ORIGINAL RESEARCH

Prediction of Psychological Distress Among Persons With Spinal Cord Injury or Acquired Brain Injury and Their Significant Others

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Abstract

Objectives: To identify intra- and interpersonal sociodemographic, injury-related, and psychological variables measured at admission of inpatient rehabilitation that predict psychological distress among dyads of individuals with spinal cord injury (SCI) or acquired brain injury (ABI) and their significant others (ie, individuals close to the individual with a disability, mostly family members) 6 months after discharge. Differences in predictors were investigated for persons with SCI or ABI and their significant others and were compared between diagnoses.

Design: Prospective longitudinal study.

Setting: Twelve Dutch rehabilitation centers.

Participants: Dyads (N=157) consisting of adults with SCI or ABI who were admitted to inpatient rehabilitation and their adult significant others.

Interventions: Not applicable.

Main Outcome Measures: Psychological distress (Hospital Anxiety and Depression Scale).

Results: Sociodemographic and injury-related variables were not or were only weakly associated with psychological distress among individuals with SCI or ABI and their significant others 6 months after discharge. Bivariately, higher baseline psychological distress, lower scores on adaptive psychological characteristics (combination of self-efficacy, proactive coping, purpose in life, resilience), and higher scores on maladaptive psychological characteristics (combination of passive coping, neuroticism, appraisals of threat and loss) were related to higher psychological distress, as well as crosswise between individuals with SCI or ABI and their significant others, although less strongly. Combined prediction models showed that psychological distress among persons with SCI or ABI was predicted by education level of their significant other, their own baseline psychological distress, and their own maladaptive psychological characteristics (explained variance, 41.9%). Among significant others, only their own baseline psychological distress predicted psychological distress (explained variance, 40.4%). Results were comparable across diagnoses.

Conclusions: Although a dyadic connection was shown, primarily one's own baseline psychological distress and psychological characteristics were important in the prediction of later psychological distress among both individuals with SCI or ABI and their significant others. Screening based on these variables could help to identify persons at risk for psychological distress.

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Chronic conditions such as spinal cord injury (SCI) or acquired brain injury (ABI) are important causes of chronic injury. In 2016, there were 0.9 million new cases of SCI worldwide and 43.6 million cases of ABI (ie, traumatic brain injury, stroke, meningitis).[1,2] In the Netherlands, nearly two-thirds of all adult patients in inpatient rehabilitation have SCI (11.0%) or ABI (53.2%).[3]

Having SCI or ABI may have consequences on the well-being of the individuals involved and their significant others (ie, persons close to the individual with a disability, mostly family members). Compared with the general population, persons with SCI (pwSCI) or persons with ABI (pwABI) and their significant others more often experience psychological distress,[4-7] defined as "a state of emotional suffering characterized by symptoms of depression or anxiety."[8(p107)] It is important to pay attention to psychological distress not only among pwSCI and pwABI, but also among their significant others, even more so because they play an important role in supporting the pwSCI or pwABI.[9-11] To be able to support the pwSCI, pwABI, and their significant others properly, it is important to identify those individuals with a higher risk of psychological distress.

The literature has shown that injury-related (eg, pain severity, physical impairment, and motor function) and sociodemographic variables (eg, age, sex, educational level) are poor and inconsistent predictors of psychological distress among pwSCI, pwABI, and their significant others.[10-14] Early postinjury symptoms of anxiety and depression were found to be important predictors of later psychological distress.[10,12,13,15] Furthermore, psychological factors including neuroticism, appraisals, coping, optimism, resilience, and self-efficacy were found to be related to psychological distress among pwSCI, pwABI, and their significant others in previous studies.[10-14,16-19]

Most research on psychological distress after the onset of SCI or ABI focuses on either pwSCI or pwABI or their significant others. However, it is also important to focus on the interdependence of individuals within a dyad.[20] For example, previous research has shown that anxiety and depression of pwABI were related to later anxiety and depression among caregivers.[10,21] A dyadic relation was also found between stroke survivors' self-esteem and partner depression.[22] These findings underline the importance of investigating distress among pwSCI or pwABI and their significant others in relation to each other. Furthermore, more insight is needed regarding the variables that are most important in the prediction of psychological distress. SCI and ABI are both conditions characterized by a sudden onset, but with diverging commonly reported consequences. For example, pain is an often reported consequence among pwSCI, and pwABI often experience problems regarding cognitive functioning. Therefore, it is also important to investigate diagnosis-based differences in predictors of psychological distress.

The present study aimed to identify intra- and interpersonal sociodemographic, injury-related, and psychological factors measured at admission of inpatient rehabiltation that predict psychological distress among dyads of pwSCI or pwABI and their significant others 6 months after discharge. The hypotheses were as follows: (1) psychological variables relate more strongly to psychological distress among pwSCI or pwABI and their significant others than sociodemographic and injury-related variables, and (2) intra- and interpersonal psychological variables are both significant predictors of psychological distress.

