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Onset and maintenance of psychiatric disorders after serious accidents

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Abstract The purpose of this study was to prospectively investigate the onset, course, and remission of psychiatric disorders in the first 6 months after a serious accident for consecutive patients in a hospital emergency department. Participants were 58 patients aged 18–65 who were assessed shortly after attending a hospital emergency department and were followed up 6 months afterwards. Patients were interviewed with regard to past and current psychiatric history using different instruments (e.g. SCID for DSM-IV). Prior to their accidents, 35% of all subjects had experienced one or more psychiatric disorders (lifetime prevalence). Shortly after the accident, the incidence of Acute Stress Disorder (7%), subsyndromal Acute Stress Disorder (12%), and adjustment disorder (1.5%) was increased as a reaction to the accident. At this time, 29% of all patients suffered from an acute psychiatric disorder. Six-months after the accident, 10% of the subjects met criteria for Major Depression, 6% for PTSD, 4% for subsyndromal PTSD, and 1.5% for Specific Phobia as newly developed disorders.

The course of the psychiatric disorders shows that those patients who met criteria for any psychiatric diagnosis shortly after the accident ran a much higher risk for developing new or comorbid psychiatric disorders in the future.

Key words posttraumatic Stress Disorder · PTSD · accidents · traumatology · injury

Introduction

Serious traffic accidents, industrial accidents, or household accidents are very frequent events that are considered as traumatic because they can be associated with threat, fear of dying, and loss. Lifetime prevalence of exposure to an accident is estimated to be 25% for men and 13% for women [14]. Recent research in the field of psychotraumatology has shown that accidents can lead to the onset of a variety of psychiatric disorders such as PTSD, depression, Specific Phobia, or substance abuse [10, 19, 24]. Nevertheless, the majority of studies on the prevalence of psychiatric disorders after serious accidents have focused on the onset of PTSD. Their results vary significantly due to small selected samples and differences in research methods [3]. Although most research about the onset of psychiatric disorders has been carried out in the first 6 months after an accident [1, 2, 5, 6, 8, 9, 19, 20, 22, 25, 26], the results of the prevalence of PTSD at that point still vary between 17.4 [25] and 46% [2]. Few studies have also explored the onset of depression and specific phobic anxiety [2, 19–21], but those that have also differ considerably in their findings. The results for depression range from 5 [19] to 17.5% [20], and those for Specific Phobia from 2 [2] to 22% [19].

Therefore, our knowledge about the psychiatric consequences of serious accidents is still very limited and inconsistent.

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A broadening of the knowledge in this area is a prerequisite for setting up procedures to identify subjects at risk for the development of PTSD, depressive, phobic or other psychiatric outcomes and to implement and evaluate preventive interventions.

This paper focuses on the onset, maintenance, and remission of various psychiatric disorders in the first 6 months after experiencing a serious accident for consecutive patients in a hospital emergency department. We were able to assess patients shortly after attending a hospital emergency department and followed them up 6 months afterwards. Past and current psychiatric diagnosis was assessed with a structured clinical interview (SCID for DSM-IV).

Patients and methods

A total of 58 subjects aged 18–65 participated in this study. All participants were recruited from the surgical ward and the plastic surgical ward of the University Hospital of Schleswig-Holstein, Campus Luebeck, and the surgical wards of the Sana Clinic in Luebeck, to which they were admitted for medical care after serious accidents. The vast majority of severely injured accident victims in the region around Luebeck are treated in these clinics, meaning that a selection bias of patients is not expected. Patients were injured either while driving a car or motorcycle, while riding a bike or as pedestrians in a traffic accident, or in an industrial or household accident. Inclusion criteria were hospital admission after a serious accident, at least moderate injuries (Injury Severity Score >4 [12]), age between 18 and 65 years, time of interview within the first 6 weeks after the accident, and sufficient knowledge of the German language. Exclusion criteria were mental disability, suffering from a serious psychiatric disorder that needed to be treated immediately by a psychiatrist, or being under psychiatric or psychotherapeutic treatment prior to admission to hospital.

■ Procedure

Hospitalized patients of the surgical wards were contacted as soon as possible after the accident, but within the first 6 weeks (mean 10.4 days, standard deviation 12.0 days). They were asked to participate in diagnostic interviews and to fill out self-rating questionnaires shortly after the accident and at a 6-month follow-up. After giving written informed consent, they were included in the study. The assessments were conducted by a trained clinical psychologist (MK).

