Prevalence and Prognostic Factors of Disability After Major Trauma

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Abstract

Background: The primary aim of this study was to assess the health-related quality of life of survivors of severe trauma 1 year after injury, specified according to all the separate dimensions of the EuroQol-5D (EQ-5D) and the Health Utilities Index (HUI).

Methods: A prospective cohort study was conducted in which all severely injured trauma patients presented at a Level I trauma center were included. After 12 months, the EQ-5D, HUI2 and HUI3 were used to analyze the health status.

Results: Follow-up assessments were obtained from 246 patients (response rate, 68%). The overall population EQ-5D (median) utility score was 0.73 (EQ-5D Dutch general population norm, 0.88). HUI2, HUI3, and EQ-5D Visual Analog Scale scores were 0.81, 0.65, and 70, respectively. Eighteen percent had at least one functional limitation 1 year after trauma, and 60% reported functional limitations on two or more domains using the EQ-5D. The female gender and comorbidity were significant independent predictors of disability.

Conclusion: Functional outcome and quality of life of survivors of severe injury have not returned to normal 1 year after trauma. The prevalence of specific limitations in this population is very high (40–70%). Female gender and comorbidity are predictors of long-term disability.

Key Words: Health-related quality of life, Outcome studies, Disability, EQ-5D, HUI.

Introduction

Major trauma can be defined as an injury with an Injury Severity Score (ISS) of at least 16 or higher (1). Major trauma is known to have a massive impact on both individual and community health: In the Netherlands, it has been shown that injuries of such a high level of severity lead on average to 25 years of healthy life lost per injured patient. Severely injured patients make an equal or higher contribution to the burden of disease compared to cerebrovascular accidents, chronic obstructive pulmonary disease or diabetes and depression (2).

Major trauma has such a large impact, because of the relatively young age of the average severely injured patient. The negative consequences of their trauma are often diverse and substantial. Under the age of 45 years, traumatic injuries are the leading cause of death world wide (3). In the long term, most survivors of major trauma still suffer from one or more permanent functional consequences. This has a negative impact on their health-related quality of life (HRQoL), which will remains far below the general population norms (2, 4, 5).

This considerable burden of mortality and disability resulting from major trauma needs to be addressed. Over the past decades, injury prevention has been very successful, but seems now facing its limits in the industrialized world (6). Therefore, advances in trauma care are complementary to injury prevention and are becoming increasingly important (7).

The implementation of regionalized trauma systems and designated trauma centers has shown to improve survival rates of major trauma patients in particular (8-13). Little is known, however, on the effects of advances in trauma care on HRQoL of major trauma survivors.

For major illnesses, improved health care has reduced mortality rates but has also resulted in a substantial increase in the burden of chronic disease. It has been shown, for example, that a sharp reduction in the case fatality rate of acute myocardial infarction has led to increasing numbers of patients with chronic heart failure and an increasing demand on health care (14-

17). Whether advances in trauma care lead to similar increases in chronic health consequences or have a net beneficial effect on HRQoL instead has not yet been studied.

Prehospital trauma care, the first link in the complex chain of trauma patient care, was upgraded in the Netherlands in 1995, when physician staffed HEMS were introduced in addition to nurse staffed Emergency Medical Services (EMS). Since then the Netherlands have a system of standard nurse staffed EMS and additional physician staffed HEMS. Because of logistic and topographical reasons HEMS in the Netherlands are primarily used to transport a physician to the scene of an accident. In only 5 % of all dispatches patients are transported by helicopter to a hospital. The presence of a physician significantly expands the scope of therapeutical options (i.e., invasive interventions or rapid sequence intubation) and experience at the scene of an accident. After introduction of HEMS in The Netherlands, a mortality reduction was observed for a subgroup of patients with major trauma in some studies (18, 19).

The aims of this study was to assess the health related quality of life of survivors of severe trauma, and to investigate a possible association with the type of prehospital care (HEMS assisted versus EMS assisted).

