

**A cross-sectional study of psychological complaints and quality of life in severely injured patients.**

**C. C. H. M. van Delft-Schreurs, J. J. M. van Bergen, P. van de Sande, M. H. J. Verhofstad, J. de Vries, M. A. C. de Jongh**

C. C. H. M. van Delft-Schreurs & M. A. C. de Jongh: Traumacentre Brabant, St. Elisabeth Hospital, Tilburg, The Netherlands, e-mail: K.v.delft@elisabeth.nl

J. J. M. van Bergen: Medical Psychology, Maxima Medisch Centrum, Eindhoven, The Netherlands

P. van de Sande & J. de Vries: Department of Medical Psychology, St. Elisabeth Hospital, Tilburg, The Netherlands

M. H. J. Verhofstad: Department of Surgery, St. Elisabeth Hospital, Tilburg, The Netherlands

M. H. J. Verhofstad: Department of Trauma Surgery, Erasmus University Medical Centre, Rotterdam, The Netherlands

J. de Vries: CoRPS, Department of Medical and Clinical Psychology, Tilburg University, Tilburg, The Netherlands

**Abstract:**

**Purpose:** The purpose of this study was to examine the incidence of psychological complaints and the relationship of these complaints with the quality of life (QOL) and accident- and patient-related factors among severely injured patients after the rehabilitation phase.

**Methods:** Patients of 18 years or older with an injury severity score (ISS) above 15 were included 15-53 months after their accident. Accident and patient characteristics were obtained from questionnaires and the trauma registry. Several questionnaires (Hospital Anxiety and Depression Scale, Impact of Events Scale and Cognitive Failure Questionnaire) were used to determine symptoms of psychological problems (respectively anxiety or depression, posttraumatic stress disorder or subjective cognitive complaints). The world health organization quality of life-bref was used to determine QOL. A reference group of the Dutch general population was used for comparison of QOL scores.

**Results:** The participation rate was 62% ( $n=173$ ). At the time of the study, 30.1% ( $n=52$ ) of the investigated patients had psychological complaints. No relation between psychological complaints and somatic severity or type of injury was found. Patients who were employed before the accident or resumed working, reported less psychological complaints. Use of any medication before the accident and treatment for pre-accidental psychological problems were positively related to psychological complaints afterwards. QOL of severely injured patients was impaired in comparison with the general Dutch population, but only for those with psychological complaints.

**Conclusions:** Psychological complaints seem to be an important and underestimated factor for a decreased QOL among severely injured patients.

## **Background**

Severely injured patients experience decreased quality of life (QOL).[1-4] There are indications of a relationship between this impaired QOL and posttraumatic psychological problems or posttraumatic stress disorder (PTSD)[3, 5-10] caused by shocking experiences, such as accidents. A psychological reaction may have an even greater effect on QOL than somatic disability. One study showed that patients reported considerable psychological problems five years after a major trauma.[1] However, most QOL observations are based on health-related quality of life (HRQOL) or health status studies. Health status has been defined as the impact of disease on a patient's physical, psychological, and social functioning.[11-13] In health status studies, patients are asked about their functioning, thereby focusing on disabilities, but not about their (dis)contentment concerning their functioning.[14] By contrast, the World Health Organization quality of life group (WHOQOL group) defines QOL as follows: "the individual's perception of his/her position in life in the context of the culture and value systems in which he/she lives, and in relation to his/her goals, expectations, standards and concerns".[15] Therefore, it also asks patients about their satisfaction with their functioning. The core of this definition is that QOL refers to patients' evaluation of functioning in line with their expectations.[16] Thus, whereas health status only concerns patients' functioning, QOL includes patients' satisfaction with functioning. This QOL is decreased in severely injured patients.[17] However, the relation between QOL and psychological problems after an accident is not clear. Little is known about whether the type of accident, the seriousness of the injury or the injured body region affects the psychological problems of patients after the rehabilitation phase.

The main objective of the current study was to examine psychological complaints (anxiety, depression, PTSD or subjective cognitive complaints) in severely injured patients after the rehabilitation phase. The three specific objects were: (1) to determine the incidence of psychological complaints, (2) to investigate the relationship of psychological complaints with accident- and patient-related factors, and (3) to examine the relationship of the psychological complaints with QOL.

The study was approved by the Medical Ethical Review Board of the St. Elisabeth Hospital.

## **Participants and methods**

### **Participants**

In the St. Elisabeth Hospital, 3195 trauma patients were hospitalised in the years 2006, 2007 and 2008, including 470 severely injured patients (injury severity score (ISS) > 15). Those severely injured patients were asked to participate in this study if they were 18 years or older at the start of the study, were still alive, and had a traceable postal address. Before the study began, 144 of the 470 patients had died (31%), 24 patients were younger than 18 years (5%), and 21 patients were untraceable (4%). The remaining 281 patients were eligible to participate. Of these patients, 173 returned the questionnaires (a response rate of 62%; see figure 1).

Socio-demographic data (age, gender, household composition, education, and employment status, use of alcohol or drugs), characteristics of the accident (traffic, at work, at home, sports, or attempted suicide), medical data (injury, duration of hospitalisation and intensive care unit (ICU) treatment, and treatment for psychological problems), and symptoms of different psychological problems (anxiety or depression, posttraumatic stress disorder, or subjective cognitive complaints) were collected.

