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Reduced Quality of Life, Fatigue, and Societal Participation After Polytrauma

Henry A. Leijdesdorff[1], Pieta Krijnen[1], Lisette van Rooyen[1], Perla Marang–van de Mheen[2], Steven Rhemrev[3], Inger B. Schipper[1]

[1]*Departments of Trauma Surgery, Leiden University Medical Center, Leiden, The Netherlands*

[2]*Department of Medical Decision Making, Leiden University Medical Center, Leiden, The Netherlands*

[3]*Department of Surgery, Haaglanden Medical Center, The Hague, The Netherlands*

Objective: This cross-sectional study analyzed associations between and determinants for health-related quality of life (HRQoL), fatigue, and societal participation in polytrauma patients.

Summary of background data: More polytrauma patients survive their injuries, often resulting in long-term disabilities. HRQoL is therefore an important outcome of trauma care. Fatigue and societal participation may be related to HRQoL. Also, their relation to severe injuries has not been studied to date.

Methods: A total of 283 polytrauma patients (injury severity score $\geq$ 16) admitted to the Dutch level 1 Trauma Centre West were analyzed. HRQoL was measured by the physical component summary (PCS) and mental component summary (MCS) scores of the SF-36, fatigue by the multidimensional fatigue inventory, and societal participation by the Utrecht scale for evaluation of rehabilitation-participation. Age, sex, comorbidity, injury pattern, injury severity, and time since trauma were analyzed as potential determinants.

Results: A total of 122 patients (43%) responded after a median follow-up of 15 (range, 10–23) months after polytrauma; 44% reported reduced physical health (PCS $<$ 45) and 47% reported reduced mental health (MCS $<$ 45). HRQoL was highly correlated with all fatigue and participation subscales. Severe head injury was associated with worse mental health. Female patients reported more general and mental fatigue and were less satisfied with their ability to perform daily activities. Patients with pre-existing comorbidity experienced worse physical health, more fatigue, and reduced societal participation.

Corresponding author: Henry A. Leijdesdorff, MD, Leiden University Medical Center, Department of Trauma Surgery, D6-28, PO Box 9600, NL-2300, RC Leiden, The Netherlands.
Tel: +31 71 5263905/1065; Fax: +31 71 5266750; E-mail: alexleijdesdorff@gmail.com

Conclusions: One to 2 years after trauma, polytrauma patients report reduced HRQoL, which is associated with more fatigue and reduced societal participation. Trauma rehabilitation strategies should focus on early recognition of reduced HRQoL, fatigue, and societal participation and facilitate early intervention to improve these outcomes.

Key words: Polytrauma – Comorbidity – Health-related quality of life – Fatigue – Societal participation

Trauma is an important cause of death and contributes significantly to the global burden of disease. Trauma affects people of all ages and particularly the young, resulting in a considerable number of life years lost due to premature death and large numbers of years lived with disability.[1] The introduction of the Advanced Trauma Life Support (ATLS) program, all-inclusive trauma systems, and centralization of trauma care have gradually resulted in reduced trauma-related mortality in The Netherlands and many other countries.[2] Subsequently, an increasing number of trauma patients survive with long-term morbidity and often face severe and prolonged deficits in health-related quality of life (HRQoL). HRQoL has therefore become an increasingly important outcome measure to evaluate further enhancement of trauma care.

Long-term effects of major trauma on physical and mental health have been extensively reported.[3–11] Fatigue, another important aspect of well being, has only been described after specific types of traumatic injuries such as traumatic brain injury[12,13] and spinal cord injury.[14–17] In these patient groups, fatigue was associated with a negative impact on the societal participation and resulted in restricted physical and social activities. Fatigue and reduced societal participation in multiple injured trauma patients after recovery have not been previously reported on, and their association with reduced HRQoL has not been described in the literature.

The objective of the study was to analyze these relations and to identify patient and injury characteristics associated with HRQoL, fatigue, and societal participation in severely injured patients 1–2 years after trauma.

