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The association between traumatic life events and psychological symptoms from a conservative, transdiagnostic perspective

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Abstract

Exposure to traumatic life events (TLEs) is strongly linked to the onset and exacerbation of an array of psychological sequelae. While studies yield minimal evidence of specificity for one disorder emerging in the aftermath of TLEs versus another, most studies do not adopt a conservative approach in controlling for multiple psychological symptoms linked to TLEs. The present study explored the association between TLEs and eight psychological constructs before and after adjusting for concurrent symptomatology in a diverse sample of 2342 undergraduates. We predicted three symptom domains would withstand conservative adjustments in their relationship to TLEs: posttraumatic stress disorder (PTSD), borderline personality disorder (BPD), and attenuated positive psychotic symptoms (APPS). Results indicated that exposure to at least one TLE, but especially four or more TLEs, was significantly associated with PTSD and BPD symptoms even after controlling for concurrent symptoms. Additionally, the association between four or more TLEs and APPS persisted despite adjusting for covariates. Findings underscore the critical role that TLE histories play in posttraumatic stress, borderline personality, and attenuated psychotic symptom expression. The relationship between TLEs and depression, cannabis and other drug use, generalized anxiety, and social anxiety disappeared after adjusting for comorbid symptoms.

Keywords

Comorbidity; Psychopathology; Depression; Anxiety; Substance use; Attenuated psychosis; Borderline personality; Posttraumatic stress

1. Introduction

The diagnostic and symptom heterogeneity linked to exposure to traumatic life events (TLEs) is vast and complex, with TLEs often facilitating, exacerbating, and maintaining the onset, course, and recurrence of psychiatric disorders, as well as comorbid psychiatric presentations (Amstadter et al., 2013; Carr et al., 2013; Cutajar et al., 2010; Green et al., 2010; Hovens et al., 2012; MacMillan et al., 2001; Scott et al., 2012). The most commonly

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investigated disorder categories among these studies include substance use, mood, and anxiety, the latter which includes posttraumatic stress disorder (PTSD) given that the identified studies were conducted prior to Diagnostic and Statistical Manual of Mental Disorders (DSM) 5 publication. While the existing studies have strong methodological foundations, they do not yield information about the main effects of TLEs to specific psychiatric outcomes since they either 1) do not report on PTSD as an independent outcome, instead grouping PTSD within the larger anxiety disorder category, or reporting on psychiatric outcomes only in the presence of comorbid PTSD or 2) do not adjust for concurrent symptomatology.

Although many studies find minimal diagnostic specificity associated with TLEs (Green et al., 2010; Matheson et al., 2012; Scott et al., 2012; van Nierop et al., 2014), these studies are limited by at least one of three factors. First, their outcomes are often dichotomous diagnostic categories rather than continuous symptom cluster endorsement, the latter which yields a more nuanced representation of the construct of interest (Fisher et al., 2013). Second, many studies do not assess for concurrent psychotic (with the exception of Matheson et al. (2012) and van Nierop et al. (2014) or personality disorder symptoms, particularly borderline personality disorder (BPD), both which have been strongly linked to a TLE history (Pietrek et al., 2013; Zhang et al., 2012; Varese et al., 2012). Lastly, the main effects between TLEs and specific psychiatric outcomes are often not tempered by conservatively adjusting for comorbid symptoms, which is critical for constructs that involve substantial comorbid psychopathology (e.g., psychosis) and because individuals with TLE histories are more likely to present with a combination of symptoms or disorders (MacMillan et al., 2001; Murphy et al., 2013; van Nierop et al., 2014). To isolate a potential main effect of TLEs on risk for psychopathology, parsing out an extensive list of covariates is imperative (Murphy et al., 2013).

