FOUR QUESTIONS TO PREDICT PTSD ONE YEAR AFTER A MOTOR VEHICLE ACCIDENT

Running title: FOUR QUESTIONS TO PREDICT PTSD

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Abstract

Background: To create and evaluate an easy and brief validated tool for use by nurses to predict chronic PTSD 1 year after a motor vehicle accident.

Methods: We performed a multicentre study including patients injured in a motor vehicle accident who were hospitalized in an Orthopaedic Trauma Unit. A nurse administered the DEPITAC questionnaire and the Peritraumatic Distress Inventory (PDI). PTSD was measured by the PTSD Check List of symptoms during the first year following the accident.

Results: The median AUC to predict PTSD in the first year for the 10-item DEPITAC score across the 10 imputed datasets was 0.623 (0.605 to 0.633). We found that only 2 questions and 2 simple elements of the patient's medical record (other injury or a person dying during the accident, perception of vital threat, number of children, length of stay in trauma) predicted PTSD 1 year after a motor vehicle accident (Se=91.9% (86.9 to 96.9), Sp=88.9% (83.8 to 94.1), AUC=0.674 (0.661 to 0.683)).

Limitations: We were unable to collect complete data from 66 patients at 1 year

Conclusions: We propose 4 questions to teach nurses to screen for the risk of PTSD after a motor vehicle accident. These questions could help to identify patients who could benefit from early interventions to prevent PTSD.

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Key words

PTSD, primary care, trauma, clinical trials, stress, nurses

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Introduction

Posttraumatic stress disorder (PTSD) is a severe disorder that can develop after traumatic experiences. This constellation of psychological symptoms has been highlighted in four clusters: "re-experiencing (intrusions), avoidance, arousal and negative alterations in cognitions and mood development"(American Psychiatric Association, 1994). This disabling disorder may lead to chronic psychiatric morbidity, loss of normal daily functioning(Neria et al., 2008), and increased risk of suicide(Tarrier and Gregg, 2004). Without appropriate treatment, this disorder can persist for many years(Kessler et al., 1995).

Motor vehicle accidents are one of the main causes of PTSD, with an incidence of approximately 25% over 5 years(Blanchard and Hickling, 2004), and they could become the third aetiology of mental health disorders in 2020(Michaud et al., 2001). Untreated traumatic stress is a key determinant of poor health outcomes after injury(Michaels et al., 1999), highlighting the importance of identifying and addressing the psychological needs of injured patients.

Early interventions are important in PTSD treatment (or outcomes) and may improve prognosis(Davidson, 2004). The main goal is to identify people at high risk of developing chronic PTSD to tailor care. Early interventions may also help to prevent unnecessary treatments(Roy-Byrne et al., 2004). Questionnaires have previously been proposed to identify trauma survivors at risk for PTSD and in need of early treatment. However, these questionnaires often take a long time to assess(Boscarino et al., 2012; Papini et al., 2018), although all are validated by researchers or PTSD specialists(Mouthaan et al., 2014; van Meijel et al., 2015; Winston et al., 2003). Patients included in these cohorts are usually followed for 3 months(Mouthaan et al., 2014), although PTSD symptoms can develop long after an accident, especially after functional rehabilitation(Mayou and Bryant, 2002). By that time, the use of self-report instruments could be an issue and could lead to a late evaluation(Mouthaan et al., 2014) because patients can rarely complete a questionnaire immediately after a motor vehicle accident, and items may not be always understood or may be understood differently by different patient groups(Engelhard and van den Hout, 2007). Overall, this type of questionnaire can be difficult to use in daily life care. The first contact in primary care is usually with a trauma centre or emergency nurse. For this reason, the role of nurses in screening for PTSD is crucial to determine the best psychotherapeutic treatment(Cottencin et al., 2006).

Aim of the study: We performed a 1-year prospective study among patients admitted to the Orthopaedic Trauma Unit after a motor vehicle accident. We aimed to create and evaluate an easy and brief validated tool for use by nurses to predict chronic PTSD one year after a motor vehicle accident. After evaluation, we sought to simplify this tool for use in daily life.

Methods

Participants

We included 274 road traffic accident victims hospitalized in an Orthopaedic Trauma Unit over five years in a prospective multicentre study (https://clinicaltrials.gov/ct2/show/NCT01200628). The inclusion criteria were as follows: men or women who were at least 18 years old, who were hospitalized in an Orthopaedic Trauma Unit after a recent motor vehicle accident (max. 15 days) and who could be reached by cell phone. The exclusion criteria were initial coma for more than 15 minutes, head injury with loss of consciousness for more than 15 minutes or cranial fracture or brain lesion, homeless patients, incapacitated adults or patients in an emergency situation, and patients with PTSD symptoms at inclusion.

Assessment Tools

The DEPITAC questionnaire

The DEPITAC questionnaire (**supplementary Table 1**) synthetized two approaches.

