

Assessing the consequences of childhood trauma on behavioral issues and mental health outcomes

Edited by

Myriam Verena Thoma, Shauna Ledean Rohner and Jan Hölzge

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Assessing the consequences of childhood trauma on behavioral issues and mental health outcomes

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Editorial: Assessing the consequences of childhood trauma on behavioral issues and mental health outcomes

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childhood trauma, mental health, behavioral issues, psychosocial adjustment, lifespan impact

Editorial on the Research Topic

Assessing the consequences of childhood trauma on behavioral issues and mental health outcomes

Introduction

Childhood trauma is a common and global phenomenon (1). Multiple reports have demonstrated a significant relationship between childhood trauma, detrimental mental and physical health outcomes, behavioral issues, and psychosocial maladjustment (2). Given its widespread prevalence and harmful health consequences, childhood trauma is a major public health concern. This Research Topic aimed to enhance the understanding of the relationship between childhood trauma and various health outcomes across the life span and in different countries around the globe. Thus, the included papers investigated links between childhood trauma and health outcomes, with seven in China (Chen; Goh et al.; Li et al.; Huang, Yuan et al.; Huang, Song et al.; Shi et al.; Xie et al.), four in Germany (Kampling et al.; Petersen et al.; Schulz et al.; Weitkämper et al.), and one each in Brazil (Muniz Magalhães et al.), Italy (Rossi et al.), and Switzerland (Lau et al.). In addition, this Research Topic contains one conceptual framework developed in United States (Cruz et al.).

The following papers addressed the relationships between childhood trauma and various mood and anxiety outcomes. Huang, Song et al. explored how Qi-stagnation constitution (QSC; unbalanced constitution due to long-term emotional dysfunction and stagnation of Qi movement) and emotion regulation affect the relationship between childhood maltreatment and depressive symptoms. Results revealed a mediating role of QSC between childhood maltreatment and depressive symptoms

and a moderating effect of emotion dysregulation on the association between QSC and depressive symptoms. [Li et al.](#) investigated if the social comparison emotions of benign and malicious envy can explain the relationship between child maltreatment and depression and anxiety. While malicious envy increased the detrimental effect of child maltreatment on depression and anxiety, benign envy attenuated these effects. [Muniz Magalhães et al.](#) analyzed if the experience of childhood sexual abuse was linked to a reduced effect of adjunctive subcutaneous esketamine for the treatment of depression in outpatients who showed resistance to conventional antidepressants. The authors found that childhood sexual abuse might not attenuate the effect of esketamine on depression in this sample, providing evidence for an alternative treatment for otherwise treatment-resistant depressive patients. [Petersen et al.](#) investigated the potential interaction of adverse childhood experiences (ACEs), depression, and economic burdens. Results show that a higher number of ACEs was linked to more depressive symptoms. Individuals who had experienced four or more ACEs showed the highest number of depressive symptoms. Moreover, depression acted as a moderator by increasing economic burden. [Shi et al.](#) assessed underlying pathways of the relationship between childhood trauma and the fear of missing out (FOMO). Their findings show that childhood trauma was positively associated with FOMO. Furthermore, the results indicate three mediating pathways on this relationship through neuroticism and social anxiety, showing a sequential mediation effect of these two constructs.

The next group of papers investigated the relationship between ACEs and outcomes specifically associated with (developmental) trauma. [Cruz et al.](#) discuss recent research on developmental trauma (disorder) and implications for research and practice. The authors also shed light on different risks regarding health and wellbeing for those affected by developmental trauma. Developmental trauma may affect attachment, worldview assumptions, self-perception, and emotion regulation, as well various physical and mental health disorders. The authors highlight the importance of the correct diagnostic process, clinical assessment, and treatment methods for those affected by developmental trauma disorder. [Kampling et al.](#) examined the mediating role of personality functioning and epistemic trust in the relationship between ACEs and posttraumatic stress disorder (PTSD) and complex (C)PTSD. Personality functioning partially mediated the relationship between ACEs and PTSD/CPTSD. When epistemic trust was included as a predictor for personality functioning, the explained variance of personality functioning increased, compared to the inclusion of ACEs as a single predictor. [Rossi et al.](#) assessed the factor and symptom structure of the Italian version of the International Trauma Questionnaire (ITQ), which measures (C)PTSD symptoms. Findings confirm the factorial validity of the ITQ and support a differentiation between symptoms of PTSD and the three CPTSD symptoms.

The following group of papers investigated various relationships between ACEs and schizophrenia spectrum disorder (SSD). [Lau et al.](#) examined whether child maltreatment in Swiss offender patients with SDD could explain the extent of offending behavior, psychopathology, and treatment success. Patients with SDD and no child maltreatment experiences showed the highest levels of psychopathology and violent offending in the past and were most likely to show criminal behavior in the future. [Weitkämper et al.](#) assessed prevalence rates of common types of childhood maltreatment in individuals with a primary diagnosis of SSD. While they found generally high rates of childhood maltreatment in individuals with SSD, the prevalence rates for physical abuse and neglect and emotional abuse varied depending on the cut-off thresholds applied.

A last group of studies examined the relationship between ACEs and survivors' behavioral problems and harmful behaviors directed toward themselves or others. The study by [Chen](#) found strong associations between ACEs and behavioral problems (e.g., hyperactivity, prosocial problems). An investigation of subgroup differences revealed that males, rural children, and children of mothers with lower education levels were more likely to have been exposed to multiple types of ACEs. [Goh et al.](#) conducted a group comparison of individuals convicted for homicide with a non-offending group to investigate if the level of plasma oxytocin could explain the link between childhood trauma and overt aggression. While childhood trauma was negatively associated with plasma oxytocin and positively associated with aggression in both groups, plasma oxytocin was only significantly associated with aggression in the offenders group. [Huang, Yuan et al.](#) examined the relationship between childhood trauma and the age of first-time drug use. Younger age of first-time drug use among methamphetamine-dependent patients was linked to more severe childhood trauma, particularly physical and emotional abuse. The results further suggest that a detrimental family environment (e.g., high levels of family conflict and independence), was linked to more severe childhood trauma. [Xie et al.](#) investigated if the positive link between child maltreatment and suicidal ideation, planning, and attempts varies by sex; and whether these sex differences can be explained by biological rhythm disorder. The authors found that adolescents with higher levels of biological rhythm disorder and child maltreatment report significantly more suicidal behavior. The extent of the biological rhythm disorder mainly played a significant role for suicidal behaviors in females.

Finally, the study by [Schulz et al.](#) shed light on underlying socio-political mechanisms of ACEs by assessing ACE frequencies in individuals who grew up in East or West Germany or abroad. Using two representative samples, they found significantly more ACEs reported by those who grew up abroad, with the lowest rates of ACEs reported by those who grew up in East Germany. They also identified significant age cohort and gender effects.

Conclusion

This Research Topic highlights recent findings on childhood trauma and various health outcomes across the lifespan and in several countries around the globe. The selected papers help to enhance the awareness of the detrimental link between childhood trauma and various mood and anxiety disorders, outcomes specifically associated with (developmental) stress (disorders), schizophrenia spectrum disorders, behavioral problems, as well as harmful behaviors directed toward themselves or others. These papers have also elucidated various potentially modifiable points of intervention to help diminish these detrimental health consequences of childhood trauma. In order to increase the understanding of the link between childhood trauma and detrimental health outcomes, it appears to be necessary to consider various socio-demographic and person-related factors, as well as aspects of the child-rearing environment, including the wider socio-political context. We believe that this Research Topic provides an up-to-date overview of some of the latest findings of the global and common risk factor that is “childhood trauma” and further advances the understanding of its detrimental health consequences.

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All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Childhood Maltreatment, Psychopathology, and Offending Behavior in Patients With Schizophrenia: A Latent Class Analysis Evidencing Disparities in Inpatient Treatment Outcome

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Background: Extant research has provided evidence for disparities between patients with schizophrenia spectrum disorder (SSD) who have and have not experienced childhood maltreatment (CM) in terms of treatment outcome, psychopathology and their propensity to engage in offending behavior. However, research addressing all phenomena is scarce.

Objective: The current study aims to explore differences between offender patients with SSD and CM and those with SSD and no CM in terms of their offending, psychopathology at different points in time and treatment outcome.

Method: In the present explorative study, latent class analysis was used to analyze differences between 197 offender patients with SSD and CM and 173 offender patients with SSD and no CM, who were admitted to forensic psychiatric inpatient treatment between 1982 and 2016 in Switzerland.

Results: Three distinct homogenous classes of patients were identified, two of which were probable to have experienced significant CM. One third of patients with SSD and CM were probable to benefit from inpatient treatment, even surpassing results observable in the group without CM, whereas the other group with SSD and CM was probable to benefit less. Patients with SSD and no CM displayed more psychopathology at first diagnosis and prior to their index offense. Interclass differences in offending behavior were minimal.

Conclusions: Offender patients with SSD and CM differ not only from offender patients with SSD and no CM, but also amongst themselves. While some with SSD and CM experience a remission in psychopathology and improve their prognosis for future offending behavior, others do not. Directions for future research on SSD and CM are discussed.

Keywords: latent class analysis, schizophrenia, childhood maltreatment, violence, offending behavior, trauma

INTRODUCTION

Patients with schizophrenia spectrum disorders (SSD) and offending behavior are a significant population in forensic psychiatry. Evidence suggests that the rate of offending behavior (i.e., illegal violent and non-violent aggression against others) may be twice as high in patients with SSD, in comparison to the overall population, even if age, substance use and socio-economic factors are controlled for (1–3). Furthermore, offending behavior is nine times higher in patients with SSD and substance use as a comorbidity and 19.5 times as high for homicide or attempted homicide (1).

Among the numerous studies on the possible underlying reasons for this association, childhood maltreatment (CM) has been recurrently identified to at least double the odds for both, substance use and offending behavior in patients with SSD (4). CM includes sexual abuse (i.e., sexual contact between child and adult), physical abuse (i.e., bodily assault), emotional abuse (i.e., verbal assaults, humiliation), emotional neglect (i.e., failure of caregivers to provide for basic emotional and psychological needs) and physical neglect (i.e., failure of caregivers to provide for basic bodily needs such as food or shelter) (5–8). While CM might be seen as an unspecific risk factor for various psychiatric diseases (9, 10), some evidence revealed a link between SSD and specific types of CM such as emotional abuse (6, 8) or emotional neglect (7, 9, 10) compared to other psychiatric diseases. Similarly, some research has linked physical abuse to homicide (11) and offending in patients with SSD (12).

Further research revealed that specific types of CM are linked to psychopathology in SSD without including the role of offending behavior. For example, drawing on network analysis, all 5 scales of the Childhood Trauma Questionnaire-Short Form were linked to general psychopathology defined in the Positive and Negative Syndrome Scale (PANSS), which again linked to positive and negative symptoms in the PANSS (7). This means, for instance, Isvoranu et al. linked physical abuse to grandiosity, excitement and hostility via poor impulse control (7). Similarly, physical abuse was connected to hallucinations, delusions and paranoia via somatic concern and unusual thought content. Finally, in the same study, physical neglect was linked to blunted affect, lack of spontaneity and flow of conversation via motor retardation. Such results seem particularly relevant for efforts aiming to optimize treatment outcomes. Especially, since another recent systematic review and meta-analysis reported treatment outcomes to be poorer in SSD when there was a history of CM (13). Odds ratios for poorer treatment outcomes in patients with CM and SSD ranged between 2.35 [CI 1.05–5.27; (14)] and 6.80 [CI 1.66–27.86; (15)].

In summary, studies have shown that specific types of CM might play an important role for offending behavior and psychopathology in SSD. However, the (inter-)relations between CM, offending behavior, and psychopathology in SSD are not sufficiently clear. A more comprehensive analysis, which enlightens the complex interaction between subtypes

of CM, psychopathology, and offending behavior in SSD, was recommended in a recent review and meta-analysis on the topic (4). This might allow more targeted preventive efforts of CM, SSD and offending behavior. As suggested by another recent meta-analysis indicating that patients with psychotic disorders and CM (regardless of violent behavior) experience poorer treatment outcomes than patients with psychosis alone (13), the effect of CM on treatment of SSD should be further evaluated in a naturalistic clinical setting in light of the presence or absence of CM.

The present study aims to identify subgroups of patients with SSD based on treatment outcome and the presence of various patient characteristics, such as the specific types of CM, psychopathology, and types of violent and non-violent offending. We were particularly interested in whether or not patients with offending behavior and SSD with and without CM are distinct groups. Further, using an exploratory approach, we investigated whether a particular subtype of CM is more prone to more severe offending or poorer treatment outcome in SSD. Using latent class analysis (LCA), all given variables were explored without prior preconceptions (i.e., preconceived classification of variables into dependent and independent variables). This allows for a more explorative and less biased interpretation of the data set.

MATERIALS AND METHODS

Source of Data and Preliminary Processing

Data on CM, symptoms of SSD and criminal behavior were collected from 370 offender patients with SSD in inpatient treatment at the Center for Inpatient Forensic Therapy at the Zurich University Hospital of Psychiatry between 1982 and 2016 [with 296 cases being treated after 2000, $n = 339$ (91.6%) male, mean age of $M = 34.1$, $SD = 10.2$, also see **Table 1**]. Data collection was done via retrospective file analysis approved by the Zurich Cantonal Ethics Committee (Ref.-No. KEK-ZH-NR 2014-0480). One hundred seventy-three of these 370 offender patients with SSD had no record of CM, while 197 had experienced one or more of the specified types of CM (emotional or physical neglect, emotional or physical abuse, sexual abuse). Standard treatment of offender patients at this forensic psychiatric hospital include antipsychotic and other medication, psychotherapeutic (mostly cognitive behavioral) interventions, occupational therapy and other social support. File review was executed by a trained psychiatrist with 10% also being coded by a second trained independent rater to ensure inter-rater reliability (Cohens's Kappa of 0.78). Both raters employed directed qualitative content analysis (16) with an objective coding protocol based on an extended set of criteria by Seifert and Leygraf (17–19) and additional parameters adopted from relevant literature. Diagnosis of SSD was based on both the international classification of diseases (ICD) (20) and diagnostic and statistical manual (DSM) (21) of psychiatric disorders. All files examined in the present study contained psychiatric and somatic anamneses, past and present psychiatric inpatient and outpatient reports, legally binding police reports, testimonies in a court of law, court proceedings, reports from social workers, and biannual reports from the nursing and care staff. Due to the significant legal

Abbreviations: CM, childhood maltreatment; LCA, latent class analysis; SSD, schizophrenia spectrum disorder.

consequences of all this documented material with insufficiencies being challenged by various legal stakeholders, its quality can be considered to be high in Switzerland.

Measures for Subsequent Data Analysis

All variables analyzed in this study are presented in the **Supplementary Materials**. Childhood was defined according to Swiss law to last from birth until the completion of 18 years of age. CM was defined as to include emotional and physical neglect, emotional and physical abuse and sexual abuse according to definitions provided by the short form of the Childhood Trauma Questionnaire (CTQ-SF) (5) and was rated as being absent or present during file analysis. In addition, the observation of domestic violence during childhood was recorded as absent or present. Before and after forensic psychiatric inpatient treatment, symptoms of SSD were assessed based on all categories of the positive and negative syndrome scale (PANSS) (22) in terms of being absent, being discretely present, or being distinctly present. This data served for computing change in psychopathology during inpatient treatment. An adoption of the CTQ-SF and PANSS for coding seemed adequate, since symptoms of CM and psychopathology were recorded by licensed psychiatrists and clinical psychologists during inpatient treatment with high requirements in professional merit. As a limitation, it may be argued that both the CTQ-SF and the PANSS did not become a standard instrument of psychopathological assessment until after 2003 and 1987, respectively. Psychopathological symptoms before admission to forensic inpatient treatment (at first diagnosis of SSD and in the 12 months prior to the index offense) were coded in broader psychopathological categories also based on the PANSS (see **Supplementary Materials**). This adjustment was adopted because psychopathology prior to admission to forensic psychiatric inpatient treatment may have been recorded by diagnosing physicians not fully trained in psychiatry in some instances. Previous and index offenses were coded based on common categories of severity. Future prognosis for release from forensic detainment and probability for further criminal behavior was coded based on the last available interdisciplinary assessment of offender patients, which can be expected to be based on the utmost diligence due to the associated legal consequences. These measures were included as a proxy for social functioning of offender patients at the end of inpatient forensic psychiatric treatment as estimated by interdisciplinary professionals. For descriptive statistics, psychiatric medication during forensic inpatient treatment was assessed, including the cumulative daily olanzapine equivalent of all prescribed antipsychotic medication, which was derived by converting dosages based on the classical weighted mean dose method (23), the minimum effective dose method (24) or international experts' consensus (25) in order of availability of conversion factors.

Statistical Analysis

Latent class analysis (LCA) was used to group offender patients into homogenous subgroups based on the parameters explored, thus creating a new multidimensional discrete latent

variable (the "latent" class or subgroup) based on a cross-classification of the observed parameters (26). Based on extant literature, the hypothesis was that offender patients with SSD and CM (in comparison to those with SSD and no CM) would compose a distinct homogenous class with characteristic parameter values (e.g., higher prevalence of all types of CM, certain symptoms of SSD, specific treatment outcome, etc.). In contrast to regression analysis, LCA holds the advantage that groups need not be defined in advance, thus allowing a more explorative and unbiased interpretation of the data set.

Latent class analysis (LCA) was conducted with the *poLCA* package implemented in R Studio version 1.1.383. Designed for the analysis of multivariate categorical data, LCA categorizes each observation probabilistically into an unobserved (= latent) nominal class, while minimizing the confusion between observations (27). The LCA model is estimated by maximizing the log-likelihood function using the expectation maximization (EM) algorithm (28).

Different numbers of classes (1–4) were evaluated to identify the most parsimonious model with the overall best fit representing the entire data set of 39 variables with 370 observations each. For the given number of classes, each latent class analysis was repeated 500 times with different starting values to avoid local extrema. An LCA model fit is considered stable, if the same solution is found at least twice. Five hundred repetitions were chosen to identify a stable solution with high certainty, but at the same time minimize computation time. In all analyses, each variable was assigned the same prior probability of belonging to a set class, given that no particular expectation regarding classification was available from the literature. For LCA, conditional independence was assumed between the individual variables. Even if this assumption were not fully met, recently it has been shown that error dependencies only add little bias to an independence model (29), particularly if the prevalence is high as was the case with CM (47%) in the current study.

To assess model fit and to compare results with the previous literature, the maximum log-likelihood, the Bayesian information criterion (BIC), Akaike's information criterion (AIC), and entropy were used. Whereas, maximum log-likelihood is exclusively a measure of goodness of model fit, BIC and AIC are measures of parsimony aiming to avoid over-fitting. Entropy is a measure of classification uncertainty (30), with values of > 0.8 indicating a good separation between classes. For a particular number of classes, the model with the lowest log-likelihood was selected. To subsequently compare models between different numbers of classes, information criteria were evaluated. BIC penalizes additional model parameters more strongly than AIC and hence can be considered more conservative in preventing over-fitting. AIC has been reported to overestimate the correct number of components in a finite mixture model (31), whereas BIC performs more adequately (32). For this reason, BIC was prioritized over AIC in selecting the best model fit. *scBIC* is a sample-size-corrected BIC value being computed for completeness.

TABLE 1 | Descriptive statistics on offender patients with SSD and CM vs. with SSD without CM.

Variable	CM experienced		No CM experienced	
	n/N	%	n/N	%
Mean age at admission (and SD)	32.54	10.12	35.99	10.07
Male gender	179/197	90.9	160/173	92.5
Country of birth Switzerland	107/197	54.3	60/173	34.7
Single (at time of index offense)	167/194	86.1	130/170	76.5
Educational level: Graduation from mandatory schooling (at time of index offense)	62/193	32.1	70/149	47.0
Unemployed (at time of index offense)	156/194	80.4	108/158	68.4
Homeless (at time of index offense)	32/133	24.1	16/97	16.5
Poverty in the patients' childhood/adolescence	76/177	42.9	31/106	29.2
Mean age at first diagnosis of SSD (and SD)	26.39	8.84	30.15	9.29
Suicidal in past	133/194	68.6	99/162	61.1
Suicide attempt in past	77/193	39.9	40/158	25.3
Substance abuse				
Alcohol	123/188	65.4	80/139	57.6
Cannabis	136/197	69.0	87/173	50.3
Opiod	65/197	33	38/173	22
Cocaine	80/197	40.6	43/173	24.9
Stimulants/ amphetamines/ecstasy	54/197	27.4	28/173	16.2
Personality disorder present	31/197	15.7	16/171	9.4
Other psychiatric/somatic comorbidity	74/196	37.8	51/169	30.2
Mean IQ score (and SD)	94.72	14.76	90.96	14.3
Mean length of forensic psychiatric inpatient treatment (and SD)	135.97	9.99	86.98	9.79
Medication during current hospitalization				
Antipsychotics	190/194	97.9	160/166	96.4
Benzodiazepines	31/167	18.6	21/145	14.5
Antidepressants	18/166	10.8	13/145	9.0
Olanzapine equivalents at discharge (and SD)	19.32	13.01	19.14	15.19

SSD, schizophrenia spectrum disorder; CM, childhood maltreatment; IQ, intelligence quotient; SD, standard deviation.

TABLE 2 | LCA model fit evaluation criteria.

Number of classes	Number of estimated parameters	Residual degrees of freedom	Maximum log-likelihood	AIC	BIC	scBIC	Entropy	Number of times solution was found
1	47	323	−6,835.912	13,765.82	13,949.76	14,079	–	500/500
2	95	275	−6,541.789	13,273.58	13,645.36	13,906	0.8446609	316/500
3	143	227	−6,336.825	12,959.65	13,519.28	13,911	0.8937778	200/500
4	191	179	−6,211.936	12,805.87	13,553.35	14,077	0.8278053	37/500

AIC, Akaike's information criterion; BIC, Bayesian information criterion; entropy, measure of classification uncertainty. Bold value indicates BIC of final model.

RESULTS

Descriptive statistics on the sample of patients studied are presented in **Table 1**. Offender patients with SSD and CM did not differ significantly from those without CM in terms of their mean age at first diagnosis of SSD, mean age at admission, gender, mean IQ, antipsychotic or other psychiatric medication or frequency of other somatic or psychiatric comorbidities. Patients with CM were more frequently born in Switzerland, more often grew up

in poverty, were less often single, had less frequently graduated mandatory schooling and were more often unemployed and homeless. They had more records of attempted suicide in the past, more illegal substance use (but less abuse of alcohol) and slightly more often a comorbid personality disorder. Their length of stay in forensic psychiatric inpatient treatment was longer than that of patients without CM.

Next, the clinically most relevant results of the LCA are presented. In comparison to the one class-, the two-class and

TABLE 3 | Conditional item response probabilities of a patient within a particular class to give a specific item response.

