ORIGINAL RESEARCH

Changes in Post-Traumatic Symptom Pattern during and after Exposure to Extreme War Stress: An Uncontrolled, Preliminary Study Supporting the Dose-Response Model

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Abbreviations:
IES-R = Impact of Event Scale-Revised
PTSD = post-traumatic stress disorder
SAAS = special army administrative staff

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Abstract

Introduction: Exposure to prolonged war stress is understudied. While there is debate regarding the empirical data of the dose-response model for post-traumatic stress disorder (PTSD), little is known about how weekly changes in external stress influences the level of PTSD symptoms. The purpose of this study was to measure the relation between objective external stress and PTSD symptoms across time, and thus, gain a deeper understating of the dose-response model.

Hypothesis: The study hypothesis postulates that the more severe the external stressor, the more severe the exhibition of traumatic symptoms.

Methods: Thirteen special army administrative staff (SAAS) members from the Rambam Medical Center in Haifa attended seven intervention meetings during the war. These personnel answered a battery of questionnaires regarding demographics and PTSD symptoms during each session. A non-parametric test was used in order to measure the changes in PTSD symptoms between sessions. Pearson correlations were used in order to study the relationship between the magnitude of external stressors and the severity of PTSD symptoms.

Results: The results suggested that there was a significant relationship between the magnitude of external stressors and the severity of PTSD symptoms. These results are in line with the dose-response model.

Conclusions: The results suggest that a pattern of decline in PTSD symptoms confirm the dose-response model for PTSD.

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Introduction

Post-traumatic symptoms begin as early as 24 hours after exposure to the traumatic event and can be traced up to 75 years after the initial exposure to the traumatic event.[1,2] In most cases of patients exhibiting post-traumatic symptoms, interventions are carried out as early as two days after an exposure to a traumatic event.[3] These interventions most likely are accompanied by a series of follow-ups that can range from a few weeks to a few years. The main problems with these interventions are that most studies do not measure traumatic symptoms during the exposure to a traumatic event, *per se*, or conduct intervention during exposure to a prolonged trauma. In addition, in the last few years, there has been a debate regarding the dose-response model for trauma. The dose-response model postulates that symptoms of post-traumatic stress disorder (PTSD) will depend on the severity of the stressor itself. Some studies tried to test this hypothesis by relating the objective severity of the traumatic event to PTSD symptoms. In addition, the empirical evidence for this model is not extensive as one might expect.[4–6] However, some studies still argue for a robust dose-response association.[7–9] This has emerged from several studies in which cumulative exposure to trauma has been linked with a

progressively increasing risk of psychiatric morbidity PTSD.[10–12] The main problem with this debate is the reliance on one follow-up after a single trauma. In order to address this problem, research was conducted during exposure to prolonged trauma with multiple measurements as part of a clinical intervention plan administered to soldiers working at the Rambam Medical Center during the 2nd war between Lebanon and Israel. These soldiers were stationed at the hospital and had a unique duty during the war: they had to handle war casualties that were admitted to the hospital. The effects of prolonged stress during the war on hospital personnel were found to be substantial.[14–16] The objective of this study was to check the dose-response model during exposure to prolonged war stress where the external traumatic stressors changed in magnitude over time. The hypothesis is derived from the dose-response model for PTSD symptoms[4–11] that states that the more severe the external stressor, the more severe the exhibition of traumatic symptoms will be.

Methods

Event

On 12 July 2006 at 09:30 hours (h), the war between Israel and Lebanon erupted. The war resulted in 163 casualties (44 civilians and 119 soldiers) and 2,400 wounded (2,000 civilians and 400 soldiers). During the war, the northern city of Haifa was targeted by hundreds of missiles. A large portion of the civilian and military casualties were admitted to Rambam hospital during the war. Rambam Hospital is the largest and most essential hospital in northern Israel. The hospital itself also was targeted by missile, and 40 missiles landed within hospital vicinity.[14–16]