■ Instruments

At the initial assessment, data about the details of the accident and about injuries and first psychological reactions were collected through a locally developed semi-structured *accident interview* and through case notes. In order to assess one or more current and lifetime (before the accident) diagnosis, the German version of the *Structured Clinical Interview for DSM-IV, Axis I (SKID-I)* [23] was administered. For the current diagnosis at initial assessment, special care was taken to determine the correct onset of the diagnosis, either before or after the accident. *Sociodemographic data* were obtained through interview and case notes. The severity of injury was assessed by the *Abbreviated Injury Scale (AIS)* [12]. In the AIS, a physician is required to rate the severity of injury for seven bodily areas separately on a scale from 0 to 6. Following this, based on an algorithm, the total score of severity of injury (Injury Severity Score, ISS) can be calculated from the single ratings.

Six-months later, participants were contacted again and a follow-up assessment took place in the clinic, in the patient's own home, or if neither of these options were possible the patients were interviewed by telephone. In this follow-up assessment, the SKID-I was administered again to assess the onset and remission of any psychiatric diagnosis since the accident.

We also assessed current posttraumatic, depressive, and anxiety symptoms, the history of previous trauma, trauma-specific cognitions, coping with intrusions, trauma-specific avoidance behavior, coping with illness strategies, sense of coherence, social support, disclosure, life satisfaction and overall ratings of psychological distress at both assessment times. We will report on these in subsequent papers.

■ Statistical analysis

Statistical analysis was performed with the SPSS program, version 10.0. The onset and course of psychiatric diagnosis were calculated with frequency analysis. Tests of significance for categorical variables were carried out using χ^2 -tests. Fisher's exact test was used when an expected cell value was <5 . Tests of normal distribution were performed using Kolmogorov–Smirnov tests. Normally distributed, continuous variables were tested for significance with *t*-tests and not normally distributed, continuous variables with *U*-tests (Mann–Whitney).

Results

■ Patients

Total of 158 patients were contacted after admission to one of the surgical wards in Luebeck. Fifty-four patients (34.2%) could not be included in our study because they suffered from mild injuries (Injury Severity Score <4), were less than 18 or more than 65 years old, could not be contacted within 6 weeks after the accident or after waking up from coma, did not have sufficient knowledge of the German language, were mentally retarded, suffered from a serious psychiatric disorder that needed to be treated immediately, or were under psychiatric or psychotherapeutic treatment prior to the accident. Seven patients (4.4%) were not able to participate in the follow-up assessment and 39 patients (24.7%) were not interested in participation. These patients ($N = 39 + 7 = 46$) were also excluded, but were compared with the participants of the initial assessment ($N = 58$) in order to examine selection bias. At 6 months, 52 patients (89.7%) were interviewed again. Table 1 shows some of the characteristics of the participants ($N = 58$) in comparison to the non-participants.

Approximately two-thirds of the participants (58.6%) were men and one-third (41.4%) were women. The mean age of the participants was 38.57 years (SD = 14.21). Nearly half were married (48.3%). The mean Injury Severity Score was 14.84 (SD = 11.53). On average, participants stayed in hospital for 45.33 days (SD = 40.04). The vast majority of the participants had suffered a traffic accident (87.9%), while the remaining patients had experienced a household accident (12.1%). None of the participants had been injured in an industrial

accident. Nearly half of those who experienced a traffic accident were vehicle drivers (45.1%), and other participants consisted of cyclists (15.7%), motorcyclists (13.7%), pedestrians (9.8%), vehicle passengers (7.8%), or moped riders (7.8%). Nearly half of all participants (46.6%) blamed other people for the accident, one quarter blamed themselves (25.9%), and for the other participants the responsibility remained unclear (27.6%). Only one fifth of all participants experienced fear of dying; the majority did not.

In order to explore selection bias, we compared the 58 participants with the 46 eligible subjects who did not participate in terms of sociodemographic, accident, and medical variables. The two groups did not differ significantly with regard to sociodemographic factors such as age, sex, or marital status, or regarding injury severity, attribution of responsibility for the accident, and fear of dying. Highly significant differences were found with regard to length of hospital stay and type of accident. Participants stayed significantly longer in hospital than non-participants ($z = -2.57$; $P = 0.01$), and patients who suffered from an industrial accident were much less likely to participate ($\chi^2 = 15.955$, $df = 2$, $P < 0.01$).