Item	Class 1	Class 2	Class 3	Maximum interclass difference
Childhood maltreatment				
Victim of emotional neglect during childhood				
No	HIGH	MEDIUM	HIGH	0.23
Yes	LOW	MEDIUM	LOW	0.23
Victim of emotional abuse during childhood				
No	VERY HIGH	HIGH	HIGH	0.16
Yes	VERY LOW	LOW	LOW	0.16
Observer of domestic violence during childhood				
No	HIGH	MEDIUM	MEDIUM	0.22
Yes	LOW	MEDIUM	MEDIUM	0.22
Victim of physical neglect during childhood				
No	MEDIUM	MEDIUM	MEDIUM	0.14
Yes	MEDIUM	MEDIUM	MEDIUM	0.14
Victim of physical abuse during childhood				
No	HIGH	MEDIUM	HIGH	0.19
Yes	LOW	MEDIUM	LOW	0.19
Symptoms at first diagnosis of SSD				
Delusions				
No	MEDIUM	LOW	LOW	0.27
Yes	VERY HIGH	HIGH	HIGH	0.27
Hallucinations				
No	LOW	LOW	MEDIUM	0.16
Yes	HIGH	HIGH	MEDIUM	0.16
Conceptual disorganization				
No	LOW	HIGH	HIGH	0.34
Yes	HIGH	LOW	LOW	0.34
Disturbed affect or drive				
No	VERY LOW	MEDIUM	MEDIUM	0.42
Yes	VERY HIGH	MEDIUM	MEDIUM	0.42
Negative symptoms				
No	VERY LOW	MEDIUM	MEDIUM	0.40
Yes	VERY HIGH	MEDIUM	MEDIUM	0.40
Symptoms prior to index offense				
Delusions				
No	VERY LOW	MEDIUM	LOW	0.35
Yes	VERY HIGH	MEDIUM	HIGH	0.35
Hallucinations				
No	LOW	MEDIUM	MEDIUM	0.20
Yes	HIGH	MEDIUM	MEDIUM	0.20
Conceptual disorganization				
No	LOW	HIGH	HIGH	0.42
Yes	HIGH	LOW	LOW	0.42
Disturbed affect or drive				
No	HIGH	VERY HIGH	VERY HIGH	0.16
Yes	LOW	VERY LOW	VERY LOW	0.16
Negative symptoms				
Not present	VERY LOW	VERY LOW	LOW	0.28
Existed discretely	VERY HIGH	MEDIUM	MEDIUM	0.45
Existed distinctly	VERY LOW	LOW	LOW	0.19

(Continued)

TABLE 3 | Continued

Item	Class 1	Class 2	Class 3	Maximum interclass difference
Alogia				
No	LOW	VERY HIGH	VERY HIGH	0.67
Yes	HIGH	VERY LOW	VERY LOW	0.67
Blunted affect				
No	VERY LOW	LOW	HIGH	0.59
Yes	VERY HIGH	HIGH	LOW	0.59
Apathy				
No	LOW	VERY HIGH	VERY HIGH	0.78
Yes	HIGH	VERY LOW	VERY LOW	0.78
Anhedonia				
No	VERY LOW	MEDIUM	HIGH	0.67
Yes	VERY HIGH	MEDIUM	LOW	0.67
Social withdrawal				
No	VERY LOW	MEDIUM	MEDIUM	0.52
Yes	VERY HIGH	MEDIUM	MEDIUM	0.52
Poor attention				
No	VERY LOW	HIGH	HIGH	0.58
Yes	VERY HIGH	LOW	LOW	0.58
History of prior offenses				
Previous offenses: assault or property crime with violence				
No	MEDIUM	HIGH	MEDIUM	0.15
Yes	MEDIUM	LOW	MEDIUM	0.15
Previous offenses: non-violent crime				
No	HIGH	HIGH	HIGH	0.14
Yes	LOW	LOW	LOW	0.14
Index offense leading to forensic hospitalization				
Index offense: homicide/attempted homicide				
No	VERY LOW	VERY LOW	LOW	0.11
Yes	VERY HIGH	VERY HIGH	HIGH	0.11
Index offense: arson				
No	HIGH	VERY HIGH	VERY HIGH	0.16
Yes	LOW	VERY LOW	VERY LOW	0.16
Therapy outcome variables				
Psychiatric prognosis on future criminal behavior as estimated at discharge				
Favorable	LOW	LOW	VERY LOW	0.17
Sufficient	VERY LOW	LOW	LOW	0.10
Doubtful	VERY LOW	LOW	LOW	0.13
Unfavorable	MEDIUM	VERY LOW	LOW	0.34
Change in PANSS-positive scale from admission to discharge				
Less symptoms	HIGH	VERY HIGH	LOW	0.54
No change	LOW	VERY LOW	HIGH	0.53
more symptoms	VERY LOW	VERY LOW	VERY LOW	0.01
Change in PANSS-negative scale from admission to discharge				
Less symptoms	LOW	HIGH	VERY LOW	0.65
No change	MEDIUM	LOW	HIGH	0.53
More symptoms	VERY LOW	VERY LOW	VERY LOW	0.12
Change in PANSS-general psychopath. scale from admission to discharge				
Less symptoms	MEDIUM	VERY HIGH	VERY LOW	0.91
No change	LOW	VERY LOW	VERY HIGH	0.87
More symptoms	VERY LOW	VERY LOW	VERY LOW	0.04

(Continued)

TABLE 3 | Continued

Item	Class 1	Class 2	Class 3	Maximum interclass difference
Change in PANSS-total scale from admission to discharge				
Less symptoms	HIGH	VERY HIGH	VERY LOW	0.89
No change	LOW	VERY LOW	VERY HIGH	0.88
More symptoms	VERY LOW	VERY LOW	VERY LOW	0.02
Estimated class population share	0.2569	0.2885	0.4546	

A higher maximal inter-class difference in the conditional item response probabilities observed within the category of a given item indicates a more relevant finding.

the four-class-model, the three-class model recorded the lowest BIC, indicating best model fit in terms of model complexity and parsimony (see **Table 2**). The other model fit criteria did not conflict with this solution, nor did clinical theories, once details of the three-class model were examined (next).

More detailed analysis of the three-class model provides evidence supporting the initial hypothesis, that offender patients with SSD and CM are distinct from those with SSD and no CM not only due to their experiencing of CM, but also due to different characteristics of the other parameters explored. Surprisingly, offender patients with SSD and CM composed two distinct subgroups (classes two and three), while those with SSD and no CM grouped separately (class one). **Table 3** presents the clinically most relevant conditional item response probabilities of the three classes with interclass differences above 10% for a subgroup-specific interpretation, as has been suggested elsewhere (33, 34). (Complete results are presented in the **Supplementary Materials**). Conditional item response probabilities quantify the probability for patients to provide a specific item response depending on the class to which they belong. They allow the comparison of variables amongst the three classes presented (e.g., the probability to be a victim of emotional neglect in class one vs. class two or three). Posterior probabilities, i.e., the probability of a patient with her/ his individual set of item responses belonging to a specific class, can be estimated with Bayes formula (35), but will not be presented here in order to maximize clarity and brevity.

Class one (estimated to comprise 26% of offender patients with SSD) in the final model is characterized by the lowest probability for any CM, with physical neglect being the most frequent CM. By contrast, class two (29% estimated population share) and (to a lesser extent) class three (45% estimated population share) are more probable to experience CM – particularly emotional and physical neglect, as well as physical abuse. At first diagnosis of SSD class one is much more probable than classes two and three to experience delusions, hallucinations, disturbed affect or drive, conceptual disorganization and negative symptoms. Class three is slightly more probable to experience these symptoms than class two, but both are significantly less probable to suffer from such symptoms than class one. In the year prior to the index offense, a similar picture is observable where class one is much more probable to exhibit positive and negative symptoms as well as disturbances of affect and drive than classes two and three. However, now

TABLE 4 | Overview of the most relevant results in the final 3-class-model.

Parameter	Class 1	Class 2	Class 3
CM	–	+	+
Symptoms of SSD	+	–	–
Violent offending	+	–	–
Symptom remission during inpatient treatment	+	+	–
Favorable prognosis on future criminal behavior	–	+	–

CM, childhood maltreatment; SSD, schizophrenia spectrum disorder.

class two is distinctly more probable to experience blunted affect, apathy and anhedonia than class three. In terms of criminal behavior, there is little difference in the probabilities for crimes committed prior to the index offense between classes. Yet for the index offense, class one is clearly more probable to engage in actual or attempted homicide or arson than classes two and three. Except for homicide, class three is slightly more probable than class two to engage in all types of index offenses. There is no difference between classes in their perspective for release from forensic detention, but the prognosis on future criminal behavior is most probable to be favorable for class two and most probable to be unfavorable for class one. It is no surprise then that class two is also most probable to experience a reduction in positive, negative and general psychopathological symptoms, class three is least probable to experience such remission and class one ranges inbetween classes two and three. Negative symptoms were most probable to remain unchanged or even worsen over inpatient treatment in all three classes in comparison to positive symptoms and general psychopathology.

DISCUSSION

To the authors' best knowledge, this is the first study to explore the role of different types of CM, psychopathology, aspects of criminal behavior and treatment efficacy of offender patients with SSD. Latent class analysis revealed significant differences between three homogenous (latent) patient groups. Among these, class one seems to be least probable to be affected by CM, most probable to experience positive and negative symptoms of SSD, most probable to engage in the most violent of offending and have an average treatment outcome in terms of symptom remission,

but the least favorable prognosis for future criminal behavior. Overall, class one seems to be more determined by factors inherent to their SSD, such as positive and negative symptoms of psychopathology, rather than CM related effects. They might represent the “late starters,” a subgroup of offenders suffering from SSD suggested by Hodgins (33).

By contrast, classes two and three were considerably more probable to be affected by CM, particularly physical neglect, physical abuse and emotional neglect. Both classes with SSD and CM, were similarly less probable to experience positive or negative symptoms of SSD and to engage in serious offending, in comparison to those with SSD and no CM. Unexpectedly, however, class two was significantly more probable than class three (and class one) to experience a positive outcome from psychiatric inpatient treatment in terms of a remission of symptoms and favorable prognosis for future offending. The most relevant and distinguishing characteristics of the three classes are summarized in **Table 4**.

Findings on the types of CM most prevalent in offender patients with SSD in the present study confirm prior research, often reporting physical and emotional neglect and sometimes physical abuse to be linked to schizophrenia, but rarely observing any sexual abuse (which may be due to patients not reporting such CM due to shame) (7, 10).

Yet, the presence of two distinct subgroups of offender patients with SSD and CM with one probable to benefit from psychiatric inpatient treatment (class two) while the other (class three) is not probable to benefit, has not been reported so far. This finding assumes particular relevance since the estimated population share of the subgroup with SSD and CM not benefiting during inpatient treatment is almost as big as the other two classes (SSD with and without CM) combined (see estimated class population share in **Table 3**). The presence of two antithetic subgroups of patients with SSD and CM in terms of treatment outcome, may provide an explanation for the disparity among results from extant research on treatment efficacy in patients with psychosis and CM with only a small pooled odds ratio in a recent meta-analysis (13).

Results (presented here) indicate that patients with SSD and no CM more probably displayed more psychopathology at first diagnosis and prior to their index offense and to be more probable to engage in more violent offending behavior (see **Table 3**). This is interesting since prior research reported CM to increase odds for SSD (9, 36) and at least double the risk for offending behavior in patients with SSD (4). However, all of these meta-analytic and review based accounts (4, 9, 36) note insufficient differentiation between subtypes of CM (especially emotional abuse vs. physical abuse) and significant variability in defining offending behavior and SSD (or more generally psychosis) in the studies reporting CM to promote SSD or offending behavior. Similarly, Teicher et al. (37) elaborate in their ecophenotype hypothesis that “the myriad (of) possible outcomes of exposure to childhood maltreatment depend on the timing, type, and severity of exposure, plus a host of genetic factors that influence susceptibility and resilience, and an array of protective factors that attenuate risk.”

Future research should explore why some offender patients with SSD and CM benefit from treatment while others do not. The fact that class two is also somewhat more probable than class three to experience blunted affect, apathy and anhedonia prior to committing a crime might hint the role of affective symptoms in this observation. Using network analysis, Isvoranu et al. (7) provided evidence for certain pathways in which specific CM (e.g., physical neglect) is connected to symptoms of general psychopathology (motor retardation), which are then linked to positive and negative symptoms of SSD (blunted affect, anhedonia) – also see introduction. Yet, authors did not consider the role of offending or the possibility for (latent) subgroups of patients with SSD and CM, who may have distinct interconnections between CM, symptoms of SSD and other (confounding) variables, as evidenced in the present study. Personality trait factors may act as confounding variables, even if they do not reach clinical significance to warrant a personality disorder (38). Unfortunately, there was no information available on personality traits in the data analyzed here, unless a personality disorder was diagnosed in addition to SSD. Adding personality disorders to LCA did not provide new insight on the results presented here. Descriptive statistics evidenced patients with CM to have a minimally higher prevalence of personality disorders (15.7 vs. 9.4%) in the sample studied here (see **Table 1**). Future research should include (subtle) personality traits as a possible confounder. In the present study, descriptive statistics did further enforce the hint on the role of affective symptoms apparent in LCA results, since patients with CM had a higher prevalence of attempted suicide in the past. Similarly, their more frequent use of illegal substances has been observed in prior research and interpreted as an attempt of patients to manage affective symptoms (39).

As a potential limitation, so far, there are no definite guidelines regarding minimal sample size in LCA models. While simulation studies recommended a heuristic number of ≥ 500 (40), many LCA applications did use smaller sample sizes (41). Associated dangers with too small a sample size are the over-extraction of classes, or the diminished detectability of classes with low prevalence. Given that the current study used a sample size of 370 patients, the risks associated with a small sample size need to be considered. Of course, on a cautionary note, the possibility exists that latent class analysis over-extracted classes and thus classes two and three might only reflect dimensional variation within a broader class, with differences in their response to inpatient treatment potentially reflecting fluctuations in the severity of psychotic symptoms over time. In contrast, as there was no underlying theory that suggested a further class, we have no reason to assume that a class was missed because of low prevalence.

Limitations of the current study, not mentioned above, involve the lack of data on (re-)victimization of patients as adults or number of overall traumatic life incidents. This seems unfortunate in light of evidence on a dose response relationship between all types of CM, later traumas and the development of SSD (42–44). However, all data on traumatic experiences are particularly vulnerable to inaccuracies due to unreported trauma (45). Descriptive statistics on the data studied here provide

evidence that patients with CM (in comparison to those without CM) were more frequently subject to numerous socio-economic disadvantages, including poverty during childhood, lower levels of education, a higher rate of unemployment and homelessness, despite an average IQ similar to those patients without CM. There is evidence that all of these factors act as stressors increasing the risk for mental illness and criminal offending (46–49). Future research should include such stressors in addition to CM and other trauma in exploring offender patients with SSD and their optimal treatment.

Another limitation pertains to the generalizability of the results presented here. In outpatient settings or inpatient settings in which adherence to therapy is less strictly enforced by legal provisions, additional factors have been reported to mediate poorer therapy outcome in patients with SSD and CM. This includes an avoidant coping style, less compliance to prescribed medication, poor therapeutic alliance and less engagement with treatment services (13). Future studies should include these parameters in analysis in addition to objective measures on social functioning and criminal behavior after release from forensic detention.

Further limitations pertain to retrospective file analysis in general and its specifics in this study. This includes the adoption of the PANSS and Childhood Trauma Questionnaire for coding and coding itself. However, similar to other present-day research (50, 51), retrospective analysis allowed the current study to include a large number of difficult to explore clinically relevant cases with the rare combination of SSD, CM and offending behavior and examine parameters over a prolonged period

of time. Future research should review current results using longitudinal and interview based study designs.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Kantonale Ethikkommission Zürich Stampfenbachstrasse 121 8090 Zürich. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

MG, JK, and SL designed the study and protocol. The survey of the data via questionnaire was preformed independently by JK and SL. All statistical analyses were carried out by MG and supervised by SK. The first draft of the manuscript was done by MG. SL, JK, SK, and SE edited multiple drafts. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2021.612322/full#supplementary-material>

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Associations Between Childhood Trauma and the Age of First-Time Drug Use in Methamphetamine-Dependent Patients

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Childhood trauma is related to substance use disorder; however, few studies have examined the relationship between childhood trauma and the age at which the drug was first used. The aim of this study was to investigate the relationship between childhood trauma and the age of first-time drug use among methamphetamine-dependent patients. Moreover, we analyzed the characteristics of adverse family environment associated with severe childhood trauma and the risk factors for starting drugs in minors. A baseline interview was conducted with 110 participants who were in detoxification, including demographic information, past substance use, and age of first-time drug use. The participants' childhood trauma experience before 18 years of age was evaluated using the simplified version of the Childhood Trauma Questionnaire (CTQ-SF). The Chinese version of the Family Environment Scale (FES-CV) was used to assess the family environment of methamphetamine-dependent patients. Among 110 non-injecting methamphetamine-dependent patients, nearly half ($n = 48$, 43.6%) had moderate and severe childhood trauma. Correlation analysis showed that the age of first-time drug use negatively correlated with emotional abuse ($r = -0.32$, $p < 0.01$) and physical abuse ($r = -0.27$, $p < 0.01$). The age of first-time drug use negatively correlated with conflict ($r = -0.20$, $p < 0.05$) and independence ($r = -0.22$, $p < 0.05$) of family environment, but positively correlated with intellectual-cultural orientation ($r = 0.28$, $p < 0.01$). Additionally, childhood trauma factors significantly correlated with many indexes of family environment, especially cohesion ($r = -0.45$, $p < 0.01$), conflict ($r = 0.49$, $p < 0.01$), and independence ($r = 0.33$, $p < 0.01$). Additionally, the regression model showed that when emotional abuse increased by one point, the age of first-time drug use was 0.69 years earlier. These findings suggest that a detrimental family environment can aggravate childhood trauma, and the experience of childhood emotional or physical abuse may be an effective predictor of early drug use among methamphetamine-dependent patients.

Keywords: methamphetamine, age of first-time drug use, minor, childhood trauma, family environment

INTRODUCTION

According to the 2020 World Drug Report released by the United Nations Office on Drugs and Crime, approximately 35.6 million people suffer from substance-related disorders globally. The use of amphetamines, especially methamphetamine, is increasing in parts of Asia and North America, with adolescents and young adults accounting for the largest share of users (1). According to the Drug Situation Report released by the Chinese government in 2019, methamphetamine drug has the largest number of abusers in China, with 1.186 million abusing methamphetamine, accounting for 55.2% of the 2.148 million existing drug users (2).

Drug abuse leads to a variety of serious consequences, such as severe depression (3), and even suicide attempts (4); drug abusers gradually become socially vulnerable and marginalized, such as unemployed and homeless. It must be noted that the social, economic, and public health burden associated with substance-related disorders, especially methamphetamine dependence, is enormous (5, 6). Moreover, worldwide, the average age at which a drug is used for the first time is reported to be relatively low, most of which begins when the individuals are underage (7–10). Therefore, initial age of drug use is becoming younger, and the issue of drug abuse among teenagers and even students needs to be urgently addressed (11). As there are no approved drugs for methamphetamine-dependent disorders currently, psychotherapy and symptomatic treatment are the main approaches (12).

The epidemiological causes of drug abuse are complex and multifactorial, and many risk factors, including childhood trauma, are related to substance use (13, 14). High levels of traumatic childhood experiences have been observed in people with substance-related disorders (15). In a study of 113 adult opioid addicts treated with buprenorphine, 80.5% reported experiencing at least one type of childhood trauma (16). Several adverse psychological and behavioral consequences of childhood abuse include depression, post-traumatic stress disorder, anxiety, attention deficit hyperactivity disorder, and conduct disorder (17). Additionally, a meta-analysis concluded a causal relationship between childhood abuse, including emotional and physical abuse, drug use, mental disorders, attempted suicide, risky behaviors, and sexually transmitted diseases (18). Moreover, in a 5-year cohort study, childhood sexual abuse was found to increase the risk of teenagers starting using injecting drugs (19).

Family environment is the most important part of childhood; an unfavorable family environment has a negative impact on children's growth (20). Parents' substance dependence behavior is closely related to children's awful childhood experiences, and children exposed to parental alcoholism are more likely to suffer from various forms of abuse, neglect, and family dysfunction.

Psychotherapy is an important research topic. Current studies have focused on childhood trauma and drug use, but there are few reports on the relationship between childhood trauma and the age of first-time drug use. Drug abuse generally starts from non-injection, gradually forms drug dependence, and finally moves to the injection mode (21–23). The transition from non-injecting drug use to injecting drug use greatly increases

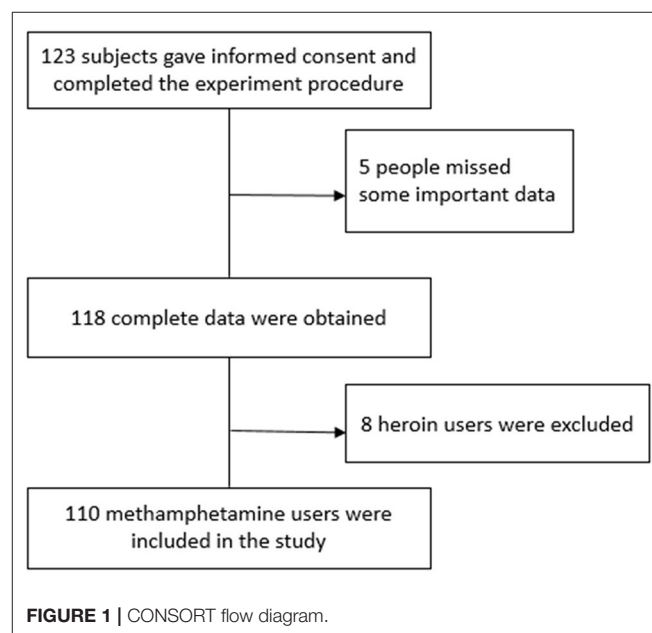
blood-borne diseases such as HIV (24–26); conversely, rates of high-risk injection and sexual activity were lower in people who started using drugs later (27). Therefore, our goal was to explore whether childhood trauma leads to an increase in the age of the first-time non-injecting drug use, and the impact of the family environment on methamphetamine-dependent patients. This provides a theoretical basis for treatment in the field of psychology. In this way, drug users who have experienced childhood trauma can have an opportunity to intervene appropriately in reducing the number of relapses, restore social function, and reduce social burden.

MATERIALS AND METHODS

Participants

The participants were recruited from a compulsory rehabilitation center in the Anhui Province, China. Individuals who met the following criteria were included in this study: (1) adults (≥ 18 years old); (2) met the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) criteria for methamphetamine dependence; (3) were non-injecting drug users, and (4) can provide informed consent. Concurrently, participants who met any of the following exclusion criteria were excluded: (1) suffering from severe mental illness, such as schizophrenia, depressive disorder, and so on; (2) those who have used psychoactive substances in the past month; (3) those who have comorbidity with serious organic diseases, including cerebrovascular disease, cardiovascular disease, and neurodegenerative disease.

After screening, 123 patients were eligible to participate in the study. Of the 13 excluded samples, eight were heroin users and five had incomplete data. As a result, 110 methamphetamine-dependent patients were included in this study (Figure 1).



This study was approved by the Ethics Committee of Chaohu Hospital of Anhui Medical University (Ethics number: 201901-kyxm-02). All research procedures were in line with the Helsinki Declaration. First, we explained the purpose, method, and process of the study to the participants in detail to ensure that the participants understood the study. After obtaining informed consent from the participants, we conducted the research using a questionnaire, and did not use any invasive or harmful examination, or medication.

Measures

A socio-demographic questionnaire was designed to collect the enrolled patients' socio-demographic information. The questionnaire mainly included age, sex, race, education status, and marital status; all the information was filled in by the participants themselves.

The childhood trauma of amphetamine users was subsequently evaluated using the simplified version of the Childhood Trauma Questionnaire (CTQ-SF), a 28-item retrospective self-report questionnaire that briefly screened the history of mental and physical abuse and neglect in childhood and adolescence before the age of 18 years. The original English version of the CTQ-SF was compiled by Professor Bernstein and his colleagues and was later translated into Chinese by Zhao et al. (28, 29). The Chinese version of the CTQ-SF has good reliability and validity (30, 31). CTQ-SF is also applicable to adult drug abusers (32).

