Prevalence and prognostic factors for psychological distress after trauma

Munter, L. de; Polinder, S.; Haagsma, J.A.; Kruithof, N.; Ree, C.L.P. van de; Steyerberg, E.W.; Jongh, M. de

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2020;101:877-84

ORIGINAL RESEARCH

Prevalence and Prognostic Factors for Psychological Distress After Trauma

Leonie de Munter, MSc,[a] Suzanne Polinder, PhD,[b] Juanita A. Haagsma, PhD,[b] Nena Kruithof, MSc,[a] Cornelis L.P. van de Ree, MD,[a] Ewout W. Steyerberg, PhD,[b,c] Mariska de Jongh, PhD[a,d]

From the [a]Department Trauma TopCare, Elisabeth-TweeSteden Hospital, Tilburg; [b]Department of Public Health, Erasmus University Medical Center, Rotterdam; [c]Department of Biomedical Data Sciences, Leiden University Medical Center, Leiden; and the [d]Brabant Trauma Registry, Network Emergency Care Brabant, The Netherlands.

Abstract

Objective: To describe the prevalence and prognostic factors of symptoms of anxiety and depression and posttraumatic stress symptoms (PTSS) after injury in the clinical trauma population.

Design: Multicenter, prospective, observational cohort study.

Setting: Ten hospitals in Noord-Brabant, The Netherlands.

Participants: Four thousand two hundred thirty-nine adult patients (N = 4239) admitted due to injury between August 2015 and December 2016.

Interventions: Patients were asked to complete a questionnaire at 1 week and at 1, 3, 6, and 12 months after injury.

Main Outcome Measures: The Hospital Anxiety and Depression Scale was used to assess anxiety and depressive symptoms and the Impact of Event Scale was used to assess PTSS.

Results: The prevalence of symptoms of anxiety and depression decreased from 10% and 12%, respectively, at 1 week after injury to 7% and 7% at 12 months after injury. Acute traumatic stress symptoms were present in 13% at 1 week and PTSS was prevalent in 10% of the participants at 12 months after injury. Strong prognostic factors for poor psychological outcome in multivariable logistic mixed models were preinjury frailty, psychological complaints and nonworking status preinjury, female sex, low educational level, and accident category (ie, traffic accident, work-related accident, or accidents at home compared to sport injuries).

Conclusions: Psychological distress is a common health problem during the first year after injury. Important prognostic factors for psychological distress include psychological complaints before injury and frailty. Early recognition of psychological problems after injury could facilitate discussion between caregivers and patients and improve recovery.

Archives of Physical Medicine and Rehabilitation 2020;101:877-84

Annually, almost 80,000 patients are admitted to a hospital after injury in The Netherlands.[1] Mortality rates in the trauma population decreased over the last decades in countries with advanced health care, causing an expansion of the focus to nonfatal consequences after trauma.[2]

Trauma patients often suffer short- and long-term psychological distress.[3,4] Psychological distress is a general term to describe a state of emotional suffering that interferes with the level of functioning and could be characterized by posttraumatic stress symptoms (PTSS) and symptoms of depression and anxiety.[5] Previous research has shown that higher psychological distress after trauma is associated with higher experienced disability, lower health-related quality of life, and lower self-reported recovery.[6-10]

Published literature about the prevalence of psychological distress after injury and its prognostic factors among the general trauma population is scarce because most studies are based on specific subsets of the trauma population, for example, specific injuries, road traffic accidents, or the male working population.[11-19] Previous studies have shown prevalence rates of

Supported by The Netherlands Organisation for Health Research and Development TopCare projects (grant no. 80-84200-98-14226).

Clinical Trial Registration No.: NCT02508675

Disclosures: none.

0003-9993/20/$36 - see front matter © 2019 by the American Congress of Rehabilitation Medicine
https://doi.org/10.1016/j.apmr.2019.10.196

symptoms of anxiety and depression or PTSS in the general trauma population of 4%-24%, 6%-42%, and 2%-30%, respectively, postinjury.[3,20,21] However, these studies were often conducted using a small sample size or were not assessed over time.

Many effective interventions are available to treat patients with psychological distress after injury.[22] However, health care providers often do not recognize patients suffering psychological distress. Early identification of patients who are vulnerable to developing subsequent psychological sequelae could help caregivers to recognize patients with a high risk of psychological distress and could benefit from patient functional recovery, rehabilitation, and wound healing.[21,23-27] Previous studies in cancer-related diseases showed that early identification of psychological distress is successful; it is likely to benefit communication and referral; and it increases patient well-being.[28,29]

This study aimed to describe the prevalence and prognostic factors of symptoms of anxiety and depression and PTSS during the first year after injury in the clinical trauma population.

Methods

Participants

This prospective cohort study was part of the Brabant Injury Outcome Surveillance (BIOS) study.[30] Adult injury patients (≥18y) who were admitted between August 2015 and November 2016, within 48 hours after injury to an intensive care unit (ICU) or a ward in the region of Noord-Brabant, The Netherlands, and survived to hospital discharge were included in this study. Patients with a pathological fracture, insufficient knowledge of the Dutch language, or with no place of residence were excluded. If patients were unable to complete the questionnaires, a proxy informant was asked to complete the questionnaires.