First, 3 expert clinicians (with at least 5 years of experience working as psychiatry consultation-liaisons in an Orthopaedic Trauma Unit and PTSD centre) were asked to propose after concertation 15 items taken from a systematic review of the literature based on their clinical experience. They proposed the following items: female, other people injured or died in the accident, any other traumatic experience during the 6 last months, revised trauma score > 2, heart rate > 90/min at emergency admission, under the effect of alcohol or drugs at the time of the accident, emotional reactions with intense fear or feelings of helplessness, abandonment or feelings of horror from the moment of the accident to rescue, elements of dissociation after the accident or in the hours that followed (torpor, detachment, absence of emotion, feeling of being in a fog, feeling that reality has changed, feeling of strangeness, total or partial amnesia of trauma), seeing oneself dying during the accident, having sleep disturbances since the accident, taking drug treatment for anxiety problems or a mood disorder at the time of the accident or consulting a psychiatrist or psychologist for anxiety or a mood disorder, police investigation in progress, responsibility of the patient in doubt or engaged in the occurrence of the accident, immediately after the accident or in the hours following it, feeling of not receiving real support, whether emotional or moral, or in the form of material help from witnesses, caregivers and/or those around them.

We also performed a retrospective analysis (logistic regression) of 200 medical records to analyse the peritraumatic factors (ie. while experiencing the distressing event) predicting PTSD 6 weeks and 6 months after a trauma. The predictors of developing PTSD at 6 weeks were the A2 criterion from the DSM IV(American Psychiatric Association, 1994) (subjects with an immediate emotional reaction of intense fear, helplessness, or horror), whether subjects were single or divorced, and whether other subjects were injured or had died during the accident. The predictors of developing PTSD at 6 months were as follows: A2 criterion from DSM IV(American Psychiatric Association, 1994) (subjects with an immediate emotional reaction of intense fear, helplessness, or horror), whether subjects were single or divorced, whether subjects were cyclists and pedestrians, whether other

subjects were injured or had died during the accident, whether the initial heart rate was >90 bpm at emergency admission, and whether depression or anxiety disorders were present at the time of the accident.

We developed a DEPITAC questionnaire, a short and simple tool (10 items) merging these two approaches for use by nurses working in a surgery unit treating patients after motor vehicle accidents.

The PDI (Peritraumatic Distress Inventory(Brunet et al., 2001))

This tool was built to measure PTSD criterion A2 in the DSM classification, which has predictive value for the development of future PTSD. The PDI is a self-questionnaire that includes 13 items rated from 0 to 4 (total score from 0 to 52). The instruction for each item consists of rating the answer based on what the subject felt during and immediately after the critical event.

The PCLS (PTSD Check List of symptoms(Weathers et al., 1993))

The PCLS is a self-questionnaire measuring the three main syndromes of PTSD. It was developed according to the diagnostic criteria of the DSM and is composed of 17 items rated from 1 to 5 (total score from 17 to 85). The 17 items can be grouped into 3 sub-scales corresponding to the 3 main syndromes of PTSD [repetition (items 1 to 5); avoidance (items 6 to 12); and neurovegetative hyperactivity (items 13 to 17)]. PTSD was diagnosed if the PCLS score was greater than 43/85.

The MINI DSM IV (Minimal International Neuropsychiatric Interview(Sheehan et al., 1998))

The MINI DSM IV was used to assess the occurrence of anxiety, depressive or addictive disorders as medium- and long-term consequences of the accident.

Assessment procedures

At the earliest possible time after consent was obtained but not later than 2 weeks after the index injury event, a nurse administered the DEPITAC questionnaire and the PDI.

All participants were contacted by telephone between the sixth and eight weeks, at 6 months and at 1 year after the accident. A personal letter announcing the call was mailed to the participant approximately 10 days before the date of the phone call. This letter reminded the patient of the terms of the participation agreement and indicated the period during which the patient would be contacted again. The PCL self-questionnaire was also included with instructions to be returned to the indicated address using a pre-stamped envelope. The telephone interview, conducted by a specially trained psychologist or psychiatrist, consisted of a PCLS assessment if it had not been returned by the subject. The MINI was assessed by phone 6 months and one year after the accident.

Statistical analysis

Continuous variables are expressed as medians (interquartile range and range values), and categorical variables are expressed as numbers (percentage). The rates of PTSD at each follow-up visit and during the first year following the MVA were calculated with their 95% confidence intervals (CIs). Receiver operating characteristic (ROC) curve analysis was conducted to assess the ability of the 10-item DEPITAC and PDI scales to predict PTSD in the first year following MVA. The PDI is indeed an independent predictor of post-traumatic stress symptoms (Nishi et al., 2010). Differences in the two AUCs were tested using the nonparametric approach of DeLong(DeLong et al., 1988).

We further investigated the ability of each individual item on the DEPITAC scale and main patient and MVA characteristics to predict PTSD at one year using logistic regression models; odds ratios (ORs) and their 95%CIs were reported. An initial multivariable logistic regression model was implemented by including all DEPITAC items from the univariate results. A second multivariable logistic regression model was implemented by including all DEPITAC items as well as patient and MVA characteristics significantly associated with PTSD in univariate analyses. Both multivariable models were simplified with a backward selection procedure using the removal criteria of $p>0.05$. Before developing the multivariable models, we examined the log-linearity assumption for continuous characteristics using restricted cubic spline functions(Harrell et al., 1996) as well as the absence of co-linearity between candidate predictors by calculating the variance inflation factors (VIFs)(Allison, 1998). Because we observed a non-log-linear relationship for length of stay in trauma, we determined the optimal cut-off value for discriminating patients with and without PTSD using ROC curve analysis by maximizing the Youden index.

