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**POSTTRAUMATIC STRESS IN TRAIN DRIVERS
INVOLVED IN RAILWAY ACCIDENTS**

PhD Dissertation

(Abstract)

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A scientific perspective regarding psychological effects of trauma starts with a description of the potential trigger events. Therefore, the reaction to trauma is studied in relation to the characteristics of the populations that were exposed to traumatic events.

Some professions, such as being a policeman, a fireman, and working in other emergency services, predispose to trauma due to the nature of the work (McFarlane & Bryant, 2007). The magnitude of the phenomenon is recognised in DSM V (2013) where it is stipulated that some occupational environments are at high risk in developing traumatic stress disorders.

The present research focuses on accidents on the railway, more specifically on their effects over mechanics. The phrase “person under train” circumscribes accidents on the railway, causing death or injury of a person who failed in front of the train, with or without intention (Theorell et al., 1992). Because it is a situation that cannot be avoided nor controlled by the train driver, it corresponds to standardised criteria for defining a traumatic event (according to DSM IV).

Under the influence of current emphasis on positive aspects of life and living, the perspective in studying psychological effects due to trauma, changed from focusing on psychopathology to focusing on adaptation, integration of the experience and psychological growing.

The necessity to investigate and address the traumatic impact of person under train accidents represents a priority for this occupational environment. Also, it is necessary to investigate possible adaptive reactions to trauma, for train drivers involved in person under train accidents.

Therefore, the first part of this chapter analyses the negative reaction to trauma, cognitive models regarding aetiology, predictors, specific symptoms and associated phenomena. In the second part, we focused on more adaptive reactions to trauma. The third part presents some diathesis- stress models, with applications in posttraumatic stress disorder. The models are utilized to differentiate between contextual and individual reactions to trauma.

The fourth part of the chapter analyses the incidence and the consequences of the trauma in the occupational environment, underlining its relevance and implications for train drivers.

I. Posttraumatic stress disorder. Evolution of the concept and actual diagnostic criteria, methods of investigation and explanatory models

The first conceptualization of the posttraumatic stress syndrome is associated with railway accidents, when train first started to be used in public transportation (Lamprecht & Sack, 2002). The development of the concept was then linked with a series of historical events starting with first and second world wars and continuing with the war in Vietnam. By the third edition of DSM (APA, 1980) and ICD-10 (OMS, 1992), PTSD was no more described as being an acute and temporary reaction of healthy people. The chronic character of symptoms and their persistence in time were considered criteria for diagnostic (Van der Kolk, 1996).

In the last three decades, epidemiological studies regarding posttraumatic stress disorder significantly increased in number (McFarlane, 2004; Weathers, Keane & Foa, 2009) and concluded that the exposure to trauma and psychological consequences became a serious health problem for the society. The findings pointed that in some professions, the prevalence is significantly higher compared to normal population. Regarding transportation departments, directions of research followed people involved in motor vehicle accidents, railway accidents, plane crashes, etc

The discrepancy between the number of persons exposed to trauma and the percentage of those that develop symptoms of psychopathology, underline the necessity to investigate the specific risk factors for different populations exposed to trauma.

Actual perspectives of PTSD in the classification system of mental disorders

The fourth edition of DSM (1994, 2000) was until recently the standard in the diagnostic of PTSD. APA recently published the fifth edition of DSM, in may 2013, with some important differences regarding PTSD.

First of all, the new edition presents a new category of disorders related to trauma and other stressors, which includes PTSD, formerly described as an anxiety disorder.

The evaluation of the diagnostic criteria A: exposure to trauma

Based on DSM IV, to meet these criteria, two distinctive components are necessary: a traumatic event and reactions of fear, helpless and horror. The new edition of DSM, no longer makes a distinction between the two dimensions. Regarding the type of exposure, A1 criteria specifies that the posttraumatic stress disorder can be developed also when the person witnesses an event without being directly involved. Also, the event should be a threat to the physical integrity of the person or should occur frequently.

Specific symptoms of PTSD

In DSM IV, the 17 symptoms are organised in three categories: re-experiencing the event, avoidance and hyperarousal (Weathers, Keane & Foa, 2009). DSM V describes two additional categories: negative cognitions and negative affect, such as feeling guilty, alienation, lack of interest for daily activities or the difficulty of remembering key details of the accident. Also, some changes are made in the content of the above criteria. For example, the criterion of physiological hyperactivity is replaced with characteristics such as aggressive reactions, neglect or self-sabotage.

DSM V does not differentiate between acute and chronic types of PTSD, based on the temporal criterion. Regarding the differential diagnostic, PTSD can be diagnosed only if the symptoms persist in time, for more than a month from the event. If the symptoms disappear in less than a month, the diagnostic is acute stress disorder. Also, if it is difficult to relate the symptomatology with a traumatic event, the diagnostic is adaptation disorder.

Regarding comorbidity, PTSD registers higher rates among persons diagnosed with depression (Campbell, Felker, Liu, Yano, Kirchner, Chan, Rubenstein & Chaney, 2006), substance use (Stewart, 1996; Rush, Coffey, Baschnagel, Drobles & Saladin, 2008) or anxiety disorders (Gizburg, Ein-Dor, Solomon, 2010).

Investigation methods in PTSD research

Conducting researches in occupational PTSD can be a challenge due to the subjective nature of the data, potential cumulative trauma, the necessity of controlling variables such as time elapsed since trauma and frequency of traumatic events, high comorbidity rates, the necessity of evaluating associated phenomenon and symptoms and the difficulty of detecting subclinical symptoms. In the present research, we followed the suggestions made by Creswell and Zhang (2009), of integrating qualitative and quantitative methods. Therefore, self-reported questionnaires were used along with in depth interviews and physiological indicators.

The purpose of the present research was not establishing an objective diagnose of PTSD in train drivers, but screening for specific symptoms in the population investigated.

Explanatory models of PTSD

Dalgleish (2004) proposes a classification of cognitive explanatory models using mental representation type of the information. First models used unique representation forms for conceptualizing the disorder, like cognitive schema, but later models combine more representation forms of the information, with the purpose of obtaining a complex image of the disorder and its effect on a cognitive, behavioral, affective and physiological level.

The most relevant contribution of the first theories regarding PTSD development is the conclusion that cognitive schemas suffer severe transformations due to the traumatic event. Schema models include Horowitz's reaction to stress theory (1986, cit. in Brewin & Holmes, 2003), or the theory of shattered assumptions (Janoff-Bulman, 1992, cit. in Dalgleish, 2004). The author presented for the first time the three principal assumptions questioned during a traumatic experience: benevolence, meaningful life and self-worth. Based on this model, after a traumatic encounter, the three beliefs suffer a transformation and favour the posttraumatic development (Brewin & Holmes, 2003).

Developing a model based on theories of information processing, Foa, Steketee and

Rothbaum (1989) stated that the difference between PTSD and other anxiety disorders is given by the fact that the traumatic event has a more powerful meaning and brakes the assumptions regarding personal safety. The theory developed lately into the theory of emotional information processing (Brewin & Holmes, 2003) and the integrated model of PTSD (Dalgleish, 2004). In their perspective, rigidity of anterior beliefs, and not the positive or negative beliefs determine the individual vulnerability. Other information processing models are based on series of models are based on classical conditioning (Jones & Barlow, 1990; Keane, Marshall & Taft, 2006).

Brewin, Dalgleish & Joseph (1996) postulated the dual representation theory with two parallel memory systems, that process in different ways the trauma related information (SAM and VAM). Because the information is encoded before reaching the conscious level, some memories of trauma are hard to be controlled and verbalized, and they determine PTSD symptoms.

Another model focused on multiple representations of the trauma is the persistence model (Ehlers & Clark, 2000). Based on this model, the pathological reaction develops when the person processes in a wrong way both the trauma related stimulus and the trauma consequences. The authors identified an impressive number of errors in reasoning, persons make when interpreting the trauma related information (the traumatic event, own reaction to trauma, symptoms, etc).

An integrative model that incorporates the relevant dimensions of previous theories is the Schematic, Propositional, Analogue and Associative (SPAARS) model (Dalgleish, 2004). Shortly, the schematic level concerns cognitive schemas. At this level, the persons evaluate and extract relevant information related to the event. The verbal representation of the experience is stored at the propositional level. The analogue system encodes the nonverbal sensory perceptive information. The information encoded at different levels is than interconnected.

In conclusion, for gaining a comprehensive view over the mechanisms involved, recent models underline the relevance of subjective evaluation and the construction of meaning in maintaining the symptomatology. The therapeutic progress is based on changes in life perspective and perceptions of the self (Dalgleish, 2004).

Models of posttraumatic adjustment

The human capacity to adapt to this phenomenon became a focus of more recent researches in this field. It is interesting that the more frequent reaction to adversity is not a pathological reaction, as we would intuitively expect, but an adaptive one and a relatively quick regain of the lost balance (Bonanno, 2004). Moreover, while being exposed to trauma, some persons transform the adverse experiences in unique opportunities for personal growth, registering positive changes after the confrontation with a traumatic event (Joseph & Linley, 2005).

Based on cognitive models, the differences in reacting to trauma and posttraumatic development are related to the subjective interpretation of the event and individual reactions to these interpretations, the adjustment process being mediated by cognition.

Essential in understanding the adjustment process are concepts of resilience and posttraumatic growth and development. Resilience represents the capacity of re-establishing the balance after the traumatic event. The probability of developing PTSD is rather low. Posttraumatic development represents the surpassing of the functional level prior to trauma. This is an intense process of meanings reconstruction and changes in general life perspective, following high levels of distress during the traumatic event.

One of the most comprehensive models that describe in detail both the process and the results of the confrontation with a threatening event is the model proposed by Tedeschi and Calhoun (2004). In their perspective, posttraumatic development is a construct with many dimensions: life appreciation, relations with significant others, personal power, values system, spiritual life appreciation, religion. The contribution of each dimension varies depending of the individual and sociocultural factors (Calhoun & Tedeschi, 2006). The posttraumatic development is dependent of the intensity of the event, only traumatic events of greater intensity may cause reason for subsequent growth. Joseph and Linley (2005) applied the organismic value theory in analysing the confrontation with the traumatic event, in order to integrate traditional theories of PTSD with those concerning posttraumatic development. The traumatic experience will produce initially an alteration of the inner balance, due to the conflict between personal assumptions regarding world and life meaning and the new information derived from the traumatic

experience. If the information is perceived as being congruent with previous personal convictions, then we can conclude that the experience has been assimilated. The assimilation represents a process of reinforcing previous life perspective, based on the denial or minimization of the trauma impact. Researches underline that the well-being based on assimilation is a fragile state due to an incomplete information processing and a lack of identifying contradictions within the personal beliefs system. The accommodation is the result of the superposing the conviction system prior to trauma over the new knowledge and has two directions: positive or negative (Payne, Joseph & Tudway, 2007). Therefore, the three possible results of the adaptation process are: assimilation, negative accommodation and positive accommodation.

