The relationship between physical and psychological complaints and quality of life in severely injured patients

van Delft-Schreurs, C.C.H.M.; van Son, M.A.C.; de Jongh, M.A.C.; Lansink, K.W.W.; de Vries, Jolanda; Verhofstad, M.H.J.

Published in:
Injury

DOI:
10.1016/j.injury.2017.05.007

Publication date:
2017

Document Version
Peer reviewed version

The relationship between physical and psychological complaints and quality of life in severely injured patients

C.C.H.M. van Delft-Schreurs MSc, Network Emergency Care Brabant, Elisabeth-TweeSteden Hospital

k.v.delft@nazb.nl

M.A.C. van Son PhD, The Netherlands Society of Occupational Medicine-Centre of Excellence

m.vanson@nvab-online.nl

M.A.C. de Jongh PhD, Network Emergency Care Brabant, Elisabeth-TweeSteden Hospital

m.d.jongh@nazb.nl

K.W.W. Lansink MSc, Department of Surgery, Elisabeth-TweeSteden Hospital &

Network Emergency Care Brabant

k.lansink@etz.nl

J. de Vries PhD, Department of Medical Psychology, Elisabeth-TweeSteden Hospital &

CoRPS, Department of Medical and Clinical Psychology, Tilburg University

j.devries@etz.nl

M.H.J. Verhofstad PhD, Department of Trauma Surgery, Erasmus Medical Centre, Rotterdam

m.verhofstad@erasmusmc.nl

Corresponding author

Ms. Katinka van Delft-Schreurs

Network Emergency Care Brabant, Elisabeth-TweeSteden Hospital, Tilburg
PO-Box 90151, 5000 LC Tilburg, The Netherlands
tel. +31 13 539 2934
e-mail: k.v.delft@nazb.nl

Abstract

Purpose: The purpose of this study was two-fold. The first goal was to investigate which variables were associated with the remaining physical limitations of severely injured patients after the initial rehabilitation phase. Second, we investigated whether physical limitations were attributable to the association between psychological complaints and quality of life in this patient group.

Methods: Patients who were 18 years or older and who had an injury severity score (ISS) > 15 completed a set of questionnaires at one time-point after their rehabilitation phase (15-53 months after their trauma). The Short Musculoskeletal Function Assessment (SMFA) questionnaire was used to determine physical limitations. The Hospital Anxiety and Depression Scale, the Dutch Impact of Event Scale and the Cognitive Failure Questionnaire were used to determine psychological complaints, and the World Health Organization Quality of Life assessment instrument-BREF was used to measure general Quality of Life (QOL).

Differences in physical limitations were investigated for several trauma- and patient-related variables using non-parametric independent-sample Mann-Whitney U tests. Multiple linear regression was performed to investigate whether the decreased QOL of severely injured patients with psychological complaints could be explained by their physical limitations.

Results: Older patients, patients with physical complaints before the injury, patients with higher ISS scores, and patients who had an injury of the spine or of the lower extremities reported significantly more physical problems. Additionally, patients with a low education level, patients who were living alone, and those who were unemployed reported significantly more long-term physical problems.

Severely injured patients without psychological complaints reported significantly less physical limitations than those with psychological complaints. The SMFA factor of Lower extremity dysfunction was a confounder of the association between psychological complaints and QOL in all QOL domains.

Conclusions: Long-term physical limitations were mainly reported by patients with psychological complaints. The decreased QOL of severely injured patients with psychological complaints can partially be explained by physical limitations, particularly those involving lower extremity function. Experienced physical limitations were significantly different for some trauma and patient characteristics. These characteristics may be used to select patients for whom a rehabilitation programme would be useful.

Keywords
Quality of life, injury, trauma, psychopathology, psychological problems, physical limitations.

Introduction

Survival from trauma has increased in recent decades.[1] Therefore, the focus is shifting from mortality to non-fatal outcome parameters, such as (health-related) quality of life ((HR)QOL). Previous studies showed that the (HR)QOL of severely injured patients is lower than that of the general population.[2-8] This decrease in (HR)QOL seems to depend on both psychological complaints and physical limitations, but few studies measured these three parameters within the same study population.

Severely injured patients can suffer from long-lasting physical disabilities.[9-12] A strong association was found between these physical limitations and (HR)QOL.[13-15] To improve the (HR)QOL of patients with physical limitations, it is important to gain more insight into factors that are associated with the long-lasting physical limitations of trauma survivors.

In addition, psychological problems in trauma survivors were shown to be an important and possibly underestimated factor for their decreased (HR)QOL.[16-20] It is known that traumatic experiences such as a life-threatening experience or a severe accident can cause psychological problems, such as anxiety, depression, or posttraumatic stress disorder (PTSD). The patients who develop these symptoms may be more bothered by similar physical complaints than the patients without psychological problems. An association between impaired functional outcome and post-traumatic psychological complaints has been described.[20-23] Therefore, psychological complaints may be caused by the physical sequelae of severely injured patients and cause a decreased QOL in trauma survivors as a result. However, as far as we know, this has not previously been investigated. Therefore, we assessed physical functioning, psychological complaints and QOL of severely injured patients after their rehabilitation phase. Strong correlations between psychological complaints and QOL and between physical limitations and QOL have already been determined in this study population.[13;18] The time between the trauma and the completion of the questionnaires neither significantly influenced the OQL nor the psychological complaints of this patient group.[18;24]

The first objective of this study was to examine the relationship between the physical functioning of severely injured patients after their first rehabilitation phase and injury- or patient-related factors. The second objective was to determine whether the decreased QOL associated with psychological complaints could be explained by the physical limitations of these patients. If their decreased QOL was mainly caused by psychological complaints, then psychological interventions would be a good foundation to improve the QOL of severely injured patients.

Patients and methods

Inclusion criteria and the methods for data collection are described briefly here because they have previously been extensively described.[18;24] Patients who were hospitalized because of a severe injury (ISS >15) were included in this cross-sectional study if they were 18 years of age or older, had a traceable home address, were able to complete a set of questionnaires in Dutch and were able to provide written informed consent. All questionnaires were completed at a single time-point. Demographic data, characteristics of the trauma, and medical data were extracted retrospectively from the Dutch trauma registry and from a general questionnaire. The Abbreviated Injury Scale (AIS) and the ISS were used to determine both the injured body area and the severity of the injuries.

