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ARTICLE

Associations between personality traits and depressive and anxiety symptoms among persons with spinal cord injury in first inpatient rehabilitation

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STUDY DESIGN: Retrospective analysis of medical records.
OBJECTIVE: To assess personality traits in persons with spinal cord injury (SCI) and compare these with the general population group. Moreover, to explore associations between personality traits and depressive and anxiety symptoms among persons with SCI in first inpatient rehabilitation.
SETTING: Specialized rehabilitation center in The Netherlands.
METHODS: Data were used from a routine psychological screening, administered in the first weeks of admission ($N = 67$). Measures included the Hospital Anxiety and Depression Scale and the Dutch Personality Questionnaire, which includes subscales measuring neuroticism, social inadequacy, rigidity, hostility, egoism, dominance, and self-esteem. Correlational and regression analyses were conducted.
RESULTS: Mean age of the participants was 58 (SD 17) years. The majority (63%) were male, and had a low lesion (57%). The participants scored significantly higher on dominance and lower on social inadequacy, hostility, and egoism in comparison with the general population. In the bivariate regression analyses, high neuroticism ($\beta = 0.42$ and $\beta = 0.53$) and low self-esteem ($\beta = -0.25$ and $\beta = -0.29$) were significantly associated with increased depressive and anxiety symptoms. In the hierarchical regression analyses, only high neuroticism was significantly associated with increased depressive ($\beta = 0.42$, $p < 0.05$) and anxiety ($\beta = 0.55$, $p < 0.001$) symptoms.
CONCLUSIONS: Personality traits are not the same between the SCI population and the general population. Assessment of personality traits early in inpatient rehabilitation can help to identify individuals at risk of mood problems and, thereby, facilitate interventions. Future research with a larger, representative SCI sample, is required to confirm these findings.

Spinal Cord (2024) 62:178–182; https://doi.org/10.1038/s41393-024-00964-z

INTRODUCTION

Spinal cord injury (SCI) is associated with physical impairments and psychosocial problems [1]. Findings suggest that 19–26% of all individuals with SCI experience elevated levels of depressive symptoms and 24–30% experience elevated levels of anxiety symptoms [2, 3]. To provide effective psychological care for this population, further studies are required to identify psychological vulnerability and risk factors [4].

One of these factors is the individual's personality. Personality traits have strong genetic and biological bases and substantial stability over the lifespan, however, personality can also be seen as a dynamic vulnerability construct that develops over the lifespan and can change in response to life circumstances [5]. The most often studied personality traits in the general population are neuroticism and extraversion [6]. Low neuroticism and high extraversion are traits consistently associated with better

psychological adjustment, while high neuroticism and low extraversion seem to be associated with more severe depressive and anxiety symptoms [6, 7]. Therefore, personality traits can be potentially used to screen vulnerable persons and tailor psychological therapy in order to increase its effectiveness [8].

Previous studies have shown that personality traits are associated with a variety of psychological adjustment outcomes in the SCI population [9–13]. As with the general population, extraversion appears to be a protective factor and neuroticism a vulnerability factor for psychopathology and adjustment to living with SCI [12, 14]. Thus, it seems conceivable that personality traits could be related with the level of depressive and anxiety symptoms. However, to our knowledge, only two studies have examined associations between personality traits and depressive and anxiety symptoms in this population in the initial rehabilitation phase [12, 14]. Furthermore, a review found inconsistent

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evidence in relation to the role of personality traits in persons with SCI [15]. The recommendation that was made in this review was to re-examine the concept of personality, which has been cast aside prematurely.

The possible relationships between personality traits and depressive and anxiety symptoms may cause different trajectories of adaptation after SCI [12]. For instance, personality traits could contribute to an individual's susceptibility to developing depression and/or an anxiety disorder [5, 8]. A combination of high neuroticism and low extraversion and self-esteem has been associated with a higher risk of depression [5] and social anxiety [8] in the general population. Other personality traits (e.g., high extraversion) may, on the other hand, provide protection from the experience of depressive or anxiety disorders and can lead to more resilient behavior [1].