Materials and Methods

Study design

In the regional trauma registry of the Dutch Trauma Centre West (DTCW), we identified all severely injured patients (injury severity score [ISS] $\geq$ 16), who had been admitted to 2 level-I trauma center locations of the DTCW, between July 2011 and July 2012. Minors (<18 years), deceased patients, patients with self-inflicted injuries, non-Dutch residents, and patients who had been lost to follow-up after discharge from the hospital were excluded from the study. In April 2013, selected patients received a letter by mail to invite them to participate in a survey including questionnaires concerning HRQoL, fatigue, and societal participation. Patients who did not respond were contacted by telephone and encouraged to participate and complete the questionnaires or, in case of missing phone numbers, were sent reminders by mail to encourage participation. The institutional Medical Ethics Review Board approved the study (protocol no. P13.061).

Demographic and clinical data

Data retrieved from the trauma registry included sex, age, anatomic injury diagnoses, and injury severity according to the abbreviated injury scale (AIS) version 2005 update 2008,[18] the initial Emergency Department Glasgow coma scale (GCS),[19] and mortality. Severe injury (AIS $\geq$ 3) was categorized using the anatomical regions defined in the AIS (head, face, neck thorax, abdomen, spine, extremities, and external). The trauma patients were divided into 2 categories: polytrauma and severe polytrauma patients. Polytrauma was defined as an ISS $\geq$16, and severe polytrauma as ISS $\geq$ 25.[20] Data on preexisting diseases were obtained from the electronic medical records. Comorbidity was scored using the Charlson comorbidity index,[21] which includes disorders defined according to the *International Classification of Diseases 10* (ICD10). All data were documented directly after trauma or after discharge from the hospital.

HRQoL, fatigue, and societal participation

HRQoL was measured using the Short Form Health Survey (SF-36), a validated questionnaire including 36 items covering 8 health domains: physical

Table 1 Demographics and clinical characteristics of polytrauma patients by study participation

Demographics	Total (n = 283)	Respondents (n = 122)	Nonrespondents (n = 161)	*P*
Male, n (%)	192 (67.8)	81 (66.4)	111 (68.9)	0.65
Age in years, mean (SD)	56.2 (21.1)	57.9 (19.2)	55.0 (22.4)	0.24
CCI, mean (SD)	0.5 (0.9)	0.4 (0.8)	0.5 (1.0)	0.35
ISS, mean (SD)	22.2 (7.3)	21.6 (6.2)	22.6 (8.1)	0.25
Number of severe injuries, mean (SD)	1.9 (1.1)	1.9 (1.2)	1.9 (1.1)	0.96
Severe injury (AIS ≥3), n (%)				
Head/face	175 (61.8)	71 (58.2)	104 (64.6)	0.27
Thorax	96 (33.9)	40 (32.8)	56 (34.8)	0.73
Abdomen	19 (6.7)	9 (7.4)	10 (6.2)	0.70
Spine	30 (10.6)	12 (9.8)	18 (11.2)	0.72
Upper extremities	18 (6.4)	8 (6.6)	10 (6.2)	0.91
Lower extremities	37 (13.1)	22 (18.0)	15 (9.3)	0.03
External	7 (2.5)	3 (2.5)	4 (2.5)	1.00
GCS, mean (SD)	13.1 (3.3)	13.4 (3.1)	13.0 (3.5)	0.42

functioning, role limitations due to physical health problems, bodily pain, vitality, social functioning, role limitations due to emotional problems, general health, and emotional well being.[22] The 8 scales can be summarized into 2 scores: the physical component summary (PCS) score and mental component summary (MCS) score. PCS and MCS scores range from 0 to 100 with higher scores reflecting better health. These scores are standardized to the general Dutch population by age and sex so that a score of 50 reflects the expected HRQoL of the Dutch population. Reduced HRQoL was defined as a score of 45 or lower, because a difference of 5 points in PCS and MCS scores is considered clinically relevant.[23]

Fatigue was measured using the multidimensional fatigue inventory (MFI-20).[24] This questionnaire evaluates 5 dimensions of fatigue: general fatigue, physical fatigue, mental fatigue, reduced motivation, and reduced activity. Scores on each scale vary from 4 to 20, with higher scores indicating higher levels of fatigue for each dimension.