Design

The BIOS study is a multicenter, prospective, observational cohort study. Patients were asked to complete a questionnaire on paper or digitally at 1 week and at 1, 3, 6, and 12 months after injury. Patients who did not complete the questionnaire 1 week after trauma were asked to participate from 1 month or 3 months onward. Patients who did not respond to a questionnaire were considered nonresponders for that time point, but were asked again to participate in the following questionnaire. Patients who did not complete questionnaires up until 3 months were asked to complete a short version of the questionnaire to increase response numbers. The short questionnaire did not include proxy assessment nor did it include digital assessment. An elaboration on the study design can be found in the literature.[30]

All patients who participated in the BIOS study signed an informed consent. The study was approved by the Medical Ethics Committee Brabant (no. NL50258.028.14). Data was anonymized before access.

List of Abbreviations:

AIS	**Abbreviated Injury Scale**
ASA	**American Society of Anesthesiologists**
BIOS	**Brabant Injury Outcome Surveillance**
CI	**confidence interval**
HADS	**Hospital Anxiety and Depression Scale**
ICU	**intensive care unit**
IES	**Impact of Events Scale**
LOS	**length of stay**
OR	**odds ratio**
PTSS	**posttraumatic stress symptoms**

Data collection

Patient characteristics were collected for all patients (ie, sex, educational level, comorbidities, and living situation). Follow-up questionnaires from the BIOS study included health status, psychological status, and functional outcome. The short questionnaire included demographics, health status, and the Impact of Events Scale (IES) (the latter was excluded in the short version of the questionnaire for patients who were ≥65 years of age and suffered hip fracture).

Patients who participated at 1 week or 1 month after trauma completed a questionnaire including preinjury psychological complaints and preinjury frailty. Preinjury psychological complaints were measured with the anxiety and depression domain of the European Quality of life EQ-5D-3L[a] questionnaire.[31] Frailty was measured with the Groningen Frailty Index[32] in patients ≥65 years old, with Groningen Frailty Index≥4 indicating frailty.[33] Patients <65 years of age were considered not frail. Education was categorized as low (no diploma, primary education, or preparatory secondary vocational education); middle (university preparatory education, senior general secondary education, or senior secondary vocational education and training); or high (university of applied science or an academic degree). Comorbidities were measured with the American Society of Anesthesiologists physical status classification (ASA)[34] ranging from 1 (disease free) to 4 (severe systematic disease, constant threat to life).

Injury characteristics and prehospital data from the Brabant Trauma Registry were merged with the BIOS data. The Injury Severity Score was calculated according to the Abbreviated Injury Scale (AIS) 2008.[35]

Outcome measures

The Hospital Anxiety and Depression Scale (HADS) was used to assess anxiety and depressive symptoms.[36] The HADS consists of 14 questions: 7 for symptoms of anxiety (HADS-A) and 7 for depressive symptoms (HADS-D). All questions have a 4-point response scale and the scores for both subscales ranged from 0-21. A higher subscale score indicates greater severity of symptoms for anxiety and depression with a subscale value of ≥11 indicating a probable case.[37] The HADS has shown to be valid in patients with traumatic brain injury and has been used in several studies of patients with trauma.[38-40]

The IES was used to assess PTSS.[41] The IES consists of 15 items of which the patient could use a 4-point scale (0=not at all, 1=rarely, 3=sometimes, and 5=often) whether the statement is present during the last 7 days. A total score for the IES could be calculated, ranging from 0-75. A sum score of ≥35 was considered as PTSS.[42] Previous research showed that the IES is a reliable measure for subjective distress and could be used as a repeated measure to track subjective distress over time.[43] In addition, the Dutch version of the IES was shown to be valid.[44] PTSS could be measured from 1 month after injury. The IES is also assessed at 1

week after injury, indicating symptoms of acute traumatic stress disorder.

If at least 1 of the outcome measures was above the cut-off value, the patient was considered psychologically distressed.

Statistical analysis

Missing sum scores ranged from 5.6% (n=165) at 6 months to 6.5% (n=117) at 1 week after injury for the HADS-A and from 5.3% (n=156) at 6 months to 6.3% (n=167) at 1 month after injury for the HADS-D. Missing items of the HADS were first imputed with individual subscale means according to the half-rule (at least half of the items were answered).[45] Missing baseline characteristics, missing IES values, and the remaining missing HADS sum scores were imputed according to multiple imputation with 15 imputations and 5 iterations using the multivariate imputation by chained equations procedure.[46] The imputation model included demographics, baseline measures, injury characteristics, and follow-up questionnaires.

Patient characteristics were compared between responders and nonresponders with Mann-Whitney *U* tests and chi-square tests for continuous and categorical variables, respectively. ASA category 3 and 4 (n=43) and the Functional Capacity Index category 1 (n=49) and 2 were combined owing to low prevalence.

Patients who were admitted owing to intentional injury (ie, self-inflicted and violence) were excluded from further analyses. Patients who were admitted to the hospital owing to self-inflicted injury (n=12) already have an indication for appropriate psychological support after admission. Patients who were admitted owing to violence (n=56) were not included because of the low number of patients and high prevalence of psychological distress.

Potential prognostic factors were sex, age, educational level, psychological complaints preinjury, ASA, hospital length of stay (LOS), Functional Capacity Index, accident category, injury region based on AIS 2008, Injury Severity Score, and work status before injury. Continuous variables were scaled to their standardized values (subtracting the mean and divided by the SD). Prognostic factors were determined with logistic mixed models.