We examined the performance of the selected models in terms of calibration and discrimination. Discrimination was evaluated using the c-statistics (AUC), and calibration (which indicates the agreement between the predicted and observed probabilities of PTSD) was evaluated using the Hosmer-Lemeshow goodness-of-fit test. We further compared the AUC of the selected models with the AUC of the initial DEPITAC scale and the PDI scale using the nonparametric approach of DeLong. We derived points-based scoring systems from both selected multivariable models using a regression coefficient-based approach. Finally, we calculated the sensitivity and specificity values (with 95%CIs) for each incremental point of the point-based scoring systems.

To avoid case deletion in analysis due to missing data, missing data were imputed by multiple imputations using a regression-switching approach (chained equations with m=10 obtained). The imputation procedure(van Buuren and Groothuis-Oudshoorn, 2011) was performed under the missing at random assumption using all baseline characteristics and available PTSD diagnosis during follow-up with a predictive mean matching method for continuous variables and a logistic regression model (binary, ordinal or multinomial) for categorical variables. Estimates (descriptive statistics and odds ratios) obtained in the different imputed datasets were combined using Rubin's rules(Rubin, 1987); for calibration and discrimination, we reported the median and range values as suggested by Marshall et al.(Marshall et al., 2009) Statistical testing was performed at the two-tailed α level of 0.05. Data were analysed using the SAS software package, release 9.4 (SAS Institute, Cary, NC).

PCLS (English version) has been validated on approximately 50 subjects(Yao et al., 2003). We considered that 50 subjects with PTSD at 6 months would be needed to validate the new scale. In these conditions, using the PCLS reference scale with all severities of AVP combined, the prevalence of PTSD among victims was 25 to 30% at 6 months and 10 to 15% among victims at 1 year(Mayou et al., 1993). Therefore, in the worst case,

at least 200 subjects should be included. We aimed to include 300 patients, assuming 30% of patients would be lost to follow-up.

Ethics

All patients gave informed and written consent. The study ID is CPP 06/91.

Results

Demographic characteristics

Over a five-year period, 274 adult motor vehicle accident (MVA) survivors were included in the DEPITAC study. The main patient and MVA characteristics of 274 MVA survivors are reported in **table 1**. Overall, the median age was 33 years (range, 18 to 86), and 72.6% (n=199) were men. Crashes involved motorcycles in most cases (56.2%), followed by cars (24.1%), bicycles (4.4%) and pedestrians (15.3%). Victims were mainly drivers (74.0%). The median length of stay in the trauma care unit was 12 days (range, 2 to 121 days), with a median trauma score of 7 (range, 1 to 12) at hospital admission. The frequency of individual items of the DEPITAC and PDI scales assessed 14 days after the MVA are available in **supplementary table 2**. The median DEPITAC score (sum of the 10 binary items) was 2 (range, 0 to 7), and the median total PDI score was 9 (range, 0 to 43). After MVA, 233 MVA survivors (85.0%) completed the 8-week visit, 224 (81.8%) completed the 6-month visit, and 208 (75.9%) completed the 1-year follow-up visit (**figure 1**). PTSD was diagnosed in 42.9% (95% CI, 36.0 to 49.9) of MVA survivors in the first year following MVA. After correcting for the missing follow-up assessment by multiple imputation, the rate of PTSD in the first year following the MVA was estimated to be 45.2% (95% CI, 39.2 to 51.1; see **supplementary table 3**).

INSERT TABLE 1 ABOUT HERE

INSERT FIGURE 1 ABOUT HERE

Performance characteristics of the DEPITAC questionnaire

The median AUC to predict PTSD in the first year for the 10-item DEPITAC score across the 10 imputed datasets was 0.623 (range, 0.605 to 0.633) compared with 0.628 (95% CI, 0.619 to 0.643) for the PDI score (**figure 2**). In each imputed dataset, there was no significant difference in AUC between the two scales (median p=0.83; range 0.59 to 0.96).

INSERT TABLE 2 ABOUT HERE

Performance characteristics

Performance characteristics of the 2-item questionnaire

Table 2 shows the ability of each individual item of the DEPITAC scale to predict PTSD in the first year after the MVA in univariate as well as multivariate analyses. Only two items predicted PTSD with a similar odds ratio: item n°3 (**there were other people injured or killed in the accident**) and item n°7 (**the person experienced threatened death of self**). The median AUC (after correction for overoptimism) of this short version of the DEPITAC scale across the 10 imputed datasets was 0.618 (range, 0.608 to 0.621) (**figure 2**), with no deviation in calibration (all p>0.55, table 2). When comparing the AUC of this short version of the DEPITAC scale with the AUCs of the 10-item DEPITAC and PDI scales, no significant difference was observed in either imputed dataset (all p>0.52; see figure 2, the ROC curves in the first imputed dataset). The sensitivity and specificity values (95% CI) combined across the 10 imputed datasets were 57.4% (48.6 to 66.3) and 65.4% (57.7 to 73.1) for ≥1 point (n=123) and 5.7% (1.5 to 9.8) and 96.7% (93.7 to 99.6) for two points (n=12) of the short-term DEPITAC version, respectively.