### **Instruments**

Demographic data, characteristics of the accident and medical data were extracted from the regular trauma registry and a general questionnaire was designed to collect data on socio-demographics, the accident, and their health situation before the accident.

The abbreviated injury scale (AIS) and ISS, which are part of the regular trauma registry, were used to determine the injured body area and severity of the injuries. The AIS is anatomically based and classifies the severity of each injury by body region on a scale from 1

(minor) to 6 (non-survivable).[18] Injuries from all patients were coded prospectively, using the (AIS)-update 98. The ISS is calculated as the sum of the square of the AIS for the three most serious injuries in different ISS body regions. Individual-level overall injury severity scores range from 1 to 75.[19, 20] Different studies have confirmed the validity of the ISS as a predictor of mortality.[21] The reliability of injury coding was found to be substantial and the reliability of the ISS almost perfect.[21, 22] Only severely injured patients (ISS > 15) were included in this study, because an ISS of 16 is predictive of 10% mortality and defines major trauma based on anatomic injury. [23] Within the group severely injured patients a cut-off score of 25 is used, because a rapid increase in fatalities is seen when the ISS exceeds the value of 25.[24]

Several general questionnaires were used to determine different psychological complaints and the QOL of the participants after their rehabilitation phase.

The Hospital Anxiety and Depression Scale (HADS)[25] was used to screen for anxiety and depressive disorders. Both types of disorders are assessed with seven questions. The HADS has a 4-point response scale (0-3) and has been validated. The homogeneity and test-retest reliability of the total scale and the subscales are good (Cronbach's alpha: 0.84 for general medical patients).[26] The Cronbach's alphas in the current study were 0.83 for the subscale anxiety and 0.86 for the subscale depression. Subscale values  $\geq 11$  for one of the subgroups were regarded as a psychological complaint, as this cut-off score provides the lowest proportion of false positives (1% for depression and 5% for anxiety).[27]

The Dutch version of the Impact of Events Scale (IES; validated translation known as "Schokverwerkingslijst"[28]) was used as an indicator for PTSD. According to an examination

of its psychometric properties, the questionnaire is reliable (Cronbach's alpha 0.95) and valid.[29] The Cronbach's alpha in the current study was 0.93. The IES consists of 15 items. Using a 4-point scale, the respondent states whether the content of each statement was present – 0 (not at all), 1 (rarely), 3 (sometimes), or 5 (often) - during the past seven days. A score of at least 35 represents the best cut-off for a probable diagnosis of PTSD.[30]

The Cognitive Failure Questionnaire (CFQ) was used to assess subjective cognitive complaints. The CFQ consists of 25 questions (with a 5-point response scale) about memory deficits, absent-mindedness, or slips of action.[31] The questionnaire has been translated and found to be valid and reliable (Cronbach's alpha: 0.92).[32][33] The Cronbach's alpha for the current study was 0.95. Higher scores indicate more subjective cognitive complaints. The correlation between CFQ-scores and objective cognitive disorders is very weak, and scores on the CFQ reflect psychological well-being in the cognitive domain. Therefore, high CFQ-scores were considered to represent psychological complaints in the current study. Scores of 55 or higher indicate very low self-reported cognitive capacities.[33]

The Dutch version of the World Health Organization Quality of Life assessment instrument-Bref (WHOQOL-Bref) was used to measure QOL.[34, 35] This instrument was used because it is a generic, cross-culturally developed comprehensive questionnaire that measures QOL as a person's subjective perceptions about his or her life with respect to goals, concerns, and satisfaction. The questionnaire consists of questions within the domains of 'physical health' (7), 'psychological health' (6), 'social relationships' (3), and 'environment' (8) and is supplemented with the domain 'general', which consists of two questions on QOL and general health. Each question has a 5-point response scale. The domain scores denote an

individual's perception of the QOL in each particular domain and are scaled in a positive direction (i.e., higher scores denote higher QOL). The reliability and validity of the WHOQOL-Bref are good (Cronbach's alpha: physical health: 0.80, psychological health: 0.74, social relationships: 0.66, environment: 0.73).[36, 37] In the current study the Cronbach's alphas are: 0.88 for physical health, 0.84 for psychological health, 0.65 for social relationships and 0.85 for environment, respectively. The domain values were calculated for each participant in the present study and compared with scores from a reference group of the Dutch general population with a mean age of 54 (SD 16) years old.[38]

When patients did not participate, they were called and asked for the reason and some basic information concerning their health status using a 3-point Likert scale from 'good' to 'not good at all'.

### Procedures

Self-report questionnaires were sent by traditional post. The participants or their caregivers determined whether they were able to answer the questionnaires. The participants were included after written informed consent was obtained and if the questionnaires were completed and returned. The participants started with some socio-demographic questions, questions about their medication and physical and psychological situation before the accident, questions about the accident, and support after the accident. Subsequently, they were asked to complete the questions of the WHOQOL-Bref, SVL, HADS, and CFQ and to return the set of questionnaires by traditional post. The questionnaires were completed between 15-53 months after their accident (mean time since injury 2.8 (SD 0.9) years). Data were entered in SPSS by a research assistant and checked on completeness and validity.



Missing data were replaced with the participant's mean value on the corresponding subscale when one or two items were missing. If more data were missing from an assessment, the assessment was discarded.

