\beta$ , standardized beta-coefficient; +, result-coefficient(s) not described in the article. <sup>a</sup>Psychological resource is the dependent variable.

Only statistically significant and consistent results are shown.

**Table 5** Associations of spirituality and hope with variables, type of analysis and corresponding coefficient

Psychological resource	Associated variable	Type of analysis	Coefficient	Study reference
<i>Spirituality and purpose in life</i>				
Spirituality	Life satisfaction	Corr	$r=0.48$ to $0.60$	84
Meaning	Well-being	Regr	$\beta=0.58$ to $0.73$	63, 85
Spirituality	Mental health	Corr	$r=-0.27$ to $-0.42$	84
Meaning	Adjustment	Corr	$r=0.50$	86
	Adjustment	Regr	+	86
Purpose in life	Mortality	Surv. Anal.	HR=0.81	87
Spirituality	Change (increase after SCI)	Desc	43% Of participants	53
	Change (rehabilitation admission vs rehabilitation discharge)	ANCOVA	Cohen's $d=0.10$	84
Purpose in life	Locus of control	Corr	$r=-0.12$ to $0.22$	86
Purpose in life	Gender	(M)ANOVA	$t(1,260)=2.11$ , $p<0.05$	90
<i>Hope and optimism</i>				
Hope	Functional independence	Corr	$r=0.33$	93
Optimism	Well-being	Regr	$\beta=0.68$	63
Hope <sup>a</sup>	Self-esteem	Corr	$r=0.91$	68
Hope <sup>a</sup>	Social support	Corr	$r=0.89$	68
Hope	Coping—acceptance	Corr	$r=0.53$	93
Hope	Coping—fighting spirit	Corr	$r=0.69$	193
Hope	Appraisal—threat	Corr	$r=-0.65$	93
Optimism <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	51, 52
Hope <sup>a</sup>	Education	Regr	$\beta=0.162$	68
Hope <sup>a</sup>	Ethnicity	Diff	$t=2.18$ , $p<0.05$	68
Hope	Time since mobilization	Corr	$r=-0.29$	93
Hope <sup>a</sup>	Patient status	Diff	$t=2.47$ , $p<0.05$	68

Abbreviations: ANCOVA, analysis of covariance; Cohen's  $d$ , measure of effect size; Corr, bivariate correlation; Desc, descriptive data analysis; Diff, bivariate difference test; HR, hazard ratio; (M)ANOVA, (multivariate) analysis of variance; Regr, regression analysis; SCI, spinal cord injury; Surv. Anal., survival analysis;  $r$ , correlation coefficient;  $\beta$ , standardized beta-coefficient; +, result-coefficient(s) not described in the article. <sup>a</sup>Psychological resource is the dependent variable. Only statistically significant and consistent results are shown.

studies<sup>30,92</sup> (Table 5). Evidence appears fragmented and contradictory. Hope and optimism showed positive bivariate relations with life satisfaction,<sup>92</sup> quality of life,<sup>30</sup> sexual well-being,<sup>63</sup> mental health<sup>93</sup> and functional independence.<sup>93</sup> However, relations were not significant in multivariate, longitudinal analyses.<sup>30,92,93</sup>

Affected persons perceived optimism as compromised by SCI.<sup>51,52</sup> Interconnections of hope with education and ethnicity,<sup>68</sup> time since mobilization<sup>93</sup> and in- or out-patient status were found.<sup>68</sup> Relations with other sociodemographic or lesion-related variables were not significant.<sup>93</sup>

High correlations of hope with self-esteem ( $r=0.908$ ) and social support ( $r=0.891$ ) were found, indicating potential conceptual overlap.<sup>68</sup> Hopeful persons applied the coping strategies acceptance and fighting spirit more often than persons who were low on hope. They were also less likely to appraise their situation as a threat.<sup>93</sup> Relationships of hope with social reliance coping, with control appraisals and challenge appraisals were statistically not significant.<sup>93</sup>

### Intellect, knowledge and competence

Ten studies addressed intelligence and competence of persons with SCI (Table 6). The evidence on the role of intellect in the adjustment process is weak. Intelligence of persons with SCI did not differ from a matched control group.<sup>94</sup> Verbal ability predicted disability acceptance at rehabilitation discharge in a longitudinal study.<sup>95</sup> Verbal ability and memory capacity were related with age, but generally not with lesion-related variables.<sup>48,95</sup> A longitudinal study ( $n=17$ ) found high skin care knowledge predicting less pressure sore occurrence<sup>37</sup> but not skin care behavior. The investigators of this study did not further elaborate

on this counter-intuitive finding. Knowledge significantly correlated with PC after 1-year follow-up and was enhanced in a multi-modal intervention program.<sup>43</sup>

### Personality and motivation

Personality is defined as characteristic patterns of thoughts, feelings and behaviors that make a person unique. Various personality attributes were assessed in 23 studies (Table 6). Overall, the evidence on the relation of personality characteristics with other variables is weak.

