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PTSD prevalence and associated risk factors after a fire disaster that broke out in a paediatric hospital: a cross-sectional study

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Key words
Fire disaster; health care workers; post-traumatic stress disorder

Parole chiave
Incendio; operatori sanitari; disturbo post traumatico da stress

Summary
Background: *Several studies have shown a higher risk of psychological problems in health care workers exposed to serious occupational stressors.* **Objectives:** *The aim of the present study was to assess the presence of Post-traumatic Stress Disorder (PTSD) and possible risk factors in a sample of 32 workers who were at the same time rescuers and victims of a fire that broke out in the neonatal intensive care unit of a large paediatric hospital.* **Methods:** *Immediately and six months after the event, the subjects underwent a study protocol aimed at the diagnostic assessment of PTSD, investigated via the Clinician-Administered PTSD Scale (CAPS) and the Impact of Event Scale-Revised (IES-R).* **Results:** *Out of the 30 subjects examined (two were missing), six showed the diagnostic criteria for a current PTSD. Risk factors for PTSD onset were a prior psychiatric disorder, the level of involvement in the fire disaster and the presence of phobias in the days immediately after the event. Gender and level of education approached statistical significance.* **Conclusions:** *The high prevalence of PTSD found in this sample was due to the fact that the risk of death or serious injury involved infants.*

Riassunto
«Disturbo post traumatico da stress in operatori sanitari coinvolti in un incidente rilevante avvenuto in ambito ospedaliero». **Introduzione:** *Diversi studi hanno evidenziato un elevato rischio di comparsa di disturbi mentali nel personale sanitario professionalmente esposto a stressor significativi.* **Obiettivi:** *Scopo del presente studio è indagare la presenza del Disturbo Post Traumatico da Stress (PTSD) e di eventuali fattori di rischio in un campione di soggetti vittime e contemporaneamente soccorritori in un incendio sviluppatosi nel reparto di rianimazione neonatale di una grande struttura ospedaliera pediatrica.* **Metodi:** *Immediatamente dopo l'evento e a distanza di*

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sei mesi, 32 soggetti sono stati sottoposti ad un protocollo sanitario finalizzato alla valutazione diagnostica del PTSD, indagato mediante la Clinician-Administered PTSD Scale (CAPS) e la Impact of Event Scale-Revised (IES-R). **Risultati***: Dei 30 soggetti esaminati (due operatori si sono persi), sei presentavano i criteri diagnostici per un PTSD attuale. Sono risultati fattori di rischio per il PTSD la presenza di una patologia psichiatrica pregressa, il livello di coinvolgimento nell'incendio e la presenza in acuto di fobie. Il sesso e il livello d'istruzione hanno ottenuto punteggi vicini alla soglia di significatività.* **Conclusioni:** *L'alta prevalenza di PTSD nel campione studiato è giustificata dal fatto che nell'incendio fossero a rischio di vita e di lesioni gravi dei neonati.*

Introduction

Post-traumatic stress disorder (PTSD) is a mental disorder characterized by the onset of specific symptoms triggered by the exposure to a traumatic event that has resulted in death, danger of death or serious injuries, but also by the threat to one's own or others' physical safety. PTSD is a disease category that has undergone many changes over time. Its first description dates back to 1952 when it was named "gross stress reaction" (2) but in later years that definition progressively disappeared. DSM-III of 1980 finally introduced the definition of Post-traumatic Stress Disorder (3), which was in use until the DSM IV-TR: subjects with PTSD have usually experienced a very traumatic event, in which they felt intense fear, feelings of helplessness or horror. According to DSM IV-TR, the main clinical features of PTSD are: 1) reliving the never-ending painful experience, 2) trying to avoid the stimuli associated with the trauma, 3) increasing alertness and reduced emotional reactivity (4). The recent fifth revision of Diagnostic and Statistical Manual of Mental Disorders (DSM-5) introduced several changes to the diagnostic criteria of Post-traumatic stress disorder (5). First, for criterion A, exposure to a traumatic and stressful event suffices, though it no longer requires that the event has resulted in the subject experiencing intense fear, feeling of helplessness or horror. A traumatic event can provoke, instead of fear and horror, anhedonia, dysphoria, anger, aggression and dissociative symptoms. For this reason, PTSD along with all disorders arising from a traumatic event, were moved from anxiety disorders into a separate and new category of disorders called "Trauma- and Stressor-Related Disorders". Criterion B remained unchanged, except for an emphasis on dissociative symptoms. Criterion C (avoidance/numbing) was divided into two different criteria: "avoidance" (C) and "negative alterations in cognitions and mood" (D). In the latter group, "negative convictions about themselves, others and the world", "self-blame", and "persistent negative emotional states" were also included. Finally, "reckless or self-destructive behavior" was added to criterion E.