Participants were considered to suffer from psychological complaints if they had a HADS score of at least 11 on one of the two subscales, an IES score of at least 35, or a CFQ score of at least 55.

### Statistical analysis

To compare the group of non-respondents with the respondents, independent sample t-tests were used for continuous variables, and Chi-square tests were used for categorical variables. One-sample t-tests were employed to compare the QOL of polytraumatised patients with WHOQOL-Bref data from a Dutch reference group.[38] Chi-square tests were used to investigate the relationship between demographic, accident and injury characteristics and the presence of one of the psychological outcome parameters. Independent sample t-tests were used for continue variables.

Independent sample t-tests were performed to investigate the difference in QOL between participants with and without psychological complaints. The data were analysed using the IBM SPSS 19 statistical software (SPSS Chicago, IL, USA; version 19.0). The significance level was  $p < 0.05$  for all tests except the Chi-square tests. To take into account the number of tests, a significance level of  $p < 0.01$  was used for these Chi-square tests.

## Results

### Participants' characteristics

Most participants were male and did not live alone. The mean age was 47 (SD 19) years, and most injuries were caused by traffic accidents. The most common injury was intracranial injury (61%). Serious intracranial injury (AIS>3) was present in 52% of the cases. The median ISS was 21 (interquartile range 17-27), and 86% of the participants had received ICU treatment. Participant characteristics are presented in table 1.

Ten participants indicated that they consumed more alcohol at present than they did prior to the accident. Only one of them drank more than 3 glasses of alcohol per day. Three participants declared that they used more drugs at present than they did before the accident. Two of these participants did not use drugs before the accident.

The respondents and non-respondents did not differ significantly with respect to age, injured body area, severity of the injury, duration of hospitalisation, or ICU care. Although both groups mainly consisted of males, the females responded significantly more often than males based on a comparison of the respondent and the non-respondent group (31% vs. 15%;  $p=0.003$ ).

Slightly more than half of the 108 non-respondents could be contacted by phone ( $n=56$ ) to determine their health status and reason for not participating. Most of them were not interested (62%), and 14% did not want to be reminded of their accident or injury any more. For 16% of the patients, their health status was too bad to participate. One third of the contacted non-respondents declared that they did not feel well at all.

### Psychological complaints

Sixteen persons of the investigated trauma population had psychological or psychiatric treatment before the accident. After the accident, 52 participants had psychological complaints. Ten of the 52 participants with psychological complaints after the accident also had psychological or psychiatric treatment before the accident. Twenty-one of the participants with psychological complaints after the accident suffered from two (11), three (6) or all four (4) investigated psychological problems. Most common was a combination of complaints of anxiousness with one of the other investigated psychological complaints. A combination of symptoms of PTSD and subjective cognitive complaints or symptoms of PTSD and depression almost only appeared in participants who also had additional psychological complaints. The frequencies of different types of psychological complaints are presented in table 2.

Regardless of the type of psychological complaint, approximately 50% of the participants with posttraumatic psychological complaints had not received psychological or psychiatric treatment after the accident. Thirty-seven participants received psychological counselling after their accident but no longer experienced psychological complaints.

### Relationship between the psychological complaints and accident- and participant-related factors

Participants who were employed before the accident ( $p=0.001$ ) and participants who resumed working after the accident ( $p<0.001$ ) reported less psychological complaints. Use of medication before the accident ( $p=0.006$ ) and treatment for psychological disorders before the accident ( $p=0.006$ ) were positively related to the presence of psychological complaints. No significant association between any accident- or injury-related factor and the occurrence

of psychological complaints was found (table 3). Psychological complaints were also unrelated to treatment-related factors, i.e., the time elapsed since the accident ( $p=0.389$ ), the duration of hospitalisation ( $p=0.629$ ), or duration of ICU treatment ( $p=0.760$ ).

#### Psychological complaints and QOL

Participants with psychological complaints displayed worse QOL scores in all domains compared with those without psychological complaints (table 4) and compared with the Dutch reference population (see figure 2). The QOL of participants without psychological complaints was not impaired compared with the reference population (see figure 2).

## Discussion

The first objective of this study was to examine the incidence of psychological complaints among severely injured patients after the rehabilitation phase. Nearly 30% of the investigated participants had psychological complaints (anxiety (14%), depression (12%), PTSD (11%), and/or subjective cognitive complaints (13%)) 15-53 months after the accident. Several participants suffered from more than one psychological complaint. Previous studies found a higher degree of patients with psychological disorders after trauma, i.e., PTSD between 18% and 25% [39], [40], [23] and anxiety or depression between 25 and 39% [41, 42] of the patients. This discrepancy may be due to different cut-off points, because we used conservative cut-off values in the current study, to find a low proportion of false positives for participants with psychological complaints. The discrepancy may also be caused by different procedures. In some former studies the assessments were conducted by a psychiatrist or trained clinical research assistants, whereas in our study the questionnaires were self-rated.

The second objective was to investigate the relationship between the psychological complaints and accident- and participant-related factors. We did not find an association between the injured body region and psychological complaints or between the severity of the injury (in terms of ISS) and the number of participants with psychological complaints. This result concurs with previous studies that did not find a relation between psychological outcome and head injury [43] or between the severity of injury and psychopathology.[6] However, Wallis et al. found more anxiety and depression in patients with a hand injury in a burn injury study, which could be caused by the high level of physical limitations, and

accompanying dependency on other people's help that is often the case with injured hands.