*Major personality dimensions (the Big Five).* Agreeableness, extraversion, conscientiousness, openness to experience and neuroticism are considered the five major personality dimensions (Big Five). Together, they explained variance of depression and predicted disability acceptance and problem solving.<sup>96</sup>

Lower conscientiousness, but equal agreeableness and extraversion levels<sup>97</sup> were reported for people with SCI in comparison with normative<sup>97</sup> and healthy samples.<sup>98</sup> Extraverted persons reported less depression,<sup>96,98</sup> (phobic) anxiety,<sup>98</sup> or other psychopathological symptoms<sup>98</sup> and rather participated in sports.<sup>99</sup>

*Social traits.* Forgiving persons reported higher life-satisfaction and were more educated. Associations with health (behavior), and other sociodemographic and lesion-related variables were inconsistent.<sup>100</sup> High sociability was related with better adjustment, PIL and personality but not with locus of control or injury level.<sup>86</sup> Persons with SCI thought they would be more sociable and understanding without



**Table 6** Associations of intellect and personality with variables, type of analysis and corresponding coefficient

<i>Psychological resource</i>	<i>Associated variable</i>	<i>Type of analysis</i>	<i>Coefficient</i>	<i>Study reference</i>
<i>Intellect, knowledge, competence</i>				
Verbal ability	Acceptance	Corr	$r=0.381$	95
	Acceptance	Regr	$\beta=0.289$	95
Verbal ability	Age	Corr	$r=-0.154$	95
Verbal ability	Education	Corr	$r=0.206$	95
Memory capacity	Age	Diff	$t(44)=(2.12 \text{ to } 3.93), p<0.05$	48
Knowledge	Pressure sore occurrence	Regr	$\beta=0.16$	37
Knowledge	PC	Corr	$r=0.34 \text{ to } 0.38$	43
Knowledge <sup>a</sup>	Intervention (treatment group vs control group))	Diff	25.9% Increase vs 12.5% increase, $p<0.05$	43
<i>Personality and motivation</i>				
<i>Big five</i>				
Big five	Depression	Regr	+	96
Big five	Acceptance	Regr	+	96
Big five	Problem solving	Regr	+	96
Conscientiousness	SCI vs general population	Diff	$t(104)=8.40, p<0.01$	97
Extraversion	Depression	Corr	$r=-0.41 \text{ to } -0.37$	98
Extraversion	Anxiety	Corr	$r=-0.32 \text{ to } -0.29$	98
Extraversion	Sport participation	(M)ANOVA	+	99
<i>Social traits</i>				
Forgiveness	Life satisfaction	Corr	$r=0.258 \text{ to } 0.277$	100
Forgiveness	Education	Corr	$r=0.20 \text{ to } 0.222$	100
Sociability	Adjustment	Corr	$r=0.24$	86
Sociability	Purpose in life	Corr	$r=0.45$	86
Sociability	Level of injury	Corr	$r=-0.06$	86
Sociability <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	51
Understanding <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	51
Faith in others <sup>a</sup>	Change (increase after SCI)	Desc	38% Of participants	53
<i>Motivational traits</i>				
Enthusiasm <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	52
Energy <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	51
Decisiveness <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	51
Activity <sup>a</sup>	Change (before SCI vs after SCI)	Diff	+	52
Activity <sup>a</sup>	SCI vs general population	Diff	$t(104)=4.48, p<0.01$	97
Activity	Sociability	Corr	$r=0.27$	86
Activity	Purpose in life	Corr	$r=0.34$	86
Compassion <sup>a</sup>	Change (increase after SCI)	Desc	50% Of participants	53
Work motivation	Employment status	Path	$\beta=0.28$	101
Work motivation <sup>a</sup>	Education	Path	$\beta=0.21$	101
Work motivation <sup>a</sup>	Level of injury	Path	$\beta=-0.20$	101
Self-determination	Leisure boredom	Regr.	+	102
<i>Other specific traits</i>				
Flexibility	Change (before SCI vs after SCI)	Diff	+	52
Imagination	SCI vs general population	Diff	$t(104)=3.55, p<0.05$	97

Abbreviations: ANCOVA, analysis of covariance; Corr, bivariate correlation; Desc, descriptive data analysis; Diff, bivariate difference test; (M)ANOVA, (multivariate) analysis of variance; Path, path analysis; Regr, regression analysis; SCI, spinal cord injury; Surv. Anal., survival analysis;  $r$ , correlation coefficient;  $\beta$ , standardized beta-coefficient; +, result-coefficient(s) not described in the article.