Sample

Thirteen special army administrative staff (SAAS) members from the Rambam Medical Center in Haifa attended seven intervention meetings during the war. These intervention meetings were conducted in order to relieve stress from the soldiers. The meetings were conducted by a clinical psychologist (YP) with extensive experience both in military settings and in civilian settings. The SAAS are responsible for the wounded soldier's personal equipment, administrative procedures concerning the equipment, and communication with the families of those who were wounded. Three meetings were conducted during the war, and four meetings were conducted following the cease-fire. During the first six weeks of the intervention program, a short demographic questionnaire (including questions about age, gender, origin, nationality, and level of religiosity), with the Impact of Event Scale-Revised (IES-R) was administered. In addition, objective external information was gathered from hospital records, military sources, and events that were published in the media regarding the hospital vicinity. In addition, none of the participants had a history of mental disorders and did not have prior exposure to war related stress. This study was formally approved according to the Helsinki Committee's ethical requirements. Special attention was paid to the events that occurred every week and their influence on the SAAS's traumatic symptoms.

The participants took part in an intervention program in order to relieve stress during the war where they were directly exposed to incoming missile attacks, as well as to causalities of war. The intervention meetings began during the second week of the war (first meeting took place on 26 July 2006). The study began during the second meeting (01 August 2006), and continued almost every week until the last meeting (10 September 2006). The cease fire began 14 August 2006.

Instruments and Measurements

Demographic measures included age, gender, origin, nationality, and level of religiosity. The 22-item Impact of Event Scale-Revised (IES-R)[17] was used to assess levels of post-traumatic symptoms, event intrusion, event-related avoidance, and event-related hyper-arousal experience during the previous seven days in response to war stress. A total score greater than 33 indicated a clinical level of distress.[18] This measure has been shown to be reliable and valid.[14,15,19,20] The level of exposure was measured by the number of wounded soldiers in the hospital each week (Table 1).

Statistical Analyses

Non-parametric tests were used to check the differences between the first administration of the IES-R as compared to the meeting after the cease-fire had begun and the last meeting (follow-up). Since the number of participants was low (n = 13), the most suitable measurement was the Wilcoxon signed ranks test, in order to examine the change of symptoms during those weeks. In addition, Pearson correlations were conducted in order to assess the relationship between exposure levels and level of PTSD symptoms as measured by the total IES-R score and its sub-scales (intrusion, avoidance, hyperarousal).

Results

The sample represents the entire SAAS population in the hospital (n = 13). The mean age of the SAAS was 22.5 ±6.2 years (1 SD) (Range 18–41 years). Women (n = 11), comprised 84.6% of the sample; and 86.4% were single (n = 13). Most of the sample were secular 76.9% (n = 10), while only 23.1% (n = 3) were conservative. All of the participants resided in the greater Haifa area that was under missile attack during the war.

The pattern of the IES-R scores showed a rapid decline following the cease-fire, and thus, a substantial reduction in external stress levels (Table 1). In addition, there was a downward trend in IES-R scores between the first and fourth meetings using the Wilcoxon Signed Ranks test (z = -1.838, p = 0.066). In addition, differences were identified between the first and last meetings using the Wilcoxon signed ranks test (z = -2.380, p = 0.017) (Table 1). The impact of external stress was correlated significantly with traumatic and post-traumatic symptoms as measured by the IES-R (r = 0.88, p = 0.021; Table 2).

Discussion

During exposure to prolonged war-related trauma, the dose-response model might explain a substantial part of the

	Dates of Intervention (dd/mm/yy)					
	01/08/06	*07/08/06*	*16/08/06*	*22/08/06*	*28/8/06*	*10/09/06*
IES-R Cronbach's α for intrusion scale	0.8174	0.8121	0.9085	0.5990	0.8110	0.8365
IES-R Cronbach's α for avoidance scale	0.8146	0.8707	0.8608	0.8823	0.8428	0.7024
IES-R Cronbach's α for hyperarousal scale	0.8388	0.5959	0.8048	0.5034	0.5172	0.7624
IES-R Cronbach's α for total score	0.9312	0.8212	0.9369	0.8551	0.8916	0.9104
IES-R intrusion score, mean (SD)	14.75 (7.33)	10.73 (6.74)	14.30 (8.97)	10.89 (5.09)	11.25 (6.34)	7.00 (5.07)
IES-R avoidance score, mean (SD)	12.42 (7.05)	9.91 (7.85)	9.91 (7.18)	6.00 (5.36)	7.25 (6.20)	5.88 (5.30)
IES-R hyperarousal score, mean (SD)	11.25 (6.50)	7.10 (3.84)	8.63 (6.39)	6.78 (3.96)	4.75 (3.81)	5.00 (4.93)
IES-R score, mean (SD)	38.42 (19.51)	28.36 (16.63)	32.82 (19.32)	23.67 (12.34)	23.25 (14.20)	17.88 (14.25)
Number of wounded soldiers in hospital	50	40	50	43	30	20
Number of rocket fell in Northern Israel (mean per day)	160	160	120*	0	0	0

