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Trauma exposure, posttraumatic stress disorder and risk for alcohol, nicotine, and marijuana dependence in Israel

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Abstract

Background—Substance dependence is more common among trauma-exposed individuals; however, most studies suggest that Posttraumatic Stress Disorder (PTSD) accounts for the link between trauma exposure (TE) and substance dependence.

Objectives—This study examined associations between TE and substance dependence (alcohol, nicotine, and marijuana), and whether PTSD accounted for this association.

Method—1,317 Jewish Israeli household residents completed in-person structured interviews assessing TE, PTSD, and substance (alcohol, nicotine, marijuana) dependence between 2007–2009. Regression analyses examined associations among TE, PTSD, and substance dependence.

Results—In the full sample, mean number of traumatic events was 2.7 ($sd=2.2$), with 83.7% experiencing at least one event. In the full sample, mean number of PTSD symptoms was 2.5 ($sd=3.4$), with 13.5% meeting PTSD diagnostic criteria. Prevalence of alcohol dependence was 13.4%; nicotine dependence 52.8%; and marijuana dependence 12.1%. Number of traumatic events was associated with increased odds of alcohol (OR=1.3; 95% CI=1.2–1.4) and nicotine (OR=1.2; 95% CI=1.1–1.3) dependence. Similarly, any traumatic event exposure was associated

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Declarations of Interest

None of the authors have financial conflicts of interest with the alcohol, tobacco, pharmaceutical, or gaming industries or with addiction recovery programs or organizations.

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with increased odds of alcohol (OR= 3.1; 95% CI= 1.6–6.0) and nicotine (OR=1.9; 95% CI=1.2–2.9) dependence. PTSD symptoms were associated with increased odds of alcohol (OR=1.2; 95% CI=1.1–1.3), nicotine (OR=1.1; 95% CI=1.1–1.2), and marijuana (OR=1.1; 95% CI=1.04–1.2) dependence; similarly, a PTSD diagnosis was associated with increased odds of alcohol (OR=3.4; 95% CI=2.1–5.5), nicotine (OR=2.2; 95% CI = 1.4–3.4), and marijuana (OR=2.6; 95% CI=1.2–5.9) dependence. PTSD symptoms accounted for a sizeable proportion of the TE effect on alcohol (46%) and nicotine dependence (31%).

Conclusion—Individuals with more traumatic events had heightened risk for alcohol and nicotine dependence, and PTSD symptoms partially accounted for this risk. However, marijuana dependence was only significantly related to PTSD symptoms. Clinicians and researchers should separately assess different types of dependence among trauma-exposed individuals both with and without PTSD symptoms.

Keywords

trauma; posttraumatic stress disorder; substance dependence; Israel

Introduction

Substance use disorders (SUDs) are highly prevalent (1–3) and associated with substantial social and economic costs. Exposure to traumatic events may increase risk for SUDs. For example, although studies with bombing victims do not all support a directional link between trauma exposure (TE) and onset of SUDs (4–6), most other adult population-based studies indicate that exposure to traumatic events [i.e., involving serious bodily injury, threat of death, or witnessing violent death or injury (7)] is associated with increased risk for SUDs (8–12). However, although motivations for use of different substances can differ (13), with few exceptions (8,12), adult population-based studies typically have examined associations between trauma exposure (TE) and any SUD, rather than examining the impact of TE on specific SUDs (9–11). Treatment-seeking samples and other special populations (e.g., adolescents) also suggest positive associations between TE and SUDs (14,15), but more information is needed on whether these findings are consistent across substances.

Associations between TE and SUDs may be impacted by posttraumatic stress disorder (PTSD), a psychobiological reaction to a traumatic event that includes intrusive recollections, avoidance/numbing, and hyperarousal symptoms (7), which is highly comorbid with SUDs (9,16). Many studies suggest that PTSD, rather than TE alone, is associated with higher prevalence of SUDs among trauma-exposed persons (reviewed in 17). For example, compared to those without PTSD, male Vietnam veterans with PTSD were more likely to meet criteria for an alcohol use disorder (AUD) (18), and male Israeli war veterans with PTSD were more likely to report any SUD (19). Individuals with PTSD perceive that different substances have different effects on their symptoms (for review see 20); therefore, relationships between TE, PTSD, and SUDs could differ by type of substance. General population studies that include both genders and that differentiate between substance-specific SUDs are needed to understand whether associations between TE and SUDs are due only to PTSD.