QOL was measured with the Dutch version of the World Health Organization Quality of Life assessment instrument-BREF (WHOQOL-BREF).[25;26] This questionnaire consists of two questions on overall QOL and general health and questions within the four domains of Physical health (7 items), Psychological health (6 items), Social relationships (3 items), and the Environment (8 items). Raw domain scores within those four domains were transformed to a 4-20 score.[25] In each domain, higher scores indicate a higher QOL.

Dutch versions of the Hospital Anxiety and Depression Scale (HADS)[27;28], the Impact of Events Scale (IES)[29;30] and the Cognitive Failure Questionnaire (CFQ)[31] were used to assess psychological complaints. Patients were believed to suffer from psychological complaints if they had an HADS score $\geq$ 11 on at least one of the two subscales (Depression and Anxiety),[27] an IES score $\geq$ 35,[32] or a CFQ score $\geq$ 55.[33]

Functional limitations were assessed using the Dutch adaptation of the Short Musculoskeletal Function Assessment (SMFA) questionnaire.[34] This questionnaire was originally designed to measure functional status and HRQOL. The adapted Dutch version of the SMFA was found to be a valid measure in severely injured patients. A three-factor structure was found with the factors Upper extremity dysfunction, Lower extremity

dysfunction and Emotion.[13] The factors Upper and Lower extremity dysfunction mainly contain questions that ask the patients about their functional status. The questions in the factor Emotion are mainly focused on how much patients are debilitated by their physical limitations. In this study, only the scores of the factors Upper and Lower extremity dysfunction were considered, as the SMFA was used in this study to determine the functional limitations of the patients. For each factor, higher scores represent more physical limitations.

The SMFA scores of the severely injured patients were compared with the baseline scores of a reference group (i.e., 351 patients with a wrist or an ankle fracture who had clearly been instructed to provide their pre-injury scores shortly after their trauma).[35]

Statistical analysis

The scores of the SMFA factors Upper extremity dysfunction and Lower extremity dysfunction were not normally distributed. Therefore, nonparametric independent-sample Mann-Whitney U tests were used to investigate the difference in SMFA scores for several trauma- and patient-related variables and to compare the scores of the SMFA factors for patients with and without psychological complaints. In addition, the scores of the traumatized patients were compared with the baseline SMFA scores of a reference group.[35]

An association between psychological complaints and the QOL had previously been determined in our study population.[18] Because an association between physical complaints and QOL had also been found,[13] multiple linear regression analyses were performed to determine whether that association could partially be explained by the physical limitations of the patients. The missing SMFA scores were completely missing at random concerning age, gender, admission time and type and severity of injury. So, the regression analysis were run on the set of patients with full SMFA data (n=128), to ensure that all models are based on the same set of patients. The possible confounding effect of physical limitations in the association between psychological complaints and the QOL (WHOQOL-BREF score) of the patients was determined by

introducing the SMFA scores of the factors Upper and Lower extremity dysfunction in this model with psychopathological complaints and QOL. QOL was the dependent variable in this model. The physical limitations were assumed to be a confounder in a QOL domain if introduction of the variables Upper or Lower extremity dysfunction caused a substantial change (>10%) in the regression coefficient of psychological complaints. In addition, interaction terms were added to determine whether physical limitations were an effect modifier in the association between psychopathological complaints and QOL.

The time between the trauma and the completion of the questionnaires was added into this model to investigate whether there was a difference for the patients whose trauma had occurred further in the past.

The data were analysed using IBM SPSS statistics 19 software (SPSS Chicago, IL, USA; version 19.0). The significance level was $p<0.05$ for all the tests used.

Results

Patients

Patient characteristics have been described extensively elsewhere.[18;24] In sum, 173 severely injured patients (response rate 61%) returned the questionnaires. The mean time since the injury was 2.8 (SD 0.9) years. Most patients were males (69%), with a mean age of 46 (SD 19) years and a median ISS of 21 (interquartile range 17-27). The most common injury was intracranial injury (61%), and 86% of the patients had received ICU treatment (table 1).

Physical functioning

Almost 3 years after their trauma, severely injured patients reported significantly more physical limitations than a reference group (figure 1). The SMFA scores for Upper and Lower extremity dysfunction were significantly higher in patients with a higher ISS, in patients with spinal injury and in patients who could not return to work after their injury. Older patients, patients who were unemployed at the time of the injury, those who had physical complaints before the trauma, and those with a low education level ($p<0.001$ for both factors) also reported more physical complaints related to both Upper and Lower extremity dysfunction after the trauma. Patients who were living alone or who had a lower extremity injury denoted only significantly higher scores for the factor Lower extremity dysfunction. Patients for whom the trauma had occurred further in the past also reported significantly lower scores, indicating less complaints, for the factor Lower extremity dysfunction ($p=0.006$ for SMFA Lower extremity dysfunction; $p=0.151$ for SMFA Upper extremity dysfunction in a linear regression model). The results for the binominal variables are shown in table 1. Furthermore, the length of in-hospital stay was also significantly correlated with both Upper extremity dysfunction ($p<0.001$) and Lower extremity dysfunction ($p=0.004$).

Association between physical functioning and psychological complaints

The patient group with psychological complaints reported significantly higher SMFA scores, indicating more physical limitations, than those of the patient group without psychological complaints ($p<0.001$). The median values and quartiles are shown in table 2. The mean SMFA scores of patients without psychological complaints did not significantly differ from those of a reference group (Lower extremity dysfunction: $p=0.069$, Upper extremity dysfunction: $p=0.147$) (figure 1).

Association between physical functioning, psychological complaints and QOL

Introducing the factor Lower extremity dysfunction into a model with psychological complaints and QOL caused a substantial change (>10%) in the regression coefficient of the psychological complaints variable for all WHOQOL-BREF domains (table 3). Introducing the factor Upper extremity dysfunction instead of Lower extremity dysfunction changed this regression coefficient as well, but to a lesser extent. Adding the factor Upper extremity dysfunction to the model with the variables Lower extremity dysfunction and Psychological complaints did not alter the regression coefficient for the effect of psychological complaints on QOL (table 3). In all WHOQOL-BREF domains, neither the interaction term between psychological complaints and Upper extremity dysfunction nor the interaction term between psychological complaints and Lower extremity dysfunction was significant. These results did not depend on the time that had elapsed between the trauma and the completion of the questionnaires.