Odds ratios (ORs) for the prognostic factors at each follow-up time point were calculated using the interaction term between

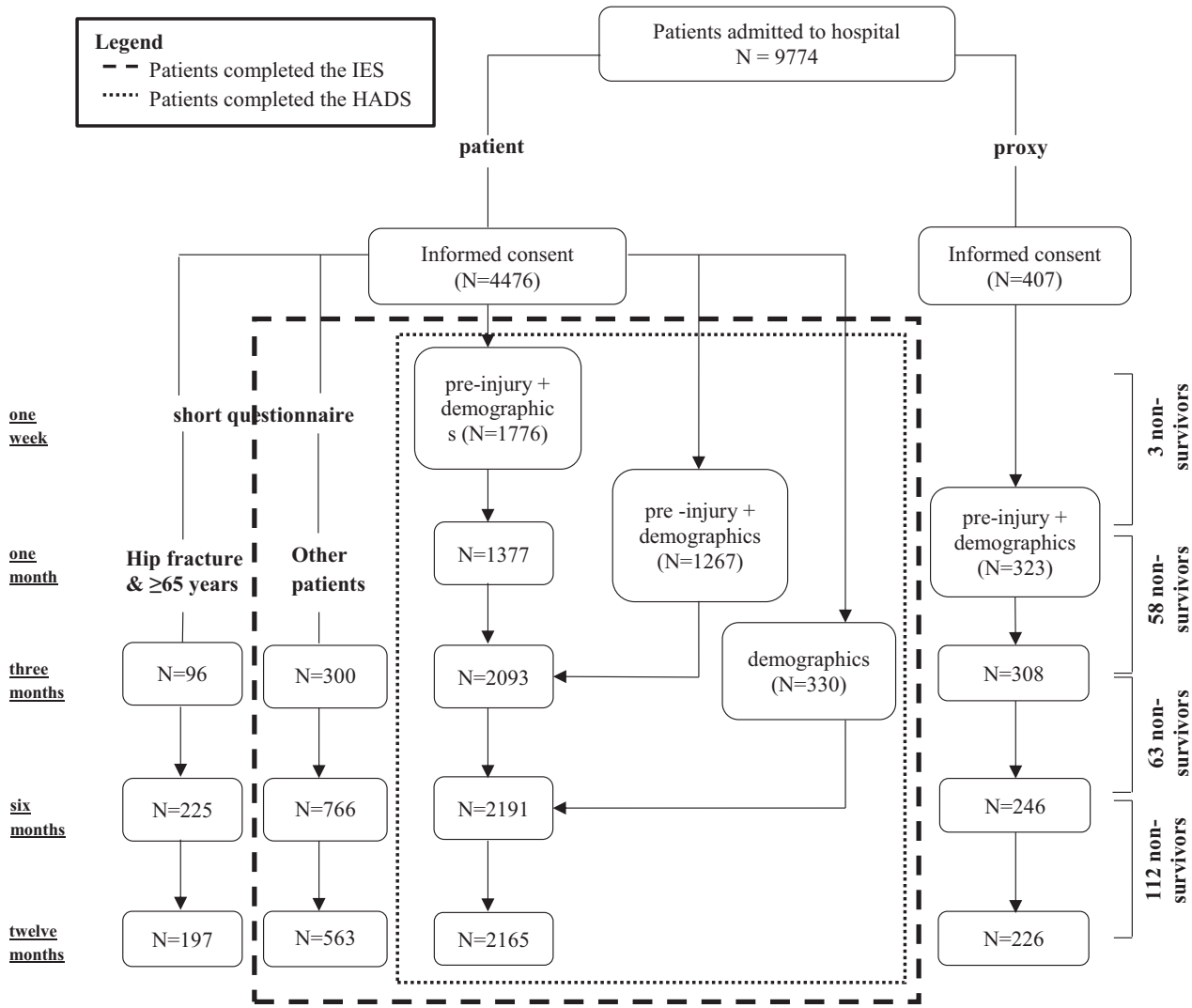

Fig 1 Flow diagram of participation in BIOS study. Abbreviation: BIOS, Brabant Injury Outcome Surveillance.

each prognostic factor and time point in a multivariable logistic mixed model, adjusted for all other factors. The reference category of the time variable was changed to calculate the main effects of the prognostic factors at each time point.

Analyses were conducted in the statistical programs SPSS version 24[b] and R version 3.4.0[c] (fig 1).

Results

Patient participation and characteristics

A total of 9774 patients were asked to participate in the BIOS study (see fig 1). Responders of the questionnaire were significantly

Table 1 Patient characteristics in the total cohort and the responders who completed the Impact of Event Scale