Lifetime prevalence of PTSD in the general population ranges between 1 and 14% (26). In their study Kessler et al. (33) highlighted an overall prevalence of lifetime PTSD of 6.8% in the American population and, stratifying it by age, of 6.3% between 18 and 29 years, 8.2% between 30 and 44 years, 9.3% between 45 and 59 years and 2.5% over 60 years of age.

Although initially the diagnosis of PTSD was linked only to the history of warfare, it was later demonstrated how also natural disasters or other accidents caused by man can have adverse effects on the subject's physical and mental health, thus leading to the onset of PTSD. In fact, there are several studies that describe the onset of a PTSD-related symptomatology as a consequence of traumatic events of various kinds (6).

Victims of a fire disaster, for example, are at high risk of developing PTSD and the rescuers, including firefighters and policemen, represent categories at risk of developing mental problems (17, 45). Among the rescuers, however, those who have better notions of how to deal with this kind of disaster more rarely develop a mental disorder resulting from the trauma (36, 55). Similarly, in health care settings, critical care professionals are con-

stantly engaged in highly-stressful activities, since they are frequently involved in assisting and managing critical situations such as death of patients, serious injuries or threats. A continuous and stressful exposure to such events can cause the progressive inability of the subject to face such difficult situations, thus rendering ineffective the individual coping strategies meant to cope with the stressors. On the other hand, in subjects who are involved in high-risk professions (the so-called *emergency workers*) also the acute exposure to particularly traumatic and unforeseen events (*critical incidents*) (8, 43, 62) can trigger the same mechanism that gives rise to the onset of psychopathologies. In fact, some studies have shown a higher risk of PTSD onset or of a psychological problem, in health care workers exposed to serious stressors (1, 21, 57). Among the potentially traumatic events, reported as highly stressful for this professional category, severe injuries or colleagues' death, as well as severe accidents that have involved children have also been reported (42).

Therefore, the present study aims at assessing, through a cross-sectional study, PTSD prevalence and its correlation with any predisposing factors in a particular sample of subjects, consisting of hospital workers involved in a major disaster that occurred in a paediatric critical care ward.

Methods

The event described in this study concerns a fire that broke out in a Resuscitation Unit of a large Paediatric Hospital that involved, besides the aforementioned Department, other neighbouring departments, including Neonatal Intensive Therapy. This was certainly a traumatic event, since it endangered the lives of many people, including health care workers and, above all, paediatric patients. The effort required in managing the emergency was remarkable, particularly to ensure the evacuation of the over 100 children and infants hospitalized. Following the disaster, no deaths were recorded, while 44 people reported physical consequences due to acute intoxication caused by fire fumes.

Subjects

The sample of this survey consisted of 32 employees of the Paediatric Hospital involved in the traumatic event described above. All subjects were engaged in various capacities in managing the emergency, actively participating in evacuation and rescue of hospitalized infants and children. Immediately after exposure these workers complained of physical symptoms of poisoning by carbon monoxide and, for that reason, were treated in the emergency department; three of them required subsequent hospitalization.

Out of the 32 subjects enrolled, 30 completed the study protocol and were therefore included in the present study. Of these, 22 were involved in health care (five doctors, 17 nurses) while eight carried out a non-health profession (four clerks, two technical employees, two security guards). The mean age was 45 years and as regards gender in this series there were 16 males and 14 females. Marital status was represented mainly by married people (n=22) (table 1). The 30 enrolled subjects participated in a cross-sectional study with a follow-up after six months to assess the psychological consequences related to the event and, in particular, to identify the symptoms referable to PTSD.