Methods

Study population and design

From January 2004 till July 2006, a prospective cohort study was conducted, including all consecutive poly-trauma patients with an Injury Severity Score (ISS)(1) of 16 or higher and older than 14 years, that were presented to the emergency department of a level I trauma centre in a Dutch trauma region serving 4.9 million inhabitants. Patients that were pronounced Dead On Arrival (DOA) at the accident scene were excluded. For the purpose of this study a Hospital Trauma Registry was started that documented the same variables as the Major Trauma Outcome Study database (20) (i.e., Age, Glasgow Coma Scale (21), Revised Trauma Score (22), Mechanism Of Injury, and injury specifics). Missing data were obtained from the original ambulance charts.

Outcome assessment

The EuroQol-5D (EQ-5D) and Health Utilities Index (HUI2 and HUI3) were used as generic measures to determine the HRQoL. The combination of the EQ-5D with the HUI3 is in accordance with international guidelines for conducting follow-up studies measuring injury-related disability (23). The EQ-5D and HUI are complementary with respect to the domains of the International Classification of Disabilities, Functioning and health (ICF) stated by the World Health Organization (24).

The generic EQ-5D classification of health (25) covers the main health domains that are affected by injury, with particular focus on the participation level of the ICF. It allows for a proper description of a heterogeneous injury population and for discrimination among specific injuries (26). Moreover, the EQ-5D has been recommended for (economic) evaluation of trauma care at a consensus conference (27). In this classification, health is defined along five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each dimension has three levels: no problem, moderate problem, and severe problem. Subsequently, a domain-related scoring algorithm based on empiric valuations from the U.K. general population and subsequent statistical modelling is available by which each health status description can be expressed into a utility score (EQ-5D) (28). This summary score ranges from 1 for perfect health to 0 for death, and can be interpreted as a judgment on the relative desirability of a health status compared with perfect health.

The second part of the EQ-5D consists of a vertical Visual Analogue Scale (VAS). This calibrated scale is marked 100 at the top, labelled *best imaginable health state* and 0 at the bottom, labelled *worst imaginable health state* (25).

The HUI is a self-administered health-status questionnaire consisting of 15 questions, which classifies respondents into either the HUI Mark 2 (HUI2) or HUI Mark 3 (HUI3) health states (29). It covers the main health domains that are affected by injury, with particular focus on functional capacities. Results of the questionnaire are converted by an algorithm, into the levels of the complementary HUI 2 and HUI 3 classification system (30), in order to form 7- and 8-element health-state vectors, respectively. From these vectors, single-attribute and overall health-state utility scores are calculated using the respective HUI2 and HUI3 utility functions (31), with preferences derived from the general public.

At twelve months after trauma admission all included patients received the written questionnaire by mail. In absence of response patients received a phone call one month after the mailing in order to stimulate participation and increase the response rate.

Socio-demographic, injury, and health care related characteristics

From the literature, potential determinants of functional outcome were identified (32-34). These determinants of functional outcome were grouped into socio-demographic (age and gender, education level, household composition, and co-morbidity), injury (ISS, Revised

Trauma Score (RTS), and injury location), and health care related characteristics (HEMS or EMS service). Education was divided into primary school level or higher, household composition into households existing of a single person or more persons, and co-morbidity was divided into a group without a co-morbidity, a group with only one co-morbidity and a group with two or more co-morbidities. A co-morbidity condition was defined as a previous disease at the time of trauma according to the patient or the family

The injury diagnosis was verified at the individual level with information from the hospital discharge register according to the *Abbreviated Injury Scale, 1990 Revision, update 1998*(35). Patients treated by nurse-staffed Emergency Medical Services only were included in the EMS-group. All patients receiving combined EMS and physician staffed Helicopter Emergency Medical Services assistance on-scene were included in the HEMS-group.

Statistical Analysis

The statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 12.0 (SPSS, Chicago, IL, USA).

A non-response analysis was performed by multivariable logistic regression. Age, sex, ISS, RTS, mechanism of injury, health status (EQ-5D summary score), and HEMS or EMS service were tested as possible determinants of non-response. All significant variables ($p<0.05$) were used to adjust for response bias. Subsequently, the respondents were weighted with the inverse probability of response resulting from the final model.