It remains unclear whether TLE exposure presents a general vulnerability existent in multiple disorders or is potentially linked to specific symptom constructs (e.g., depression, psychosis). To address this uncertainty, the current study aimed to determine whether a history of TLE exposure was associated with certain psychological domains after controlling for a comprehensive set of psychological symptoms, including PTSD, BPD, attenuated positive psychotic symptoms (APPS), depression (DEP), generalized anxiety (GENANX), social anxiety (SOCANX), cannabis use, and other drug use. To our knowledge, no study assessing the independent contribution of TLEs on psychiatric outcomes have examined the role of concomitant borderline and psychotic pathology. We hypothesized that, of the eight psychological constructs measured, PTSD, BPD, and APPS would be the specific outcomes that remain significantly associated with TLEs after adjusting for comorbid symptomatology. This hypothesis was based on several factors. The first is the robust associations that have been found between TLEs and PTSD, BPD, and APPS, with the TLE-APPS link persisting despite adjusting for a host of concurrent symptoms like depression and anxiety (Sunderland et al., 2016; Pietrek et al., 2013; Zhang et al., 2012; Varese et al., 2012). Second, while several studies have concluded that TLEs are not associated with specific symptom constructs, these studies have methodological limitations. In particular, they have 1) not assessed or adjusted for borderline and psychotic-like symptoms, 2) clustered PTSD with other anxiety disorders, or 3) examined only outcomes at the clinical

disorder threshold. Lastly, although significant associations have been found between TLEs and GENANX, SOCANX, DEP, and substance use, these studies did not adjust for coexisting symptoms (Carr et al., 2013; Dube et al., 2003; Hovens et al., 2012; MacMillan et al., 2001). Therefore, it is important to further investigate whether symptom specificity exists in the aftermath of trauma.

2. Method

2.1. Participants

Participants included a socioeconomically and racially diverse sample of 2343 undergraduate students between the ages of 18 and 35 from a large urban university who were recruited across multiple disciplines via an online recruitment website. The study was approved by the university's Institutional Review Board and informed consent was obtained from all participants, who received course credit for their participation. Following informed consent, participants were directed to a laboratory computer where questionnaires were individually administered.

2.2. Measures

Traumatic life events exposure was evaluated with the 17-item Life Events Checklist (Gray et al., 2004). For the present study only responses of "happened to me" and "witnessed it" (the latter only for items where "happened to me" was not a viable option, such as sudden, violent death) were counted. Only 16 TLEs were assessed, as the "other" TLE category was excluded. This questionnaire has been shown to have good convergent validity with well-established measures of trauma histories, and also has been found to have moderate temporal stability (Gray et al., 2004). The frequency of attenuated (i.e., less frequent, severe, distressing or convincing) positive psychotic symptoms (APPS) in the past month while not under the influence of drugs, alcohol, or other medications, was measured with the 45-item positive symptom domain of the Prodromal Questionnaire (Loewy et al., 2007). The PQ has been found to demonstrate moderate concurrent validity, strong sensitivity, and moderate specificity with other semi-structured interviews that assess for psychosis (Kline et al., 2012; Miller et al., 2002). The depression dimension was measured with the brief version of the Center for Epidemiologic Studies-Depression Scale, which measures the presence and severity of depressive symptoms in the past week (Radloff, 1977). This scale has been found to be reliable and valid (Radloff, 1977; Roberts et al., 1989). Trait anxiety was assessed with the State Trait Anxiety Inventory Trait Form Anxiety Subscale; specifically, a version that excludes items that load predominantly on the depression factor (Bieling et al., 1998; Spielberger et al., 1983). The 20-item Social Phobia Scale assessed for the presence of anxiety symptoms associated with social performance on diverse tasks (Mattick and Clarke, 1998). Both anxiety scales have been found to demonstrate good construct, discriminant, and convergent validity, as well as test-retest reliability (Mattick and Clarke, 1998; Rule and Traver, 1983; Smeets et al., 1997; Spielberger et al., 1983). The 17-item PTSD Checklist-Civilian Version measured the presence and distress level of PTSD symptoms and has been found to have strong validity and reliability (Conybeare et al., 2012; McDonald and Calhoun, 2010). The McLean Screening Instrument for Borderline Personality Disorder examined BPD symptoms based on 10 true-false items derived from DSM-IV criteria, and