[44]

The presence of psychological complaints seemed to be related to pre-accidental socio-demographic and health-related factors. In line with previous studies,[8], [45, 46] females and patients who were unemployed or had psychological complaints before the accident more frequently reported psychological morbidity after rehabilitation. The use of any medication before the accident was related to psychological complaints after the accident. Remarkably, medication for psychological complaints before injury was not related to psychological complaints after the accident. This finding may be biased by the small number of patients with psychological complaints before the accident.

High prevalence of acute intoxication and chronic alcoholism in trauma patients were found in former studies, [47-49] and mental disease was found to be attributable to increased substance abuse. [50] However, we could not confirm these results in our study. The use of alcohol or drug may be underreported, because of the self-report method.

Survivors of a severe injury often have difficulties returning to work.[51, 52] In accordance with previous studies,[40, 50] return to work was related to the presence of psychological complaints after the accident. This association is important, as employment is an aspect of reintegration into society. In addition, disqualification from work causes high costs for society. Moreover, it may prolong psychological complaints leading to additional costs. However, this causality is unknown and should be investigated in a prospective study.

Approximately 50% of the participants with psychological complaints indicated that they had not received psychological counselling or social assistance after the accident. It is possible that the number of patients with psychological complaints and an impaired QOL after the injury would be lower if they had received more psychological support during treatment.

Therefore, a higher awareness among hospital health care professionals is necessary to place greater emphasis on the involvement of psychological health care during the rehabilitation process of severely injured patients. Routine screening for psychological complaints would assist this awareness of appropriate psychological care.

The third objective was to investigate the relationship between the psychological complaints in severely injured patients and their QOL. Most previous studies investigated only HRQOL or only psychological complaints in trauma patients. In line with those studies,[1-4] we found a significantly decreased QOL of the severely injured patients compared to the general Dutch population in all domains except the social domain. The few studies that investigated HRQOL combined with psychological complaints after an injury, found an association between both factors.[3, 53] We found similar results in patient experienced QOL. When we excluded participants with psychological complaints from the analysis, a difference with the Dutch general population was no longer demonstrated. Thus, psychological morbidity appears not only to be an important factor in the decreased HRQOL, but also in the experienced QOL of severely injured patients after the rehabilitation phase.

Some important factors that were associated with psychological complaints after the rehabilitation phase, such as return to work and psychological treatment before the accident, are also known to be associated with (HR)QOL.[3, 7] Although a previous study found that QOL was mainly related to living alone,[17] we did not find a relationship between household composition and the appearance of psychological disorders.

Several limitations should be mentioned. First, selection bias may be present, as the response rate was 62%. However, the group of non-respondents was similar to the group of respondents, except for a slight overrepresentation of women in the respondent group. Although gender did not affect QOL, women were found to suffer from psychological complaints more often than men. Moreover, many of the non-respondents indicated that they did not feel well at all, felt too unwell to participate, or did not want to be reminded of the accident. Therefore, the number of patients with psychological morbidity may be even higher and the QOL lower in the severely injured trauma population than was found in this study.

Second, recall bias may influence the current results. This problem is well-known in trauma care studies. Prospective documentation of patients' physical, psychological, and social well-being or health is impossible because it is not known who will experience an injury. To reduce recall bias, early documentation of health status is advisable. The patients were asked retrospectively for their pre-accident physical health and treatment for psychological complaints. The number of participants in the study that indicated that they had treatment for psychological complaints before the accident (9%) was similar to the number of patients with pre-existing psychological disturbance found in a previous study (11%).[5]

Third, we compared the present data with data from a reference group of the Dutch general population, of which the incidence of psychological complaints is unknown. Future studies should incorporate a healthy control group.

Finally, the total number of participants was insufficient for subgroup analysis, and a follow-up was not possible due to the cross-sectional study design. Future studies should include prospective follow-up studies with larger samples. The relationship with physical impairment should also be taken into account.



## **Conclusion**

To our knowledge, this is the first study to show that QOL may only be impaired in the severely injured patients who suffer from psychological complaints. One third of the participants suffered from psychological complaints 15-53 months after their accident, and only half of them received psychological counselling. Pre-accident mental treatment and inability to return to work (social reintegration) may be risk factors for psychological complaints. It seems that the need for psychological treatment remains underestimated after a severe trauma. Therefore, greater attention should be paid to psychological complaints in severely injured patients during treatment, and routine screening for these complaints may be warranted.

