ORIGINAL REPORT

PSYCHOLOGICAL FACTORS AND MENTAL HEALTH IN PERSONS WITH SPINAL CORD INJURY: AN EXPLORATION OF CHANGE OR STABILITY

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Objectives: To examine the course of mental health and psychological factors over time in persons with a recent spinal cord injury and to determine whether change in psychological factors is associated with change in mental health.
Design: Prospective cohort study in the Netherlands with 3 measurement time-points.
Subjects: A total of 60 persons with recently acquired spinal cord injury.
Methods: Standardized validated measurement instruments were used to assess mental health, self-efficacy, mastery, optimism, illness cognitions, purpose in life, and social comparison. Descriptive statistics and multilevel analysis were used.
Results: Multilevel regression analyses showed that neither mental health nor psychological factors, except for social comparison-upward identification, showed statistically significant change over time. However, increasing scores for self-efficacy, mastery, acceptance cognitions, and purpose in life were significantly associated with increasing mental health. In contrast, increasing scores for optimism, social comparison, helplessness cognitions, and disease benefits cognitions were not significantly associated with increasing mental health in persons with spinal cord injury.
Conclusion: Most psychological factors showed stability up to 6 months post-discharge. Purpose in life, acceptance cognitions, self-efficacy, and mastery showed more variability and seem to be most promising as targets for interventions, which may lead to an improvement in mental health in persons with spinal cord injury.

Key words: spinal cord injury; rehabilitation; prospective study; psychological factors; mental health.

INTRODUCTION

Spinal cord injury (SCI) can lead to loss of motor and sensory function, disrupted bladder and bowel function, pressure sores and other secondary health conditions (1). Also, the prevalence of mental health problems, such as depression, anxiety, and post-traumatic stress disorder, is elevated in persons with SCI (2, 3). Mental health problems are, however, not inevitable after SCI, and psychological and social factors play a role in the occurrence and continued existence of mental health problems (4, 5).

Systematic reviews showed that psychological factors, such as self-efficacy, mastery, purpose in life, and optimism (6–7), and social factors, such as social support and social skills (8), are consistently associated with better mental health in persons with SCI. Predictors of mental health in persons with SCI correspond with those found in the general population and with those in studies in persons with other chronic health conditions, such as cancer, diabetes, heart disease, stroke, rheumatoid arthritis and multiple sclerosis (9–11).

From these findings one could assume that fostering protective psychological factors may lead to a reduction in mental health problems. However, in persons with SCI, longitudinal observational studies or intervention studies examining changes in psychological factors are limited (2). Longitudinal observation studies in persons with SCI suggest that several psychological factors, such as self-efficacy, are potential determinants of mental health in the long term (7). Intervention studies in persons with SCI (2) have reported some promising results with respect to improving mental health; however, the effects are inconsistent. This may be due to small study samples (2), or because factors targeted in the interventions were difficult to change. Thus, it would be worthwhile to examine the stability and instability of psychological factors related to mental health. By determining which psychological factors, correlated to mental health, are most susceptible to change, we could determine which factors are the most suitable targets for interventions to improve mental health in persons with SCI.

Thus, the principal aim of the present study was to examine whether the psychological factors self-efficacy, mastery, optimism, illness cognitions, purpose in life, and social comparison, as well as the dependent variable mental health show changes over time in persons with SCI. The null-hypothesis is that there are no changes over time in psychological factors or mental health in persons with SCI. The second aim was to examine whether positive changes in psychological factors are associated with improvement in mental health in persons with

SCI. The null-hypothesis for the second aim is that changes in psychological factors are unrelated to changes in mental health.

METHODS

Study design

The present study is a Dutch multicentre prospective cohort study with 3 measurement time-points, carried out in 5 rehabilitation centres specialized in SCI.

Participants

Persons were included if they: (*i*) had a recently acquired SCI; (*ii*) were admitted for inpatient rehabilitation to a participating study centre; (*iii*) were between 18 and 75 years of age; and (*iv*) were able to speak and understand Dutch. Persons were excluded if they had only minor functional losses (i.e. neither problems with walking ability nor problems with bladder or bowel functions), or psychiatric or cognitive problems. The research protocol was approved by the medical ethics committee of Leiden University Medical Centre (LUMC) and the local ethics committees of the rehabilitation centres.