has yielded good sensitivity and specificity (Zanarini et al., 2003). Substance use was assessed via the Drug Use Frequency Measure, which measures the frequency of use of various substances in the past three months on a scale ranging from “never” to “daily” (O’Farrell et al., 2003). This scale has been established to have adequate reliability and validity (O’Farrell et al., 2003). Cannabis and other drug use (i.e., amphetamines, opioids/heroin, and hallucinogens) was dichotomized into a “high” versus “low” use category based on a previous study using the same sample (Reeves et al., 2014).

2.3. Statistical analysis

Eighteen participants were removed from analyses since their age (> 35) was beyond the typical age of onset for schizophrenia spectrum disorders (American Psychiatric Association, 2013) and more than four standard deviations above the mean sample age. Continuous dependent variables were examined for normality based on visual inspection and skewness and kurtosis values. Bivariate analyses were used to determine whether significant differences existed among the independent and dependent variables (chi-square when both variables were dichotomous, ANOVAs when there was one continuous and one dichotomous variable, and Pearson correlations when both variables were continuous). Age and gender also were tested as potential covariates and included in models if significantly related to main independent (i.e., TLE variables) and dependent variables.

ANOVA was used to test the independent relation between TLEs and the six continuous psychological symptom variables. Logistic regression was used to test the independent relation between TLEs and the two substance use variables. To determine the strength of the relationship between TLE and the psychological symptom outcome variables, ANCOVA and logistic regressions were repeated, adjusting for all other comorbid symptoms. All models were conducted separately for Any TLE versus No TLE and four or more (4+) TLE versus No TLE. The latter category was created due to previous findings in a similar sample that 1) 4+ TLEs led to significantly higher APPS compared to individuals endorsing any, one, two, or three TLEs and that 2) the relationship between TLEs and APPS appears to plateau after four TLEs, suggesting that additional TLEs beyond four may not have additive or multiplicative influences in increasing risk for APPS (Gibson et al., 2014). The 4+ TLE threshold has also been associated with other negative outcomes, such as increased number of psychiatric diagnoses and risk for substance use, depression, and PTSD (Dube et al., 2003; Ippen et al., 2011; Putnam et al., 2013). Collinearity of models was tested by assessing for more conservative variance inflation factor (VIF) values (above 5.0, see Barrowclough et al., 2011) than the typical VIF of 10 rule of thumb (Cohen et al., 2003; Nachtsheim et al., 2004). To reduce the possibility of Type I error, Bonferroni corrected p values were used, such that $p < 0.05$ was divided by 8 (p=0.0063), which represents the number of models tested within each hypothesis (e.g., all of the unadjusted models for Any TLE versus No TLE). Odds ratios and Cohen’s d (0.80, 0.50, and 0.20 for large, medium, and small, respectively) were used as measures of effect size (Cohen, 1988). All tests were two-tailed. Data were analyzed using SPSS Statistics Version 22 software (IBM Corp, New York).

3. Results

Demographic and clinical characteristics are presented in Table 1. Given the positively skewed distribution of the continuous psychological symptom variables, each were log transformed ($\log_{10}$ +1) and were used in models when they represented the dependent variable. Age was not significantly related to any of the psychological symptom variables (*p* values > 0.06) and gender was not related to the TLE variables (*p* values > 0.47); therefore neither were controlled for in models.