Despite strong linkages between PTSD and SUDs, not all studies suggest that relationships between TE and SUDs are due entirely to PTSD. For example, PTSD has been shown to only partially account for associations between childhood TE and substance use (21–23). However, these studies did not examine SUD diagnoses, and were conducted only in females. Two population-based studies found that TE was associated with different types of SUDs among individuals with and without PTSD: the first was a nationally representative US study on alcohol use disorders (8), and the second was a study from the Vietnam Era

Twin Registry on nicotine dependence (12). However, neither study considered different types of SUDs concomitantly within the same study. In the only population-based study to separately examine associations of TE and PTSD with different substance use disorders in the same study, relationships between TE, PTSD and different forms of SUD were inconsistent (24). Specifically, neither TE nor PTSD was associated with alcohol use disorders, TE was associated with slightly elevated risk for nicotine dependence, and only PTSD was associated with drug use disorders (24). However, this study was conducted in one area of the US (Detroit area) and examined different drug use disorders as a single class rather than examining substance-specific drug use disorders. Given the methodological variability across studies, inconsistencies in results on associations between TE, PTSD, and different types of SUDs are difficult to interpret. A single study of a general population sample that includes both genders, TE, PTSD, and separate indicators of substance-specific SUDs would hold methods constant across all these variables, potentially offering a clearer picture of the relationship of TE, PTSD and different SUDs.

Using data from a large Israeli household sample containing information about a broad range of TE, this study tested associations between TE, PTSD, and substance (alcohol, nicotine, marijuana) dependence, and examined whether TE is significantly associated with each type of substance dependence after accounting for PTSD. This study advances the extant research by examining associations between TE, PTSD symptoms, and various types of substance dependence within a single study that uses a mixed gender population-based sample with potentially high exposure to traumatic events.

Methods

Study procedures

Data were collected in 2007–2009 from 1,349 household residents in Israel; details are available elsewhere (25–28). The current paper is based on secondary analyses of a study designed to investigate environmental and genetic influences on alcohol-related traits; therefore, males were oversampled because drinking among Israeli women is limited (29,30). Interviewers received extensive structured training and then administered face-to-face computer-assisted interviews, after obtaining written informed consent. All procedures were approved by relevant American and Israeli Institutional Review Boards (26–28). The overall response rate was 68.9%. Quality control included field observation, reviews of recorded interviews, and telephone verification of responses.

Sample

The present analysis included 1,317 participants with complete responses to all relevant interview items. Of these, 76.4% were male; 24.4% were 21–29 years old, 34.6% were 30–44, and 41.0% were 45 or older; and 34.8% were immigrants. Monthly income was dichotomized by less than or equal to 10,000 NIS (New Israeli Shekel), ~\$2,300 in 2007), close to the average monthly household income in Israel (31), with 55.2% in the “lower” income category.

Stressful events and Posttraumatic Stress Disorder (PTSD)

Lifetime DSM-IV PTSD symptoms were assessed using the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS) (2,3,32,33), which has good test-retest reliability for PTSD assessment ($\kappa=0.64$; (34)). To operationalize DSM-IV Criterion A and assess overall trauma load, respondents were asked if they had experienced 17 types of traumatic events that were life-threatening or could have led to serious injury, including civilian trauma, combat/military activities, terrorism, and the 2006 Second Lebanon War. We created a TE count variable based on number of traumatic events reported (range, 0–12).

Respondents were assessed for PTSD symptoms based on the most stressful event experienced, following DSM-IV criteria (7). PTSD symptoms formed a scale with high internal consistency (Cronbach's $\alpha = 0.88$) and are often considered to measure an underlying latent trait (35). Therefore, similar to other studies (21,23), the PTSD variable reflected the number of symptoms endorsed for DSM-IV criteria B, C, and D (range 0–17).