The recognition of the benefits a person can extract from a traumatic experience is the most important contribution of the explanatory models of posttraumatic development.

Diathesis-stress models in posttraumatic adjustment

A practical way of conceptualising the relation between vulnerability and resilience in front of the trauma is offered by these models. They are relevant because they can explain different reactions in the confrontation with trauma and can predict the development of PTSD or the surpassing of the traumatic experience without psychological negative effects. The main assumption is that the presence of these diathesis is insufficient for starting the symptomatic manifestation specific to different mental disorders. The onset of the symptoms is linked with a triggering event, a stressful situation (Ingram & Price, 2002).

The persons with high vulnerability need low intensity stressors for developing different forms of psychopathology while the resilient persons develop psychopathology only after the confrontation with high intensity stressors. The models can be applied in explaining the aetiology of PTSD (Harvey & Yehuda, 1999; McKeever & Huff, 2003).

The traumatic incidence and trauma effects in transportation

The investigation of posttraumatic stress in relation to different professions generated the

concept development, distinguishing new subcategories such as secondary traumatic stress or vicariant stress. Extensive researches (Shalev & et al., 1998; Wastell, 2002; Crabbe et al., 2004; Gerke & Violanti, 2006) due to the high prevalence of PTSD in these professions sated the ground for the development of strategies of prevention through a rigorous selection of the personal (Shakespeare-Finch, 2007) and an early identification of employees with PTSD symptoms for applying psychological intervention and treatment measures (Tehrani, 2002).

Regarding the frequency of traumatic exposure, the most recent statistical data for European Union, published in a Eurostat report EU-27, realised by collecting data from 27 European countries, brings evidence that in 2011, 2685 railway accidents with 2325 deceases or severe injuries were reported. Based on the Eurostat report three out of the 27 European countries are responsible for almost half of the total number of victims. Romania is one of these three countries.

Researches regarding the effects of railway accidents over train drivers follow three directions, based on the severity of the accidents and the consequences over the involved persons (Chung, Werrett, Easthope, Farmer & Chung, 2002; Engelhart, van der Hout, Arntz & McNally, 2002). Some studies investigate the effects of train collisions while others focus on suicide on railway and methods of preventing these situations (Krysinska & De Leo, 2008). The third line of research focuses on how the railway employees are affected by different train accidents. Based on Lunt and Hartley (2004), there is a high prevalence of posttraumatic stress disorder among the train drivers involved in person under train accidents compared to any other type of accident on the railway. Researches from different countries show that the probability for train mechanics to be involved in a violent decease of a person is higher compared to the general population (Siol et al., 2003).

Based on the number of subjects involved and the methodology, the percentages vary, the lowest being 4% for the French population (Cothereau et al., 2004) and the highest being 17% (Tranah & Farmer, 1994).

Compared to other occupational environments with high risks of being exposed to trauma, such as military, fire workers, police, emergency services, train drivers are exposed to trauma in an atypical way. In a railway PUT incident, the train driver is usually an

involuntary witness (Lin & Gill, 2009; Lunt & Hartley, 2004). In most cases, the collision cannot be avoided. The specificity of the event is not associated with the competency of being a train driver. The lack of control over the train makes the difference between railway accidents and car accidents, where a driver has more options of avoiding a collision. Despite this, the illusion of control and the self-blame are present. In the context of lacking training for these type of events, an interpretation of the self-reaction as being inadequate can cause feelings of guilt when involved in a person under train accident (Siol et al., 2003; Cothureau et al., 2004).

Compared to other professions, train drivers experience the image of the person alive followed by the image of the injured or dead person. Also, the train driver is responsible to make the announcement of the accident and to drive the train safely to the destination. In most cases he is alone in the cabin. All these factors are potential predictors of trauma development and they influence the health and the working capacity (Vatshelle & Moen, 1997).

For some professional categories exposed to risk of trauma, the potential of being traumatized on the job is set as an explicit expectation regarding their job, and may be associated with professional benefits, by contributing to promotions or better recompensation, within the organization.

Posttraumatic symptoms are regularly associated with health problems, workplace avoidance, and higher medical leave, and in some extreme cases it may induce leaving the workforce for good.

Chapter 2. Motivation and Objectives

2.1. Motivation

Motivation for present research has emerged from the practical need of assessment of traumatic incidents' impact on train drivers.

Empirical studies presented above show that one of the main sources of psychological distress faced by railway personnel is represented by incidents resulting persons hit by a train. The most affected are train drivers, because they are involuntary witnesses of violent, uncontrollable and unavoidable accidents. Subsequently train drivers can develop PTSD symptoms. The impact has often extremely violent effects, the person in front of the locomotive being dismantled and disfigured after the collision, in the sight of the driver. As agents on the locomotive train drivers may blame themselves for collision with persons or vehicles on the line (Cothereau et al., 2004), although the possibilities of changing the outcome of these extreme situations are usually very limited for technical reasons independent of driver's action.

2.2. Thesis objectives

Analysis of cognitive models of posttraumatic adaptation provided theoretical and empirical foundation for the development of the conceptual framework of the current research .

Particular context of trauma that we investigate is represented by PUT incidents and the overall objective of the thesis is to investigate posttraumatic reactions of train drivers exposed to these incidents.

The research objectives were generated on the basis of the raised practical problem, previous studies in the field and selecting research directions that must be addressed.

Previous research on exposure to incidents of train drivers highlighted variability in their response to PUT incidents (Pinarowicz, 2012) and emphasised the influence of cultural factors on how to integrate the traumatic experience (Lunt & Hartley, 2004). We considered the necessity to investigate the relationship between PUT incidents and symptoms of posttraumatic stress for Romanian train drivers, in order to provide empirical support for the traumatic impact of these accidents. Accordingly, our first study aims to evaluate the impact of traumatic incidents PUT in a sample of Romanian drivers, highlighting the direct relationship between aversive stimulus (PUT incident) with posttraumatic stress symptoms and the role of circumstantial factors found in previous research as predictors of posttraumatic distress in predicting distress. It is important to stress that the research aimed to explore the main symptoms associated with PTSD in

developed because of these specific incidents. We did not want to diagnose participants with PTSD, but to see if these incidents represent a potential traumatic threat, by assessing dimensional severity of PTSD symptoms, without claiming to diagnose PTSD. As a result, participants in the study cannot be considered clinical samples and the results can not be generalized to clinical cases.

A further problem highlighted in the analysis of literature devoted to PUT incidents was the almost exclusive focus of previous studies on the identification of circumstantial risk factors (frequency, severity of incidents recently particularities), at most investigating individual pretraumatic dispositional factors (traumatic history, certain personality characteristics) as predictors of posttraumatic stress symptoms within the investigated population. Given that not all train drivers exposed to PUT incidents have shown to be affected by these incidents, we considered necessary to identify individual proximal factors as potential predictors of posttraumatic stress symptoms. Based on theoretical models and previous research, especially with motor vehicle accident survivors, we identified peritraumatic distress intensity as one potential predictor of subsequent development of PTSD symptoms.(Brunet et al., 2001 Bern et al., 2012; Thomas, Saumier & Brown, 2012).

In line with cognitive models of development and persistence of PTSD symptoms the development of posttraumatic specific maladaptive cognitions about self, world and self-blame, mediate the relationship between acute stress response and persistence of PTSD symptoms (Foa & Rothbaum , 1998; Foa, Ehlers, Clark, Tolin & Orsillo, 1999, Beck et al. 2004 Bryant & Guthrie, 2005; Startup Makgekgenene & Webster, 2007).

Therefore, Study 2's objective was to evaluate the cognitive and emotional correlates associated with the development of posttraumatic stress symptoms (PTSD) in train drivers involved in PUT incidents, aiming to highlight the mediating role of maladaptive cognitions in maintenance of traumatic emotional distress associated with trauma and persistent symptoms of PTSD.

In correspondence with the contemporary trend in psychotraumatology studies, that encourages research to address multilevel response to trauma, we also identified the lack of empirical data in the literature outlining other changes associated with trauma, such as posttraumatic growth. Investigating the phenomenon of growth after trauma and the relationship between it and posttraumatic stress symptoms as a result of involvement in

PUT accidents, was the specific objective in study 3. The study also proposed investigating specific cognitive mechanisms of processing trauma that proved to be predictors of posttraumatic development in previous studies on different types of traumatised persons (Williams, Davis & Millsap, 2002 Phelps, Williams, Raichle, Ehde & Turner, 2008; Gangstad, Norman & Barton, 2009).

In Study 4 we sought to explore, by the means of qualitative methodology the subjective experience of train drivers regarding PUT incidents, while pursuing deeper cognitive processing mechanisms they apply to accommodate the reality of these incidents.

Repeated exposure to PUT incidents is a high probability for train drivers. In consequence, in the absence of data documenting the effects of anterior exposure on train drivers' acute stress reaction to new traumatic stimuli, we adapted an experimental procedure used to investigate how train drivers react to simulated PUT incidents. The study objective was to assess the impact of previous exposure to incidents on acute stress reaction of train drivers to a simulated PUT incident. The simulated incident and experimental task allowed continuous assessment of cardiac reactivity and related subjective distress, following procedures previously used in a study on the impact of traumatic critical incidents on police officers (Regehr et al., 2007).

Chapter III. Traumatic impact of PUT incidents on exposed train drivers

Psychological studies have documented the traumatic impact that this type of accident may have on railway personnel (Lunt & Hartley, 2004). 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 (Siol et al., 2003).

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 for psychological trauma (Siol et al., 2003).

According to the last revised edition of DSM-IV (APA, 2000), 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*).