Procedure

Eligible persons were invited to join the study by their physician or psychologist in the first weeks of admission. Those who gave consent to the study protocol were contacted by one of the researchers. The first measurement was carried out within 4 weeks of admission. The second measurement was conducted during active inpatient rehabilitation, at the latest 2 weeks prior to discharge. To account for the generally longer duration of rehabilitation of patients with tetraplegia, the second interview was scheduled approximately 3 months after the first interview for patients with paraplegia and approximately 6 months after the first interview for patients with tetraplegia. The third measurement was made after discharge from inpatient rehabilitation, at least 6 months after discharge. This last measurement was conducted at home or during an outpatient clinic visit to the rehabilitation centre. The questionnaires used in the present study were part of an oral interview with a trained research assistant. On the first measurement occasion the local rehabilitation centre ethics committees judged that the administration of the illness cognitions and purpose in life questionnaires was unethical. Therefore, these were administered only on the second and third measurement occasions.

Instruments

Mental health. The Mental Health Index (MHI-5), a subscale of the Short-Form 36 (SF-36), comprising 5 items concerning nervousness, sadness, peacefulness, depressed mood, and happiness, was used to assess mental health (12). Respondents rate the frequency of how they felt during the previous 4 weeks on a 6-point scale. A total score between 0 (lowest mental health) and 100 (highest mental health) was computed. The MHI-5 has been shown reliable and valid in the SCI population and showed changes over time in persons with SCI (13).

Self-efficacy. The Dutch version of the general self-efficacy scale was used (14, 15). The scale consists of 16 items measuring expectancies about competencies that are not attributed to specific situations or behaviour. The total sum score ranges between 16 (low self-efficacy) and 80 (high self-efficacy). The scale showed good test-retest reliability and internal consistency (14, 15) and was used successfully in another Dutch SCI study (16, 17).

Mastery. The Pearlin and Schooler Mastery Scale was used (18, 19). This consists of 7 items assessing the extent to which a person perceives that they are in control of events and ongoing situations. The sum score ranges between 7 and 35, higher ratings indicating a greater sense of mastery. The scale showed good validity and reliability and was found to be sensitive to change over time (19, 20).

Optimism. Revised Life Orientation Test (LOT) was used to measure optimism (21). The revised LOT consists of 10 items scored on a 5-point scale. Three items measure optimism, 3 items pessimism and 4 items are filler questions. One total score, ranging from 0–24, was calculated after re-coding the 3 items measuring pessimism. A higher score refers to higher optimism. The revised LOT showed good internal consistency and test-retest reliability (21). The scale was applied in a study with persons with SCI (22).

Social comparison. The social comparison scale (23) measures strategies for identification and contrast with others. Some terms were slightly modified to refer to SCI. Four items refer to "how you feel or what you think when you are in a situation in which another person with SCI is better-off than you are". Two of these items refer to *upward contrast* (e.g. "I feel frustrated about my situation") and 2 refer to *upward identification* (e.g. "It makes me happy realizing that it is possible for me to improve"). Another 2 items refer to *downward identification* (e.g. "I experience fear that my health status would decline") and 2 items refer to *downward contrast* (e.g. "I am happy that I am doing so well myself"). Respondents gave their answers on a 5-point scale ("never" up to "very often", leading to 4 subscale scores between 2 and 10 for upward contrast, upward identification, downward contrast and downward identification. The reliability and validity of the scale were good (23) and a considerable degree of consistency of social comparison strategies over time (around 0.70 over a 3-month period) was found, suggesting that these social comparison strategies may be regarded as dispositional tendencies (24).

Illness cognitions. The Illness Cognition Questionnaire (ICQ) (25) was used. Some terms in the questions were slightly modified to refer to SCI (26). The ICQ consists of 18 statements in 3 subscales, "helplessness", "acceptance" and "disease benefits", each with a subscale score between 6 and 24. The ICQ has been shown to be reliable and valid in rheumatoid arthritis and multiple sclerosis (25), and was used in a study with SCI (26).