Measurements

All participants were administered the Clinician-Administered PTSD Scale (CAPS), a structured interview composed of 30 items, standardized to measure frequency and intensity of PTSD symptoms (9). In addition to the 17 symptoms

Table 1 - Socio-demographic features of sample

Sample	Tested subjects (n = 30); Missing (n = 2)
Age	Range (n = 26-58); M = 45,50
Gender	Males (n = 16); Females (n = 14)
Profession	Physicians (n = 5); Nurses (n = 17); Other (n = 8)
Marital status	Unmarried (n = 4); Married (n = 22); Divorced (n = 3); Widowers (n = 1)

foreseen by *DSM-IV* criteria for PTSD, the CAPS also assesses subjective distress, social, occupational or school damage, reliability of responses, disorder severity and overall improvement of the subject, real or imaginary guilty feeling for having committed or omitted something during the traumatic event, sense of emotional distance from everyday life (family, social or working context), symptoms of derealisation (10, 64). Symptoms were assessed according to a Likert-type rating scale from 0 to 4 and the total score varied from 0 to 136. On the basis of the final score, it was therefore possible to quantify the severity of PTSD as follows: 0-19 asymptomatic/few symptoms; 20-39 mild PTSD; 40-59 moderate PTSD; 60-79 severe PTSD; equal or >80 extreme PTDS (63). The *CAPS* is the gold standard for the diagnostic assessment of PTSD, since it has high sensitivity (0.84) and specificity (0.95) with respect to the *Structured Clinical Interview for the DSM-IV Axis I Disorders* (SCID PTSD diagnosis) as well as a good coefficient of test-retest reliability (13).

In addition to the CAPS, participants also completed the *Impact of Event Scale-Revised (IES-R)* a self-administered scale composed of 22 items (65), and an updated version of the *Impact of Event Scale (IES)* composed of 15 items (30). The IES-R was administered to assess the severity of post-traumatic symptoms in patients with PTSD at the time of the interview. In fact this scale evaluates the presence and the severity of symptoms of intrusion, avoidance and hyper-arousal during the last week before the interview. It is a non-diagnostic and non-DSM-oriented scale. Symptoms are assessed according to a Likert-type rating scale from 0 to 4. The cut-off is 35. The IES-R scale, Italian version, showed good internal consistency (intrusion, α=0.78; avoidance, α=0.72; hyper-arousal, α=0.83) and good psychometric properties (18).

Procedures

In the days following the fire disaster, all workers underwent examination to assess the psychophysical consequences in the short term and evaluate the level of involvement in the traumatic event. Personal, socio-demographic and clinical-anamnestic features were recorded for each subject, and informed consent for the study was acquired in writing during the occupational health surveillance carried out by the Hospital Medical Service.

Assessment of the risk level to which each person had been subjected during the event was performed through the application of a semi-quantitative method that allowed measuring the degree of the rescuer's involvement in the fire disaster. Since each employee enrolled in the study had participated in various capacities and with different responsibilities in the emergency management, for each of them it was possible to gather the necessary information relative to the following three criteria: (a) *proximity to the fire epicenter*; (b) *type and number of activities/tasks performed while managing the emergency* (activation of rescues, collaboration in fire-fighting operations, coordination of escape operations, assistance to patients/relatives); (c) *level of exposure to the fire fumes* (through anamnestic information and vital signs recorded in the ER). To each criterion a score, based on the information collected, was then assigned and the sum of these provided the final score, denoting the "*involvement level of each subject in the traumatic event*" and thus indirectly the risk to which the employee had been exposed (table 2). The final score was divided into sections, corresponding to three levels of risk: (a) level 3 (maximum involvement = score from 10 to 7); (b) level 2 (intermediate involvement = score from 6 to 4); (c) level 1 (minimum involvement = score equal to 3).

Six months after the event, the study participants were again invited by the hospital structure they belonged to for a targeted follow-up aimed at making a PTDS diagnostic assessment. The presence of symptoms consistent with PTSD was investigated through the use of the CAPS. The time period assessed for the presence of PTSD symptoms was the month preceding the interview. We also asked the respondents whether, after the trauma, there had been a period during which they had experienced symptoms which fulfilled a diagnosis of PTSD for at least one month. Subjects who responded affirmatively indicated the month immediately following the trauma as a symptomatic period *(Current and Lifetime Diagnostic Version - CAPS-DX)*.