Substance Use Disorders

Lifetime alcohol dependence (AD)—The AUDADIS was used to diagnose lifetime AD following DSM-IV guidelines (7) (i.e., experiencing 3 or more dependence criteria within a 12 month period). Reliability of AUDADIS alcohol diagnoses in clinical and general population samples (in the U.S. and elsewhere) ranges from very good to excellent ($\kappa=0.70$ – 0.84 ; (32,33,36–38). Analyses were conducted among lifetime drinkers, defined as ever drinking at least one alcoholic drink ($N=1,141$).

Lifetime nicotine dependence (ND)—The AUDADIS was used to diagnose lifetime ND following DSM-IV guidelines (7); however, additional nicotine-specific tolerance experiences were included to improve diagnostic validity (39). Test-retest reliability for ND is good ($\kappa=0.60$ – 0.63) (32). Analyses were carried out among lifetime smokers, defined as having smoked at least 100 cigarettes ($N=712$).

Lifetime marijuana dependence (MD)—The AUDADIS was used to diagnose lifetime MD, following DSM-IV guidelines (7), but also adding a marijuana withdrawal criterion as in DSM-5 (40). Reliability of AUDADIS marijuana dependence diagnosis is good-to-excellent ($\kappa=0.71$ – 0.78 ; (36). Analyses were conducted among lifetime users, defined as ever having used marijuana ($N=315$).

Statistical analysis

Analyses were conducted using SAS 9.2 (SAS Institute, Cary, NC). Kruskal-Wallis χ^2 statistics examined mean differences in number of traumatic events and PTSD symptoms by substance dependence status. Logistic regression tested associations between TE load (number of traumatic events) and substance dependence, and PTSD symptoms and substance dependence, controlling for demographic variables (gender, age, immigrant status, and income level). As AD and ND were related to both TE and PTSD, we tested whether relationships between TE load and AD or ND were attenuated after controlling for the effect of PTSD symptoms on AD/ND. We did this by comparing the effect of TE load on substance dependence *without* PTSD in the model (regression coefficient = τ) to the effect of TE *with* PTSD in the model (regression coefficient = τ'). A significant difference between τ and τ' ($\tau - \tau' > 0$) indicates that PTSD symptoms account for at least some of the relationship between TE and AD or ND (41). To generate empirical percentile confidence intervals (CIs) and p values for $\tau - \tau'$ since its distribution is unknown (41), we first created 1,000 bootstrapped samples. Empirical 95% CIs were then computed by ordering $\tau - \tau'$ values from the bootstrapped samples from lowest to highest; the 25th value represents the lower bound (2.5%), and the 975th value represents the upper bound (97.5%). P values reflect the percentage of bootstrapped samples with $\tau - \tau' \leq 0$ (i.e., the proportion of samples indicating no change in the TE effect with the inclusion of PTSD symptoms).

We then evaluated the percentage of the TE effect accounted for by PTSD. This percentage was calculated as follows: $([\exp(\tau) - \exp(\tau')]/[\exp(\tau) - 1]) \times 100$, where $\exp(\tau)$ was the odds ratio (OR) for the TE effect *without* PTSD symptoms in the model and $\exp(\tau')$ was the OR for the TE effect *with* PTSD symptoms in the model (28). When the ORs for the TE effect are the same whether or not PTSD symptoms were included in the regression model [i.e., $\exp(\tau) = \exp(\tau')$], this equation evaluates to 0%. When there is no remaining TE effect

when PTSD symptoms are included in the model [i.e., $\exp(\tau') = 1$], this equation evaluates to 100% (28). Empirical CIs and p values were calculated for this percentage.

To examine these relationships while accounting for potential comorbidity in outcomes, the above-described analyses were reanalyzed controlling for each of the other substance dependence types.

Sensitivity Analysis

Sensitivity analyses were conducted examining associations between TE load, PTSD symptoms, and alternative substance-related outcomes, including any AUD (alcohol abuse or dependence), any MUD (marijuana abuse or dependence), and any SUD, to allow comparison to similar studies (e.g., 19). Given the recent impetus to examine SUDs as graded variables (e.g., 42), we also analyzed severity scores (number of criteria endorsed) for AD, AUD, ND, MD, and MUD.