Table 2 provides ANOVA, ANCOVA, and logistic regression results for the basic TLE and psychological symptom relationship before and after adjusting for comorbid psychopathology, as well as associated effect sizes. The continuous psychological symptom variables did not appear to be highly collinear given their low VIF values (VIF_{max}=2.50). Results suggest BPD, PTSD, and APPS were the only psychological constructs to survive conservative covariate adjustments and Bonferroni corrections in their association with trauma (APPS only with 4+ TLEs). Of note is that the models that remained significant yielded small to medium effect sizes. The relationships between TLEs and DEP, GENANX, SOCANX, and both cannabis and other drug use disappeared after adjusting for comorbid psychopathology and/or Bonferroni corrections.

4. Discussion

This study investigated whether a history of TLE exposure is associated with certain psychological symptoms once a broad range of symptoms (that have been repeatedly associated with trauma exposure) are controlled. We found that the only constructs to remain significantly associated with TLEs were PTSD, BPD, and APPS, the latter only in the context of a history of 4+ TLEs. These findings are consistent with previous reports of particularly robust associations between TLEs and BPD (Pietrek et al., 2013), as well as PTSD and APPS (Matheson et al., 2012; Varese et al., 2012). However, our findings challenge other studies regarding the lack of specificity between TLEs and psychiatric symptoms (Green et al., 2010; Matheson et al., 2012; Scott et al., 2012; van Nierop et al., 2014) given that our study addressed two methodological approaches that, to our knowledge, no other study has taken the conservative approach of jointly adopting: investigating psychotic, posttraumatic stress, and borderline personality symptoms independently, as well as adjusting associations for concurrent symptoms. Our results also indicate that the TLE-depression, TLE-anxiety (generalized and social), and TLE-substance use associations were no longer significant when concurrent symptoms were accounted for, which suggests that these three psychiatric outcomes may be due to an admixture of other symptoms that surface post-trauma (van Nierop et al., 2014). Therefore, it appears that TLE exposure is linked to specific symptom constructs and may not necessarily be an underlying general vulnerability factor existent in a vast array of psychological disorders.

There are several noteworthy limitations to this study. The main limitation of our study is generalizability. The current sample was non-clinical, and thus, endorsing less psychopathology than clinical samples, which restricts our ability to generalize our conclusions to a sample with more severe symptom presentations. Although we collected

information about whether participants were in current treatment in the past month (see Table 1) this does not directly address the severity of their symptoms. Indeed, 11.40% of individuals endorsed being in treatment over the past month, although we only know that they were in treatment currently, not why they might have been in treatment (e.g., distress related to APPS or another psychological domain, or both). Consequently, we did not remove these participants in our analyses (although supplementary analyses controlling for treatment status did not change the findings; data available upon request). As a result, it is difficult to extend the findings to individuals whose symptoms exceed clinical thresholds. Thus, replicating these findings in general psychiatric samples would prove useful. While our measures have been found to be psychometrically stable among clinical samples, it is possible that treatment-seeking samples are more likely to endorse a TLE history, thereby increasing the mean scores on the measures of psychopathology across the board. Relatedly, the lower percentage of males in our study restricts the generalizability of our findings; however, there were over 600 males in our sample and gender was not related to the TLE variables.

Another limitation is that the nature of TLE assessment was subjective and retrospective, and as a result, recall and reporting bias may have influenced results. Further, information on the timing, sequence, and severity of TLE exposure was not assessed, each which could impact symptom presentation. Nevertheless, several studies find that retrospective and prospective TLE reporting is stable across time, aligns with corroborating reports, and yields similar rates of prevalence and clinical symptoms (Fisher et al., 2011; Scott et al., 2012). Additionally, the cross-sectional nature of the study prevents conclusions about the directionality of the results. However, several longitudinal studies suggest that TLEs often precede psychiatric symptom or disorder development (for a review, see Carr et al., 2013). A final limitation is that our measures were based on self-report and would ideally be corroborated with interview data (Kessler et al., 1997). Nonetheless, our measures were carefully selected for their robust psychometric properties (e.g., good concurrent validity with structured or semi-structured interviews that assess the same information), breadth of use across clinical and general populations, and associations with biological constructs (e.g., Furmark et al., 2002; Lang et al., 2005).