Table 2 - Level of subject's involvement in the traumatic event

Criterion A	Criterion B	Criterion C
Proximity to the epicenter	Typology and number of activities performed:	Exposure to fire fumes
High=3 Moderate=2 Negligible=1	Rescuers activation=1 Firefighter operation=1 Escape coordination=1 Support to patients=1	High=3 Moderate=2 Negligible=1
Score from 1 to 3	*Score from 1 to 4 (sum of more than one activities)*	*Score from 1 to 3*
TOTAL SCORE	Sum of the scores Criterion A + Criterion B + Criterion C *= from a min of 3 to a max of 10*	
	LEVEL OF INVOLVEMENT	
Maximum – Level 3 (total score from 7 to 10)	Intermediate – Level 2 (total score from 4 to 6)	Minimum – Level 1 (total score equal to 3)

Data Analysis

The study was conducted on a series stratified on the basis of the presence or absence of PTSD. For each statistical unit, personal data, medical history, demographic, and clinical parameters relating to the study were collected (table 3). PTSD was considered present according to "rule of 3" of the CAPS, whereby a PTSD symptom was present if its frequency was equal or greater than one (F≥1), and its intensity equal or greater than two (I≥2) (63). Subjects positive for PTSD were compared with the negative subjects, to highlight possible differences of presence and distribution of the observed parameters. The distributions of the nominal variables in the two groups are described with the percentages of presence/absence of the parameter itself, while the distributions of the numerical variables are reported with the usual indices of central tendency and dispersion. Significance tests of nonparametric univariate type were applied: Fisher exact test for qualitative/nominal variables and U Mann-

Table 3 - Description of the study population

Tested subjects (N = 30)		n		n
Gender	Males	16	Females	14
Family situation	U – W – D	8	C – M	22
Profession	Health prof.	22	Non-health prof.	8
Intensive Care Unit	Yes	14	Other	16
Education level	High	24	Low	6
Family history of psychiatric disorders	Yes	11	No	19
Previous psychiatric disorder	Yes	5	No	25
Involvement level in the fire disaster	Level 3	6	Level 2 + Level 1	24
Fire-fighting training	Yes	12	No	18
Previous traumatic events	Yes	11	No	19
Acute psychiatric symptoms	Yes	25	No	5
Acute physical symptoms	Yes	26	No	4

Note: U=unmarried, W=widower, D=divorced, C=cohabiting, M=married

Whitney test for the numeric variables. SPSS 18.0 for Windows was used for data analysis and an *alpha level* of 0.05 for the evaluation of the results and the acceptance/rejection of the null hypothesis.

Results

Out of the 30 subjects examined, six fulfilled the diagnostic criteria for current PTSD, satisfying the "rule of 3" for the *CAPS* scoring (F1/I2). Of these, four had moderate PTSD and two mild PTSD.

Regarding the assessment of lifetime PTSD, for the subjects who after the trauma suffered from these symptoms for one month, such as to meet the diagnostic criteria for PTSD, the month immediately after the fire disaster was identified as "the period". Nine subjects presented a PTSD in the month immediately following the trauma: out of these, four were severe, four moderate and one mild. After six months, three PTSD (one mild and two moderate) experienced resolution or, anyhow, such a reduction in the symptoms that the PTSD diagnostic criteria were no longer met. Between lifetime PTSD and current PTSD, we also noted an improvement of 15 points compared to the CAPS score in six out of nine cases, although the subjects had not followed any therapeutic course (64).