Variables	Total Cohort	Responders*	Nonresponders	*P* Value
No. (%)	9774 (100)	4239 (43)	5535 (57)	
Male sex, n (%)	4736 (49)	2161 (51)	2575 (47)	<.001
Median age, y (IQR)	69 (50-82)	65 (51-77)	73 (48-85)	<.001
ASA classification, n (%)				<.001
1 (healthy)	2458 (25)	1502 (35)	1224 (22)	
2	3627 (37)	2056 (49)	1949 (35)	
3	1817 (19)	638 (15)	1348 (24)	
4 (severe systemic disease)	62 (1)	43 (1)	51 (1)	
Missing	1810 (19)	-	953 (17)	
ISS, median (IQR)	5 (3-9)	5 (3-9)	6 (3-9)	<.001
LOS, median (IQR)	4 (2-8)	4 (2-7)	5 (2-9)	<.001
FCI, n (%)				<.001
1-2 (worse state)	410 (4)	234 (6)	184 (3)	
3-4	3734 (38)	1541 (36)	2254 (41)	
5 (best possible state)	4938 (51)	2464 (58)	2569 (46)	
Missing	692 (7)	-	528 (10)	
Accident category, n (%)				<.001
At home	5499 (56)	2320 (55)	3179 (57)	
Traffic incident	2133 (22)	1194 (28)	939 (17)	
Work-related	337 (3)	192 (5)	145 (3)	
Sport	468 (5)	299 (7)	169 (3)	
Violence	205 (2)	54 (1)	151 (3)	
Self-inflicted	39 (0)	12 (0)	27 (0)	
Missing	1093 (11)	168 (4)	925 (17)	
Region of injury with AIS≥3, n (%)				
Upper/lower extremity	2780 (28)	980 (23)	1800 (33)	<.001
Spine/neck	124 (1)	72 (2)	52 (1)	<.01
Head/face	442 (5)	206 (5)	236 (4)	.160
Torso	450 (5)	257 (6)	193 (3)	<.001
Injury classifications, n (%)				
Pelvic injury	444 (5)	276 (7)	168 (3)	
Hip fracture	2365 (24)	778 (18)	1587 (29)	
Tibia, complex foot or femur fracture	1074 (11)	543 (13)	531 (10)	
Shoulder and upper arm injury	890 (9)	444 (11)	446 (8)	
Radius, ulna or hand fracture	591 (6)	293 (7)	293 (5)	
Head injury with AIS≤2	2767 (28)	1268 (30)	1499 (27)	
Head injury with AIS≥3	367 (4)	168 (4)	199 (4)	
Facial injury	552 (6)	242 (6)	310 (6)	
Thoracic injury	360 (4)	193 (5)	167 (3)	
Rib fracture	939 (10)	529 (13)	410 (7)	
Abdominal injury	227 (2)	109 (3)	118 (2)	
Spinal cord injury	37 (0)	27 (1)	10 (0)	
Stable vertebral fracture or disc injury	550 (6)	290 (7)	260 (5)	
Admission to ICU, n (%)	650 (7)	318 (8)	332 (6)	<.001
Admission to trauma center, n (%)				<.001
Level I	2287 (23)	1112 (26)	1175 (21)	
Level II	5431 (56)	2253 (53)	3178 (57)	
Level III	2056 (21)	874 (21)	1182 (21)	

Abbreviations: FCI, Functional Capacity Index; IQR, interquartile range; ISS, Injury Severity Score.
* Missing values for the responders were imputed.

younger compared with the nonresponders (mean age in y ± SD, 62.4±18.7 and 65.8±22.8, respectively; table 1). Responders were more often healthy (with ASA = 1 for 35% vs 22%), had a shorter LOS (mean LOS in d ± SD, 6.2±5.5 vs 6.9±7.2), and were more often admitted to the ICU (8% vs 6%) and a level I trauma center (26% vs 21%) compared with the nonresponders. A total of 4239 patients (43%) completed at least 1 IES questionnaire and 3388 patients (35%) completed at least 1 HADS questionnaire. Half of the responders reported having a low level of education. A total of 363 responders reported depression or anxiety preinjury and 487 patients were considered frail. Of the working-age population (<65 y), 24% (n = 403) of the participants of the HADS questionnaire and 26% (n = 537) of the participants of the IES questionnaire reported to have no job before the injury.

Prevalence of psychological distress

Psychological distress was prevalent in 23% (n = 414) of the participants at 1 week and in 14% (n = 361) at 12 months after injury (fig 2). Participants reported most often to have only 1 of the following complaints: PTSS, symptoms of anxiety or depression (13% at 1wk, 9% at 12mo after injury) followed by the co-occurrence of all 3 complaints (3% in the first 3mo after injury, 2% at 12mo after injury).

Prevalence of anxiety symptoms ranged from 10% (n = 169) at 1 week to 7% (n = 157) at 12 months postinjury. Symptoms of depression reduced from 12% (n = 208) at 1 week to 7% (n = 156) at 12 months postinjury. Acute traumatic stress symptoms were prevalent in 13% (n = 226) at 1 week, and PTSS was prevalent in 10% (n = 267) of the participants at 12 months after injury.

The prevalence of symptoms of anxiety, symptoms of depression, and PTSS in patients who were admitted owing to violence were 39%, 35%, and 50%, respectively, at 1 week after injury and 44%, 27%, and 43%, respectively, at 12 months after injury.

Prognostic factors for psychological distress

Univariable analyses showed that female sex, psychological complaints preinjury, frailty, and longer LOS at hospital were prognostic factors for symptoms of anxiety, depression, and posttraumatic stress during 1 year after injury (table 2). Low

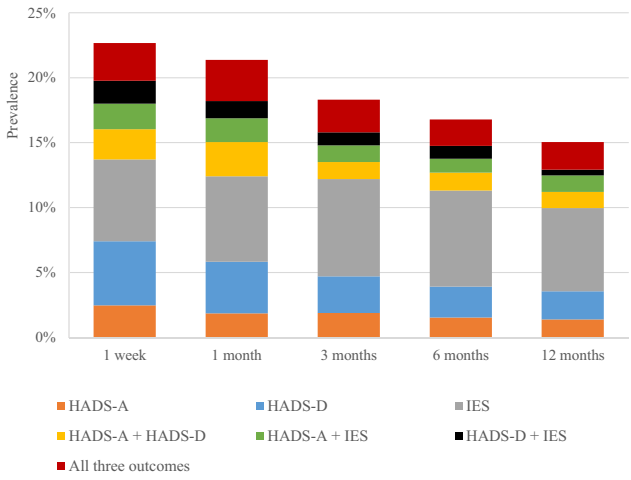

Fig 2 Prevalence of patients with psychological distress (at least one of the outcome measures above cut-off) in the first year after injury and percentages of co-occurrence of psychological distress.

educational level, upper or lower extremity injury (AIS≥3), no work status before injury, and accidents at home or at work also showed to be prognostic factors for at least 1 of the outcome measures.