As an explorative investigation, differences in predictors between diagnoses (ie, SCI, ABI) were studied. Insight in predictors and differences between diagnoses can contribute to the early identification of individuals who are vulnerable for psychological distress after discharge from inpatient rehabilitation and, therefore, provides knowledge to help optimize rehabilitation care.

Methods

Design

The current analyses are part of the POWER study.[23] The overall aim of the cohort part of this study was to identify predictors of empowerment and adjustment among dyads of pwSCI or pwABI and their significant others. The study was conducted in 12 Dutch rehabilitation centers. Dyads were included between April 2016 and July 2018. The Medical Ethics Committee of the University Medical Center Utrecht declared that this study did not require approval according to the Dutch Law on Medical Research (protocol 15-617/C). Boards of all participating rehabilitation centers provided approval to perform the study.

Participants

PwSCI and pwABI were eligible to participate if they met the inclusion criteria: first inpatient rehabilitation after the onset of injury (no inpatient readmission), expected inpatient stay of 4 weeks or longer, age of 18 years or older, and ability to name a significant other (partner, other family member, or close friend). Exclusion criteria were expectation of a full or nearly full recovery, discharge to a long-term care facility, or limited life expectation based on clinical judgment by rehabilitation physicians, or when they were not able to respond to questionnaires because of severe cognitive disabilities, as assessed by nurses based on their clinical view and the Dutch aphasia scale.[24] Significant others had to be at least 18 years of age. All participants signed informed consent. Data of dyads in which both individuals completed the baseline and follow-up assessments were used in the current study.

Procedure

Soon after admission, dyads were informed about the study and a few days later their willingness to participate was investigated. Participants completed self-report questionnaires (print or online, according to personal preference). The baseline assessment was completed on average 2 weeks after inpatient admission. Baseline injury-related information was obtained from the medical file. The follow-up assessment was conducted 6 months after discharge (print or online).

List of abbreviations:

ABI	acquired brain injury
A-PC	adaptive psychological characteristics scale
HADS	Hospital Anxiety and Depression Scale
MANCOVA	multivariate analysis of covariance
M-PC	maladaptive psychological characteristics scale
pwABI	persons with ABI
pwSCI	persons with SCI
SCI	spinal cord injury
USER	Utrecht Scale for Evaluation of Rehabilitation

Measures

At both baseline and follow-up, psychological distress was measured with the Hospital Anxiety and Depression Scale (HADS),[25] which is an effective measure of general psychological distress.[26,27] Fourteen questions answered on a 4-point scale assess symptoms of anxiety and depression. A total HADS sum score was computed in which higher scores reflected greater psychological distress (range, 0-42). The HADS has been used in various populations and has shown good clinimetric properties.[28]

Baseline sociodemographic variables included sex (male, 0; female, 1), age (y), and education (low, 0 [ie, <bachelor degree]; high, 1 [ie, ≥bachelor degree), and type of relationship with the pwSCI or pwABI (ie, partner, parent, child, other family, friend, or other).

Baseline injury-related variables included diagnosis (SCI, 0; ABI, 1), level of SCI (paraplegia, 0; tetraplegia, 1), completeness of SCI (A-D, 0-3),[29] and location of ABI. Physical independence was measured with the sum score of the mobility and self-care scales of the Utrecht Scale for Evaluation of Clinical Rehabilitation (USER).[30] Higher scores indicated greater physical independence (range, 0-70). Causes of SCI and ABI were categorized as traumatic (0) or non-traumatic (1).

The psychological measures assessed at baseline are shown in table 1.[31-43] All measures were found to be valid and reliable,[28,32,37,42-45] and the internal consistency figures of all measures were satisfactory (Cronbach's alpha, ≥0.7) in the current study.[46]

Statistical analysis

Data were analyzed with IBM SPSS Statistics 25.[a] A significance level of P less than .05 (2-tailed) was used. To reduce the number of psychological variables, we clustered these in 2 scales based on exploratory factor analysis (principal components extraction, oblim rotation) using data of all participants who had completed the baseline assessment (n=223), similar to the method used in a previous study.[47] The adaptive psychological characteristics scale (A-PC) included self-efficacy, proactive coping, purpose in life, and resilience (pwSCI/pwABI: Eigenvalue, 3.58; 51.14% explained variance; factor loadings, .64-.87; significant others: Eigenvalue, 3.66; 52.26% explained variance; factor loadings; .59-.85). The maladaptive psychological characteristics scale (M-PC) included passive coping,

neuroticism, and appraisals of threat and loss (pwSCI/pwABI: Eigenvalue, .95; 13.55% explained variance; factor loadings, .72-.90; significant others: Eigenvalue, .94; 13.48% explained variance; factor loadings, .72-.96). Both psychological variables were calculated as the mean of the scores of the underlying scales, which were first standardized into z scores to obtain a common metric. A maximum of 1 missing score on an underlying scale was allowed.