Discussion

The first objective of our study was to examine physical function among severely injured patients and its relationship with trauma-related and patient-related factors. In agreement with the results from former studies that described long-lasting physical limitations after a severe injury,[6;12;20] the severely injured patients in this study reported more physical limitations than a reference group. However, patients without psychological complaints did not report more physical complaints than a reference group. The observed increase in physical limitations seemed to be primarily reported by the severely injured patients who were suffering from psychological complaints. Previous studies also reported a relationship between posttraumatic psychological complaints and impaired functional outcome.[20;22;23]

In addition, older patients and patients with a higher ISS, a longer in-hospital stay, physical complaints before the trauma, or an injury of the spine or the lower extremities reported more physical limitations. Similar associations were found in a previous study, except for the association between ISS and physical limitations.[36] This may be due to different inclusion and exclusion criteria because MackKenzie et al. included less severely injured patients and excluded patients with severe brain injury in their study. Holtslag et al. also mentioned age, comorbidity, and spinal cord or extremity injury as predictors of long-term disability after major trauma.[37]

The association between physical limitations and employment or educational level is in agreement with previous studies, in which employment and educational level were important predictors of long-term functional problems after a severe injury.[38;39] Possibly, patients with a low education more often have a job that requests greater physical capacities, resulting in more physical complaints before the trauma. If there are physical sequelae of the injury, this may also cause more difficulties in returning to work or could even result in unemployment.

Although the improvement in physical functionality seems to occur mainly in the first year after the trauma,[40] Soberg et al. also found better physical function in the second year after the trauma compared with the first year.[12] In our study, we found a long-term positive effect of time on

Lower extremity dysfunction. In agreement with the results found in a previous study,[41] many patients reported no long-term problems in the function of their upper extremities. Most likely, the process of recovery from an injury to the upper extremities had already been completed when the questionnaires were completed.

In previous studies, brain injury was described as a predictor of disability.[37;39;41] In prior research, trends towards a difference in physical limitations between patients with and without brain injury and in the extent to which patients with and without brain injury seem to be debilitated by their limitations were found.[13] In addition, patients with both a brain injury and a moderate rating of disability reported a lower life satisfaction rating than patients with either a severe or mild disability rating.[42] In that context, it would have been relevant to perform subgroup analyses of patients with and without brain injury with respect to physical limitations and QOL. However, the patient numbers were insufficient to produce reliable and significant results. Therefore, a larger study would be advisable to facilitate subgroup analysis.

The second objective of this study was to determine whether an association between psychological complaints and QOL could be explained by the physical limitations of the patients. The association between psychological complaints and QOL was not different between patients with and without physical limitations, as no effect modification was found. Further, the variance of the decrease in QOL of patients with psychological complaints could partially be explained by their physical limitations, as physical limitations of both the upper and lower extremities were confounders in the association between psychological complaints and QOL. The confounding effect was larger for Lower extremity dysfunction than for Upper extremity dysfunction. This is probably due to a complete recovery of injuries to the upper extremities, given the large ceiling effect for the factor Upper extremity dysfunction. Stalp et al. also found more functional limitations for patients with injuries to the lower extremities two years after multiple blunt injuries.[9] Patients with an injury to the upper extremities needed a shorter rehabilitation phase to get

similar results in functionality than patients with injuries of comparable severity to the lower extremities. In addition, pain may be a relevant component in explaining the different effect of functional limitations in the upper and lower extremities. More than half of the patients reported that they still suffered from severe pain that persisted two years after their trauma.[15] Patients with lower limb injuries often have a larger quantity and more constant pain than patients with upper limb injuries. This would be reflected in more restricted function of the lower extremities, which results in restricted movement. This makes patients with lower limb injuries more dependent on others. Therefore, functional limitations of the lower extremities will have a larger impact on the social aspects of life than comparable complaints of the upper extremities. The above factors may result in a later and more difficult acceptance of sequelae for patients with injuries to the lower extremities.

It is still unclear how the association between physical limitations, psychological complaints and QOL operates and which comes first. Physical limitations might cause decreased QOL, but physical limitations may also cause psychological complaints and influence QOL indirectly. Moreover, patients with psychological complaints might suffer more from similar functional limitations or experience more physical limitations than patients without psychological complaints even though their objective physical abilities are similar. This should be further investigated.

Physical limitations might be more important for (HR)QOL directly after the trauma because patients and doctors are mainly working to achieve good physical recovery at that moment. Psychological factors may become more important later for some patients, when the patients realize that they will have to live with the sequelae of the trauma such as permanent impairment. Indeed, previous studies found that physical wellbeing was further decreased after the trauma than mental wellbeing[5;8] but that the overall decrease in HRQOL remained and primarily had a psychological basis.[5] Future studies should follow patients over time to determine how physical limitations and psychological complaints develop over time while investigating how these factors influence each other.

Multidisciplinary revalidation programmes are now mainly accessible for trauma survivors with a poor physical recovery. It should be explored whether not only patients with a low physical recovery but also patients for whom low QOL or psychological problems are expected could benefit from revalidation programmes. Several parameters that were associated with physical limitations are also associated with QOL, such as inability to return to work, physical complaints before the trauma, or low educational level. As described above, educational level and physical limitations may be related to return to work. Patients who cannot regain their previous job or become unemployed may experience lower QOL, but it is also possible that patients with decreased QOL need more time to return to work. Age and ISS were not related to QOL in our study population,[24] although older patients and more severely injured patients reported more physical limitations. Older patients may have accepted their physical limitations easier because they might be used to the expectation of physical limitations due to ageing. Very severely injured patients may accept their limitations easier, as they are mainly happy to still be alive. In addition, the process of acceptance may start earlier if it is immediately evident that previous activity levels will not be regained.