In exposed train drivers, PTSD symptom prevalence is not very high, but its presence is constant across studies (Lunt & Hartley, 2004), stressing the need to manage this occupational hazard.

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 (Cothereau et al., 2004; Yum et al., 2006). 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.

2. Objectives:

The overall objective of our study was to assess the traumatic impact of PUT incidents on train drivers, by evaluating specific PTSD symptoms associated with PUT incidents, general mental health symptoms and specific contextual factors that may influence the traumatic outcome of these experiences.

3. Methods:

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 National 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. Questionnaires and informed consents were completed individually.

3.1. Participants:

The final sample consisted of 193 train drivers (mean age = 38.42, SD= 9.64).

3.2. 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 relation to that one.

2. Impact of Events Scale-Revised-IES-R (Weiss & Marmar, 1996). Internal consistency for IES-R in the present sample was adequate (Alpha Cronbach = 0.75). IES-R 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 (Goldberg & Hilier, 1997). GHQ-28 is a measure of mental health screening, with four subscales: severe depression, anxiety and sleep disturbance, somatic symptoms and social dysfunctions.

4. Results:

4.1. 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. As for time since the last PUT incident, the mean number of years reported from the last event was $m = 3$, $S.D. = 3.67$.

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 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 fourth category (49 respondents- 25.4%) consisted of train drivers with a high frequency of reported PUT incidents (6 incidents or more).

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, 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 (Creamer et al., 2003), 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.

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. The accidents happened during the day (57%). Most of them (90 %) involved at least an 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%).

None of these factors did not significantly differentiate between train drivers with PTSD symptoms below or above the average.

Correlation analysis also provided information that age and professional experience, and time elapsed since incident are not significantly associated with intensity of symptoms. The only significant association we found was that of frequency of repeated incidents and PTSD symptoms ($r = -0,21$, $p = 0,05$).

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 1.

Table 1. Differences in reported symptoms between differently exposed train drivers

Frequency of exposure	1-2 PUT incidents	3-5 PUT incidents	< 5 PUT incidents	F	p
N	38	65	49		
IES-R total	M = 20.73 A.S. = 8.86	M = 16.01 A.S.=10.30	M = 14.16 A.S.= 9.40	5.14	0.002
Intrusions	M = 6.52 A.S. = 3.26	M = 5.29 A.S.=4.22	M = 4.38 A.S.= 3.61	3.37	0.03
Avoidance	M = 9.23 A.S. = 4.24	M = 7.00 A.S.=4.63	M = 6.32 A.S.= 4.02	5.13	0.002
Hiperarousal	M = 4.97 A.S. = 3.16	M = 3.72 A.S.=2.88	M = 3.44 A.S.=2.71	3.28	0.04
GHQ total	M =11.92 A.S. = 3.52	M = 12.72 A.S.=4.17	M = 12.93 A.S.= 3.20	0.86	0.42

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. The three separate clusters of symptoms show similar results. 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. 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. As can be seen in Table 1, there were no statistically significant differences between general symptoms reported by the three categories of respondents ($F(2,149) = 0.86$, $p = 0.42$).

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 (Lunt & Hartley, 2004).

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, such that higher frequency of exposure was associated with lower levels of posttraumatic stress symptoms. A similar result is presented in a Korean study, Yum et al., 2006).

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. The higher risk category was that of train drivers that were at their first traumatic

experiences, with results suggesting habituation effects over time. It would be useful to evaluate how immunization takes place and influencing factors.

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.

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 symptom development.

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, in considering further developments of these research, 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 generate further research regarding optimal management strategies for PUT incidents.

Our findings highlight that frequency of traumatic exposure represents an essential factor that needs to be taken into consideration when identifying particular risk categories of train drivers.

Chapter IV. Cognitive and emotional correlates of PTSD symptoms in train drivers exposed to PUT incidents

Traumatic exposure is necessary, but not enough for developing PTSD. In consequence, researchers have directed their efforts to identifying the most influential risk

factors that predict specific symptom development. Metaanalysis of Ozer et al. (2003) and Brewin et al. (2000) highlight the importance of traumatic event particularities, as well as individual characteristics that may put the person at risk of being traumatised. In light of recent findings, instead of dealing with isolated risk factors, there is a need to see how these factors interact influencing the person's reaction to trauma and the experience of subsequent symptoms. Thus, trauma researchers' current recommendations strongly suggest the need to identify risk pathways or mechanisms, underlying their relationship to outcome variables (Kallay, 2011).

Studies investigating traumatic impact of PUT incidents support the need to evaluate the role of individual differences in the development and maintenance of PTSD symptoms in train drivers involved in PUT incidents (Lunt & Hartley, 2004).

Current perspective on the development and persistence of PTSD symptoms emphasizes the role of cognitive appraisal of the traumatic experience as a fundamental mediator in the posttraumatic adaptation process (11). Cognitive models of PTSD (Ehlers & Clark, 2000; Dalgleish, 2004) assert that dealing with trauma produces alterations in the generic cognitive schemas about the world, self and others. Exposed persons' perspective and belief system is being affected by the traumatic event, so that the world is perceived to be unsafe and threatening, and the self is seen as lacking the resources and skills needed to cope with the adverse environment.

Cognitive distortions about the world and the self proved to be strong predictors of PTSD diagnosis, as they can discriminate between all trauma exposed individuals, those that developed clinically significant symptoms (Foa, Ehlers, Clark, Tolin & Orsillo, 1999; Beck, et al., 2004)). Studies in samples with various types of trauma provide strong

empirical support for the relationship between the altered beliefs about the self and the world and the frequency and severity of posttraumatic symptoms (Foa et al., 1999; Cieslak, Benight & Lehman, 2008; Beck et al., 2004; Startup, Makgekgenene & Webster, 2007).

According to a french study(Cothereau et al., 2004), the traumatic potential of these incidents is mainly determined by the fact that the train driver may feel responsible for the death of the victims.

Another relevant risk factor for the development and persistence of PTSD symptoms, is peritraumatic emotional reactivity (Ozer et al., 2003).

Differences in peritraumatic emotional intensity may be of relevance for the subsequent development of PTSD symptoms in these professionals, as a particularity of trauma related to accidents. Studies provide empirical support for the relationship between increased intensity of emotional reaction during traumatic confrontation with motor vehicle accidents and subsequent PTSD symptoms (Bernat, Ronfeldt, Calhoun & Arias, 1998; Brewin, Andrews & Rose, 2000; Simeon, Greenberg, Knutelska, Schmeidler & Hollander, 2003; Birmes et al., 2005; Daisuke et al., 2010).

2.Objectives:

The present study aims to investigate differences in appraisal and emotional reactivity to PUT incidents between train drivers that report PTSD symptoms and those who do not report being affected by these incidents. Also, we want to investigate the way that cognitive interpretation and emotional reaction to PUT incidents combine in predicting subsequent distress in exposed train drivers. Also, we hypothesize that posttraumatic cognitions mediate the relationship between intensity of peritraumatic emotional reaction to PUT incidents and subsequent PTSD symptoms.

3. Metodology:

3.1.Procedure

Selection of participants was done on a voluntary basis. Of the 176 initially approached train drivers, 12 refused to participate, and 35 declared they never had an PUT incident. Questionnaires and an informed consent were completed individually, during three professional training meetings.

3.2.Participants

129 drivers (mean age = 37.8, SD= 8.19) belonging to locomotive depots in Cluj, Dej, Bistrita and Brasov were included in the final sample. The average frequency of PUT incidents throughout train driver's career was 3.43 (SD= 2.86).

3.3.Instruments

1. *Impact of Events Scale-Revised* -IES-R (Weiss &Marmar, 1996) has been used to identify the specific symptoms of PTSD in relation to a specific traumatic even

2. *Posttraumatic cognitions inventory* (PTCI) was developed by Foa, et al.(1999) to assess cognitive distortions that dealing with trauma may produce. Subscales of negative cognitions about the self and the world prove relevant predictors of the onset and maintenance of PTSD symptoms.

3. *Peritraumatic distress inventory*-PDI (Brunet et al., 2001) is a useful tool in investigating emotional reactivity to trauma. The instrument has adequate psychometric qualities and is an effective method for assessing the diagnostic criterion A2 for PTSD.

4. *Demographic questionnaire* regarding personal information (age, tenure, marital status, etc.), number of PUT incidents, details of the most significant incident.

4. Results :

4.1. Evaluation of differences between train drivers that reported PTSD symptoms and those without symptoms

Testing the first hypothesis required dividing the sample into three categories. The first category consisted of those who reported no psychological distress as a consequence of PUT experiences. 13 participants were included in this category, reporting complete absence of PTSD symptoms, although they were exposed to PUT incidents. We followed current recommendations (28) and used the cut-off value of 33 (of max. 88, on the global IES-R scale) to differentiate train drivers who report clinically significant PTSD symptoms. 16 of the participants had scores above 33, corresponding to a clinical level of PTSD symptoms' intensity. The third group (N = 100) consisted of the majority of train drivers involved in the study, who reported low levels of PTSD symptoms.

Results comparing means of the two groups (no exposure versus high PTSD symptoms) are depicted in Table 2, for each type of cognition separately, for the global cognition scale, as for the peritraumatic distress intensity.

Table 2. Differences in posttraumatic cognitions and peritraumatic distress between symptom free train drivers and the group that reported significant PTSD symptom levels

	Symptom free group N=13	Significant symptoms group N= 16	T , df, p
Self posttraumatic cognitions	17.92 1.32	30.40 10.97	- 4.52 15.53 p= 0.00
World posttraumatic cognitions	11.23 4.67	17 4.83	- 3.24 27 p= 0.00
Self-blame	8.46 3.71	15.56 5.66	- 3.88 27 p= 0.00
Global posttraumatic cognitions	37.61 5.97	63 17	- 5.56 19.35 p=0.00
Peritraumatic intensity of distress	11.61 1.12	15.26 3.21	-3.67, 27, p=0.00

Differences between groups confirm that, unlike train drivers that did not report symptoms of PTSD, more affected train drivers make negative interpretations of self and world and also make internal attributions of responsibility for the incidents. In terms of reported peritraumatic emotional reaction, the average reactivity reported by train drivers in the group without PTSD symptoms ($m = 11.61$, $S.D. = 1.12$) was significantly lower than that of the group with symptoms of PTSD ($m = 15.06$, $S.D. = 3.21$). Greater peritraumatic intensity of distress was reported by train drivers that also report more frequent PTSD symptoms ($t = -3.67$, $df = 27$, $p = 0.00$).