The HADS scores were positively skewed and were transformed (square root). Descriptive statistics report raw data, and statistical analyses were carried out on transformed data.

Missing sociodemographic data (total, 8 data points) were imputed with the score of the other person in the dyad. Other missing baseline scores (6 USER, 1 HADS, and 1 A-PC and M-PC) were imputed with the mean score within the corresponding scale, adjusted for diagnosis. Missing follow-up HADS-scores were not imputed.

Independent samples t tests and Pearson chi-square tests were conducted to investigate sociodemographic, injury-related, psychological differences between dropped-out and analyzed dyads, as well as between SCI and ABI.

To investigate our first hypothesis, we calculated Pearson correlations between potential predictors and follow-up psychological distress among pwSCI or pwABI and their significant others. Multivariate analyses of covariance (MANCOVA) were used to investigate our second hypothesis. MANCOVA takes into account nonindependence between individuals within a dyad with the possibility to analyze 2 interdependent outcome variables simultaneously, in our case psychological distress of pwSCI or pwABI and their significant others.[20] The results provided insight into the independent predictors of psychological distress at dyad level (multivariate effects) and at the level of pwSCI or pwABI and their significant others separately (between-subjects effects). Only variables that were bivariately significantly related with at least 1 dependent variable (follow-up HADS of the pwSCI, pwABI, or significant other) were added in the MANCOVA. In the first model, only sociodemographic and injury-related variables were entered as predictors. In model 2a through 2c, respectively, early post-injury psychological distress, A-PC, and M-PC were additionally entered. The final model (model 3) contained all variables together in a single model. All analyses were repeated for SCI and ABI separately to explore diagnosis-based differences.

Table 1 Psychological variables and the measures used

Independent Variable	Measure	No. of Items	Range Score	Higher Score Indicates
Self-efficacy	ALCOS-12[31,32,*]	12	12-60	Higher self-efficacy
Proactive coping competencies	Shortened Utrecht Proactive Coping Competence scale[34]	7	1-4	Better proactive coping competency
Purpose in life	Purpose in Life Scale-Short Form[35,36]	4	4-28	Higher purpose in life
Resilience	Connor-Davidson Resilience Scale[37,38]	10	0-40	Higher resilience capacity
Passive coping	Passive reaction pattern subscale of the Utrecht Coping List[39,40]	7	7-28	Greater tendency to adopt a passive coping style
Neuroticism	Neuroticism subscale of the Eysenck Personality Questionnaire-Revised Short Form[41,42]	12	0-12	Higher levels of neuroticism
Appraisals	Threat and loss subscales of the Appraisals of Life Events scale[43,†]	10	0-5	More appraisals of threat and loss

* The ALCOS-12 is the Dutch version of the General Self Efficacy originally developed by Sherer.[33]

† The threat subscale contains 6 items, and the loss subscale contains 4 items. Subscale scores were computed as the mean of the respective item scores. A total score was computed as the mean of the 2 subscale scores so that both subscales contributed equally to the total score.
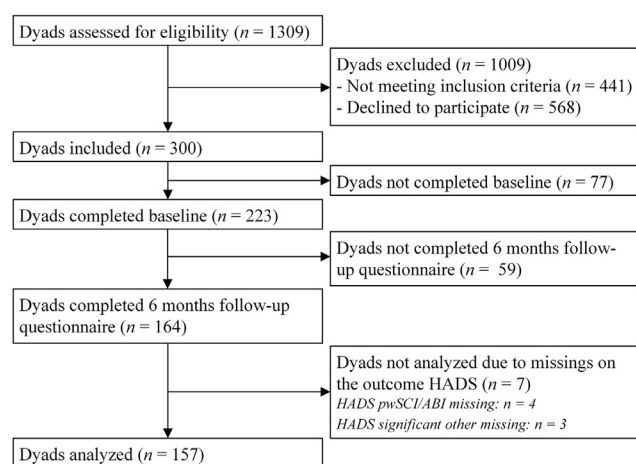
Fig 1 Flowchart showing the inclusion of dyads of pwSCI or pwABI and their significant others.