Therefore, the first aim of this study was to assess personality traits in persons with SCI and compare these with the general population. The hypothesis was that personality traits in persons with SCI did not differ from the general population. The second aim was to explore which personality factors are associated with depressive and anxiety symptoms. The hypothesis was that personality traits in persons with SCI would be associated with depressive and anxiety symptoms. The last hypothesis was that personality traits would still be associated with depressive and anxiety symptoms if controlled for demographic and injury variables.

METHOD
Design
Data were derived from a standard psychological screening at admission. Every new admission with a recently acquired SCI is standardly screened in the intake process of our ward.

Procedures
Participants had completed questionnaires as part of their routine psychological assessment shortly after admission to the rehabilitation center. Psychological screenings that were performed between March 2016 and November 2017 were retrieved from medical files and de-identified by the treating psychologist. All applicable institutional and governmental regulations concerning the ethical use of personal data were adhered to during the course of this research, including informed consent.

Patients
Inclusion criteria for the psychological screening were (1) inpatient rehabilitation because of a recently acquired SCI (2) no serious cognitive or intellectual problems (i.e., diagnosed brain injury, intellectual disability or psychiatric disorder as identified in medical records retrieved from the hospital or general practitioner) that have such an effect on answering questions, (3) and no signs of psychiatric comorbidity. Only patients with complete data were selected for the current study.

Measures
Age and gender were the demographic variables used in this study. All participants underwent a standard neurological examination by a rehabilitation physician [16]. Neurological levels of injury at or below T6 were defined as low level of SCI (0), neurological levels above T6 were defined as high level of SCI (1). To classify the severity of the injury, categories of the American Spinal Injury Association Impairment Scale (AIS) were dichotomized into: AIS A, B or C; 0 versus AIS D; 1.

Depressive and anxiety symptoms were measured with the Hospital Anxiety and Depression Scale (HADS) [17]. The HADS consists of 14 statements about the past week with a four-point response scale, equally divided over the anxiety and depression scales. Sample items are "I feel tense" (anxiety) and "I feel as if I am slowed" (depression). The HADS is a valid and reliable measure of depressive and anxiety symptoms in individuals with SCI (2). A cut-off score of > 8 was used to delineate possible symptoms of anxiety and depression [17]. A cut-off score between 8 and 10 inclusive means that there are possible symptoms of anxiety and depression.

The Dutch Personality Questionnaire (DPQ) [18, 19], consists of 140 items, non-overlapping keyed in seven scales of 20 items each. Positively and negatively phrased items are used in each scale and all items are answered on a three-point scale (agree, unsure, disagree). The seven scales are named: neuroticism, social inadequacy, rigidity, hostility, egoism, dominance and self-esteem. Sample items are "Life is often difficult for me" (neuroticism), "I get shy when people look at me" (social inadequacy), "I want everything to be at a standard place at home" (rigidity), "People often fail to keep their promise" (hostility), "I don't care what others think of me" (egoism) and "I like to give orders" (dominance), and "I can solve my problems myself" (self-esteem). The maximum score range of all scales is 0–40. Median Cronbach alpha values ranged from 0.78 (egoism) to 0.92 (neuroticism) across multiple samples. Test-retest reliability coefficients ranged from 0.86 (hostility) to 0.92 (neuroticism and social inadequacy). A comparison between the DPQ and the Revised NEO Personality Inventory showed strong positive correlations between the neuroticism scales (0.87), and between rigidity and conscientiousness (0.49). Further, strong negative correlations between social inadequacy and extraversion (−0.81), between both egoism and hostility and agreeableness (−0.58 and 0.52, respectively). Norm scores are available to interpret the scale scores relatively to those of a representative sample of the general Dutch population ($N = 770$) on a 7-point scale based on the score distribution in this population sample: very low (below 5th percentile), low (between 5th and 20th percentile), below average (between 20th percentile and 1 standard error below the mean), average (between 1 standard error below and 1 standard error above the mean), above average (between 1 standard error above the mean and the 80th percentile), high (between the 80th and 95th percentile) and very high (above the 95th percentile) [18].