Purpose in life. This was measured with the Purpose in Life Scale (PIL) (27), assessing the extent to which people perceive their life to be purposeful and meaningful. The PIL consists of 20 items on a 7-point scale, leading to a total sum score between 20 and 140. Higher scores represent a higher sense of life purpose. Good internal consistency and good validity have been reported (27). The PIL showed sensitivity to change in persons with SCI (28, 29).

Socio-demographics

Age, gender, marital status (married, divorced, widow, single), and level of education (low, middle, high) were measured.

Lesion-related variables

Level of lesion (tetraplegia or paraplegia) and completeness of lesion (complete or incomplete) were assessed. Information about lesion-related variables was retrieved form medical files without specifying a time-point, e.g. at admission to the rehabilitation centre or the most recent score available. Persons were classified according to the International Standards for Neurological Classification of Spinal Cord Injury for neurological level and degree of impairment.

Statistical analyses

Descriptive statistics (mean; standard deviations; correlations) were used to describe how persons with SCI score on mental health and different psychological factors over time for each corresponding time-point. A correlation was considered weak at less than 0.3, moderate between 0.3 and 0.5, and strong at higher than 0.5 (30). Multilevel regression analyses were used to investigate changes in mental health and psychological factors over time and to examine whether changes in psychological factors are related to changes in mental health. Multilevel regression analyses consider the dependency of repeated measures and allow varying numbers of observations per person and temporal spacing between these observations (31).

To study changes in mental health over time, mental health at all 3 time-points was entered as dependent variable and time was entered

as the only determinant in the model as a set of 2 dummy variables. The first measurement time-point (T1) was used as a reference. The same method was used to study changes in each separate psychological factor over time.

To examine whether changes in psychological factors are related to changes in mental health between measurement time-points (T1–T2 and T2–T3), 2 models were compared: a basic model (with mental health as the dependent variable at T1, T2 and T3) and a change model (with changes in mental health between measurement time-points T1–T2 and T2–T3 as dependent variable). This method was chosen to detect whether regression coefficients mainly reflect between-subjects variance or within-subject variance. If the results of the basic model and the change model show similar relationships (same direction and significance), the association between mental health and the psychological factor is based mainly on within-subject variance and reflects change. If not, the association is based mainly on between-subjects variance and reflects differences between individuals. In the basic model, mental health at all 3 time-points was entered as the dependent variable. The psychological factors were added one by one to study their bivariate relationships with mental health. The possible confounding effects of gender, age, marital status, education, level of lesion, and completeness of lesion on the relationship between each separate psychological factor and mental health was examined. These characteristics were considered confounders if the Beta value of the psychological factor changed more than 10% after adding the characteristic to the model (31). In the change model, a change in mental health between T1–T2 and T2–T3 was used as the dependent variable. Change scores between T1–T2 and T2–T3 for the psychological factors were added one by one, to study their bivariate relationship with changes in mental health. The possible confounding effects of the demographics and lesion characteristics were investigated again.

SPSS statistical programme for Windows (version 18.0) and the MlWin program of the Centre for Multilevel Modelling of the Institute of Education in London (version 2.28) were used for the analyses. Significance was set at a *p*-value less than $0.05/12 = 0.004$ to correct for multiple testing.

RESULTS

Respondent characteristics

Overall, 74 persons met the inclusion criteria and were invited to join the current study. Thirteen persons declined and one was subsequently excluded because he declined to answer several questions due to his religion. Overall, 60 person were analysed

at T1. Six persons withdrew for personal reasons and 4 had less than one month between their first and second interview, leading to a sample of 50 participants for T2. At T3, 51 persons participated. One person withdrew after T2 due to major pain, one had passed away, and one was not interviewed due to logistic reasons, but 4 persons were assessed at T3, but not at T2.

Table I shows the demographics and lesion characteristics.