Additionally, to explore the family environmental factors influencing childhood trauma, we used a Chinese version of the Family Environment Scale (FES-CV); it comprises 90 items classified into 10 areas: cohesion, expressiveness, conflict, independence, achievement orientation, intellectual-cultural orientation, active-recreational orientation, moral-religious emphasis, organization, and control (33). The FES-CV has been widely used with good reliability and validity (34).

Statistical Analysis

First, we described the socio-demographic characteristics of the participants, and then divided them into minor and adult groups according to the age of the first-time drug use. The data were expressed as mean \pm standard deviation. The Kolmogorov-Smirnov single-sample test was used to evaluate the normal distribution of continuous variables. According to the results of the normality test, Pearson correlations or Spearman correlations were used to determine the correlations between each family environment variable and each childhood trauma subtype of amphetamine users. Then, the childhood trauma of the minor and adult groups were compared. Independent sample *t* test or the Mann-Whitney *U* test were used to compare the two groups depending on the normal distribution of the continuous variables. Additionally, the chi-square test was used to compare classified variables. Finally, linear regression and binary logistic regression were applied to obtain more valuable information. Statistical analyses were performed using IBM SPSS21.0. Statistical significance was set at $p < 0.05$, and all reported *p* values were bilateral.

RESULTS

Social Demographic Characteristics of Methamphetamine Users

The sociological characteristics and drug abuse data are presented in **Table 1**. A total of 110 methamphetamine-dependent patients were included in this study, and none of them used injections. The participants were all Han Chinese adult males, with an average age of 30.7 ± 3.6 years. Among them, 46 (41.8%) were unmarried, 35 (31.8%) were married, and 29 (26.4%) were divorced. Additionally, 65 (59.1%) had urban household registration, and 45 (40.9%) had rural household registration. The average length of education of the participants was 8.27 ± 3.03 years. The majority ($n = 76$, 69.1%) reported having a junior high school education or below, some ($n = 33$, 30.0%) reported having high school education, and only one had completed his college. There was a significant difference between the adult and minor groups. Participants who started using methamphetamine before adulthood were likely to be less educated, unmarried, and lived in cities.

Association Between Childhood Trauma, Family Environment and the Age of First-Time Drug Use

Nearly half (48, 43.6%) of the 110 participants had moderate and severe childhood trauma. The average age of initial drug use was 22.6 ± 4.2 (oldest, 32 years; youngest, 14 years). According to **Table 2**, the Pearson correlation analysis shows that the age of first-time drug use negatively correlated with the total score of childhood trauma ($r = -0.24$, $p < 0.05$), emotional abuse ($r = -0.32$, $p < 0.01$), and physical abuse ($r = -0.27$, $p < 0.01$). The age of first-time drug use negatively correlated with conflict ($r = -0.20$, $p < 0.05$) and independence ($r = -0.22$, $p < 0.05$) of family environment, but positively correlated with intellectual-cultural orientation ($r = 0.28$, $p < 0.01$). Additionally, childhood trauma factors significantly correlated with many indexes of family environment, especially cohesion ($r = -0.45$, $p < 0.01$), conflict ($r = 0.49$, $p < 0.01$), and organization ($r = -0.29$, $p < 0.01$).

The Differences in Childhood Trauma Between Minor Group and Adult Group

The results of the Mann-Whitney *U* test (**Table 3**) show that the minor group had more severe childhood trauma ($Z = -2.15$, $p = 0.03$), especially emotional ($Z = -3.10$, $p = 0.00$) and physical abuse ($Z = -2.77$, $p = 0.01$) than the adult group. Additionally, there was no significant difference in relapse times and frequency of drug abuse between the two groups (**Table 1**).

Quantitative Analysis of Factors Influencing Age of First-Time Drug Use

Based on a further analysis of the age of first-time drug use, we found that under age methamphetamine-dependent patients had a higher level of childhood trauma than those who started using methamphetamine in adulthood.

TABLE 1 | Social demographic characteristics of methamphetamine dependent patients.

	Total (n = 110)	Minor (n = 21)	Adult (n = 89)	t/Z/λ	p
Age (years)	30.70 ± 3.60	28.20 ± 3.20	31.30 ± 3.50	−3.74	0.00
Education (years)	8.30 ± 3.00	6.80 ± 2.40	8.60 ± 3.10	−2.53	0.01
Marital status				12.16	0.00
Unmarried	46 (41.80%)	16 (76.00%)	30 (34.00%)		
Married	35 (31.80%)	2 (10.00%)	33 (37.00%)		
Divorced	29 (26.40%)	3 (14.00%)	26 (29.00%)		
Place of household registration				110.00	0.00
Urban areas	65 (59.10%)	15 (71.00%)	50 (56.00%)		
Rural areas	45 (40.90%)	6 (29.00%)	39 (44.00%)		
Relapse times	0.70 ± 1.00	1.00 ± 1.40	0.60 ± 1.00	1.76	0.08
Frequency of drug abuse per month	13.80 ± 11.80	16.00 ± 12.30	13.30 ± 11.70	−0.97	0.33

TABLE 2 | Correlation between childhood trauma, family environment and age of first-time drug use.

n = 110	Age of first drug use	Childhood trauma	Emotional abuse	Physical abuse	Sexual abuse	Emotional neglect	Physical neglect
Age of first drug use	–	−0.24*	−0.32**	−0.27**	−0.09**	−0.16	−0.03
Cohesion	0.03	−0.45**	−0.28**	−0.28**	−0.17	−0.37**	−0.38**
Expressiveness	0.07	−0.22*	−0.14	−0.24*	−0.03	−0.23*	−0.07
Conflict	−0.20*	0.49**	0.47**	0.41**	0.18	0.38**	0.24*
Independence	−0.22*	0.33**	0.19	0.33**	0.09	0.29**	0.15
Achievement orientation	−0.02	−0.12	−0.04	−0.09	−0.09	−0.09	−0.09
Intellectual-cultural orientation	0.28**	−0.13	−0.12	−0.16	0.06	−0.14	−0.03
Active-recreational orientation	0.12	−0.21*	−0.19*	−0.15	−0.08	−0.18	−0.10
Moral-religious emphasis	−0.05	−0.15	−0.06	−0.08	−0.06	−0.17	−0.08
Organization	0.14	−0.29**	−0.21*	−0.24*	−0.13	−0.20*	−0.22*
Control	0.12	−0.11	−0.10	−0.13	0.04	−0.16	0.01

* $p < 0.05$, ** $p < 0.01$.**TABLE 3 |** The difference of childhood trauma between minor group and adult group.

	Minor (n = 21)	Adult (n = 89)	Z	p
Childhood trauma	42.90 (12.15)	37.13 (7.91)	−2.151	0.031
Emotional abuse	8.10 (2.28)	6.62 (1.75)	−3.099	0.002
Physical abuse	8.29 (4.36)	6.13 (1.80)	−2.772	0.006
Sexual abuse	5.71 (1.27)	5.81 (1.64)	−0.189	0.850
Emotional neglect	11.76 (4.62)	9.70 (3.64)	−1.899	0.058
Physical neglect	9.05 (3.85)	8.88 (2.87)	−0.115	0.908

We conducted a linear regression analysis between the age of first-time drug use and childhood trauma factor scores, and entered it stepwise; emotional abuse was retained in the regression model. The regression model showed that when emotional abuse increased by 1 point, the age of first-time drug use was 0.69 years earlier. The age of first-time drug use

and the number of childhood traumas were analyzed using regression analysis; for each additional type of childhood trauma, the age at first-time drug use was 0.95 years earlier. Finally, the binary logistic regression between first-time time drug abuse in adulthood and family environmental factors showed that conflict was a risk factor for starting drugs in minors ($p = 0.04$) (data not shown).

DISCUSSION

In this study, we examined the relationship between childhood trauma and the age at which non-injecting drug was used for the first-time time among Chinese methamphetamine-dependent patients. It was found that the age of first-time drug use of methamphetamine-dependent patients experiencing severe childhood trauma, especially emotional abuse or physical abuse, will be earlier, with more childhood trauma subtypes. The in-depth quantitative analysis conducted in our study shows that, in the regression model, for each additional score of emotional

abuse, the age of first-time drug use will be 0.69 years earlier, and for each additional trauma subtype, the age of the first-time drug use will be 0.95 years earlier. Our study found no correlation between physical neglect and age of first-time drug use, even though the incidence of physical neglect was high. After exploring the causes of childhood trauma our findings suggest that family environmental factors are strongly associated with the level of childhood trauma and the age of first-time drug use.

Previous research has shown that childhood trauma can lead to early drug use (7, 35), which is consistent with the results of our study. However, existing studies have focused on drug users who inject the drug, while this study focused on drug users who use non-injecting drugs. Drug abuse usually begins with non-injecting drug use and gradually transforms into injecting the drug under the influence of a variety of complex factors (36–38). Therefore, from this point of view, our study on the age of first-time drug use among non-injecting drug users is more sensitive, persuasive, and practical than the research on injecting drug use.

Our study observed that emotional and physical abuse was associated with first-time drug use at younger ages before adulthood. Emotional abuse refers to the long-term and inappropriate emotional reaction of the caregivers or others to children, such as malicious refusal, isolation, intimidation, or the use of insulting, satirical and discriminatory language to treat children. Physical abuse refers to actual or potential physical harm to children caused by the rude and inappropriate behavior of caregivers or others. Physical and emotional abuse in childhood has a negative effect on mental health in adulthood (39, 40). A correlation was found between childhood trauma and emotional disorders (41), and emotional regulation is found to play an intermediary role in childhood trauma led substance abuse (42). Early childhood stress interferes with the maturation of brain networks associated with cognitive and emotional processes, which adversely affect cognitive and emotional processes during adolescence (43). Additionally, the brain structure of people who experienced childhood trauma changed accordingly, including reduction of the caudate nucleus (44), hippocampus (45), and amygdala (46). Similar results were obtained in animal models of childhood trauma, such as loss of hippocampal volume, and destruction of dendritic structures (47). Childhood trauma can affect HPA axis activity, which may be related to post-traumatic depression (48). There is a significant correlation between childhood trauma and low cortisol arousal levels (49), resulting in pro-inflammatory state, which plays an important role in the development of emotional disorders in adulthood (50). Traumatic events can lead to negative emotions, which persist over time, are difficult for individuals to manage, and may lead to the use of drugs for self-treatment (51, 52). Especially in individuals who do not have enough emotional regulation strategies to tolerate strong negative emotions, substance use may become a repetitive and maladaptive coping mechanism. In presence of multiple traumatic experiences, substance use may intensify, and individuals exposed to traumatic events may turn to substance use, to mitigate the long-term negative effects of exposure to trauma (53). This mechanism of mood disorders leads to early drug use in individuals with severe childhood trauma. Furthermore, these results are similar to our study's results, which

show that longer the years of education, or the older the age of first-time drug use, lower the number of relapses. Compared to people with low levels of education, people with higher education know more emotional regulation strategies, while older people are better at emotional regulation than teenagers.

Our study found that the more subtypes of childhood trauma, the earlier the age of first-time drug use. A previous national study in the UK found a significant cumulative relationship between trauma and mental illness, and the more types of trauma, the higher the probability of mental illness (54). Early childhood abuse will physically change neurobiological development, excluding direct physical harm, have a negative impact on cognitive, emotional, and social growth, and lead to psychological, behavioral, and learning problems; these problems will continue throughout the whole life (55–57). A growing body of evidence suggests that the origins of most adult diseases are associated with childhood development and biological disorders. These early life experiences may affect the mental and physical health of adults, either through the accumulation of time or the biological embedding of adversity during sensitive developmental periods (58). Physical abuse in childhood may be an experience that changes neurobiological development and increases the risk of mental illness.

Although a high incidence of physical neglect among methamphetamine-dependent patients has been observed, the internal correlation with the age of first-time drug use could not be found. To investigate its reason, several previous studies had shown that the internal consistency of CTQ-SF's physical neglect subscale is relatively low (31, 59, 60), and this phenomenon can be attributed to the cultural differences in the definition of physical neglect.

Our results show that family environment is closely related to the level of childhood trauma and the age of first-time drug use. Methamphetamine-dependent patients who experienced high levels of family conflict and independence, or low family cohesion and emotional expression, reported more severe childhood trauma. Cohesion and conflict are mainly reflected in the relationships among family members. In a low cohesion and high conflict family environment, family members lack communication and do not publicly express their views and emotions. Previous studies have shown that psychosocial background includes childhood trauma, maternal mental illness, maladaptive parenting styles, and dysfunctional parent-child relationships, all of which are recognized as contributing factors to the development of marginal characteristics (61). Borderline personality disorder has a mediating effect on drug abuse and childhood trauma, and there is a relationship between multiple childhood trauma and borderline personality (62–64). Additionally, childhood abuse has a cumulative effect, and those who have experienced more developmental abuse show significantly higher levels of marginal characteristics (65). Synchronously, borderline personality shows more impulsive behaviors, including alcoholism, drug abuse (66), gambling, and promiscuity (67). Conversely, positive affect and resilient coping in adulthood were both positively correlated with positive family environment and negatively correlated with childhood trauma (68). In adulthood, when faced with adversity, individuals with poor ability to resist adversity will develop maladaptive behavior,

including drug abuse. Additionally, previous studies have shown that family history of drug and alcohol abuse is closely associated with childhood trauma (35), and that maternal alcohol abuse is significantly associated with all types of childhood trauma except physical abuse, while physical abuse is associated with paternal alcohol abuse (69). Meanwhile, the family history of drug use is related to the earlier age of first drug use, and childhood physical trauma plays an intermediary role in the relationship between the family history of substance use problems and the age at first-time drug use (7).

There are some limitations to our research. First, this study uses a cross-sectional survey, so causality cannot be inferred. Second, our study is based on the participants in the cultural background of the Han nationality in China, which may not be completely representative of other cultural backgrounds in the world. Third, the sample size of the minor group of amphetamine users in this study was not large enough, leading to the restriction of discovering some meaningful indicators. Finally, the CTQ-SF is a self-retrospective reporting tool that may not accurately reflect the level of trauma exposure, and recall bias may also affect our results, especially those who frequently take drugs are more likely to recall the history of childhood abuse.

CONCLUSION

In short, childhood trauma is a strong predictor of the age at which drug is used for the first time, and the more severe childhood trauma is, the younger the age of first-time drug use is. Trauma interventions for drug users and early trauma screening and treatment for children and adolescents may reduce drug abuse throughout life. Therefore, public health policies need to address this specifically in order to reduce the chances of potential drug users becoming drug users.

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DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of Chaohu Hospital of Anhui Medical University. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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The manuscript was designed and written by author CH. Data was collected by CH, QY, LZ, LW, and SC, analyzed by CH and KZ, and verified by XZ. All authors read and agreed to the final manuscript.

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Childhood Maltreatment in Individuals With Schizophrenia Spectrum Disorders: The Impact of Cut-Off Scores on Prevalence Rates

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Childhood maltreatment is a common phenomenon in various psychiatric disorders. Accordingly, patients with disorders from the schizophrenia spectrum (SSD) appear to have high prevalence rates of childhood maltreatment. However, the interpretation and comparability of prevalence rates is impeded by methodological weaknesses and differences such as measures and thresholds used in previous studies. Therefore, we aimed to provide and compare systematically captured data on prevalence rates of all common types of childhood maltreatment in patients with SSD using a standardized and well-established questionnaire and the most frequently used thresholds. The sample consisted of 48 patients with a primary diagnosis of SSD. 58.3–77.1% of the sample experienced at least one type of childhood maltreatment. Prevalence rates for physical abuse, physical neglect, and emotional abuse were dependent on the thresholds used, while equal rates were found for emotional neglect and sexual abuse. Physical neglect (46–67%), and emotional abuse (44–48%) were most commonly reported, followed by emotional neglect (38%), physical abuse (25–38%), and sexual abuse (25%). Additionally, high levels of peer victimization were reported by SSD patients. It appears that childhood maltreatment is a common phenomenon in SSD, even though methodological details, especially cut-off scores, have a substantial impact on the prevalence rates that are determined. Therefore, the methodology of studies should be closely examined when drawing conclusions from presented prevalence rates.

Keywords: schizophrenia spectrum disorders, child neglect, child abuse, childhood maltreatment, peer victimization, prevalence of childhood maltreatment

INTRODUCTION

One of the most important challenges worldwide is childhood maltreatment (1). Childhood maltreatment refers to all forms of physical, emotional, or sexual abuse, neglect, or transgressions resulting in actual or potential harm to the child's health, survival, or development (2). Generally, experiences of childhood maltreatment appear to be an important risk factor for mental health

problems (3) and are associated with various psychiatric disorders such as substance use disorder, depression, anxiety disorders, and eating disorders (3–5). Individuals who have experienced childhood maltreatment present with an earlier onset of symptomatology, a greater symptom severity, more hospitalizations and more suicide attempts (6–11).

A growing body of research has investigated childhood maltreatment in disorders of the schizophrenia spectrum (SSD), resulting in a change in the conceptualization of SSD leading from a rather narrow focus on genes and brain functions to an integrated bio-psycho-social approach (12). Accordingly, several studies reported that childhood maltreatment is also very common in SSD with prevalence rates ranging between 18 and 87% (8, 13–18). In line with findings in other psychiatric disorders, SSD patients who have experienced childhood maltreatment exhibited higher symptom severity, more comorbid disorders, greater cognitive impairment, an earlier age at first hospitalization, more hospitalizations, and more suicide attempts than SSD patients without childhood maltreatment experiences (8, 10, 17). Thus, childhood maltreatment is not only a common phenomenon in SSD but also appears to be associated with a less favorable course of disease.

However, previous studies reported a wide range of rates of childhood maltreatment in cases of SSD (8, 14–17, 19–30). The wide range may be due to real differences in different samples but also to methodical differences. For instance, childhood maltreatment was assessed using different methods (e.g., interviews, questionnaires) and different measures [e.g., Childhood Trauma Questionnaire (CTQ; 2), Maltreatment and Abuse Chronology of Exposure – Scale (MACE; 34)].

For example, Kim et al. (21) used a semi-structured interview on the history of sexual and physical abuse, based on Russell's typology (31) of severe and very severe sexual abuse and the operationalization of physical abuse in the Conflict Tactics Scale (32). The authors reported prevalence rates of 19% for sexual abuse and 24.7% for physical abuse. Rubino et al. (27) reported a slightly higher prevalence rate of 28.7% of at least one type of childhood maltreatment while using a semi-structured interview [the Abuse Questionnaire; (33)]. However, the authors assessed physical and sexual abuse as well as emotional and psychological abuse which may explain the higher frequency of childhood maltreatment. Husted et al. (14) used a modified structured clinical interview for DSM-IV and additional data sources (medical, social and legal records and collateral information provided by other family members) to assess childhood maltreatment and reported a relatively low prevalence rate of 18.4%. Schenkel et al. (8) also used a detailed structured interview supplemented by information from the medical chart. The authors reported a prevalence rate of at least one type of childhood maltreatment more than twice as high (45.1%). Whereas, Husted et al. (14) defined childhood maltreatment “as a threat to physical, emotional and sexual integrity, a victim of serious injury or illness or a witness of violence” (p. 3) with no distinction of subtypes, Schenkel et al. (8) only captured sexual and physical abuse.

When questionnaires have been used to capture childhood maltreatment, prevalence rates tended to be higher compared to data collected via interviews. In two studies, sexual abuse alone was captured using a 4-item screening questionnaire, which was created for a Canadian survey, and prevalence rates of 35 and 40% were reported (22, 23). Perona-Garcelán et al. (26) used an event checklist to capture traumatic events in childhood and determined slightly higher prevalence rates of sexual and physical abuse of 46.8 and 49%, respectively. Álvarez et al. (19) ascertained a similar prevalence rate of at least one type of childhood maltreatment of 46.1%. In the study, an event checklist on traumatic events was used and 4 subtypes of childhood maltreatment were defined: physical abuse, sexual abuse, witness to family violence, and psychological abuse, and negligence. In doing so, physical abuse and witness to family violence were assessed using single items and psychological abuse and negligence were requested by an open-ended question. Sexual abuse was assessed using three items, whereby the questions were not explicitly related to abuse by caregivers.

Higher prevalence rates of at least one type of childhood maltreatment can be seen when measures based on broader definitions of childhood maltreatment were used. For example, McCabe et al. (16) used a modified version of the Childhood Adversity Questionnaire [CAQ; (34)] and determined a relatively high prevalence rate of 86.6%. In addition to parental behavior toward the child, the CAQ also covers parental mental health problems and substance use as well as parental separation or loss of a parent and sibling. Further, Schalinski et al. (17) used a more extensive measure, the standardized MACE (35), which, in addition to childhood maltreatment by caregivers, also includes victimization by peers. The authors determined a slightly lower rate of 73% of at least one type of childhood maltreatment, which may be caused by different definitions of childhood maltreatment compared to McCabe et al. (16).

In sum, previous studies often used single items, self-created or modified, and unvalidated measures to capture childhood maltreatment in patients with SSD (e.g., 17, 19, 11), thus the reliability and validity of the data remain unclear. Moreover, some previous studies have focused on sexual and physical abuse (e.g., 24, 25, 26, 29), although emotional forms of child abuse seem to have similarly harmful consequences for mental health as sexual and physical abuse (36). Finally, the conceptualization of measures was often based on different definitions of childhood maltreatment, which complicates the comparability of the data even further (e.g., 22, 17, 11).

In order to facilitate comparability between studies, it is helpful to use standardized, well-established measures. One of the most commonly used standardized measure is the Childhood Trauma Questionnaire (CTQ; 2). The CTQ captures all common types of abusive and neglectful behaviors by family members, such as emotional abuse, sexual abuse, physical abuse, emotional neglect, and physical neglect. Presenting with strong psychometric properties in both clinical and community samples (37, 38), the strength of this instrument is that it allows for a severity rating of the different types of childhood maltreatment (“none to low,” “low to moderate,” “moderate to severe,” and “severe to extreme”) reflecting the fact that types of maltreatment

may be continuous phenomena rather than clearly delineated events or experiences (37, 39). However, a dichotomous categorization of the different types of maltreatment using a severity cut-off is indicated to enable the comparison of rates of child maltreatment from studies that applied different instruments based on similar definitions. While the authors do not provide dichotomous thresholds to determine the presence or absence of the different types of childhood maltreatment, previous studies have indicated prevalence rates of childhood maltreatment in SSD patients based on severity ratings. In doing so, Larsson et al. (15) have used the “low to moderate” severity rating as a dichotomous threshold and reported a rate of at least one type of childhood maltreatment of 85%. Other studies have used the more conservative “moderate to severe” threshold and have determined lower prevalence rates between 45 and 73% (25, 28–30). In contrast, some authors have not utilized threshold values based on the original severity ratings, but on empirically determined and validated threshold values as reported by Walker et al. (20, 24, 40). To ascertain these cut-off scores, the CTQ-subscale scores were related to ratings of experts blind for the CTQ-scores who conducted detailed clinical interviews. Experts determined whether participants had a history of clinically significant maltreatment based on the fulfillment of consensus child abuse and neglect criteria (40). These criteria comprised the same definitions of abuse and neglect from which the items of the CTQ subscales were derived. Threshold scores were determined applying receiver operating characteristic (ROC) methods and showed good to excellent sensitivity and specificity (40). Hence, the cut-off scores established by Walker et al. (40) allow for a more accurate and clinically relevant evaluation of the presence of childhood maltreatment while clinical significance of the thresholds according to Bernstein and Fink (41) remains unclear. So far, comprehensive reports of prevalence rates of childhood maltreatment in SSD applying the cut-off scores according to Walker et al. (40) are scarce. While Hassan et al. (20) and Mohammadzadeh et al. (24) determined prevalence rates of the different forms of childhood maltreatment with emotional abuse (45.1 and 54.6%) and physical neglect (52.4 and 56.8%) being most commonly reported, detailed information on co-occurrence of forms of maltreatment were not presented.