Social participation was measured using the Utrecht scale for evaluation of rehabilitation-participation (USER-P).[25] This instrument measures 3 aspects of participation: frequency of leisure and societal activities, restriction in daily activities, and satisfaction with the ability to perform daily activities. Scores range from 0 to 100, with higher scores indicating higher levels of participation.

Data analysis

Characteristics of respondents and nonrespondents, and of patients with or without reduced HRQoL, were compared using the unpaired *t*-test for continuous data, and the χ^2 test for categorical data. The average PCS and MCS scores in our study group were compared with the reference score of 50 (SD, 10) for the general Dutch population using a 1-sample *t*-test. Scores on the fatigue and societal participation scales were compared between patients with and without reduced HRQoL using an unpaired *t*-test. Furthermore, it was assessed whether patient and injury characteristics (age, sex, presence of comorbidity, severe injury to the head, neck, trunk [thorax and abdomen], extremities, and severe polytrauma) and length of follow-up since trauma were associated with HRQoL, societal participation, and fatigue using linear regression analysis. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS Inc, Chicago, Illinois), version 20. $P < 0.05$ was considered statistically significant.

Results

Study group

Of the 372 identified polytrauma patients, 89 patients were excluded: 51 patients had died due to their injuries, 10 patients were minors, 9 patients had inflicted the injuries themselves, 2 patients were living abroad, and 17 patients were lost to follow-up. Therefore, 283 met the inclusion criteria and were contacted for participation. Of these, 122 patients filled out the questionnaire (response rate, 43.1%). Respondents and nonrespondents were comparable with respect to patient and injury characteristics, although respondents more often had severe injuries to the lower extremities (Table 1). The median follow-up of the respondents was 15.0 months (range, 10–23 months).

Table 2 Associations between reduced health-related quality of life and fatigue and societal participation after polytrauma

Dimension	PCS < 45 (n = 50)	PCS ≥ 45 (n = 64)	*P*	MCS < 45 (n = 53)	MCS ≥ 45 (n = 61)	*P*
General fatigue	14.8 (3.9)	8.4 (4.2)	<0.001	14.5 (3.7)	8.3 (4.4)	<0.001
Physical fatigue	15.4 (3.7)	7.8 (3.8)	<0.001	14.3 (4.4)	8.4 (4.6)	<0.001
Reduced activity	13.8 (3.9)	8.2 (3.9)	<0.001	13.5 (4.2)	8.2 (3.7)	<0.001
Reduced motivation	12.4 (4.3)	7.9 (3.8)	<0.001	12.9 (3.9)	7.2 (3.3)	<0.001
Mental fatigue	11.8 (5.3)	8.2 (4.5)	<0.001	12.8 (4.7)	7.2 (3.9)	<0.001
USER-P frequency	23.8 (13.2)	38.3 (10.7)	<0.001	25.2 (13.4)	37.5 (11.7)	<0.001
USER-P restriction	64.1 (21.1)	96.2 (7.6)	<0.001	72.5 (23.3)	92.3 (14.9)	<0.001
USER-P satisfaction	57.9 (19.4)	84.8 (14.6)	<0.001	58.2 (17.8)	86.9 (14.1)	<0.001

All results are presented as mean scores (SD). General fatigue, physical fatigue, reduced activity, reduced motivation, and mental fatigue are the 5 scales of the MFI-20. USER-P frequency (measuring the frequency of leisure and societal activities), USER-P restriction (measuring restriction in daily activities), and USER-P satisfaction (measuring satisfaction with the ability to perform daily activities) are the 3 scales of the USER-P. The PCS score and MCS score are summary measures that are based on the scores of the 8 scales of the SF-36.

HRQoL

The PCS and MCS scores could be computed for 114 patients (8 missing). Compared with the general Dutch population of the same sex and age, the polytrauma study group scored on average 4.2 PCS points (95% confidence interval [CI], 2.0–6.4) lower for physical health and 5.4 MCS points (95% CI, 3.3–7.6) lower for mental health ($P < 0.001$ for both comparisons). Fifty patients (43.9%) reported reduced physical health (PCS < 45) and 53 patients (46.5%) reported reduced mental health (MCS < 45).

