

# Posttraumatic Stress Disorder Following Injury: Trajectories and Impact on Health-Related Quality of Life

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## Abstract

**Background:** Little is known about posttraumatic stress disorder (PTSD) trajectories of injury patients of all severity levels and external causes. The aim of our study was to assess prevalence rates, predictors, trajectories and impact on health-related quality of life (HRQoL) of PTSD 2.5, 5, 12 and 24 months post-injury.

**Methods:** We selected a sample of 8,057 patients aged 15 years and older who attended the Emergency Department (ED) followed by either hospital admission or discharge to the home environment. The sample received postal questionnaires 2.5, 5, 12 and 24 months after treatment at the ED. The questionnaires included items regarding socio-demographics, EQ-5D to measure HRQoL, and the Impact of Event Scale-Revised (IESR). An IESR-score  $\geq 33$  was used as indication for the presence of PTSD.

**Results:** 2,918 (36%) injury patients completed the 2.5 months follow-up survey. PTSD prevalence rate at 2.5 month follow-up was 9%. At 5, 12 and 24 month follow-up PTSD prevalence rates were 7%, 6% and 5% respectively. Comorbid disease, female gender and low educational level were the strongest independent predictors of PTSD. One in ten patients had PTSD at some point during 24 month follow-up. PTSD was associated with a significantly decreased HRQoL.

**Conclusions:** We conclude that almost one in ten injury patients of all causes and severity levels treated at an ED suffer from PTSD symptoms, which is associated with a considerable decrease in HRQoL. PTSD symptoms may therefore raise a major barrier for full recovery of injury patients of even minor levels of severity.

**Keywords:** Trauma; Posttraumatic stress disorder; Follow-up study; Quality of life

**Abbreviations:** CI: Confidence Interval; ED: Emergency Department; EQ-5D: EuroQoL-5 Dimensions; IESR: Impact of Event Scale Revised; HRQoL: Health-Related Quality of Life; OR: Odds Ratio; PTSD: Posttraumatic Stress Disorder

## Introduction

In rehabilitation of injury patients, the main focus lies in the treatment of physical injuries. Nonetheless, over the past decades the importance of psychological morbidity following injury continued to gain attention. Psychological morbidity includes Posttraumatic Stress Disorder (PTSD), depression and other maladaptive syndromes. PTSD may result from any event that involves an injury, or threatened or actual death (of others). Among injury patients relatively high prevalence rates of PTSD have been reported, both shortly after injury and at long-term follow-up [1-7]. Understanding the patterns of PTSD symptoms over time, and how these may vary by type of traumatic event and subgroup is important for targeting of PTSD prevention and to facilitate treatment when PTSD has developed. Longitudinal studies that assess prevalence and risk factors of PTSD at different time points provide important insight in patterns of PTSD over time. Recently, Santiago et al. published a systematic review of 58 longitudinal studies and a meta-analysis of the trajectories of PTSD [8]. This review included studies that investigated prevalence rates of PTSD following injury at the higher end of the severity spectrum, such as victims of motor vehicle accidents or patients who required admission to hospital or the Intensive Care Unit. Less is known about PTSD trajectories in a comprehensive population of injury patients of all severity levels and external causes:

Apart from prevalence and trajectories of PTSD, the impact of PTSD has recently gained attention. Previous research has shown

that PTSD has a substantial impact on health-related quality of life (HRQoL), of adult hospitalized injury patients as was demonstrated by Holbrook et al. in one of the few studies that addressed this matter [1,9]. Similar results were found among adolescents and children [10,11]. However, these studies were again restricted to victims at the higher end of the severity spectrum. In a study that included a comprehensive population of injury patients the impact of PTSD on HRQoL was measured at 24 months post-injury only [12]. A longitudinal study on PTSD and HRQoL with multiple assessments over time might elucidate the association between PTSD and reduced HRQoL further.

The aims of this study were:

- 1) To assess the prevalence rate and predictors of PTSD 2.5, 5, 12 and 24 months post-injury in a comprehensive population of injury patients treated at the Emergency Department (ED), followed by either hospital admission or direct discharge to the home environment;
- 2) To assess the trajectories of PTSD following injury;
- 3) To assess the association between posttraumatic stress

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symptoms indicative of PTSD and HRQoL among this comprehensive injury population.