In the multivariable analyses, psychological complaints preinjury, frailty, and longer LOS at the hospital were prognostic factors for all 3 outcome measures (anxiety and depressive symptoms and PTSS; see table 2; supplemental appendix S1, available online only at http://www.archives-pmr.org/). An additional prognostic factor for depressive symptoms was female sex (OR = 1.33; 95% confidence interval [CI], 0.79-2.22). Additional prognostic factors for PTSS were female sex (OR = 1.66; 95% CI, 1.07-2.59) and traffic accident (OR = 3.12; 95% CI, 1.16-8.39) with sport injury as reference.

Short- and long-term prognostic factors

Short-term prognostic factors (first 3mo) for symptoms of anxiety were younger age, low educational level, longer LOS, and frailty (supplemental appendix S2, available online only at http://www.archives-pmr.org/). Long-term prognostic factors (3-12mo) were female sex and younger age.

Longer LOS was a prognostic factor for short-term symptoms of depression. No long-term prognostic factors were found. Younger age and female sex were short-term prognostic factors for PTSS and long-term prognostic factors were longer LOS and low educational level.

Discussion

Psychological distress was prevalent in 23% of the patients 1 week after injury and decreased to 14% of the patients 12 months after injury. Prognostic factors for poor psychological outcome were preinjury frailty, psychological complaints, nonworking status preinjury, female sex, low educational level, and accident category (ie, traffic, work-related, or at-home accidents compared to sport injuries). Psychological complaints preinjury and frailty were the most important prognostic factors for psychological distress.

Prevalence of psychological distress among patients who were admitted owing to intentional injury (ie, self-inflicted or violence) was high, which is in line with previous literature,[47-49] indicating that those patients should be monitored or evaluated carefully. Therefore, prognostic factors were only based on patients who did not suffer intentional injury.

In line with previous research, prognostic factors for psychological distress were mainly patient characteristics, whereas injury characteristics were not.[3,23,50] Even though previous research showed that ICU admission is a prognostic factor for the development of psychological distress after injury,[24,51] this study does not support this evidence. A longer LOS possibly reflects social indication or (medical) complications following patient injury.

Psychological distress could result in lower health-related quality of life, indicating poor recovery after injury.[52] The prognostic factors discussed in this study could help clinicians to recognize patients suffering psychological distress and guide them to discuss those problems to improve recovery. Psychologists might be needed to discuss issues with personality traits, coping strategies and social support, which were previously suggested as predictors of psychological distress.[53,54] We did not

Table 2 Univariable and multivariable ORs with 95% CI for risk factors of anxiety, depressive symptoms, and PTSS measured with the HADS-A, HADS-D, and IES, respectively