Psychiatric disorders prior to the accident (lifetime)

Approximately one third (34.5%) of all participants fulfilled criteria for at least one lifetime psychiatric diagnosis prior to the accident. The most frequent diagnoses were depression (19.0%), alcohol abuse (6.9%), and anorexia nervosa (5.2%). Nearly half (45.8%) of all women and 26.5% of all men had suffered from one or more psychiatric disorders. The most frequent diagnoses for women were depression (29%) and anorexia nervosa (12.5%), whereas men suffered most frequently from alcohol abuse (11.8%) and depression (11.8%). (Table 2)

Number of psychiatric disorders within the first 6 weeks after the accident

Within the first 6 weeks after the accident, one or more current psychiatric disorders were diagnosed by one quarter (27.6%) of all subjects. The diagnosis of one or more psychiatric disorders 6 weeks after the accident was significantly higher for women (41.7%) than for men (17.6%, $\chi^2 = 4.063$, $df = 1$, $P < 0.05$). Acute Stress Disorder (6.9%) and subsyndromal

Table 1 Characteristics of participants and non-participants

Characteristic	Participants		Non-participants		Analysis		
	Mean (N = 58)	SD	Mean (N = 46)	SD	Test	df	P
Demographic							
Age	38.57 N	14.21 %	41.70 N	14.50 %	$t = -1.10$ Test	102 df	n.s. P
Sex							
Male	34	58.6	33	71.7	$\chi^2 = 1.926$	1	n.s.
Female	24	41.4	13	28.3			
Marital status					$\chi^2 = 2.366$	4	n.s.
Married	28	48.3	20	43.5			
Single	22	37.9	21	45.7			
Divorced	6	10.3	4	8.7			
Widowed	2	3.4	1	2.2			
Injury	Mean	SD	Mean	SD	Test	df	P
Injury severity score	14.84	11.53	15.04	14.62	$z = -0.717$		n.s.
Hospital days	45.33	40.04	34.17	56.54	$z = -2.57$		0.01
Accident	N	%	N	%	Test	df	P
Type of accident					$\chi^2 = 15.955$	2	0.00
Traffic accident	51	87.9	29	63.0			
Industrial accident	0	0.0	11	23.8			
Household accident	7	12.1	6	13.0			
Attribution of responsibility					$\chi^2 = 2.115$	2	n.s.
Self	15	25.9	18	39.1			
Others	27	46.6	17	37.0			
Unclear	16	27.6	11	23.9			
Traffic accident: the patient was injured as					$\chi^2 = 3.034$	5	n.s.
Vehicle driver	23	45.1	10	34.5			
Vehicle passenger	4	7.8	4	13.8			
Motorcyclist	7	13.7	5	17.2			
Moped rider	4	7.8	2	6.9			
Cyclist	8	15.7	7	24.1			
Pedestrian	5	9.8	1	3.4			
Fear of dying					$\chi^2 = 0.18$	1	n.s.
Yes	13	22.4	8	17.4			
No	44	75.9	29	63.0			
No answer	1	1.7	9	19.6			

Table 2 Number of psychiatric disorders prior to the accident (lifetime)

Diagnostic category	Total N of patients	%	Gender	
			Male (N = 34)	Female (N = 24)
Posttraumatic stress disorder	1	1.7	0 (0.0%)	1 (4.2%)
Major depression	11	19.0	4 (11.8%)	7 (29.2%)
Specific phobia	2	3.4	1 (2.9%)	1 (4.2%)
Panic disorder	1	1.7	0 (0.0%)	1 (4.2%)
Dysthymia	1	1.7	0 (0.0%)	1 (4.2%)
Anorexia nervosa	3	5.2	0 (0.0%)	3 (12.5%)
Alcohol abuse	4	6.9	4 (11.8%)	0 (0.0%)
Substance abuse	2	3.4	1 (2.9%)	1 (4.2%)
Other psychiatric diagnosis	7	12.1	3 (8.8%)	4 (16.7%)
No psychiatric diagnosis prior to the accident	38	65.5	25 (73.5%)	13 (54.2%)
Total prevalence of psychiatric diagnosis prior to the accident	20	34.5	9 (26.5%)	11 (45.8%)

Acute Stress Disorder (12.1%) showed the highest prevalence rates. With regard to the diagnosis of Acute Stress Disorder (ASD), there was a significant difference between men and women (ASD: $\chi^2 = 6.086$, $df = 1$, $P < 0.05$). The vast majority of participants who fulfilled criteria for ASD were female (women: 16.7%; men: 0.0%) (Table 3).