Performance characteristics of the 4-item questionnaire

To improve the prediction performance of item n°3 (**there were other people injured or killed in the accident**) and item n°7 (**the person experienced threatened death of self**), we attempted to add simple demographic characteristics to our model from the medical records. Univariate analyses of the association of PTSD with the main patient and MVA characteristics are reported in **supplementary table 4**. Women, no children, trauma score>4, and length of stay in trauma (>10 days) were associated with PTSD in the first year after the MVA. When these characteristics were included in the previous multivariate analysis, the same DEPITAC items were selected as independent predictors of PTSD. In addition, **no children and length of stay in trauma (>10 days)** were retained as predictors of PTSD. The sensitivity and specificity values (95%CIs) (combined across the 10 imputed datasets) were 91.9% (86.9 to 96.9) and 21.5% (14.7 to 28.3) for ≥1 point (n=232), 70.9% (62.8 to 79.1) and 58.2% (50.2 to 66.2) for ≥1 point (n=151), and 26.3% (18.3 to 34.3) and 88.09% (83.8 to 94.1) for ≥3 points (n=49), respectively; only 4 patients were graded with 4 points. The median AUC (after correction for overoptimism) of this selected multivariable model across the 10 imputed datasets was 0.674 (range 0.661 to 0.683), with no deviation in calibration (all p>0.66). For each imputed dataset, the AUC of this selected multivariable model was significantly greater than the AUC of the short version of the DEPITAC scale (median p=0.032; range 0.009 to 0.048).

INSERT FIGURE 2 ABOUT HERE

Discussion

In this 1-year prospective multicentre study, we created and evaluated the accuracy of a 10-item questionnaire that predicted the occurrence of a PTSD diagnosis 1 year after being admitted to the Orthopaedic Trauma Unit after a motor vehicle accident. We ultimately reduced this questionnaire to 2 questions and 2 simple elements of the patient's medical record (other injury or a person dying during the accident, perception of vital threat, number of children, length of stay in trauma) that were easy for non-specialized nurses to ask.

The brevity (4 questions) of this evaluation, simple scoring rules, and screening test performance suggest that this new screening tool can be easily administered in the acute care setting by nurses. We evaluated for the first time a screening questionnaire directly assessed by nurses. Placing nurses on the front line of PTSD screening seems crucial as it will never be possible to provide a caregiver with psychiatric or psychological training at the bedside of each motor vehicle accident victim. The cost would be disproportionate despite the expected results, and the number of caregivers is currently insufficient.

Three expert clinicians (with at least 5 years of experience working as psychiatry consultation-liaisons in an Orthopaedic Trauma Unit and PTSD centre) were asked to propose 15 items taken from the literature based on their clinical experience. We also performed a retrospective analysis on 200 medical records, analysing the peritraumatic factors predicting PTSD 6 weeks and 6 months after a trauma. We preferred a hypothesis-driven method of selection to machine-learning selection to propose items that can be easily administered in acute care settings by nurses, avoiding selection of inappropriate items by the algorithm. We also performed a review of the literature and a retrospective analysis of medical records to propose additional items that were not found in previous meta-analysis (such as cardiac frequency).

The performance of item n°3 (**there were other people injured or killed in the accident**) and item n°7 (**the person experienced threatened death of self**) seemed too weak to be used alone in clinical practice to predict the occurrence of PTSD one year after a motor vehicle accident. The sensitivity and specificity were approximately 60%. We attempted to improve this model with the addition of simple demographic elements of the patient's medical record. Adding only two elements (number of children, length of stay in trauma) led to a significant improvement in sensitivity of 91.9% (86.9 to 96.9) and 21.5% (14.7 to 28.3) for ≥1 point and in specificity of 88.09% (83.8 to 94.1) for ≥3 points (n=49) as well as in sensitivity of 21.5% (14.7 to 28.3) for ≥1 point and in specificity of 88.09% (83.8 to 94.1) for ≥3 points (n=49).

Screening for PTSD risk factors is appropriate in the trauma acute care setting because the diagnosis of PTSD cannot be made until symptoms have persisted for at least 1 month, a time course beyond the length of stay following most Orthopaedic Trauma Unit admissions. A lack of early care has been associated with poor medical and functional outcomes(Michaels et al., 1999). Moreover, positive results have been obtained in the area of secondary prevention from both pharmacological and psychotherapeutic interventions(Davidson, 2004). For

example, Bryant and his collaborators compared two groups of road accident victims who were treated with acute stress and intervention therapy within 2 months after the accident(Bryant et al., 1999). They showed that fewer than 23% of the subjects who benefited from 5 sessions of cognitive-behavioural therapy developed post-traumatic stress disorder at 6 months compared to 67% of subjects who received supportive counselling sessions. Moreover, giving propranolol after acute stress might decrease the risk of developing PTSD(Vaiva et al., 2003). Therefore, it is crucial to identify those at risk of developing PTSD in an effort to ensure that appropriate psychological care is delivered after acute medical treatment is completed. Early identification could also have an important economic impact. An Australian study(Chan et al., 2003) found that the economic cost for 391 motor vehicle accident victims was A$6,369,519.52. PTSD cases incurred significantly higher health care costs than non-PTSD cases, and untreated PTSD cases incurred significantly higher economic losses than treated PTSD and non-PTSD cases.

