

TRAUMATIC EXPOSURE AND POSTTRAUMATIC SYMPTOMS FOR TRAIN DRIVERS INVOLVED IN RAILWAY INCIDENTS

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Abstract

Aims. International research highlights the occupational risk of train drivers of being exposed to work related traumatic incidents and subsequently developing posttraumatic symptoms or other comorbid dysfunctions.

Participants and methods. The article focuses on investigating the effects of repeated traumatic exposure on posttraumatic reactions in a sample of 193 Romanian train drivers. We used the Impact of Event Scale-Revised (IES-R) to retrospectively evaluate symptoms of Posttraumatic Stress Disorder (PTSD), The General Health Questionnaire to investigate related mental health symptoms, and a demographic questionnaire to assess contextual factors like frequency or severity of exposure.

Results. Sample reports of exposure to PUT ("person under train") incidents were high. An interesting finding was that train drivers exposed to just one or two PUT incidents reported significantly more posttraumatic symptoms than train drivers with more PUT experiences, accounting for a habituation effect of repeated traumatic exposure.

Conclusions. Reported posttraumatic reactions to PUT incidents and influencing factors provide evidence recommending systematic screening of train drivers for posttraumatic symptoms, general emotional distress and further elaborating prevention and treatment strategies for specific risk categories of these professionals.

Keywords: prevalence, trauma, posttraumatic stress disorder, train drivers, railway incidents.

Introduction

Railway accidents are one of the major concerns of worldwide traffic safety that impact global public health strategies. Recent statistics reports [1] from the European Union show a slightly declining trend in train accidents observed since 2004, in all European states. Nevertheless, in the EU-27 for 2011, Romania was one of the three countries responsible for 48% of rail victims, after Poland and Germany, with 217 train accidents and 251 persons killed or seriously injured.

Analysis of the international data revealed that 83.6 % of victims were included in the category of 'other persons' (e.g.: level-crossing users or unauthorised persons on railway premises). This is particularly relevant because psychological studies have documented the traumatic impact

that this type of accident may have on railway personnel [2-10]. Collisions resulting in death or serious injury of persons who fall or intentionally throw themselves in front of the moving train, are known in the literature as „person-under-train” (PUT) incidents [2]. Studies have found that accidents causing death or serious injury to other persons are as traumatic for the train driver as collisions between trains where the driver's own life is directly threatened [2,4].

Because of involuntary exposure to PUT incidents, the likelihood of train drivers to witness the violent death of a person is much higher than that of the general population, and that puts the train driver at risk of psychological trauma [5]. Moreover, psychological disability due to involvement in PUT accidents is likely to affect cognitive and affective functions that are essential for train drivers' capacity to work and further ensure traffic safety [9].

The most investigated forms of traumatic reactions

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are acute stress and posttraumatic stress response, which may develop into disorders. According to the current international standards for mental health (DSM-IV), Posttraumatic Stress Disorder (PTSD) is defined by the following criteria: *Criterion A*: The individual must have experienced a traumatic incident of great severity that caused him to feel intense fear, helplessness and horror. *Criterion B*: The event is persistently re-experienced through intrusive memories, dreams, flashes etc. (*Intrusion*). *Criterion C*: The individual consistently avoids stimuli associated with the trauma and/or has numbed or significantly reduced responsiveness (*Avoidance*). *Criterion D*: The individual shows persistent symptoms of increased arousal, like sleep disturbance, or inability to concentrate, exaggerated startle response (*Hyperactivation*) [11].

In exposed train drivers, the PTSD symptom prevalence is not very high, but its presence is constant across studies [3,6], stressing the need to manage this occupational hazard. In terms of PTSD comorbidity, depressive disorders are the most common dysfunctions associated with posttraumatic stress in train drivers [2].

In a sample of Romanian train drivers we found that exposure to PUT incidents is high and train drivers with PUT experiences report significantly more psychological symptoms when compared to train drivers without PUT incidents [3].

To better understand variations in the prevalence of PTSD symptoms between train drivers exposed to PUT incidents, studies have investigated specific factors that may predict PTSD symptom development. Most relevant and pervasive vulnerability factors across studies are: a history of psychiatric problems, anterior trauma, current life stressful events, and certain features of the PUT incidents, for example, their severity or frequency of exposure [4,6]. There are also some conflicting data, identified in the literature [6]. Train drivers' repeated confrontation with PUT incidents has been interpreted by researchers both as a vulnerability factor and as a factor that can provide inoculation and psychological resilience to such incidents.

In our sample we identified that the frequency of exposure to PUT incidents was the only factor significantly related to PTSD symptoms that train drivers reported. It was interesting to note that train drivers who were involved in repeated PUT experiences over the years reported less PTSD symptoms, accounting for a habituation effect of repeated traumatic exposure [3].