The physical limitations themselves seem less important for QOL than the extent to which patients are bothered by them.[13] Therefore, it might be worthwhile to help patients to accept their limitations and to try to decrease the extent to which they are bothered by their experienced limitations. This might be possible by focusing on the patients' capacities instead of their limitations during the revalidation process. This kind of assistance may particularly be helpful for patients with characteristics such as psychological complaints, comorbidities, low education and lack of employment.

Some limitations of this study should be mentioned. Selection bias cannot be excluded, as the response rate was 61%. However, the groups of respondents and non-respondents were comparable, except for a slight overrepresentation of women in the respondent group. Although QOL and

physical limitations were not found to be gender-dependent, women reported psychological complaints more often than men in our study population. In addition, recall bias may have influenced the results because the condition of the patients before their trauma can only be determined retrospectively in trauma care studies.

Furthermore, the SMFA Upper extremity dysfunction value could not be determined for all patients because some patients did not complete all questions of the questionnaire. We assume that some of those patients accidentally did not receive the last page of the questionnaire because 12 patients did not return this page. Therefore, the responses to the last ten questions of the SMFA were missing for those patients. We assume that the missing values did not influence the outcomes of our study, as the missing responses were randomly spread among the study population. None of the questions of the last page were incorporated in the factor Upper extremity dysfunction, and only two of these questions were incorporated in the factor Lower extremity dysfunction.

Because of the cross-sectional design of the study, it was impossible to investigate the exact interaction between physical limitations, psychological complaints and QOL or to determine which one preceded the others. In addition, the number of patients was insufficient to perform subgroup analyses according to the type of conditions (e.g., brain injury or extremity injury). Therefore, it would be advisable to perform larger prospective follow-up studies in the future.

Conclusions

Approximately 3 years after a severe injury, physical limitations were mainly reported by patients with psychological complaints. Physical limitations seem to be important in the association between psychological complaints and QOL. In the longer term, functional limitations of the lower extremities seem to be particularly relevant. However, it is unclear how the interaction between physical limitations, psychological complaints and QOL operates and which one precedes the others. For treatment purposes, the development of this association should be further investigated in larger, longitudinal follow-up studies in the future. Furthermore, several patient- and injury-related characteristics that were associated with QOL were also associated with physical limitations (e.g., physical complaints before the injury, education level and employment status). Such parameters may be used to select patients for whom a multidisciplinary rehabilitation programme would be useful.

Figure 1

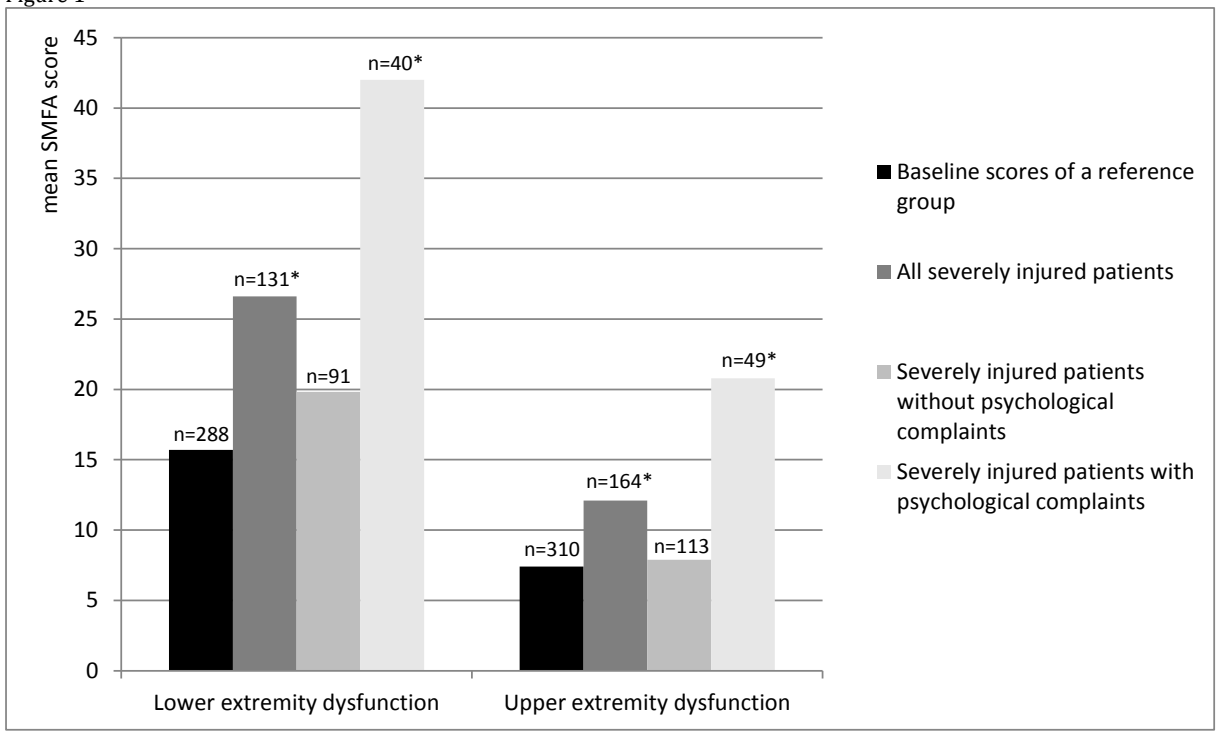
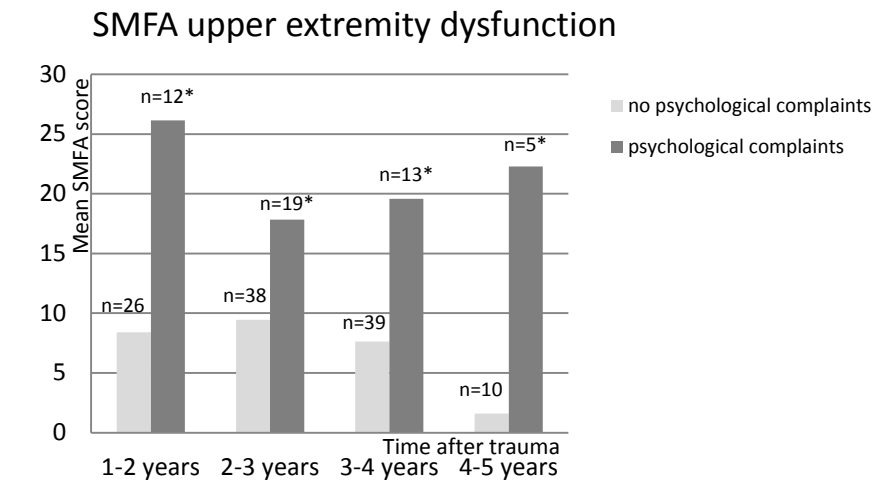


Figure 1: Mean SMFA scores of the factors Upper extremity dysfunction and Lower extremity dysfunction in severely injured patients with and without psychological problems compared with a reference group of the general Dutch population.
* (non-parametric Mann-Whitney test); $p < 0.001$.