With prevalence rates ranging between 45 and 85%, the presented lack of consistency in applying threshold values may be responsible for the wide range of reported maltreatment frequencies while using the CTQ. Therefore, more information on the impact of threshold scores on prevalence rates of childhood maltreatment in SSD is needed to facilitate the comparison of studies using the CTQ.

However, in addition to childhood maltreatment referring to transgressions by caregivers, victims of maltreatment by caregivers are also more likely to experience maltreatment by peers, often referred to as peer victimization (42–45). Peer victimization includes overt victimization (physical aggression or verbal threats), relational victimization (malicious manipulation of relationships, such as social rejection) and reputational victimization (damaging another's peer relationships, for example by spreading rumors) (46). In contrast to the consequences of childhood maltreatment, the effects of

peer victimization on mental health have been underestimated until recently, as peer victimization has long been considered a normal, developmental experience. However, a growing body of research indicates that peer victimization is also associated with psychopathology such as depression and social anxiety (46–51). However, only a few studies have investigated the relationship between peer victimization and psychosis, reporting prevalence rates up to 48% in patients with psychotic disorders (17, 52). In addition, peer victimization appears to increase the risk of individual psychotic symptoms (53, 54). Nevertheless, given the paucity of studies that have examined the role of peer victimization in SSD, valid conclusions about the relationship between peer victimization and SSD remain open.

In sum, data on prevalence rates of childhood maltreatment in patients with SSD are rare and very heterogeneous. Only a few studies captured childhood maltreatment systematically and reported prevalence rates of all common types of childhood maltreatment (15, 17, 20, 25, 28, 55, 56). However, different thresholds were used to determine prevalence rates of childhood maltreatment in patients with SSD, resulting in a lack of comparability. Additionally, little is known about peer victimization, as another form of adverse childhood experiences, in patients with SSD. Therefore, we aimed to provide and compare systematically captured data on prevalence rates of all common types of childhood maltreatment in patients with SSD using the standardized and well-established Childhood Trauma Questionnaire (CTQ; 1) and the most frequently used thresholds following the guidance of Bernstein and Fink (41) and Walker et al. (40). We expected to find high prevalence rates of childhood maltreatment in SSD. However, we presumed remarkable differences in prevalence rates depending on cut-off scores established. In particular, we presumed higher prevalence rates for emotional abuse, physical abuse and physical neglect, when rates were calculated using cut-off scores according to Walker et al. (40) due to the fact that the corresponding cut-off scores are less conservative. In addition, we aimed to increase knowledge about peer victimization in SSD by conducting exploratory analyses of the extent of experiences of peer victimization in a sample of SSD patients.

MATERIALS AND METHODS

Participants

48 patients with a primary diagnosis of SSD were recruited in four local outpatient and inpatient psychiatric clinics. In these clinics patients with varying psychiatric disorders were treated due to standard clinical care. Eligible patients were recruited by medical staff members through personal contacts on the wards and during group therapy sessions. Participants were included if they met criteria for any schizophrenia-spectrum-disorder according to the International Classification of Mental and Behavioral Disorders Tenth Version [ICD-10: F20–F29; (57)]. Exclusion criteria were an age below 18 and above 65, an IQ below 85, insufficient knowledge of the German language, acute suicidality, substance-induced psychosis, and psychotic disorder due to (brain-) organic dysfunction. Information on exclusion criteria was obtained from the patients' medical records. Of the

48, 72.9% were inpatients. More than 85% of the sample met criteria for schizophrenia, 2.1% for a brief psychotic disorder, and 12.5% for a schizoaffective disorder. Data collection in inpatients took place after an acute psychotic episode. Prior to assessment, patients were informed about the objectives and the procedure of the study and gave their written informed consent to participate. The study was reviewed and approved by the Ethics Committee of the Bielefeld University and of the Department of Medicine at the Justus Liebig University Giessen, Germany.

Measures and Instruments

Information about number and type of diagnoses was obtained from the medical records of the clinic where participants received care. Sociodemographic data were collected using a sociodemographic questionnaire. Self-reported data were then validated with data from the medical record (e.g., age, number, and duration of inpatient treatments).

Symptom severity was evaluated using the *Positive and Negative Syndrome Scale* [PANSS; (58)]. The 30-item expert rating assesses symptoms of schizophrenia based on information reported by the patient, direct observations, and observations made by health care staff or family members. The severity of each item for the past 7 days is rated on a scale of 1 (absent), 2 (minimal), 3 (mild), 4 (moderate), 5 (moderate to severe), 6 (severe), to 7 (extreme), resulting in three subscales: positive symptoms (range: 7–49), negative symptoms (range: 7–49) and general psychopathology (range: 16–112). Interviews were carried out by trained research assistants or master level clinical psychologists, whereas the PANSS interviews were conducted only by master level clinical psychologists.

The German version of the self-rating scale *Childhood Trauma Questionnaire* (CTQ; 1) was employed to retrospectively assess the exposure to childhood maltreatment by family members. The 28-item scale captures five types of abusive and neglectful behaviors by family members (emotional abuse, sexual abuse, physical abuse, emotional neglect, and physical neglect). Each item is rated from 1 (never true) to 5 (very often true) with a possible range of subscale scores of 5–25 and a total sum score ranging from 25 to 125.

Peer victimization was retrospectively assessed using the *Fragebogen zu belastenden Sozialerfahrungen* [FBS; (59)] [*Adverse Social Experiences Questionnaire*]. The self-rating scale consists of a list of 22 aversive social situations. Patients can indicate whether they had experienced these situations (rated 1) or not (rated 0) during childhood (age 6–12) or adolescence (age 13–18) resulting in two subscales ranging from 0 to 22 and a total sum score ranging from 0 to 44. The total-score of the FBS presented with a satisfying stability over a 20-month period and construct validity has been confirmed suggesting a good fitness of the instrument [e.g., (49, 50, 59)].

Statistical Analyses

To allow comparability of different studies, the most common thresholds established by Bernstein and Fink (41) and Walker et al. (40) were applied to determine prevalence rates of childhood maltreatment. While cut-off scores according to Walker et al. (40) allow a dichotomous classification, thresholds reported by Bernstein and Fink (41) can also be used to inform

about the severity of childhood maltreatment (“none to low,” “low to moderate,” “moderate to severe,” and “severe to extreme”). The cut-off scores established by Walker et al. (40) were 10 for emotional abuse, 15 for emotional neglect, 8 for physical abuse, 8 for physical neglect, and 8 for sexual abuse. The Bernstein severity thresholds are presented in **Table 3**. Unfortunately, previous studies that have applied severity ratings reported by Bernstein and Fink (41) used different thresholds (“low to moderate” or “moderate to severe”) to determine the frequency of childhood maltreatment. In the present study, the more common and more conservative severity ratings of at least “moderate to severe” were used to obtain a dichotomous classification. To determine the prevalence rates of childhood maltreatment, subjects were divided into groups according to fulfillment of the different types of maltreatment. Furthermore, to provide descriptive data, mean values and standard deviations on childhood maltreatment and peer victimization were calculated. To analyze gender differences in prevalence rates, Pearson’s chi-square tests or, for expected cell frequencies below 5, the Fisher’s exact test, were performed. T-tests for independent samples were used to analyze gender differences in mean scores of all types of childhood maltreatment and peer victimization. All analyses were carried out with SPSS 26.

RESULTS

The total sample consisted of 48 SSD patients. The average age of the participants was $M = 39.1$ ($SD = 10.3$). **Table 1** presents participants’ demographics and means on psychopathology.

TABLE 1 | Subject characteristics and mean values on psychopathology measures (N = 48).

Age, M (SD, range)	39.1 (10.3, 20–64)
Gender, % female (n)	29.2 (14)
Nationality, % German (n)	81.3 (39)
Family status, % single (n)	81.3 (39)
Income per month (in euro), M (SD), range	811.6 (649.7), 90–2,900
Total duration (weeks) of inpatient treatments, M (SD), range	57.8 (61.9), 3–288
Total number of inpatient treatments, M (SD), range	8.6 (9.9), 1–46
Positive and Negative Syndrome Scale, M (SD)	55.2 (14.7)
Positive Symptoms	13.3 (4.9)
Negative Symptoms	14.2 (5.9)
General Psychopathology	27.5 (7.1)
Childhood Trauma Questionnaire, M (SD)	49.3 (15.5)
Emotional abuse	11.6 (5.3)
Emotional neglect	13.6 (5.6)
Physical abuse	8.1 (4.2)
Physical neglect	9.2 (3.2)
Sexual abuse	6.9 (3.7)
Peer victimization, M (SD) ^a	12.9 (7.7)
Age 6 – 12	4.9 (4.3)
Age 13 – 18	8.0 (4.9)

^aFragebogen zu belastenden Sozialerfahrungen [FBS; (59)] [*Adverse Social Experiences Questionnaire*, n = 47].

TABLE 2 | Prevalence rates of childhood maltreatment based on thresholds as established by Bernstein and Fink (41) and Walker et al. (40) in the present study with SSD patients and in a representative sample of the German population.

	Present study, <i>N</i> = 48						Iffland et al. (60) ^b , <i>N</i> = 2,500	Häuser et al. (61) ^b , <i>N</i> = 2,504
	Walker et al. (40), % (<i>n</i>)			Bernstein and Fink (41), % (<i>n</i>)			Walker et al. (40), % (<i>n</i>)	Bernstein and Fink (41) ^a , % (<i>n</i>)
	Total	Female	Male	Total	Female	Male	Total	Total
Emotional abuse	47.9 (23)	57.1 (8)	44.1 (15)	43.8 (21)	57.1 (8)	38.2 (13)	10.2 (254)	4.6 (115)
Emotional neglect	37.5 (18)	57.1 (8)	29.4 (10)	37.5 (18)	57.1 (8)	29.4 (10)	13.9 (348)	13.9 (348)
Physical abuse	37.5 (18)	42.9 (6)	35.3 (12)	25.0 (12)	28.6 (4)	23.5 (8)	12.0 (301)	5.6 (139)
Physical neglect	66.7 (32)	71.4 (10)	64.7 (22)	45.8 (22)	50.0 (7)	44.1 (15)	48.4 (1,210)	28.7 (719)
Sexual abuse	25.0 (12)	42.9 (6)	17.6 (6)	25.0 (12)	42.9 (6)	17.6 (6)	6.2 (156)	6.2 (156)
At least one type	77.1 (37)	92.9 (13)	70.6 (24)	58.3 (28)	78.6 (11)	50.0 (17)	33.9 %	–

^aReported prevalence rates based on the “moderate to severe” thresholds; ^bAnalyses based on the same sample; No significant gender differences were found for CTQ subscales (all *p*'s > 0.05).

Out of the sample of 48 SSD patients, we found 37 participants (77.1%) meeting cut-off scores according to Walker et al. (40) and 28 patients (58.3%) meeting the “moderate to severe” thresholds established by Bernstein and Fink (41) for at least one type of childhood abuse or neglect, as measured by the CTQ subscales (41). The prevalence rates for the different types of childhood maltreatment are presented in **Table 2**. Using cut-off scores established by Walker et al. (40), 18.8% (*n* = 9) of the participants met threshold level for one subtype, 16.7% (*n* = 8) met threshold levels for two subtypes, 14.6% (*n* = 7) for three subtypes, 16.7% (*n* = 8) for four subtypes, and 10.4% (*n* = 5) for all five subtypes. In addition, 10.4% (*n* = 5) met the threshold level as established by Bernstein and Fink (41) for one subtype, 12.5% (*n* = 6) met threshold levels for two subtypes, 8.3% (*n* = 4) for three subtypes, 18.8% (*n* = 9) for four subtypes, and 8.3% (*n* = 4) for all five subtypes. **Table 3** shows the distribution of childhood maltreatment severity for all types of childhood maltreatment assessed with the CTQ (41).

As can be seen in **Table 1**, the mean value of childhood maltreatment in the total sample was 49.3 (*SD* = 15.5). Females had a mean value of 54.57 (*SD* = 16.46) while males showed a mean value of 47.15 (*SD* = 14.86; *t*(46) = 1.53, *p* = 0.13). A significant gender difference was observed for sexual abuse (*t*(46) = 2.00, *p* = 0.05), with higher mean values in females (*M* = 8.57, *SD* = 3.72) compared to males (*M* = 6.29, *SD* = 3.54), while no significant gender differences were found for emotional abuse, emotional neglect, physical abuse, and physical neglect (all *p*'s > 0.05).

Table 1 also shows that the mean value of peer victimization in the total sample was 12.9 (*SD* = 7.7). Female patients had a mean value of 14.1 (*SD* = 10.3) while a mean value of 12.3 (*SD* = 6.5) was obtained for male patients (*t*(45) = 0.70, *p* = 0.49). In childhood (age 6–12) a mean value of 4.9 (*SD* = 4.3) was determined in the total sample, female patients showed a mean value of 5.6 (*SD* = 5.5) and male patients a mean value of 4.6 (*SD* = 3.6) (*t*(45) = 0.80, *p* = 0.43). In adolescents (age 13–18) a mean value of 8.0 (*SD* = 4.9) was determined in the total sample. A mean value of 8.4 (*SD* = 6.3) was observed for female patients and 7.8 (*SD* = 4.3) for male patients (*t*(45) = 0.41, *p* = 0.69).

DISCUSSION

With this study we aimed at presenting and comparing prevalence rates of childhood maltreatment in a sample of patients with SSD based on both the original “moderate to severe” severity ratings established by Bernstein and Fink (41) and the empirically determined and validated cut-off scores established by Walker et al. (40). 58.3% of the sample reached threshold for at least one type of childhood maltreatment using “moderate to severe” thresholds established by Bernstein and Fink (41), while 77.1% of the sample reached cut-off score according to Walker et al. (40) for at least one type of maltreatment. Physical neglect (46–67%) and emotional abuse (44–48%) were found to be the most frequently reported types of childhood maltreatment followed by emotional neglect (38%), physical abuse (25–38%) and sexual abuse (25%). In addition, we have run exploratory analyses on peer victimization in SSD and reported descriptive data.

Prevalence rates of childhood maltreatment in SSD show a large variability with our results being in a medium range (**Table 4**). With respect to the prevalence rates for at least one type of childhood maltreatment in patients with SSD, Mørkved et al. (25) reported a slightly higher rate of 67.3%, while the prevalence rate in the study of Schäfer et al. (28) was higher (73.0%) than our finding (58.3%). Both studies also used the “moderate to severe” thresholds as established by Bernstein and Fink (41) for calculating prevalence rates. A comparison of the prevalence rate with the results of Schäfer et al. (28), however, is limited by the fact that the authors included only female subjects in their study. Generally, females report significantly higher rates of sexual abuse than males (60). This is also reflected in our study in the significantly higher mean score of sexual abuse among females compared to males. Accordingly, when comparing the prevalence rates of the different types of childhood maltreatment in our study with those reported by Schäfer et al. (28), rates of emotional and physical types of childhood maltreatment are similar, while prevalence rates of sexual abuse reported by Schäfer et al. (28) are noticeably higher (37%) than in the present study (25%). This difference may have led to a clearly higher prevalence

TABLE 3 | Severity thresholds and distribution of childhood maltreatment severity (41) ($N = 48$).

	Severity rating, % (n)															
	None to low				Low to moderate				Moderate to severe				Severe to extreme			
	Thresh- old	Total	Female	Male	Thresh- old	Total	Female	Male	Thresh- old	Total	Female	Male	Thresh- old	Total	Female	Male
Emotional abuse	≤8	45.8 (22)	35.7 (5)	50 (17)	9–12	10.4 (5)	7.1 (1)	11.8 (4)	13–15	14.6 (7)	7.1 (1)	17.6 (6)	≥16	29.2 (14)	50.0 (7)	20.6 (7)
Emotional neglect	≤9	18.8 (9)	7.1 (1)	23.5 (8)	10–14	43.8 (21)	35.7 (5)	47.1 (16)	15–17	10.4 (5)	14.3 (2)	8.8 (3)	≥18	27.1 (13)	42.9 (6)	20.6 (7)
Physical abuse	≤7	62.5 (30)	57.1 (8)	64.7 (22)	8–9	12.5 (6)	14.3 (2)	11.8 (4)	10–12	8.3 (4)	7.1 (1)	8.8 (3)	≥13	16.7 (8)	21.4 (3)	14.7 (5)
Physical neglect	≤7	33.3 (16)	28.6 (4)	35.3 (12)	8–9	20.8 (10)	21.4 (3)	20.6 (7)	10–12	27.1 (13)	28.6 (4)	26.5 (9)	≥13	18.8 (9)	21.4 (3)	17.6 (6)
Sexual abuse	5	58.3 (28)	21.4 (3)	73.5 (25)	6–7	16.7 (8)	35.7 (5)	8.8 (3)	8–12	18.8 (9)	28.6 (4)	14.7 (5)	≥13	6.3 (3)	14.3 (2)	2.9 (1)

TABLE 4 | Summary of prevalence rates in SSD patients reported in previous studies (in %).

	Thresholds	CTQ total, <i>M (SD)</i>	At least one type	Emotional abuse	Sexual abuse	Physical abuse	Emotional neglect	Physical neglect
Present study	Walker et al. (3)	49.3 (15.5)	77.1	47.9	25.0	37.5	37.5	66.7
	Bernstein and Fink (2)		58.3	43.8	25.0	25.0	37.5	45.8
Hassan et al. (20)	Walker et al. (3)	–	–	54.6	34.3	43.2	29.6	56.8
Mohammadzadeh et al. (24)	Walker et al. (3)	–	–	45.1	32.9	40.2	39.0	52.4
Larsson et al. (15)	Bernstein and Fink (2) ^a	–	85.0	63.0	35.0	29.0	67.0	46.0
Li et al. (74)	Bernstein and Fink (2) ^a	42.7 (12.1)	–	31.7	39.9	22.2	58.7	71.7
Haug et al. (75)	Bernstein and Fink (2)	47.2 (18.8)	–	32.0 ^b	14.0 ^b	11.0 ^b	32.0 ^b	32.0 ^b
				26.0 ^c	30.0 ^c	15.0 ^c	26.0 ^c	33.0 ^c
Mørkved et al. (25)	Bernstein and Fink (2)	46.4 (15.5)	67.3	23.1	26.9	17.3	30.8	38.5
Schäfer et al. (28)	Bernstein and Fink (2)	48.5 (18.3)	73.0	40.0	37.0	20.0	43.0	37.0
Shannon et al. (29)	Bernstein and Fink (2)	–	45.0	–	–	–	–	–
Vogel et al. (56)	Bernstein and Fink (2)	45.4 (17.5)	–	46.8	27.8	25.6	62.3	65.8
Wang et al. (76)	Bernstein and Fink (2)	–	71.1 ^d	10.9 ^d	27.3 ^d	19.5 ^d	25.8 ^d	63.3 ^d
			69.0 ^e	8.6 ^e	18.9 ^e	14.7 ^e	37.8 ^e	55.2 ^e
Xie et al. (30)	Bernstein and Fink (2)	41.3 (12.4)	47.2	19.4	13.9	11.1	19.4	38.9

Thresholds according to Bernstein and Fink (41) refers to the “moderate to severe” severity ratings; ^aThe “low to moderate” severity ratings were used as dichotomous thresholds; ^bMale; ^cFemale; ^dFirst episode; ^eChronic.

rate for at least one type of childhood maltreatment reported by Schäfer et al. (28).

In contrast to our findings and the studies already mentioned, Shannon et al. (29) reported a smaller prevalence rate for at least one type of childhood maltreatment of 45%, although the authors also used the “moderate to severe” threshold. When considering the findings of Shannon et al. (29) it is important to note that the CTQ, designed to be used as a self-report questionnaire, was used as an interview by Shannon et al. (29). The authors themselves limited the method they used, since maltreatment could have led to general mistrust among those affected. Additionally, mistrust as a common symptom in patients with SSD may have led to an underreported history of maltreatment in a research interview. In contrast, a self-report questionnaire provides anonymity and perhaps an increased sense of confidentiality, which may facilitate disclosure. Taking into account the positive

correlation between childhood maltreatment and symptom severity (8, 10, 17) and the assumption that inpatients exhibit higher symptom severity, the place of recruitment as an index for symptom severity, may also be an explanation for the difference. While our results are based on data from a mixed sample of outpatients and inpatients, Shannon et al. (29) only examined outpatients, whereas the higher prevalence rate reported by Schäfer et al. (28) was determined in a sample of inpatients.

Unsurprisingly, in line with previous studies in representative samples (60, 61), the prevalence rates calculated with the cut-off scores established by Walker et al. (40) were higher than the rates calculated using the thresholds established by Bernstein and Fink (41). This is due to the fact that the “moderate to severe” thresholds are as or more conservative than the cut-off scores reported by Walker et al. (40).

Accordingly, as expected, prevalence rates for emotional abuse, physical abuse, and physical neglect were higher when rates were calculated using cut-off scores according to Walker et al. (40) whereas prevalence rates for emotional neglect and sexual abuse were equal to prevalence rates calculated using thresholds as established by Bernstein and Fink (41). In comparison, the “low to moderate” thresholds established by Bernstein and Fink (41) are the least conservative of the thresholds described. In line, applying this thresholds led to elevated prevalence rates of at least one type of childhood maltreatment of up to 85% in a previous study (15).

Comparing our results with those of studies that have used other questionnaires instead of the CTQ, we find that the use of thresholds as reported by Walker et al. (40) has resulted in a prevalence rate, which is similar to those of other studies with similarly broad definitions of childhood maltreatment (e.g., 19, 20). The comparatively lower prevalence rate we determined based on the thresholds according to Bernstein and Fink (41) can be classified between those of previous studies. It is lower than those of previous studies with similarly broad definitions of childhood maltreatment (e.g., 19, 20) but, as expected, it is higher than rates in previous studies that have limited the investigation to sexual or physical abuse (e.g., 25, 26, 29). Thus, comparing studies that used different instruments remains difficult when different definitions of childhood maltreatment were used.

Considering the prevalence rates of the various forms of maltreatment, emotional abuse and physical neglect were most frequently reported in our study. These results are similar to those of previous studies that have used the CTQ to capture childhood maltreatment in SSD (15, 20, 24, 28, 55, 56, 62). Physical neglect and emotional types of childhood maltreatment were also most commonly reported in a representative sample of the German population (60, 61). However, prevalence rates of all types of childhood maltreatment in our SSD sample were clearly higher and more than twice as high for at least one type of childhood maltreatment compared to the prevalence rates in the representative sample (see **Table 2**). This highlights the relevance of childhood maltreatment in SSD.

However, a validation study from the general German population indicated that the subscale for physical neglect shows high intercorrelations with the other subscales and a weak internal consistency (63), thus elevating the risk of an over-estimation of prevalence rates for physical neglect. When following the authors' recommendation to apply the subscale “physical neglect” with caution or even to exclude it from analyses, the present results indicate the specific significance of emotional forms of maltreatment in patients with SSD. Because similar distributions were also found in studies examining other psychiatric disorders such as affective or anxiety disorders (49, 50, 64), it may be suggested that the distribution and significance of the different types of childhood maltreatment are not limited only to patients with SSD.