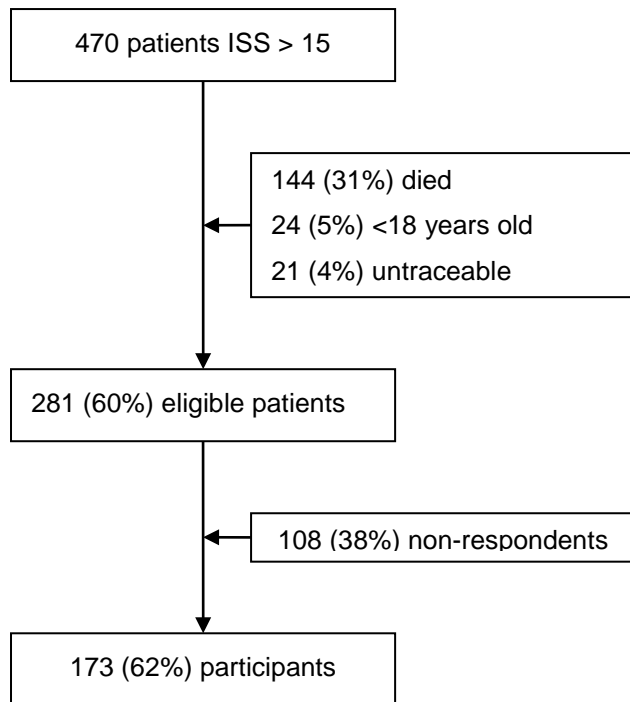
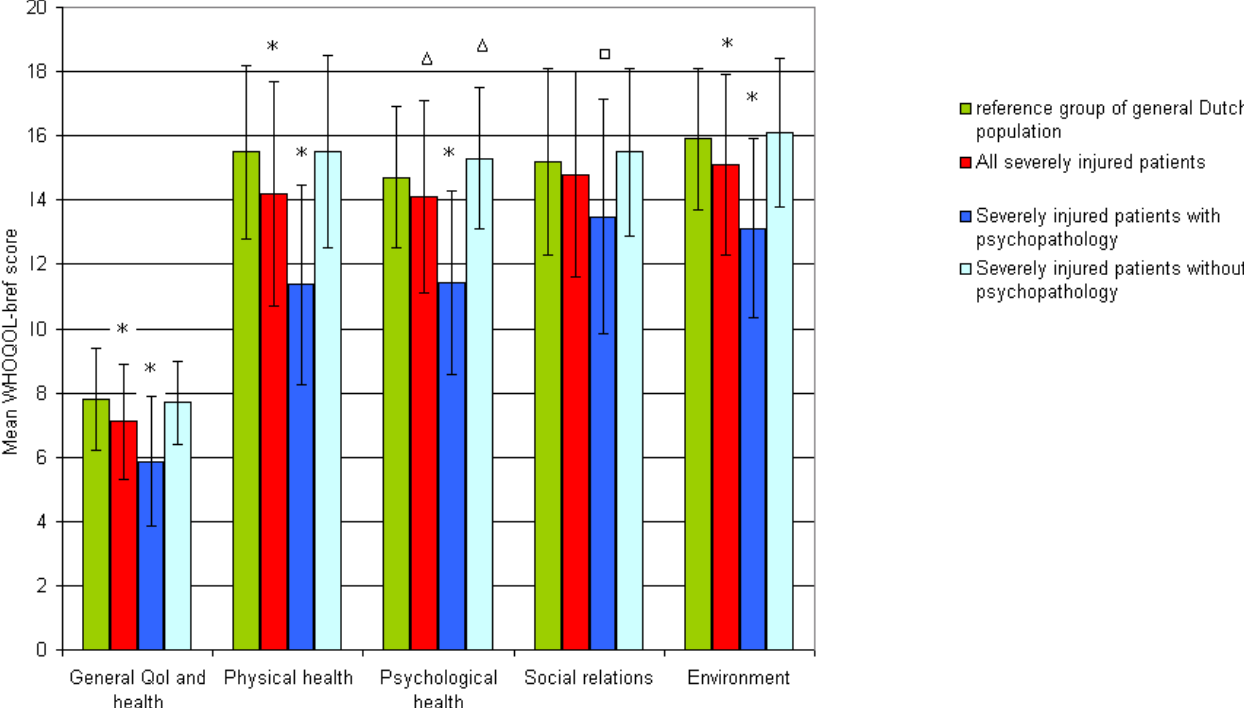


Figure 1: flowchart of selection of eligible patients.

Figure 2: QOL scores of severely injured patients with and without psychological problems compared with a reference group of general Dutch population.



$\Delta p < 0.05$ ,  $\square p = 0.002$ ,  $* p < 0.001$

Table 1: Patient characteristics of severely injured patients.

<b>Socio-demographic characteristics (n=173)</b>	<b>category</b>	<b>n</b>		
Age at start of the study	< 55	111	(64%)	
	>=55	62	(36%)	
Gender	Male	120	(69%)	
	Female	53	(31%)	
Education level*	Basic	33	(19%)	
	Middle	86	(50%)	
	High	44	(25%)	
Household*	Alone	40	(23%)	
	Together with*	Partner	131	(76%)
		Children	55	(32%)
		Partner and children	9	(5%)
		Parents	36	(21%)
		Students	23	(13%)
	3	(2%)		
Employment at time of injury		113	(65%)	
Returned to work after injury*		54	(31%)	

<b>Accident-related characteristics (n=173)</b>		<b>n</b>	
ISS	16 - 25	97	(56%)
	>=25	76	(44%)
Mechanism of accident	Blunt	166	(96%)
	Penetrating	7	(4%)
Type of accident*	Traffic	93	(54%)
	At home	33	(19%)
	At work	10	(6%)
	Sports	8	(5%)
	Raid	2	(1%)
	Attempted suicide	3	(2%)
	Other type of accident	23	(13%)
At least one injury in this AIS region	Head	131	(76%)
		Intracranial	105
	Face	46	(27%)
	Thorax	71	(41%)
	Abdomen	30	(17%)
	Spine	38	(22%)
		Transverse myelitis	12
	Upper extremity	53	(31%)
Lower extremity	53	(31%)	

<b>Comorbidity before trauma (n=173)</b>	<b>n</b>	
Physical disorders*	43	(25%)
Treatment for psychological complaints*	16	(10%)
Medication for psychological disorders	13	(8%)
Medication use*	67	(39%)

\*Category unknown: Education level: 10, Household: 2, Living together with: 5. Returned to work after injury: 4, Physical comorbidity: 1, Medication use: 4, Mental treatment: 1

Table 2: Number of severely injured patients with psychological complaints.