Secondary Analysis

Because the sample had potential for high levels of TE due to ongoing political violence and terrorism, the primary analysis focused on graded TE and PTSD variables to capture individual variability in the amount of TE and number of PTSD symptoms experienced. However, analyses also were conducted with binary variables for comparison to prior research and to provide information on these relationships from a diagnostic perspective, potentially of interest to clinicians. The binary TE variable reflected ever experiencing any traumatic event, and the binary PTSD variable reflected meeting criteria for either full PTSD based on DSM-IV criteria (7) or partial PTSD (i.e., endorsed at least 1 symptom from each of Criteria B, C, and D, and symptoms lasted at least 1 month following the traumatic event) (43). Both full and partial PTSD groups evidenced similar rates of and associations with substance dependence in preliminary analyses and thus were combined, similar to other studies (44). Logistic regression analyses with bootstrapping were used to evaluate the effect of TE *with* and *without* PTSD in the model, as described in the “*Statistical Analysis*” section above.

Results

Descriptive Statistics for Continuous Predictors

Lifetime mean number of traumatic events (TE load) in the total sample was 2.67 (s.d.=2.17). Males and older respondents (45+) reported a significantly greater mean number of traumatic events than females and those under 45, but mean number of events did not differ by immigrant status or income levels (Table 1). Mean number of PTSD symptoms in the total sample was 2.48 (s.d.=3.42). Females, older participants (45+), and immigrants endorsed significantly more PTSD symptoms on average, relative to males, younger participants, and non-immigrants; mean number of PTSD symptoms did not differ by income levels (Table 1). Histograms of the TE and PTSD count variable distributions are shown in Figure 1.

Prevalence of Trauma Types in the Sample

Table 2 shows the prevalence of types of traumatic events. The most common stressors were knowing someone who experienced a terrorist attack and direct personal exposure to the 2006 Lebanon War (ranked highly by both genders), having someone close die unexpectedly (especially for females), and participating in combat (especially for males). The worst stressors (those assessed for subsequent PTSD) identified by respondents were someone close died unexpectedly and experiencing the 2006 Lebanon War (ranked highly by both

genders), combat/military participation (especially for males), and knowing someone who was in a terrorist attack (especially for females).

Alcohol Dependence (AD)

The prevalence of lifetime AD was 13.4% among lifetime alcohol users ($n = 1,141$); individuals with AD showed higher mean number of traumatic events and PTSD symptoms (Table 1). Within the lifetime alcohol use sample ($n=1,141$), 968 (84.8%) reported any trauma exposure; among those TE individuals, mean PTSD symptoms was 2.80 ($sd=3.40$). After controlling for demographic variables, each additional traumatic event experienced increased odds of AD by 1.3, and each additional PTSD symptom increased odds of AD by 1.2 (Table 3). When PTSD symptoms were included in the regression analyses, estimates of the difference in the TE effect ($\tau-\tau'$) were significantly greater than 0 (Table 4), showing that PTSD accounted for at least part of the relationship between TE and AD. Specifically, 46.1% of the effect of TE load on AD was accounted for by PTSD symptoms (Table 4). However, trauma load increased risk for AD even after PTSD was accounted for ($OR = 1.14$, 95% $CI=1.04-1.24$; based on regression coefficient τ' in Table 4), suggesting that TE also plays a role in AD that is independent of PTSD. Results for AD were consistent when controlling for ND and MD in that TE and PTSD were related to AD; the TE effect was reduced when PTSD was included, but TE effect was still significant.

Nicotine Dependence (ND)

Prevalence of lifetime ND among lifetime smokers ($n = 712$) was 52.8%; individuals with ND showed significantly higher mean number of traumatic events and PTSD symptoms (Table 1). Within the lifetime nicotine use sample ($n=712$), 602 (94.6%) reported any trauma exposure; among those TE individuals, mean PTSD symptoms was 3.26 ($sd=3.80$). After controlling for demographic variables, each additional traumatic event experienced increased odds of ND by 1.2, and each additional PTSD symptom increased odds of ND by 1.1 (Table 3). When PTSD was included in the regression analysis of ND on TE, estimates of the difference in the TE effect ($\tau-\tau'$) were significantly greater than 0 (Table 4), showing that PTSD accounted for at least part of the relationship between TE and ND. Specifically, 30.5% of the total effect of TE was explained by PTSD symptoms (Table 4). Here, trauma load also increased risk for ND even after PTSD was included ($OR= 1.14$, 95% $CI=1.06-1.24$; based on regression coefficient τ' in Table 4), suggesting that TE plays a role in ND that is independent of PTSD. Results for ND were consistent when controlling for AD and MD in that TE and PTSD were related to ND; the TE effect was reduced when PTSD was included, but TE effect was still significant.