Wanting to further investigate this result, we supplemented the original sample with a new set of data and then explored the differences regarding event particularities, subsequent PTSD and general health symptoms between younger train drivers, with few PUT experiences, and more experienced train drivers, that reported repeated exposure to PUT incidents over the years.

Objectives

The overall objective of our study was to assess

differences in PTSD, general health symptoms and event particularities between train drivers that were at their first or second PUT experience, and train drivers that reported repeated PUT incidents.

Methods

Our research protocol was approved by the Babeş-Bolyai University Research Ethics Committee. We obtained the approval for research objectives and procedure from the Head of the Railway Regional Department of Cluj, Traffic Division that allowed us access to train drivers involved in Traffic Safety. Selection of participants was done on a voluntary basis. We also accessed train drivers in two private companies involved in passenger transport on the railway. Of the total 216 train drivers we first approached, 23 refused to participate, and 41 declared they never had a PUT incident. Questionnaires and informed consents were completed individually.

Participants

The final sample consisted of 193 train drivers (mean age = 38.42, SD = 9.64) currently working for The Locomotive Depots in Cluj, Dej, Bistriţa and Braşov. Of them, 29 (15%) belong to a private railway company. Average professional experience in our sample was of 17.54 years (SD = 9.64).

Instruments

All participants completed a series of questionnaires, as follows:

1. A questionnaire about demographic and circumstantial variables (the frequency of reported PUT incidents, time passed since the accident, details about the most severe incident, knowledge about standard procedures etc.). Train drivers were instructed to think of the most severe incident and describe the symptoms they experienced in the weeks that followed.

2. Impact of Events Scale-Revised-IES-R [12,13]. Internal consistency for IES-R in the present sample was adequate (Alpha Cronbach = 0.75). IES-R is one of the most frequently used measures for traumatic impact of specified events. It has three subscales, corresponding to the three clusters of PTSD symptoms: re-experiencing of the traumatic events, avoidance and hyper arousal.

3. General Health Questionnaire-GHQ-28 [14]. GHQ-28 is a measure of mental health screening, with good psychometric qualities (Alpha Cronbach = 0.70 in the present sample). It has four subscales: severe depression, anxiety and sleep disturbance, somatic symptoms and social dysfunctions.

Results

Traumatic exposure

In the present sample, exposure to PUT incidents was high. Of the 193 train drivers, 152 (78.75%) reported at least one PUT incident. Respondents reported as much as 14 PUT incidents/person, with a mean of 4 (SD =

2.83) incidents/train driver. As for time since the last PUT incident, the mean number of years reported from the last event was $m = 3$, $SD = 3.67$.

The average age that the train drivers were when exposed to their first PUT incident, was 27 years ($SD = 6.95$). Train drivers that did not report being exposed to PUT incidents were significantly younger ($t = 3.5$, $df = 79$, $p = 0.00$) and had significantly less professional experience ($t = 5.8$, $df = 79$, $p = 0.00$) than a randomly selected similar size sample of their colleagues with experienced PUT incidents.

For further analysis of data, we divided the sample into four subgroups of train drivers, based on number of reported PUT incidents, as follows: first category (41 respondents - 21.2%) were non/exposed train drivers (0 PUT incidents), second category (38 respondents - 19.7%) were train drivers with a low exposure (1 or 2 reported PUT incidents), third category (65 respondents - 33.7%) consisted of train drivers with medium traumatic exposure (3-5 reported PUT incidents) and forth category (49 respondents - 25.4%) consisted of train drivers with a high frequency of reported PUT incidents (6 incidents or more).

PUT incident particularities

Most of reported PUT incidents were accidents (44%) due to lack of attention on part of the victims walking on the railway, or car collisions at crossing levels, 37% were suicides and in 19% of cases, respondents did not know the cause of the accident. Most of them involved passengers'

trains (80%), as opposed to freight trains or other types of railway vehicles. Most accidents happened during daytime (57%). Most of them (90 %) involved at least one injured person, and in 40 % of cases at least one person was killed because of the accident. Most of the time, the train driver was alone on the locomotive (65%) and had to drive the train to destination immediately after the incident (72%). Almost half of the sample saw the victim before and after the collision (45%), but in most cases they couldn't offer medical assistance to the victims (86%). Some of the train drivers reported sick leave days after the PUT incident (12%) and relying on more experienced train drivers, for discussing the event and its consequences (13%).

To test for significant differences between categories of exposure to PUT incidents, with regard to contextual particularities, we calculated separate frequencies. We used a contingency chi-square test for finding out if differences were significant. Results for each factor are synthesised in Table I. We found no significant differences between categories of exposure to PUT incidents in regard to circumstantial factors.