The two questions of our 4-item questionnaire are in line with predictive factors found in the literature. Injured or dead persons during the accident and seeing oneself dying during the accident are two items used in our model. Perceived threat to life has previously been found to be a predictive factor for PTSD(Heron-Delaney et al., 2013), and it is one criterion used for PTSD diagnosis(American Psychiatric Association, 1994). Length of stay in trauma has also been previously identified as a predictive factor(Heron-Delaney et al., 2013). This item can be linked to the severity of symptoms, which is also a predictive factor(Heron-Delaney et al., 2013). We did not find any study linking the number of children and the risk of developing PTSD. However, social support is an important predictive factor(Heron-Delaney et al., 2013) and could be part of this item.

Limitations

More than the 200 patients expected to complete follow-up effectively completed follow-up. A potential limitation of our study is that we were unable to collect complete data from 66 patients at 1 year, and we cannot exclude selection bias. We were also not able to report test-retest reliability, because of our sample size. However, missing data were handled with bootstrap resampling. Moreover, most of the incomplete data were linked to patients' missing heart rate information upon emergency admission. These results showed that this point could be difficult to assess in daily life. However, this question was not included in our 2- and 4-item models, and it may be an argument for the better feasibility of asking 4 questions compared to our initial 10-question questionnaire. Another limitation could be the use of the PCLS and MINI DSM-IV. Moreover, the PCL-5 was not validated when the study began. However, the results must not have been affected, especially for PTSD diagnosis, because changes are very limited between DSM IV and DSM 5 criteria.

Finally, we proposed 4 questions (other injury or a person dying during the accident, perception of vital threat, number of children, length of stay in trauma) to teach nurses to screen for the risk of PTSD 1 year after a motor vehicle accident. These questions could be used to perform very early psychotherapeutic or pharmacologic interventions. These results should be replicated, and questionnaires should be adapted (especially for length of stay in trauma), especially in other traumatized populations. A future study could involve all patients admitted for any psychological trauma to an emergency unit.

Figure caption

Figure 1: Study flow chart

Figure 2: Receiver operating characteristic (ROC) curves of the PDI score as well as initial and reduced DEPITAC scores for the diagnosis of PTSD in the first year following an MVA

Table 1: Characteristics of patients and motor vehicle accidents (MVAs) of 274 MVA survivors

Table 2: Univariate and multivariate analyses of individual DEPITAC items to predict PTSD in the first year following MVA (after correcting for missing values by a multiple imputation method)**.**

Supplementary table 1: DEPITAC questionnaire

Supplementary table 2: Distribution of individual items and total scores for the DEPITAC and PDI scales assessed 14 days after the motor vehicle accident

Supplementary table 3: Diagnosis rates of posttraumatic stress disorder (PTSD) overall and by study visits before and after correcting for missing values

Supplementary Table 4. Association between patient and MVA characteristics with PTSD in the year following MVA in univariate analyses (after correcting for missing values by a multiple imputation method)

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Tables

Table 1. Patients' and Motor Vehicle Accidents (MVA)' Characteristics of 274 MVA survivors

	N	Values
Patient's characteristics		
Age, years, median(IQR)	274	33 (24 to 46)
Men	274	199 (72.6)
Married or cohabitating	274	136 (49.6)
Children	271	118 (43.5)
Employed	272	217 (79.8)
Current alcohol consumers	270	124 (45.9)
Current tobacco consumers	273	129 (47.3)
Current drug consumers	271	36 (13.3)
MVA history	203	95 (46.8)
MVA characteristics		
Vehicle type of victim		
Cars	274	66 (24.1)
Motorcycle		154 (56.2)
Bicycle or pedestrian		54 (19.7)
Position of victim		
Driver	273	202 (74.0)
Passenger		29 (10.6)
Pedestrian		42 (15.4)
Consumption during MVA		
Alcohol	269	57 (21.2)
Drug	271	13 (4.8)

Benzodiazepine medications	274	13 (4.7)
Alpha-beta blockers	274	9 (3.3)
Trauma score, median (IQR)	270	7 (4 to 11)
Amnesia	271	49 (18.1)
Length of stay in trauma	273	12 (7 to 20)

Values are number (%) unless otherwise as indicated.