The Kolmogorov-Smirnov test was used to test for normality of the data. The Levene's test was applied to assess homogeneity of variance between groups. Since not all outcome measures showed normal distribution or equal variance, all items were regarded as non-parametric for the statistical analysis. For continuous data, e.g., age, ISS, GCS, EMV, and RTS the Mann-Whitney U-test was used to assess the difference between HEMS and EMS groups. For dichotomous data, e.g., gender, mechanism of injury, mortality, and prehospital intubation, the chi-square test was performed to compare HEMS with EMS.

Socio-demographic and injury related characteristics were tested as predictors of HRQoL in univariate and step-forward multivariable regression analyses. To determine differences in health-related quality of life (EQ5D and HUI) between EMS and HEMS assisted patients, the non-parametric Mann-Whitney U-test was conducted. Differences regarding the mean utility scores were tested with a one-way Analysis of Variance (ANOVA). P-values < 0.05 were considered to indicate statistical significance.

Results

During the study period of 30 months, 524 poly-trauma patients (ISS>15) over 14 years of age were admitted to the Emergency Department of the study hospital. Of these patients, 162 (30.9%) died within 30 days after hospital admission and the remaining 362 survivors were included in the prospective cohort study on HRQoL. One year follow-up measurements of 246 patients (response rate 68%) were obtained (Table 1). Of the 116 patients that did not participate, 107 patients were untraceable, 1 could not be included since the patient had insufficient knowledge of the Dutch or English language to properly communicate about the investigation, and the remaining 8 patients were unwilling to participate.

Patient characteristics

One hundred and sixty-two patients (66 %) were male (Table 1). The median ISS of this study population was 22, with a median age of 40 years. The vast majority of patients (97%) sustained a blunt force trauma. Patients in the HEMS group were significantly younger than in the EMS group (median age 31 versus 43 years). Patients in the HEMS group were on average more severely injured (median ISS of 26 versus 20) and had more disturbed vital parameters (median GCS 10 versus 14 and median RTS of 11 versus 12). In the HEMS population relatively more patients were intubated compared with the EMS group (34% versus 6%). The patients in the HEMS group had significantly less co-morbidity (27%) than in the EMS group (43).

Description of health-related quality of life one year after trauma

The median EQ-5D utility score of 0.73 of the total population of major trauma patients was far below the Dutch general population norms (EQ-5D summary measure 0.88)(36) (Table 2). A median EQvas score for the total population was calculated of 70. The median HUI2 and HUI3 scores for the total population were 0.81 and 0.65, respectively. Gender and co-morbidity were significantly and consistently associated with worse EQ-5D and HUI outcomes. Females reported worse 1-year follow-up health states compared with males. This difference was statistically significant for EQ-5D, HUI2 and EQvas. In all generic measures used, 1 or more co-morbidities were associated with worse HRQoL. The observed associations between the other included variables and HRQol were less consistent. Patients with a higher age (≥55) had significantly worse HUI3 and EQvas scores. A household composition of more than one person was associated with a better reported HRQoL on the EQus and Eqvas. Only the HUI3 showed a association of higher ISS (≥25) with reduced HRQoL. There were no differences between the EMS and HEMS group in any of the EQ-5D or HUI2/HUI3 summary scores (Table 2).

One year after trauma, the prevalence of physical and physiological limitations for the total patient population was high on all dimensions of both EQ-5D (44% for mobility, 19% for self-care, 53% for usual activities, 62% for pain and discomfort, and 41% for anxiety and depression) (Figure 1a) and HUI3 (54% for vision, 14% for hearing, 29% for speech, 29% for ambulation, 21% for dexterity, 65% for emotion, 55% for cognition, and 68% for pain) (Figure 1b).

Differences between the EMS and HEMS group on all the separate dimensions of EQ-5D and HUI3 were inconsistent, small, and not significant. On some dimensions (e.g., mobility, self care and ambulation) the prevalence of limitations was slightly lower in the HEMS group compared with the EMS group, whereas for other dimensions (e.g., pain, anxiety/depression and emotion) the reverse was observed.