Marijuana Dependence (MD)

Among lifetime marijuana users ($n = 315$), prevalence of lifetime MD was 12.1%. Within the lifetime marijuana use sample ($n = 315$), 275 (87.3%) reported any trauma exposure; among those TE individuals, mean PTSD symptoms was 3.17 ($sd=3.61$). Trauma load was not associated with increased risk for MD; however, individuals with MD showed significantly greater mean PTSD symptoms (Table 1). After controlling for demographic variables, each additional PTSD symptom increased odds of MD by 1.1 (Table 3). Results for MD were consistent when controlling for AD and ND in that MD was not related to TE and was related to PTSD.

Sensitivity Analysis of additional substance-related variables

Sensitivity analyses examining additional binary and graded substance-related variables revealed that TE load and PTSD symptoms were related to all alcohol- and nicotine-related variables, and the TE load effect was reduced but still significant after accounting for PTSD

symptoms; marijuana-related variables were only related to PTSD symptoms (results available upon request).

Secondary Analysis with binary predictor variables

Although the primary analyses focused on graded TE and PTSD variables to capture variability in trauma exposure and PTSD symptoms, analyses also were conducted with binary variables for comparison to prior research and to provide information on these relationships from a diagnostic perspective. In the full sample, lifetime prevalence of trauma exposure was 83.7%; lifetime prevalence of PTSD was 13.5% (full PTSD [5.4%] and partial PTSD [8.1%]). Similar to the main results, AD was related to binary TE/PTSD, except that the percentage of the TE effect explained by PTSD was lower (24.0%; Table 3. ND was related to binary TE/PTSD, and the percentage explained by PTSD was also lower (24.6%). Finally, MD was similarly related to binary PTSD and not TE.

Discussion

Findings from this Israeli household study indicate that individuals with greater TE and PTSD symptoms were at increased risk for alcohol and nicotine dependence compared to those with less TE and PTSD symptoms. However, importantly, not all of the association between TE load and alcohol and nicotine dependence was accounted for by PTSD symptoms, suggesting that TE load had a significant effect on AD and ND after considering the effects of PTSD symptoms on these outcomes. In contrast, PTSD symptoms, but not TE load, were associated with elevated risk of MD. Despite considerable comorbidity across substance dependence types, results for one substance dependence type were not driving the results for the others as indicated by consistent findings when adjusting for the effects of the other substance dependences. For example, results for ND were similar when controlling for AD or MD such that both TE and PTSD were related to ND, and the TE effect was reduced, but remained significant, when PTSD was included in the model.

In secondary analyses examining trauma exposure and PTSD as binary variables, individuals with any trauma exposure had two to three times the odds of meeting criteria for ND and AD, respectively, while those with full or partial PTSD had two times the odds of meeting criteria for ND, nearly three times the odds of meeting criteria for MD, and three times the odds of meeting criteria for AD. These results suggest high risk for SUD for those with trauma exposure and PTSD. The odds ratios for the binary variables were larger than those for the graded variables because the effect for the former reflects the increase in odds based on the presence versus absence of trauma exposure or PTSD, while the effect of the latter reflects the increase in odds based on a one unit change in trauma exposure or PTSD symptoms. However, PTSD accounted for a smaller proportion of the relationship between TE and AD and ND (~24% for both) than PTSD symptom count accounted for in the association between TE load and AD (49.8%) and ND (37.9%). These findings indicate that the accumulation of PTSD symptoms and not merely a PTSD diagnosis may increase risk for substance dependence. Although graded PTSD symptoms accounted for a greater proportion of the TE effect on substance dependence, the general pattern of associations was consistent regardless of type of variable used.