	HADS-A		HADS-D		IES	
Variables	Univariable	Multivariable	Univariable	Multivariable	Univariable	Multivariable
Age,* y	1.09 (0.81-1.45)	0.67 (0.43-1.06)	1.21 (0.92-1.58)	0.87 (0.58-1.30)	1.04 (0.84-1.28)	0.72 (0.51-1.03)
Female sex	1.86 (1.13-3.08)	1.67 (0.93-2.99)	1.61 (1.01-2.55)	1.33 (0.79-2.22)	1.78 (1.26-2.53)	1.66 (1.07-2.59)
Frail preinjury	4.03 (2.04-7.97)	2.53 (1.07-5.98)	5.39 (2.82-10.31)	3.43 (1.59-7.39)	2.93 (1.68-5.13)	1.81 (0.89-3.66)
Education						
Low	Ref	Ref	Ref	Ref	Ref	Ref
Middle	0.65 (0.35-1.20)	0.69 (0.35-1.38)	0.83 (0.48-1.44)	1.12 (0.62-2.04)	0.66 (0.41-1.05)	0.71 (0.42-1.19)
High	0.46 (0.22-0.95)	0.65 (0.30-1.41)	0.59 (0.31-1.12)	1.04 (0.53-2.02)	0.43 (0.24-0.79)	0.60 (0.33-1.09)
Work status preinjury	0.61 (0.35-1.07)	1.04 (0.46-2.34)	0.62 (0.38-1.03)	1.05 (0.52-2.12)	0.62 (0.45-0.84)	0.71 (0.39-1.32)
Preinjury anxiety/depression complaints	40.12 (18.15-88.71)	33.97 (13.85-83.29)	31.50 (13.94-71.18)	22.53 (9.92-51.19)	12.14 (5.94-24.84)	9.05 (4.34-18.88)
ASA						
1 (disease free)	Ref	Ref	Ref	Ref	Ref	Ref
2	1.46 (0.80-2.66)	1.30 (0.63-2.69)	1.08 (0.65-1.80)	0.78 (0.41-1.47)	1.35 (0.94-1.94)	1.18 (0.67-2.06)
3-4 (severe)	2.08 (0.98-4.41)	1.38 (0.48-3.95)	2.64 (1.39-5.01)	1.71 (0.70-4.14)	1.49 (0.90-2.46)	1.04 (0.46-2.36)
ISS*	0.99 (0.76-1.29)	0.84 (0.47-1.49)	1.22 (0.97-1.53)	1.27 (0.80-2.02)	0.97 (0.80-1.18)	0.78 (0.50-1.19)
Spine neck†	0.93 (0.11-7.82)	0.92 (0.09-9.81)	1.68 (0.31-9.27)	0.63 (0.08-4.88)	1.76 (0.49-6.29)	2.23 (0.40-12.45)
Head face†	0.85 (0.22-3.28)	0.70 (0.11-4.51)	1.11 (0.35-3.48)	0.56 (0.12-2.49)	0.91 (0.34-2.41)	0.94 (0.25-3.54)
Torso†	0.94 (0.32-2.80)	1.15 (0.22-5.94)	0.99 (0.37-2.66)	0.55 (0.14-2.21)	0.84 (0.38-1.88)	1.27 (0.37-4.32)
Upper/lower extremity†	1.07 (0.60-1.92)	1.43 (0.48-4.21)	1.54 (1.01-2.35)	1.15 (0.47-2.82)	1.00 (0.78-1.28)	1.07 (0.48-2.38)
Accident category						
At home	3.17 (0.83-12.01)	1.79 (0.45-7.01)	2.36 (0.80-6.97)	1.26 (0.44-3.63)	2.81 (1.08-7.31)	2.16 (0.80-5.80)
Traffic	2.55 (0.64-10.13)	2.37 (0.61-9.20)	1.79 (0.58-5.56)	1.70 (0.60-4.85)	2.80 (0.64-7.55)	3.12 (1.16-8.39)
Work	1.73 (0.27-11.32)	1.42 (0.22-9.22)	1.87 (0.41-8.51)	2.07 (0.51-8.44)	2.55 (1.04-10.16)	2.81 (0.76-10.35)
Sport	Ref	Ref	Ref	Ref	Ref	Ref
FCI						
1-2 (worst limitation)	1.37 (0.47-4.03)	1.24 (0.38-4.04)	1.56 (0.57-4.25)	0.94 (0.31-2.86)	1.05 (0.42-2.61)	0.89 (0.33-2.38)
3	0.76 (0.19-3.10)	0.69 (0.16-2.97)	0.91 (0.26-3.24)	0.64 (0.17-2.36)	0.88 (0.30-2.59)	0.78 (0.26-2.36)
4	0.85 (0.48-1.51)	0.55 (0.24-1.27)	1.19 (0.71-1.98)	0.74 (0.37-1.50)	0.93 (0.60-1.45)	0.75 (0.41-1.38)
5 (no limitation)	Ref	Ref	Ref	Ref	Ref	Ref
Admission to ICU	1.17 (0.45-3.04)	0.97 (0.27-3.44)	1.44 (0.62-3.36)	0.77 (0.26-2.29)	1.30 (0.71-2.38)	1.24 (0.48-3.22)
LOS*	1.35 (1.06-1.72)	1.44 (1.01-2.06)	1.69 (1.28-2.22)	1.71 (1.22-2.40)	1.29 (1.05-1.59)	1.41 (1.05-1.91)
Follow-up measurements						
1 wk	Ref	Ref	Ref	Ref	Ref	Ref
1 mo	1.06 (0.72-1.58)	1.11 (0.75-1.64)	0.80 (0.57-1.12)	0.77 (0.55-1.08)	0.94 (0.64-1.37)	0.91 (0.63-1.30)
3 mo	0.55 (0.36-0.82)	0.59 (0.39-0.90)	0.37 (0.25-0.54)	0.42 (0.29-0.61)	0.76 (0.53-1.09)	0.75 (0.52-1.07)
6 mo	0.45 (0.29-0.68)	0.57 (0.37-0.88)	0.35 (0.24-0.51)	0.39 (0.27-0.58)	0.53 (0.37-0.75)	0.52 (0.36-0.74)
12 mo	0.48 (0.31-0.74)	0.51 (0.32-0.80)	0.25 (0.17-0.37)	0.25 (0.17-0.37)	0.48 (0.34-0.70)	0.45 (0.30-0.65)

Abbreviations: FCI, Functional Capacity Index; ISS, Injury Severity Score; Ref, reference category.

* Continuous variables were scaled.

† Patients were selected in this category if AIS≥3 for this region.

include such characteristics and could therefore not confirm their relevance as potential prognostic factors. A more comprehensive study, including the prognostic factors assessed in this study and the previously described factors should aim to develop a valid and simple prediction model for psychological distress after injury. Such a prediction model could help triage patients who are at risk on developing psychological distress after injury at an early stage.

Study limitations

The first limitation considers the possibility of generalizing the results to other trauma populations. The BIOS study is considered representative for the total trauma population in The Netherlands because it contains urban and rural areas and includes level I, level II, and level III trauma centers. However, only 43% of all patients participated and differences were found between baseline characteristics of responders and nonresponders implying that selection bias could have occurred. Furthermore, it is likely that selective dropout occurred. Patients who were fully recovered were probably less likely to complete the follow-up questionnaires compared with patients who still perceived complaints after their injury, resulting in an overestimation of prevalence rates of psychological distress.

Second, this study was based on self-reported questionnaires. Official diagnosis of mental health problems should be conducted with a structured interview according to the statistical manual for psychiatric disorders.[55] The questionnaires in this study only suggest psychological complaints and could be used to refer patients for further evaluation by a psychologist. In addition, the IES only measures 2 out of 3 clusters of PTSS.[41]

Conclusions

Psychological distress is a common health problem during the first year after injury. The most important prognostic factors for psychological distress were psychological complaints before injury and frailty. Early recognition of psychological problems could facilitate discussions between caregivers and patients and could improve recovery after injury.