Data analysis
Statistical analyses were performed using SPSS, version 26 [20]. First, descriptive statistics were used to describe the study population, the dependent and independent variables. Scores on the DPQ among this SCI sample were compared with scores among the population sample using a one-sample t-test. Before conducting further analyses, scores on the neuroticism, social inadequacy, and self-esteem subscales were square root transformed, because of non-normal score distributions. Thereafter, Pearson correlations were calculated to examine the associations between the personality variables. Associations between scores on each DPQ subscale and the HADS scales were analyzed by conducting a series of bivariate regression analyses. Lastly, hierarchical regressions were conducted to examine associations between DPQ subscales and HADS scores, controlling for demographic and injury variables (gender, age, level of injury, and completeness of injury). Demographic (age, gender) and lesion (level, severity) characteristics were entered in the first step. In the second step, personality variables were entered. Due to sample size restrictions, only those personality variables that showed significant ($p < 0.05$) bivariate associations with depressive or anxiety scores were entered in the respective hierarchical regression analysis. Sensitivity analyses using more liberal cutoff p values of 0.10 and 0.20 did not show diverging results (data not displayed).

RESULTS
This sample ($N = 67$) consisted of participants with a mean age of 58 (SD 17) years. The majority were male had ASIA D and a low level of SCI (Table 1). The mean time since injury was 42 days. Mean scores on the HADS depression and anxiety scales were 6.2 (SD 4.5) and 6.0 (SD 4.5), respectively. A minority of 37.3% and 29.8% of the sample showed possible or clinically relevant levels of depressive and anxiety symptoms, respectively.

Descriptive statistics on the DPQ subscales are presented in Table 2. Participants showed lower scores on the subscales social inadequacy, hostility and egoism, and higher scores on the subscales dominance in comparison with the general population group. When corrected for gender-specific norms (such norms only exist for neuroticism and dominance), these differences still existed (See Table 2).

Strong positive correlations (>0.50) were found between the neuroticism and social inadequacy, between self-esteem and dominance, and between egoism and hostility (Table 3). Strong negative correlations were found between neuroticism and self-esteem and between social inadequacy and egoism. The rigidity

and hostility scales showed weak or non-significant associations with the other personality factors.

To test the second objective, bivariable regression analyses were conducted (see Table 4). Neuroticism was associated with higher HADS depression and anxiety scores. Self-esteem was associated with lower HADS depression and anxiety scores.

Subsequently, hierarchical regression analysis was used to test the last hypothesis (Table 4). In the final models, demographic and injury variables together explained 2.0% and 7.0% of the variance of the HADS depression and the HADS anxiety scales, respectively. Neuroticism and self-esteem together explained 15% and 22% of the variance of the HADS depression and the HADS anxiety scales, respectively. Neuroticism was the only personality factor that was independently associated with the HADS scores.

DISCUSSION

The results of this study showed that persons with SCI in our sample scored lower on social inadequacy, hostility and egoism,

and higher on dominance in comparison with the general Dutch population group. The hypothesis that personality traits in persons with SCI would be the same as in the general population group was, therefore, rejected. Moreover, high neuroticism and low self-esteem were associated with increased symptoms of depression and anxiety. The hypothesis that personality traits in persons with SCI would be associated with depressive and anxiety symptoms was, thus, partially confirmed. In the regression analyses, only higher neuroticism was independently related to increased depressive and anxiety scores. Consequently, the last hypothesis that personality traits would still be associated with depressive and anxiety symptoms if controlled for demographic and injury variables, was also partially confirmed.

Considering the personality scores of this sample, it could be assumed that the SCI population does not have the same personality traits as the general population. Whether this finding reflects a trait or state situation remains to be determined. Earlier studies also compared persons with SCI with normative control samples and found that persons with SCI are elevated in extraversion and showed lower scores on consciousness [9, 12]. In the present study, we found that persons with SCI showed lower levels of social inadequacy, which correlate strongly and negatively with extraversion [18]. Consciousness correlated with rigidity, however, we did not find a distinct score on rigidity in our sample. However, according to Eurelings-Bontekoe and Snellen [21], a combination of high scores on dominance and low scores on hostility and egoism can refer to a lack of self-insight, which may relate to a lower score on consciousness. However, lower scores on hostility and egoism could also be the result of the dependent situation, persons with SCI are facing, at the start of inpatient rehabilitation. Therefore, future research is needed to measure personality at different moments in time after SCI.