Our findings that PTSD accounted for only a proportion of the TE effect on AD and ND are consistent with studies showing an effect of TE alone on AUDs (8) and ND (12) and those showing that PTSD partially accounts for associations between TE and substance use (21–23). Our finding that MD was associated with PTSD but not TE corroborates research revealing that PTSD alone is associated with drug use disorders (24), although we examined MD specifically rather than any drug use disorder more generally. Together, results add to the literature by examining dependence on three different substances within a single

population-based study of men and women; findings highlight the need to examine substance-specific SUDs separately rather than examining any SUD (19), as combining SUDs may mask differences in their relationships with risk factors.

MD may have demonstrated relationships with PTSD alone because individuals with PTSD may use marijuana for coping reasons (20,45,46) or to regulate emotions (47). Continued use for these reasons may increase the likelihood of becoming dependent on marijuana, especially among individuals with untreated PTSD. The finding that TE did not significantly increase risk for marijuana dependence may indicate the importance of the emotional reaction to trauma (and not trauma exposure itself) in increasing MD risk, or may be a function of limited power to detect smaller effects in the 315 participants reporting lifetime marijuana use. Future studies with larger proportions of marijuana use could determine if TE and marijuana dependence are related.

Findings should be considered within the context of study limitations. First, data were cross-sectional; longitudinal studies are needed for conclusions regarding directionality or causality. However, age-of-onset analyses indicated that approximately 75% of participants had TE and PTSD symptoms at an earlier age than their dependence symptoms onset, and between 4–8% reported that their PTSD and dependence symptoms onset at the same age. Thus, TE/PTSD occurring prior to substance dependence is most commonly reported; however, we were unable to formally incorporate age of onset into analyses because age of dependence symptom onset was only available for those diagnosed with dependence. Future longitudinal studies should include these data to confirm temporality. Second, data were based on self-report, as are most large-sample surveys of the issues addressed above. However, the use of reliable, validated measures of psychopathology lessens such concerns. Third, for theoretical reasons and ease of interpretability, the current study focused only on how PTSD affected relations between TE and various types of SUD; however, future studies should consider whether other forms of psychopathology (e.g., depression) also account for additional portions of the trauma effect. Fourth, future studies should consider other substance use constructs including age of first use and level of use, as these variables can influence the development and severity of SUD. Fifth, the relatively small proportion of women in the current sample precluded an examination of whether gender modifies pathways from TE/PTSD to SUDs. Future studies with larger proportions of women may better elucidate this question.

Several important strengths also warrant mention. All symptoms were assessed using the AUDADIS, a structured interview with good test-retest reliability in U.S. (e.g., 32–34) and international studies (36,38). Extensive training and quality control procedures were implemented to ensure proper administration of the AUDADIS. The study obtained a large sample with a good response rate. Respondents were drawn from the general population in Israel, which is an informative population in which to understand associations between TE, PTSD, and SUDs, given ongoing armed conflict in the area. This study determined the relative contributions of TE and PTSD on SUDs, which provides valuable information beyond studies that only examine the effect of TE or PTSD on SUDs. Results were strengthened by sensitivity analyses demonstrating similar relationships to additional alcohol, nicotine, and marijuana variables. The differences between results for alcohol, nicotine, and marijuana demonstrated the benefits of separately evaluating dependence for different substances.

This study adds important information to the existing literature on TE, PTSD, and SUDs, by showing that while the risk for alcohol and nicotine dependence is elevated among adults who have PTSD symptoms after experiencing trauma, TE itself also increases the risk for these disorders. This issue requires further investigation for marijuana dependence, since

findings suggested similar relationships, but sample size may have limited the ability to find significance. Clinically, these results indicate the need for vigilance regarding comorbidity in multiple types of treatment settings, including PTSD and substance disorder treatment centers, as well as the need to provide integrated treatment for both conditions. Treatment providers should also be aware that trauma-exposed individuals without PTSD have elevated alcohol and nicotine dependence rates, and thus could potentially benefit from screening and possible interventions. Furthermore, PTSD symptoms, rather than diagnoses, provided more information about increased risk for dependence, thus, providers could target treatments to particular symptoms to more effectively treat both disorders. If coping or affect regulation are motives for substance dependence among trauma-exposed patients, therapists could help patients identify and utilize other, more functional strategies to cope with these emotions. Finally, the results suggest the need to understand mechanisms at different levels (from the societal to the cellular) that lead to increases in substance dependence among those who are trauma-exposed, whether they develop PTSD or not, to guide effective treatment and prevention strategies.