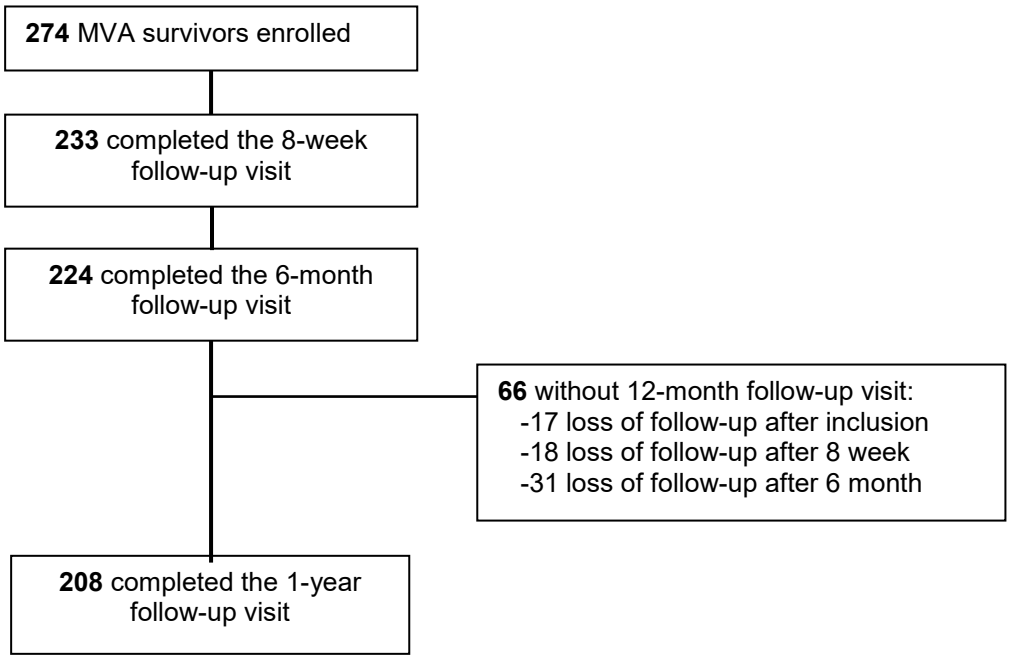
Abbreviations: IQR=interquartile; MVA=motor vehicle accident.

Table 2. Univariate and Multivariate analysis of individual DEPITAC items to predict PTSD in the first year following MVA (after handling missing values by multiple imputation method)

	PTSD diagnosis		**Univariate analysis**		**Multivariate analysis**	
	No (n=150)	**Yes** (n=124)	**OR (95%CI)**	***P***	**OR (95%CI)**	***P***
DEPITAC items						
1	58 (38.7)	41 (33.3)	0.79 (0.45 to 1.38)	0.41		
2	35 (23.0)	38 (31.0)	1.50 (0.86 to 2.61)	0.15		
3	27 (17.8)	38 (30.9)	2.06 (1.16 to 3.66)	0.013	2.24 (1.25 to 4.03)	0.007
4	27 (18.0)	27 (21.8)	1.27 (0.68 to 2.39)	0.45		
5	63 (42.3)	65 (52.1)	1.49 (0.91 to 2.43)	0.11		
6	70 (46.8)	72 (57.7)	1.55 (0.94 to 2.55)	0.084		
7	30 (20.1)	40 (32.3)	1.88 (1.08 to 3.28)	0.025	2.06 (1.16 to 3.63)	0.013
8	7 (4.5)	8 (6.6)	1.50 (0.50 to 4.41)	0.46		
9	8 (5.3)	11 (8.9)	1.73 (0.67 to 4.46)	0.25		
10	17 (11.6)	17 (13.7)	1.21 (0.58 to 2.85)	0.61		
			C statistics, median (range)[1,2]		*0.618 (0.608 to 0.621)*	
			Hosmer-Lemeshow, median (range)[1]		*0.60 (0.55 to 0.63)*	

