

# Incidence of Posttraumatic Stress Disorder after Traffic Accidents in Germany

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**ABSTRACT:** *Posttraumatic stress disorder (PTSD) is possibly an overlooked diagnosis of victims suffering from traffic accidents sustaining serious to severe injuries. This paper investigates the incidence of PTSD after traffic accidents in Germany.*

*Data from an accident research unit were analyzed in regard to collision details, and preclinical and clinical data. Preclinical data included details on crash circumstances and estimated injury severity as well as data on victims' conditions (e.g. heart rate, blood pressure, consciousness, breath rate). Clinical data included initial assessment in the emergency department, radiographic diagnoses, and basic life parameters comparable to the preclinical data as well as follow-up data on the daily ward. Data were collected in the German-In-Depth Accident Research study, and included gender, type of accident (e.g. type of vehicle, road conditions, rural or urban area), mental disorder, and AIS (Abbreviated Injury Scale) head score. AIS represent a scoring system to measure the injury severity of traffic accident victims.*

*A total 258 out of 32807 data sets were included in this analysis. Data on accident and victims was collected on scene by specialized teams following established algorithms. Besides higher AIS Head scores for male motorcyclists compared to all other subgroups, no significant correlation was found between the mean maximum AIS score and the occurrence of PTSD. Furthermore, there was no correlation between higher AIS head scores, gender, or involvement in road traffic accidents and PTSD.*

*In our study the overall incidence of PTSD after road traffic accidents was very low (0.78% in a total of 32.807 collected data sets) when compared to other published studies.*

*The reason for this very low incidence of PTSD in our patient sample could be seen in an underestimation of the psychophysiological impact of traffic accidents on patients.*

*Patients suffering from direct experiences of traumatic events such as a traffic accident and presenting with signs of clinically significant distress or impairment in social interactions should be treated in a team approach including not only trauma surgeons and surgical skilled staff but also psychophysiological experienced physicians.*

**Key words:** *Traffic accidents, post-traumatic stress disorder, AIS*

## INTRODUCTION

Road traffic accidents are a major cause of morbidity and mortality in children and adults, and account for up to 59% of global road deaths (Brand et al., 2012; Brand et al., 2013; "Fatal crashes involving young drivers," 2010; Hanna, Taylor, Sheppard et al., 2006; Plessinger & Frisch, 2005; Tay, 2001; Toroyan, Peden, & Iaych, 2013). Besides physical injuries, psychological consequences are often neglected or overseen by the patient treating clinical staff (McFarlane, 1994; Saberi, Abbasian, Kashani et al., 2013). However, emotional consequences resulting from traffic accidents are believed to be considerable, and expected to occur in victims of road traffic accidents (Brom, Kleber, & Hofman, 1993; Kuch, Swinson, & Kirby, 1985; Meyer & Steil, 1998). Either by direct experience of a traumatic event or by witnessing this event in person, this exposure can lead to a Post-traumatic-Stress-Disorder (PTSD).

PTSD is finally classified as a trauma- and stressor-related disorder in DSM-5 (Friedman, 2013a; Zoellner, Bedard-Gilligan, Jun et al., 2013). Diagnostic criteria for PTSD in DSM-5 are now:

Criterion A: Exposed to: death, threatened death, serious injury, and sexual violence

Criterion B: Intrusion symptoms

Criterion C: Avoidance of stimuli associated with the trauma

Criterion D: Negative alterations in cognitions and mood associated with the traumatic event

Criterion E: Alterations in arousal and reactivity associated with the traumatic event

Criterion F: Persistence of symptoms for more than one month

Criterion G: Symptom-related distress or functional impairment

Criterion H: Not due to medication, substance or illness (Armour, Elklit, Lauterbach et al., 2014; Friedman, 2013a, 2013b; Kilpatrick, 2013).

Additionally, separate diagnostic criteria for children 6 years or younger are implemented (Kramer, Hertli, & Landolt, 2013).

The reported incidence of PTSD resulting from road traffic accidents has been inconsistent. Nishi et al. reported an incidence of 7.5% of victims of motor-vehicle crash (MVA) referred to an intensive care unit suffering from PTSD at 6-month follow-up (Nishi et al., 2013). Besides this, the influence of heart and breath rate immediately at accident scene still remains controversially.

Whereas earlier reports state that elevated heart rates at accident scene were predictive of later PTSD (Bryant, Harvey, Guthrie et al., 2000; Shalev et al., 1998), Blanchard et al. were not able to replicate these results in their study (Blanchard, Hickling, Galovski et al., 2002). Baker et al. and Andrews et al. reported a higher probability of suffering from PTSD for the female gender (Andrews, Brewin, & Rose, 2003; C. K. Baker et al., 2005).

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This study evaluated the incidence of PTSD resulting from high-velocity road traffic accidents in Germany. All accidents met Criterion A of DSM-5 as described above. All patients admitted to our level-1 trauma centre were exposed to death or threatened death. Data collection and analysis was based on the German-in-Depth-Accident Research Study (GIDAS), which is a nationwide collection on accident data.

It was hypothesized that compared to the literature in our patient sample the incidence of PTSD is lower. Furthermore, a higher probability of PTSD in the female group was expected.