Relation between reduced HRQoL and fatigue/societal participation

Polytrauma patients with reduced physical and/or mental health scored higher on all dimensions of the MFI-20 ($P < 0.001$), indicating that they experienced more general, physical, and mental fatigue and more reduced activity and reduced motivation than polytrauma patients without reduced HRQoL (Table 2). Furthermore, polytrauma patients with reduced HRQoL scored lower on all USER-P subscales ($P < 0.001$), indicating that they participated less frequently in social activities, were less satisfied with their societal participation, and experienced more restrictions in their daily activities (Table 2).

Determinants of HRQoL

Preexisting comorbidity was associated with worse physical health (on average 12.9 points lower PCS scores; 95% CI, –17.9; –7.9; $P < 0.001$; Table 3). Severe head injury was associated with worse mental health (on average 6.8 points lower MCS scores; 95% CI, –13.1; –0.6; $P = 0.03$). PCS and MCS scores were not associated with severe injury to the trunk or to the extremities, severe polytrauma, and time since trauma. The models explained 25.6% and 8.0% of the variance in PCS and MCS scores, respectively.

Determinants of fatigue

Female patients reported more general fatigue (on average 2.3 points higher scores; 95% CI, 0.3–4.4; $P = 0.03$) and more mental fatigue (on average 2.3 points higher scores; 95% CI, 0.1–4.5; $P = 0.04$) than male patients (Table 4). Patients with comorbidity had higher scores on most fatigue subscales indicating more general fatigue (5.0 points higher scores; 95% CI, 2.7–7.4; $P < 0.001$), more physical fatigue (4.8 points higher scores; 95% CI, 2.3–7.3; $P < 0.001$),

Table 3 Associations between patient and injury characteristics[a] and HRQoL in polytrauma patients, assessed by linear regression analysis

Characteristic	PCS	MCS
Presence of comorbidity	**−12.9 (−17.9; −7.9)**	−0.9 (−6.1;4.3)
Severe injury[b] to the Head	2.8 (−3.2;8.9)	**−6.8 (−13.1; −0.6)**
Neck, thorax, abdomen, or spine	−0.5 (−6.3;5.4)	−2.6 (−8.6;3.5)
Extremities	−4.5 (−10.0;1.0)	−2.1 (−7.8;3.6)
Severe polytrauma[c]	−1.6 (−7.2;4.0)	−0.1 (−5.9;5.7)
Time since trauma, per month increase	0.1 (−0.6;0.7)	0.4 (−0.2;1.0)

Data are presented as regression coefficients with their 95% CI. Statistically significant regression coefficients ($P < 0.05$) are presented in bold. The PCS score and MCS score are summary measures that are based on the scores of the 8 scales of the SF-36.

*Not including age and sex, because PCS and MCS scores are standardized by these characteristics.

[b]AIS ≥ 3.

[c]ISS ≥ 25.

Table 4 Associations between patient and injury characteristics and fatigue in polytrauma patients, assessed by linear regression analysis

Characteristic	General fatigue	Physical fatigue	Reduced activity	Reduced motivation	Mental fatigue
Age, per year increase	−0.03 (−0.08;0.02)	0.01 (−0.04;0.07)	0.01 (−0.05;0.06)	0.01 (−0.04;0.06)	−0.03 (−0.09;0.03)
Female sex	**2.3 (0.3;4.4)**	1.9 (−0.4;4.1)	1.5 (−0.5;3.6)	1.2 (−0.8;3.2)	**2.3 (0.1;4.5)**
Presence of comorbidity	**5.0 (2.7;7.4)**	**4.8 (2.3;7.3)**	**3.3 (1.0;5.6)**	**2.3 (0.1;4.6)**	2.1 (−0.4;4.5)
Severe injury[a] to the head	−0.6 (−3.1;2.0)	−0.9 (−3.7;1.8)	0.4 (−2.1;3.0)	0.7 (−1.8;3.2)	1.2 (−1.6;3.9)
Neck, thorax, abdomen, or spine	0.7 (−1.8;3.1)	0.3 (−2.3;2.9)	−0.5 (−3.0;1.9)	−0.8 (−3.2;1.6)	0.7 (−1.9;3.2)
Extremities	1.0 (−1.3;3.4)	1.3 (−1.3;3.8)	0.8 (−1.5;3.1)	1.1 (−1.2;3.4)	0.6 (−1.9;3.1)
Severe polytrauma[b]	0.6 (−1.8;3.0)	1.0 (−1.3;3.8)	1.8 (−0.6;4.1)	1.7 (−0.6;4.0)	1.2 (−1.3;3.7)
Time since trauma, per month increase	−0.02 (−0.28;0.25)	−0.1 (−1.6;3.5)	−0.03 (−0.29;0.23)	−0.1 (−0.4;0.1)	−0.09 (−0.36;0.19)