## Methods

### Study design

A patient-follow-up study was conducted among a population-based sample of injury patients of all severity levels. This study included all injury patients aged 15 years and older who attended the ED of the Dutch Injury Surveillance System. The Dutch Injury Surveillance System is a representative continuous registry of intentional and unintentional injuries of 15 hospitals in the Netherlands that are geographically spread across the country. The 15 hospitals are a representative sample of the general and university hospitals in the Netherlands with a continuously staffed ED-department. In the registry all intentional and unintentional injuries are recorded. Surveys were conducted at 2.5 months, 5 months, 12 months and 24 months after initial treatment.

### Subject

Between 1 February 1 2007 and 31 January 2008 a sample was selected of 8,057 patients aged 15 years and older who attended the ED of the Dutch Injury Surveillance System. The patients were treated at the ED, followed by either hospital admission or direct discharge to the home environment. The sample of patients consisted of victims of traffic, home and leisure, occupational and sport accidents and violence. The sustained injuries varied from minor to severe injury, single and multiple injury and hospitalized and non-hospitalized patients. The sample was stratified in such a way that severe, less common injury groups and hospitalized patients were overrepresented in the survey in order to get high enough numbers of patients to analyse differences in functional outcome by type of injury. In case of multiple injuries, the first step in the sampling process was to assign the injury patient to the injury category of the most severe injury. The second step was to randomly select patients according to a fixed percentage of between 2-100% of patients per injury category and hospital admission. Each injury patient of the selected sample received a postal questionnaire 2.5 months after the initial treatment of the injury. It was confirmed that the patient was not deceased before the questionnaire was sent. The first questionnaire was made anonymous for privacy reasons. At 5, 12 and 24 months a follow-up questionnaire was sent to patients that responded to the preceding questionnaire. For these questionnaires the patients needed to give permission by an informed consent form. Non-responders on these questionnaires received a reminder, aiming to increase response rates.

### Questionnaire

Data were collected by postal questionnaires at 2.5, 5, 12 and 24 months after injury. The questionnaires included items regarding socio-demographics (age, gender, educational level and household composition), injury-related characteristics (severity, type, and external cause), health care related characteristics (e.g. hospital admission), medical consumption, functional outcome and the Impact of Event Scale-Revised (IESR).

The IESR may be used to assess symptoms of posttraumatic stress indicative of PTSD [13]. The IESR consists of 22 items, which measure intrusive re-experiences of the trauma, avoidance of trauma-related stimuli and hyper arousal. By combining the 22 items the total IESR-score, ranging from 0 through 88, can be calculated. Creamer et al. showed that a cut-off score of 33 on the total IESR-score produced a sensitivity of 0.91, and a specificity of 0.82 against the DSM-IV (the

fourth edition of the Diagnostic and Statistical Manual for Psychiatric Disorders) diagnostic criteria for PTSD as the gold standard [14]. Therefore, we assumed that an IESR-score higher than 32 ( $IESR \geq 33$ ) represents symptoms of posttraumatic stress indicative of PTSD.

The 2.5 month follow-up questionnaire included 19 items regarding the presence of one or more chronic disease(s) prior to the injury to assess comorbidity [15], e.g. chronic non-specific lung disease, heart disease, diabetes, backache, arthrosis, rheumatoid arthritis. Comorbidity is defined as the presence of any coexisting medical conditions or disease processes additional to the injury that the injury patients sustained [16].

The 2.5, 5, 12 and 24 month follow-up questionnaire included items to measure HRQoL. HRQoL is an index of perceived functional outcome of an illness and disability that is anchored between 0 (worst imaginable health state or death) and 1 (full health), thus allowing comparison between the health status of patients with distinct diseases. To measure functional outcome and HRQoL, the 2, 5, 12 and 24 month follow-up questionnaires included the EQ-5D. With the EQ-5D classification system, subjects describe their health state by assigning themselves to one of three function levels (grades) in 5 separate domains: mobility, self-care, usual activities, pain/discomfort and anxiety/depression [17,18]. Subsequently, the utility weight of that health state is computed by a formula that firstly yields a partial weight score for each domain depending on the reported level, and secondly adds the utility weights (also referred to as the tariff), which were derived at an earlier stage from preference data of the population of the United Kingdom [19].