Table I. *Descriptive characteristics at the start of inpatient rehabilitation (*n = *60)*

Characteristics	*n* (%)
Gender	
Men	41 (68.3)
Women	19 (31.7)
Marital status	
Married	38 (63.3)
Divorced	9 (15.0)
Widowed	1 (1.7)
Single	12 (20.0)
Education[a]	
Low	22 (33.6)
Middle	21 (39.7)
High	17 (27.0)
Work	
Yes	43 (71.7)
No	17 (28.3)
Type of injury	
Incomplete paraplegia	19 (31.7)
Complete paraplegia	19 (31.7)
Incomplete tetraplegia	20 (33.3)
Complete tetraplegia	2 (3.3)
Cause of injury	
Traumatic	34 (56.7)
Non-traumatic	26 (43.3)
Age, years[b]	46.4 (15.9)

[a]Low education refers to primary school or the lowest level of secondary school. Middle education refers to completed secondary school or practical education. High education refers to completed (applied) university.
[b]For age the mean and standard deviation are reported instead of the number of persons and the percentage.

Table II. *Descriptive data of mental health and psychosocial factors*

Variable	Range	T1 (*n*=60) Median (IQR)	T2 (*n*=50) Median (IQR)	T3 (*n*=51) Median (IQR)	Spearman's correlation		
					Correlation T1–T2	Correlation T2–T3	Correlation T1–T3
Mental health	0–100	80 (68–88)	84 (63–93)	80 (71–92)	0.55	0.64	0.56
Self-efficacy	16–80	70.5 (64–75)	71 (61.8–75.3)	68 (59–75)	0.74	0.74	0.70
Mastery	7–35	25.5 (21–28.8)	25 (20–28)	24.5 (21–28)	0.51	0.60	0.41
Optimism	0–24	16.5 (14–19)	17 (14.8–19)	17 (14–19)	0.63	0.72	0.50
Social comparison							
Upward identification	2–10	7 (5–8)	6 (4–8.3)	6 (3–8)	0.43	0.59	0.20
Upward contrast	2–10	3 (2–4.8)	2 (2–4)	3 (2–4)	0.39	0.45	0.31
Downward contrast	2–10	8 (6–9.8)	7 (5.8–10)	7 (4–8)	0.60	0.62	0.44
Downward identification	2–10	2 (2–4)	3 (2–4)	2 (2–5)	0.17	0.41	0.36
Illness cognitions							
Helplessness	6–24	–	13 (10–19)	13 (9–16)	–	0.72	–
Acceptance	6–24	–	19 (14–22)	19 (13.8–22.3)	–	0.68	–
Disease benefits	6–24	–	15 (11–20)	15 (9.8–18.3)	–	0.68	–
Purpose in life	20–140	–	111 (99.8–120)	111.3 (101–118.3)	–	0.72	–

A correlation was considered weak at less than 0.3, moderate between 0.3 and 0.5, and strong at higher than 0.5 (30). IQR: interquartile range.

Changes in mental health and psychological factors over time

Tables II and III show descriptive data and correlations of mental health and psychological factors at each measurement time-point. Multilevel regression analyses showed that, at a group level, mental health did not show a significant change over time (Table IV). However, 27 persons showed an increase of at least 4 points in their mental health, 6 showed stable levels, and 18 showed a decrease of at least 4 points in their mental health between T1 and T3. Similarly, most psychological factors did not show changes over time at the group level. However, changes were seen at the individual level (Table IV). For social comparison upward, no change was established between T1 and T2, but it showed a decrease over time at group level between T2 and T3, with a moderate effect size (0.55) (Table IV).

Relationships between changes in psychological factors and changes in mental health

Multilevel analyses with the basic model showed that higher self-efficacy, higher mastery, higher optimism, lower social comparison (upward contrast and downward identification), higher acceptance, lower helplessness, and higher purpose in life were bivariately associated with higher mental health. The highest standardized coefficients were observed for purpose in life and acceptance (Table V).