Psychiatric disorders 6 months after the accident

Six-months after the accident, one fifth (19.2%) of participants continued to report psychiatric symptoms. The added incidence rates for PTSD (5.8%) and subsyndromal PTSD (3.8%) were as high as the incidence rate for Major Depression (9.6%). Only one patient developed a specific phobic disorder with onset after the accident (3.2%). No significant gender differences could be found at this point. During the first 6 months after the accident, the total number of women who fulfilled criteria for at least one psychiatric diagnosis remitted from ten (41.7%) to three subjects (14.3%). Remission of prevalence could not be found for male participants. The overall prevalence rate for men remained approximately the same over time (17.6 and 22.6%) (Table 4).

Table 3 Onset of psychiatric disorders within the first 6 weeks after the accident

Diagnostic category	Total N of patients	%	Gender	
			Male (N = 34)	Female (N = 24)
Onset before accident				
Major depression	1	1.7	0 (0.0%)	1 (4.2%)
Specific phobia	2	3.4	1 (2.9%)	1 (4.2%)
Alcohol abuse/dependency	3	5.2	3 (8.8%)	0 (0.0%)
Other psychiatric diagnosis	1	1.7	0 (0.0%)	1 (4.2%)
Onset after accident				
Acute stress disorder, ADS ^a	4	6.9	0 (0.0%)	4 (16.7%)
Subsyndromal ADS	7	12.1	2 (5.9%)	5 (20.8%)
Adjustment disorder	1	1.7	0 (0.0%)	1 (4.2%)
No psychiatric diagnosis	42	72.4	28 (82.4%)	14 (58.3%)
Total prevalence of psychiatric diagnosis/first 6 weeks after accident ^b	16	27.6	6 (17.6%)	10 (41.7%)

^a Significant difference between men and women (Fisher's exact test: $P < 0.05$)

^b Significant difference between men and women ($\chi^2 = 4.063$, $df = 1$, $P < 0.05$)

Course of psychiatric disorders

In Fig. 1, patients are arranged according to their psychiatric diagnosis 6 weeks after the accident. Only patients who were available at the 6-month follow-up ($N = 52$) were included in the evaluation. From those patients who met diagnostic criteria for Acute Stress Disorder (ASD) within the first 6 weeks after the accident (A; $N = 4$), one quarter developed a PTSD and depression, one quarter a subsyndromal PTSD and depression, and 50% recovered completely. Patients who suffered from a subsyndromal ASD at initial assessment (B; $N = 6$) developed either a PTSD (17%) or a Specific Phobia (17%), while approximately two thirds (66%) recovered. Of those subjects who met criteria for any other psychiatric disorder (Specific Phobia, Alcohol Abuse) shortly after the accident (C; $N = 4$), all still suffered from this psychiatric disorder 6 months afterwards, and half of them developed comorbid diagnosis with onset after the accident. One quarter met criteria for alcoholism and comorbid depression, and one quarter suffered from Specific Phobia, comorbid PTSD and Major Depression. Interestingly, of those patients who did not meet diagnostic criteria for any psychiatric disorder shortly after the accident (D; $N = 38$), only one

Table 4 Prevalence of psychiatric disorders 6 months after the accident

Diagnostic category	Total <i>N</i> of patients	%	Gender	
			Male (<i>N</i> = 31)	Female (<i>N</i> = 21)
Onset before accident				
Specific phobia	2	3.8	1 (3.2%)	1 (4.8%)
Alcohol abuse	2	3.8	2 (6.5%)	0 (0.0%)
Onset after accident				
Posttraumatic stress disorder (PTSD)	3	5.8	1 (3.2%)	2 (9.5%)
Subsyndromal PTSD	2	3.8	1 (3.2%)	1 (4.8%)
Major depression	5	9.6	2 (6.5%)	3 (14.3%)
Specific phobia	1	1.9	1 (3.2%)	0 (0.0%)
No psychiatric diagnosis	42	80.8	24 (77.4%)	18 (85.7%)
Total prevalence of psychiatric diagnosis 6 months after accident	10	19.2	7 (22.6%)	3 (14.3%)