4.2. Assessment of the relationship between risk factors and reported PTSD symptoms

In line with findings from other studies, current findings support the positive association of posttraumatic cognitions about the self ($r = 0.45$, $p = 0.01$) and the world ($r = 0.27$, $p = 0.01$) and reported PTSD symptoms. The more negative the individual views the self and the world, the higher the level of posttraumatic symptoms he reports. Perception of self as incompetent, or lacking ability to cope with trauma may be a relevant predictor of persistence of PTSD symptoms for train drivers involved in PUT incidents.

Also self-blaming cognitions were significantly positively associated with PTSD symptoms ($r = 0.38$, $p = 0.01$). If the train driver considers himself blameworthy for causing the incident, the level of PTSD symptoms he reports will be greater. Relationship with this risk factor is particularly relevant because the context of PUT incidents leaves room for negative interpretation on the adequacy of their behavioral reaction in the situation and may cause the train driver to hold himself responsible for the accident.

Peritraumatic distress intensity was also significantly positively correlated with the presence of posttraumatic stress symptoms ($r = 0.41, p = 0.01$). If the intensity of peritraumatic emotional distress was reported to be high, subsequent reported levels of PTSD symptoms were also higher.

To see if we can predict on the basis of these correlates, variance in PTSD symptoms, we used hierarchical regression analysis. When controlling demographic variables, both posttraumatic cognitions and intensity of peritraumatic distress were found to be significant predictors of the criterion variable, the symptoms of PTSD. The model explains 43% of variance in PTSD symptoms.

4.3. Mediation analysis

According to current criteria for mediation analysis (Baron & Kenny, 1986), we checked if posttraumatic cognitions satisfy necessary conditions as mediator of the relationship between emotional peritraumatic reaction and PTSD symptoms. Results showed that preconditions were satisfied only for self-blame as the mediator variable (figure 1), because this was the only posttraumatic cognition that significantly correlated to both outcome (PTSD symptoms) and predictor (peritraumatic emotional intensity).

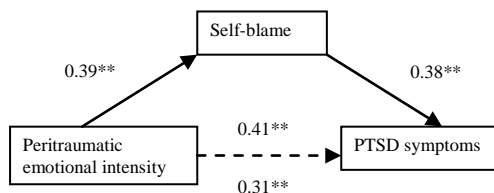


Figure. 1. Mediation diagram for peritraumatic emotional intensity as predictor of PTSD symptoms with self-blame as mediator

All regression beta coefficients were significant. Adding self-blame to the equation significantly decreased the amount of variance in PTSD symptoms explained by

peritraumatic emotional intensity. The Sobel test used to test the indirect effect for this mediation was found to be significant, 1.80 ($p < 0.03$). According to results, self-blame acts as a significant partial mediator on the relationship between peritraumatic emotional intensity and PTSD symptoms.

5. Conclusions and discussion

5.1. Negative cognitions about the self, world, and self-blame

Results of the present study confirm the hypothesis derived from cognitive models of PTSD, for train drivers exposed to trauma. It is interesting that in the current study, negative cognitions about self, world, and self-blame are factors that significantly differentiate train drivers with clinical symptoms of posttraumatic stress from those that did not exhibit such symptoms. According to Ehlers & Clark's cognitive model of PTSD persistence, posttraumatic symptoms are prevalent when appraising trauma experiences causes a sense of serious current threat and the perception that the individual does not have the ability to surpass the consequences of extreme stressors.

It is possible that exposure to PUT incidents may determine train drivers to perceive they lack necessary resources to cope with these recurrent traumatic events, which, according to theoretical and empirically supported perspectives, predicts persistent symptoms of PTSD. Results are congruent with other studies that involved on the job risk for trauma. For example, negative beliefs about oneself was found to be a relevant prospective predictor for the development and maintenance of posttraumatic symptoms in firefighters (Bryant & Guthrie, 2005).

Particularly for train drivers exposed to PUT incidents, internal attribution of responsibility or feeling guilty after the traumatic encounter, seems to be associated with later posttraumatic distress. Because they are the agents that drive the locomotive, train

drivers have a higher probability to consider themselves blameworthy for the accidents and responsible for fatalities. This particularity is congruent with anterior research on train drivers, highlighting the need to offer information about trauma and posttraumatic symptoms and construct behavioral protocols for these specific contexts (Cothereau et al.,2004).

Present findings on negative cognitions developed by train drivers, also have a pragmatic impact, as they can be modified through cognitive therapy, ensuring positive posttraumatic outcomes.

5.2. Intensity of peritraumatic distress

We found that peritraumatic distress intensity is significantly lower for train drivers that didn't report symptoms of PTSD, and a significant correlate of PTSD symptom levels. However, this result must be interpreted keeping in mind that present data are retrospective self-reports and that we couldn't control the effects of inaccurate memory over time.

A surprising result was the significant association of peritraumatic distress with self-blame. The more train drivers reported feeling responsible for the incidents, the stronger was the intensity of their peritraumatic reaction. Using mediation analysis, we found self-blame to partially mediate the relationship of peritraumatic distress and PTSD symptoms. This result is congruent with current research in PTSD risk factors in stressing that synergistic response to trauma is determined as a cumulative action of variables.

5.3. Concluding remarks

In interpreting the results we should consider some limitations of the current research: using relative cutoff values to discriminate the train drivers that report more severe PTSD symptoms, cross-sectional design and use of retrospective self-report data.

Although it is a first study regarding the relations between studies variables, our results contribute to understanding the development of posttraumatic stress symptoms for train drivers exposed to trauma in their professional environment. Findings support the need for replication studies. Also, they highlight the need to include individual risk factors, in particular posttraumatic cognitions and peritraumatic distress, as relevant to prevention and intervention programs tailored for train drivers exposed to PUT incidents.

Chapter V. Posttraumatic development associated with PUT incidents

Studies highlight that most of the exposed train drivers adjust without difficulties to PUT incidents (Lunt & Hartley, 2004). For example, in a sample of French train drivers, Cothureau et al. (2004), found that initial traumatic symptoms tend to fade within 1 year after the incident and that the occupational future of the train drivers will not be altered. This result is consistent with current theoretical models and empirical findings in the field of posttraumatic research, that highlight the human capacity to adapt after traumatic confrontations (Bonanno, Brewin, Kaniasty & La Greca, 2010). According to current theories, after confrontation with a life-changing event, trauma reactions should be viewed as ranging along a continuum of adaptation (Joseph, Williams & Yule, 1997). Pathological reactions like PTSD are dysfunctions that set in, only when efforts of adaptation are not efficient, but most people manage to recover quickly and without reporting much change after a traumatic encounter (Bonanno et al., 2010). Studies also indicate that there are persons who surpass their pre-traumatic levels of functioning, due to the traumatic confrontation (Tedeschi & Calhoun, 2004; Joseph & Linley, 2005). For those, coping with trauma may have a transformational function, allowing them to learn from the traumatic experiences and evolve. Some of them report a change in priorities and in appreciating life or personal relationships, others report they are finding out new possibilities for themselves, or discover unknown personal strength. This type of reported thriving after a traumatic

experience has been labeled posttraumatic growth (Tedeschi & Calhoun, 2004) and involves a shift in how individuals view themselves, their priorities and interactions with others.

Considering the relationship between PTG and reported symptoms of posttraumatic psychopathology, studies have shown mixed results. Although posttraumatic development is related to a positive posttraumatic adjustment and lower distress levels in some studies (Park & Fenster, 2004; Carver & Antoni, 2004), others do not support this relationship. For example, Tomich and Helgeson (2004) and Butler, Blasey, Garland, et al. (2005) provide empirical evidence that growth after adversity is associated with more traumatic distress symptoms and poorer quality of life. There are also studies that didn't find any significant associations between posttraumatic development and subsequent adaptation patterns (Cordova, Cunningham, Carlson & Andrykowski, 2001; Grubaugh & Resick, 2007).

A plausible explanation for these mixed results lies in the different methodological approaches and use of different instruments for assessing posttraumatic growth (Zoellner & Maercker, 2006). Another explanation of this relationship is that, although experiencing severe traumatic distress is directly related to some factors of PTG (new possibilities, appreciation of life), fostering growth in these specific domains, other factors are more likely resilience enhancing factors (personal strength) and will be negatively associated with symptoms of PTSD. This explanation is congruent with Janoff-Bulman's model of psychological preparedness. There are in fact some studies that provide empirical evidence in survivors of motor vehicle accidents (Zoellner, Rabe, Karl, & Maercker, 2008; Nishi, Matsuoka, & Kim, 2010), relating some PTG factors to PTSD and other growth specific factors to resilience, and absence of symptoms. A third possible explanation is that the two constructs may not be associated in a linear way. Recent studies found that the relationship between posttraumatic growth and traumatic distress is curvilinear (Lechner, Antoni, & Carver, 2006; Kleim, & Ehlers, 2009; Nuttman-Shwartz, Dekel, & Tuval-Mashiach, 2011). These studies provide empirical evidence that immediately after trauma, PTSD and PTG often coexist, but, as time progresses, their relationship loses its power, and ultimately the two become opposite constructs, once the person develops a more coherent perspective of what has happened. When time has elapsed since the traumatic encounter, people tend to exhibit either chronic PTSD associated with low PTG reports or they report high PTG

associated with low symptom levels of PTSD. These data support the three stages model of processing proposed by Joseph & Linley (2005).

The cognitive models of coping with trauma suggest that successful adaptation, absence of psychopathology and growth are essentially achieved through cognitive processes, such as altering one's basic assumptions or core beliefs to better accommodate the traumatic experience (Janoff-Bulman, 1989), or seeking beneficial aspects of the experience (Tedeschi & Calhoun, 2004). Cognitive processing strategies like acceptance or positive reappraisal have demonstrated their efficiency in adaptation to different types of traumatic events (Gangstad, Norman, & Barton, 2009; Phelps, Williams, Raichle, Turner & Ehde, 2008; Williams, Davis & Millsap, 2002), being associated with low reports of PTSD symptoms and also growth reports. Studies highlight that positive reinterpretation and acceptance are essential contributors to long-term adjustment, particularly in situations not amenable to active, problem-focused coping, when stressors are unchangeable and require accommodation (Updegraff & Taylor, 2000). By allowing individuals to accept a situation and focus on its positive implications, however scarce, these coping strategies may determine people's beliefs that they have benefited from a stressful life event, or a traumatic encounter (Carver, Sheier, & Weintraub, 1989).