Results

Background: participants and main outcomes

Data of 157 dyads were analyzed (fig 1). The main reasons for excluding dyads were expected stay in inpatient rehabilitation less than 4 weeks (26.0%), limited life expectancy (16.3%), no significant other (15.2%), or severe cognitive disabilities (13.3%). The main reasons for declined participation were "no interest" (45.2%) or "too burdensome" (34.0%). Table 2 shows sociodemographic and injury-related information of the analyzed dyads. The cause of SCI was traumatic in half the cases (fall, 21.5%; sport/leisure accident, 15.2%; traffic accident, 12.7%; occupational accident, 1.3%). Non-traumatic causes included spinal degeneration (11.4%), tumor (11.4%), inflammation (10.1%), medical complication (8.9%), and vascular diseases (7.6%). Causes of ABI were mostly nontraumatic (infarction, 48.7%; hemorrhage, 26.9%; or "other" such as meningitis, 11.5%). Table 2 shows the differences between sociodemographic and injury-related variables between the analyzed dyads and those who dropped out during follow-up. Score distributions of the psychological variables are shown in table 3. No differences were found regarding psychological variables between the analyzed dyads and those that dropped out.

Hypothesis 1: correlations

Of all sociodemographic and injury-related variables, only higher education level of the significant other was related to lower psychological distress among pwSCI or pwABI. A diagnosis of ABI was related to lower psychological distress among the significant others (table 4). With respect to psychological factors, higher early postinjury psychological distress, higher M-PC, and lower A-PC were related to higher psychological distress at follow-up, both intrapersonal and crosswise, although less strongly, between pwSCI or pwABI and their significant others.

Hypothesis 2: prediction at dyad level (multivariate effect)

The first MANCOVA model (table 5) included only educational level (significant other) and diagnosis. Both variables were

significant predictors of psychological distress at the dyad level. Model 2a through 2c showed that early post-injury psychological distress (of pwSCI/pwABI and significant others), A-PC (of both), and M-PC (of both) were significant predictors of psychological distress at the dyad level, adjusted for significant others' education level and diagnosis. The final model, which contained all variables together, showed that only diagnosis, early postinjury psychological distress (of both), and M-PC (of the pwSCI or pwABI) remained significant predictors of psychological distress at the dyad level.

Hypothesis 2: predictors for pwSCI/ABI (between-subjects effects)

Adjusted for educational level of the significant other and diagnosis, early postinjury psychological distress, A-PC, and M-PC among pwSCI and pwABI were significant predictors of psychological distress among pwSCI and pwABI when tested in separated models (see table 5, model 2a-c). The final model showed that, when adjusted for other variables, educational level of the significant other, early postinjury psychological distress (pwSCI/pwABI), and M-PC (pwSCI/pwABI) were significant predictors of psychological distress at follow-up (explained variance, 41.9%).

Hypothesis 2: predictors for significant others (between-subjects effects)

Adjusted for significant others' educational level and diagnosis, significant others' scores on early postinjury psychological distress, A-PC, and M-PC were significant predictors of follow-up psychological distress when tested in separated models (see table 5, model 2a-c). The final model showed that, when adjusted for other variables, early postinjury psychological distress of the significant others themselves was the only significant predictor of psychological distress at follow-up (explained variance, 40.4%).

Exploratory: SCI vs ABI

Differences between SCI and ABI were found in the level of physical independence (SCI was lower), cause of injury (SCI was more often traumatic), and sex of the significant other (SCI was more often female) (see table 2). Significant others of pwSCI reported higher baseline and follow-up psychological distress than significant others of pwABI (see table 3). PwSCI and their significant others reported higher levels of appraisals of threat and loss (resulting in higher M-PC scores) than individuals in the ABI subgroup.

Correlation and MANCOVA analyses were repeated for SCI and ABI separately (supplemental tables S1-S3, available online only at http://www.archices-pmr.org/). In the final MANCOVA model for SCI, early postinjury psychological distress of the pwSCI and that of the significant other were found to be significant predictors of psychological distress at the dyad level. Among pwSCI, only the individual's own early postinjury psychological distress and M-PC were found to be significant predictors. Among significant others, their own early postinjury psychological distress was found to be the only significant predictor.

In ABI, the final MANCOVA model showed that early postinjury psychological distress of the significant other was the only predictor of psychological distress at the dyad level. Among

Table 2 Sociodemographic and injury-related characteristics of pwSCI or pwABI and their significant others