### Statistical Analysis

For analysis of the data the Statistical Package for the Social Sciences version 21 was used (SPSS Inc, Chigaco, Ill). Chi-square statistics (dichotomous variables) and Fisher's exact tests were used to test for differences between the non-respondents and the respondents. Non-parametric variables (age) were tested using the Mann-Whitney U-test. To assess PTSD, we calculated the IESR-score of each of the injury patients. The IESR-score can only be calculated if all 22 IESR items are completed. Chi-square statistics (dichotomous variables) and Student *t* tests (continuous variables) were used to test for differences between injury patients with IESR-scores higher or lower than 33.

We firstly used univariate logistic regression analysis to explore the association between patient demographics, presence of comorbid diseases and care with regard to PTSD ( $IESR \geq 33$ ) at 2.5, 5, 12 and 24 month post-trauma. Secondly, stepwise multiple logistic regression analyses (enter method) was applied to investigate the association between socio-demographics (block 1), hospitalization and comorbidity (block 2) and PTSD ( $IESR \geq 33$ ) further.

We composed flow charts including respondents that completed the IESR at the four time points, to gain insight in PTSD trajectories.

For the analysis of the association between  $IESR \geq 33$  and HRQoL, we selected participants that filled in the EQ-5D and the IESR. To test differences between participants with and without PTSD and mean EQ-5D summary scores were tested with a one-way ANOVA. Stepwise multiple linear regression analyses (enter method) was applied to investigate the association between socio-demographics (block 1), comorbidity and hospitalization (block 2), PTSD ( $IESR \geq 33$ ) (block 3) and HRQoL measured with the EQ-5D.

P-values < 0.05 were considered to indicate statistical significance.

## Results

### Study population

The response rates were 36% (n=2918) at 2.5 months; 16% (n=1267) at five months; 13% (n=1076) at twelve months and 13% (n=1045) at 24 months following initial treatment of the injury. A flow chart of study participants demonstrates the number of respondents and the number of respondents that completed the IESR at each time point (Figure 1).

Respondents were significantly older than non-respondents (median age 54 versus median age 47,  $p < 0.05$ ), the proportion females was higher (non-responders: 43% female versus responders: 52% females,  $p < 0.01$ ) and the proportion of hospitalized patients was higher (non-responders: 45% hospitalized versus responders: 55% hospitalized,  $p < 0.01$ ). Accident category and type of injury also differed significantly between responders and non-responders (both  $p < 0.01$ ) (Table 1).

### Prevalence of PTSD

With reference to the respondents that completed the 2.5 month follow-up questionnaire, 2322 (80%) filled out the IESR. At 5, 12 and 24 month follow-up, 80%, 77% and 56% respectively filled out the IESR (Table 2) shows the characteristics of the respondents with an IESR-score of 33 or higher, which indicates the likely presence of PTSD. At 2.5, 5, 12 and 24 month follow-up 8.7%, 6.8%, 6.3% and 5.3% respectively of the respondents had PTSD (IESR  $\geq 33$ ).

### Risk factors for developing PTSD

Univariate logistic regression analyses showed that older age (age  $\geq 55$ ), female sex, lower educational level, household composition (alone), co-morbid disease and hospital admission were significantly associated with PTSD at 2.5 month follow-up. At 5 months follow-up female sex, lower educational level and comorbid disease were significantly associated with PTSD. At 12 follow up female sex and comorbid disease and at 24 month follow up older age (age  $\geq 55$ ), female sex, household

	Sample	Non-respondents	Respondents
n	8057	5139	2918
Patient demographics			
Age $\ddagger$	49.8 (SD <sup>b</sup> 31.3)	47.2 (SD <sup>b</sup> 32.7)	54.2 (SD <sup>b</sup> 28.1)
Female sex $\ddagger$	46.3	42.9	52.4
Accident category $\ddagger$			
Home and leisure	54.6	59.0	52.9
Traffic	21.2	19.5	26.1
Occupational	7.5	8.8	6.1
Sport	12.2	12.7	12.6
Violence	4.5	5.9	2.2
Type of injury $\ddagger$			
Skull-brain injury	11.4	11.3	11.8
Facial fracture, eye injury	4.0	4.5	3.2
Spine, vertebrae	4.6	3.9	5.7
Internal organ injury	5.9	5.8	6.0
Upper extremity fracture	11.1	10.1	12.9
Upper extremity, other	6.6	6.9	5.9
Hip fracture	8.1	7.4	9.2
Lower extremity fracture	12.9	12.0	14.6
Lower extremity, other	10.5	10.4	10.6
Superficial injury, open wounds	18.6	20.0	16.1
Burns	1.3	1.5	1.0
Poisonings	1.6	2.1	0.6
Other injury	3.4	3.9	2.4
Hospitalization $\ddagger$	49.0	45.3	55.4