Objectives:

The aim of our study was to assess growth reports related to PUT experiences in train drivers, and their relationship with post-traumatic symptoms and cognitive processing strategies used to deal with trauma. We hypothesize that posttraumatic growth will be related to PTSD symptom reports. We also wanted to explore which specific cognitive processing strategies are significant predictors of growth, facilitating optimal adaptation after this type of a traumatic encounter.

Procedure

Train drivers completed informed consent forms and questionnaires, in groups of 10 to 20 train drivers, during their monthly training activities. The procedure took about 30 minutes, with each group. We used SPSS software to analyze the collected data.

Participants

The study involved 126 train drivers, all men, with an average age $M = 40$ years ($SD = 8.77$).

Instruments

Posttraumatic symptoms were assessed using the Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1996). The global scale has 22 items and is formed of three subscales, corresponding to the three clusters of PTSD specific symptoms: reexperiencing traumatic events, avoidance and hyperarousal.

The Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996), is a 21-item self-report questionnaire that was used to assess growth in five different domains: (1) Relating to others; (2) New possibilities; (3) Personal Strength; (4) Spiritual Change and (5) Appreciation of Life.

The Cognitive Processing of Trauma Questionnaire (CPOTS; Williams, Davies & Millsap, 2002) was used to assess five different cognitive coping mechanisms that were shown to be frequently used in dealing with trauma: acceptance/resolution, positive reinterpretation, downward social comparison, regret, denial.

Demographic data and accident details were collected using another self-report questionnaire.

RESULTS

Rates of posttraumatic growth and PTSD symptoms following PUT incidents

All train drivers in the present sample reported being exposed to at least one PUT incident. Consistent with the tenets of present trauma research literature, train drivers also reported some levels of posttraumatic growth. Posttraumatic growth scores were generally moderate, with a mean PTGI score of $M = 35.15$ ($SD = 6.84$). The highest scores were found for improved relations with others ($M = 9.78$, $SD = 2.66$), increased appreciation for life ($M = 7.45$, $SD = 3.13$) and new found personal strength ($M = 7.26$, $SD = 1.73$). Lower scores were reported for finding new opportunities ($M = 6.49$, $SD = 1.57$) and changes in spirituality ($M = 4.15$, $SD = 1.95$).

Results show that PTG reports and PTSD symptoms are negatively correlated in our sample of train drivers exposed to PUT accidents ($r = -0.42$; $p < 0.01$).

Correlates of posttraumatic growth

In regard to cognitive processing strategies, we found that resolution/acceptance ($r = 0.48, p < 0.01$) and positive reframing ($r = 0.27, p < 0.01$) were significantly positively associated to PTG reports, so that higher levels of PTG were associated with more acceptance and positive reinterpreting of traumatic encounters. The two significant relationships are consistent with previous findings.

Predictors of PTG reports

We used hierarchical multiple regression to identify the contribution of the cognitive processing strategies to the prediction of posttraumatic growth, while controlling for PTSD symptom severity and demographic and exposure variables.

Results (Table 3) highlight that, among specific strategies used to process trauma, acceptance was the only significant contributor to the variance of posttraumatic growth, while controlling for PTSD symptoms, with the final model accounting for 36% of the variance in PTG reports.

Table 3. Hierarchical regression analysis for predicting PTG reports

		Model I		Model II		Model III		R ²	Δ R ²
		β	B(SE)	β	B(SE)	β	B(SE)		
Step 1.	Control variables								
	Age	-0.07	-0.05(0.09)	-0.07	-0.06(0.09)	-0.03	-0.02(0.09)		
	Professional experience	-0.08	-0.08(0.12)	-0.13	-0.13(0.11)	-0.09	-0.09(0.10)		
	Frequency of put incidents	0.21*	0.60(0.30)	0.14	0.40(0.28)	0.04	0.11 (0.27)		
	Time elapsed since incident	-0.08	-0.20(0.25)	-0.05	-0.13(0.22)	-0.05	-0.13(0.21)	0.04	
Step 2.	PTSD symptoms			-0.43***	-0.28(0.06)	-0.20*	-0.13(0.64)	0.21	0.17**
Step 3.	Denial					0.02	0.04(0.13)	0.33	0.12**
	Regret					0.10	0.15(0.12)		
	Downward social comparison					-0.13	-0.22(0.15)		
	Positive reframing					0.12	0.19(0.14)		
	Acceptance					0.39**	0.48(0.12)		

* $p < 0.05$ ** $p < 0.01$, *** $p < 0.001$

Discussion and Conclusions

Faced with PUT incidents because of their work, train drivers are exposed to a traumatic context that elicits both PTSD symptoms and PTG reports. Findings should be interpreted while considering methodological limitations mainly due to the use of retrospectively assessed, self-reported data with a cross-sectional design. However, we can say, that based on present findings, train drivers do experience posttraumatic growth after confrontation with PUT incidents.

Investigating PTG reports in train drivers involved in PUT incidents is rare. Our results provide empirical evidence that train drivers may report levels of moderate growth related to their traumatic on the job experiences, this being consistent with results presented by Pinarowicz (2012). When compared to growth reports from studies on medical conditions (Phelps et al., 2008) or studies on motor vehicle accident survivors (Zoellner, Rabe, Karl, & Maercker, 2008; Nishi, Matsuoka, & Kim, 2010) our data show relatively low levels of growth.

We found the relationship between PTSD symptoms and PTG reports to be significant, negative and linear. This result contradicts findings from another study involving train employees exposed to work related trauma (Pinarowicz, 2012) that found a positive linear relationship between the two. In fact, the relationship of posttraumatic growth with mental health in the aftermath of a traumatic confrontation is a complex and dynamic one, as they may influence each other, or they may evolve independently, possibly at different rates (Kleim & Ehlers, 2009). Our results provide evidence that posttraumatic growth may be proof of reducing difficulties of adjustment after traumatic encounters, by being significantly associated with less posttraumatic distress. Respondents that reported higher levels of PTSD symptoms, exhibited less growth, whereas those that reported more growth complained about fewer symptoms.

Current findings show that adaptive strategies for cognitive processing, are helpful in confrontation with uncontrollable traumatic contexts, being negatively associated with PTSD symptoms and at the same time positively related to posttraumatic growth. Research on the correlates of PTG is consistent with this position, as cognitive processing of the event is related to PTG (Helgeson et al., 2006; Linley & Joseph, 2004).

Acceptance/resolution is the essential strategy, associated with reduced PTSD symptoms and engendering posttraumatic growth after PUT incidents. The fact that we found acceptance to have a stronger effect on the relationship between PTSD symptoms and PTG reports even stronger than positive reframing, may be particular to this type of trauma, that makes positive reframing more difficult to use as an efficient cognitive strategy when dealing with trauma. Results should be tested in samples exposed to different kinds of traumatic encounters using longitudinal designs.

In order to analyze in depth the way drivers apply these cognitive mechanisms in adapting to incidents, we performed a qualitative analysis on the subjective experience of trauma after PUT incidents detailed in Study 4.

Study 4. Exploring the subjective experience of PUT incidents in train drivers

The qualitative study provides insight into the subjective experience of train drivers involved in PUT accidents by exploring their perception regarding the traumatic impact of PUT incidents and subsequent adaptation.

Methodology

Data collection procedure:

The 12 semi-structured interviews have been conducted at different dates and have lasted 50-60 minutes on average. The data was recorded in an audio format and fully transcribed afterwards.

Participants:

The selection of participants for the interview was conditioned by the presence of a traumatic stressor and the convenience criterion (Băban, 2002). The 12 participants were selected according to the number of “person under train” incidents in which they were involved. The group included train drivers with a higher exposure frequency to PUT incidents (minimum 4, maximum 8) and with a solid professional experience (15-26 years in the field).

From the perspective of socio-professional experience, the group is homogenous. All participants have graduated from high school and have completed the mandatory studies for practicing the afore-mentioned profession. All have a similar socio-economic

status; 10 of them are married, one is divorced and remarried, one is a unmarried and the majority have families with 1 or 2 children.

All selected train drivers have agreed to be included in the research, have signed informed consent forms and have been assured they can withdraw from the study at any time. It has also been underlined that the participants' involvement in the ongoing study is independent of the result of periodical psychological assessment which were performed by a different psychologist.

Data analysis procedure:

The interview transcripts have been subjected to thematic analysis (Braun & Clarke, 2006). The scope of the thematic analysis was to identify common contents, as well as diverging elements and to capture the relationships between the pinpointed themes through a deductive analysis based on specific PTSD symptoms described in DSM IV. Concomitantly, an inductive approach aimed to highlight post-traumatic adaptation reactions and cognitive mechanisms employed to facilitate surpassing traumatic incidents.

In accordance with the previously mentioned research, the interviews revolved around the following aspects: what a PUT incident represents for the train driver, the ensuing professional and personal ramifications, the intensity and evolution of the psychological reaction to a PUT incident, the factors that triggered an intensified reaction and protective factors. Moreover, increased attention was directed towards detailing the adaptation mechanisms employed to surpass vulnerable moments following such incidents.

Results

The data analysis procedure was conducted in an ideographical manner. Each interview was analyzed separately, while the themes were identified and grouped into categories according to intra-individual saturation and importance. Confrontation analysis was then applied to highlight the points of convergence and particularities. It has been determined that PUT incidents exert highly variable emotional impacts on train drivers and that the dynamics of symptom persistence also differs. The participants unanimously believe that even though PUT incidents can be labeled as extreme life experiences, their traumatic potential is lower compared to other potentially distressing scenarios.

All categories of PTSD specific symptoms have a high incidence in the train drivers' descriptions. Intrusive thoughts appear frequently, but do not have the "here and

now” peculiarity specific to post-traumatic intrusions (flashbacks) of experimentation outside the temporal frame of distress triggers. For example, one participant reports that *“they weigh on your conscience...even though you understand it’s not your fault and maybe you put them out of their misery, you keep thinking you killed someone...I don’t think many people are at peace with that thought...”* (participant 4, age 47, 6 PUT incidents).