Although exploratory, the present study was among the first to examine associations of peer victimization and SSD. Levels of peer victimization presented in our SSD sample ($M = 12.9$, $SD = 7.7$) were consistent with previous studies that used the FBS to capture peer victimization in different clinical samples [e.g., (65,

66)]. Most notably, Iffland et al. (67) as well as Sansen et al. (50) showed that levels of peer victimization in a healthy sample [$M = 7.7$ ($SD = 4.8$) and $M = 9.0$ ($SD = 6.6$)] were substantially lower than in patients with varying psychiatric disorders [$M = 16.5$ ($SD = 8.7$) and $M = 12.7$ ($SD = 8.5$)]. Due to a lack of cut-off scores for the FBS, no actual prevalence rate of peer victimization could be reported in this study, resulting in a lack of comparability with other studies. For instance, Schalinski et al. (17) used the German version of the MACE Scale (68) to assess childhood maltreatment and peer victimization in SSD. The authors reported prevalence rates of peer victimization up to 48% in patients with SSD suggesting that experiences of peer victimization are as common as childhood maltreatment in patients with SSD.

Strengths and Limitations

To our knowledge, the present study is the first to present prevalence rates for childhood maltreatment in SSD based on both cut-off scores according to Walker et al. (40) and Bernstein and Fink (41), which allows a thorough evaluation of data for childhood maltreatment in SSD in future research. Accordingly, our results provide information on how conservative the investigated cut-off scores are and may thus facilitate the decision on which cut-off scores to use in future research. Additionally, explorative data of peer victimization were presented in this study. With respect to the alarming prevalence rates, the current study has practical implications. Prevention of childhood maltreatment is highly relevant - with respect to our explorative analyses maltreatment here refers to victimization by caregivers and by peers. In particular, sensitizing, informing, and training relevant (e.g., caregivers, educators, teachers) could help identifying children at risk for childhood maltreatment, especially emotional types of childhood maltreatment, and latter impacts on mental health. Moreover, the routine collection of any form of childhood maltreatment history from all users of mental health services is recommended. In this regard, when using standardized self-reports such as the CTQ, more sensitive cut-off scores, such as those established by Walker et al. (40), should be used in order to minimize false-negative results. Finally, patients who have been abused or neglected by caregivers during childhood or adolescence should receive the offer of appropriate psychosocial treatments. At this point, the present study emphasizes that this also applies to patients with more genetically-conceptualized disorders such as SSD.

However, the present study has several limitations. First of all, memory errors and biases may have influenced the results of our study. Particularly, the retrospective nature of the CTQ and FBS may have led to inaccuracy of reports. Memory biases may be a particular problem in SSD, since patients could have difficulties in reality testing. This may be even more true in not fully clinically stabilized SSD patients as tested in our study. However, Read et al. (69) suggested that retrospective self-reports can be considered reliable even if participants with a history of psychosis were included. Fisher et al. (70) also found that reports of childhood maltreatment were not associated with current severity of psychotic symptoms. However, co-morbid disorders or sociodemographic characteristics may have influenced the prevalence rates calculated in our study. Accordingly, Bonoldi et al. (71) indicated that childhood maltreatment is moderated

by substance abuse and age. Further, it is uncertain whether our sample of patients with SSD is representative of all patients with SSD, especially since our sample size is small and includes relatively few females, as it is often the case in SSD research. Therefore, subgroup analyses, for example exploration of gender differences, were limited in our study and should be investigated in future research. In addition to the small sample size, the present study lacks a healthy control group. Hence, conclusions regarding increased prevalence rates in SSD patients and its role in the etiology of the disorder have to be drawn with caution. Finally, although the German version of the CTQ seems to be a reliable and valid measure for childhood maltreatment in clinical samples (72, 73), a validation study from the general German population has indicated that the subscale for physical neglect shows high intercorrelations with the other subscales and a weak internal consistency (63), therefore the authors recommend applying the physical neglect subscale with caution.

CONCLUSION

Childhood maltreatment is a common phenomenon in SSD, even though methodological details, especially cut-off scores, have a substantial impact on the prevalence rates that are determined. Therefore, the methodology of studies should be closely examined when drawing conclusions from presented prevalence rates.

DATA AVAILABILITY STATEMENT

The data sets presented in this article are not readily available. To preserve the anonymity of participants, only aggregated data can be provided. Requests for access to datasets should be directed to Angelina Weitkämper, angelina.weitkaemper@uni-bielefeld.de.

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ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the Bielefeld University and the Ethics Committee of the Department of Medicine at the Justus Liebig University Giessen. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AW made substantial contributions to the conception and design of the work, the acquisition, analysis, and interpretation of the data, drafted, revised, and approved the manuscript, and ensures the accuracy and integrity of any part of the work. MK, JL, MD, HK, and FN contributed to the conception of the study and revised the manuscript critically for important intellectual content. MK, JL, MD, and HK made substantial contributions to data acquisition. BI was the chief investigator for this study, contributed to the conception of the study, supervised data analyses, participated in the interpretation of the data, and critically revised the manuscript for important intellectual content. All authors contributed to the article and approved the submitted version.

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Childhood Trauma and Aggression in Persons Convicted for Homicide: An Exploratory Study Examines the Role of Plasma Oxytocin

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Evidence has demonstrated the association between childhood trauma and criminality in adulthood, however, less is known about how best to explain the route from childhood trauma to adulthood aggression. Results from both human and animal studies have generated the hypothesis that dysfunction of the oxytocinergic system may correlate with pathological aggression. The current study represents a first exploratory examination to investigate the trajectory from childhood trauma to aggression, specifically, plasma oxytocin's role in this association. We assessed the childhood trauma experiences in a total of 108 participants, including 33 persons convicted for homicide and 75 non-offending healthy participants, using the Childhood Trauma Questionnaire, with in-depth clarification interviews for cross-validation. All participants were checked for aggression using the Modified Overt Aggression Scale and their plasma oxytocin levels were obtained. Results indicated that persons convicted for homicide had higher childhood trauma scores and lower plasma oxytocin levels than healthy controls. The plasma oxytocin levels were inversely correlated with childhood trauma in all participants. Further mediation models were constructed to explore these associations, in the best-fit model, the relationship between childhood trauma and aggression is mediated by plasma oxytocin levels in persons convicted for homicide. In conclusion, the association between childhood trauma and aggression of persons convicted for homicide is mediated by their plasma oxytocin levels. With leading to further theoretical consideration in the causality on how best to explain the interaction between childhood trauma and aggression, the current study may assist in developing further research and preventive strategies for aggression, particularly the importance of early identification of childhood trauma.

Keywords: oxytocin, childhood trauma and adversity, homicide, aggression, violence

INTRODUCTION

Violence remains a leading cause of mortality worldwide. The burden and harm elicited by violent crimes are tremendous, engendering a combined negative effect on society in terms of both insecurity and physical disability. Considering the relation to offender characteristics and violent crime formation models, recent studies have reported that most offenders have a history

of childhood trauma (1, 2). Trauma experienced in childhood has severe consequences. Individuals with childhood trauma are at higher risk of engaging in problematic behaviors; subsequently resulting in adverse effects, on both physical and mental health, that may appear in childhood and continue into adulthood (3, 4). Although several studies using forensic and psychiatric samples have suggested a relationship between childhood trauma and violent crime (5–7), less is known about how best to explain the route from childhood trauma to adulthood aggression. Various brain circuits, including the amygdala and pre-frontal cortex, may be involved in aggression formulation (8). In addition to these anatomical findings, neurotransmitter activity, such as serotonin, dopamine, norepinephrine, and γ -aminobutyric acid, is proposed to be positively correlated with aggression (8). Childhood trauma compromises homeostasis and leads to numerous psycho-neuroendocrine changes that may affect physiological, emotional, cognitive, and social functioning, including the ability to regulate, affect, and subsequently develop empathy (9, 10).

Oxytocin plays a crucial role in stress and aggression, with animal studies demonstrating its association to maternal behavior, aggression, non-social behaviors (11), and stress response regulation (12). Oxytocin lowers hypothalamus–pituitary–adrenal activity and cortisol levels, which increases levels of plasma oxytocin; this results in a negative feedback system, where stress increases the level of cortisol, which in turn increases the level of oxytocin, resulting in a subsequent decrease in cortisol (13). History of aggression was shown to inversely correlate with oxytocin levels in the cerebral spinal fluid, indicating that oxytocin plays a mechanistic role in human aggression (14). In one study, the fight-or-flight response increased activation of the amygdala in participants with low oxytocin levels, which was associated with a lack of trust (15) in children who had experienced trauma. The association of oxytocin with trustworthiness was also demonstrated in an experimental adult's monetary payoffs study (16). Low plasma oxytocin levels have been observed in children who experienced trauma (17) and in adults who were exposed to childhood trauma (18). Further, disrupted oxytocin regulation was noted in individuals with childhood trauma (19). The severity of childhood trauma may also have an inverse correlation role in modulating oxytocin concentrations (20). It is possible that individuals who have experienced trauma do not have a normally functioning oxytocin inhibition process, allowing stress responses to escalate to unproportionally high levels (13). This phenomenon may also be caused by a failure to exhibit high oxytocin receptor levels in the amygdala of children with experiences of trauma. A low oxytocin level may be associated with neurostructural changes in those who experienced maltreatment, for example, a low oxytocin level is associated with larger hypothalamus and amygdala volumes (21) as a result of the compensatory growth mechanism. Reduced amygdala activation, under the influence of oxytocin, has been shown to reduce danger signaling, and is linked to the promotion of trust, increased sociability, and decreased social fear (22). Lower salivary oxytocin levels in maltreated children lead to a lower percentage of

gaze fixation for the human face eye area and this visual attention deficit is resulting in social-emotional problems (23). It is believed that untoward childhood trauma may interfere with the oxytocinergic system on a more fundamental level, particularly affecting the molecular and genetic mechanisms. Genetic variation, of the oxytocin receptor (Oxtr) gene for example, may moderate the link between childhood trauma and social relationship in adulthood (24). The total Oxtr-knockout male mice (excised at the time of conception) had heightened aggression compared with the controls while the predominantly forebrain-specific Oxtr-knockout male mice (excised postnatally) displayed similar aggression levels with controls mice (25). This animal study indicates that oxytocin may play an important role in the development of neural circuits that underlie aggression in adulthood. In the human study, the single-nucleotide polymorphisms of the Oxtr gene, for example, rs7632287 (26) and rs53576 (27) were associated with the frequency of aggressive behaviors.

Supplementation of exogenous oxytocin has been shown to attenuate the amygdala's response to social stress and fear (28). Exogenous oxytocin induces a momentary “state of mind” change in individuals through a reduction in feelings of fear (29) and resulting in an alteration to the brain's cognitive–emotional schemas and shifting an individual's perception of others as untrustworthy to more trustworthy (30). Intranasal oxytocin administration decreased social threat hypersensitivity and, accordingly, reduced both anger and aggressive human behaviors (31). In the study of task-related aggressive responses, oxytocin administration decreased aggression in healthy young men and the higher baseline endogenous urinary oxytocin levels were associated with less aggressive responses (32). In a study of general healthy participants, compared with a placebo group, behavioral aggression was slightly higher in the experimental group directly after the intranasal administration of oxytocin, although the opposite was found as the study period progressed (33). In another study of healthy participants, compared with the placebo group, the intranasal administration of oxytocin increased the aggressive responses of participants in the experimental group while playing a monetary game (34). The acute effect of oxytocin on aggressive behavior did not been observed in another study of the healthy adult man but when examining those responders, higher scores on antisocial personality traits were related to their increase in aggression response following oxytocin administration (35).

All of the evidence implies that endogenous and exogenous oxytocin may be capable of modulating aggressive behaviors in humans. However, the link between downregulation of the oxytocinergic system and heightened aggression is less straightforward and required further research (36). Various experimental studies try to postulate the pathways and possible factors that may tangle between childhood trauma, aggression, and oxytocinergic dysfunction. Despite this evidence, results of research investigating the correlation between childhood trauma, oxytocin levels and aggression are, in general, mixed and inconsistent.

The role of oxytocin in persons convicted for homicide is the primary focus of our study. Childhood trauma may disrupt oxytocin regulation, with a decrease in oxytocin levels potentially correlating with heightened levels of aggression. However, if oxytocin mediates the route from childhood trauma to adulthood aggression is still unknown. This study aims to explore a theoretical framework that may explain the pathway through which childhood trauma leads to aggression in persons convicted for homicide. First, it is hypothesized that persons convicted for homicide have higher scores in childhood trauma measures compared with those healthy participants. Further, we postulate that persons convicted for homicide have lower plasma oxytocin levels than healthy participants who have not committed violent crimes. In addition, under the presumption that aggression is a phenotype associated with persons convicted for homicide and manifests in them committing violent crimes, this study aimed to examine the proposed trajectory from childhood trauma to adulthood aggression, oxytocin is considered to contribute to aggression.

METHODS

Participants

This study was conducted between November 1, 2018, and April 30, 2019, following approval from Taiwan's Ministry of Justice. Persons convicted for homicide (Taiwan Criminal Codes §271, §272, §273, and §274) were recruited from probation offices in Taipei, Shihlin, Taoyuan, and Hsinchu, while control group participants were recruited from the community through research advertisements, and were without a history of criminal convictions, illicit drug use, and mental disorders. A total of 108 participants, composed of 33 in the homicide group and 75 in the control group, were enrolled. The demographic data of participants and their related characteristics are shown in **Table 1**. All participants were aged 20–65 years, male, had adequate mental competence, and were willing to provide written informed consent. Those who had received hormone therapy were excluded. All participants were interviewed by qualified psychiatrists using structured interviews for the screening and diagnosis of mental disorders. To minimize the possible confounding effects of current trauma-related symptom severity and other psychopathology, none of the participants had schizophrenia, bipolar disorder, posttraumatic stress disorder, epilepsy, intellectual disability, dementia, neurocognitive disorder, or other serious medical illnesses. Explanations regarding the purpose, content, process, and possible risks involved in this study were delivered orally to all participants. Participant rights were thoroughly explained, particularly, that their criminal sentences, parole or probation periods would not be affected by whether they chose to participate in the study or not, and written informed consents were collected. Participants were free to withdraw from the study at any time. Recruited offenders continued to serve their sentences, with their probation periods unchanged. This study was approved by the Joint Institutional Review Board of Taipei Medical University.

Measures

Demographic Questionnaire

The first part of the questionnaire related to participants' basic demographic data, including height, weight, age, date of birth, place of birth, marital status, educational history, occupational history, family history, medical history, psychiatric history, current medication use, alcohol and cigarette use, and self-reported criminal convictions. Additional information on age at index offense, length of sentence, and length of imprisonment were collected through questionnaires provided to persons convicted for homicide only.

Childhood Trauma

Childhood trauma is defined as child maltreatment constitutes all forms of ill-treatment, abuse, neglect or negligent treatment or commercial or other exploitation, resulting in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power (37). The Childhood Trauma Questionnaire-Short Form (CTQ-SF) (38) was used to assess the childhood trauma of participants. In a previous study, the CTQ-SF was translated into Chinese, and the translated version's reliability was confirmed (Cronbach's $\alpha = 0.57$ – 0.90 ; Intra-class coefficient = 0.67 – 0.85) (39). The CTQ-SF screens the history of participants for childhood adversities and consists of 28 items, measuring five types of aforementioned childhood trauma. Participants with scores exceeding the moderate exposure cutoff point on each subscale (physical abuse: ≥ 10 ; emotional abuse: ≥ 13 ; sexual abuse: ≥ 8 ; physical neglect: ≥ 10 ; emotional neglect: ≥ 15) were classified as having a history of exposure to childhood trauma (19, 40). Physical, emotional, and sexual abuse were further categorized as major childhood trauma. For cross-validation, participants were asked to provide detailed clarification about their childhood trauma experiences during individual interviews.

Aggression

Aggression is defined as an intention to harm another person who is motivated to avoid that harm and the perpetrator has strong faith that the behavior will harm the target (41). Besides the homicide crimes convicted by the offenders, the characteristics of aggression of all participants were also been measured using both the Modified Overt Aggression Scale (MOAS) (42), a 4-part behavior rating scale designed to measure four types of aggressive behaviors; namely, verbal aggression, aggression against property, auto-aggression, and physical aggression. Participants were asked to determine whether each statement appropriately described their behaviors over the past week, and during the most serious incidents of their lifetime. The reliability and validity of the Chinese versions of MOAS were assessed in previous studies (Intra-class coefficient = 0.94 ; Mann-Whitney test $Z = -2.89$) (43).

Oxytocin Laboratory Assessment

Ten milliliters of venous blood were collected from each participant's antecubital region or hand. Plasma oxytocin levels were determined using an enzyme immunoassay (Catalog number: EKE-051-01, Phoenix Pharmaceuticals, Inc.,

TABLE 1 | Demographic characteristics of all participants.

	Homicide group (<i>N</i> = 33)		Healthy group (<i>N</i> = 75)		<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age (in year)	39.97	12.44	39.05	12.48	0.73
Height (in cm)	170.18	7.15	173.15	5.75	0.02
Weight (in kg)	72.82	19.97	69.16	11.04	0.23
Education (<i>n</i> , %)					<0.001
University		4 (12.1)		41 (54.6)	
High School		16 (48.5)		27 (36.0)	
Middle School		10 (30.3)		5 (6.7)	
Primary School		3 (9.1)		2 (2.7)	
Marital Status (<i>n</i> , %)					<0.01
Single		22 (66.6)		48 (64.0)	
Cohabit		4 (12.1)		2 (2.7)	
Married		2 (6.1)		22 (29.3)	
Divorced		5 (15.2)		3 (4.0)	
Age at index offense (in year)	29.82	11.26			
Length of sentences (in year)	12.85	7.95			
Length of imprisonment (in year)	8.46	5.76			
Alcohol drinking (<i>n</i> , %)					<0.001
No drinking		11 (33.3)		50 (66.7)	
Low risk drinking		5 (15.2)		23 (30.6)	
Risky alcohol drinking (≥ 14 drinks/week)		17 (51.5)		2 (2.7)	
Overall self-rated health condition					0.04
Very poor		3 (9.1)			
Poor		3 (9.1)		2 (2.7)	
Equivocal		8 (24.2)		27 (36.0)	
Good		16 (48.5)		39 (52.0)	
Very good		3 (9.1)		7 (9.3)	
Cigarette smoking (<i>n</i> , %)		26 (78.8)		6 (8.0)	<0.001
Cigarette consumption (in pack per day)	0.64	0.52	0.02	0.09	<0.001

Burlingame, California, USA) with an oxytocin detection range of 0–100 ng/mL. Each plasma sample was assayed twice, and the mean of the two measurements used for analysis; with intra- and inter-assay coefficients of variation both being <5%. No significant cross-reactivity or interference between oxytocin and analogs was observed.

Statistical Analysis

All collected data were transcribed to SPSS Statistics version 25.0 (IBM Corporation New York, USA), for coding and analysis. Data ranges for each variable were checked to ensure they adhered to the prescribed range for each questionnaire manual. Descriptive statistics were applied to summarize the demographic characteristics and psychometric measurements of participants. Continuous variables were expressed as means with standard deviations, whereas categorical data were presented in numbers and percentages. The Kolmogorov–Smirnov test was performed to determine the normal distribution of participant age. Levene's test was used to determine the homogeneity of variances. For descriptive statistics and outcome measurements, an independent sample *t*-test was used to evaluate

continuous variables; whereas Pearson's chi-square test was used to evaluate categorical variables and compare demographic variables among two groups. To investigate our theory-based hypotheses, a bivariate Pearson correlation analysis was used to estimate correlations between outcome measurements. Outcome measurements were included in a mediation analysis if all their correlations were statistically significant. Age, height, body weight, and cigarette smoking, which may interact with plasma oxytocin levels, were included as covariates in the mediation analysis model. For mediation analysis, SPSS macro PROCESS v3.3 (model 4) was applied to analyze three significant outcome measurements. Mediation effects were reconfirmed using a structural equation model, which was analyzed using the SPSS Amos 26.0 software program. Regression (path) coefficients were all in unstandardized form, as standardized coefficients generally have no use in substantive interpretations (44). A positive regression coefficient implies that a unit increase in a variable leads to a direct increase in the variable it is projected to, proportional to the size of the coefficient; vice versa for a negative coefficient. Thus, the extent of change in a dependent variable (aggression), when one unit of the independent variable

(childhood trauma) increases under the condition of an unaltered mediator variable (oxytocin), is considered to be due to a direct effect in mediation analysis. An indirect effect is the extent to which a dependent variable changes when the independent variable is held constant, and changes in the mediator variable are consistent with increases of one unit in the independent variable. In other words, an indirect effect is the extent of mediation. The total effect is the sum, or modified combination, of direct and indirect effects in this study. Bootstrapping, which is considered the most effective method to use with small samples and has the lowest susceptibility to type 1 error, was used to assess the mediation effect's stability (45). Both bias-corrected and percentile-method bootstrapping were conducted, with the data resampled 5,000 times. Statistical significance for all tests was represented by a p -value <0.05 .

Models

As all measures of childhood trauma and aggression were collected retrospectively, in terms of causal relationships, we examined these variables in different models, to illustrate possible links between variables. In Model 1, as proposed according to our theoretical hypothesis, we examined the mediating role of oxytocin between childhood trauma and aggression. In Model 2, childhood trauma and oxytocin both contributed to aggression independently. In Model 3, childhood trauma was linked to both oxytocin and aggression independently. In Model 4, both childhood trauma and aggression contributed to changes in oxytocin, with childhood trauma also leading to aggression.

In Model 5, childhood trauma was linked to aggression, with aggression subsequently promoting changes in oxytocin. In all tested models, model fit was examined using a goodness of fit index (GFI) ≥ 0.90 , and a root mean square error approximation (RMSEA) value of ≤ 0.06 (46). The best-fit model was selected by considering all criteria in this study.

RESULTS

Demographic Characteristics

The proportion of graduates from higher education institutions was significantly lower in the homicide group than in the control ($p < 0.001$). The prevalence of alcohol drinking and cigarette smoking was higher in the homicide group than in the control group ($p < 0.001$). Notably, almost half of the participants in the homicide group had risky alcohol drinking problems. A higher proportion of participants in the homicide group rated their health condition as poor or very poor ($p < 0.05$) (see **Table 1**).

Childhood Trauma

The total scores of CTQ-SF among persons convicted for homicide were higher than those of participants in the control group ($p < 0.001$). Participants in the homicide group surpassed participants in the control group in terms of the prevalence of and the proportion screened positive for physical abuse, emotional abuse, physical neglect, and emotional neglect, except for sexual abuse. Both the prevalence of major childhood trauma ($p < 0.01$),

TABLE 2 | Childhood trauma and measures of aggression in all participants.