## MATERIALS AND METHODS

### Data Collection by an Accident Research Unit

A 1972 by legal mandate established local traffic accident research unit collected prospective data in regard to all reported traffic crashes within a metropolitan area. Since 1988 approx. 1000 accidents per year have been documented. Specially trained documentation personnel are notified by police dispatchers and arrive on scene, often simultaneously with the rescue personnel. The circumstances of the crash are investigated by taking photographs and using a 3D-laser scanner to document the occurrence (Otte, 2005). Slide and skid marks of involved objects, vehicles and persons are measured for later reconstruction of the crash and calculation of collision speeds. Furthermore, technical features of involved vehicles (e.g. weight and size) are obtained, as well as on-scene clinical data from injured persons. Data collection on scene is provided by specially trained documentation teams including physicians. The collected data on vehicle deformation leads to reconstructions of accident scene and improved developments in passenger safety.

Additional patient data (e.g. heart rate, blood pressure, and oxygenation) are collected at the hospital where the injured occupants are admitted, including documentation of x-ray films, diagnoses after the first in-hospital examination and estimation of injury severity.

The data consist of demographics, type of road user (car/truck occupant, motorcyclist, bicyclist, pedestrian), Abbreviated Injury Scale (AIS), Maximum AIS (MAIS), and incidence of serious and/or severe multiple injuries (polytrauma, ISS  $\geq$  16) (American Association for Automotive Medicine, 1995; S. P. Baker, O'Neill, Haddon et al., 1974; Haasper et al., 2008; Richter et al., 2007). AIS represent a scoring system to measure injury severity based on anatomical regions. The different severity of the single injuries is then scored from one to six, with one being a minor injury and six being maximal (currently untreatable) (Haasper et al., 2010).

Maximum AIS represents the highest AIS-score of a patient regardless of anatomical region. ISS (Injury Severity Score) is a measuring tool for a combination of injuries using the single anatomical-based AIS-codings. The three highest AIS-score are then combined to an ISS-score, with scores  $\geq$  16 represent a severely multiple injured patient.

The database used in this study comprises all traffic accidents fulfilling Criterion A of PTSD that were documented between 1988 and 2012. Data were analyzed for age, gender, AIS score, MAIS score, and presence of PTSD.

In a second step, all victims of road traffic accidents that fulfilled the Criterion A of PTSD were screened for PTSD after discharge from the hospital. The screening was done after discharge but not before 30 days after the traumatic event. The screening tool was a self-reporting telephone interview performed at a minimum of 30 days after trauma.

The study design was retrospective; all PTSD positive self-

reports were included in the PTSD group; the control group was formed. Children below 6 years were excluded.

Prism 5 for Mac OS was used for statistical analysis. Student's t-test was applied. *P* values below 0.05 were regarded as significant; *p* values below 0.001 were regarded as highly significant.

## RESULTS

From a total of 32,807 collected data sets of victims of road traffic accidents, 258 (0.78%) patients with PTSD were included in the present study. Of these, there were 123 men and 135 women.

The mean age for women in the sample was 45.69 years (range 7-91 years; SD 19.37) and for men it was 38.38 years of age (range 8-91 years; SD 19.44). In our study group there were 19 pedestrians, one motorcycle rider, 98 car passengers and 17 bicyclists in the female group, whereas for the men there were 18 pedestrians, 23 motorcyclists, 63 car passengers and 19 bicyclists.

The mean maximum AIS was 2.5 in the male (range 0-5), and 2 in the female group (range 0-5).

The mean AIS Head was 1.9 in the female (range 0-5) and 2.4 in the male group (range 0-5).

The AIS was higher in the group of male motorcyclists (3.4) compared to all other subgroups ( $p < 0.01$ ; student's t-test).

No significant correlation was found between the mean maximum AIS and the occurrence of PTSD for the overall sample of men and women. Furthermore, there was no correlation between higher AIS Head rates, gender or participation in road traffic accidents and PTSD.

## DISCUSSION

As noted, PTSD might be an overlooked consequence of traffic accidents. Though often overseen, early diagnosis might be important in the initiation of professional support to those suffering from PTSD. Sufficient predictors of PTSD have not been established so far, neither heart rate nor respiratory rate has been shown to be reliable predictors for subsequent PTSD.

In our data collection of victims of road traffic accidents there was no correlation found between occurrence of PTSD gender, traffic participation and/or maximum AIS and/or AIS head scores.

Overall, the incidence of PTSD was very low in our group compared to those presented in other studies. (Nishi, et al., 2013). Having ten-times lower rate of diagnosed PTSD in Germany compared to for example Japan does not seem to be plausible.

This appears to be the major drawback of this limited study design. The idea was to evaluate our traffic accident data matching the Criterion A of PTSD retrospectively on the occurrence and onset of PTSD. Self-report and telephone interviews were used to assess the data.

Although specially trained documentation teams are collecting the accident data immediately at scene, the major focus is clearly on physical injuries and deformities of the crash-involved vehicle. Little to none effort is so far undertaken to seriously integrate PTSD Criteria in the daily routine. This of course can probably lead to the very low incidence of PTSD in our patient sample.

A similar incidence to those reported by Nishi et al. has to be expected.

Also, little to none psychological professional support was offered routinely to those patients exposed to near-by death traffic

accidents during their hospital stay.

As a conclusion, routinely integration of PTSD Criteria in the on scene documentation as well as in the daily ward round should be administered; furthermore early professional support should be offered to those obviously suffering from PTSD.

Short-time follow-ups at 1 month to 6 weeks after exposition to the traumatic event with pronunciation on PTSD Criteria could be a useful tool to reduce the number of overseen or late-diagnosed trauma- and stress-related disorders.

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