Psychological problem Mental treatment	Anxiety	Depression	PTSD	Cognitive complaints	Participants with psychological problems*	No	Unknown	Total
Pre-traumatic only	5	4	1	2	5	2	1	8
Pre- and post- traumatic	2	3	2	4	5	3	0	8
Post-traumatic only	10	5	7	10	22	34	1	57
None	7	9	8	7	19	76	3	98
Unknown	0	0	1	0	1	0	1	2
<b>Total</b>	<b>24</b>	<b>21</b>	<b>19</b>	<b>23</b>	<b>52</b>	<b>115</b>	<b>6</b>	<b>173</b>
<b>Percentage**</b>	<b>(14%)</b>	<b>(12%)</b>	<b>(11%)</b>	<b>(13%)</b>	<b>(30%)</b>	<b>(67%)</b>	<b>(4%)</b>	<b>(100%)</b>

\* Participants can have more than one psychological problem. Therefore, the number of participants with psychological problems is not equal to the sum of the participants within the different specified subgroups of psychological problems.

\*\* Percentage of the 173 investigated participants.

Table 3: Frequencies, percentages and p-values of Chi-square test for demographic, accident-related and injury-related factors of severely injured patients.

		No psychological complaints <i>n</i>	Psychological complaints <i>n</i>	<i>p</i> -value
Age at start of study	≥ 55	38 (23%)	21 (13%)	0.358
	< 55	77 (46%)	31 (19%)	
Gender	Male	86 (51%)	30 (18%)	0.026
	Female	29 (17%)	22 (13%)	
Housing situation at start of study	With others	89 (53%)	39 (23%)	0.735
	Alone	26 (16%)	13 (8%)	
Employment at time of injury	Yes	85 (51%)	25 (15%)	0.001*
	No	30 (18%)	27 (16%)	
Returned to work after injury**	Yes	51 (48%)	3 (3%)	<0.001*
	No	30 (28%)	22 (21%)	
ISS	≥ 25	49 (29%)	25 (15%)	0.510
	< 25	66 (40%)	27 (16%)	
Memories of accident	Yes	40 (25%)	16 (10%)	0.588
	No	72 (44%)	35 (21%)	
At least one injury in anatomic body region:	Head	(51%)	(24%)	0.766
	Face	(17%)	(10%)	0.260
	Thorax	(28%)	(13%)	0.953
	Abdomen	(12%)	(5%)	0.989
	Spine	(14%)	(8%)	0.467
	Upper extremity	(20%)	(10%)	0.685
	Lower extremity	(20%)	(10%)	0.602
Physical disorders before injury	Yes	23 (14%)	17 (10%)	0.064
	No	92 (55%)	34 (20%)	
Treatment for psychological complaints before injury	Yes	5 (3%)	10 (6%)	0.006*†
	No	110 (66%)	42 (25%)	
Before injury medication for psychological disorders***	Yes	3 (20%)	9 (60%)	0.242†
	No	2 (13%)	1 (7%)	
Medication use before injury	Yes	35 (21%)	28 (17%)	0.006*
	No	77 (47%)	24 (15%)	

Result from crosstabs Chi-square: \*  $p < 0.05$ , †Fisher exact

\*\*Determined for participants with employment at time of injury

\*\*\*Determined for participants with treatment for psychological problems before the injury

Table 4: QOL scores were decreased in all domains for severely injured patients with psychological complaints.

WHOQOL-Bref	<i>n</i>	General QOL and health	Physical health	Psychological health	Social relations	Environment
With psychological complaints	51	5.9 ± 2.0*	11.4 ± 3.1*	11.4 ± 2.9*	13.5 ± 2.7*	13.1 ± 2.8*
Without psychological complaints	113	7.7 ± 1.3	15.0 ± 3.0	15.3 ± 2.2	15.5 ± 2.6	16.1 ± 2.3