Multivariable analyses

A multivariable regression analysis was conducted to further explore the influence of the type of prehospital care (HEMS versus EMS) and sociodemographic and injury related factors on health status one year after trauma (Table 3).
After adjustment for confounders, including age, gender, co-morbidity and injury severity, the functional outcome of patients assisted by HEMS or EMS showed no differences on any of the separate dimensions of the EQ-5D. In comparing HEMS with EMS, the odds ratios (OR) were ranging from 0.6 (95% CI 0.2-1.3) for the dimension self care to 1.8 (95% CI 0.9-3.6) for the dimension anxiety/depression.

Post trauma problems concerning anxiety or depression were significantly influenced by sociodemographic determinants and co-morbidity. The female gender, a higher educational level and a household consisting of one person led to more problems concerning anxiety and depression. Females were also more likely to experience limitations due to pain and physical discomfort.
Absence of co-morbidity was an independent predictor for less mobility related limitations (OR =0.5), limitations for usual activities (OR=0.4), pain or discomfort (OR=0.2) and anxiety or depression (OR=0.3).
Patients with a higher ISS (≥25) were more likely to report limitations concerning mobility, self-care and usual activities. Patients who sustained severe chest injuries showed less problems on several health domains, compared to patients with severe injuries of other body regions. This association was only significant for less limitation in self-care. As to be expected, severe injuries to the extremities were significant independent predictors of limitations in mobility.

Comparable results as shown for the EQ-5D were found in a separate multivariable regression analysis with the HUI as outcome measure (data not shown). In this analysis too, no significant differences on any of the separate functional outcome dimensions of the HUI were found between patients assisted by HEMS or EMS. The absence of co-morbidity was a significant independent predictor for fewer limitations concerning the HUI-dimensions ambulation (OR=0.3), emotion (OR=0.5), cognition (OR=0.3) and pain (OR=0.4). Comparable to the results found with the EQ-5D, the HUI showed that females were more likely to experience problems concerning pain compared with men (OR=0.4). Patients with a higher ISS (≥25) were more likely to report limitations concerning ambulation (OR=2.6) and dexterity (OR=2.9). As to be expected, severe injuries to the extremities were independent predictors of dexterity (OR=4.1).

Discussion

One year after trauma, the average day-to-day function of major trauma patients has not returned to normal in the current study population. Health-related quality of life, as measured by the summary scores of both the EQ-5D and HUI remained far below general population norms. The prevalence of specific limitations in this population was very high, with 40-70% of patients still suffering from problems with mobility (44%), usual activities (53%), pain (62-68%), anxiety/depression (41%), emotion (65%), and cognition (55%) after one year. Since this was the first study applying the HUI, we could add prevalences of problems among major trauma patients with dexterity (21%), cognition (55%), and emotion (65%) to the literature.

In this study the advances in trauma care, which may lead to an increase in chronic health consequences or may have a beneficial effect on HRQoL instead, have been subjected to evaluation. Specifically the effect of an advancement of pre-hospital trauma care, i.e., assistance of physician staffed Helicopter Emergency Medical Services (HEMS) at the scene of the accident was explored. No difference in outcomes between patients receiving more or less advanced pre-hospital trauma care has been found. Differences in the summary scores of EQ-5D and HUI between the physician assisted HEMS group (advanced prehospital trauma care) and the nurse assisted EMS group (less advanced prehospital trauma care) were small and not significant. Moreover, differences between those groups in all specific health dimensions were small, not significant and inconsistent. Multivariable analysis showed that HEMS assistance was not independently and significantly associated with HRQoL. Health-related quality of life at one year after major trauma was far more influenced by personal factors than by the level of pre-hospital care, as reflected by the significant and consistent negative effects of female gender and co-morbidity on the (dimensions of the) EQ-5D and HUI.