<sup>b</sup>sd = standard deviation

$\ddagger p < 0.001$  (comparison between nonrespondents and respondents)

$\ddagger p < 0.05$  (comparison between nonrespondents and respondents)

**Table 1:** Characteristics of the study population (age 15 and older).

composition (alone) and comorbid disease were significantly associated with PTSD.

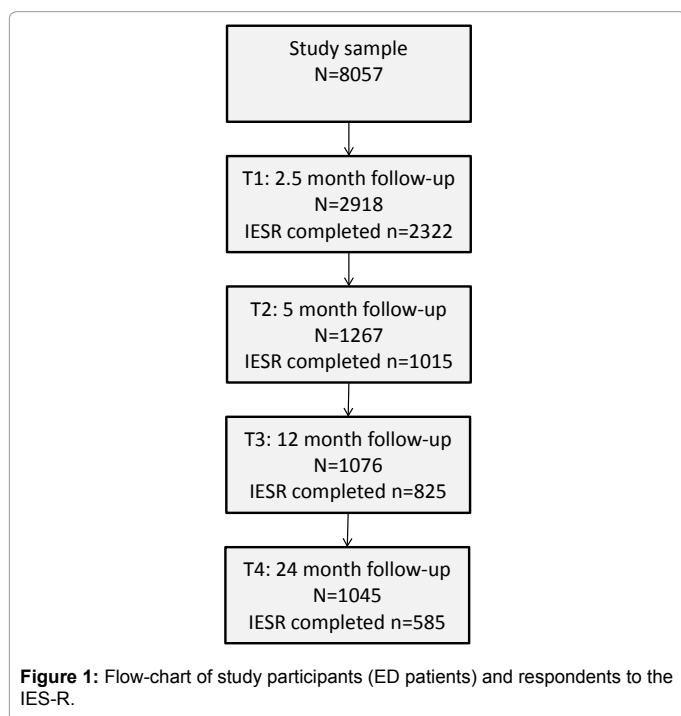
Multivariate logistic regression analysis including socio-demographic, physical and injury care variables, indicated that comorbid disease (OR 2.1; 95% CI, 1.5 to 2.9), lower educational level (OR 2.0; 95% CI, 1.4 to 2.7), admission to hospital (OR 1.8; 95% CI, 1.3 to 2.5) and female gender (OR 1.5; 95% CI, 1.1 to 2.1) are independent predictors of PTSD 2.5 month year after injury. Lower educational level (OR 2.6; 95% CI, 1.5 to 4.4), comorbid disease (OR 1.9; 95% CI, 1.1 to 3.3) and female sex (OR 1.8; 95% CI, 1.0 to 3.1) and were independent predictors of PTSD 5 months after injury. At 12 month after injury comorbid disease (OR 2.8; 95% CI, 1.5 to 5.2) was an independent predictor of PTSD (Table 3).

### PTSD trajectories

(Figure 2A and 2B) show the PTSD trajectories. These figures include only those patients who completed the IESR at 2.5, 5, 12 and 24 month follow-up (n=451). Of the injury patients who did not meet the PTSD criterion of an IESR of 33 or higher at 2.5 month follow-up, 18 (4.3%) did meet this criterion of PTSD later on. Of the patients with PTSD at 2.5 month follow-up, 15 (45.5%) did not meet the PTSD criterion at 5 month follow-up or later. Approximately one in four patients who met the criterion for PTSD at 2.5 month follow-up (27%; n=9) had PTSD (IESR  $\geq 33$ ) a year later.