Suppliers

a. EurQoL-5D-3L; EurQoL Group.
b. SPSS version 24; IBM Corp.
c. R program; R Foundation for Statistical Computing.

Keywords

Anxiety; Depression; Post-traumatic stress disorders; Prevalence; Prognosis; Prospective studies; Rehabilitation; Wounds and injuries

Corresponding author

Leonie de Munter, MSc, Department Trauma TopCare, Elisabeth-TweeSteden Hospital, Hilvarenbeekseweg 60, 5000 LC Tilburg, The Netherlands. *E-mail address:* l.demunter@etz.nl.

References

1. LNAZ. Traumazorg in Beeld: Landelijke Traumaregistratie 2013–2017: rapportage Nederland. Tilburg: LNAZ; 2018. Available at: https://www.lnaz.nl/cms/18.335_LNAZ_LTR_Rapportage-2013-2017.pdf. Accessed July 2, 2019 [Dutch].
2. Patton GC, Coffey C, Sawyer SM, et al. Global patterns of mortality in young people: a systematic analysis of population health data. Lancet 2009;374:881-92.
3. Wiseman TA, Curtis K, Lam M, Foster K. Incidence of depression, anxiety and stress following traumatic injury: a longitudinal study. Scand J Trauma Resusc Emerg Med 2015;23:29.
4. Bryant RA, O'donnell ML, Creamer M, McFarlane AC, Clark CR, Silove D. The psychiatric sequelae of traumatic injury. Am J Psychiatry 2010;167:312-20.
5. Drapeau A, Marchand A, Beaulieu-Prévost D. Epidemiology of psychological distress. In: Mental illnesses-understanding, prediction and control. InTechOpen; 2012. p 111-3.
6. Richmond TS, Kauder D, Hinkle J, Shults J. Early predictors of long-term disability after injury. Am J Crit Care 2003;12:197-205.
7. Di Gallo A, Parry-Jones WL. Psychological sequelae of road traffic accidents: an inadequately addressed problem. Br J Psychiatry 1996;169:405-7.
8. Sutherland AG, Alexander DA, Hutchison JD. The mind does matter: psychological and physical recovery after musculoskeletal trauma. J Trauma 2006;61:1408-14.
9. Baranyi A, Leithgöb O, Kreiner B, et al. Relationship between post-traumatic stress disorder, quality of life, social support, and affective and dissociative status in severely injured accident victims 12 months after trauma. Psychosomatics 2010;51:237-47.
10. Kellezi B, Coupland C, Morriss R, et al. The impact of psychological factors on recovery from injury: a multicentre cohort study. Soc Psychiatry Psychiatr Epidemiol 2017;52:855-66.
11. Mason S, Turpin G, Woods D, Wardrope J, Rowlands A. Risk factors for psychological distress following injury. Br J Clin Psychol 2006;45:217-30.
12. Mason S, Wardrope J, Turpin G, Rowlands A. The psychological burden of injury: an 18 month prospective cohort study. Emerg Med J 2002;19:400-4.
13. Andruszkow H, Deniz E, Urner J, et al. Physical and psychological long-term outcome after traumatic brain injury in children and adult patients. Health Qual Life Outcomes 2014;12:26.
14. Mayou R, Bryant B, Ehlers A. Prediction of psychological outcomes one year after a motor vehicle accident. Am J Psychiatry 2001;158:1231-8.
15. Sterling M, Jull G, Vicenzino B, Kenardy J, Darnell R. Physical and psychological factors predict outcome following whiplash injury. Pain 2005;114:141-8.
16. Sigurdardottir S, Andelic N, Røe C, Schanke A. Depressive symptoms and psychological distress during the first five years after traumatic brain injury: relationship with psychosocial stressors, fatigue and pain. J Rehabil Med 2013;45:808-14.
17. Whelan-Goodinson R, Ponsford JL, Schonberger M, Johnston L. Predictors of psychiatric disorders following traumatic brain injury. J Head Trauma Rehabil 2010;25:320-9.
18. Shalev AY, Freedman S, Peri T, et al. Prospective study of post-traumatic stress disorder and depression following trauma. Am J Psychiatry 1998;155:630-7.
19. Skogstad L, Tøien K, Hem E, Ranhoff AH, Sandvik L, Ekeberg Ø. Psychological distress after physical injury: a one-year follow-up study of conscious hospitalised patients. Injury 2014;45:289-98.
20. Haagsma JA, Polinder S, Olff M, Toet H, Bonsel GJ, van Beeck EF. Posttraumatic stress symptoms and health-related quality of life: a two year follow up study of injury treated at the emergency department. BMC Psychiatry 2012;12:1.