Our main findings, as summarized above, are based upon a prospective cohort study of severely injured survivors in a Dutch trauma region. This study was designed according to international guidelines for the conduction of follow-up studies measuring injury-related disability (23). First of all, in this study the internationally accepted case definition for major trauma (ISS>15 (1)) was used and no prior exclusions of patients based on social characteristics (e.g. language, ethnicity) were made. As recommended, HRQoL was measured with EQ-5D and HUI in order to cover all health dimensions of the ICF that are relevant for patients with (major) trauma. In previous studies (5, 37), determinants of long-term functional consequences of major trauma have demonstrated good performance of EQ-5D in major trauma survivors, in terms of discriminative power and sensitivity to change. Nevertheless, some limitations of EQ-5D were identified (e.g. lacking information on dexterity and cognition), that have been addressed in this study by additionally applying the HUI. The validity of our descriptive results is supported by the consistency of results on the EQ-5D and HUI, respectively. The prevalence of pain (i.e., the single dimension with full overlap between both measures) was comparably high on both the EQ-5D (62%) and HUI (68%). High prevalence's of limitations on all health domains were consistently found on both measures.

Since well-validated instruments were used, the reported high prevalence of health related limitations in this study is a good reflection of the health situation of major trauma patients after one year.

Beyond the overall description of HRQoL of major trauma survivors, a comparison on several outcome measures between the physician staffed HEMS assisted population and the nurse staffed EMS group was made. It must be considered, that this comparison is hampered by limitations of the study design. By necessity, an observational study was conducted, i.e., a design which can hardly ever provide evidence on therapeutic effectiveness (38). In theory, a (cluster) randomized controlled trial would be preferable to study the effectiveness of HEMS on HRQoL. But in practice, for ethical and societal reasons, this was not an option. Two observational studies had already shown improved survival rates among HEMS assisted patients in the Netherlands (18, 19). Moreover, HEMS had already been nationally implemented prior to this study and had rapidly gained a position as publicly well accepted and highly appreciated health service (39). In order to assess the influence of this health service on HRQoL we therefore had to rely on an observational design, which almost inevitably suffers from confounding by indication if therapeutic questions are addressed (38). The comparison of patient characteristics of the HEMS group versus the EMS group identified significant differences, which are probably (partly) based on confounding by indication. Patients in the HEMS group were more severely injured and had more physiological disturbances on the one hand, but they were younger and were less affected by co-morbidities on the other. In the Netherlands, the decision to assign a patient to HEMS or EMS assistance is made by a trained health professional (usually with a nursing background) at a regional call center. In our trauma region, HEMS assistance seems more easily requested in case of accidents among younger patients with higher (expected) injury severity levels. These two types of confounders, that have opposite effects on HRQoL, may affect comparisons of HEMS with EMS. This implies that comparisons between HEMS and EMS should be interpreted with reason.

In the multivariable models, however, we were able to adjust the results for the most important confounders, including those related to differential indication. By linking the follow-up data with the Rotterdam trauma registry, our results could be adjusted for differences in both the age and injury severity distribution of the patients. Moreover, the collected data on socio-demographic factors and co-morbidity, allowed adjustments for these factors in the comparisons between HEMS and EMS. The extensive data collection facilitated adjustment for the most important factors with both an established effect on HRQoL and a relation with the indication process for HEMS assistance (injury severity, age and co-morbidity). This provides support for the main finding one year after trauma, i.e., that generic average HRQoL is not different in patients with HEMS or EMS assistance, and is far more influenced by personal factors (as reflected by the significant and consistent negative effects of female gender and co-morbidity) than by the level of prehospital care.

This negative influence of co-morbidity and female gender is consistent with previous reports. Numerous investigators have previously reported that co-morbidity is an important independent predictor of worse health outcomes after major trauma (34, 37, 40-42).

And the influence of gender as an independent predictor of worse functional outcome after major trauma has also been reported in different studies (5, 26, 43, 44). Vles et al (5) hypothesized that the relation between adverse outcomes and the female gender could be related to physiological, psychological and social differences between males and females. We found that females experience worse generic HRQoL in the long term, mainly because of significantly more problems on psychological dimensions.