Student t-test; \* $p < 0.001$

## References

1. Sluys, K., Haggmark, T., & Iselius, L. (2005). Outcome and quality of life 5 years after major trauma. *J Trauma*, *59*, 223-232.
2. Ringburg, A. N., Polinder, S., van Ierland, M. C., Steyerberg, E. W., van Lieshout, E. M., Patka, P. et al. (2011). Prevalence and Prognostic Factors of Disability After Major Trauma. *J Trauma*, *70*(4), 916-922.
3. Holbrook, T. L., Anderson, J. P., Sieber, W. J., Browner, D., & Hoyt, D. B. (1999). Outcome after major trauma: 12-month and 18-month follow-up results from the Trauma Recovery Project. *J Trauma*, *46*, 765-771.
4. Alves, A. L., Salim, F. M., Martinez, E. Z., Passos, A. D., De Carlo, M. M., & Scarpelini, S. (2009). Quality of life in trauma victims six months after hospital discharge. *Rev Saude Publica*, *43*, 154-160.
5. Sutherland, A. G., Alexander, D. A., & Hutchison, J. D. (2006). The mind does matter: Psychological and physical recovery after musculoskeletal trauma. *J Trauma*, *61*, 1408-1414.
6. Baranyi, A., Leithgob, O., Kreiner, B., Tanzer, K., Ehrlich, G., Hofer, H. P. et al. (2010). Relationship between posttraumatic stress disorder, quality of life, social support, and affective and dissociative status in severely injured accident victims 12 months after trauma. *Psychosomatics*, *51*(3), 237-247.
7. Michaels, A. J., Madey, S. M., Krieg, J. C., & Long, W. B. (2001). Traditional injury scoring underestimates the relative consequences of orthopedic injury. *J Trauma*, *50*, 389-395.
8. Bombardier, C. H., Fann, J. R., Temkin, N. R., Esselman, P. C., Barber, J., & Dikmen, S. S. (2010). Rates of major depressive disorder and clinical outcomes following traumatic brain injury. *JAMA*, *303*(19), 1938-1945.
9. Di, G. A. & Parry-Jones, W. L. (1996). Psychological sequelae of road traffic accidents: an inadequately addressed problem. *Br J Psychiatry*, *169*(4), 405-407.
10. Ward, C. L., Flisher, A. J., Zissis, C., Muller, M., & Lombard, C. (2001). Exposure to violence and its relationship to psychopathology in adolescents. *Inj Prev*, *7*(4), 297-301.
11. Hays, R. D., Sherbourne, C. D., & Mazel, R. M. (1993). The RAND 36-Item Health Survey 1.0. *Health Econ*, *2*(3), 217-227.
12. McHorney, C. A., Ware, J. E., Jr., & Raczek, A. E. (1993). The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*, *31*(3), 247-263.
13. Van der Zee KI, Sanderman. R. (2012) Het meten van de algemene gezondheidstoestand met de RAND-36. [Measuring health status with the RAND-36]. Rijksuniversiteit Groningen; 1993.



14. De Vries J. (2001). Quality of life assessment. (In Ad Vingerhoets (Ed.), *Assessment in behavioral medicine*. (pp. 353-370).: Hove: Psychology Press.)
15. (1995). The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. *Soc Sci Med*, 41(10), 1403-1409.
16. Hamming, J. F. & De Vries, J. (2007). Measuring quality of life. *Br J Surg*, 94(8), 923-924.
17. van Delft-Schreurs, C. C., van Bergen, J. J., de Jongh, M. A., van de Sande, P., Verhofstad, M. H., & De Vries, J. (2013). Quality of life in severely injured patients depends on psychosocial factors rather than on severity or type of injury. *Injury*, S0020-S1383.
18. Association for the Advancement of Automotive Medicine (AAAM). (1998) *The Abbreviated Injury Scale 1990 Revision - Update 98*.
19. Baker, S. P., O'Neill, B., Haddon, W., Jr., & Long, W. B. (1974). The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma*, 14, 187-196.
20. Baker, S. P., & O'Neill, B. (1976). The injury severity score: an update. *J Trauma*, 16, 882-885.
21. MacKenzie, E. J. (1984). Injury severity scales: overview and directions for future research. *Am J Emerg Med*, 2(6), 537-549.
22. Olthof, D. C., Luitse, J. S., de Groot, F. M., & Goslings, J. C. (2013). A Dutch regional trauma registry: quality check of the registered data. *BMJ Qual Saf*, 22(9), 752-8.
23. Boyd, C. R., Tolson, M. A., & Copes, W. S. (1987). Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. *J Trauma*, 27(4), 370-378.
24. Semmlow, J. L., & Cone, R. (1976). Utility of the injury severity score: a confirmation. *Health Serv Res*, 11(1), 45-52.
25. Snaith R.P., & Zigmond. A.S. (1994) Hospital Anxiety and Depression Scale (HADS) - experimentele Nederlandstalige versie ten behoeve van wetenschappelijk onderzoek.
26. Spinhoven, P., Ormel, J., Sloekers, P. P., Kempen, G. I., Speckens, A. E., & Van Hemert, A. M. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. *Psychol Med*, 27, 363-370.
27. Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatr Scand*, 67, 361-370.
28. Brom, D., & Kleber, R. J. (1985). De Schokverwerkingslijst. *Nederlands tijdschrift voor psychologie*, 40, 164-168.