Variable	n	Total (N=157) n (%) or Mean ± SD, Range	Dropped Out (n=66) n (%) or Mean ± SD, Range	SCI (n=79) n (%) or Mean ± SD, Range	ABI (n=78) n (%) or Mean ± SD, Range
pwSCI/pwABI					
Sex (female)	157	67 (42.7)	18 (27.3)	28 (35.4)	39 (50.0)
Age, y	157	56.3±14.9, 18-87	57.8±14.4, 22-84	55.3±16.3, 18-81	57.3±13.3, 26-87
Education (high)*	154	58 (37.7)	15 (23.4)	25 (32.9)	33 (42.3)
Physical independence (USER, 0-70)†	151	36.4±19.0, 1-70	29.3±15.8, 1-70‡	28.8±17.9, 1-70§	44.4±16.9, 5-70§
Cause of injury (non-traumatic)	–	–	–	39 (49.4)§	68 (87.2)§
AIS‖ (SCI only)					
A	–	–	–	10 (12.7)	–
B	–	–	–	12 (15.2)	–
C	–	–	–	17 (21.5)	–
D	–	–	–	40 (50.6)	–
Tetraplegia (SCI only)	–	–	–	44 (55.7)	–
Location (ABI only)					
Left	–	–	–	–	31 (39.7)
Right	–	–	–	–	27 (34.6)
Both sides	–	–	–	–	13 (16.7)
Brainstem	–	–	–	–	3 (3.9)
Unknown	–	–	–	–	4 (5.2)
Weeks between admission and completing baseline assessment	157	2.0 (2.0)§	2.0 (2.0)¶	2.0 (2.0)¶	2.0 (2.0)¶
Significant others					
Sex (female)	157	97 (61.8)	52 (78.8)	55 (69.6)§	42 (53.8)§
Age, y	155	55.5±12.4, 23-82	51.0±13.1, 25-79‡	56.6±12.9, 25-82	54.4±11.9, 23-75
Education (high)*	155	64 (41.3)	19 (30.6)	31 (39.7)	33 (42.9)
Relationship with pwSCI/pwABI					
Partner	157	123 (78.3)	40 (62.5)‡	60 (75.9)	63 (80.8)
Parent		14 (8.9)	5 (7.8)	9 (11.4)	5 (6.4)
Child		11 (7.0)	16 (25.0)	5 (6.3)	6 (7.7)
Other family		5 (3.2)	2 (3.1)	2 (2.5)	3 (3.8)
Friend		3 (1.9)	–	2 (2.5)	1 (1.3)
Other		1 (0.6)	1 (1.6)	1 (1.3)	–

Abbreviation: AIS, American Spinal Injury Association Impairment Scale.

* High education indicates a bachelor degree or higher.

† Physical independence was measured with the Utrecht Scale for Evaluation of Clinical Rehabilitation. Higher scores indicated greater physical independence (range, 0-70).

‡ Independent samples t tests or Pearson χ^2 test showed a significant difference between analyzed and dropped out dyads.

§ Independent samples t tests or Pearson χ^2 test showed a significant difference between SCI and ABI.

‖ American Spinal Injury Association Impairment Scale. A, complete SCI; B, sensory incomplete; C, motor incomplete with less than half of key muscle functions below the single neurological level of injury having a muscle grade ≥3; D, motor incomplete with at least half of key muscle functions below the single neurological level of injury having a muscle grade ≥3.[29]

¶ Median and interquartile range is given rather than mean and SD.

pwABI, none of the variables was a significant predictor of psychological distress when adjusted for other variables. Among significant others, their own early postinjury psychological distress was found to be the only significant predictor.

Discussion

By using a dyadic approach and comparing 2 diagnostic groups, this study extended upon earlier research aimed to identify sociodemographic, injury-related, and psychological predictors of later psychological distress among pwSCI or pwABI and significant others.

The hypothesis that psychological variables related more strongly to psychological distress among pwSCI or pwABI and significant others than sociodemographic and injury-related variables was supported and in line with previous research findings.[10-14,16-19] It was additionally hypothesized that intra- and interpersonal psychological variables were both important in the prediction of psychological distress. As an indication of interdependence between pwSCI or pwABI and significant others,[20] correlations were found between psychological variables of 1 person in a dyad and outcome psychological distress of the other person. At the dyad level, psychological variables of both individuals within a dyad did indeed add in the prediction of psychological distress. On the other hand, the crosswise correlations