Strengths of the present study include the large and diverse nature of our sample, which enhances generalizability, as well as the comprehensive yet conservative methodological nature of the study. Specifically, the clinical scope was broad, including such clusters as psychotic and borderline personality, neither which have been investigated in conjunction with one another in relation to TLEs nor with other psychiatric outcomes (e.g., depression, substance use). Further, the findings of this study are not likely to be inflated given that we adjusted all analyses for wide-ranging concomitant psychopathology.

This study addresses recent public health calls (e.g., the National Institute of Mental Health's Research Domain Criteria [RDoC] project) to shift from discrete categorization of mental disorders to a continuum conceptualization, with the goal of evaluating constructs that span diagnostic categories and underscoring specificity by examining how a risk factor for multiple disorders (e.g., TLEs) might specifically lead to certain sequelae (e.g., borderline personality versus depressive symptoms; Cuthbert and Insel, 2013). Establishing

specificity has the potential to allow for more nuanced trauma prevention and treatment efforts, such as targeting emotion regulation given the strong link with borderline personality symptoms. It would be interesting for future studies to examine the potential thematic nature of the TLEs the individual experienced (e.g., comprised of more interpersonal, gruesome, and/or invalidating content), which is likely to have implications for symptom expression and treatment. For example, exploring TLEs that are more chronic or invalidating in nature may have affected the result of our study, such that BPD symptoms may have been the only outcome to withstand adjustments for concurrent psychopathology. Although treatment efforts often emphasize creating safe, trusting, validating environments, these non-specific therapeutic factors may be even more vital for those with TLE histories given that these three aspects are often the most compromised elements of those presenting with borderline, posttraumatic stress, and attenuated psychotic symptomatology (as opposed to other psychological constructs). More generally, trauma prevention programs are all the more warranted and likely to have far-reaching public mental health implications given the vast array of symptoms that can present in the aftermath of TLE exposure.

In conclusion, our study underscores three important findings that add to the literature on the transdiagnostic implications of TLE exposure. First, we established robust associations between TLEs and PTSD, BPD, and APPS. The novelty of this study is that we not only adjusted for seven general psychopathology covariates, but also that two of these covariates were psychotic-like and borderline personality symptoms, neither of which have been assessed in conjunction with one another. Further, few studies independently consider the mediating role of PTSD as this study has (Sideli et al., 2012). Second, our study provides support for the clinical significance of the 4+ TLE threshold across various disorders, as found in several other studies (Dube et al., 2003; Gibson et al., 2014; Ippen et al., 2011; Putnam et al., 2013). Finally, our results suggest that the relationships found in previous studies between TLEs and generalized anxiety, social anxiety, depression, and substance use may be contingent on other psychological experiences, such as posttraumatic stress or borderline personality symptoms, as well as attenuated forms of psychosis. Future studies that are likely to prove useful include those that consider how family psychiatric history, particularly for psychosis, might influence the relationship between TLE and associated symptoms. It will also be critical for future research to examine the impact of TLE exposure on general psychopathology while removing the effect of an exhaustive list of covariates across several time points, and testing plausible transdiagnostic mechanisms (e.g., emotion regulation, attribution styles) that account for why an individual may go on to develop a certain clinical presentation (e.g., BPD) in the aftermath of TLE exposure versus another presentation (e.g., APPS).

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Table 1

Participant demographic and clinical characteristics.