The pressure of guilt is reflected by one participant’s statement: *„ every time I hit somebody I kept thinking if I could have avoided the accident...maybe if I had sounded the whistle earlier or braked sooner... these questions haunt you the most and as hard as you try, you can’t shake them off sometimes.”* (participant 6, age 50, 8 PUT incidents).

The intrusive content is seldom represented by auditive sensations, given that avoiding visual contact is among the only defense mechanisms available upon impact. One train driver recalls that: *“about two years ago, I hit a car with three passengers...the whistle and brakes were useless...when I came close to the car I closed my eyes...I can still hear that metallic noise, it sounded like I was pounding the nails in their coffins...”* (participant 11, age 47, 5 PUT incidents)

The gathered data supports the conclusions of prior studies. Namely, in what avoidance is concerned, the impossibility of resigning from the workplace prevents train drivers from escaping the triggers associated with the trauma. *“It’s hard, especially when you always have the same routes... I can point out all the places where people were hit and, to make matters worse, it tends to happen again in the same spots.”* (participant 5, age 48, 4 PUT incidents).

Hyper-vigilance and persistent physiological activation are regularly mentioned by train drivers. Participants declare they feel the peak of activation and persistence at the workplace when they travel on the same routes. A telling example is the following statement: *„I am so tense every time I reach a place where I had an incident, I even forget to breathe and I blow the whistle restlessly, be it day or night...”* (participant 1, 41, 6 PUT incidents)

Train drivers admit to feeling more affected when the victims are women or children, such as the next example: *“two incidents affected me the most. I once hit a woman with a child, I can’t figure out how the child pulled away from her and she threw*

herself to catch him...there was nothing she could do and they both died... the other time is when I hit an old man...he was crossing the tracks, it was dark and he didn't see me coming. During the investigation I found out he was deaf-mute, that's why he couldn't hear me no matter how hard I tried to sound the whistle" (participant 11, age 47, 5 PUT incidents)

Another relevant variable is the impact of the first PUT incident. This is always regarded the most difficult experience overcome: *„ I believe that the first incident always affects you the most, whether it is an accident or suicide...of course you can't say you become immune the next time, but the first one is the most difficult"* (participant 3, age 45, 5 PUT incidents)

The classification of circumstantial risk factors according to their relevance, as assigned by train drivers, is consistent with the results of previous research.

The manner in which the train driver processes the information and interprets the experience of a PUT incident seems to have a defining role in emotional balance.

Social support, especially when received from work, along with family support are protective factors essential for readaptation. One of the most popular coping strategies among participants is sheer acceptance of the situation. For example, one participant declares: *"as an train driver, you hold responsibility for the entire train, but not for what happens on the tracks in front of you...you can't help it, these incidents can happen again and again, sometimes even to the same people..."*(participant 11, age 47, 5 PUT incidents).

Minimizing the traumatic experience is made by calling black humor, mechanics highlighting a dose of cynicism. For example, one participant said, *„to me were not so serious incidents, I have a colleague who once hit a cart with seven people, an entire family and did not make any ... we call him the brave little taylor* (participant 1, 41, 6 PUT incidents)".

Drivers actively try to think of pleasant things related to work to counteract the harmful effects of PUT incidents. One of the train drivers said they always tell the colleagues involved in such incidents to think about the reasons that led them to choose the profession, *"I think I chose this job, though I knew it was hard for that I liked to be alone on the train and see all the time to track where I go ... "*(participant 4, 47, 6 PUT incidents).

Conclusions and discussion

Using qualitative methodology to explore subjective experiences dealing with incidents highlighted train drivers on specific symptom particularities. Also have revealed a number of coping mechanisms that ensure efficient accommodation to these incidents. Specific posttraumatic symptoms described by people with frequent exposure, show common confrontation with the same harmful effects. Drivers tend to report auditory intrusions primarily, experiencing guilt, are unable to avoid traumatic stimuli, leading to difficulty in regulation of arousal at work. Risk factors are relevant in determining symptomatology: victims' peculiarities, first exposure to these incidents. Regarding the coping mechanisms used, the results confirm the role of social support from colleagues as a protective factor.. A number of emotion regulation strategies are identified as being predominantly used: ability to accept incidents as an inherent part of the job, refocusing attention on the positive aspects of the job, downward social comparison, minimizing the experience by calling black humor or drastic perspective change.

Chapter VI. Impact of prior exposure to PUT incidents on acute stress reaction in dealing with a simulated traumatic incident

Repeated exposure to PUT incidents may have different effects on train drivers. Different studies provide support both for an inoculation effect of repeated experiences, or on the contrary, for a cumulative effect of multiple traumas in this population (Lunt & Hartley, 2004). These conflicting results support the need for research to clarify the role of previous trauma on rail worker's susceptibility to posttraumatic stress disorder (PTSD).

Among train drivers, PTSD symptom prevalence is not very high, but its presence is constantly reported across studies (Lunt & Hartley, 2004). It seems that the immediate impact of PUT incidents is significantly higher than long-term psychological consequences for most of the exposed train drivers (Cothereau et al., 2004; RSSB, 2005). Experiencing acute and posttraumatic stress reactions might affect work performance for train drivers. In the long run, more distressed drivers will need more sick leave days, most probably due to unresolved trauma (Theorell et al., 1992). For example, the effort of accomplishing common job demands may be higher for exposed train drivers, because of constant

reminders of the traumatic incident. Because of high probability of repeated exposure to these on the job incidents, it is important to explore the impact of one or more PUT experiences on response to acute stress reactions, in these professionals.

Studies on motor vehicle accident survivors (Blanchard, Hickling, Buckley, Taylor, Vollmer & Loos, 1996; Blanchard & Hickling, 2004; Suendermann, Ehlers, Boellinghaus, Gamer & Glucksman, 2010) and also studies involving traumatized professionals, like policemen (Regehr, LeBlanc, Jelley, Barath & Daciuk, 2007) provide empirical evidence supporting the changes in reactivity to acute stress situations. When compared to non-traumatized persons, affected victims tend to show significantly higher physiological and psychological reactions to reminders of the traumatic event, even in laboratory settings that elicit feelings of control and safety.

In a meta-analysis of psycho-physiological responses to trauma cues, Pole (2007) identified differences in heart rate (HR) to be the most constant physiologic discriminant between adults with or without PTSD, across four types of experimental paradigms: resting baseline studies, startle response studies, standardized and idiographic trauma cue studies.

Current perspective on PTSD (Dalgleish & Power, 2004) holds that aside from fear, traumatic events can elicit other negative emotions such as sadness, guilt or anger, depending on different appraisals of the traumatic event that can involve loss, repulsion, and respectively blame attribution, instead of threat. The emergence of this theoretical view made it interesting to investigate other negative emotions that the traumatic reminder might elicit in these professionals, aside from anxiety.

Objectives:

This study investigates the association between repeated traumatic exposure to PUT incidents, level of posttraumatic stress symptoms, psychophysiological reactivity and subjective distress after exposure to a simulated traumatic railway incident.

Our specific objectives are to evaluate the impact of repeated PUT exposure on psycho-physiological reactivity to a simulated PUT accident and subjective levels of distress.

Hypothesis 1: The simulated PUT will impact subjective distress causing significantly higher level of all dysphoric emotions when compared to both initial baseline, and post-task evaluation.

Hypothesis 2: The simulated PUT will impact HR reactivity, causing significantly higher HR values when compared to initial baseline, response to neutral stressor and post-task evaluation.

Also we expect that train drivers who report a higher level of PTSD symptoms as a consequence of being involved in PUT incidents, are more psychologically and physiologically vulnerable to acute traumatic stress encounters that resemble the specific incidents.

Hypothesis 3: Train drivers with a higher level of PTSD symptoms will show greater HR responses to traumatic reminders of the PUT incidents, than train drivers with a lower PTSD symptom level.

Methodology:

Participants:

Participants were recruited from the train drivers scheduled to do their periodical psychological evaluation at the Psychological Evaluation Laboratory in Cluj-Napoca, on a volunteering basis. 5 of the volunteers were excluded because of heart conditions and current use of betablocant medication. The number of participants in the final sample was 76 train drivers.

Procedure

First, participants completed self-report measures, a demographic questionnaire, describing number and frequency of PUT incidents, the POMS (Shacham, 1983), and the IES-R (Weiss & Marmar, 1997). Then, they proceeded to complete the experimental task.

E-Test program package provides a specific tool for examining train driver's ability to drive locomotives. The simulating driving task requires the driver to monitor both the railway and board's display of driving indicators and take appropriate measures when necessary. One of the critical incidents that they have to react to is the sudden appearance of a car in front of the train. Because of train speed, the collision cannot be avoided, thus simulating a PUT accident.

Physiological (HR) reactivity was measured continually across the testing procedure, but five baselines were extracted from the recorded HR. Baseline 1 was before the initiation of the task. Baseline 2 consisted of a reaction to a neutral stressor: they saw a log falling on the railway and had to stop using emergency brakes. Baseline 3 consisted of the reaction to the traumatic stressor. The stimulus that served as a PUT reminder was the sudden appearance of a car in front of the moving train. The train driver is instructed to stop the train as soon as he can, using the emergency brakes protocol. Usually it takes a few seconds to restore the conditions of driving. After that, the train driver is advised to proceed with the task until completion of the test. Baseline 4 consisted of a new evaluation immediately after ending the task, after a 5 minute relaxation period in another room, and baseline 5 was one hour later, after debriefing the participant. Self-reports of current distress state was collected using POMS-SV in three different moments: baseline 1, 3 and 5. Train drivers were also asked to complete a peritraumatic intensity measure, immediately after the traumatic exposure (baseline 3).

Instruments:

Heart rate measures: We used a Kalenji heart rate monitor to continuously record HR in beats per minute. In accordance with specifications of Regehr et al.(2007), we calculated the average HR for equal time intervals before the beginning of the experiment(baseline1), on encountering a neutral stressor(baseline 2), on encountering the reminder of the traumatic stressor (baseline 3), immediately after finishing the test, after a short relaxation period(baseline 4) and one hour later(baseline5). To check for differences in reaction intensity to stressors, we also calculated a HR acceleration response, as the difference between average HR during the confrontation with the traumatic stressor (baseline3) and baseline 1. We also thought that differences might appear in the way post modulation of arousal takes place and we calculated a measure of HR deceleration, by subtracting baseline 5 from baseline 3.