Figure 2



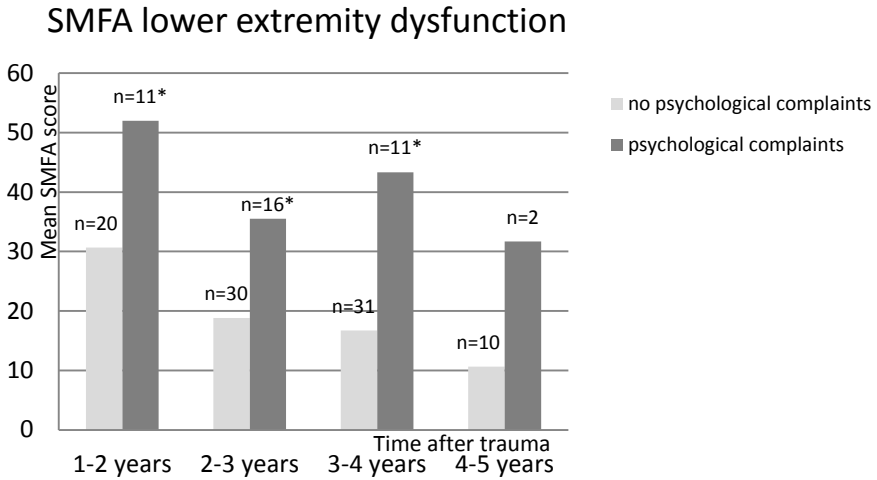


Figure 2: Comparison of mean SMFA scores of the factors Upper extremity dysfunction and Lower extremity dysfunction in severely injured patients with and without psychological problems for four groups of patients with a different time that elapsed between their trauma and the completion of the questionnaires.
* (non-parametric Mann-Whitney test); $p < 0.001$ in the comparison between patients with and without psychological problems.

Table 1: Patient characteristics, WHOQOL-BREF scores (N; mean (SD)) for all domains and SMFA scores (N; median (min, max)) for the SMFA factors Upper extremity dysfunction and Lower extremity dysfunction in severely injured patients.