		Homicide group (<i>N</i> = 33)		Control group (<i>N</i> = 75)		<i>p</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Childhood trauma						
Positive for childhood trauma (<i>n</i> , %)	Physical abuse		13 (39.4)		6 (8.0)	<0.001
	Emotional abuse		6 (18.2)		2 (2.7)	<0.01
	Sexual abuse		5 (15.2)		7 (9.3)	0.38
	Physical neglect		32 (97.0)		54 (72.0)	<0.01
	Emotional neglect		13 (39.4)		9 (12.0)	<0.01
	≥1 type of major trauma		16 (48.5)		11 (14.7)	<0.01
CTQ-SF	Total scores	58.85	14.67	46.87	9.89	<0.001
	Physical abuse	9.15	4.54	6.52	2.18	<0.001
	Emotional abuse	8.79	3.81	6.92	2.19	<0.01
	Sexual abuse	6.12	2.43	5.48	1.13	0.06
	Physical neglect	13.91	2.71	11.16	2.06	<0.001
	Emotional neglect	12.15	4.50	9.37	3.06	<0.01
Number of childhood trauma types		2.09	1.71	1.04	0.88	<0.001
Aggression						
MOAS	Total scores	28.61	7.63	8.75	8.85	<0.001
	Physical aggression	4.00	0.00	1.03	1.24	<0.001
	Verbal aggression	3.00	1.12	1.15	1.20	<0.001
	Aggression against object	2.39	1.50	0.91	1.15	<0.001
	Auto-aggression	1.39	1.68	0.56	0.99	0.02

and the mean number of trauma types ($p < 0.001$), were higher in the homicide group than control (see **Table 2**).

Aggression

Participants in the homicide group had a higher total score for the history of incidents of aggression (measured by the MOAS; $p < 0.001$) and had more incidents of all four types of aggressive behaviors, than those in the control group (see **Table 2**).

Plasma Oxytocin Levels

The plasma oxytocin levels in participants of different groups are illustrated in **Figure 1**. Overall, plasma oxytocin levels were not correlated with age ($r(107) = -0.15$, $p = 0.60$). Participants in the homicide group ($M = 10.74$, $SD = 4.19$, 95% CIs [9.25, 12.22]) had lower levels of plasma oxytocin than those in the control group ($M = 15.49$, $SD = 6.00$, 95% CIs [14.11, 16.87]) ($p < 0.001$).

Interaction Between Variables in a Zero-Order Correlation

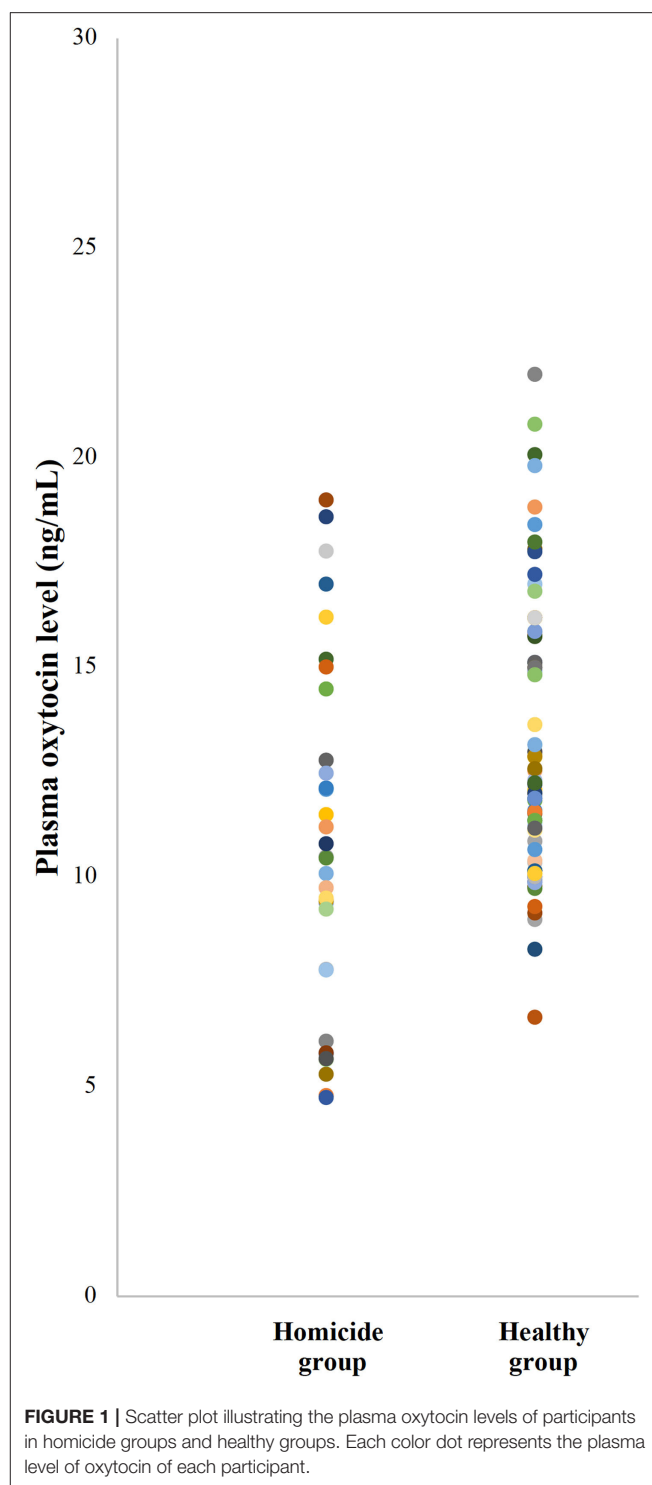
Childhood trauma was significantly associated with aggression, both in the homicide group [$r(32) = 0.48$, $p < 0.01$] and the control group [$r(74) = 0.49$, $p < 0.001$]. Plasma oxytocin levels were inversely correlated with childhood trauma in both the homicide group [$r(32) = -0.45$, $p < 0.01$], and the control group [$r(74) = -0.30$, $p < 0.05$]. Aggression was inversely associated with plasma oxytocin levels in participants of the homicide group [$r(32) = -0.61$, $p < 0.001$], but was non-significant in participants of the control group [$r(73) = -0.01$, $p = 0.94$].

Mediation Analysis

A mediation analysis was further performed for participants in the homicide group. The overall mediation analysis of plasma oxytocin levels is illustrated in **Figure 2**. After considering all criteria in this study, Model 1 was selected as the best-fit model (GFI = 0.974; RMSEA = 0.041). For participants in the homicide group, the regression coefficient between childhood trauma and plasma oxytocin levels was statistically significant ($p < 0.01$), as was the regression coefficient between plasma oxytocin levels and aggression ($p < 0.01$). The bootstrapped unstandardized indirect effect was non-significant ($\beta = 0.13$, $SE = 0.06$, 95% CIs [0.02, 0.25]). The effect of childhood trauma on aggression was fully mediated by plasma oxytocin levels among participants in the homicide group. All other covariates proposed in this study, including age ($p = 0.76$), height ($p = 0.98$), body weight ($p = 0.27$), and cigarette smoking ($p = 0.50$), did not interfere with regression coefficients in the mediational model.

DISCUSSION

The results indicate that traumatic experiences in childhood were higher in the persons convicted for homicide than among those in the control group without criminal convictions. In particular, persons convicted for homicide had a higher prevalence of physical abuse during childhood, than control group participants in this study. Despite the widespread prevalence of childhood trauma, less is known about its biological import. Humans are irrevocably shaped by their developmental environment



through the biological imprinting of early experiences (47). The current study demonstrated a positive correlation between childhood trauma and aggression, with plasma oxytocin levels inversely correlated with both factors. Although a history of childhood trauma appears to contribute to the use of violence, few studies have explored the nature of this relationship and

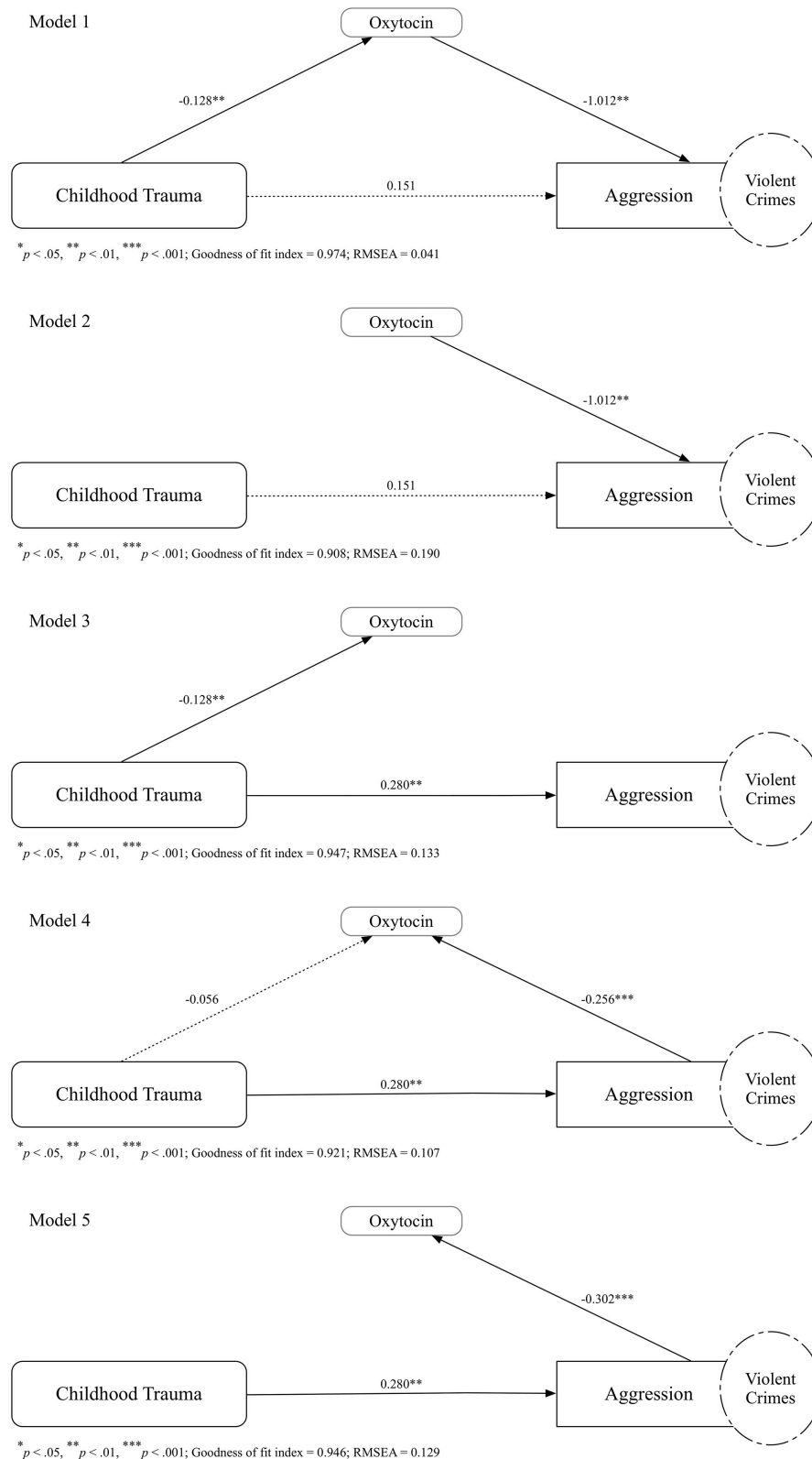


FIGURE 2 | Path diagram illustrating the unstandardized regression coefficients for the relationship between childhood trauma and aggression, as mediated by levels of plasma oxytocin in persons convicted for homicide. Several theoretical hypotheses of the relationship between childhood trauma, aggression, and plasma oxytocin levels have been postulated: (Model 1) the relationship between childhood trauma and aggression was mediated by oxytocin, (Model 2) childhood trauma and

(Continued)

FIGURE 2 | oxytocin both contributed to aggression independently, (Model 3) childhood trauma was linked to both oxytocin and aggression independently, (Model 4) both childhood trauma and aggression contributed to changes in oxytocin and the childhood trauma also leading to aggression, and (Model 5) childhood trauma was linked to aggression while aggression subsequently promoting changes in oxytocin. The numbers above the arrows indicate the unstandardized regression coefficients of the path in the model. Fitness of the model was examined using a goodness of fit index (GFI) ≥ 0.90 , and a root mean square error approximation (RMSEA) value of ≤ 0.06 . The Model 1, as the best-fit model (GFI = 0.974; RMSEA = 0.041), shows that the effect of childhood trauma on aggression was mediated by plasma oxytocin levels among participants in the homicide group.

its association with hormonal changes. Reduced endogenous oxytocin levels in people with childhood trauma were also observed in previous meta-analyses, supporting the hypothesis that early adversity persistently alters oxytocin production and release in adulthood (48).

The role of oxytocin in the mediation model is notable. Several mediation models have been postulated and the main differences between the five models are the path directions between plasma oxytocin levels and aggression. In Model 1 and Model 2, plasma oxytocin levels are proposed to have contributed to the later aggression. In Model 4 and Model 5, aggression is proposed to promote the changes in plasma oxytocin. Model 1, as the best-fit model, shows that the effect of childhood trauma on aggression was mediated by plasma oxytocin levels among participants in the homicide group. The bidirectional interaction between aggression and oxytocin that is demonstrated in different mediation models may add to the ongoing debate questioning the unidirectional prosocial role of oxytocin (36). However, in this study, the models other than Model 1 are rather satisfied to examine their mediation path, yet, still too early to draw any conclusion for the other models. In this study, the mediation analysis demonstrated that those with higher childhood trauma scores had lower plasma oxytocin levels, which may have led to them having higher aggression levels. Oxytocin lowers the cortisol levels that increased in the hypothalamus–pituitary–adrenal axis for stress response. Dysregulation of oxytocin inhibition process caused by a failure to exhibit high oxytocin receptor levels in the amygdala of individuals who have experienced trauma allowing stress responses to escalate to unproportionally high levels (13). By reducing the amygdala activation with supplementation of exogenous oxytocin has been shown to reduce danger signaling, promote trust, increase sociability, decrease social fear, and possibly attenuate aggression (22).

In this study, the effect of childhood trauma on aggression was mediated by plasma oxytocin levels in persons convicted for homicide; however, the mediation effect could not be verified among participants in the control group. Differences between these two groups of participants may imply some hidden factors contributing to, or preventing, the occurrence of aggressive behaviors. In other words, the proposed hypothesis regarding the association between oxytocin level and the attachment of individuals with experiences of childhood trauma, did not fully explain the results found in this study. One possible explanation is the oxytocin's dose-dependent variability in aggression. Acute administration of oxytocin produces dose-dependent changes in reducing aggression in rats (49). The degree of oxytocin deprivation has to exceed the threshold to become violent is a probable factor that resulted in this disparity across participants.

The concept of resilience may also explain the discrepancy between different sequelae faced by individuals with experiences of childhood trauma. The timing of exposure to childhood trauma may result in different developmental sequelae (50). For example, earlier exposure to maltreatment was associated with a blunted amygdala response and failure to centrally upregulate oxytocin receptors, reducing sensitivity to adaptational fight-or-flight reactions that promote survival (51). Besides, several studies have focused on adaptive coping styles and personal attributes, such as ego strength, tenacity, self-efficacy, and cognitive flexibility, related to resilience, that appear to mitigate negative sequelae in response to childhood trauma (52, 53). In addition to coping styles and personal attributes, resilience may be predicted by “gene \times environment” interactions with childhood trauma. Studies showed that only individuals surrounded by a positive family environment during childhood (54) and higher school connectedness (55) were found to have increased resilience in adulthood, likely as a result of a heightened sense of belonging (56). Although they have lower resilient functioning than those without childhood trauma, traumatized children nonetheless strive to be resilient. A strong moderating effect from having a positive social environment was identified in adults with a specific allele of the oxytocin receptor gene, *OXTR*, who had been exposed to early childhood trauma (9). Childhood trauma has been shown to consistently exert strong and adverse effects on the resilience of those who experience it; indicating that the path to aggression is mediated by oxytocin.

Limitations and Future Research Directions

The strength of this study lies in providing relevant findings which further illustrate the role of oxytocin in linking childhood trauma to aggression. As with any study, the findings should be interpreted with consideration to recognized limitations. First, the validity and reliability of the retrospective self-reporting of childhood trauma carry their own caveats as, due to potential recall bias, possible under-reporting may lead to substantial measurement errors (57). Albeit the simple forgetting, non-awareness, and non-disclosure (19), retrospective reports of childhood trauma are still valuable for examining its association with adulthood adversities, such as psychiatric problems (58). In this study, participants were asked to provide in-depth clarification about their experiences of childhood trauma during interviews, for cross-validation, to minimize any aforementioned reporting biases. A prospective study design, with follow-up from baseline experiences of childhood trauma and oxytocin level changes, is necessary to confirm correlations more definitively among these factors.

Oxytocin is determined not only by childhood trauma, but also from other stressful events (59), inflammation (60),

nicotine use (61), and the hypothalamus–pituitary–adrenal axis (62). Perhaps not only oxytocin but aggression is explained by the aforementioned factors besides childhood trauma. In interpreting the positive correlation between childhood trauma and plasma oxytocin levels, these unmeasured factors should be taken into account. Although it is impractical to sample the cerebrospinal fluid, using the peripheral plasma oxytocin level as a surrogate for central oxytocin function may raise questions about the accuracy of oxytocin measurement and its implications. The previous study had demonstrated a positive association does exist between central and peripheral oxytocin levels (63). Age-related patterns of oxytocin concentration are influenced by reproductive status, and plasma oxytocin levels are significantly higher in women than in men (64). Therefore, the enrollment of participants in this study was limited to men who had not undergone hormone therapy, to avoid the confounding effects of gender on the findings. This design restriction means that the results cannot be generalized to women.

Finally, given the study's cross-sectional design, this study could not isolate the effects of trauma exposure timing. This is an inherent design obstacle, as obtaining self-reports prospectively from young children is ethically inappropriate. As with most cross-sectional studies, a causal relationship cannot be determined unless assumptions are made. We tried to examine the possible links between childhood trauma, oxytocin, and aggression, by performing different structural equation models to establish the best fit. After careful modification and validation through statistical analysis, with the assumption that oxytocin concentration remained relatively stable across adulthood, this study sought to determine a path between childhood trauma and aggression and reveal the interaction of oxytocin within. Owing to limitations inherent in this cross-sectional design, it is recommended that in any future study, longitudinal relationships be examined to confirm causality more definitively over time.

CONCLUSIONS

This study explored the pathway of oxytocin through which childhood trauma leads to later aggression in persons convicted for homicide. Fully elucidating the factors leading to homicide is difficult as crime involves a complex interplay between an individual and the society in which they grow up. Childhood trauma is correlated with aggression, whereas plasma oxytocin level is inversely correlated with childhood trauma. A theoretical framework has been postulated to explain this possible pathway, as experiencing childhood trauma decreases plasma oxytocin levels and subsequently contributes to higher aggression in persons convicted for homicide. Prevention and

early identification of childhood trauma are crucial for reducing aggression in adulthood. A decrease in incidents of childhood trauma could decrease the risk of alterations in oxytocin gene expression and secretion. For those with severe childhood trauma experiences, efforts to activate secure attachment should be made promptly. We hope that the results of this study will lead to further theoretical consideration of how best to explain the interaction between childhood trauma and aggression, thus assisting to develop further preventive strategies.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Joint Institutional Review Board of Taipei Medical University. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

KKG provided the ideation, collected and analyzed the data, and wrote the manuscript. M-LL had made a critical review of the manuscript. SJ assisted in interpreting the data and contributed to the writing of the manuscript. All authors have approved the final version of the manuscript.

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A Clinical Rationale for Assessing the Impact of Childhood Sexual Abuse on Adjunctive Subcutaneous Esketamine for Treatment-Resistant Depression

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Background: A history of child sexual abuse (CSA) is related to higher suicide rates and poor treatment outcomes in depressed adult patients. Twenty years after the first study investigating the effects of ketamine/esketamine on depression and suicide, there is a lack of data on the CSA effects on this emerging treatment. Here, we assess the impact of CSA on adjunctive subcutaneous (SC) esketamine for treatment-resistant depression (TRD).

Methods: A directed acyclic graph (DAG) was designed to identify clinical confounders between CSA and esketamine predictors of response. The confounders were applied in a statistical model to predict depression symptom trajectory in a sample of 67 TRD outpatients.

Results: The patient sample had a relatively high prevalence rate of CSA (35.82%). Positive family history of first-degree relatives with alcohol use disorder and sex were clinical mediators of the effects of esketamine in a CSA adult population. Overall, the presence of at least one CSA event was unrelated to esketamine symptom reduction.

Conclusions: Unlike responses to conventional antidepressants and psychotherapy, CSA does not appear to predict poor response to esketamine.

Keywords: child sex abuse, treatment-resistant depression, esketamine, sex, directed acyclic graph

INTRODUCTION

The adverse effects of childhood abuse on health are substantial and well-documented. The WHO estimated in 2002 that 150 million girls and 73 million boys under the age of 18 had suffered various forms of sexual violence (1). Females have a two- or threefold higher risk compared with males to be sexually abused during childhood (2), resulting in a worldwide prevalence of 15–19.7% for women and 7.6–8% for men (3). Regrettably, most studies solely include reports from children's protection services, detecting only a small fraction of cases (4). This type of trauma can be considered as “toxic” and causes a prolonged activation of the body's stress response system (5). It impairs and affects regulation, impulse control, sense of self, socialization (6), and the brain changes have enduring consequences throughout life, mediating a negative trajectory to mood disorders in this population (7).

Depression is a disorder long known to be associated with CSA (8); poorer outcomes are related to CSA severity (9). Meta-analytic reviews have found evidence of associations between CSA and adult depression (10, 11). Despite the significant correlations between childhood abuse and adult depression, little is known about its specific effects on treatment (12), although, it is associated with reduced responsiveness to antidepressant pharmacotherapy and psychotherapy (13).

In view of the need for more effective treatments for individuals with TRD and CSA history, we sought to determine whether a subpopulation of patients with CSA and a current TRD episode would benefit from an investigational protocol with multiple subcutaneous (SC) esketamine injections. The subcutaneous route of administration is a reasonable alternative that leads to similar plasma concentrations and more feasible procedure for many clinics (14). A recent study outlined the cardiovascular safety of multiple SC esketamine injections in TRD (15).

To answer our research question, the relationship between exposure and outcome can be clarified using information from previous studies on CSA and predictors of response to ketamine. We can encode these evidences, and the links thereof, in an illustrative way, applying a directed acyclic graph (DAG). It is a useful method to identify and exemplify the concepts of exposure, outcome, causation, and confounding (16), especially when considering the complexities of CSA. DAG graphically sheds light on presumed relationships among variables, allowing bias adjustments in a standardized manner.

METHODS

Participants

Our sample consisted of 70 outpatients (men and women, aged 15 to 66 years) experiencing TRD episode (unipolar and bipolar) referred by psychiatrists to the esketamine clinic in the Department of Psychiatry of the Federal University of São Paulo, Brazil, between April 2017 to December 2018. Eligibility criteria included: (a) TRD defined as the absence of response (<50% symptomatology reduction) in the current episode to at least two medication trials over an adequate period of time

and with a minimal dose approved for the treatment; (b) the *Montgomery-Åsberg Depression Rating Scale* (MADRS) (17) severity score ≥ 25 ; and (c) stable physical health assessed by medical history. Exclusionary criteria were as follows: (a) history of hypersensitivity and/or allergy to esketamine; (b) diagnosis of esketamine abuse or dependence; (c) uncontrolled hypertension; or (d) pregnancy or breastfeeding.

Measures

Each patient had one baseline assessment in which a certified psychiatrist conducted a structured clinical interview. This survey included socio-demographical questions and inquired about the medical history from the patients and their first-degree relatives, including the presence of alcohol and substances use disorders. A current major depressive episode diagnosis was confirmed applying the *Mini-International Neuropsychiatric Interview (MINI)*-plus 5.0 (18), and patient's history of childhood sexual trauma was assessed using the *Early Trauma Inventory Self Report-Short Form (ETISR-SF)* (19).