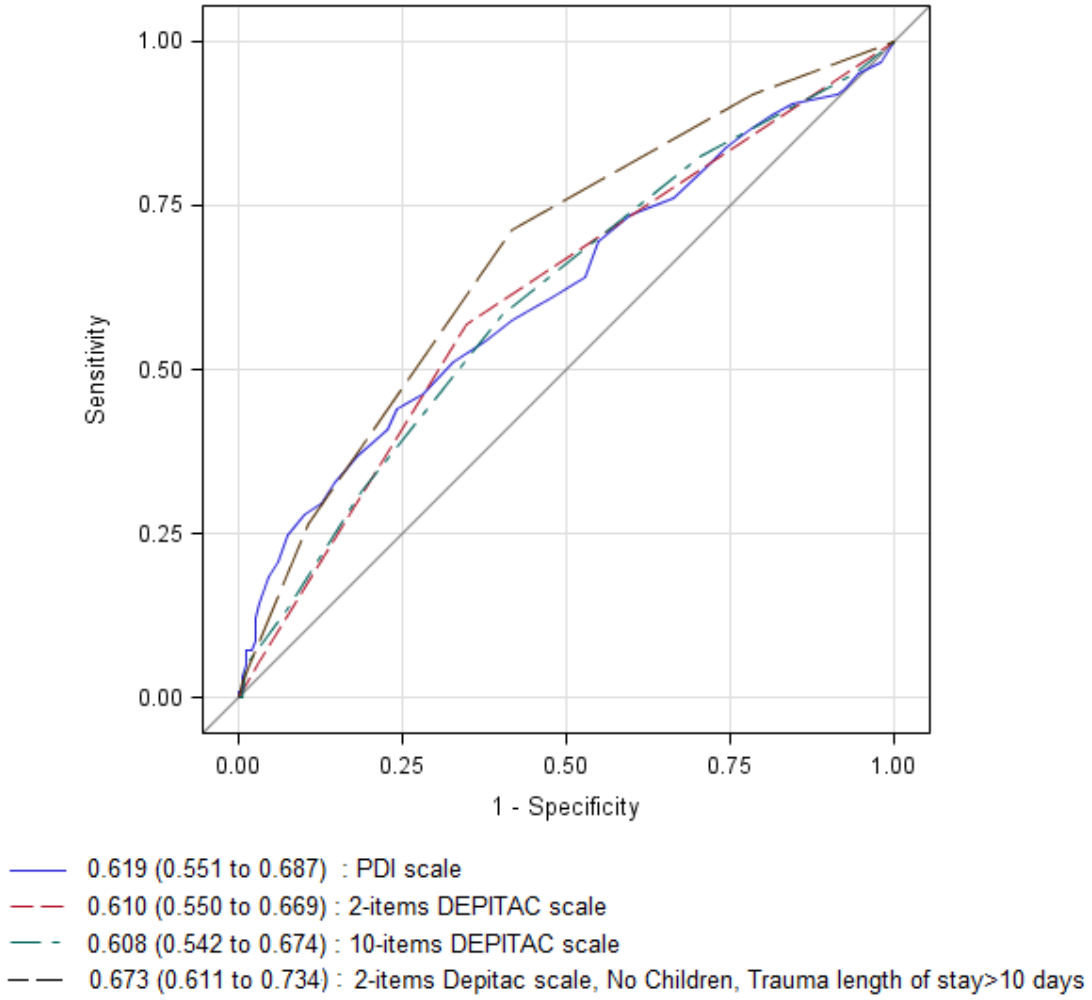
[1] median and ranges values across the 10 imputed datasets. [2] correct for overoptimism bias.

Figures



MVA indicates motor vehicle accidents

Figure 1: Study flow chart



ROC curves were constructed in the first imputed dataset.

Figure 2: Receiver operating characteristic (ROC) curves of the PDI score as well as initial and reduced DEPITAC scores for the diagnosis of PTSD in the first year following an MVA

1	Was the **heart rate** of the patient at **emergency** admission **> 90 pulses/min**?	YES 1	NO 0
2	Do you live **alone** ?	YES 1	NO 0
3	Was there other **injured or died person** during the accident ?	YES 1	NO 0
4	Were you **cycling** ? Were you **pedestrian** ?	YES 1	NO 0
5	Were you **very scared at the time of the accident?** **Were your feelings close to horror?** Have you felt **helpless or abandoned?**	YES 1	NO 0
6	After the accident do you feel **weird, strange, detached** or like **asleep**? Have you **forgotten** the accident or part of the accident?	YES 1	NO 0
7	Did you see yourself **dying** during the accident?	YES 1	NO 0
8	At the time of the accident, were you taking medication for **anxiety** problems, or were you consulting a psychiatrist or psychologist for **anxiety**?	YES 1	NO 0
9	At the time of the accident, were you taking medication for **depression**, or were you seeing a psychiatrist or psychologist for **depression**?	YES 1	NO 0
10	After the accident did you feel **supported** (**morally** or **materially**) by the witnesses, the rescuers or your relatives?	NO 1	YES 0
	Total score =		

Supplementary table 1: DEPITAC questionnaire

	N	Values
DEPITAC items		
1 (0 / 1)	235	64.3 / 35.7
2 (0 / 1)	274	73.4 / 26.6
3 (0 / 1)	273	76.2 / 23.8
4 (0 / 1)	274	80.3 / 19.7
5 (0 / 1)	274	53.3 / 46.7
6 (0 / 1)	272	48.2 / 51.8
7 (0 / 1)	274	74.5 / 25.5
8 (0 / 1)	274	94.5 / 5.5
9 (0 / 1)	274	93.1 / 6.9
10 (0 / 1)	272	87.5 / 12.5
Total (sum of points)	232	2 (2 to 3)
PDI score		
1 (0 / 1 / 2 / 3 / 4)	272	21.7 / 10.3 / 13.2 / 23.9 / 30.9
2 (0 / 1 / 2 / 3 / 4)	273	45.1 / 13.9 / 11.0 / 15.7 / 14.3
3 (0 / 1 / 2 / 3 / 4)	270	28.9 / 8.9 / 14.8 / 27.4 / 20.0
4 (0 / 1 / 2 / 3 / 4)	271	36.9 / 14.0 / 15.9 / 18.1 / 15.1
5 (0 / 1 / 2 / 3 / 4)	271	59.4 / 13.3 / 8.5 / 9.2 / 9.6
6 (0 / 1 / 2 / 3 / 4)	273	85.7 / 5.1 / 2.2 / 4.4 / 2.6
7 (0 / 1 / 2 / 3 / 4)	271	54.2 / 9.2 / 7.8 / 11.8 / 17.0
8 (0 / 1 / 2 / 3 / 4)	273	64.8 / 9.9 / 11.4 / 8.0 / 5.9
9 (0 / 1 / 2 / 3 / 4)	271	94.8 / 1.5 / 0.4 / 2.2 / 1.1
10 (0 / 1 / 2 / 3 / 4)	273	58.6 / 9.5 / 8.4 / 11.4 / 12.1
11 (0 / 1 / 2 / 3 / 4)	272	39.7 / 11.8 / 12.5 / 17.3 / 18.7
9 (0 / 1 / 2 / 3 / 4)	272	66.5 / 11.4 / 4.8 / 8.8 / 8.5
10 (0 / 1 / 2 / 3 / 4)	273	66.3 / 9.5 / 5.5 / 7.7 / 11.0
Total (sum of points)	261	9 (14 to 22)