Stressful life experiences and personality can influence one another [22]. Fluctuations of personality traits have been found in patients after stroke [23], chronic pain patients [24], and patients with Alzheimer's [25]. In persons with SCI, no or limited associations were found between time since injury and personal factors [26]. Therefore, a potential explanation for the SCI group could be that high extraversion, or traits commonly associated with extraversion, such as sensation seeking or risk taking [12], are related to risky behavior. These traits could possibly work as pre-injury risk factors [12], however further research is needed to examine whether such personality traits reflect pre-injury risk factors or post-injury change. In other words, one must be cautious whether the personality scores of this sample reflect a trait or a state, considering the timing of the screening, which is just 2 weeks after admission to inpatient rehabilitation. A recommendation for further research would be to measure

Table 1. Demographics, injury characteristics, and HADS scores.

Variables	N (%) or mean (SD)
Age (mean (SD))	58 (17)
Gender	
Male	43 (64.2)
Female	24 (35.8)
Lesion	
ASIA ABC	20 (29.9)
ASIA D	47 (70.1)
Level	
Low	38 (56.7)
High	29 (43.3)
HADS depression (mean (SD))	6.2 (4.5)
Non-clinical cases (score below 8)	42 (62.7)
Possible cases (score between 8–10)	8 (11.9)
Clinical cases (score above 10)	17 (25.4)
HADS anxiety scale (mean (SD))	6.0 (4.5)
Non-clinical cases (score below 8)	47 (70.2)
Possible cases (score between 8–10)	8 (11.9)
Clinical cases (score above 10)	12 (17.9)

Table 2. Descriptive statistics of the scores on the Dutch Personality Questionnaire in the SCI sample in comparison with the norming group.

Variables	M	SD	General norming group (M)	General norming group (SD)	t-test (p value)	Very low (%)	Low (%)	Below average (%)	Average (%)	Above average (%)	High (%)	Very high (%)
Neuroticism	10.5	10	12.0	9.8	−1.23	n.a	20.9	28.4	26.9	11.9	3.0	9.0
Social anxiety	8.6	8.9	14.1	9.8	−5.05**	n.a	40.3	29.9	14.9	6.0	3.0	6.0
Self-esteem	32	7.0	30.5	7.0	1.4	4.5	11.9	6.0	22.4	14.9	31.3	9.0
Rigidity	25.7	7.4	27	7.3	−1.47	3.0	13.4	22.4	31.3	10.4	11.9	7.5
Hostility	11.0	8.6	16	8.1	−4.73 **	14.9	28.4	17.9	19.4	4.5	10.4	4.5
Egoism	7.4	5.3	9.9	5.8	−3.90 **	4.5	22.4	25.4	31.3	1.5	11.9	3.0
Dominance	26.3	7.8	23	8.2	3.44 **	3.0	3.0	10.4	25.4	19.4	25.4	13.4

Neuroticism % for men were: very low (0%), low (16.4%), below average (37.3%), average (17.9%), above average (10.4%), high (9.0%), very high (9.0%).
Dominance % for men were: very low (3.0%), low (6.0%), below average (11.9%), average (28.4%), above average (13.4%), high (22.4%), very high (14.9%).
*$p < 0.05$; **$p < 0.01$.

Table 3. Associations between personality scales of the Dutch Personality Questionnaire.

	Neuroticism	Social anxiety	Self-esteem	Rigidity	Hostility	Egoism
Social anxiety	0.51**					
Self-esteem	−0.61**	−0.62**				
Rigidity	0.23	0.20	−0.06			
Hostility	0.41**	0.34**	−0.08	0.15		
Egoism	0.23	0.52**	−0.19	−0.02	0.66**	
Dominance	−0.28*	0.50**	0.62**	0.08	0.15	−0.12

*$p < 0.05$; **$p < 0.01$.