Data are presented as regression coefficients with their 95% CI. Statistically significant regression coefficients ($P < 0.05$) are presented in bold. Fatigue was measured using the MFI-20.

[a]AIS $\geq$ 3.

[b]ISS $\geq$ 25.

more reduced activity (3.3 points higher scores; 95% CI, 1.0–5.6; $P = 0.006$), more reduced motivation (2.3 points higher scores; 95% CI, 0.1–4.6; $P = 0.006$). Age, severe polytrauma, location of severe injury, and time since trauma were not associated with any of the domains of fatigue (Table 4). The percentage of variance explained by the models ranged from 10.7% for mental fatigue to 22.0% for general fatigue.

Determinants of societal participation

Sex and presence of comorbidity were associated with some dimensions of societal participation (Table 5).

Female patients reported more restrictions in social participation than male patients with on average 13.5 points lower scores (95% CI, –22.8; –4.2; $P = 0.005$). Compared with patients without comorbidity, the patients with comorbidity experienced more restrictions in social participation (scores on average 21.0 points lower; 95% CI, –31.6; –10.3; $P < 0.0001$), as well as less satisfaction with social participation (scores on average 14.9 points lower; 95% CI, –25.7; –4.0; $P = 0.008$). Age, severe polytrauma, location of severe injury, and time since trauma were not associated with any of the dimensions of societal participation. The percentage of variance explained by the models was 12.4% for frequency of leisure and societal activities, 28.7% for restrictions in daily activities, and 17.4% for satisfaction with the ability to perform daily activities.

Discussion

The aim of this study was to analyze HRQoL, fatigue, and societal participation after polytrauma

Table 5 Associations between patient and injury characteristics and social participation in polytrauma patients, assessed by linear regression analysis

Characteristic	USER-P frequency	USER-P restrictions	USER-P satisfaction
Age, per year increase	−0.1 (−0.2;0.1)	0.0 (−0.3;0.2)	−0.03 (−0.27;0.22)
Female sex	−0.2 (−5.9;5.5)	**−13.5 (−22.8; −4.2)**	−6.7 (−15.9;2.5)
Presence of comorbidity	−5.3 (−11.9;1.3)	**−21.0 (−31.6; −10.3)**	**−14.9 (−25.7; −4.0)**
Severe injury[a] to the head	−2.5 (−9.5;4.5)	−2.4 (−14.0;9.3)	−9.3 (−20.3;1.8)
Neck, thorax, abdomen, or spine	0.5 (−6.2;7.3)	−9.1 (−20.1;1.9)	−2.9 (−13.5;7.8)
Extremities	−2.9 (−9.4;3.5)	−4.5 (−15.7;6.7)	−5.5 (−16.0;5.0)
Severe polytrauma[b]	−3.1 (−9.6;3.5)	5.2 (−6.3;16.6)	1.5 (−9.1;12.1)
Time since trauma, per month increase	0.6 (−0.1;1.4)	0.2 (−1.0;1.3)	0.6 (−0.6;1.7)

Data are presented as regression coefficients with their 95% CI. Statistically significant regression coefficients ($P < 0.05$) are presented in bold. USER-P frequency (measuring the frequency of leisure and societal activities), USER-P restriction (measuring restriction in daily activities), and USER-P satisfaction (measuring satisfaction with the ability to perform daily activities) are the 3 scales of the USER-P.

[a]AIS $\geq$ 3.

[b]ISS $\geq$ 25.

in relation to specific patient and injury characteristics.