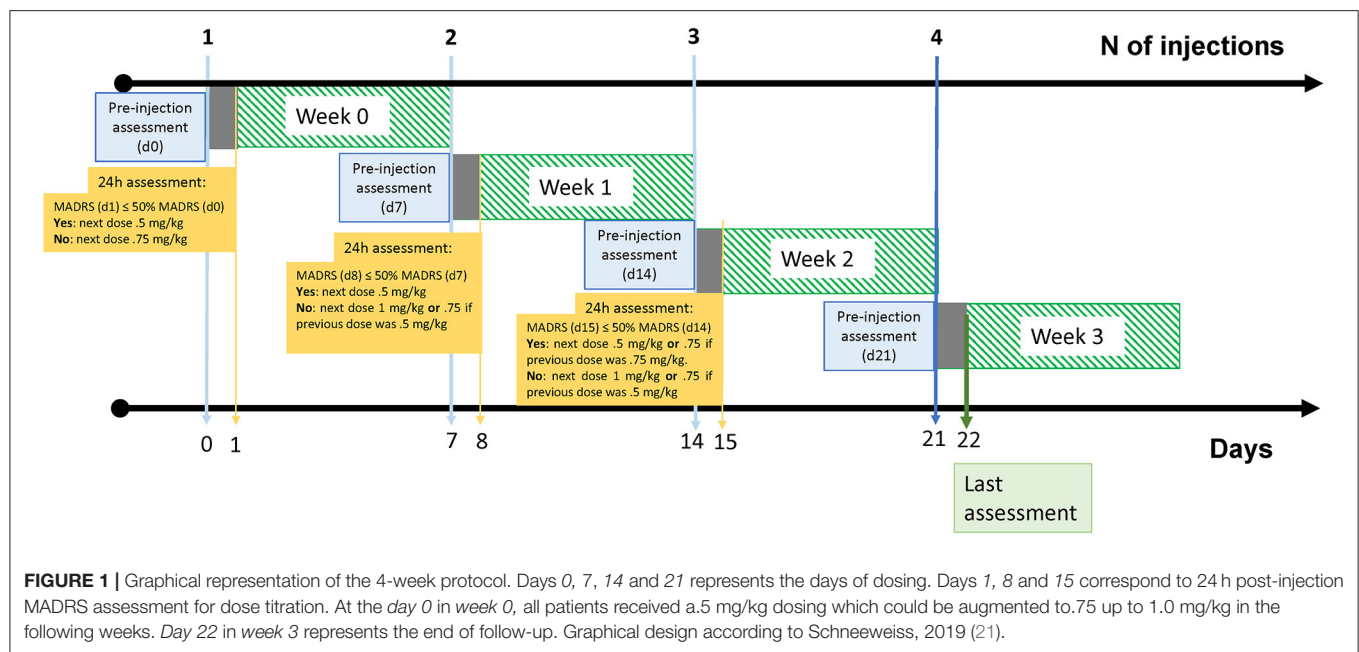
The ETISR-SF comprises six dichotomous (yes/no) questions about CSA posed in a steadily increasing emotional intensity whereby favoring its assessment (19). For this study, CSA is defined as yes responses to any of these six items. The scoring strategy is the simple method of counting the number of events that had occurred. The version translated and validated on Brazilian-Portuguese was applied. It was used in this study for being a brief (about 15 min) and feasible screening tool for quantitative and Qualitative childhood trauma in clinical practice. The Brazilian-Portuguese version has been shown to be suitable in terms of both validity and internal consistency for assessing traumatic experiences (alpha value for the total scale = 0.83 and alpha value for sexual events = 0.73; test-retest reliability = 0.78–0.90) (20).

The MADRS measured depression symptom severity at baseline and throughout the treatment.

Subcutaneous Esketamine Protocol

A titrating dose protocol with SC esketamine injection once a week for up to 4 weeks was conducted (**Figure 1**) (22). This protocol was administered by a certified psychiatrist with ACLS training and a nurse. Each patient had the same weekly schedule. Pre-injection ratings included the MADRS and vital signs (measurement of blood pressure, heart rate, and digital pulse oximetry). In the first session, all patients received 0.5 mg/kg of ketamine (ideal body weight) injected SC in the abdomen. We monitored vital signs at 15-min intervals for 120 min. A clinical assessment was performed before the patient was discharged, and they were accompanied by a close acquaintance.

Participants remained on their prescribed psychotropic medications, and all subjects provided written informed consent after a complete description of the protocol. This study was approved by the Federal University of São Paulo ethics committee.



Statistical Analysis

Confounders Selection

Given the observational study design (i.e., non-experimental design), the relationship between exposure and outcome and potential confounders can be clarified using information from previous studies on the health consequences of CSA and predictors of response to depressive symptoms following treatments using ketamine; therefore, we conducted a search in the literature for retrieving those predictors. Then, we constructed a first DAG linking these predictors using the DAGitty graphical interface (23), in which the users promptly check changes in the diagram assessing the modifications of causal and biasing effects (24).

The main advantage in using this template is to select the confounders needed to adjust for (condition on) in the latent growth model to the extent that it would be possible to make valid inferences, answering the research question (25) based on findings that had been replicated in studies with greater samples. Finally, we removed the variables that were not in the path for confounding (i.e., covariates, which are not confounders *per se*), and created a summarized DAG for a clearer depiction. The medications currently prescribed for the participating patients (SSRI, SNRI, other classes of antidepressants, mood stabilizers, drugs for anxiety and insomnia, antipsychotics, and stimulants) were not employed as confounders.

Latent Growth Model Assessment

To estimate the effect of CSA, we fitted a latent growth model (26) using Mplus version 8.3 (27), where a latent intercept and a latent slope were estimated common to all individuals. The intercept is the systematic part of the variation in the outcome variable at baseline (i.e., time point zero) and slope growth factor is the trend, the growth rate, being the systematic part of the decrease

(or increasing) in the outcome variable for a time score increase of one unit.

Latent growth model does not require complete data to estimate latent variables because under the assumption of missing at random mechanism, missingness is estimated unbiased via full-information maximum likelihood. Consequently, even when few patients had not responded to all evaluations, they were still considered in the analysis in an intention-to-treat approach given the maximum likelihood estimator.

Model fit was evaluated using the comparative fit index (CFI), root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). CFI values >0.95 , RMSEA values of <0.06 , and SRMR values >0.06 , and a non-significant χ^2 statistic were considered a good model fit (28).

RESULTS

Sample Characteristics

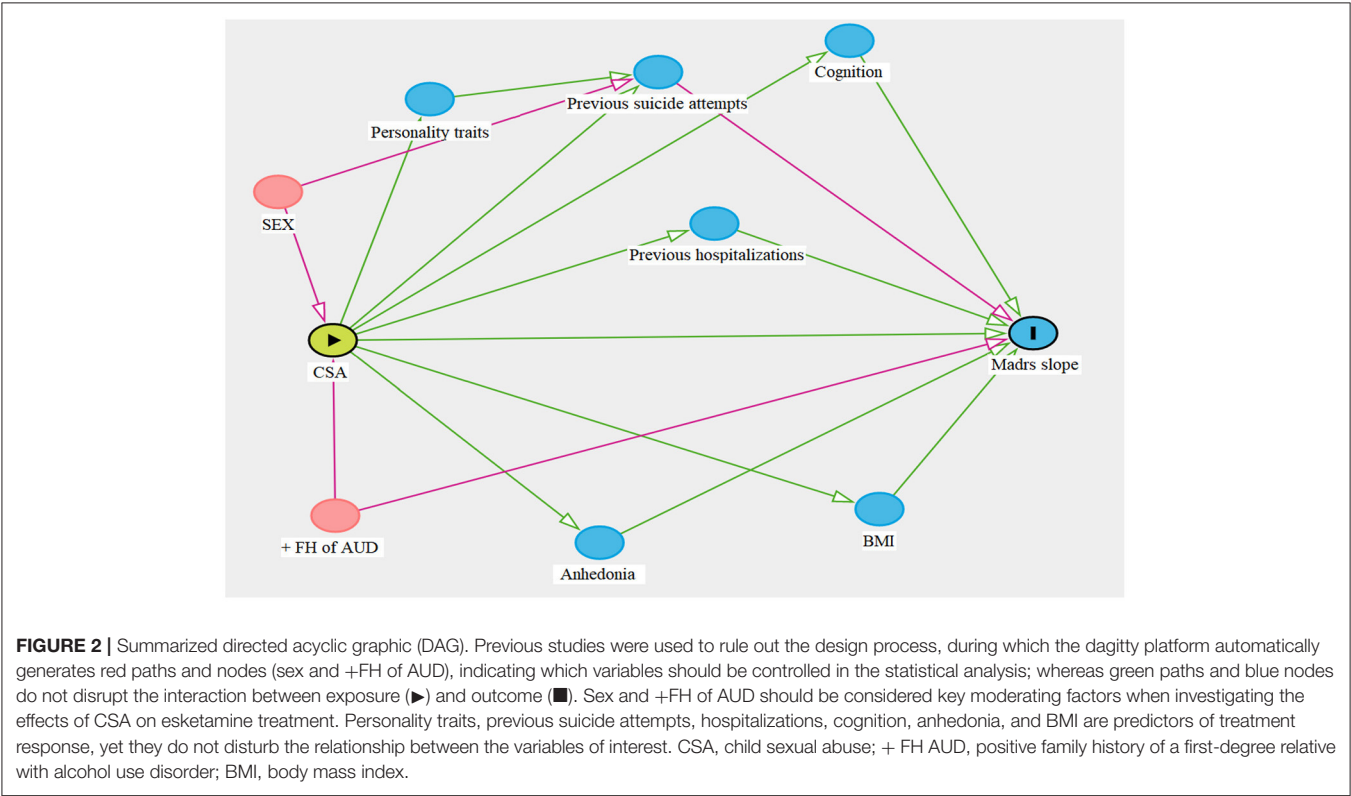
Three patients were excluded from the initial sample ($n = 70$) because of missing 24-h post-injection data. The demographic and clinical characteristics of the 67 patients included are presented in Table 1.

The prevalence of CSA among the 67 patients was 35.82%, with a sexual trauma load of 1 or higher (mean 1; SD: 1.45). Among patients reporting a CSA history, the proportions within the six ETISR-SF items were as follows: 31.3% disclosed a history of uncomfortable touching in intimate parts; 17.9% for having someone rubbing their genitals; 10.5% for being forced to touch genital parts; 7.5% for forced kiss; 7.5% for forced genital sex, and 4.5% for being forced to perform oral sex.

TABLE 1 | Clinical and demographic characteristics of patients (total *n* = 67) at the enrollment.

	<i>n</i> = 67 (100%)		Unipolar depression		Bipolar depression	
	N/mean	(%/SD)	N/mean	(%/SD)	N/mean	(%/SD)
CSA history	24	(35.8)	11	(29.7)	13	(43.3)
No-CSA history	43	(64.2)	26	(70.3)	17	(56.7)
Age of first episode (years)	21	(8.72)	22.76	(9.50)	19.00	(7.27)
BMI	29	(7.66)	27.26	(7.35)	31.19	(7.60)
Family history- SUD	22	(32.8)	11	(29.7)	11	(36.7)
MADRS baseline	30	(6.95)	33.19	(5.34)	34.00	(7.05)
Sex (female)	44	(65.7)	25	(67.6)	19	(63.3)
Age (years)	40	(12.93)	41.24	(13.23)	39.47	(12.70)
Educational level (college)	40	(59.70)	20	(54.1)	20	(66.7)
Employed	40	(59.70)	18	(48.6)	22	(73.3)

CSA, child sexual abuse; N, number of patients; SD, standard deviation; BMI, body mass index; SUD, substance-use disorder.



First-Degree Relatives With Alcohol Use Disorder (+FH) and Sex as Confounders

The summarized DAG (Figure 2) showed that the presence of first-degree relatives with alcohol use disorder (+FH) and sex is a minimum set for adjustment (i.e., confounders) when analyzing the effects of esketamine in adults with CSA. These confounders were included in the latent growth model to minimize bias.

Effect of Child Sex Abuse on Symptom Trajectory

For our main hypothesis, we observed that the overall presence of at least one CSA event was not a statistically significant predictor of the trajectory of symptom reduction [β (csa) = 0.386; p = 0.225; 95% CI = −0.137:0.909].

Table 2 displays mean MADRS scores according to the presence of CSA and depression subtype.

TABLE 2 | Mean Montgomery-Åsberg depression rating scale (MADRS) score according to CSA history and depression subtype.

	CSA history							No-CSA history						
	Unipolar			Bipolar			<i>p</i>	Unipolar			Bipolar			<i>p</i>
	Mean	N	(SD)	Mean	N	(SD)		Mean	N	(SD)	Mean	N	(SD)	
Day 0	32.8	11	(1.5)	28.8	13	(2.5)	<i>0.190</i>	29.7	26	(1.2)	31.3	17	(1.7)	<i>0.453</i>
Day 1	17.8	9	(2.5)	20.9	13	(3.0)	<i>0.435</i>	19.6	23	(2.1)	23.3	16	(2.1)	<i>0.239</i>
Day 7	22.4	11	(2.8)	26.7	13	(2.5)	<i>0.265</i>	23.2	26	(1.8)	24.3	17	(2.6)	<i>0.200</i>
Day 8	16.8	10	(3.1)	20.6	12	(2.7)	<i>0.372</i>	18.2	22	(1.8)	22.8	17	(2.8)	<i>0.156</i>
Day 14	18.3	11	(3.1)	23.4	13	(3.7)	<i>0.318</i>	20.8	24	(1.7)	25.1	15	(2.9)	<i>0.180</i>
Day 15	14.7	9	(1.6)	19.9	11	(4.1)	<i>0.258</i>	17.7	22	(2.0)	17.2	12	(2.4)	<i>0.885</i>
Day21	23.1	11	(2.9)	20.7	12	(2.9)	<i>0.578</i>	19	25	(2.1)	22.8	17	(2.8)	<i>0.288</i>
Day22	16.4	8	(2.8)	15.2	8	(4.0)	<i>0.822</i>	14.3	24	(1.9)	18.2	16	(3.0)	<i>0.259</i>

N, number of patients; *SD*, standard deviation. The italic values indicate the “*p* value”.

DISCUSSION

To our knowledge, this is the first protocol investigating CSA as a clinical predictor of response of multiple subcutaneous esketamine injections in treatment-resistant depression.

In our model, +FH of alcohol use disorder and sex were highlighted as sources of bias between CSA and symptoms trajectory. Being raised by an alcohol-abusing parent increases the likelihood of sexual abuse exposure (29), and esketamine has been reported to be more effective in treatment-resistant depressed patients with a first-degree relative with alcohol use disorder (30). Child sexual abuse and +FH of alcohol use disorder are related to long-lasting neurodevelopmental or genetic/epigenetic variations (30) that predispose to depression in later life.

Female sex has a robust link to childhood sexual trauma and suicidal behaviors (2, 31). CSA is associated with a 2-fold increased risk for suicidal ideation, 3-fold risk for suicide attempts, and an 18-fold higher risk for dying by suicide (32). Conversely, esketamine has demonstrated rapid reductions in suicidal ideation (33). According to the diagrammed DAG, a way for clarifying the path among sex, suicidal ideation, and treatment outcome was controlling for sex as a confounder.

We hypothesized a negative effect of CSA on MADRS scores after repeated esketamine SC injections. However, even after adjustments for confounding factors (+FH of alcohol use disorder and sex), there was a lack of evidence of the effect of CSA and the esketamine response.

When investigating the effect of CSA on treatment response, it is essential to consider that abused patients have an increased probability of having suffered additional untoward experiences that may modify treatment response, disrupting data analysis. An advantageous method to avoid this not-randomizable limitation is by using a schematic representation for recognizing confounders. To this end, we first gathered knowledge from previous investigations, not constrained to our measured variables, thereby identifying common associations between CSA and outcome. Then, these relations were standardized in a DAG. This alternative approach allows a clearer perception of bias while

measuring multiple potential confounders without creating other sources of distortions. It focuses on the understanding of prior empirical evidence between exposure and outcome, managing the selection of variables needed to be controlled in the statistical analysis (34). Hence, we could use a clear theoretical rationale to elect appropriate confounders, reducing bias and improving statistical data interpretation (35).

The outcomes from this naturalistic study suggests that, in contrast to the poorer response to conventional antidepressants, we have a lack of evidence that childhood sexual trauma results in a poorer response of depression symptoms to SC esketamine in the sample of patients participating in this study. Thus, the practical relevance of these findings is the need to screen for childhood trauma, detect patients that may not benefit from standard first-line antidepressants, and utilize adjunctive interventions, such as esketamine, especially for those with high suicide risk. Therefore, mental health providers should be conscious of the cumulative effect of CSA, assess child abuse not only as a hallmark of treatment-resistance but rather as a chronic treatment-resistant depression subtype.

Our study has several limitations, including the characteristics inherent to real-world analysis such as broad inclusion criteria, absence of a placebo-treated group, lack of randomization, small sample size, short length of follow-up, concomitant administration of different classes of psychotropic medications, and the usual scoring method of retrospective assessment of reported CSA in which detailed features of severity are not considered. Another limitation was the employment of the same protocol to unipolar and bipolar depression. However, Lucchese et al. (36) reported that there were no statistical associations between diagnosis and response to SC esketamine in this same sample (36). The results should be cautiously interpreted, and replication is essential.

The follow-up period of 4 weeks may have been too brief. As previously reported in an open-label trial of algorithm-guided pharmacotherapy, the rate of symptom improvement increases more slowly in patients with a history of childhood adversity. The difference in remission was more significant by the end of 12 weeks (32% compared with 44% of patients without abuse

history) (13). The lack of early improvement at 2 to 4 weeks may be a predictor of later antidepressant non-response/non-remission (37). Therefore, we might theorize that the presence of CSA could slow even the rapid antidepressant response of esketamine, adding a potential need for treatment maintenance and more complexity in the care of this population.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics committee of the Federal University of São Paulo. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

EM, LS, LD, ACL, CN, MT, CP, VR, RD, JS, MS, MB, GA, and AM: substantial contributions to the conception of the

study and data acquisition. EM, LS, HC-M, and AM: analysis, or interpretation of data for the work. EM: drafting of the manuscript. LS, CBN, HC-M, JD, ALTL, and AM: critical review for important intellectual content. EM, LS, LD, ACL, CN, MT, CP, VR, RD, JS, MS, MB, GA, HC-M, JD, ALTL, and AM: final approval of the version to be published. All authors involved in this manuscript agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2021.608499/full#supplementary-material>

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The Role of Qi-Stagnation Constitution and Emotion Regulation in the Association Between Childhood Maltreatment and Depression in Chinese College Students

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Background: Childhood maltreatment is known as a significant risk factor for later depression. However, there remains a lack of understanding about the mechanisms through which childhood maltreatment confers risk for depression. This study explores how Qi-stagnation constitution (QSC) and emotion regulation affect the link between childhood maltreatment and depressive symptoms in Chinese college students.

Methods: We recruited 2,108 college students aged 18–25 years between November 2020 and December 2021. Participants were required to complete four self-report questionnaires, including the Childhood Trauma Questionnaire-Short Form (CTQ-SF), Qi-Stagnation Constitution (QSC) subscale of the simplified Chinese Medicine Constitution Questionnaire, Difficulties in Emotion Regulation Scale (DERS), and the Beck Depression Inventory-II (BDI-II). Moderated mediation analyses were conducted.

Results: There was a positive correlation between childhood maltreatment and QSC, while the QSC partially mediated the effect of childhood maltreatment on depressive scores in college students. In addition, emotion dysregulation moderated the association between QSC and depressive scores.

Conclusion: These results enhance understanding of key factors influencing the link between childhood maltreatment and depressive symptoms among college students by combining the theory of TCM constitution with psychological processes. The development of strategies to prevent biased Qi-stagnation constitution and emotion dysregulation may help to improve college students' mental health and strengthen the resilience of individuals to depression.

Keywords: childhood maltreatment, depression, Qi-stagnation constitution, emotion dysregulation, moderated mediation model

INTRODUCTION

Depression is an important public health issue. The World Health Organization (WHO) predicts that depression will be the leading cause of global burden of disease by 2030 (1). Over 20 percent of Chinese college students suffered from depression and this proportion has been on the increase over the past decade (2–5). Patients with depression manifest heterogeneous symptom profiles, including persistently depressed mood, loss of interest, low self-esteem and energy level, weight loss, insomnia or hypersomnia, disturbed appetite, and disturbance in cognitive functions such as attention and memory (6). These symptoms can cause impairment to daily life and increase the risk of suicide and mortality (7). Apart from severely affecting the health of people, depression is associated with substantial financial burden (8, 9). It is essential to treat and prevent depression from various perspectives depending on the exact etiological factors due to its heterogeneous symptoms as well as the resulting difficulty in diagnosis and treatment.

There is ample evidence suggesting that childhood maltreatment is a significant risk factor for the development of depression in adulthood. Almost half of depression sufferers experienced maltreatment during their childhood (10). Childhood maltreatment, including physical and emotional neglect as well as physical, emotional and sexual abuse, is the most common psychological stressor that exerts negative effects on the healthy development among adolescents and even in adults (11). The high prevalence of childhood maltreatment has been reported both in Western countries and in China. Half of the Americans and Europeans experienced at least one childhood maltreatment (12). Meanwhile, in China, up to 64.7% of college students encountered adversity in their early life (13). Childhood maltreatment causes not only physical wounds, but also severe psychological trauma to individuals, and predisposes the sufferers to psychiatric conditions, especially for depression (14). As suggested by meta-analytic evidence (10, 15, 16), individuals subjected to prolonged and severe neglect or abuse during their childhood were put at a significantly higher risk of depression, earlier depression onset, greater disease severity and were more likely to develop chronic or treatment-resistant depression compared to those who did not experience childhood maltreatment. Although childhood maltreatment is a powerful predictor of depression, this association is not deterministic. Instead of developing depression, some individuals who have encountered severe childhood adversity demonstrate resilience (17, 18), which suggests a potentially higher complexity in the association between childhood maltreatment and depression. It is possible that childhood maltreatment is associated with depression through other variables in indirect ways. As depression remains a major public health concern among those suffering from childhood maltreatment, especially college students, research needs to focus on revealing the specific mechanism underlying the association between childhood maltreatment and later heterogeneous depression. That is, it appears necessary to gain a better understanding of the potential influencing factors or pathways between childhood maltreatment and depression,

which may provide viable intervention targets for the treatment or prevention of depression.

According to Response Styles Theory (RST), depression is caused by personality and idiosyncratic tendencies of early experience (19). Similarly, Traditional Chinese medicine (TCM) believes that biased constitution is among the contributors to diseases, playing a major role in the occurrence, development, and outcome of diseases (20, 21). As a relatively stable and comprehensive natural characteristic, TCM constitution reflects a combination of various factors including physiologic function, morphology and structure, and psychological state (22, 23), which affect how you feel and behave, and how your body responds to pathogenic factors (24, 25). TCM constitution contributes to a better understanding of an individual's overall physical and mental conditions and lays the foundation for disease prediction, prevention and treatment (26). TCM constitution can be categorized into nine types: balanced constitution, Qi-deficiency quality, Yang-deficiency quality, Yin-deficiency quality, blood stasis quality, phlegm-dampness quality, damp-heat quality, Qi-stagnation quality, and special constitution (27). Different types of constitution can predispose individuals to different disease susceptibilities and pathological processes (24, 25).