### Association of PTSD with HRQoL

Injury patients with PTSD had a significantly lower mean EQ-



	PTSD			
	2.5 months (%)	5 months (%)	12 months (%)	24 months (%)
<b>Total</b>	8.7	6.8	6.3	5.3
<b>n</b>	202	69	52	31
<b>Mean IESR-score<sup>a</sup></b>	46.6 (SD <sup>b</sup> 12.2)	47.6 (SD <sup>b</sup> 13.1)	44.8 (SD <sup>b</sup> 12.3)	45.4 (SD <sup>b</sup> 12.3)
<b>Socio-demographics</b>				
Age				
<50	7.8‡	6.4	6.3	3.4‡
≥ 50	9.9	7.0	6.2	6.9
Gender				
Male	6.8‡	5.1‡	4.5‡	3.7‡
Female	10.7	8.4	7.9	7.1
Household composition				
Alone	11.0‡	7.4	8.1	10.7‡
Not alone	6.8	6.6	5.7	3.8
Educational level				
Primary and lower	13.4‡	11.9‡	8.7	9.6
Middle and higher	6.6	5.4	5.5	4.1
<b>Physical</b>				
Comorbid disease				
No comorbidity	6.3‡	5.0‡	4.0‡	3.2‡
Comorbid disease(s)	13.5	9.8	10.2	9.0
<b>Care</b>				
ED treatment	6.4‡	6.8	7.3	5.6
Admitted to hospital	10.8	6.8	5.7	5.0

<sup>a</sup> Continuous variable

<sup>b</sup> SD = standard deviation

‡ p<0.001

‡ p<0.05

**Table 2:** Characteristics of the respondents and post-injury care, stratified by presence of PTSD (IESR-score ≥ 33).

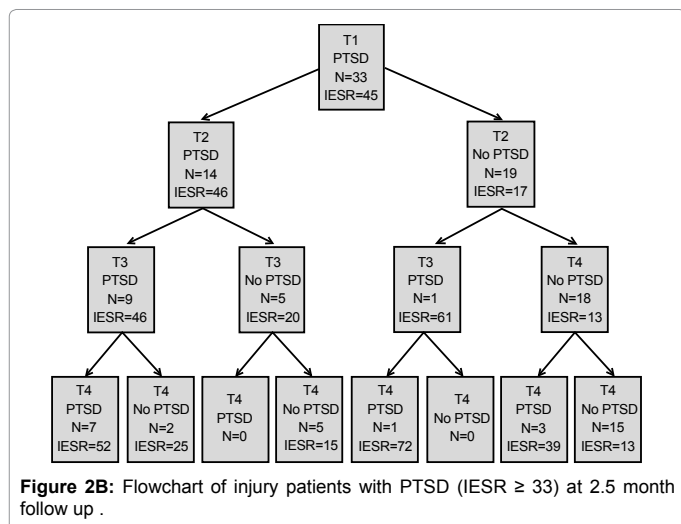
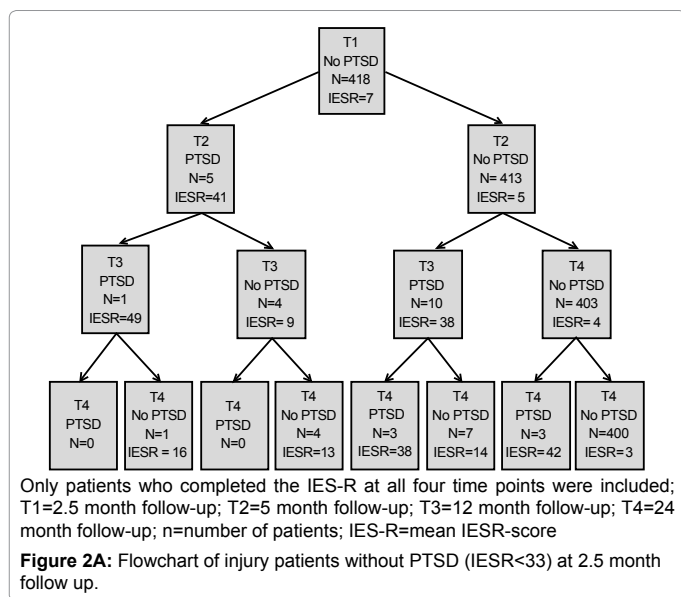
	OR	95% CI	p
2.5 month follow up			
Female sex	1.54	1.11-2.12	<0.05
Age <sup>b</sup>	1.00	0.99-1.01	0.729
Lower educational level	1.96	1.42-2.71	<0.001
Household composition (alone)	1.29	0.92-1.81	0.145
Comorbid disease	2.06	1.48-2.87	<0.001
Admitted to hospital	1.81	1.30-2.51	<0.001
5 month follow up			
Female sex	1.77	1.03-3.05	<0.05
Age <sup>b</sup>	0.99	0.98-1.01	0.237
Lower educational level	2.58	1.52-4.38	<0.001
Household composition (alone)	0.98	0.53-1.82	0.954
Comorbid disease	1.92	1.12-3.31	<0.05
Admitted to hospital	1.00	0.59-1.69	0.987
12 months follow up			
Female sex	1.75	0.94-3.24	0.077
Age <sup>b</sup>	1.00	0.98-1.02	0.922
Lower educational level	1.61	0.87-3.01	0.131
Household composition (alone)	1.28	0.67-2.43	0.452
Comorbid disease	2.78	1.48-5.23	<0.05
Admitted to hospital	0.88	0.49-1.59	0.675