			Patient characteristics N (%)	WHOQOL general (N; mean (SD)	WHOQOL Physical (N; mean (SD)	WHOQOL Psychological (N; mean (SD)	WHOQOL Social (N; mean (SD)	WHOQOL Environment (N; mean (SD)	Upper extremity dysfunction (N; median (min, max)	Lower extremity dysfunction (N; median (min, max)
Age	< 55		111 (64)	108; 7,0 (1,9)	107; 14,0 (3,8)	109; 13,8 (3,3)	109; 14,5 (3,6)	109; 14,7 (3,0)	106; 1.1 (0-86,4)	91; 16.7 (0-83,3)
	>= 55		62 (36)	57; 7,4 (1,4)	58; 14,6 (3,1)	58; 14,5 (2,5)	58; 15,4 (2,1)*	58; 15,9 (2,3)*	58; 6.8 (0-100) *	40; 26.7 (0-93,3)*
Gender	Male		120 (69)	114; 7,2 (1,7)	115; 14,4 (3,5)	115; 14,3 (3,0)	115; 14,7 (3,0)	115; 15,1 (2,7)	115; 2.3 (0-100)	90; 17.5 (0-93,3)
	Female		53 (31)	51; 7,0 (1,9)	50; 13,7 (3,6)	52; 13,6 (3,1)	52; 15,1 (3,6)	52; 15,3 (3,0)	49; 4.5 (0-65,9)	41; 21.7 (0-83,3)
Household composition	Alone		40 (23)	39; 6,4 (2,0) *	39; 12,9 (3,7) *	39; 13,1 (3,2) *	39; 13,6 (3,8) *	39; 14,1 (2,9) *	38; 3.4 (0-86,4)	27; 26.7 (1,7-93,3)*
	Together		131 (76)	125; 7,4 (1,6)	125; 14,6 (3,4)	127; 14,4 (2,9)	127; 15,3 (2,8)*	127; 15,5 (2,7)	126; 2.3 (0-100)	104; 15 (0-90)
Employed at the time of injury	Yes		113 (65)	110; 7,2 (1,8)	110; 14,3 (3,5)	112; 14,1 (3,0)	112; 14,8 (3,1)	112; 15,0 (2,9)	108; 2.3 (0-100)	89; 15 (0-90)*
	No		60 (35)	55; 7,0 (1,8)	55; 14,0 (3,6)	55; 14,0 (3,2)	55; 14,9 (3,2)	55; 15,4 (2,7)	56; 4.5 (0-90,9)	42; 26.7 (0-93,3)
Returned to work after injury	Yes		54 (31)	53; 7,9 (1,1)**	53; 16,3 (2,5)**	54; 15,3 (2,3)**	54; 15,5 (2,4)*	54; 16,2 (2,3)**	54; 0 (0-34,1)**	45; 5 (0-61,7)**
	No		55 (32)	53; 6,5 (2,0)	53; 12,6 (3,3)	54; 12,9 (3,2)	54; 14,2 (3,7)	54; 13,9 (2,9)	50; 11.4 (0-100)	42; 33.3 (0-90)
ISS	16-25		97 (56)	90; 7,1 (1,8)	91; 14,2 (3,4)	92; 14,0 (2,9)	92; 14,8 (2,9)	92; 15,1 (2,8)	91; 2.3 (0-100)	74; 13.3 (0-90)
	>= 25		76 (44)	75; 7,2 (1,8)	74; 14,2 (3,7)	75; 14,1 (3,1)	75; 14,9 (3,4)	75; 15,2 (2,9)	73; 4.5 (0-90,9)*	57; 26.7 (0-93,3)*
AIS region	Head	Yes	131 (76)	123; 7,0 (1,8)	123; 14,1 (3,4)	125; 13,9 (3,0)	125; 14,5 (3,3)*	125; 15,0 (2,8)	123; 2.3 (0-90,9)	101; 20 (0-86,7)
		No	42 (24)	42; 7,4 (1,7)	42; 14,4 (4,0)	42; 14,6 (3,0)	42; 15,8 (2,4)	42; 15,4 (2,7)	41; 4.5 (0-100)	30; 22.5 (0-93,3)
	Face	Yes	46 (27)	44; 6,9 (1,7)	44; 13,7 (3,8)	45; 13,5 (3,0)	45; 14,5 (3,0)	45; 14,8 (2,7)	43; 0 (0-70,5)	37; 20 (0-86,7)
		No	127 (73)	121; 7,2 (1,8)	121; 14,4 (3,4)	122; 14,3 (3,0)	122; 15,0 (3,2)	122; 15,3 (2,9)	121; 2.3 (0-100)	94; 20 (0-93,3)
	Thorax	Yes	71 (41)	69; 7,2 (1,7)	68; 14,5 (3,6)	70; 14,3 (3,0)	70; 15,2 (3,2)	70; 15,7 (2,5)*	67; 4.5 (0-86,4)	51; 16.7 (0-86,7)
		No	102 (59)	96; 7,0 (1,8)	97; 14,0 (3,5)	97; 13,9 (3,0)	97; 14,6 (3,2)	97; 14,7 (3,0)	97; 2.3 (0-100)	80; 20.8 (0-93,3)
	Abdomen	Yes	30 (17)	29; 7,3 (1,8)	30; 14,9 (4,0)	30; 14,6 (3,3)	30; 15,1 (3,7)	30; 15,6 (2,9)	30; 1.1 (0-45,5)	26; 7.5 (0-78,3)
		No	143 (83)	136; 7,1 (1,8)	135; 14,0 (3,4)	137; 13,9 (3,0)	137; 14,8 (3,0)	137; 15,0 (2,8)	134; 2.3 (0-100)	105; 21.7 (0-93,3)
	Spine	Yes	38 (22)	38; 6,9 (1,8)	37; 13,3 (3,6)	38; 13,7 (2,7)	38; 14,9 (2,8)	38; 14,2 (2,5)*	35; 6.8 (0-100)*	26; 33.3 (1,7-93,3)*
		No	135 (78)	127; 7,2 (1,8)	128; 14,4 (3,5)	129; 14,2 (3,1)	129; 14,8 (3,3)	129; 15,4 (2,8)	129; 2.3 (0-77,3)	105; 18.3 (0-86,7)
	Upper extremity	Yes	53 (31)	50; 7,0 (1,8)	48; 13,9 (3,5)	50; 13,7 (3,3)	50; 15,1 (3,3)	50; 14,7 (2,9)	50; 4.5 (0-86,4)	40; 24.2 (0-86,7)
		No	120 (69)	115; 7,2 (1,8)	117; 14,3 (3,6)	117; 14,2 (2,9)	117; 14,8 (3,1)	117; 15,3 (2,8)	114; 2.3 (0-100)	91; 20 (0-93,3)
	Lower extremity	Yes	53 (31)	49; 6,9 (1,8)	48; 14,0 (3,7)	50; 13,9 (3,1)	50; 15,0 (3,3)	50; 15,1 (3,0)	49; 2.3 (0-70,5)	38; 32.5 (0-86,7)*
		No	120 (69)	116; 7,2 (1,8)	117; 14,3 (3,5)	117; 14,1 (3,0)	117; 14,8 (3,1)	117; 15,2 (2,7)	115; 2.3 (0-100)	93; 15 (0-93,3)
Physical disorders before injury	Yes		43 (25)	42; 6,7 (2,0)	42; 12,9 (3,4)*	42; 13,6 (3,2)	42; 14,2 (3,3)	42; 14,4 (2,7)	40; 19.3 (0-90,9)**	28; 55.8 (0-93,3)**
	No		129 (75)	122; 7,2 (1,7)	122; 14,6 (3,5)	124; 14,2 (3,0)	124; 15,1 (3,1)	124; 15,4 (2,8)	124; 0 (0-100)	103; 13.3 (0-76,7)
Mental treatment before injury	Yes		16 (10)	16; 6,1 (2,6)*	16; 12,4 (4,5)*	16; 11,5 (4,0)*	16; 13,7 (4,5)	16; 13,8 (4,1)	14; 3.4 (0-65,9)	12; 37.5 (0-83,3)
	No		156 (90)	149; 7,2 (1,6)	149; 14,4 (3,4)	151; 14,3 (2,8)	151; 15,0 (3,0)	151; 15,3 (2,6)	149; 2.3 (0-100)	119; 20 (0-93,3)
Received ICU treatment	Yes		148 (86)	143; 7,1 (1,8)	143; 14,2 (3,6)	145; 14,0 (3,1)	145; 14,9 (3,1)	145; 15,1 (2,9)	141; 2.3 (0-100)	112; 20.8 (0-93,3)
	No		25 (14)	22; 7,4 (1,7)	22; 14,2 (3,2)	22; 14,2 (2,5)	22; 14,7 (3,5)	22; 15,4 (2,4)	23; 2.3 (0-65,9)	19; 15 (0-61,7)

* $p < 0.05$; ** $p < 0.001$ in nonparametric independent-samples Mann-Whitney U tests for SMFA scores and in independent Student's t-tests for WHOQOL-BREF scores.

Table 2: SMFA scores for both Upper extremity dysfunction and Lower extremity dysfunction were significantly decreased in severely injured patients with psychological complaints compared to patients without psychological complaints. The median values and first and third quartiles are presented.