At one year after trauma, both in comparing the crude data and after adjustment for injury severity and other confounders (including age and co-morbidity) no statistical significant differences in HRQoL between HEMS and EMS assisted patients were found. This indicates that HEMS assistance neither leads to a shift from mortality to injury-related morbidity and disability nor to improved functional outcome in the long term. This result is consistent with the small amount of previous studies on this topic. Oppe et al.(19) found comparable EQ-5D summary scores of 0.67 and 0.71 for the Amsterdam population at 9 and 15 months, respectively. Overall, they found that the quality of life was lower for the HEMS population compared with the EMS group. However, after correcting for injury severity no differences in functional outcome remained. Similar results were found in the United Kingdom. Six months after trauma no differences in health status, measured by the Nottingham Health Profile, were found between EMS and HEMS assisted patients (45). Also a small study performed in Finland using the SF-36 quality of life questionnaire, could not demonstrate an improved HRQoL by a physician staffed HEMS assistance (46).

In order to draw more definite conclusions on the effects of HEMS on functional outcome, further research is indicated. For this purpose (inter-) national studies on the effects of HEMS with much larger sample sizes should be performed. These studies should focus on the long-term effects of prehospital care on HRQoL and comply with the guidelines for conducting follow-up studies measuring injury-related disability as suggested by the European Consumer Safety Association is recommended (23). Determinants should be identified that affect quality of life. More efforts are needed to improve the HRQoL of major trauma patients. The prevalence of reported limitations after major trauma is high and advanced prehospital trauma care alone seems not enough to achieve more acceptable outcomes.

Conclusion Functional outcome and quality of life of survivors of severe injury has not returned to normal one year after trauma. The prevalence of specific limitations in this population is very high (40-70%) and does not differ significantly between HEMS and EMS assisted patients. Health-related quality of life at one year after major trauma was far more influenced by personal factors than by the level of prehospital care.

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Table 1. Characteristics of the study population (patients surviving major trauma at 12 months follow-up) by gender

	Overall	Male	Female	P-value
N	246	162	84	
Age[1] (year)	40 (23-57)	36 (22-55)	44 (24-66)	0.054[+]
Blunt Trauma[2]	238 (97)	158 (98)	80 (95)	0.450[++]
Glasgow Coma Score[1]	14 (7-15)	14 (6-15)	13 (8-15)	0.555[+]
Revised Trauma Score[1]	12 (10-12)	12 (10-12)	11 (11-12)	0.723[+]
Injury Severity Score[1]	22 (17-29)	22 (17-29)	20 (17-29)	0.382[+]
Prehospital intubation[2]	43 (18)	33 (20)	10 (12)	0.113[++]
Co-morbidity[2]	90 (37)	56 (35)	34 (40)	0.403[++]
HEMS	101 (41)	70 (43)	31 (37)	0.412

[+]Mann-Whitney U-test, [++] Fisher's exact test.

[1], data are displayed as median, with the first and third quartile given within brackets; [2], patient numbers are displayed, with the percentages given within brackets; EMS, nurses assisted Emergency Medical Services; HEMS, physician assisted Helicopter Emergency Medical Services.

Table 2. Health-related quality of life of severely injured patients at 12 months after trauma by sociodemographic, physical and injury related factors, and type of prehospital care

Determinants	**Subgroup**	**N**	**EQ-5D Median**	**HUI2 Median**	**HUI3** *Median*	**EQvas Median**
Total study population		246	0.73	0.81	0.65	70
Sociodemographic						
Gender	Male	162	**0.80**	**0.83**	0.68	**74**
	Female	84	**0.69**	**0.77**	0.50	**68**
Age	<55	176	0.76	0.82	**0.68**	**72**
	≥55	70	0.69	0.78	**0.49**	**69**
Education	Primary	45	0.73	0.78	0.44	70
	Higher	181	0.73	0.81	0.66	70
Household composition	Alone	69	**0.69**	0.77	0.59	**68**
	Not alone	166	**0.78**	0.81	0.68	**73**
Physical						
Co-morbidity	None	155	**0.80**	**0.85**	**0.73**	**76**
	1	67	**0.60**	**0.76**	**0.47**	**66**
	≥2	23	**0.64**	**0.61**	**0.31**	**55**
Injury related						
ISS	<25	145	078	0.81	**0.68**	73
	≥25	101	0.72	0.80	**0.59**	70
Injury localization						
Head	<3	65	0.69	0.82	0.66	68
	≥3	181	0.76	0.80	0.64	73
Face	<3	240	0.73	0.80	0.65	70
	≥3	6	0.72	0.73	0.48	76
Chest	<3	146	0.74	0.80	0.65	71
	≥3	100	0.73	0.80	0.63	70
Abdomen	<3	213	0.73	0.81	0.65	70
	≥3	33	0.76	0.82	0.65	70
Extremities	<3	185	0.76	0.81	0.67	71
	≥3	61	0.69	0.78	0.55	70
Type of prehospital care	EMS	145	0.73	0.83	0.66	70
	HEMS	101	0.76	0.80	0.64	70