21. O'donnell ML, Bryant RA, Creamer M, Carty J. Mental health following traumatic injury: toward a health system model of early psychological intervention. Clin Psychol Rev 2008;28:387-406.
22. Bisson J, Andrew M. Psychological treatment of post-traumatic stress disorder (PTSD). New York: Wiley; 2007.
23. Wiseman T, Foster K, Curtis K. Mental health following traumatic physical injury: an integrative literature review. Injury 2013;44: 1383-90.
24. Zatzick D, Jurkovich GJ, Rivara FP, et al. A national US study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. Ann Surg 2008; 248:429-37.
25. Gouin JP, Kiecolt-Glaser JK. The impact of psychological stress on wound healing: methods and mechanisms. Immunol Allergy Clin North Am 2011;31:81-93.
26. Ponsford J, Hill B, Karamitsios M, Bahar-Fuchs A. Factors influencing outcome after orthopedic trauma. J Trauma 2008;64:1001-9.
27. O'Donnell ML, Creamer MC, Parslow R, et al. A predictive screening index for posttraumatic stress disorder and depression following traumatic injury. J Consult Clin Psychol 2008;76:923-32.
28. Kazak AE, Barakat LP, Ditaranto S, et al. Screening for psychosocial risk at pediatric cancer diagnosis: the psychosocial assessment tool. J Pediatr Hematol Oncol 2011;33:289-94.
29. Ryan H, Schofield P, Cockburn J, et al. How to recognize and manage psychological distress in cancer patients. Eur J Cancer Care 2005;14:7-15.
30. de Jongh MA, Kruithof N, Gosens T, et al. Prevalence, recovery patterns and predictors of quality of life and costs after non-fatal injury: the brabant injury outcome surveillance (BIOS) study. Inj Prev 2017;23:59.
31. The EuroQol Group. EuroQol-a new facility for the measurement of health-related quality of life. Health Policy 1990;16:199-208.
32. Steverink N, Slaets J, Schuurmans H, van Lis M. Measuring frailty: developing and testing the GFI (Groningen Frailty Indicator). Gerontologist 2001;41:236-7.
33. Peters LL, Boter H, Buskens E, Slaets JP. Measurement properties of the groningen frailty indicator in home-dwelling and institutionalized elderly people. J Am Med Dir Assoc 2012;13:546-51.
34. Dripps R. New classification of physical status. Anesthesiology 1963; 24:111.
35. Gennarelli TA, Wodzin E, editors. The Abbreviated Injury Scale 2005 - Update 2008. Barrington, IL: Association for the Advancement of Automotive Medicine; 2008.
36. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983;67:361-70.
37. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the hospital anxiety and depression scale: an updated literature review. J Psychosom Res 2002;52:69-77.
38. Bocci MG, Grieco DL, Lochi S, et al. Defining needs and goals of post-ICU care for trauma patients: preliminary study. Minerva Anestesiol 2016;82:22-9.
39. Whelan-Goodinson R, Ponsford J, Schönberger M. Validity of the hospital anxiety and depression scale to assess depression and anxiety following traumatic brain injury as compared with the structured clinical interview for DSM-IV. J Affect Disord 2009;114:94-102.
40. Whittaker R, Kemp S, House A. Illness perceptions and outcome in mild head injury: a longitudinal study. J Neurol Neurosurg Psychiatry 2007;78:644-6.
41. Horowitz M, Wilner N, Alvarez W. Impact of event scale: a measure of subjective stress. Psychosom Med 1979;41:209-18.
42. Wohlfarth TD, van den Brink W, Winkel FW, ter Smitten M. Screening for posttraumatic stress disorder: an evaluation of two self-report scales among crime victims. Psychol Assess 2003;15:101-9.
43. Sundin EC, Horowitz MJ. Impact of event scale: psychometric properties. Br J Psychiatry 2002;180:205-9.
44. van der Ploeg E, Mooren T, Kleber RJ, van der Velden, Peter G, Brom D. Construct validation of the *dutch* version of the impact of event scale. Psychol Assess 2004;16:16-26.
45. Bell ML, Fairclough DL, Fiero MH, Butow PN. Handling missing items in the hospital anxiety and depression scale (HADS): a simulation study. BMC Res Notes 2016;9:479.
46. van Buuren S, Oudshoorn K. Flexible Multivariate Imputation by MICE. PG/VGZ/99.054. Leiden: TNO; 1999.
47. Santiago PN, Ursano RJ, Gray CL, et al. A systematic review of PTSD prevalence and trajectories in DSM-5 defined trauma exposed populations: intentional and non-intentional traumatic events. PloS One 2013;8:e59236.
48. Mello-Silva ACC, Brasil VV, Minamisava R, Oliveira LM, Cordeiro JABL, Barbosa MA. Quality of life and psychological trauma in firearm violence victims. Texto Contexto Enferm 2012;21: 558-65.
49. Pajonk F, Ruchholtz S, Waydhas C, Schneider-Axmann T. Long-term follow-up after severe suicide attempt by multiple blunt trauma. Eur Psychiatry 2005;20:115-20.
50. Quale AJ, Schanke A, Frøslie KF, Røise O. Severity of injury does not have any impact on posttraumatic stress symptoms in severely injured patients. Injury 2009;40:498-505.
51. Corrigan I, Samuelson KA, Fridlund B, Thomé B. The meaning of posttraumatic stress-reactions following critical illness or injury and intensive care treatment. Intensive Crit Care Nurs 2007;23:206-15.
52. Kendrick D, Kelllezi B, Coupland C, et al. Psychological morbidity and health-related quality of life after injury: multicentre cohort study. Qual Life Res 2017;26:1233-50.
53. Myhren H, Ekeberg Ø, Tøien K, Karlsson S, Stokland O. Posttraumatic stress, anxiety and depression symptoms in patients during the first year post intensive care unit discharge. Crit Care 2010;14: R14.
54. Birkeland MS, Nielsen MB, Hansen MB, Knardahl S, Heir T. Like a bridge over troubled water? A longitudinal study of general social support, colleague support, and leader support as recovery factors after a traumatic event. Eur J Psychotraumatol 2017;8:1302692.
55. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5). Philadelphia: American Psychiatric Publishing; 2013.