	Upper extremity dysfunction	Lower extremity dysfunction
With psychological complaints	15.9 (2.3-31.8)* n=49	36.7 (21.7-62.1)* n=40
Without psychological complaints	0.0 (0.0-6.8) n=113	10.0 (3.3-30.0) n=91

Non-parametric Mann-Whitney test; * $p<0.001$ compared with patients without psychological complaints.

Table 3: Results from the multiple linear regression analysis of severely injured patients with complaints for quality of life, adjusted for physical limitations.

	WHOQOL-BREF General n=126	WHOQOL-BREF physical n=127	WHOQOL-BREF psychological n=128	WHOQOL-BREF social n=128	WHOQOL-BREF environmental n=128
Psychological complaints present	-1.9 (-2.5 to -1.3) p<0.001 R^2=.234	-4.1 (-5.3 to -2.9) p<0.001 R^2=0.279	-4.1 (-5.0 to -3.1) p<0.001 R^2=0.376	-2.1 (-3.3 to -0.9) p=0.001 R^2=0.091	-3.1 (-4.0 to -2.1) p<0.001 R^2=0.239
Psychological complaints present, adjusting for the following factors:					
SMFA Lower extremity dysfunction	-1.3 (-1.9 to -0.7)* p<0.001 R^2=0.333	-2.3 (-3.4 to -1.3)* p<0.001 R^2=0.521	-3.2 (-4.2 to -2.3)* p<0.001 R^2=0.440	-1.4 (-2.7 to -0.2)* p=0.028 R^2=0.132	-2.0 (-3.0 to -1.0)* p<0.001 R^2=0.363
SFMA Upper extremity dysfunction	-1.7 (-2.3 to -1.0)* p<0.001 R^2=0.256	-3.3 (-4.5 to -2.2)* p<0.001 R^2=0.355	-3.8 (-4.8 to -2.8) p<0.001 R^2=0.390	-1.8 (-3.0 to -0.5) P=0.006 R^2=0.109	-2.5 (-3.5 to -1.6)* p<0.001 R^2=0.291
SMFA Upper extremity dysfunction and SMFA Lower extremity dysfunction	-1.3 (-1.9 to -0.7) P<0.001 R^2=0.342	-2.3 (-3.4 to -1.3) P<0.001 R^2=0.530	-3.3 (-4.3 to -2.3) P<0.001 R^2=0.447	-1.4 (-2.7 to -0.2) P=0.028 R^2=0.133	-2.0 (-3.0 to -1.0) P<0.001 R^2=0.364

Beta and 95% confidence intervals, p-values and R^2 values for the unstandardized regression coefficients from a linear regression model are shown.
R^2 (= variance explained by variables)
* Confounding. The variables SMFA Lower extremity dysfunction and SFMA Upper extremity dysfunction were adjusted to a simple linear regression model with psychological complaints and the dependent variable QOL in the different QOL domains. Confounding is based on a 10% change of the regression coefficient (Beta) of psychological complaints in this model. Upper extremity dysfunction and Lower extremity dysfunction were both confounders in this model if they were adjusted. Adjustment of both variables did not change the model that had only been corrected for Lower extremity dysfunction.

Reference List

(1) van Beeck EF, Looman CW, Mackenbach JP. Mortality due to unintentional injuries in The Netherlands, 1950-1995. *Public Health Rep* 1998; 113(5):427-439.

(2) Sampalis JS, Liberman M, Davis L, Angelopoulos J, Longo N, Joch M et al. Functional status and quality of life in survivors of injury treated at tertiary trauma centers: what are we neglecting? *J Trauma* 2006; 60(4):806-813.

(3) Polinder S, Haagsma JA, Belt E, Lyons RA, Erasmus V, Lund J et al. A systematic review of studies measuring health-related quality of life of general injury populations. *BMC Public Health* 2010; 10:783.

(4) Toien K, Bredal IS, Skogstad L, Myhren H, Ekeberg O. Health related quality of life in trauma patients. Data from a one-year follow up study compared with the general population. *Scand J Trauma Resusc Emerg Med* 2011; 19:22.

(5) Orwelius L, Bergkvist M, Nordlund A, Simonsson E, Nordlund P, Backman C et al. 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* 2011.

(6) Ringburg AN, Polinder S, van Ierland MC, Steyerberg EW, van Lieshout EM, Patka P et al. Prevalence and Prognostic Factors of Disability After Major Trauma. *J Trauma* 2010.

(7) Kiely JM, Brasel KJ, Weidner KL, Guse CE, Weigelt JA. Predicting quality of life six months after traumatic injury. *J Trauma* 2006; 61(4):791-798.

(8) Christensen MC, Banner C, Lefering R, Vallejo-Torres L, Morris S. Quality of life after severe trauma: results from the global trauma trial with recombinant Factor VII. *J Trauma* 2011; 70(6):1524-1531.

(9) Stalp M, Koch C, Ruchholtz S, Regel G, Panzica M, Krettek C et al. Standardized outcome evaluation after blunt multiple injuries by scoring systems: a clinical follow-up investigation 2 years after injury. *J Trauma* 2002; 52(6):1160-1168.

(10) Kaske S, Lefering R, Trentzsch H, Driessen A, Bouillon B, Maegele M et al. Quality of life two years after severe trauma: a single-centre evaluation. *Injury* 2014; 45 Suppl 3:S100-S105.

(11) Airey CM, Chell SM, Rigby AS, Tennant A, Connelly JB. The epidemiology of disability and occupation handicap resulting from major traumatic injury. *Disabil Rehabil* 2001; 23(12):509-515.

(12) Soberg HL, Bautz-Holter E, Roise O, Finset A. Long-term multidimensional functional consequences of severe multiple injuries two years after trauma: a prospective longitudinal cohort study. *J Trauma* 2007; 62(2):461-470.

(13) van Delft-Schreurs CC, Van Son MA, de Jongh MA, Gosens T, Verhofstad MH, De Vries J. Psychometric properties of the Dutch Short Musculoskeletal Function Assessment (SMFA) questionnaire in severely injured patients. *Injury* 2016; 47(9):2034-2040.