<sup>a</sup>Psychological resource is the dependent variable.

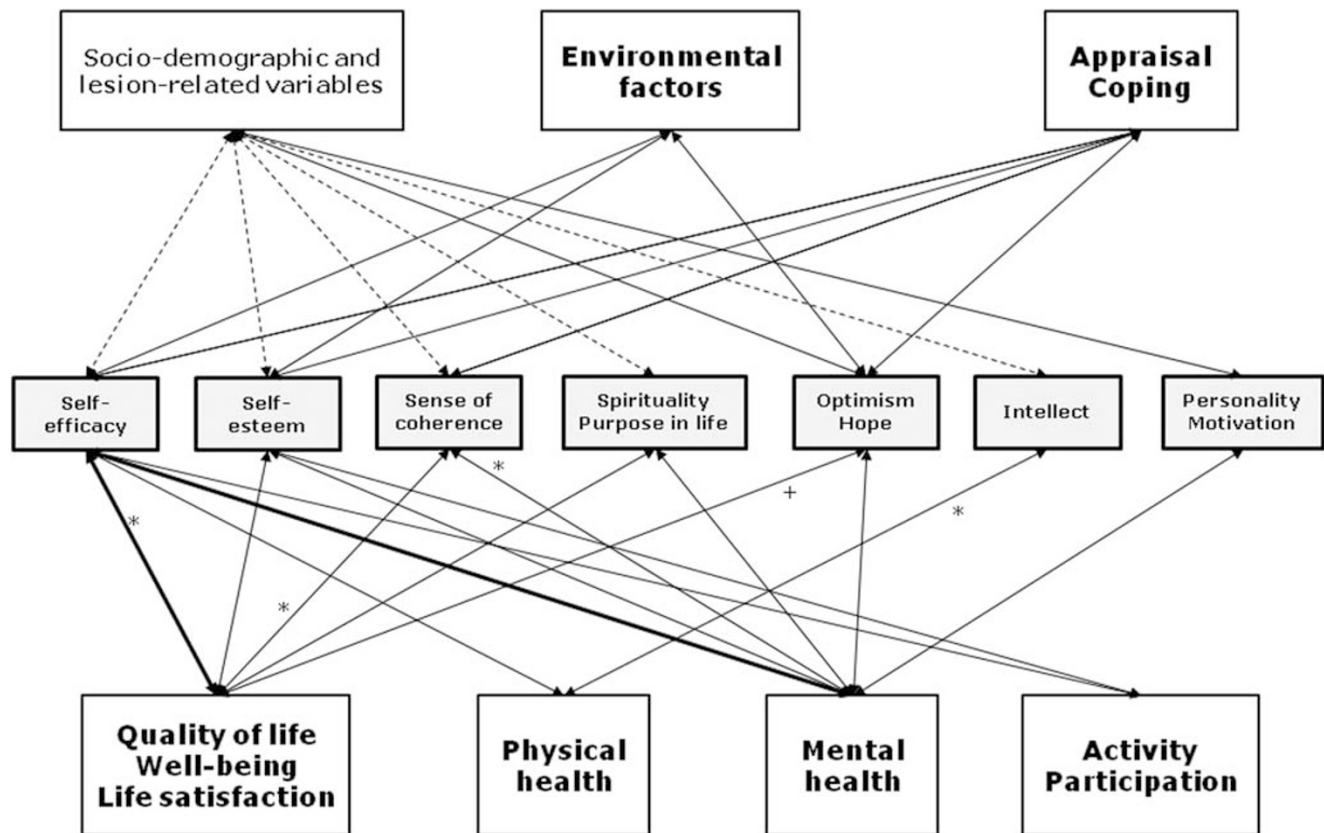
Only statistically significant and consistent results are shown.