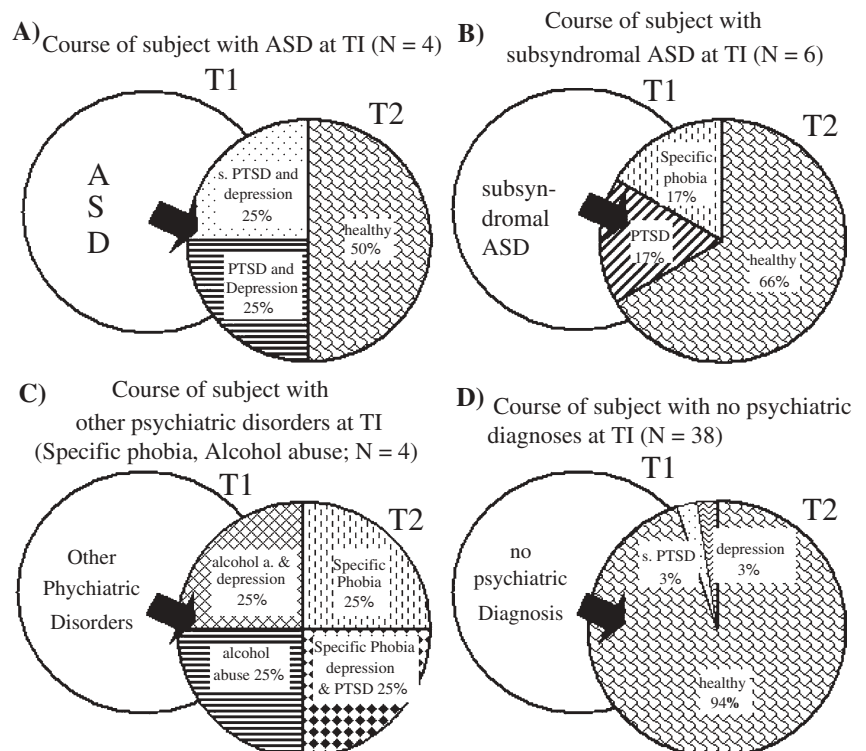
subject developed Major Depression (3%), while one developed a subsyndromal PTSD (3%), and 94% (*N* = 36) remained psychiatrically healthy. The correlation between the prevalence of any psychiatric disorder in the first 6 weeks after an accident and the prevalence of a psychiatric diagnosis 6 months later was tested and found to be highly significant ($\chi^2 = 16.617$, *df* = 1, *P* < 0.001).

Discussion

In our prospective study of 58 moderately to severely injured accident victims, we found a rate of psychiatric disorders prior to the accident (lifetime) of 34.5%. This result might be a rather conservative estimation of the prevalence rate of psychiatric disorders prior to the accident, as accident victims who suffered from a

serious psychiatric disorder that had to be treated immediately by a psychiatrist or who were under psychiatric or psychotherapeutic treatment until admission to hospital were excluded. Nevertheless, our results for the total sample are higher than those of a prospective Israeli study [15] and Swiss study [11]. Differences in results might be due to different characteristics of the samples and assessments of diagnosis. In comparison to our sample, participants of the Israeli study were an average of 10 years younger. In the Swiss study, prevalence of lifetime psychiatric disorders was assessed using a screening interview. In our study, diagnoses were given after interviewing patients with a clinical interview by a trained clinical psychologist. On the other hand, the psychiatric history of non-participants is unknown. It is possible that subjects who experienced psychiatric problems in the past and became acquainted with psychiatric or psy-

Fig. 1 Course of psychiatric outcomes shortly (T1) and within the first 6 months after an accident (T2). ASD: Acute Stress Disorder; PTSD: Posttraumatic Stress Disorder; s. PTSD: subsyndromal Posttraumatic Stress Disorder



chotherapeutic treatment were more likely to participate in our study because they expected psychological support. Unfortunately, this hypothesis cannot be proved by our data. Nonetheless, our results support previous findings [17] that accident victims are more likely to have a positive psychiatric history than the average population.

In the first 6 weeks after an accident, we found a total prevalence rate of psychiatric disorders of 27.6%. Some of these patients were suffering from psychiatric disorders that had started before the accident and did not have any causal link to the accident. As a direct consequence of the accident, the incidence rate for Acute Stress Disorder was 6.9%, for subsyndromal Acute Stress Disorder 12.1%, and for Adjustment Disorder 1.7%. None of our participants showed a depressive disorder with onset after the accident at this point. The prevalence rates of full and subsyndromal Acute Stress Disorder were slightly higher than those found in a Swiss Study [11], but lower than those in an Australian study [13]. Again, these studies vary in terms of assessment procedures and recruitment of subjects, which could explain the differences in results. In our study, patients were recruited consecutively from emergency departments and diagnoses were conservatively given by using a clinical interview.