The six cases of current PTSD were compared to the 24 subjects who did not develop any PTSD. Personal, socio-demographic and anamnestic features of the two groups were subsequently analyzed to identify any possible statistically significant associations with the current PTSD (table 4). As re-

Table 4 - *Features of the sample stratified on the basis of presence or absence of PTSD*

		Absent	Present	p
Gender	Males (after 1 month)	14	2	**0.008**
	Females (after 1 month)	7	7	
	Males (after 6 months)	15	1	0.072
	Females (after 6 months)	9	5	
Family situation	U – W – D	7	1	0.655
	C – M	17	5	
Profession	Health professionals	16	6	0.155
	Non-health professionals	8	0	
Intensive Care Unit	Yes	10	4	0.168
	Other	14	2	
Educational level	High	21	3	0.075
	Low	3	3	
Family history of psychiatric disorders	Yes	7	4	0.141
	No	17	2	
Previous psychiatric disorder	Yes	2	3	**0.041**
	No	22	3	
Involvement level in the fire disaster	Level 3	1	5	**< 0.001**
	Level 2 + Level 1	23	1	
Fire-fighting training	Yes	10	2	1
	No	14	4	
Previous traumatic events	Yes	8	3	0.640
	No	16	3	
Acute psychiatric symptoms	Yes	3	4	**0.015**
	No	21	2	
Acute physical symptoms	Yes	21	5	1
	No	3	1	

Note. U=unmarried, W=widower, D=divorced, C=cohabiting, M=married

gards the diagnosis of PTSD, no significant difference between males and females ($p=0.072$) was observed; however, the presence of an approach to significance in favour of the latter is noteworthy. Among the disorders present in the days immediately after the trauma, onset of phobias was frequent, compared to the presence of a current (and therefore chronic) PTSD ($p=0.015$). The occupation of the subjects (health and non-health), as well as their age, were not significant for PTSD onset.

Half of the people with PTSD (three out of six) had presented a previous psychiatric disorder, unlike almost all the non-PTSD group, most of whom had had no previous psychiatric problem (22 cases out of 24). In this sample, therefore, a previous psychiatric disorder proved to be a risk factor for developing PTSD ($p=0.041$). In particular, the three subjects positive for PTSD were all women and had suffered in the past from depression.

A low educational level was not significantly correlated with the development of PTSD but it did approach statistical significance ($p=0.075$). The level of operator involvement in the traumatic event (as described above: $p<0.001$) was an undoubtedly significant factor in the development of current, and therefore chronic, PTSD. Finally, comparing the results of IES-R of the subjects with PTSD with the non-PTSD subjects, it was possible to highlight a significant scale score in relation to the presence of the disorder ($p<0.001$). Such correlation implies that the subjects who, six months after the fire disaster, had a PTSD of mild/moderate intensity also had a compromised psychopathological status at the time of the interview, due to the presence of significant symptoms in the previous week.

Discussion

The main result of this study was the existence of a high prevalence of PTSD (20%) in a specific population, consisting of employees of a Paediatric Hospital involved in a fire that broke out in the Neonatal Intensive Care Unit. Although the percentage of PTSD in individuals involved in fires disasters is very high (36), this specific event did not lead to real severe consequences to justify such a high number of PTSD cases. We believe that the high prevalence found in the population under study has to be related with the type of trauma suffered, i.e., an accident that endangered the life of infants already suffering from serious diseases. Accidents involving children cause acute stress for healthcare staff, higher than other possible events. Some studies conducted on nursing staff showed that the risk factors for development of PTSD are death or sexual abuse of a child (14, 46). Moreover, the fact that the personnel involved in the fire had co-workers exposed to risk of death or serious injury is an additional risk factor for the development of PTSD. Burns and Harm showed that emergency nurses deem, after the death of a child, the death of a co-worker as the most severe among all possible occurrences (14).

While in health care personnel who work in the emergency field a higher risk of developing PTSD was highlighted (1, 42), the studies relative to personnel working in intensive care and resuscitation units are not only scarce and contradictory but generally concern only nursing personnel (7, 19, 32, 54). While some authors (19, 32) found no increased risk of PTSD, Mealer et al (41) and other authors (7, 54), showed a greater vulnerability of nursing personnel in Intensive Care Units, compared to staff working in other wards. In our survey, however, neither the health profession nor the work performed in Intensive care or Resuscitation Units proved to be significant. Therefore, the high rate of PTSD seems independent of a possible increased risk associated with working in critical care units because, conversely, it strictly depends on the type of accident suffered, which endangered the life and physical integrity of infants and colleagues.