SCI,<sup>51</sup> reported increased faith in others<sup>53</sup> and were as gregarious as a normative sample.<sup>97</sup>

**Motivational traits.** Persons with SCI indicated that the injury negatively affected their enthusiasm,<sup>52</sup> energy,<sup>51</sup> decisiveness<sup>51</sup> and activity,<sup>52,97</sup> but increased their compassion.<sup>53</sup> Work motivation predicted employment status, was explained by education and lesion level, but not related with age at injury, driving ability, locus of control

and social support in a study using unstandardized measurement instruments.<sup>101</sup> People with high activity-orientation were more sociable and reported higher PIL.<sup>86</sup> Self-determination was not related to leisure boredom.<sup>102</sup> Leisure motivation did not increase in a sports program ( $n=24$ ).<sup>103</sup>

**Other specific traits.** People with SCI reported less flexibility since the injury.<sup>52</sup> They were more imaginative than a normative sample.<sup>97</sup>



**Figure 2** Associations between psychological resources and factors and outcomes of the adjustment process in SCI. Bold line: Association with strong evidence, several studies conducted consistent results shown. Normal line: Modest/weak evidence. Single studies with associated variable conducted, or inconsistent results found. Dotted line: No association, several studies conducted, consistent results shown. \*: Psychological resource is predictor of the variable in a longitudinal study. +: Psychological resource is NOT a predictor of the variable in a longitudinal study. Interrelations of the selected psychological resources are not depicted in this figure.

Hardiness was not related with locus of control or ethnicity, but explained variance of self-concept dependent on ethnicity.<sup>104</sup>

### Study quality

The evaluation of the studies' quality showed overall satisfying results. Case-control, cohort and cross-sectional studies were rated with STROBE and attained a score of 15 on average (range from 9 to 21 points). Abstracts, introduction, variable definition, presentation and interpretation of study results were mostly satisfactory. However, only few studies considered potential sources of bias (9%), explained how the sample size was determined (4%) or reported additional analyses (9%).

Five randomized controlled trials were identified and rated with PEDro.<sup>35,47,56,58,60</sup> On average, studies achieved a score of 7.4 out of 11. Therapists and assessors were not blinded and only two studies<sup>56,58</sup> performed concealed allocation and 'intention to treat' analyses.<sup>22</sup>

Overall, the results are fragmented, frequently not comparable across studies, and therefore require replication. The identified studies suffer from potential problems in measurement robustness, low sample sizes and problems of sample representativeness, for example, by using convenience samples.

### DISCUSSION

Research on psychological resources in SCI appears to be broad, but fragmented, and consists mainly of cross-sectional studies conducted in English-speaking countries. This review shows that psychological

resources can be compromised by SCI, and are associated with various adjustment outcomes, particularly mental health and well-being, but not with sociodemographic and lesion-related variables.

SE, PC and self-esteem were frequently assessed. Fewer studies examined SOC, spirituality and PIL, optimism and hope, intelligence and personality. Relationships of psychological resources with coping, cognitive appraisals, activity and participation were rarely studied. Various psychological resources that were explicitly searched for in the literature were not identified in this review, although they might be important with regards to adjustment outcomes. For example, curiosity has a predictive role for the longevity of older adults<sup>105</sup> and correlates positively with life satisfaction<sup>106</sup> and well-being.<sup>107,108</sup> In SCI, their role remains unclear.

The evidence for the relationship of SE and self-esteem with better mental health and higher well-being is fairly consistent in the SCI literature and in line with findings in other health conditions or the general population.<sup>109–114</sup> However, little is known about changes over time, and the direction of relationships or potential causal mechanisms have not been studied. In one longitudinal study, SE predicted quality of life post-injury, suggesting that strengthening SE might enhance life quality.<sup>30</sup>

Evidence regarding associations of SE with other variables is to a large extent inconsistent or fragmented. Limiting the capacity to compare findings is the fact, that SE is not a homogeneous concept. Beside GSE, diverse specific constructs, like exercise SE, pain SE or social SE were assessed in single studies (Table 2).