Table 3 Psychological scores of pwSCI or pwABI and their significant others

Variable	N	Total (N=157) Mean ± SD	Dropped Out (n=66)* Mean ± SD	SCI (n=79) Mean ± SD	ABI (n=78) Mean ± SD
pwSCI/pwABI					
Psychological distress (HADS, 0-42)					
Baseline[†]	156	12.0 (6.0-17.0)[‡]	12.0 (7.0-19.0)[‡]	13.0 (6.0-17.0)[‡]	12.0 (6.7-17.0)[‡]
Follow-up[§]	157	11.0 (5.0-16.0)[‡]	NA	11.0 (5.0-12.0)[‡]	11.0 (5.8-16.0)[‡]
Adaptive psychological characteristics[§]					
Total	157	-0.0±0.8	-0.02±0.8	0.0±0.8	-0.0±0.7
Self-efficacy (blinded for peer review, 12-60)	155	48.1±8.1	48.9±8.0	49.1±7.9	47.1±8.3
Proactive coping (UPCC-SF, 1-4)	157	2.9±0.5	2.9±0.5	2.9±0.5	3.0±0.4
Purpose in life (PIL-SF, 4-28)	156	22.8±3.8	22.9±3.5	23.0±3.9	22.5±3.7
Resilience (CD-RISC-10, 0-40)	157	27.7±6.9	27.2±6.8	27.6±7.0	27.8±6.8
Maladaptive psychological characteristics[§]					
Total	157	-0.0±0.8	0.1±0.9	0.1±0.9[‖]	-0.1±0.8[‖]
Passive coping (UCL, 7-28)	156	10.5±2.9	10.9±3.3	10.8±3.1	10.1±2.7
Neuroticism (EPQ-RSS-N, 0-12)	155	3.1±3.1	3.1±3.4	3.3±3.2	2.9±3.0
Appraisals of threat and loss (ALE, 0-5)	157	1.8±1.2	2.0±1.4	2.0±1.3[‖]	1.5±1.1[‖]
Significant others					
Psychological distress (HADS, 0-42)					
Baseline[†]	157	12.0 (7.0-18.0)[‡]	12.0 (8.0-19.0)[‡]	13.0 (8.0-21.0)[‡,‖]	10.7 (6.0-17.0)[‡,‖]
Follow-up[†]	157	9.0 (4.0-15.0)[‡]	NA	11.0 (5.0-16.0)[‡,‖]	8.0 (3.0-12.0)[‡,‖]
Adaptive psychological characteristics[§]					
Total	156	-0.0±0.8	0.1±0.8	-0.1±0.7	0.1±0.8
Self-efficacy (blinded for peer review, 12-60)	156	49.7±6.9	48.8±8.0	48.8±6.7	50.5±7.1
Proactive coping (UPCC-SF, 1-4)	156	3.0±0.4	3.1±0.4	3.0±0.4	3.0±0.4
Purpose in life (PIL-SF, 4-28)	154	22.7±3.6	23.0±3.8	22.4±3.4	23.0±3.7
Resilience (CD-RISC-10, 0-40)	155	28.2±6.1	28.2±6.0	27.4±6.2	29.1±5.8
Maladaptive psychological characteristics[§]					
Total	156	0.0±0.8	0.1±1.0	0.2±0.9[‖]	-0.2±0.7[‖]
Passive coping (UCL, 7-28)	156	10.4±2.7	10.6±3.0	10.7±2.9	10.0±2.4
Neuroticism (EPQ-RSS-N, 0-12)	153	2.8±2.6	3.6±3.4	3.0±2.7	2.7±2.5
Appraisals of threat and loss (ALE, 0-5)	155	1.3±1.1	1.4±2.3	1.6±1.1[‖]	0.9±0.9[‖]

Abbreviations: ALE, Appraisals of Life Events scale; CD-RISC, Connor-Davidson Resilience; EPQ-RSS-N, Neuroticism subscale of the Eysenck Personality Questionnaire-Revised Short Form; NA, not applicable; PIL-SF, Purpose in Life Scale-Short Form; UCL, Utrecht Coping List; UPCC-SF, Shortened Utrecht Proactive Coping Competence scale.

* Independent samples t tests showed no significant difference between analyzed and dropped out dyads for any of the variables.
[†] Assessed at the start of inpatient rehabilitation (baseline).
[‡] Median and interquartile range are presented rather than mean and SD.
[§] Assessed at 6 months after inpatient discharge (6mo follow-up).
[‖] Independent samples t tests or Pearson χ^2 test showed a significant difference between SCI and ABI.

were relatively weak ($r<.3$) and in combination with the individual's own psychological variables, they were not of added value in the prediction of psychological distress at individual level, which contradicts our hypothesis. This could possibly be explained by the strong correlation between one's own baseline and follow-up psychological distress in combination with a relatively small change in psychological distress scores over time, which might limit the impact of other variables in the explanation.

Separately, early postinjury psychological distress, A-PC, and M-PC were all significant predictors of psychological distress, both at the dyad and individual levels. However, altogether, early postinjury psychological distress and M-PC were the most important predictors of psychological distress among pwSCI and pwABI, and early post-injury psychological distress was the most important among significant others. Possibly, the concept of "maladaptive psychological characteristics" measured with the

M-PC is more similar to the HADS (measuring anxiety and depression) than the concept measured with the A-PC, which may explain why A-PC was found to be a less important predictor of psychological distress. This idea is supported by the relatively strong correlation between the baseline HADS and M-PC (pwSCI/pwABI: $r=.76$; significant others: $r=.80$).