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Figure 1. Distribution of number of (a) traumatic events reported (TE count) and (b) number of PTSD symptoms endorsed, showing proportion of the whole sample (N=1,317), among males (1,006), and among females (N=311).
 ■ all □ male ▤ female

Table 1

Average number of traumatic events (Trauma exposure) and PTSD symptoms by demographic group and substance dependence (N=1,317)

	Trauma exposure		PTSD	
	Mean (s.d.)	K-W χ^2	Mean (s.d.)	K-W χ^2
Demographics				
<i>Gender</i>		36.86 ^g		27.74 ^g
Male	2.87 (2.24)		2.15 (3.11)	
Female	2.02 (1.81)		3.54 (4.08)	
<i>Age</i>		7.03 ^e		15.12 ^f
20–29	2.56 (2.13)		1.92 (2.88)	
30–44	2.52 (2.14)		2.39 (3.42)	
45+	2.86 (2.22)		2.88 (3.66)	
<i>Immigrant</i>		0.12		13.37 ^f
Yes	2.65 (2.20)		2.85 (3.50)	
No	2.68 (2.16)		2.27 (3.36)	
<i>Monthly income</i>		0.05		2.45
0–10,000 NIS ^b	2.69 (2.27)		2.69 (3.67)	
10,001 NIS+	2.64 (2.16)		2.21 (3.06)	
Substance dependence				
<i>Alcohol dependence^c</i>		24.14 ^g		22.74 ^g
Yes	3.65 (2.49)		3.67 (4.20)	
No	2.62 (2.12)		2.17 (3.08)	
<i>Nicotine dependence^d</i>		18.88 ^g		25.02 ^g
Yes	3.26 (2.44)		3.33 (3.89)	
No	2.45 (2.03)		2.12 (3.33)	
<i>Marijuana dependence^e</i>		3.55		5.61 ^e

	<i>Trauma exposure</i>		<i>PTSD</i>	
	Mean (s.d.)	K-W χ^2	Mean (s.d.)	K-W χ^2
Yes	4.11 (2.81)		4.16 (4.24)	
No	3.17 (2.36)		2.57 (3.39)	

Trauma exposure reflects number of traumatic events experienced (0–12); PTSD reflects number of symptoms and D (0–17); K-W = Kruskal-Wallis χ^2 statistic

^a NIS=New Israeli Shekel; dichotomized as greater or less than 10,000 (~2,300 USD), close to the average Israel (Central Bureau of Statistics, 2011)

^b among respondents who had at least one drink, lifetime (N=1,141)

^c among respondents who had smoked at least 100 cigarettes, lifetime (N=712)

^d among respondents who ever used marijuana, lifetime (N=315)

p-values:

^e <0.05;

^f 0.01;

^g 0.0001

Table 2

Prevalence of any traumatic event

	Overall			Males			Females		
	N	Prevalence (%) in exposed group ^a	Prevalence (%) in whole set ^b	N	Prevalence (%) in exposed group ^a	Prevalence (%) in whole set ^b	N	Prevalence (%) in exposed group ^a	Prevalence (%) in whole set ^b
<i>Traumatic Event</i>									
Combat/military	449	40.7	34.1	438	51.4	43.5	11	4.4	3.5
Direct exposure to terrorist attack	255	23.1	19.4	218	25.6	21.7	37	14.9	11.9
Someone close was killed/injured in terrorist attack	534	48.5	40.6	426	49.9	42.4	108	43.4	34.7
Refugee	19	1.7	1.4	19	2.2	1.9	0	0	0
Unwanted sexual behavior	64	5.8	4.9	12	1.4	1.2	52	20.9	16.7
Violent crime victim	33	3.0	2.5	28	3.3	2.8	5	2.0	1.6
Physical assault or kidnapping	86	7.8	6.5	76	8.9	7.6	10	4.0	3.2
Serious accident	263	23.9	20.0	219	25.7	21.8	44	17.7	14.2
Life threatening illness	71	6.4	5.4	56	6.6	5.6	15	6.0	4.8
Natural disaster	141	12.8	10.7	123	14.4	12.2	18	7.2	5.8
Chemical spill	38	3.4	2.9	34	4.0	3.4	4	1.6	1.3
Neglect before age 18	48	4.4	3.6	40	4.7	4.0	8	3.2	2.6
Abuse before age 18	60	5.4	4.6	44	5.2	4.4	16	6.4	5.1
Witnessed serious injury/death	360	32.7	27.3	320	37.5	31.8	40	16.1	12.9
Someone close died unexpectedly	450	40.8	34.1	350	41.0	34.8	100	40.2	32.2
Someone close experienced significant trauma	137	12.4	10.4	110	12.9	10.9	27	10.8	8.7
Lebanon War	507	46.0	38.5	375	44.0	37.3	132	53.0	42.4
None	215	--	16.3	153	--	15.2	62	--	19.9