24 month follow up			
Female sex	1.35	0.60-3.02	0.464
Age <sup>b</sup>	1.03	1.00-1.05	0.055
Lower educational level	2.00	0.90-4.43	0.088
Household composition (alone)	2.00	0.89-4.51	0.094
Comorbid disease	2.08	0.94-2.04	0.070
Admitted to hospital	0.93	0.42-2.04	0.858

<sup>a</sup> Adjusted for all included predictors in model using multivariate logistic regression analysis

<sup>b</sup> Continuous variable

**Table 3:** Odds ratios<sup>a</sup>(OR) and 95% confidence interval (CI) for the association of PTSD (IESR score  $\geq$  33) with characteristics of the respondent and post-injury care.



5D summary score compared to injury patients without PTSD at all follow-up time points. At 2.5 month follow-up the calculated mean EQ-5D summary score for injury patients with IESR scores  $\geq$  33 was 0.34, whereas for injury patients with lower IES scores the mean EQ-5D summary score was 0.72: (t=108.2; p<0.001). At 5 month follow-up the calculated mean EQ-5D summary score for injury patients with IESR scores  $\geq$  33 was 0.40, whereas for injury patients with lower IESR scores the mean EQ-5D summary score was 0.76: (t=41.4; p<0.001). At 12 and 24 month follow-up the calculated mean EQ-5D summary scores for

injury patients with IESR scores  $\geq$  33 were 0.42 and 0.43 respectively, whereas for injury patients with lower IESR scores the mean EQ-5D summary score were 0.80 and 0.84 respectively: (12 month: t=23.5; p<0.001; 24 month t=39.0; p<0.001). PTSD (IESR  $\geq$  33) was associated with a mean utility loss of 0.31-0.45 in injury patients without comorbid disease and 0.23-0.36 in injury patients with comorbid disease (Figure 3).

The models tested to predict HRQoL measured with EQ-5D at 2.5, 5, 12 and 24 month follow-up were all statistically significant (2.5 month follow-up: F=257.42, p<0.001; 5 month follow-up: F=151.74, p<0.001; 12 month follow-up: F=122.30, p<0.001; 24 month follow-up: F=95.96, p<0.001). (Table 4) shows that PTSD (IESR  $\geq$  33) is associated with decreased HRQoL, even after controlling for possible confounders.

## Discussion

PTSD is common in a comprehensive population of injury patients at severity levels and external causes. At 2.5 month follow-up 9% of our sample had an IESR-score of 33 or higher, indicating probable PTSD. At 5, 12 and 24 month follow-up PTSD prevalence rates were 7%, 6% and 5% respectively. These prevalence rates are higher compared to PTSD prevalence rate of the general Dutch population, which is estimated to range between 3% and 4% [20,21].

The PTSD prevalence rates that we found in our study are comparable to those found by O'Donnell et al. [2] and Turpin et al. [22], who reported PTSD prevalence rates of 9% and 7% respectively regarding injury patients treated at the ED and/or hospitalized at 3 months follow-up. At later follow-up time points (5-6 months and 12 months follow-up) both studies found much higher PTSD prevalence rates, ranging from 10% to 30%. Shalev et al. who investigated PTSD among a similar ED population also found much higher PTSD prevalence rates ranging from 30% at one month follow-up to 18% at 4 month follow-up [3]. This difference in PTSD prevalence rates may be explained by the different diagnostic instruments that were used to assess PTSD symptoms. O'Donnell et al. [2], Turpin et al. [22], nor Shalev et al. [3] used the IESR to assess PTSD and this may have affected the PTSD prevalence rates that were found.