Exploratory differences between the diagnostic groups were investigated. We did find some diagnosis-based differences in levels of variables and correlations, but not in the predictors of psychological distress. In both diagnosis subgroups, the individual's own early postinjury psychological distress and M-PC appeared to be the most important predictors. Results were less consistent in the ABI subgroup owing to an absence of significant predictors to predict psychological distress among pwABI. However, F values found among pwABI were comparable to those found among pwSCI and P values were close to .05. Future

Table 4 Bivariate correlation coefficients between independent variables and psychological distress of the pwSCI or pwABI and significant others 6 months after discharge from inpatient rehabilitation (N=157)

Variable	Psychological Distress pwSCI/pwABI* Correlation Coefficient (P Value)	Psychological Distress Significant Others* Correlation Coefficient (P Value)
Sex (female)		
pwSCI/pwABI	.10 (.20)	-.08 (.33)
Significant others	-.04 (.61)	.05 (.56)
Age		
pwSCI/pwABI	-.06 (.46)	.07 (.41)
Significant others	.02 (.83)	.10 (.24)
Education (high)		
pwSCI/pwABI	-.13 (.12)	.03 (.72)
Significant others	-.24 (<.01)[†]	-.07 (.40)
Significant other is partner	.02 (.85)	.04 (.60)
Diagnosis (ABI)	.01 (.94)	-.22 (<.01)[†]
Physical independence	.02 (.78)	-.12 (.14)
Psychological distress[‡]		
pwSCI/pwABI	.57 (<.001)[§]	.12 (.12)
Significant others	.21 (<.01)[†]	.61 (<.001)[§]
Adaptive psychological characteristics[‡]		
pwSCI/pwABI	-.46 (<.001)[§]	-.19 (.02)[‖]
Significant others	-.25 (.001)[†]	-.37 (<.001)[§]
Maladaptive psychological characteristics[‡]		
pwSCI/pwABI	.57 (<.001)[§]	.21 (<.01)[†]
Significant others	.17 (.03)[‖]	.49 (<.001)[§]

* Assessed at 6 months after inpatient discharge (6mo follow-up).
† $P<.01$.
‡ Assessed at the start of inpatient rehabilitation (baseline).
§ $P<.001$.
‖ $P<.05$.

research should be conducted to explore whether the differences reflect diagnosis-based differences in the prediction of psychological distress, or if the differences could be explained by the limited power in our sample.

Study limitations

First, to increase the power, we combined different psychological scales, with the result that no statements can be made about the predictive value of individual psychological variables. Exploratory factor analysis and a comparable application in previous research supported our decision to cluster the scales.[47] Second, a relatively large number of the dyads did not meet the inclusion criteria or declined to participate, which may have resulted in selection or nonresponse bias. Unfortunately, we have no information on the excluded and declined dyads. However, regarding age, sex, and injury-specific information (completeness of SCI, level of SCI, physical independence pwABI), our sample appears to be highly comparable to the general Dutch SCI and stroke population in an inpatient setting.[48,49] Third, selective loss to follow-up may have influenced the results. However, this seems to be unlikely as scores on the significant predictors of psychological distress did not differ between the analyzed and dropped out dyads. Fourth, half of the pwSCI had an AIS D score. They have a better prognosis than pwSCI with a score of A through C, possibly resulting in lower psychological distress levels at baseline and follow-up. However, because we found that injury-related factors did not

add to the prediction of psychological distress, we do not expect major differences in the results when a smaller proportion of the pwSCI would have had an AIS score of D. Fifth, different kinds of significant others participated in the study. Most significant others (78.3%) were partners and, therefore, the results apply mainly to situations in which the significant other is the partner. Lastly, previous research has shown that a history of preinjury psychological problems is an important predictor of postinjury psychological distress.[11-14] We have not assessed preinjury psychological problems. Alternatively, we included the HADS at baseline, which was considered an indicator for vulnerability at admission.

Implications

Our results highlight the importance of one's own early postinjury psychological distress and adaptive and maladaptive psychological characteristics in the prediction of later psychological distress. A screening based on these variables conducted at the start of inpatient rehabilitation could help to identify individuals more at risk for psychological distress earlier. Screening only the pwSCI or pwABI does not appear to be sufficient to accurately predict psychological distress among both individuals within the dyad. It is also important to obtain insight into distress among significant others because significant others play an important, and often necessary, role in providing practical and emotional support to pwSCI and pwABI.[50,51] If significant others become overloaded, this has adverse consequences for themselves, but also for the

Table 5 MANCOVA to predict psychological distress 6 months after discharge from inpatient rehabilitation (N=157)