The review identified evidence for the relationship of SOC with SCI adjustment. SOC predicted mental health and was linked with coping and appraisal variables.<sup>93</sup> The findings confirm the theoretical role of SOC as a salutogenetic factor and are in line with research across various populations and health conditions connecting SOC with psychological well-being<sup>115–118</sup> or coping.<sup>119</sup>

Spirituality and PIL in persons with SCI were only assessed in few studies. However, cross-sectional as well as longitudinal findings suggest associations with better mental health, higher quality of life and reduced mortality. These results are in line with research with populations with other health conditions such as human immunodeficiency virus or Alzheimer disease or healthy populations.<sup>120–129</sup> Spirituality can be an important component in psychotherapy.<sup>130–132</sup> Beneficial effects of meaning making interventions on SE, optimism and self-esteem are reported.<sup>133</sup>

The review of the literature suggests that people with SCI who are hopeful and optimistic are also more satisfied and less depressed.<sup>30,63,92,93</sup> However, this relationship did not hold in longitudinal studies.<sup>30,92,93</sup> It could be hypothesized that hope and optimism support the affected people during rehabilitation while other resources might become more important after rehabilitation discharge. A second assumption could be that coping might mediate the long-term effect of optimism, because optimistic persons tend to use different coping strategies from pessimists.<sup>134</sup> Longitudinal multi-variate studies are required to test these assumptions.

Only few intervention studies were identified that aimed at strengthening psychological resources. Testing psychological interventions and conducting randomized controlled trials in rehabilitation settings remains challenging.<sup>135</sup> SE was the only psychological resource, which was enhanced in multi-content intervention studies conducted with persons with SCI living in the community.<sup>42,47,56–58</sup> This is consistent with research in other chronic health conditions, where SE interventions that adopt various strategies such as the use of different modes of learning or the involvement of significant others proved to be useful.<sup>136,137</sup> Other studies might have failed to report similar results because of low sample sizes, underpowered analyses or because the interventions were not appropriately targeted (for example, for persons with low self-esteem).

Most studies on psychological resources have been conducted in the community but not in the clinical setting. It remains unclear whether psychological resources are more important in the short or long term. Thus, early detection and long-term follow-up in longitudinal studies would be valuable.

Overall, the associations found between psychological resources and other variables need to be interpreted with caution, because they might be the result of conceptual overlap. For example, certain spirituality questionnaires contain items referring to emotional well-being, which would explain consistent correlations of spirituality with well-being.<sup>138</sup> Research of psychological resources could be enhanced by a clearer and more differentiated conceptualization and operationalization of the various factors.

This literature review is subject to several limitations. The search strategy as well as the selection of the literature depended on a rather narrow definition of the term 'psychological resource' as concepts that are positively valued in themselves. In contrast, resources are often defined in a broader sense by their effect and include any means that serve to achieve a positively valued end. Therefore, the list of psychological resources, which guided this review could be debated and might not be fully exhaustive. Furthermore, social skills, locus of control and coping, which are psychological resources, have not been considered, because current reviews summarizing findings about these

factors have been published in SCI.<sup>18–20</sup> It is important to note that coping was only mentioned if it was associated with one of the psychological resources, which we have included. Consequently, the results of this review do not represent the whole picture of current knowledge on coping in SCI.

This review conveys a broad overview of the associations of psychological resources with factors and outcomes of the SCI adjustment process, but does not contain an in-depth analyses of specific aspects. Finally, this study focused only on quantitative research. A systematic review of qualitative studies could provide a complementary and more in-depth view for the understanding of psychological resources in persons with SCI.

A number of conclusions can be drawn from the findings of this review considering possible directions for future research. First, to achieve a less fragmented and more comprehensive understanding of the role of psychological resources and their complex interplay with other factors, appropriate data collection and analyses methods are required, that is, the assessment of potential confounding variables and the use of multivariate analyses. Second, with regard to outcome variables, behavioral and social outcomes such as participation and integration were found to be rarely studied in relation to psychological resources in people with SCI. As participation and integration represent key outcomes of rehabilitation, further research would be warranted. Third, little is known about the changes in psychological resources across time following SCI and about the direction of effects in relation to other factors. However, longitudinal studies hinted at SE, SOC, spirituality and PIL as potential variables affecting adjustment outcomes in the long term. Therefore, multivariate longitudinal research could provide further insights. Fourth, potentially useful psychological resources, such as curiosity<sup>105,106</sup> or humor,<sup>139</sup> are underrepresented in SCI research, and could be targets for further exploration. Finally, only few intervention studies were identified. However, studies suggest that strengthening SE, for example, could have a positive effect on quality of life.<sup>30</sup> The development and testing of targeted psychological resource-based interventions could benefit people with SCI and represent worthwhile research efforts.

This review emphasizes and provides insight into the role of psychological resources in the SCI adjustment process. It can inform health professionals who adopt a resource-oriented, person-centered approach in both the clinical and the community setting, and can add to the design of future SCI research.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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