Additional multilevel analyses based on the change model found that self-efficacy, mastery, acceptance, and purpose in life showed similar relationships (same direction and significance) in the basic model (with mental health as the dependent variable at T1, T2 and T3) as in the change model (with changes in mental health between measurement time-points T1–T2 and T2–T3 as dependent variable), while optimism, social comparison (upward contrast and downward identification) and helplessness did not. This means that the longitudinal relationship between self-efficacy, mastery, acceptance and purpose in life on the one hand, and mental health on the other hand, was based mainly on within-subject change over time. In contrast, the longitudinal relationship between optimism,

social comparison (all 4 strategies), helplessness, and disease benefits with mental health, was based mainly on between-subjects variance. This means that, for example, a person with a high score for optimism had a higher mental health score than a person with a low score for optimism.

DISCUSSION

The present longitudinal study examined whether mental health and the psychological factors self-efficacy, mastery, optimism, social comparison, illness cognitions, and purpose in life, showed

Table III. *Spearman's correlations between mental health and psychosocial factors at the 3 measurement time-points*

	Mental health		
Variable	T1	T2	T3
Self-efficacy	0.25	0.41	0.48
Mastery	0.41	0.43	0.41
Optimism	0.26	0.29	0.28
Social comparison			
Upward identification	0.08	0.25	0.04
Upward contrast	−0.28	−0.64	−0.40
Downward contrast	0.10	−0.06	0.12
Downward identification	−0.25	−0.33	−0.31
Illness cognitions			
Helplessness	–	−0.43	−0.55
Acceptance	–	0.69	0.52
Disease benefits	–	0.22	0.31
Purpose in life	–	0.59	0.58

A correlation was considered weak at less than 0.3, moderate between 0.3 and 0.5, and strong at higher than 0.5 (30).

Table IV. *Multilevel linear regression model for the course of mental health and psychosocial factors*

	Beta	SE	p-value
Mental health			
Constant	77.133	2.294	
Time (T1–T2)	1.291	2.143	0.547
Time (T1–T3)	2.231	2.143	0.298
Self-efficacy			
Constant	68.400	1.333	
Time (T1–T2)	−1.367	1.076	0.204
Time (T1–T3)	−2.228	1.076	0.038
Mastery			
Constant	25.283	0.660	
Time (T1–T2)	−1.519	0.685	0.027
Time (T1–T3)	−1.194	0.685	0.081
Optimism			
Constant	16.367	0.454	
Time (T1–T2)	0.047	0.444	0.916
Time (T1–T3)	0.013	0.444	0.977
Social comparison upward identification			
Constant	6.683	0.329	
Time (T1–T2)	−0.340	0.391	0.385
Time (T1–T3)	−1.347	0.391	0.000
Social comparison upward contrast			
Constant	3.383	0.224	
Time (T1–T2)	−0.133	0.241	0.581
Time (T1–T3)	−0.159	0.241	0.509
Social comparison downward contrast			
Constant	7.450	0.328	
Time (T1–T2)	−0.433	0.327	0.185
Time (T1–T3)	−0.910	0.327	0.005
Social comparison downward identification			
Constant	2.900	0.164	
Time (T1–T2)	0.160	0.203	0.431
Time (T1–T3)	0.365	0.203	0.072
Helplessness			
Constant	14.281	0.667	
Time (T2–T3)	−0.671	0.554	0.226
Acceptance			
Constant	17.564	0.682	
Time (T2–T3)	−0.018	0.545	0.974
Disease benefits			
Constant	15.376	0.736	
Time (T2–T3)	−0.516	0.622	0.407
Purpose in life			
Constant	108.592	2.130	
Time (T2–T3)	−0.082	2.070	0.968

Beta: non-standardized regression coefficient in multilevel analyses. The models had a random intercept. There were no random slopes in the models. SE: standard error. NB: a Bonferroni correction was applied and the *p*-value was set to 0.004.