Independent Variables	Model 1: Basic Model*			Model 2a: Psychological Distress[†]			Model 2b: Adaptive Psychological Characteristics[†]		
	Multivariate	Between-Subjects Effects		Multivariate	Between-Subjects Effects		Multivariate	Between-Subjects Effects	
		Distress pwSCI/pwABI	Distress SO		Distress pwSCI/pwABI	Distress SO		Distress pwSCI/pwABI	Distress SO
	$V^{‡}$ (P Value)	F (P Value)	F (P Value)	$V^{‡}$ (P Value)	F (P Value)	F (P Value)	$V^{‡}$ (P Value)	F (P Value)	F (P Value)
Education (high)									
pwSCI/pwABI	—	—	—	—	—	—	—	—	—
SO	.06 (<.01)[§]	9.78 (<.01)[§]	.54 (.47)	.03 (.08)	4.90 (.03)[‖]	.14 (.71)	.04 (.04)[‖]	6.33 (.01)[‖]	.00 (.99)
Diagnosis (ABI)	.06 (.01)[‖]	.05 (.83)	7.63 (<.01)[§]	.04 (.05)[‖]	.74 (.39)	3.68 (.06)	.04 (.04)[‖]	.02 (.89)	5.89 (.02)[‖]
Psychological distress[†]									
pwSCI/pwABI	—	—	—	.32 (<.001)[¶]	61.95 (<.001)[¶]	.00 (.96)	—	—	—
SO	—	—	—	.35 (<.001)[¶]	2.96 (.09)	80.73 (<.001)[¶]	—	—	—
Adaptive psychological characteristics[†]									
pwSCI/pwABI	—	—	—	—	—	—	.16 (<.001)[¶]	29.72 (<.001)[¶]	1.54 (.22)
SO	—	—	—	—	—	—	.10 (<.001)[¶]	1.73 (.19)	16.24 (<.001)[¶]
Maladaptive psychological characteristics[†]									
pwSCI/pwABI	—	—	—	—	—	—	—	—	—
SO	—	—	—	—	—	—	—	—	—
Explained variance (%)	NA	6.0	5.2	NA	36.0	38.6	NA	25.5	17.7

Independent Variables	Model 2c: Maladaptive Psychological Characteristics[†]			Model 3: Final Model		
	Multivariate	Between-Subjects Effects		Multivariate	Between-Subjects Effects	
		Distress pwSCI/pwABI	Distress SO		Distress pwSCI/pwABI	Distress SO
	$V^{‡}$ (P Value)	F (P Value)	F (P Value)	$V^{‡}$ (P Value)	F (P Value)	F (P Value)
Education (high)						
pwSCI/pwABI	—	—	—	—	—	—
SO	.05 (.02)[‖]	8.21 (<.01)[§]	.41 (.52)	.04 (.07)	5.23 (.02)[‖]	.05 (.82)
Diagnosis (ABI)	.05 (.03)[‖]	3.23 (.07)	2.09 (.15)	.05 (.03)[‖]	1.75 (.19)	3.27 (.07)
Psychological distress[†]						
pwSCI/pwABI	—	—	—	.07 (<.01)[§]	6.07 (.02)[‖]	1.43 (.23)
SO	—	—	—	.18 (<.001)[¶]	.29 (.59)	31.46 (<.001)[¶]
Adaptive psychological characteristics[†]						
pwSCI/pwABI	—	—	—	.01 (.45)	.84 (.36)	1.27 (.26)
SO	—	—	—	.01 (.55)	.31 (.58)	1.15 (.29)
Maladaptive psychological characteristics[†]						
pwSCI/pwABI	.32 (<.001)[¶]	70.20 (<.001)[¶]	1.65 (.20)	.07 (<.01)[§]	10.90 (<.01)[§]	.41 (.52)
SO	.20 (<.001)[¶]	1.09 (.30)	36.53 (<.001)[¶]	.00 (1.00)	.00 (1.00)	.00 (.98)
Explained variance (%)	NA	37.8	26.0	NA	41.9	40.4

Abbreviations: NA, not applicable; SO, significant other.

* Only bivariately significant variables (P<.05) were added in the MANCOVA models.

[†] Assessed at the start of inpatient rehabilitation (baseline).

[‡] Pillai's trace value.

[§] P<.01.

[‖] P<.05.

[¶] P<.001.

E.W.M. Scholten et al

pwSCI or pwABI, possibly even resulting in institutionalization.[52,53] Therefore, we recommend screening both pwSCI or pwABI and their significant others.

Risk screening also helps to personalize the support provided to pwSCI, pwABI, and their significant others, thereby making the most efficient use of available resources.[54] Previous research has shown that tailored interventions provide more positive outcomes than the application of standard interventions.[55] Interventions that apply psychological techniques (eg, cognitive behavioral therapy, coping skill-training, problem-solving therapy) appear to be most effective in the reduction of psychological distress.[55]

Finally, identifying pwSCI or pwABI and significant others at greater risk for psychological distress earlier and providing them with appropriate support could be crucial in reducing healthcare system burden and costs.[56-58]

Conclusions

There is a dyadic connection between early postinjury psychological distress, psychological variables, and follow-up psychological distress among pwSCI or pwABI and their significant others. However, primarily one's own early postinjury psychological distress and psychological variables were important in the prediction of follow-up psychological distress. The results were comparable for SCI and ABI. A psychological screening of patients and significant others could help with early identification of individuals more at risk for later psychological distress.

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Supplier

a. SPSS; IBM Corp.

Keywords

Brain injuries; Caregivers; Mental health; Rehabilitation; Spinal cord injuries

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