Shortly after the accident, there were significantly more women who suffered from an Acute Stress Disorder. These results are in line with recent findings about ADS [7]. The total prevalence of one or more psychiatric disorders shortly after the accident was also significantly higher for women, which is due to those female participants who reported symptoms of full and subsyndromal ASD.

At the 6-month follow-up assessment, the total prevalence rate of psychiatric disorders decreased from 27.6 to 19.2%. This is in line with findings of other authors, who also found a decrease of psychopathological symptoms within 6 months after an accident [16, 18]. We found incidence rates of 5.8% for PTSD, 3.8% for subsyndromal PTSD, 1.9% for Specific Phobia, and 9.6% for depression. The results clearly show that the development of depression after motor vehicle accidents is an important problem, which is not to be neglected. The incidence rate for depression is in line with previous findings [25], while incidence rates of full and subsyndromal PTSD and Specific Phobia are lower than expected [e.g. 8, 9, 25, 27]. The relatively low number of participants who experienced fear of dying could be discussed as an explanation for the low prevalence of PTSD. No significant gender differences in prevalence rates could be found, which was rather surprising. In a recently published meta-analysis about predictors of PTSD, the effect size for gender in the population of traffic accident victims was weak to moderate [4]. Therefore, our results might have been influenced by the small sample size.

The results show considerable differences in onset and course of psychiatric disorders after an accident.

Full and subsyndromal Acute Stress Disorder occurred during the first few weeks after the accident, and resolved in either full or subsyndromal PTSD with or without comorbid depression (30%), Specific Phobia (10%), or symptom remission (60%). Half of those patients with other psychiatric diagnoses shortly after the accident (Specific Phobia, Substance Abuse) had developed comorbid diagnosis (Major Depression, PTSD) 6 months after the accident. Therefore, not only the onset of full or subsyndromal Acute Stress Disorder after an accident, but also the incidence of other psychiatric disorders, such as Specific Phobia or alcohol abuse, increases the risk for developing new or comorbid psychiatric disorders in the future. None of our patients who met criteria for Major Depression at the 6-month follow-up fulfilled criteria for a depressive diagnosis in the first few weeks after the accident. Therefore, depressive symptoms develop with latency, possibly as a reaction to negative health, or social or psychiatric consequences of the accident, but not as an immediate psychological adjustment reaction to a traumatic event. The results of our study also show that patients who were found to be psychiatrically healthy shortly after the accident run a very low risk of developing a psychiatric diagnosis within the first 6 months after an accident.

These findings have important implications. Within the first 6 months, the incidence of depressive disorders seems to be as clinically important as the development of PTSD. In order to identify subjects at risk for developing psychiatric disorders after an accident, future research and clinicians should not only focus upon psychopathological symptoms caused by the accident, such as acute stress symptoms, but should also assess general psychopathology. It is not only the subjects who show symptoms of acute stress in the first weeks after an accident who run a high risk for developing PTSD, Major Depression, and Specific Phobia within the first 6 months after an accident; patients who suffer from a psychiatric disorder that was present prior to the accident are also at risk.

Some limitations of the study should be taken into consideration when interpreting these results. These include a relatively small sample size, a short follow-up period, and a large number of non-participants. However, participants and non-participants only differed with regard to length of hospital stay and type of accident, with participants staying longer in hospital and being more likely to have experienced a traffic accident. Therefore, the results seem to be more representative for traffic accident victims. Furthermore, recruitment of the participants from an emergency department and the specific premorbid psychiatric history of the sample should be interpreted as special characteristics of this study.

Another limitation is the difference in time interval between admission to hospital and first assessment of the subjects. Subjects who were interviewed and filled out questionnaires 6 weeks after their accidents an-

swered some questions retrospectively and therefore, some data might be biased or lost. But due to the fact that some of the patients were severely injured, it was impossible to interview them at an earlier point in time (e.g. treatment at intensive care unit).

We conclude that injured victims of accidents are at a considerable risk for developing PTSD as well as other psychiatric disorders such as depression. Therefore, screening procedures should be set up to identify subjects at risk for PTSD, depression, and other psychiatric disorders, and differential preventive interventions for different psychiatric outcomes should be implemented and evaluated.

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