Table V. *Multilevel linear regression model for the bivariate relationship between mental health and psychosocial variables*

Variables	Basic model				Change model			
	Beta	St. beta	SE	*p*-value	Beta	St. beta	SE	*p*-value
Time-dependent variables T1–T2 and T2–T3								
Self-efficacy	0.63	0.37	0.14	0.00*	0.92	0.30	0.19	0.00*
Mastery	1.26	0.36	0.26	0.00*	1.21	0.36	0.32	0.00*
Optimism	1.23	0.24	0.38	0.00*	1.26	0.24	0.52	0.02
Social comparison								
Upward identification	0.40	0.06	0.48	0.40	1.02	0.17	0.62	0.10
Upward contrast	−2.54	−0.25	0.73	0.00*	−0.91	−0.10	0.95	0.34
Downward contrast	−0.01	−0.00	0.56	0.99	0.41	0.06	0.78	0.60
Downward identification	−3.09	−0.22	0.89	0.00*	1.11	0.10	1.15	0.33
Time-dependent variables T2–T3								
Illness cognitions								
Helplessness	−1.84	−0.51	0.37	0.00*	−1.17	−0.28	0.28	0.06
Acceptance	2.42	0.65	0.30	0.00*	2.15	0.52	0.54	0.00*
Disease benefits	0.76	0.22	0.34	0.02	0.44	0.12	0.55	0.43
Purpose in life	0.81	0.76	0.09	0.00*	0.50	0.46	0.15	0.00*

Beta: non-standardized regression coefficient in multilevel analyses. St. beta: standardized regression coefficient. The standard models had a random intercept, the change models had no random intercept. All time-dependent covariates had a fixed slope, except for mastery, helplessness and disease benefits, which had a random slope in the standard model. Education is a confounder for social comparison upward identification and downward contrast in the standard model and only for downward contrast in the change model. Level of injury is a confounder for downward contrast in the standard model and for upward and downward contrast in the change model. Completeness of injury is only a confounder for upward contrast in the change model. SE: standard error. *Significant.

changes over time in persons with SCI. The null hypothesis of no changes over time at the group level was, in general, not rejected. Only social comparison-upward identification showed negative changes over time at the group level. However, at the individual level, we found that positive changes in self-efficacy, mastery, acceptance, and purpose in life were bivariately associated with increases in mental health within persons with SCI.

Changes in mental health: Mean scores or change scores?

The present study showed that the mean mental health score did not change between admission and discharge from inpatient rehabilitation. This finding is in line with 2 other studies that reported stable levels of depressed mood during inpatient rehabilitation (32, 33), but is in contrast with 2 other studies that found a decline in depressed mood within the first 12–18 weeks after SCI (34, 35). However, mean scores can obscure individual differences in the course of mental health after an SCI (36). Earlier studies found distinct trajectories in the course of mental health in persons with SCI, which showed that persons differ in their rate and pace of mental recovery after an SCI (36, 37). Therefore, it is important to examine individual change scores along with mean scores.

Changes in psychological factors: State or trait?

Only social comparison-upward identification showed negative changes over time at the group level. Qualitative comments made by the patients reveal that, initially, patients thought that if other patients who were more advanced in the rehabilitation process were able to make certain progress that they would also be able to make such progress. Later in the rehabilitation patients learned that they might not be able to make the same progress as other patients, which probably lead to a decrease in upward identification.

The longitudinal relationship between self-efficacy, mastery, acceptance and purpose in life, on the one hand, and mental health, on the other hand, was based mainly on within-subject variance. This means that if self-efficacy, mastery, acceptance, and purpose in life scores increased, this increase was associated with improvement in mental health. These psychological factors might therefore serve as targets for intervention to improve the mental health of a person with SCI.

Purpose in life and acceptance, and changes in these variables over time, were most strongly related to mental health in persons with SCI. Previous studies also concluded that purpose in life is a powerful predictor of adjustment to SCI, and that it is not the severity of the injury, but the generation of purpose in life that influences mental health (28, 29). Interventions to stimulate purpose in life have been effective in other diagnostic groups (38). Therefore, an intervention at the existential level, for example by means of logotherapy which focuses on re-shaping a sense of meaning and purpose in life (39, 40), can be an aid in the rehabilitation process.

With respect to the 3 illness cognitions, a change in acceptance was related to a change in mental health, while changes in helplessness and disease benefits were not. Acceptance and commitment therapy (ACT) aims to stimulate acceptance of what cannot be changed, including distressing thoughts, beliefs, sensations and feelings (41). It might be promising to test ACT as an intervention to improve the mental health of persons with SCI.