Utility scores of the EuroQol-5D (EQ-5D) and Health Utility Index (HUI2 and HUI3) were calculated as described in the Material and Methods. These scores range from 0 for death to 1 for perfect health; the EQvas score ranges from 0 for the worst imaginable health state to 100 for the best imaginable health). Median scores are displayed.
The first row displays the median scores for the total study population. In all subsequent rows, utility and VAS scores of subgroups based on the determinants sociodemographic, physical and injury related factors were compared. Results printed in bold indicate a statistically significant difference in utility or VAS score between the indicated determinants

(Mann-Whitney U-test, $p<0.05$). For co-morbidity, pairwise comparison was made for all three groups. Statistical significance was reached when comparing absence of co-morbidity versus either one or multiple co-morbidities. ISS, Injury Severity Score.

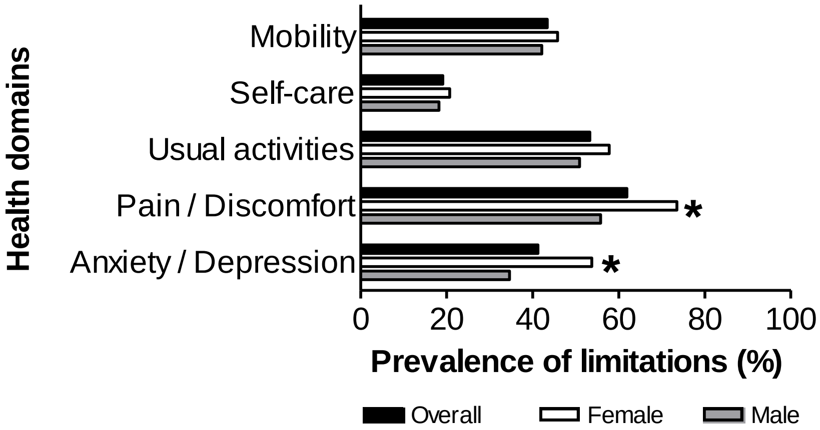
Table 3. Odds ratios of determinants of limitations of functional outcome after major trauma assessed by multivariable logistic regression analyses