Self-report measures

Self-report PTSD. Participants completed the Impact of Events Scale-Revised (Weiss & Marmar, 1997).

Disphoric emotions

Profile of Mood States Short Version (POMS-SV) (Shacham, 1983) is a valid and reliable instrument frequently used in the assessment of specific affective states and emotions. We used a shortened form of the classic mood adjective checklist that consisted of 37 items assessing five different negative dispositional states: tension/anxiety, depression, anger and confusion, and one positive mood: vigor. The scale also provides a total distress score.

Peritraumatic intensity responses

Intensity of reaction to traumatic stressor was measured with the Peritraumatic Distress Inventory (Brunet, Weiss, Metzler et al., 2001).

Results:

1. PUT exposure and associated PTSD symptoms

Of the 76 train drivers we included in the study, 53 reported being exposed to one or more PUT events throughout their careers. Average time passed since the last reported PUT accident was 3, 70 years (SD 1, 84) and was not significantly related to the reported level of posttraumatic symptoms. Frequency of PUT exposure in the group of train drivers we included in the study was relatively high ($m = 3, 55$, $SD = 1, 61$), but not all of the exposed train drivers reported experiencing specific PTSD symptoms.

More experienced train drivers to report fewer specific symptoms related to more exposure to traumatic on the job experiences ($r = - 0,34$, $p < 0,05$, $N = 53$). Also, we found that repeated PUT exposure was significantly related to negative affective state induced by the the simulated incident ($r = 0, 32$, $p < 0, 05$).

Further, we wanted to explore the differences in acute stress reactivity, between those who report significantly more PTSD symptoms and those who report just minimal posttraumatic distress caused by previous exposure to PUT incidents. So, for further analysis, we divided the group of exposed train drivers in two subgroups, based on the average level of reported PTSD symptoms: a low level group (0-17 score on the IES-R total scale $N = 26$) and a high level group (over 17 score on the IES-R total scale $N = 27$). Groups significantly differ in terms of age of participants ($t = 2, 19$ $p < 0, 03$) and number of

reported incidents ($t = 2,08, p < 0,04$), with the group of participants that reported a higher level of symptoms being younger and with fewer PUT incidents.

Level of reported disphoric emotions

To confirm our first hypothesis, we performed a one-way repeated measures ANOVA procedure on the whole sample, to see if mood alteration between the three times participants reported disphoric emotions was significant ($F_{75,1} = 372,05, p < 0,01$). Differences between the repeated POMS as reported by the three groups of train drivers are shown in Figure 2.

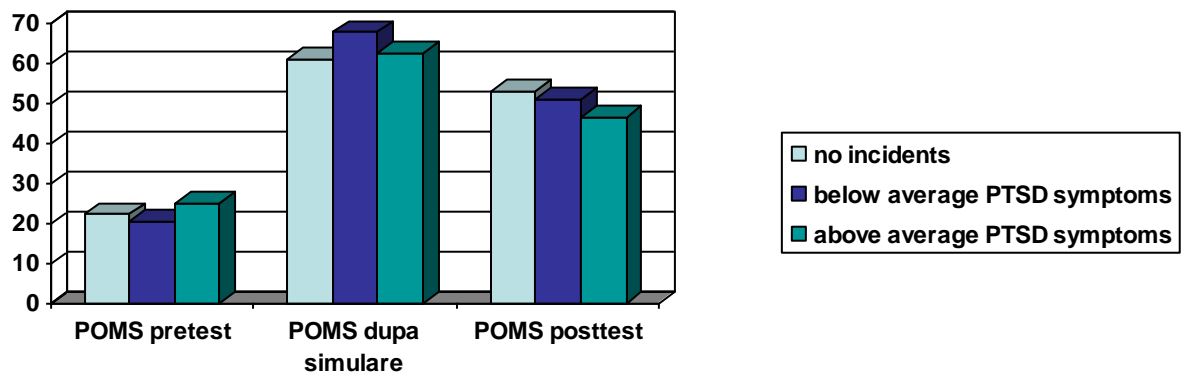


Figure 2: Mean differences between the three administrations of POMS-SV, between the three groups of train drivers

Results with a Bonferroni correction confirmed our hypothesis: significantly higher values for disphoric emotions emerged immediately after the simulated PUT than before and after the experimental task. All comparisons were found statistically significant ($p < 0,01$). This result suggests that for all participants, exposure to a simulated PUT causes relevant subsequent distress. We performed the same analysis for all POMS subscales, to see effects of exposure on different emotions and found significant increases in tension ($F_{75,1} = 71,86, p < 0,01$) and anger ($F_{75,1} = 340,89, p < 0,01$). Differences between the three

repeated measures in depression ($p < 0,20$), confusion ($p < 0,06$), vigor ($p < 0,27$) and fatigue ($p < 0,20$) were not statistically significant for all three comparisons.

Level of heart rate reactivity

Average heart rate before the beginning of the experimental procedure was of 75, 74, st dev. 4, 21. This average level increased during the performance of the experimental task, reaching highest values when train drivers were confronted with the traumatic stressor ($m = 96, 42, SD = 9$), which is congruent with findings from other studies relying on simulation of traumatic events (Regehr et al., 2007).

To confirm our second hypothesis, we used one-way repeated measures ANOVA, and, after a Bonferroni adjustment for multiple comparisons, found a significant increase in heart rate during the simulated PUT ($F 4, 72 = 154,44, p < 0, 001$) different from the levels of arousal determined by the confrontation with another neutral stressor, also different from HR evaluation at the beginning and end of the experimental task, and after a relaxation period.

We also performed an independent one-way ANOVA procedure to confirm our third hypothesis, regarding differences in HR reactivity after the simulated PUT among the three groups of participants. We found support for our hypothesis, with mean HR of the higher PTSD symptom group ($m = 101, 93$) being significantly higher than mean HR values ($m = 89, 26$) of the non-exposed group ($F 73, 2 = 17, 99, p < 0,001$). Mean differences between the five groups evaluations can be seen in figure 3.

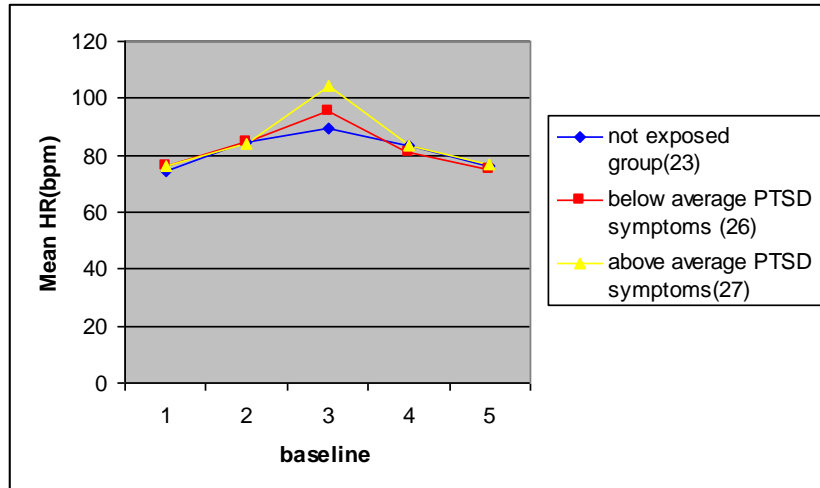


Figure 3. Pattern of HR changes across the five baselines for the three groups of train drivers

We also calculated HR acceleration and HR deceleration measures that allowed us to assess relationships between change in heart rate reactivity because of the simulation exercise and the peritraumatic intensity of the simulated events, level of disphoric emotions, traumatic exposure and reported PTSD symptoms.

Correlation analysis revealed a positive relationship between the intensity of the subject matter peritraumatică and increased heart rate ($r = 0.54$, $p .01$). Increased heart rate was also associated with high values of anxiety / tension ($r = 0, 30$, $p <0.01$) measured immediately after the incident simulation.

On the other hand, the reduction in heart rate was not significantly associated with any of the measures reported subjective distress.

Discussion

Because of high frequency of railway incidents, we were concerned with the impact of being traumatically exposed on train drivers' reaction when needed to manage similar job demands, resulting in PUT incidents. The need to simultaneously deal with the distracting effects of specific symptoms, like intrusive thoughts or elevated physiologic arousal, and specific job demands, may become a vulnerability factor putting the train driver at great strain, especially when confronted with new traumatic incidents. Our results

show this is particularly relevant for younger, inexperienced train drivers, who tend to report fewer PUT incidents but more PTSD symptoms.

We used a computer based methodology to expose train drivers to a simulated PUT incident. Although it is a laboratory simulation with no actual consequences, it seems that our experimental task was a powerful reminder of PUT traumatic experiences. The level of peritraumatic intensity reported by participants suggests that the simulated incident provides a good idea of the intensity of the train driver's reaction to a real life PUT experience. It is a relevant stress reaction task, because it combines the vividness of script scenes with the active involvement of the subject in stress inducing tasks.

Regarding the reactions of the three different groups to the simulated traumatic incident, we found substantial differences in dysphoric emotions and heart rate reactivity.

We wanted to explore differences in distress determined by simulated traumatic exposure and found that simulated PUT incident significantly increased subjective distress. Results concerning specific dysphoric emotions revealed interesting differences between the specific emotions that the traumatic exposure determined, with tension and anger being significantly increased. This promising result suggested the need to further investigate the association of more specific peritraumatic emotions, aside from fear. Specific emotional responses like anger or guilt may have different patterns of association with physiological reactivity to traumatic incidents, and this might be relevant to posttraumatic symptom development.

Physiological reactivity to the simulated PUT, measured in HR responses, across five baselines showed interesting results. Our hypothesis regarding the significant impact of the PUT simulation on HR reactivity was confirmed. All train drivers showed significantly higher HR responses to the traumatic stimuli, when compared to all baselines. Also, train drivers' physiological reactivity significantly differed between the non-exposed group and the group that reported a higher PTSD symptom level. Overall, high cardiac reactivity to the simulated incident was associated with peritraumatic reported distress.