(14) O'Donnell ML, Creamer M, Elliott P, Atkin C, Kossmann T. Determinants of quality of life and role-related disability after injury: impact of acute psychological responses. *J Trauma* 2005; 59(6):1328-1334.

(15) Kaske S, Lefering R, Bouillon B, Maegele M, Driessen A, Probst C et al. Pain assessment of severely injured patients 2 years after trauma. *Schmerz* 2016; 30(3):273-278.

(16) Holbrook TL, Anderson JP, Sieber WJ, Browner D, Hoyt DB. Outcome after major trauma: 12-month and 18-month follow-up results from the Trauma Recovery Project. *J Trauma* 1999; 46(5):765-771.

(17) Haagsma JA, Polinder S, Toet H, Panneman M, Havelaar AH, Bonsel GJ et al. Beyond the neglect of psychological consequences: post-traumatic stress disorder increases the non-fatal burden of injury by more than 50%. *Inj Prev* 2011; 17(1):21-26.

(18) van Delft-Schreurs CC, van Bergen JJ, van de Sande P, Verhofstad MH, De Vries J, de Jongh MA. A cross-sectional study of psychological complaints and quality of life in severely injured patients. *Qual Life Res* 2014; 23(4):1353-1362.

(19) Soberg HL, Bautz-Holter E, Roise O, Finset A. Mental health and posttraumatic stress symptoms 2 years after severe multiple trauma: self-reported disability and psychosocial functioning. *Arch Phys Med Rehabil* 2010; 91(3):481-488.

(20) O'Donnell ML, Varker T, Holmes AC, Ellen S, Wade D, Creamer M et al. Disability after injury: the cumulative burden of physical and mental health. *J Clin Psychiatry* 2013; 74(2):e137-e143.

(21) Holbrook TL, Hoyt DB, Anderson JP, Hollingsworth-Fridlund P, Shackford SR. Functional limitation after major trauma: a more sensitive assessment using the Quality of Well-being scale--the trauma recovery pilot project. *J Trauma* 1994; 36(1):74-78.

(22) Sutherland AG, Alexander DA, Hutchison JD. The mind does matter: Psychological and physical recovery after musculoskeletal trauma. *J Trauma* 2006; 61(6):1408-1414.

(23) O'Donnell ML, Holmes AC, Creamer MC, Ellen S, Judson R, McFarlane AC et al. The role of post-traumatic stress disorder and depression in predicting disability after injury. *Med J Aust* 2009; 190(7 Suppl):S71-S74.

(24) van Delft-Schreurs CC, van Bergen JJ, de Jongh MA, van de Sande P, Verhofstad MH, De Vries J. Quality of life in severely injured patients depends on psychosocial factors rather than on severity or type of injury. *Injury* 2014; 45(1):320-326.

(25) WHOQOL group. WHOQOL-Bref. 1996. Geneva, WHO.

(26) Vries de J, van Heck GL. De Nederlandse versie van de WHOQOL-Bref [The Dutch version of the WHOQOL-Bref]. 1996. Tilburg, Tilburg University.

(27) Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; 67(6):361-370.

(28) Zigmond AS, Snaith RP. Hospital Anxiety and Depression Scale (HADS) - experimentele Nederlandstalige versie ten behoeve van wetenschappelijk onderzoek. 1994.

(29) van der Ploeg E, Mooren TT, Kleber RJ, van der Velden PG, Brom D. Construct validation of the Dutch version of the impact of event scale. *Psychol Assess* 2004; 16(1):16-26.

(30) Brom D, Kleber RJ. De Schokverwerkingslijst. *Nederlands tijdschrift voor psychologie* 1985; 40:164-168.

(31) Broadbent DE, Cooper PF, FitzGerald P, Parkes KR. The Cognitive Failures Questionnaire (CFQ) and its correlates. *Br J Clin Psychol* 1982; 21 (Pt 1):1-16.

(32) Neal LA, Busuttil W, Rollins J, Herepath R, Strike P, Turnbull G. Convergent validity of measures of post-traumatic stress disorder in a mixed military and civilian population. *J Trauma Stress* 1994; 7(3):447-455.

(33) Ponds R., van Boxtel HW, Jolles J. De "Cognitive Failure Questionnaire" als maat voor subjectief cognitief functioneren. *Tijdschrift voor Neuropsychologie* 2006; 2:37-45.

(34) Swiontkowski MF, Engelberg R, Martin DP, Agel J. Short musculoskeletal function assessment questionnaire: validity, reliability, and responsiveness. *J Bone Joint Surg Am* 1999; 81(9):1245-1260.

(35) Van Son MA, Den Oudsten BL, Roukema JA, Gosens T, Verhofstad MH, De Vries J. Psychometric properties of the Dutch Short Musculoskeletal Function Assessment (SMFA) questionnaire in patients with a fracture of the upper or lower extremity. *Qual Life Res* 2014; 23(3):917-926.

(36) MacKenzie EJ, Shapiro S, Moody M, Siegel JH, Smith RT. Predicting posttrauma functional disability for individuals without severe brain injury. *Med Care* 1986; 24(5):377-387.

(37) Holtslag HR, Post MW, Lindeman E, Van der Werken C. Long-term functional health status of severely injured patients. *Injury* 2007; 38(3):280-289.

(38) Holtslag HR, van Beeck EF, Lindeman E, Leenen LP. Determinants of long-term functional consequences after major trauma. *J Trauma* 2007; 62(4):919-927.

(39) Connelly J, Chell S, Tennant A, Rigby AS, Airey CM. Modelling 5-year functional outcome in a major traumatic injury survivor cohort. *Disabil Rehabil* 2006; 28(10):629-636.

(40) Gabbe BJ, Simpson PM, Sutherland AM, Wolfe R, Lyons RA, Cameron PA. Evaluating time points for measuring recovery after major trauma in adults. *Ann Surg* 2013; 257(1):166-172.

(41) Regel G, Seekamp A, Takacs J, Bauch S, Sturm JA, Tscherne H. [Rehabilitation and reintegration of polytraumatized patients]. *Unfallchirurg* 1993; 96(7):341-349.

(42) Mailhan L, Azouvi P, Dazord A. Life satisfaction and disability after severe traumatic brain injury. *Brain Inj* 2005; 19(4):227-238.