Values are % for each answer or median (IQR) for total scores.

Abbreviations: PDI=peritraumatic distress inventory.

Supplementary table 2: Distribution of individual items and total scores for the DEPITAC and PDI scales assessed 14 days after the motor vehicle accident

Diagnosis	n/N	Before imputation	After Imputation
		% (95%CI)	% (95%CI)
8 weeks	48 / 233	20.6 (15.4 to 25.8)	21.9 (16.9 to 26.9)
6 months	49 / 223	22.0 (16.5 to 27.5)	24.5 (19.2 to 29.9)
One-year	43 / 206	20.9 (15.3 to 26.5)	25.8 (20.5 to 31.1)
At least one visit	85 / 198[1]	42.9 (36.0 to 49.9)	45.2 (39.2 to 51.1)

[1] defined as patients with one-year visit or with a PTSD diagnosis before one-year

[2] missing diagnosis were imputed by multiple imputation method (m=10 imputed datasets).

Supplementary table 3: Diagnosis rates of posttraumatic stress disorder (PTSD) overall and by study visits before and after correcting for missing values

	PTSD diagnosis			
	No (n=113)	**Yes** (n=85)	**OR (95%CI)**	***P***
Patient's characteristics				
Age, years, median(IQR)	35 (26 to 46)	32 (24 to 46)	0.92 (0.77 to 1.09)[1]	0.30
Women	31 (20.8)	44 (35.3)	2.07 (1.19 to 3.61)	0.010
Married or cohabitating	80 (53.3)	56 (45.2)	0.72 (0.44 to 1.18)	0.19
None children	74 (49.1)	80 (64.7)	1.90 (1.15 to 3.14)	0.012
Employed	118 (78.8)	100 (80.7)	1.13 (0.60 to 2.10)	0.70
Current alcohol consumers	70 (46.8)	55 (44.7)	0.92 (0.55 to 1.51)	0.73
Current tobacco consumers	65 (43.3)	65 (52.0)	1.42 (0.86 to 2.32)	0.16
Current drug consumers	20 (13.4)	16 (12.8)	0.95 (0.45 to 1.99)	0.90
MVA history	77 (51.3)	56 (45.2)	0.78 (0.45 to 1.34)	0.37
MVA's characteristics				
Vehicle type of victim				0.087
Bicycle or pedestrian	27 (18.0)	27 (21.8)	1.00 (ref.)	-
Cars	30 (19.8)	36 (29.2)	1.21 (1.57 to 2.57)	*0.61*
motorcycle	93 (62.2)	61 (49.0)	0.65 (0.33 to 1.25)	*0.20*
Position of victim				0.55
Driver	115 (76.8)	88 (70.8)	1.00 (ref.)	-
Passenger	15 (9.9)	14 (11.5)	1.26 (0.57 to 2.79)	*0.56*
Pedestrian	20 (13.3)	22 (17.8)	1.45 (0.71 to 2.95)	*0.30*
Consumption during MVA				
Alcohol	27 (18.2)	31 (24.8)	1.48 (0.80 to 2.74)	0.20
Drug	6 (3.8)	7 (6.0)	1.65 (0.44 to 6.22)	0.45
Benzodiazepine medications	6 (3.8)	7 (5.8)	1.54 (0.48 to 4.92)	0.47
Alpha-beta blockers	4 (2.8)	5 (4.0)	1.47 (0.37 to 5.80)	0.58
Trauma score				
≤4	54 (36.3)	27 (22.1)	1.00 (ref.)	0.041
4 to 9	26 (24.0)	41 (32.5)	2.22 (1.15 to 4.28)	*0.017*
>8	60 (39.8)	56 (45.4)	1.87 (1.02 to 3.46)	*0.044*
Amnesia	32 (21.3)	18 (14.4)	0.62 (0.32 to 1.19)	0.15
Length of stay in trauma, days	10 (6 to 20)	13 (7 to 20)	1.15 (0.98 to 1.34)[1]	0.083
> 10 days	68 (45.0)	79 (63.8)	2.16 (1.30 to 3.57)	0.003

[1]Odds ratio (OR) per 10-unit increase.

Supplementary Table 4. Association between patient and MVA characteristics with PTSD in the year following MVA in univariate analyses (after correcting for missing values by a multiple imputation method)