With regards to the association of characteristics and PTSD the findings of the current study showed that female gender and lower educational level were predictors of PTSD at 2.5 and 5 month follow-up, whereas comorbid disease was a predictor of PTSD at 2.5, 5 and 12 month follow-up. The finding that female gender was associated with PTSD is in line with findings in the general literature [23] and has been reported by other studies on PTSD following injuries [1,24-26].

Previous studies on PTSD and injury focussed on the prevalence of PTSD, whereas this study also provided insight in PTSD trajectories. Our study showed that, although overall PTSD patients were a recovering (and thus declining) cohort, a number of patients entered the threshold of PTSD, recovered, and lapsed back at different time

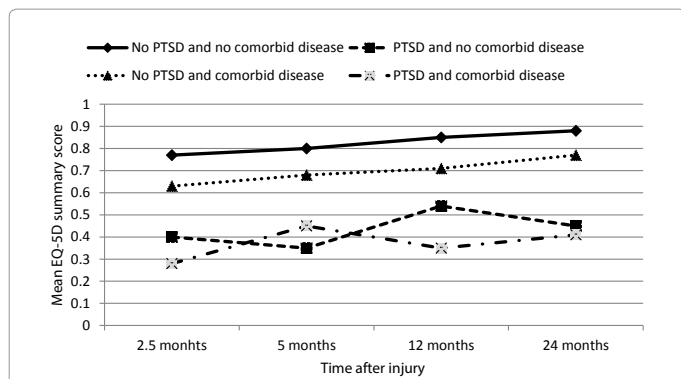


Figure 3: Mean EQ-5D summary scores of injury patients with and without PTSD (IESR ≥ 33).

	Comorbidity		0.194	<0.001
	Hospitalization		0.154	<0.001
	PTSD <sup>d</sup> (IESR-score ≥ 33)		0.357	<0.001
		0.296		

<sup>§</sup>Analysis based on stepwise multivariate regression analysis with demographics (age, sex, household composition and educational level) as block 1; comorbidity and hospitalization as step 2, and posttraumatic stress symptoms indicative of PTSD (IESR-score ≥ 33) as step 3.

<sup>a</sup>PTSD (IESR ≥ 33) at 2.5 month follow-up

<sup>b</sup>PTSD (IESR ≥ 33) at 5 month follow-up

<sup>c</sup>PTSD (IESR ≥ 33) at 12 month follow-up

<sup>d</sup>PTSD (IESR ≥ 33) at 24 month follow-up

Table 4: Predictors of health-related quality of life measured with the EQ-5D at 2.5, 5, 12 and 24 month follow-up<sup>§</sup>.

	Predictors	R <sup>2</sup>	Standardized B	p
2.5 month follow-up				
	Sex		0.080	<0.001
	Age		-0.085	<0.001
	Household composition		0.041	<0.05
	Educational level		0.066	<0.05
	Comorbidity		0.165	<0.001
	Hospitalization		0.256	<0.001
	PTSD <sup>a</sup> (IESR-score ≥ 33)		0.301	<0.001
		0.273		
5 month follow-up				
	Sex		0.055	0.056
	Age		-0.165	<0.001
	Household composition		0.003	0.908
	Educational level		0.048	0.097
	Comorbidity		0.145	<0.001
	Hospitalization		0.190	<0.001
	PTSD <sup>b</sup> (IESR-score ≥ 33)		0.349	<0.001
		0.255		
12 month follow-up				
	Sex		0.120	<0.001
	Age		-0.142	<0.001
	Household composition		-0.036	0.250
	Educational level		0.117	<0.001
	Comorbidity		0.202	<0.001
	Hospitalization		0.135	<0.001
	PTSD <sup>c</sup> (IESR-score ≥ 33)		0.339	<0.001
		0.292		
24 month follow-up				
	Sex		0.087	<0.05
	Age		-0.141	<0.001
	Household composition		-0.001	0.970
	Educational level		0.107	<0.05

points following injury. Even though this latter group of patients did not meet the criterion of PTSD (IESR ≥ 33) at each time point, the mean IESR-score of patients who recovered and lapsed was on average much higher (mean IESR-scores between 9 and 25) when they did not meet the criterion compared to the patients who did not meet the criterion at any follow-up time (mean IESR-scores between 3 and 7). This signifies that PTSD symptoms fluctuate over time; patients meet criteria or cut-off at some time points, and at other points they fall just below, but they do suffer from the prolonged effects of posttraumatic stress symptoms. Of the patients who did meet the criterion of PTSD at all four time points almost three quarters was female. This is in line with findings by Holbrook et al., who showed that female injury patients are at significantly higher risk for prolonged PTSD than male patients [1].