Table 4. Bivariate and hierarchical regression analyses on the association between personality traits and depressive and anxiety scores.

	Depressive symptoms		Anxiety symptoms	
	Bivariate regression	Hierarchical regression[a]	Bivariate regression	Hierarchical regression[a]
Neuroticism	0.42 (<0.001)	0.42 (0.009)	0.53 (<0.001)	0.55 (<0.001)
Social anxiety	−0.22 (0.076)	Not applicable	−0.23 (0.066)	Not applicable
Self-esteem	−0.25 (0.040)	−0.10 (0.947)	−0.29 (0.016)	−0.05 (0.709)
Rigidity	0.18 (0.153)	Not applicable	0.20 (0.105)	Not applicable
Hostility	0.17 (0.165)	Not applicable	0.21 (0.085)	Not applicable
Egoism	0.03 (0.798)	Not applicable	−0.06 (0.635)	Not applicable
Dominance	−0.12 (0.30)	Not applicable	−0.14 (0.261)	Not applicable

[a]All coefficients corrected for age, sex, and injury characteristics.

personality again in a later stage after SCI in our study population in order to better distinguish between state and trait.

The proportions of participants showing clinically relevant levels of depressive and anxiety symptoms are in line with results from previous studies [1, 27]. In this study, neuroticism was strongly related to depressive and anxiety symptoms, resembling findings in the general population [2] and the SCI population [14]. A more or less similar correlation of 0.54 between the NEO personality questionnaire and depression (measured with the BDI) was found by Salter, Smith, and Ethans [10]. This is an interesting finding, which implies that neuroticism could be potentially used to screen vulnerable individuals during their rehabilitation process and could be a target for psychological treatment. Life events could positively or negatively affect neuroticism. For example, persons with neuroticism who were in a stable relationship and who got work that they liked and were appreciated for, scored lower on neuroticism over the years. So, recommendations to lower scores on neuroticism were to invest in meaningful work, to stimulate persons to dare to make decisions to increase quality of life, to put energy in self-regulation to lower the influence of negative emotions, find solutions to transform a stressful situation into a positive experience, and maintain a strong and stable social network [28]. While it is not the aim to change someone's personality during inpatient rehabilitation, some of these skills can be trained and paid attention to during the rehabilitation process. Moreover, early identification and treatment of depressive and anxiety symptoms are important in SCI rehabilitation, as these clinically relevant symptoms can undermine functional recovery [3].

It is rather surprising that social inadequacy was not found to have a significant negative relationship with depressive symptoms when controlled for demographic and injury variables. The p value found was just above the conventional cut-off value of 0.05. This is likely due to the small sample size, hence the data must be interpreted carefully. The lack of statistical significance does not mean there is no effect. Nevertheless, another possibility could be that social

inadequacy does not influence depressive symptoms directly, but rather indirectly, for example through social support [29].

Limitations
The present study represents an attempt to address the relationship between personality and depressive and anxiety symptoms in a SCI sample. One limitation of this study is that there was a small sample, meaning that the current results are difficult to generalize.

Further, researchers have suggested that resilience and coping are important factors in explaining the complicated relationship between personality traits, depressive and anxiety symptoms in medical populations [15]. Moreover, the cause of injury was not considered in this study population. Unfortunately, it was beyond the scope of this study to examine those measures and, therefore, they were not included.

CONCLUSION
Considering the personality scores of this sample, persons with SCI in our sample scored lower on social inadequacy, hostility and egoism, and higher on dominance in comparison with the general Dutch population group. Moreover, the results of this study partly confirm the hypothesized associations between personality traits and depressive and anxiety symptoms. For the SCI psychologist, assessing personality traits could offer unique contributions to the total psychosocial assessment and help tailoring individual treatments.

Further research should focus on how other psychological variables, like resilience and coping, and injury-related characteristics (cause of injury) influence the relationship between personality and mood after SCI.

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