Table 1—IES-R psychometric properties, score, and number of soldieries hospitalized
*An estimate based on the average number of missiles that fell from 8/8–14/8 - From 14/08/06, a ceasefire had begun and the number of missile attacks dropped to 0 (IES-R = Impact of Event Scale-Revised)

	IES-R Scores							
	Intrusion		Avoidance		Hyperarousal		Total	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Number of wounded soldiers (meeting 1 to 6)	0.906*	0.013	0.720	0.107	0.852*	0.031	0.880*	0.021
Number of rockets that fell in Northern Israel (between meetings 1 to 6)	0.642	0.169	0.935**	0.006	0.788	0.063	0.850*	0.032

Table 2—Correlation table between level of exposure and IES-R scores (intrusion, avoidance, hyperarousal, total)
*p <0.05.

change in symptoms as a function of the level of external stressors. The general pattern displayed a rapid decline once the cease-fire took place, indicating that a rapid decrease in external stress translates into a rapid reduction in traumatic and post-traumatic symptoms. This is in line with the dose-response model that is the fundamental concept of PTSD criteria in the DSM,[21] as found in earlier studies.[7–9] During the third week, the change in PTSD symptoms exhibited an ascent that may be connected to the resumption of the bombing after nine missile-free days in Haifa. Although this ascent was not statistically significant, it is in-line with the dose-response model that postulates that any increase in external stressors would lead to an increase in PTSD symptoms. In addition, it appears that the IES-R sub-scales score exhibited similar tendencies during the research period (01 August–10 September). These findings support the hypothesis: the dose-response model was supported by the results, and it may be argued that the personal differences and are influenced by external factors that may have played a much more dominant role in the development of PTSD.[4–6] Higher level of wounded soldiers as well as number of landed rockets were significantly positively correlated with a higher level of IES-R sub-scale scores (intrusion, avoidance, hyperarousal) and general IES-R scores.

It seems that the dose-response model presents a critical issue in post-traumatic literature.[4–11] The dose-response model represents the DSM-IV-TR's[21] basic assumption

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that those extreme external events, and not the predisposed personality, are the prominent features in the reaction to traumatic events. This is in contrast to an earlier edition of the DSM[22] that assumed the predisposed personality is the main trigger of the reaction to the traumatic event. The present results, although limited in statistical power, indicate that the dose-response model is a relevant model for examining traumatic symptoms during prolonged stress due to traumatic exposure.

In addition to the quantitative data obtained, there is some qualitative data that captured the soldiers' personal perceptions of the situation. The soldiers' expressions during the war mainly were of surprise and anxiety. When the war ended, most of the expressions were related to the meaning of the experience they had undergone. For example, after the first week, one participant stated "I came and saw that G. (one soldier) had seen death as it was reflected in his eyes." A 40-year-old commander in the unit said, "There are two wars going on right now, one outside and one inside me." During the fourth week, one participant said, "Now I can appreciate life much more, I felt like I was fortunate to experience the war since it strengthened me…".

Limitations

The results, although significant, have some limitations. First and foremost, there is the small sample size. Although such a small sample is considered insufficient for statistical analysis and may cause some biases and issues related to statistical powers and their effect on sample size, the confidence that can be placed in the results and the generalization of the findings gives a unique advantage to this research because of the use of weekly, consecutive, repeated measures, thus giving the strength of longitudinal design to the study. No prior research has examined the dose-response model during prolonged traumatic events in this way. In such unique cases, Streiner stated that "It is worth the gamble".[23]

Conclusions

More research is needed in order to determine whether the dose-response model is the best model to explain the linear association between objective stress and PTSD symptoms. Such research should be conducted on people who are exposed to prolonged stress with variability in objective stressors that change periodically. In this case, we can replicate our preliminary results and get a further support for the dose-response model that is still considered understudied.

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