Regarding health-related quality of life, we found that injury patients with PTSD had a significantly lower mean EQ-5D summary score compared to injury patients without PTSD, indicating a lower HRQoL. A study of patients with PTSD following cardiac arrest reported similar findings [27]. In another study among adolescent victims PTSD was associated with impairments in Role/Social Behavioral, Role/Social Physical, Bodily Pain, General Behavior, Mental Health, and General Health Perceptions subscales of the 87-item Child Health Questionnaire [11]. The resulting EQ-5D summary scores of injury patients with PTSD found in the current study are approximately in the range of: the utility scores that Holbrook et al. derived with the Quality of Well-being scale [9]. In our study the EQ-5D summary scores showed that injury patients with had a mean utility loss of 0.23 – 0.45 compared to injury patients without PTSD. This corresponds with the utility loss of 0.23-0.33 of patients with PTSD compared to those without found by Haagsma et al. in a similar sample of injury patients [12].

Our findings that PTSD is associated with a considerable decrease of HRQoL at each time point, even after correction for possible confounders such as comorbidity and hospitalization concurs with the findings by O'Donnell et al. who found that psychiatric symptoms play a substantial role in the development and maintenance of long-term disability measured with the World Health Organization Disability Assessment Schedule [28].

### Strengths and limitations

A main limitation of our study was the low response rate. Comparison of the characteristics of non-responders and responders extracted from the Dutch Injury Surveillance System revealed that respondents who were willing to participate in the study were significantly older, significantly more likely to be female and more severely injured patients. As a result the results of this study may not be generalizable to young male injury patients. The lowresponse rates may

have led to selection bias and in its turn to under- or overestimation of the prevalence of PTSD [20]. In the case of our study there was the risk of overestimation, since women were overrepresented while female gender is thought to be a predictor of PTSD [1,12,29,30]. Also patients who demonstrated PTSD symptoms at a previous time point tended to respond to the questionnaire more often, who are likely to still have PTSD at later time points.

Despite the low response rate, a strength of our study is that we used a relatively large study sample; even at 24 months the number of participants (n=1,045) was high compared to previous work in this field. Additionally, this study was not restricted to particular injury subgroups, whereas most studies regarding the prevalence of PTSD among injury patients concern specific groups of injury patients such as victims of motor vehicle accidents or victims with severe injuries [9,31-34]. The high variety of type of injury and injury severity included in this study and the relatively large sample size allowed examination of the association of a number of patient and injury characteristics and PTSD.

This study used a self-report questionnaire to identify cases of PTSD. However, it should be noted that self-report questionnaires are not designed to diagnose mental disorders according to the DSM-IV. As a result, cases identified with post-traumatic stress symptoms indicative of PTSD may not meet the DSM-IV criteria of clinical PTSD, and conversely. In our study the IESR was used to measure PTSD. The IESR measures symptoms of all three main PTSD criteria rather than two as measured by the IES [35]. To avoid over diagnosing of PTSD in a comprehensive population with a relative low PTSD prevalence, it is important to use a high IESR cut-off score that incurs a high specificity. In our study, we used an IESR cut-off of 33. This is in line with earlier studies that suggest that an IES-score of greater than 33 is appropriate to avoid overestimation [14].

## Conclusions

We conclude that 2.5 months following injury almost 10% of patients admitted to an ED due to injuries of all causes and severity levels have an IESR-score of 33 or higher, indicating evident symptoms of PTSD. Comorbid disease, female gender, low educational level, and hospitalization were the strongest independent predictors of PTSD. The results of the current study showed that PTSD is associated with decreased HRQoL even after correction for possible confounders such as comorbidity. PTSD seems a major barrier for full recovery of injury patients of even minor levels of severity, and the development and evaluation of ED based policies for its early diagnosis and treatment should therefore be stimulated.

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