Results have important clinical implications for train drivers, suggesting that repeated exposure to PUT incidents over the course of a career may increase vulnerability to more intense acute stress reactions when confronted with similar traumatic situations.

Chapter VII . General conclusions and discussions

The analysis of the how the issue of „person under train” (PUT) incidents is addressed in the specialized literature reveals how often train drivers are exposed to such incidents (Krysinska, & De Leo, 2008). On the other hand, the same analysis points out their traumatic potential (Lunt & Hartley, 2004) and therefore the need of systematic investigation of certain key-aspects concerning the post-traumatic adaptation to these incidents, within the Romanian cultural environment. Consequently, the general purpose of this thesis is to highlight the train drivers' post-traumatic reactions to these incidents, which are specific to their work environment.

Our research and the choice of the specific objectives of the five studies are guided by examination of the reactions to these incidents by means of cognitive models of post-traumatic adaptation, of the PTSD explanatory models, as well as of models which reveal several potential reactions to trauma.

The first study focused on describing the traumatic impact of PUT incidents in a group of Romanian train drivers. The results show that train drivers frequently experience PUT incidents and that they develop specific PTSD symptoms following these incidents, which are associated to more general symptoms of anxiety and somatic complaints. Among the circumstantial and demographic risk factors advanced by previous research, PTSD symptoms are significantly and negatively related to the frequency of incidents.

Another issue revealed by previous research is the exclusive focus of studies on identifying the PUT incidents as circumstantial risk factors which lead to a later development of specific traumatic stress disorder symptoms. We deemed necessary to investigate several subjective variables, created on the basis of the cognitive models of PTSD growth. These variables are capable of predicting the post-traumatic stress disorder symptoms following PUT incidents.

The objective of the second study was to investigate the relationship between the post-traumatic maladaptive appraisals, the intensity of peritraumatic distress and the PTSD symptoms developed by train drivers. The results showed that the mentioned factors are meant to differentiate the train drivers with PTSD symptoms from the ones without

symptoms. The factors are also significant predictors of the accused symptoms. Moreover, we specified the mediation role of a specific post-traumatic cognition, namely self-blame. This is a mechanism which mediates the relationship between peritraumatic distress and the PTSD symptoms, according to a model pertaining to the cognitive approach of the resilience of PTSD symptoms (Foa & Rothbaum, 1989; Ehlers & Clark, 2000).

We based our third study on the need of investigation of a phenomenon occurring when confronting the trauma, namely post-traumatic growth. In our research, we were motivated by the lack of previous studies investigating post-traumatic growth following a PUT experience. When identifying post-traumatic growth following PUT incidents, we find evidence of the traumatic potential of these incidents on the train driver. The analysis of the relationship between post-traumatic growth and post-traumatic stress symptoms points out a negative, significant connection. Moreover, we found out that, when controlling the stress symptoms and the demographic variables, post-traumatic growth is predicted by acceptance, which is a strategy of cognitive trauma processing.

The fourth study was aimed at associating the quantitative data, retrieved by exploratory research, to qualitative data on the characteristics of PUT incidents considered as traumatic experiences. The analysis led to revealing PTSD symptoms, relevant risk and protection factors from the train drivers' perspective and to discovering the strategies and mechanisms which determine the appropriate assimilation of such experiences.

The last study proposed investigating the manner in which repeated traumatic exposure influences the reaction to acute traumatic stress in the event of a new PUT incident. It uses an experimental sample to simulate such an incident. The results highlighted the high impact of exposure to the simulated incident on a subjective reaction (self-reported emotional distress), and on cardiovascular reactivity, which is a psychophysiological indicator of PTSD symptoms. The results also revealed that if the PTSD symptoms have been previously developed, train drivers have a higher cardiovascular reactivity when confronted with a new traumatic stimulus.

The specificity of the trauma for train drivers is worth mentioning. As they are exposed to PUT incidents, train drivers are similar to other professions which are well-known for their traumatic occupational risk (police officers, fire-fighters, emergency services staff). However, given the specific characteristics of how train drivers are exposed

to trauma and given the individual specific factors (see the mediation role of the self-blame, study 2) which are involved in the rehabilitation process, this type of traumatic confrontation has a quite high level of specificity. The experience of PUT incidents therefore determines a special type of trauma having specific consequences on train drivers.

The results firstly document the traumatic potential of PUT incidents, associated to a high frequency of exposure. The analysis of previous empirical data highlighted the important role of contextual factors (frequency, immediacy, severity of incidents) when identifying post-traumatic distress reported by train drivers. We proposed testing the influence of these factors on the PTSD symptoms reported by train drivers participating in the study (study 1). The only factor which was significantly associated to PTSD symptoms was the frequency of PUT incidents, as data supports the inoculating effect of the trauma. The relationship and its practical implications were discussed and integrated via the theoretical models and previous empirical studies.

In the second study we identified the emotional and cognitive correlates of the PTSD symptoms, on the basis of empirical data regarding other populations similarly exposed to trauma (survivors of motor vehicle accidents, other professions systematically exposed to trauma). We then proposed and, for the first time, tested a model specific to the investigated traumatic context, related to the cognitive models of PTSD resilience. According to our proposed model, the relationship between the acute stress reaction (the intensity of peritraumatic distress) and the resilience of PTSD symptoms is intermediated by cognitive processing following the incident. As a result of this processing, post-traumatic maladaptive appraisals of self-blame are detected. The predictors of PTSD symptoms therefore involve cognitive variables, the train driver's interpretation of the events, of his own reaction, but also the complementary emotional impact. The peritraumatic intensity of distress predicts self-blame and this is theoretically consistent with the necessity of a strong subjective impact of the traumatic incident. In this case the incident is followed by maladaptive appraisals and finally by PTSD symptoms. The second study shows that, for train drivers involved in PUT incidents, self-blame is a mechanism of avoidance coping, a type of counterfactual thinking which has its part in maintaining PTSD symptoms. Therefore, the intervention programs centered on this type of trauma have to change this conviction. The results could also be applied to motor vehicle

accidents, when the driver feels guilty for somebody else's death because he takes responsibility for the accident upon himself, he feels guilty and later develops specific PTSD symptoms.

The combination of results of studies 1 and 2 suggests the fundamental role of subjective variables as related to the contextual risk factors when identifying the train drivers' reactions to traumatic incidents.

On the other hand, when analyzing research conducted in the field, it became evident that positive changes associated to traumatic events and the factors which predict a better adaptation following trauma also need to be investigated. Previous studies highlighted the traumatic potential of „person under train” incidents and their impact on the railway staff, especially train drivers (Lunt & Hartley, 2004). But the new directions of research in psychotraumatology alert about the risk of a restrictive view when the approach focuses exclusively on the pathology as a reaction to trauma. On the contrary, current trends in psychology support the relevance of studying positive aspects, factors which promote mental health and wellness even in a traumatic context. It is important to acknowledge different scenarios of post-traumatic adaptation from the point of view of the implications of managing traumatic incidents taking place on railways. The third study is among the first to propose the investigation of aspects of post-traumatic growth in train drivers involved in PUT incidents.

The need to investigate and rapidly identify the maladaptive forms of reaction to trauma is still a priority when it comes to populations with a high risk of trauma exposure. However, highlighting the post-traumatic growth in train drivers is rather important for the strategies of prevention and intervention conceived for this profession, in order to facilitate the process of post-traumatic adaptation.

The fifth study represents a first experimental assessment of the impact of previous PUT incidents on the acute stress reaction in case of exposure to a new stimulus. The impact of the simulated confrontation with the traumatic stimulus has proved to have an effect on cardiovascular reactivity, as well as on the reported subjective distress and on specific emotional states: tension and anger. The results empirically support the role of specific PTSD symptoms following previous PUT incidents for cardiovascular reactivity in case of a new confrontation to the traumatic stimulus.

From a methodological point of view, we applied a mixed method to assess and investigate the train drivers' reactions when exposed to PUT incidents. This method efficiently combines the advantages offered by diverse research methods and, at the same time, observes the methodological standards specific to each method. The combination of quantitative and qualitative methods is based in the application of a self-administered survey, in recording of cardiovascular reactivity and in the comprehension of the phenomenon by means of qualitative survey. The method has proven its effectiveness. Another contribution of the present research is the adaptation to an experimental sample, which is highly specific and aims to test the impact of simulated incidents in train drivers having experienced PUT incidents.

From a practical point of view, the conclusions of the present research strongly highlight the need of permanently monitoring the trauma risk related to the experience of PUT incidents in train drivers. The tools used in research can be employed to assess the railways staff, especially train drivers involved in PUT incidents, after being adapted to and validated on the Romanian population. The results prove their effectiveness in conceiving prevention and intervention programs which target populations with different approaches to the PUT incidents.

When synthesizing the results of the five studies, we can argue that training programs could benefit from information on awareness on traumatic risk, on specific PTSD symptoms and on the acute stress reaction, on the potential of post-traumatic growth, on risk factors (first exposures to trauma, a higher intensity of peritraumatic distress, post-traumatic maladaptive cognitions) which are associated to PTSD symptoms, protecting factors (mechanisms of cognitive processing of trauma, especially acceptance) and with post-traumatic growth, but also with social support from the group and with the consequences of repeated exposure to PUT incidents.

Another practical contribution of the present research is the identification of sub-groups with higher risk among the train drivers, namely train drivers after their first PUT and those who already had accused PTSD symptoms and were again exposed to a traumatic incident.

When interpreting the results of the research, it is necessary to take into account several methodological limitations of our investigations, mainly those related to the

retrospective assessment and self-reporting by transversal design. The acknowledgement of these limits is relevant for new directions of research, generated by the investigation of post-traumatic stress in train drivers involved in PUT incidents, presented in a dedicated section of the thesis.

The main contribution of the thesis is the assessment of multiple reactions in train drivers exposed to traumatic incidents and the impact that previously developed symptoms have in case of a new traumatic confrontation, when there is a high probability of repeated exposure to these incidents.

The results of the present research underline the need to address the risk of trauma to which train drivers involved in PUT incidents are exposed. Systematic efforts of research and implementation of the latest prevention and intervention methods are needed so that traumatic exposure and the psychological impact of PUT incidents on railways staff are reduced.

Keywords: „person under train” incidents, occupational trauma, posttraumatic stress, posttraumatic growth, train drivers

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