^a ever exposed to trauma: overall, N=1,102; males, N=853; females, N=249^b ever exposed or unexposed: overall, N=1,317; males, N=1,006; females, N=311

Association between lifetime DSM-IV substance dependence and lifetime trauma exposure or PTSD status, showing odds ratios and 95% confidence intervals^a

Table 3

Variable	form	Alcohol dependence ^b	Nicotine dependence ^c	Marijuana dependence ^d
Trauma exposure	count	1.25 (1.16–1.36) ^g	1.21 (1.12–1.30) ^g	1.15 (1.00–1.31)
	binary	3.13 (1.63–6.01) ^f	1.87 (1.22–2.87) ^e	1.75 (0.51–6.07)
PTSD	count	1.20 (1.14–1.27) ^g	1.12 (1.07–1.17) ^g	1.13 (1.04–1.23) ^e
	binary	3.43 (2.13–5.53) ^g	2.16 (1.39–3.36) ^f	2.62 (1.17–5.86) ^e

Trauma exposure count variable reflects number of traumatic events reported; range, 0–12; PTSD graded variable reflects number of symptoms for criteria B, C, and D; range = 0–17; PTSD binary variable combines full and partial PTSD

^a logistic regression, adjusted for gender, age, immigrant status, and income level

^b among respondents who had at least one drink, lifetime (N=1,141)

^c among respondents who had smoked at least 100 cigarettes, lifetime (N=712)

^d among respondents who ever used marijuana, lifetime (N=315); not adjusted for age due to lack of convergence of the model

p-values:

^e <0.05;

^f 0.001;

^g 0.0001

Table 4

Relationship between TE and substance dependence, with and without PTSD in the regression model

Variable form	PTSD not included		PTSD included		
	TE effect on dependence [τ (95% CI)] ^a	τ	TE effect on dependence [τ (95% CI)] ^a	Reduction in TE effect [τ - τ' (95% CI)] ^b	% of TE effect explained by PTSD [% (95% CI)] ^b
AD ^c	count	0.23 (0.15–0.30) ^g	0.13 (0.04–0.22) ^f	0.10 (0.06–0.14) ^g	46.1 (24.2–76.7) ^g
	binary	1.14 (0.49–1.79) ^g	0.96 (0.30–1.62) ^f	0.18 (0.09–0.28) ^g	24.0 (11.9–43.7) ^g
ND ^d	count	0.19 (0.11–0.26) ^g	0.13 (0.05–0.21) ^g	0.05 (0.02–0.09) ^g	30.5 (10.9–63.6) ^g
	binary	0.63 (0.20–1.05) ^f	0.51 (0.07–0.94) ^e	0.12 (0.04–0.20) ^g	24.6 (8.7–70.4) ^g

AD = Alcohol dependence; ND = Nicotine dependence; TE = trauma exposure; CI = confidence interval; τ count variable reflects trauma number of traumatic events reported; range 01–2; PTSD graded variable reflects number of symptoms for criteria B, C, and D; range = 0–17; PTSD binary variable combines full and partial PTSD

^alogistic regression coefficient, adjusted for all demographic variables

^bEmpirical percentile CI and p-value from 1,000 bootstrapped samples.

^camong respondents who had at least one drink, lifetime (N=1,141)

^damong respondents who had smoked at least 100 cigarettes, lifetime (N=712)

p-values:

^e <0.05;

^f 0.01;

^g 0.001