Demographics	Overall sample (N=2342)
Male, n (%)	630 (26.90)
Age (years), mean (SD) [range]	20.57 (2.42) [17–35]
Race, n (%)	
Non-Hispanic White	1360 (58.10)
African-American/African	304 (13.00)
Asian/Pacific Islander	304 (13.00)
Hispanic/Latino	108 (4.60)
Multiracial	106 (4.50)
Other	160 (6.80)
Clinical characteristics	
Total number of TLEs endorsed, mean (SD) [range]	2.10 (2.02) [0–16]
Any TLE, n, %	1840 (78.60)
0 TLEs, n, %	502 (21.40)
4+ TLEs, n, %	446 (19.00)
% Seeking treatment, n, %*	267 (11.40)
APPS, mean (SD) [range]	8.89 (7.18) [0–40]
BPD, mean (SD) [range]	2.60 (2.46) [0–10]
DEP, mean (SD) [range]	7.52 (5.07) [0–28]
GENANX, mean (SD) [range]	11.96 (4.46) [7–28]
PTSD, mean (SD) [range]	12.55 (11.71) [0–68]
SOCANX, mean (SD) [range]	13.22 (12.01) [0–73]
Cannabis use, n (%)	317 (13.50)
Other drug use, n (%)	44 (1.90)

TLEs=Traumatic Life Events; APPS=Attenuated Positive Psychotic Symptoms; BPD=Borderline Personality Disorder Symptoms; DEP=Depressive Symptoms; GEN-ANX=Generalized Anxiety Symptoms; PTSD=Posttraumatic Stress Disorder Symptoms; SOCANX=Social Anxiety Symptoms.

*=The percentage of individuals that endorsed receiving or seeking out counseling or mental health services for emotional/psychological difficulties in the past month.

Table 2

Associations between traumatic life events and psychological symptoms before and after adjusting for comorbid symptomatology.

Psychological symptom construct	Any TLE vs. No TLE F and p value	Cohen's d	4+ TLE vs. No TLE F and p value	Cohen's d
APPS	34.75, $p < 0.0001$	0.30	76.65, $p < 0.0001$	0.56
Adjusted APPS	2.61, $p=0.11$	0.09	**9.81**, p=**0.002**	**0.25**
DEP	30.44 $p < 0.0001$	0.28	67.40, $p < 0.0001$	0.54
Adjusted DEP	0.37, $p=0.54$	0.03	2.46, $p=0.12$	0.13
SOCANX	11.29, $p=0.001$	0.17	13.40, $p < 0.001$	0.24
Adjusted SOCANX	0.47, $p=0.50$	0.04	6.65, $p=0.01$	0.20
GENANX	22.77, $p < 0.0001$	0.24	55.12, $p < 0.0001$	0.48
Adjusted GENANX	0.01, $p=0.91$	0.00	0.58, $p=0.45$	0.06
BPD	69.17, $p < 0.0001$	0.47	131.21, $p < 0.0001$	0.83
Adjusted BPD	**25.44**, p < **0.0001**	**0.29**	**27.94**, p < **0.0001**	**0.42**
PTSD	59.03, $p < 0.0001$	0.43	126.27, $p < 0.0001$	0.81
Adjusted PTSD	**17.70**, p < **0.0001**	**0.24**	**28.41**, p < **0.0001**	**0.42**
Psychological symptom construct	**Any TLE vs. No TLE unstandardized B value and p value**	**Odds Ratio**	**4+ TLE vs. No TLE unstandardized B value and p value**	**Odds ratio**
Other drug use	0.55, $p=0.21$	1.74	1.12, $p=0.02$	3.07
Adjusted other drug use	0.11, $p=0.82$	1.12	0.40, $p=0.53$	1.50
Cannabis use	0.35, $p=0.03$	1.42	0.60, $p < 0.01$	1.82
Adjusted cannabis use	0.17, $p=0.36$	1.19	0.31, $p=0.19$	1.37

Note: Models that survive conservative adjustment for comorbid psychopathology and for Bonferroni corrections (new p value comparison=0.0063) are bolded; TLEs=Traumatic Life Events; APPS=Attenuated Positive Psychotic Symptoms; BPD=Borderline Personality Disorder Symptoms; DEP=Depressive Symptoms; GENANX=Generalized Anxiety Symptoms; PTSD=Posttraumatic Stress Disorder Symptoms; SOCANX=Social Anxiety Symptoms.