29. van der Ploeg, E., Mooren, T. T., Kleber, R. J., van der Velden, P. G., & Brom, D. (2004). Construct validation of the Dutch version of the impact of event scale. *Psychol Assess*, *16*, 16-26.
30. Neal, L. A., Busuttill, W., Rollins, J., Herepath, R., Strike, P., & Turnbull, G. (1994). Convergent validity of measures of post-traumatic stress disorder in a mixed military and civilian population. *J Trauma Stress*, *7*, 447-455.
31. Broadbent, D. E., Cooper, P. F., FitzGerald, P., & Parkes, K. R. (1982). The Cognitive Failures Questionnaire (CFQ) and its correlates. *Br J Clin Psychol*, *21 (Pt 1)*, 1-16.
32. Bridger, R. S., Johnsen, S. A., & Brasher, K. (2013). Psychometric properties of the Cognitive Failures Questionnaire. *Ergonomics*, (Epub ahead of print)
33. Ponds R., van Boxtel, M., & Jolles J. (2006). De "Cognitive Failure Questionnaire" als maat voor subjectief cognitief functioneren. *Tijdschrift voor Neuropsychologie*, *2*, 37-45.
34. WHOQOL group. (1996) WHOQOL-Bref. Geneva, WHO.
35. De Vries, J. & Van Heck, G. L. (1996) De Nederlandse versie van de WHOQOL-Bref [The Dutch version of the WHOQOL-Bref]. Tilburg, Tilburg University.
36. O'Carroll, R. E., Smith, K., Couston, M., Cossar, J. A., Hayes, P. C. (2000). A comparison of the WHOQOL-100 and the WHOQOL-BREF in detecting change in quality of life following liver transplantation. *Qual Life Res*, *9*, 121-124.
37. Trompenaars, F. J., Masthoff, E. D., Van Heck, G. L., Hodiament, P. P., & De Vries J. (2005). Content validity, construct validity, and reliability of the WHOQOL-Bref in a population of Dutch adult psychiatric outpatients. *Qual Life Res*, *14*, 151-160.
38. De Vries J., & Van Heck G.L. (2003) Nederlandse handleiding van de WHOQOL. [Dutch manual of the WHOQOL].
39. Frommberger, U. H., Stieglitz, R. D., Nyberg, E., Schlickewei, W., Kuner, E., & Berger, M. (1998). Prediction of posttraumatic stress disorder by immediate reactions to trauma: a prospective study in road traffic accident victims. *Eur Arch Psychiatry Clin Neurosci*, *248(6)*, 316-321.
40. Yasan, A., Guzel, A., Tamam, Y., & Ozkan, M. (2009). Predictive factors for acute stress disorder and posttraumatic stress disorder after motor vehicle accidents. *Psychopathology*, *42(4)*, 236-241.
41. Ringdal, M., Plos, K., Lundberg, D., Johansson, L., & Bergbom, I. (2009). Outcome after injury: memories, health-related quality of life, anxiety, and symptoms of depression after intensive care. *J Trauma*, *66*, 1226-1233.
42. Schnyder, U., Moergeli, H., Trentz, O., Klaghofer, R., & Buddeberg, C. (2001). Prediction of psychiatric morbidity in severely injured accident victims at one-year follow-up. *Am J Respir Crit Care Med*, *164(4)*, 653-656.

43. Zeckey, C., Hildebrand, F., Pape, H. C., Mommsen, P., Panzica, M., Zelle, B. A. et al. (2011). Head injury in polytrauma-Is there an effect on outcome more than 10 years after the injury? *Brain Inj*, 25, 551-559.
44. Wallis, H., Renneberg, B., Ripper, S., Germann, G., Wind, G., & Jester, A. (2006). Emotional distress and psychosocial resources in patients recovering from severe burn injury. *J Burn Care Res*, 27(5), 734-741.
45. Holbrook, T. L. & Hoyt, D. B. (2004). The impact of major trauma: quality-of-life outcomes are worse in women than in men, independent of mechanism and injury severity. *J Trauma*, 56, 284-290.
46. Toien, K., Myhren, H., Bredal, I. S., Skogstad, L., Sandvik, L., & Ekeberg, O. (2010). Psychological distress after severe trauma: a prospective 1-year follow-up study of a trauma intensive care unit population. *J Trauma*, 69, 1552-1559.
47. Rivara, F. P., Jurkovich, G. J., Gurney, J. G., Seguin, D., Fligner, C. L., Ries, R. et al. (1993). The magnitude of acute and chronic alcohol abuse in trauma patients. *Arch Surg*, 128(8), 907-912.
48. Poole, G. V., Lewis, J. L., Devidas, M., Hauser, C. J., Martin, R. W., & Thomae, K. R. (1997). Psychopathologic risk factors for intentional and nonintentional injury. *J Trauma*, 42(4), 711-715.
49. Soderstrom, C. A., Smith, G. S., Dischinger, P. C., McDuff, D. R., Hebel, J. R., Gorelick, D. A. et al. (1997). Psychoactive substance use disorders among seriously injured trauma center patients. *JAMA*, 277(22), 1769-1774.
50. Michaels, A. J., Michaels, C. E., Smith, J. S., Moon, C. H., Peterson, C., & Long, W. B. (2000). Outcome from injury: general health, work status, and satisfaction 12 months after trauma. *J Trauma*, 48(5), 841-848.
51. Livingston, D. H., Tripp, T., Biggs, C., & Lavery, R. F. (2009). A fate worse than death? Long-term outcome of trauma patients admitted to the surgical intensive care unit. *J Trauma*, 67, 341-348.
52. Orwelius, L., Bergkvist, M., Nordlund, A., Simonsson, E., Nordlund, P., Backman, C. et al. (2012). Physical effects of the trauma and psychological consequences of preexisting diseases account for a significant portion of the health-related quality of life pattern of former trauma patients. *J Trauma*, 72(2), 504-512.
53. Haagsma, J. A., Polinder, S., Toet, H., Panneman, M., Havelaar, A. H., Bonsel, G. J. et al. (2011). Beyond the neglect of psychological consequences: post-traumatic stress disorder increases the non-fatal burden of injury by more than 50%. *Inj Prev*, 17(1), 21-26.