The lack of a significant difference between males and females with respect to the presence of PTSD, despite an approach to significance of the female gender, corresponds to the findings reported in several studies. Although PTSD is generally more common in women (44, 56, 66), if it is considered in relation to accidents (as in our case) it does not show significant gender differences (11, 52). In this survey, however, we found a higher presence of PTSD in women than in men

(p=0.008) only in the period, over one month, after the fire disaster. Such significance, 6 months after the event, was no longer detectable when evaluating chronic PTSD. These data confirm what was already reported in previous research on children and adolescents (35, 51, 60, 67) where gender differences, although present in the period immediately after the event, tend to disappear over time. The non-significance of gender differences with regard to the development of PTSD was confirmed not only in civilians but also in war veterans (28, 48, 50). However, as reported in a study on adults, there is conflicting evidence that shows a higher presence of PTSD in women, both acute and chronic (31).

No significant differences in the development of PTSD, in relation to the age of the participants enrolled in the study, were found *(p=0.815)*. Our sample (table 1) includes people aged between 26 and 58 years. The mean age of subjects suffering from PTSD was 45 years and that of the non-PTSD group was 44.5 years. This age group, in fact, does not seem to be at risk of developing PTSD. The only age with significantly higher incidence is childhood (37, 39) with an increased risk of developing the disorder the younger the child's age (67). In adults, the higher prevalence of PTSD among young people compared to older people seems to depend on other risk factors related to youth, particularly assaultive trauma and low socioeconomic status. Consequently, young age is not an independent risk factor (16). Conversely, other studies report that this gradient, which is evident in childhood, is valid even in adults and therefore the youngest subjects are more likely to develop a PTSD (25).

Although non-significant, the cultural level approached significance with respect to the development of PTSD in subjects with a lower cultural level, which is potentially in accordance with other studies where the cultural level was strictly related to the risk of developing PTSD (15, 27, 66).

Similarly to other research (61, 68), the present study demonstrated that family status was not significantly associated with PTSD. Literature data were not clear about the possibility for unmarried status to be regarded as a pre-trauma risk factor for PTSD. Some studies did not find any significant correlation between unmarried status and PTSD, but others detected such a correlation (24, 34). Further research is needed to understand whether being single, divorced/separated or widowed increases the risk of developing PTSD.

Our survey demonstrated that, in agreement with other studies (12, 22, 29, 40) the presence of a previous psychiatric disorder is a risk factor for the onset of PTSD.

The level of operator involvement in the fire disaster increased vulnerability to develop PTSD. Our results confirm literature findings, which show that the level of involvement in the traumatic event (closeness, duration or intensity) is a risk factor for PTSD (12, 44, 58, 59).

The results of this study regarding family disorders do not support literature data because we did not find a significant correlation between psychiatric disorders in family members and PTSD (12, 20, 47). Furthermore, fire fighting training was not found to be protective with respect to development of PTSD.

The presence of acute psychiatric symptoms (i.e. phobias) immediately after the fire showed a significant correlation with the development of PTSD. However, physical symptoms (i.e. dyspnea, cough, hoarseness, headache, eye irritation, epigastric pain, etc.) were not correlated with PTSD. In our opinion, this is linked to the mildness of physical injuries reported by the subjects in our sample. Several studies (23, 38, 49) showed that moderate, serious or severe injuries are risk factors for PTSD, even though some studies (53) disagree.

The major limitation of the study was the small sample size. Conclusions from this study require caution because of poor representativeness of the sample and poor possibility of generalization of the results. Being such a single-centre study, the possibility of generalization of findings is poor. Another limitation was that we did not assess the presence or absence of Acute Stress Disorders in the days immediately after the fire.

One of the strengths of the study lies in assessing the potential onset of mental disorders in the victims of accidents at work, as well as showing that this occurrence cannot be considered negligi-

ble (in particular for some professions, such as health care workers). The results also suggest the importance of a comprehensive preventive approach in the management of injured workers which allows, on the one hand, studying the physical and psychological consequences of the incident and, on the other, providing subsequent adequate treatment processes for the people involved.

The present study thus confirms the need for further research with larger samples. In this way, it may even be possible to identify both PTSD etiopathogenetic aspects and the contribution of possible protective and/or predisposing factors.

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