Changes in self-efficacy and mastery were also related to changes in mental health. Self-efficacy and mastery are described in the literature both as changeable factors through social-cognitive learning processes (42–44), and as stable characteristics suggesting stability over the life-span (19). In other words, they seem to have both a state and a trait characteristic. This might explain why changes in self-efficacy and mastery were

less strongly related to changes in mental health than those in purpose in life and acceptance. Social learning theory describes ways to influence personal competence (43) and it would be worthwhile to integrate these principles in a systematic way in the rehabilitation programme of persons with SCI to stimulate self-efficacy and mastery. A systematic review in persons with SCI already showed that some specific interventions were found that stimulated self-efficacy in persons with SCI (7).

Changes in optimism and changes in social comparison strategies were not related to changes in mental health. According to several researchers optimism is not easily modifiable (21). The same applies to social comparison strategies as they may be considered as dispositional tendencies (45). Randomized controlled trials (RCTs) in other diagnostic groups that tried to stimulate optimism and social comparison showed mixed results with respect to change (45, 46). However, in clinical practice it might be useful to screen persons on optimism and social comparison strategies, because persons who score low on optimism, and high on social comparison-upward contrast and -downward identification appear to have a higher risk of developing mental health problems. The findings with respect to social comparison correspond with findings of other studies that found that social comparison upward contrast and downward identification had an effect on depression (23, 47).

Although some mental health interventions have already been developed in persons with SCI (e.g. cognitive based strategies (2), coping effectiveness training (48), and supportive group therapy (49)), it would be worthwhile to develop and examine mental health interventions that target specific psychosocial factors to better understand the mechanism behind the intervention.

Limitations

A limitation of the present study is the relatively small sample size. Therefore, we only made use of bivariate analyses, corrected for confounders, instead of multivariate analyses with all psychological factors in a single regression model. Thus we do not know which psychological factors would remain significant and which would show no independent significant association with mental health. Lack of statistical power might have resulted in non-significant results. We did not perform a power analysis beforehand, because this is secondary data analysis of existing data collected in a prospective cohort study (50). Therefore, the results must be interpreted with caution. Secondly, only Dutch persons with SCI in the age range 18–75 years admitted to a rehabilitation centre were included. This influenced the representativeness of the population and thereby the degree to which the results can be generalized to the entire population of persons with SCI. A third limitation is that the difference in variability between psychological factors might be influenced by differences in random error or in sensitivity to change of the questionnaires instead of reflecting "real" change or stability, respectively. However, we used established measures and the associations between change in psychological factors and change in mental health suggests this change was not due to random error. A fourth limitation is that illness cognitions and purpose in life were measured only at T2 and

T3. Therefore, it was not possible to examine change scores between T1 and T2 for these variables.

A fifth limitation is that all questionnaires were administered as part of an oral interview. This might have led to socially desirable answers. Moreover, the questionnaires used in this study were administered as part of a larger interview on quality of life valuation (50) and other questions might have had influence on the responses. A sixth limitation is that persons with tetraplegia had a longer rehabilitation period than persons with paraplegia. However, the advantage of multilevel regression analyses is that the temporal spacing of observations can vary between persons. Moreover, level of injury was entered in the analyses as a confounder. A seventh limitation refers to the calculation of the PIL. Schulenberg et al. (51) suggest that a 2 factor-model of the PIL may be better than the 1-factor model. However, since the studies carried out with the PIL so far in persons with SCI (28, 29) have used the original 1-factor model of the PIL we chose to focus on this 1-factor model.

Conclusion

Some psychological factors seem to be more variable and thereby susceptible to change than others, which may make them more suitable as targets for interventions to enhance the mental health of persons with SCI. Purpose in life, acceptance, self-efficacy, and mastery seem to be the most promising psychological factors to stimulate with the aim of increasing mental health in persons with SCI. These results need to be confirmed with larger sample sizes and multivariate analyses. Different RCTs are recommended to test interventions on logotherapy, acceptance and commitment therapy, and on sources of personal competence for their effect on mental health in persons with SCI.

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