Reported PTSD symptoms

The impact of event scale-revised [12] assesses three categories of symptoms for PTSD: intrusive thoughts (nightmares, flashbacks, the feeling of reliving the event), avoidance (emotional numbness, avoidance of feelings, sensations, ideas and traumatic context) and physiological state of hyper-arousal (irritability, hyper vigilance,

Table I. Circumstantial factors for differently exposed subgroups of train drivers (N=152).

Subgroup of train drivers	I. 1-2 PUT incidents n= 38	II. 3-5 PUT incidents n= 65	III. At least 6 PUT incidents n= 49	Chi-square
N				
Incident type				
Suicide	34%	35%	41%	ns
Accident	44%	45%	43%	ns
Uncertain cause	21%	20%	16%	ns
Train type				
Passenger's train	76%	80%	84%	ns
Freight train	5%	8%	4%	ns
Automotor	19%	12%	12%	ns
Time of day				
Day time	58%	55%	59%	ns
Night time	42%	44%	41%	ns
Train driver's status				
Driving alone	71%	68%	57%	ns
Two train drivers	29%	32%	43%	ns
At least one deceased in the incident	42%	47%	29%	ns
At least one injured person in the incident	86%	82%	90%	ns
Train driver sees the victim before collision	65%	60%	71%	ns
Train driver offers first aid to the victim	18%	15%	13%	ns
Train driver drives again immediately after the incident	74%	78%	65%	ns
Sick leave after the incident	13%	12%	12%	ns
Train driver solicits help for recovery	16%	16%	8%	ns

difficulty concentrating, exaggerated startle reaction), in correspondence to DSM IV diagnostic criteria for PTSD.

For establishing clinical significance of PTSD symptoms, we followed the recommended procedure [13], using the cut-off value of 33 (on the IES-R scale). Of the 152 drivers who reported being involved in PUT incidents, 142 (93.4%) had scores below the threshold value set for the IES-R. Also, 13 (8.6 %) train drivers reported that they didn't experience any specific PTSD symptoms related to experienced PUT incidents. 6.6% of the participants reported PTSD symptoms over the cut-off score, that ranged up to 44, which is still a low score value when considering a diagnosis of PTSD.

To assess the impact of the frequency of PUT incidents on specific PTSD symptoms, we calculated, using one-way ANOVA test, significance of differences between the three categories of exposed train drivers. Results are presented in Table II.

The effect of frequency of PUT incidents on specific PTSD symptoms was significant ($F(2,149) = 5.14$, $p=0.00$). The average PTSD symptoms that train drivers in the low frequency category reported was higher than the average number of symptoms reported by train drivers who were repeatedly exposed to PUT incidents. We further investigated which of the differences between subgroups were significant. Levene's test for homogeneity of variances was not statistically significant, and we worked with unequal sample sizes, so we used Hochberg GT2 correction to assess significance of differences between our three categories of train drivers. The symptom difference between the subgroup of train drivers at their first or second PUT incident and the third group that reported at least six incidents was significant (Hochberg GT2 = 6.57, $p=0.00$).

The three separate clusters of symptoms show similar results. In case of avoidance, both differences between first subgroup of train drivers and the two repeatedly exposed categories are significant (Subgroup (1, 2) Hochberg GT2 = 2.23, $p=0.03$; Subgroup (2, 3) Hochberg GT2 = 2.91, $p=0.00$).

Results stand as evidence that the repeated exposure to these traumatic incidents determines a habituation effect on the train drivers, reducing reports of PTSD symptoms.

General health symptoms

Train drivers also completed the GHQ-28 questionnaire, used as an indicator of general health and detection of psychological symptoms. Results show that they report low levels of depression, anxiety, somatic discomfort and social dysfunctions [15], with all of the subscale and total scores below recommended cut-off points for identification of mental health disorders. In terms of the relationship with specific symptoms of posttraumatic stress, anxiety symptoms ($r=0.35$, $p=0.01$) and somatic symptoms ($r=0.18$, $p=0.05$) significantly correlated with the overall score of IES-R.

To highlight the impact of repeated traumatic PUT incidents on train drivers, we investigated the differences between general symptoms reported by the three categories of train drivers. Results are presented in Table 2. There were no statistically significant differences between general symptoms reported by the three categories of respondents ($F(2,149) = 0.86$, $p=0.42$).

To assess differences in general health between train drivers with and without PTSD symptoms, we divided the sample using mean IES-R score as cut-off point. Using independent samples T test, we identified a significant difference in general health symptoms between train drivers that reported above average PTSD symptoms ($M\ GHQ = 13.48$, $SD = 3.48$) and train drivers with below average PTSD symptoms ($M\ GHQ = 11.74$, $SD = 3.92$). Thus train drivers that reported higher than average PTSD symptoms also struggled with significantly more symptoms of depression, anxiety, sleep disturbances, social dysfunction and somatic symptoms ($t = 2.96$, $df = 150$, $p=0.00$).