	EQ-1 Mobility	**EQ-2** Self-care	**EQ-3** Usual activities	**EQ-4** Pain / discomfort	**EQ-5** Anxiety / Depression
Sociodemographic					
Male	1.0 (0.5-1.9)	0.9 (0.4-1.9)	0.8 (0.5-1.6)	**0.4 (0.2-0.8)** $^{+}$	**0.4 (0.2-0.8)** $^{++}$
Age <55 years	0.7 (0.4-1.5)	0.8 (0.3-1.9)	1.0 (0.5-2.1)	1.5 (0.7-3.1)	1.3 (0.6-2.6)
Primary education	2.0 (1.0-4.2)	1.5 (0.6-3.7)	1.2 (0.6-2.6)	0.7 (0.3-1.5)	**0.4 (0.2-1.0)** $^{+}$
Living alone	1.6 (0.8-3.0)	1.1 (0.5-2.5)	1.7 (0.9-3.3)	1.7 (0.8-3.5)	**2.3 (1.2-4.6)** $^{+}$
Physical					
No co-morbidity	**0.5 (0.2-0.8)** $^{+}$	0.5 (0.2-1.2)	**0.4 (0.2-0.8)** $^{++}$	**0.2 (0.1-0.5)** $^{++}$	**0.3 (0.1-0.5)** $^{++}$
Injury related					
ISS ≥25	**2.3 (1.1-4.9)** $^{+}$	**5.2 (2.1-12.8)** $^{++}$	**2.6 (1.2-5.6)** $^{+}$	0.9 (0.4-1.9)	1.0 (0.5-2.1)
Injury localization					
Head ≥3	0.8 (0.3-2.0)	0.4 (0.1-1.1)	0.6 (0.2-1.4)	0.4 (0.1-1.1)	1.2 (0.5-3.1)
Face ≥3	0.9 (0.1-5.5)	0	4.7 (0.5-44.2)	1.9 (0.3-12.9)	1.7 (0.3-10.4)
Chest ≥3	0.6 (0.3-1.3)	**0.3 (0.1-0.9)** $^{+}$	0.7 (0.3-1.5)	1.2 (0.5-2.8)	0.9 (0.4-1.9)
Abdomen ≥3	0.8 (0.3-2.2)	1.0 (0.3-3.0)	0.7 (0.3-1.9)	0.8 (0.3-2.4)	1.5 (0.5-4.3)
Extremities ≥3	**2.3 (1.0-4.9)** $^{+}$	1.6 (0.6-4.0)	0.8 (0.4-1.8)	1.6 (0.7-3.9)	0.9 (0.4-2.0)
HEMS	0.9 (0.5-1.6)	0.6 (0.2-1.3)	0.8 (0.4-1.5)	1.4 (0.7-2.8)	1.8 (0.9-3.6)

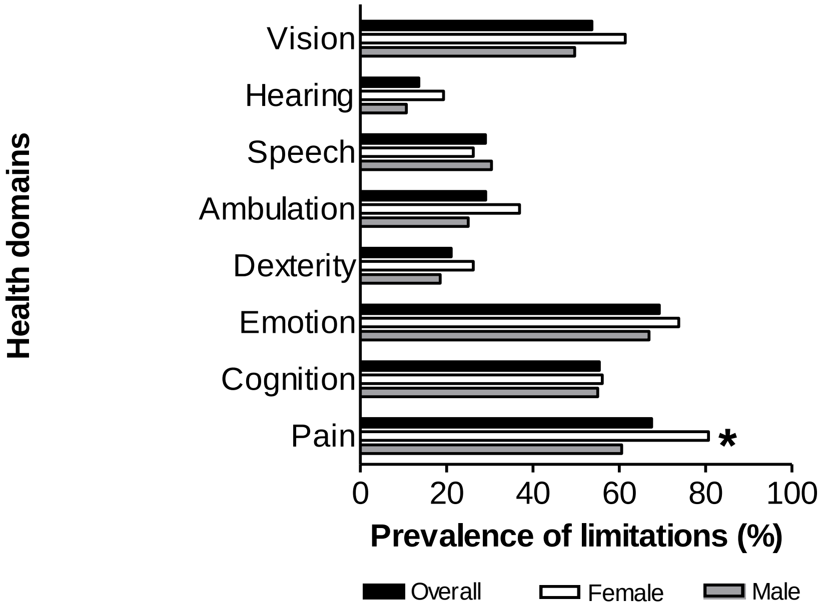
Step-forward multivariable regression analysis was performed to determine the odds of developing posttraumatic problems in each of the five domains of the EQ-5D (EQ-1 to EQ-5). Odds ratios were calculated for potential high-risk groups based on sociodemographic, physical, or injury related factors. Odds ratios are displayed with the 95% confidence interval between brackets. Bold fonts indicate that the association is statistically significant; $^{+}$=<0.05. $^{++}$=p<0.01.

Figure 1. Prevalence of physical and physiological limitations (moderate or severe) of the EQ-5D (panel A) and HUI3 (panel B) health domains by gender

A



B



The percentage of patients with limitations in any of the health domain is shown.

Differences between males and females were tested with the Chi-square test.

*, P ≤ 0.01.