One to 2 years after being severely injured, almost half of the participants in our study reported reduced physical and/or mental health compared with the general Dutch population of the same age and sex. Reduced HRQoL was strongly associated with increased fatigue and reduced societal participation. Within this group of polytrauma patients, the injury severity and location of severe injuries were not associated with HRQoL, fatigue, and societal participation, except that mental health was worse in patients who had suffered severe head injury. Female patients and patients with comorbidity were found to be at risk for decreased HRQoL, more fatigue, and lower societal participation.

HRQoL, fatigue, and societal participation

Although the mean PCS and MCS scores of the polytrauma patients were statistically lower compared with those of the general Dutch population with similar age and sex, the clinical significance of these differences on a group level was marginal (respectively, 4.2 and 5.4 on average). Differences found with the general population in overall HRQoL are in concordance with earlier studies in different countries, for instance in Denmark,[3] Sweden,[4] Norway,[5] Germany,[6] and The Netherlands.[11] However, considering the fact that more than half of the patients in our study did not report reduced HRQoL together with the marginal clinical significant difference in PCS and MCS, it seems that many polytrauma patients in contrast to the previous stated studies recover fully from their injuries.

Our study showed that both reduced physical health and reduced mental health were strongly associated with all dimensions of fatigue and societal participation. Fatigue is often found in patients with various chronic diseases and is perceived by patients to have a major impact on their quality of life.[26] The results of this study confirm our assumption that reduced HRQoL and fatigue have a large impact on the ability of polytrauma patients to participate in social activities. Although not measured in our study, it is also known from other studies that up to 30% of polytrauma patients in the working ages are unable to return to work after recovery of their injuries.[6,7,27] It is important to recognize that, beside physical disabilities, psychologic factors such as depressive symptoms and posttraumatic stress disorder (PTSD) are common in trauma patients. These psychologic factors can limit societal participation and prevent return to work.[28–31] Physicians should be aware of these symptoms so that psychologic intervention can be started early if needed.[32]

Determinants of HRQoL, fatigue, and societal participation

There is a vast body of literature describing various determinants of reduced HRQoL after polytrauma. Several studies have identified demographic determinants such as age,[4,33–36] sex,[11,27] educational level,[11,36] social economic status,[35] and living with a partner[11,35]; clinical determinants such as preexisting comorbidity[9,11,33,34]; and injury-related determinants such as injury severity[11,27,33–35] and injury location.[15,33,35–38] In this study, we focused on injury severity, the anatomical site of the injuries, and basic patient characteristics (sex, age, preexisting comorbidity) as potential determinants because the socioeconomic status and educational level at the time of the hospital admission were not available in the analyzed data.

Only preexisting comorbidity was identified as a determinant for worse physical health, and only severe head injury was a determinant for worse mental health. Both determinants were associated with a clinically relevant decrease in scores of 7 and 13 points, respectively. The fact that varying determinants of HRQoL are found in the present and previous studies indicates that influences on HRQoL after trauma are multifactorial and that most probably many of the determinants of reduced HRQoL are correlated. In previous studies, the length of the patients' follow-up since trauma also differed between 1 and 5 years, which may explain some of the variation in determinants found in the literature.

Although persistent fatigue is a frequent complaint after traumatic head injury[12,13,39] and spinal cord injury,[14,17] determinants of fatigue in the general polytrauma population have not previously been described. Fatigue is a multidimensional concept that was studied using the MFI-20 that measures fatigue on 5 subscales. These 5 include general fatigue that refers to daily functioning, physical functional fatigue that refers to physical tiredness, mental fatigue that refers to cognitive symptoms of fatigue, reduced motivation that refers to the lack of motivation to start any activity, and reduced activity.[24] We found that scores on all

subscales of the MFI were equally high for polytrauma patients with severe injury to the head, trunk (including neck, thorax, abdomen, and spine) or extremities. Unfortunately, in our study, there were only 12 patients with severe spinal injury, which was too small a number to be studied as a separate group. Similarly, to injury location, fatigue scores also did not relate to the overall ISS. From these results, we tentatively conclude that fatigue is equally present in all types of polytrauma patients, irrespective of injury severity and anatomical injury site. Preexisting comorbidity was found to be a determinant of most aspects of fatigue except for mental fatigue.