Discussion and Conclusions

One of the main sources of psychological distress faced by rail transport personnel, are PUT incidents. Results of the present study reflect the same tendency as statistical reports of train accidents, showing that Romanian train drivers are exposed to a significant number of PUT incidents. Our results are comparable to the findings of studies from other European countries, and tend to display a low, but constant prevalence of PTSD symptoms for train drivers involved in PUT incidents [2-6,8].

Table II. Reported symptoms according to category of exposure frequency and differences between them.

PUT incident frequency	First category (1-2 PUT incidents)	Second category (3-5 PUT incidents)	Third category (at least 6 PUT incidents)	F	p
Number of respondents	38	65	49		
PTSD total score	M = 20.73 SD = 8.86	M = 16.01 SD = 10.30	M = 14.16 SD = 9.40	5.14	0.00
Intrusions	M = 6.52 SD = 3.26	M = 5.29 SD = 4.22	M = 4.38 SD = 3.61	3.37	0.03
Avoidance	M = 9.23 SD = 4.24	M = 7.00 SD = 4.63	M = 6.32 SD = 4.02	5.13	0.00
Hyper-arousal	M = 4.97 SD = 3.16	M = 3.72 SD = 2.88	M = 3.44 SD = 2.71	3.28	0.04
GHQ total score	M = 11.92 SD = 3.52	M = 12.72 SD = 4.17	M = 12.93 SD = 3.20	0.86	0.42

According to circumstantial risk factors identified in studies on train drivers, we previously evaluated the relationship between age, professional experience, frequency and time since the PUT incident and PTSD symptoms reported. We found that neither age nor professional experience of the train driver, not even time passed since the PUT incident, were correlated with the intensity of PTSD symptoms. The only significant association we found was between the frequency of PUT incidents and the intensity of reported PTSD symptoms [3].

Thinking that this negative relationship between the two variables may be evidence that over time, train drivers may develop the ability to reduce their reactivity to these incidents we wanted to further investigate differences between train drivers with fewer PUT experiences and train drivers with average or high level of traumatic job exposure. Results confirmed that higher frequency of exposure was associated with lower levels of posttraumatic stress symptoms. A similar result is presented in a Korean study [7]. Authors identified age to be the only factor in a wider range of individual and circumstantial variables that was significantly negatively associated with posttraumatic distress levels following PUT incidents.

Because the train drivers mainly reported subclinical PTSD symptoms that were associated with other types of anxiety or somatic symptoms, further research should consider other dimensions of the traumatic impact of such incidents. Post-incident reactions can be very different: from the transient state of shock, occurring immediately after the PUT incident to long-term psychological impairment. New research efforts should be oriented to double the evaluation of PTSD symptoms with the assessment of more subtle changes in neuro-physiological functioning of the train drivers involved in PUT incidents.

Results on circumstantial variables as sources of influence, determining the level of psychological distress after the PUT experience were not all relevant. We suggest that this puzzling finding, which contradicts some of the anterior studies, needs to be more fully assessed. Differing from other areas, most accident situations are quite uniform (mostly suicides; the driver can neither anticipate nor prevent the accident) and the group of train drivers is rather homogenous regarding socio-demographic variables. These circumstances present an opportunity to examine the role of individual disposition with regard to the aetiology of posttraumatic syndromes [4].

It is interesting that no relationship was found between time passed since the accident and specific PTSD symptoms. Also, we found interesting results regarding the influence of multiple traumatic experiences, which is associated with reductions in the intensity of reported PTSD symptoms. This result can be explained on the basis of habituation principles of learning theory. It would be useful to evaluate how immunization takes place, what are the factors that influence it, and which are the most effective cognitive and emotional coping mechanisms that favour it.

Our results provide empirical support for the need to address PUT incidents as occupational hazards for train drivers, putting them at risk for struggling with specific posttraumatic and more general health symptoms. However, we must take into account the limitations of the study, due to the retrospective methods of data collection and exclusively basing our findings on the train drivers' subjective reports.

Results also generate further research regarding optimal management strategies for PUT incidents. Empirical evidence of risk and resilience factors relevant for exposed train drivers is highly needed because of the frequency of PUT incidents and their traumatic potential. Identifying the individual and organisational factors that influence the posttraumatic reactions of train drivers will be essential to substantiate effective methods of primary and secondary prevention and intervention procedures when dealing with effects of PUT incidents. Our findings highlight that the frequency of traumatic exposure represents an essential factor that needs to be taken into consideration when identifying particular risk categories of train drivers. First experiences of PUT incidents seem to have more traumatic impact than repeated ones, establishing newly exposed train drivers as a main category of traumatic risk, and certifying tailored prevention and intervention strategies.

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