The female patients in our polytrauma population scored on average respectively 2.3 points higher than the male patients on both the subscales for general and mental fatigue, which is in line with a previous study conducted by Cantor.[13] The effect seems to be clinically meaningful and is similar to that described in patients with cancer-related fatigue.[40] General fatigue relates to general remarks made by a person concerning his or her functioning, whereas the MFI-20 mental subscale reflects fatigue related to "mental ability to do things" and "mental condition" that causes a feeling of decreased ability to manage daily activities. Female patients are known to report significantly worse on long-term well-being after major trauma than male patients.[11,27] They are at risk for worse functional and psychologic outcomes, independent of age, injury severity, and trauma mechanism.[41] The underlying mechanism is not well understood, although psychologic factors may play a role, as female patients seem to be more susceptible to depression and post-traumatic stress after major trauma than male patients.[42] This may explain why the female patients in our study reported more general fatigue and mental fatigue. The female patients also seemed to score more fatigue on the other 3 subscales (physical fatigue, reduced motivation, and reduced activity), but these effects were not as large and not statistically significant.

Societal participation other than return-to-work has rarely been studied as an outcome measure after trauma. In the present study, societal participation was measured using the Utrecht scale for evaluation of rehabilitation-participation (USER-Participation). This instrument measures both objective participation (the frequency of leisure and societal activities) and subjective participation (experienced restriction in daily activities and satisfaction with the ability to perform daily activities). Patients with preexisting comorbidity experienced more restrictions in social participation due to their condition and were also less satisfied with their level of social participation. Female patients did not report less participation in leisure and societal activities than the male patients, but they did feel notably more restricted in participating in daily activities. The explanation for these seemingly contradictory results for the objective and subjective levels of social participation is not clear and can only be speculated on. As women are more at risk for psychologic morbidity than men after severe trauma,[42] the perception of being able to participate after recovering from their injuries may be more adversely affected in female than in male patients.[42] This assumption is strengthened by the fact that the female patients also seemed to feel less satisfied with their ability to participate socially, although this finding was not statistically significant.

Limitations

This study has several limitations. First, the study had a cross-sectional design, so causal relationships could not be established. Moreover, the actual levels of HRQoL, fatigue, and societal participation of the patients before their injuries were not measured so that changes from baseline could not be taken into account.

Second, the response rate in our study was low, which may have resulted in a bias. The questionnaire sent to the polytrauma population was lengthy because it included specific instruments for measuring HRQoL, as well as fatigue and societal participation. Therefore, the length of the used questionnaire could not be shortened, which may have discouraged study participation, especially in specific subgroups such as patients struggling with fatigue after and polytrauma and patients with cognitive limitations after severe head injury. Also, the order of the instruments within the questionnaire was not randomized. Although selection and information bias cannot be ruled out entirely, our study group of polytrauma patients seemed representative since the respondents and nonrespondents were comparable regarding patient and injury characteristics, which renders the risk of bias to be low.

Third, it can be assumed that the time elapsed between trauma and participation in our survey was relatively short (between 10 and 23 months). However, the length of follow-up since trauma did not have a measurable effect on any of the outcomes in the study. Also, it has been demonstrated that after 1 year of

follow-up, hardly any improvement in functioning is hardly seen, so 1 year seems sufficient to gain insight into HRQoL after severe injuries.[5,21]

Last, although every effort was made to code injuries accurately in our regional trauma registry, a possible selection bias might have been introduced concerning the interpretation of injury pattern and injury outcome, therefore influencing the AIS and ISS coding.

Conclusions

Between 1 and 2 years after trauma, nearly half of all polytrauma patients still have a reduced HRQoL, which is associated with more fatigue and reduced societal participation. It can be assumed that female polytrauma patients and patients with comorbidities have higher risks for reduced HRQoL, more fatigue, and lower societal participation compared with other polytrauma patients.

Despite the previously stated limitations, this study underlines the importance of early identification of polytrauma patients at risk for suboptimal physical and/or mental recovery. Increased awareness of signs and symptoms, both in-hospital and after discharge, of reduced HRQoL, fatigue, and societal participation after polytrauma can help achieve improved guidance by clinicians and rehabilitation specialists.

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