Notably, Qi-stagnation constitution (QSC) is most closely associated with depression (28). QSC is an unbalanced constitution due to long-term emotional dysfunction and stagnation of Qi movement (29). From the perspective of TCM, Qi represents the fundamental substance required for life-sustaining activities and will have an impact on individual's mental health (30). Qi is the equivalent of “energy” or “signaling” in Western medicine. Qi stagnation is regarded as a condition in which energy metabolism or signal transduction is stagnant in the living body, which may lead to the occurrence of various diseases (31). Distinct from the neuroticism of personality psychology, Qi stagnation covers more than the category of psychology. Qi-stagnation constitution is assessed based on the shape, physiological function, psychological, and other characteristics of the human body. Qi stagnation can be manifested as pain and swelling, sentimentality, chest tightness, and taut pulse (27). Besides, the abnormality of emotional and psychological distress is also regarded as the signs of Qi stagnation. Individuals with QSC are not good at social intercourse, rather, they are quiet, introverted, fragile, sentimental, stressed, depressed, and prone to insomnia (27). A considerable number of studies have been conducted to explore the relationship between QSC and depression. For example, Liu et al. (32) revealed a positive association between QSC and depression in 1,200 female college students, and showed that the QSC could be used to significantly predict depression in women after 1 year (33). According to a review of 1,639 clinical studies (34), different types of biased constitution predisposes individuals to different disease susceptibilities. Among them, QSC accounted for the highest proportion among patients with depression. A survey of 250 patients with depression found that the proportion of patients with QSC was significantly higher than that of patients with other TCM constitutions (28). Another cross-sectional study of college students found that individuals with QSC had a significantly

increased risk of major depression compared to those with balanced constitution (35). These studies are consistent in demonstrating that QSC is a risk factor for depression. Besides, TCM holds that TCM constitution is not only the result of the congenital hereditary factors, but also some acquired factors (36). The acquired factors influencing QSC development mainly include lifestyles, social and growth environment, such as unhealthy family environment and negative parenting styles (37, 38). The psychological trauma caused by the adverse environment will leave the individual emotionally distressed for a long time and gradually build up to QSC (27). Research has indicated that current life stress is associated with QSC which is a risk factor for psychological disorders such as depression (32). However, it remains unclear whether early life stress, such as childhood maltreatment is associated with QSC.

In addition, emotion regulation is suspected to be another significant factor influencing the association between childhood maltreatment and depression (39, 40). Emotion regulation refers to a variety of processes through which individuals attempt to control and manage their spontaneous flow of emotions in order to accomplish their needs and goals (41, 42). Several cross-sectional (43, 44), longitudinal (45, 46), and treatment outcome (47, 48) studies have indicated that deficits in emotion regulation contribute to the development and maintenance of depression. Other studies have provided empirical evidence that dysfunctional emotion regulation originating from childhood trauma can contribute to the development, maintenance, and treatment of depression. These studies have revealed that emotion regulation played a moderating (49) or mediating role (39, 40, 50, 51) in the association between childhood maltreatment and depression. However, evidence is inconsistent in the conclusions about the role that emotion regulation could play in the association between childhood maltreatment and depression. One possible reason for this inconsistency may be the different samples with various age ranges and gender distributions included in different studies. Another reason worth considering is that there may be other influencing factors affecting the role of emotion regulation in the pathway between childhood maltreatment and depression. Notably, among the nine types of TCM constitution, QSC is most closely related to negative emotions, emotion processing and regulation, which are known as the internal causes of psychosomatic diseases (37). TCM experts suggest that Qi stagnation often causes emotional abnormalities (52). Individuals with QSC may manifest symptoms of neurosis, showing unstable emotions and appearing depressive, thus increasing the risk of depression (53, 54). To sum up, these findings indicate the interaction effect of QSC and emotion regulation on the association between childhood maltreatment and depression, which deserves further investigation.

In this study, we aim to explore the relationships among childhood maltreatment, QSC, emotion regulation and depression among college students by assuming a conceptual model as displayed in **Figure 1**. Specifically, we will first ascertain whether childhood maltreatment is associated with QSC. If the relationship holds, we will then examine whether QSC plays a mediating role between childhood maltreatment and depression. Finally, we will examine whether emotion regulation would

moderate this mediation effect. From the perspective of TCM, adverse living environment and psychological barriers are the influencing factors for the formation and change of constitution and unhealthy constitution is the soil of disease. Thus, it is hypothesized that childhood maltreatment may be associated with QSC, and that QSC may mediate the effect of childhood maltreatment on the severity of depression. Furthermore, we assumed that emotion regulation would moderate the indirect association between childhood trauma and depressive scores *via* QSC.

MATERIALS AND METHODS

Participants

We recruited 2,500 Chinese college students from Guangzhou University of Chinese Medicine to participate in this study between November 2020 and December 2021. All participants were invited to complete four self-report questionnaires (listed in the next section) in the classrooms with the guidance of well-trained investigators. Participants were excluded if they were unwilling or unable to complete the questionnaires and/or there were missing/multiple selections or obvious fictions (logical contradiction). In total, 2108 questionnaires were valid and included for analysis with an effective recovery rate of 84.32%. Informed consent was obtained from each participant before the survey. This study was approved by the local Research Ethics Committee.

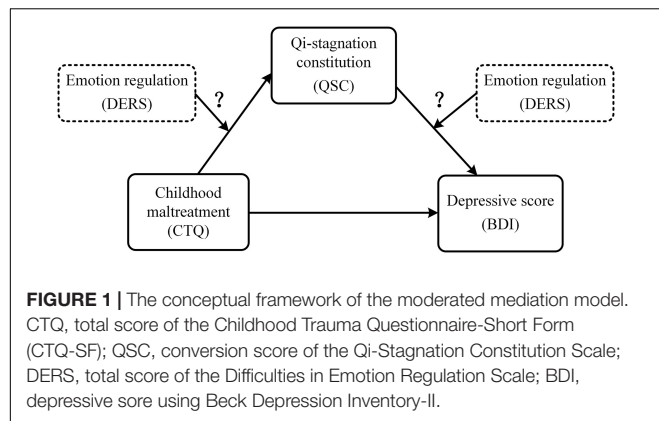
Measures

Childhood Trauma Questionnaire-Short Form

Severity of childhood maltreatment was assessed using the Childhood Trauma Questionnaire-Short Form (CTQ-SF), an easily administered, retrospective, self-report questionnaire (55). The 28-item CTQ-SF is a brief version of the Childhood Trauma Questionnaire and showed excellent reliability and validity (55, 56). The Chinese version of CTQ-SF adopted in the present study was translated into Chinese by Zhao et al. (56) and showed a good internal consistency. The CTQ-SF involves five sub-scales intended to assess five dimensions of childhood maltreatment (physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect), with each sub-scale consisting of five items. The CTQ-SF also involves three additional validity items assessing minimization/denial. The CTQ-SF uses a 5-point Likert scale to characterize the frequency of maltreatment experiences ranging from never true (score 1) to very often true (score 5). Individual was scored on each of the five items in each sub-scale with higher scores representing higher levels of being abused or neglected. The total score ranges from 25 to 125. The Cronbach's alpha coefficient for CTQ was 0.82 in this study.

Qi-Stagnation Constitution Scale

Level of Qi-Stagnation Constitution (QSC) was evaluated using the Qi-stagnation Constitution Scale, a subscale of the simplified Chinese Medicine Constitution Questionnaire (57). The subscale includes four items to assess individual constitutional differences based on characteristics such as bodily sensations and psychological characteristics (e.g., Do you get



anxious and worried easily? Did you feel sensitive, vulnerable, or emotionally upset? Do you have pain in your ribs or breasts? Do you have chest tightness or abdominal fullness?). Items are rated on a 5-point Likert scale ranging from “hardly any” (score = 1) to “nearly all the time” (score = 5). The total score (i.e., original score) of QSC was obtained by summing the score of all items and then convert them into one grand total (i.e., conversion score). The conversion score = (total score - lowest possible score) divided by (highest possible score - lowest possible score). The score indicates the tendency of the Qi-stagnation constitution type. This subscale has been widely used to measure the QSC in China and was found to have good validity and reliability in Chinese (58). The Cronbach’s alpha coefficient for QSC was 0.794 in this study.

Difficulties in Emotion Regulation Scale

The Difficulties in Emotion Regulation Scale [DERS (59)] is a 36-item self-assessment questionnaire measuring several facets of emotion regulation. The questionnaire involves difficulties relevant to an individual’s (a) emotional perception, (b) emotional understanding, (c) acceptance of emotional response, (d) control of emotional impulses, (e) difficulty in target orientation, and (f) difficulty in effective use of emotion regulation strategies. Participants rate how frequent each item applies to them on a 5-point Likert scale ranging from 1 (“almost never”; 0–10% of the time) to 5 (“almost always”; 91–100% of the time). In case of a higher score, it indicates the worse capability of emotion regulation. The Chinese version of the DERS was demonstrated to be a reliable and valid measurement (60). The Cronbach’s alpha coefficient for DERS was 0.922 in this study.

Beck Depression Inventory-II

Beck Depression Inventory-II (BDI-II) is a widely used self-reported scale for assessing the severity of depressive symptoms of participants during the past 2 weeks based on DSM-IV criteria (61). It involves 21 items, each with a 0–3 rating (e.g., from 0 = “I have not lost interest in other people or activities” to 3 = “It’s hard to get interested in anything”). The total score of the BDI-II ranges from 0 to 63 with higher scores indicating higher levels of depression. It has demonstrated excellent validity and reliability in samples of Chinese adults (62). The Cronbach’s alpha coefficient for BDI-II was 0.954 in this study.

Data Analysis

The data was analyzed using SPSS 25.0 (IBM Corp., Armonk, NY, United States). Univariate descriptive statistics were performed to examine the distributions of age, childhood trauma (CTQ), Qi-stagnation constitution (QSC), difficulties in emotion regulation (DERS), and depressive symptoms (BDI) of the study participants. Pearson’s correlation analyses were conducted to examine the association between age, CTQ, QSC, DERS, and BDI. Point-biserial correlations were calculated to test the relationships between gender and the studied variables. We also calculated the Pearson’s correlation coefficient between QSC and the scores of the five subscales (physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect) of the CTQ-SF to further explore whether QSC was associated with different types of childhood maltreatment. Multiple linear regression analyses and a PROCESS macro program (63) were used to examine the mediating effect of QSC and the moderating effect of DERS between childhood maltreatment (CTQ) and depression scores (BDI), taking gender and age as control variables. When evaluating the moderating effect of DERS, all of the independent variables were mean-centered before the interaction terms were constructed to avoid the influence of multi-collinearity (64). Additionally, simple slope analyses were carried out to demonstrate the significant interaction at 1 Standard Deviation (SD) below the mean and 1 SD above the mean of DERS. The 95% confidence interval (CI) was calculated based on 5,000 bootstrap samplings and the significance of the point estimate ($p < 0.05$) was determined by the absence of zero within the 95% CI.

In addition, in order to examine whether gender has an effect on our model, we divided the participants into male and female groups, and repeated the data analyses above in each group, respectively, with age as a covariate.

RESULTS

Demographics Characteristics and Preliminary Statistics

Among the 2,108 college students, 670 (31.8%) were males and 1,438 (68.2%) were females. The gender ratio was imbalanced but was comparable to those of previous studies of medical universities (65–68). The sample was aged 18–25 years (Mean = 18.51 years old, $SD = 0.77$). **Table 1** shows the descriptive statistics of the studied variables and the percentages of different types of childhood maltreatment exposures.

Childhood Maltreatment

The average CTQ-SF total score within our sample was 34.15 ($SD = 9.96$). A total of 1,150 participants (54.6%) reported having experienced at least one type of maltreatment during childhood. The prevalence rate was comparable to those of previous findings in the university population (13). Specifically, 17.8% endorsed having experienced some degree of emotional abuse; 11.7% endorsed having experienced some degree of physical abuse; 14.3% endorsed having experienced some degree of sexual abuse; 39.1% endorsed having experienced some degree of emotional

TABLE 1 | Descriptive statistics of the studied variables.

Variables	Mean	SD	Range	n/N (%)
Age (years old)	18.51	0.77	18–25	
CTQ				
Total score	34.15	9.96	25–92	
Emotional abuse	6.79	2.66	5–23	17.8%
Physical abuse	5.91	2.03	5–22	11.7%
Sexual abuse	5.44	1.53	5–21	14.3%
Emotional neglect	9.06	4.34	5–25	39.1%
Physical neglect	6.95	2.54	5–21	29.3%
Single exposure	N/A	N/A	N/A	21.9%
Multiple exposures	N/A	N/A	N/A	32.6%
QSC	27.28	19.48	0–100	
DERs	84.78	21.19	36–153	
BDI	7.26	6.82	0–47	

N = 2108. SD, standard deviation; CTQ, Childhood Trauma Questionnaire-Short Form (CTQ-SF); QSC, conversion score of the Qi-Stagnation Constitution Scale; DERs, total score of the Difficulties in Emotion Regulation Scale; BDI, depressive score using Beck Depression Inventory-II; n/N (%), percentage of different type of childhood maltreatment exposures.

neglect, and 29.3% endorsed having experienced some degree of physical neglect. 21.9% endorsed having experienced one type of maltreatment while 32.6% endorsed having experienced two or more types of maltreatment.

Symptoms of Depression

The average score on the BDI-II within our sample was 7.26 (*SD* = 6.82). 15% reported having mild to severe depressive scores. The prevalence rate was comparable to those of previous findings in Chinese university population (3–5). Specifically, 9.7% had depressive symptoms within the mild range (score of 14–19), 4.5% within the moderate range (score of 20–28), and 0.8% within the severe range (score of 29–63) based on cut-offs defined by Beck, Steer, and Brown (61).

Table 2 shows the results of bivariate correlation analyses of demographic variable (gender, age) and the four studied variables (CTQ, DERs, QSC, and BDI). The results were in line with the hypothesis that CTQ ($r = 0.325$, $p < 0.001$), QSC ($r = 0.556$, $p < 0.001$) and DERs ($r = 0.532$, $p < 0.001$) were positively correlated with depressive scores using BDI in college students. Additionally, DERs was positively correlated with both CTQ ($r = 0.397$, $p < 0.001$) and QSC ($r = 0.619$, $p < 0.001$). Moreover, there was a significant positive correlation between CTQ and QSC ($r = 0.323$, $p < 0.001$). In addition, we found a significant gender effect in QSC ($r = 0.100$, $p < 0.01$).

The Correlations Between Qi-Stagnation Constitution and Different Types of Childhood Maltreatment

We further examined whether QSC was correlated with different types of childhood maltreatment. **Table 3** shows the correlation between QSC and CTQ-SF total score as well as scores of the five subscales of CTQ-SF. Bivariate correlation analyses indicated that QSC was significantly positively associated with CTQ-SF total score ($r = 0.323$, $p < 0.001$), emotional abuse ($r = 0.352$, $p < 0.001$), physical abuse ($r = 0.215$, $p < 0.001$), sexual abuse

TABLE 2 | Intercorrelations between the studied variables.

Variables	1	2	3	4	5
1. Gender ^a					
2. Age (years old)	0.034				
3. CTQ	0.019	0.016			
4. QSC	0.100**	0.006	0.323***		
5. DERs	0.019	0.015	0.397***	0.619***	
6. BDI	0.031	0.072	0.325***	0.556***	0.532***

N = 2,108. Pearson's correlation analyses were performed to investigate the association between age, CTQ, QSC, DERs, and BDI.

^aPoint-biserial correlations were performed to test the association between "gender" variable and other variables.

SD, standard deviation; CTQ, total score of the Childhood Trauma Questionnaire-Short Form (CTQ-SF); QSC, conversion score of the Qi-Stagnation Constitution Scale; DERs, total score of the Difficulties in Emotion Regulation Scale; BDI, depressive score using Beck Depression Inventory-II. ** $p < 0.01$, *** $p < 0.001$.

($r = 0.181$, $p < 0.001$), emotional neglect ($r = 0.251$, $p < 0.001$), and physical neglect ($r = 0.189$, $p < 0.001$).

The Mediation Effect of Qi-Stagnation Constitution on the Association Between Childhood Maltreatment and Depression

The results of the mediation effect of QSC on the association between CTQ and BDI was depicted in **Table 4**. First, Model 1 showed a positive association between CTQ and QSC ($B = 0.323$, $p < 0.001$). Second, Model 2 showed a positive association between CTQ and BDI ($B = 0.321$, $p < 0.001$). Third, after controlling for CTQ, QSC was positively associated with BDI ($B = 0.508$, $p < 0.001$) as shown in Model 3. Although CTQ was still significantly associated with depressive scores ($B = 0.158$, $p < 0.001$), its effect on depressive scores was reduced in Model 3 after controlling for QSC compared to Model 2.

To revalidate the mediating role of QSC between CTQ and BDI, Hayes' (63) Model 4 of SPSS Process macro was used to calculate the 95% confidence interval (CI) of the indirect effect based on 5,000 bootstrap samplings. In the calculation, gender and age were included as covariates. It was found that the indirect effects of CTQ on BDI through QSC were significant (95% CI = [0.138, 0.191]), which further confirmed that QSC mediated the association between childhood maltreatment and depressive scores in college students.

The Moderation Effect of Emotion Regulation on the Mediation Model

First, our results showed that the interaction between CTQ and DERs cannot predict QSC ($B = 0.015$, $p = 0.426$), indicating that DERs had no significant moderating effect on the association between CTQ and QSC. But our results showed that the interaction between QSC and DERs can predict the level of depression to a significant level ($B = 0.166$, $p < 0.001$), indicating that DERs had a moderating effect on the association between QSC and BDI as shown in **Figure 2** and **Table 4**-Model 4. **Figure 3** shows the results of the simple slope analyses used to demonstrate the significant interaction at 1 SD below the mean and 1 SD above the mean of DERs. We found that for

TABLE 3 | The correlations between Qi-stagnation constitution (QSC) and different types of childhood maltreatment.

	CTQ	EA	PA	SA	EN	PN
Mean \pm SD	34.15 \pm 9.96	6.79 \pm 2.66	5.91 \pm 2.03	5.44 \pm 1.53	9.06 \pm 4.34	6.95 \pm 2.54
QSC	0.323***	0.352***	0.215***	0.181***	0.251***	0.189***

The values in the second row of the table represent the Pearson's correlation coefficients between Qi-stagnation constitution (QSC) and different types of childhood maltreatment. SD, standard deviations; CTQ, total score of the Childhood Trauma Questionnaire-Short Form (CTQ-SF); EA, emotional abuse; PA, physical abuse; SA, sexual abuse; EN, emotional neglect; PN, physical neglect; QCS, conversion score of Qi-stagnation constitution Scale. *** $p < 0.001$.

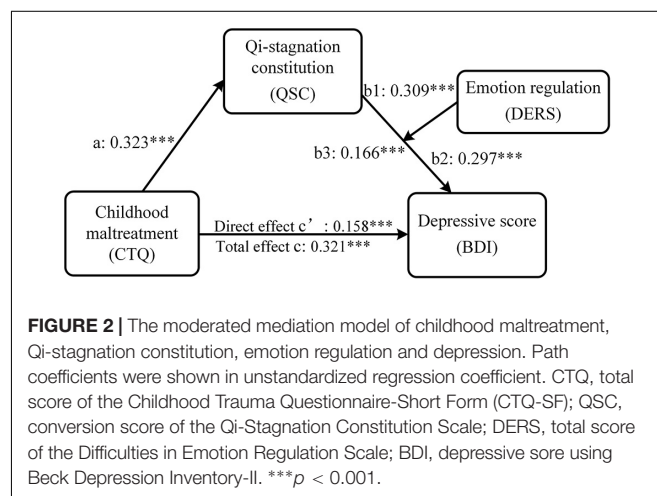
individuals with no matter how low or high DERS, higher levels of QSC were associated with higher depressive scores (Low DERS: $B_{simple} = 0.143$, $t = 4.788$, $p < 0.001$; High DERS: $B_{simple} = 0.475$, $t = 19.574$, $p < 0.001$). Nevertheless, the relationship between QSC and depressive scores was stronger when DERS was high (1 SD above the mean) and weaker when DERS was low (1 SD below the mean).

We also use Hayes' (63) Model 14 of SPSS Process macro to revalidate the moderated mediation effect, controlling for gender and age. The 95% confidence interval (CI) was calculated based on 5,000 bootstrap samplings. The results showed that DERS did moderate the effect of CTQ on BDI through QSC (indirect effect = 0.100, $SE = 0.010$, 95% CI = [0.081, 0.120]). The conditional indirect effects of CTQ on BDI under different levels of DERS and pairwise contrasts between conditional indirect effects were depicted in Table 5. Pairwise contrasts between conditional indirect effects of CTQ on BDI under different levels of DERS found that the indirect effect for high DERS college students (indirect effect = 0.153, $SE = 0.014$, 95% CI = [0.127, 0.183]) was significantly stronger than that of low DERS college students (indirect effect = 0.046, $SE = 0.010$, 95% CI = [0.028, 0.067]), as zero was not contained in the 95% CI

presented in Table 5. That is, for individuals with higher DERS, higher childhood trauma was associated with higher depressive scores through QSC.

Testing for Gender Effects on the Moderated Mediation Model

The results on investigating the gender effects on the moderated mediation model are presented in the **Supplementary Material**. In brief, the same pattern of results derived from all samples was found in both male and female groups.

**TABLE 4 |** Results of moderated mediation analyses.

Predictor variable	QSC		BDI	
	Model 1	Model 2	Model 3	Model 4
Intercept	0.065	-1.323	-1.356	-1.655
Control variables				
Gender	-0.203***	0.050	-0.053	-0.009
Age (years old)	-0.022	0.067	0.078	0.085
Independent variable				
CTQ	0.323***	0.321***	0.158***	0.100***
Mediator				
QSC			0.508***	0.309***
Moderator				
DERS				0.297***
Interaction term				
QSC \times DERS				0.166***
R^2	0.114	0.109	0.337	0.410
F	89.94***	85.58***	267.23***	243.22***

$N = 2,108$. Unstandardized regression coefficients are reported. CTQ, total score of the Childhood Trauma Questionnaire-Short Form (CTQ-SF); QCS, conversion score of the Qi-Stagnation Constitution Scale; DERS, total score of the Difficulties in Emotion Regulation Scale; BDI, depressive score using Beck Depression Inventory-II. *** $p < 0.001$.

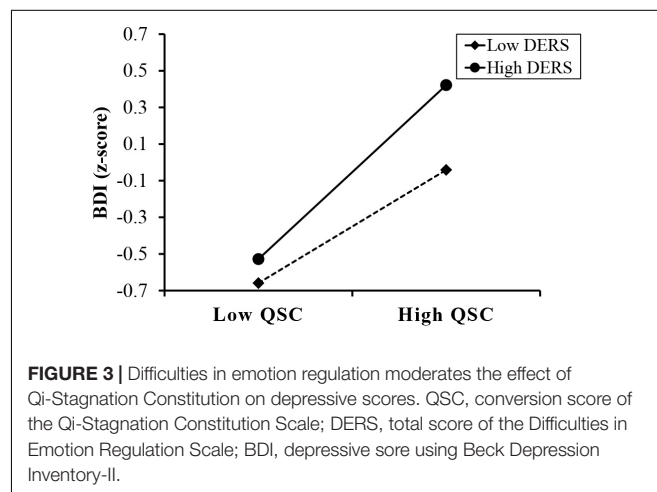


TABLE 5 | Conditional indirect effects of CTQ on BDI under different levels of DERS and pairwise contrasts between conditional indirect effects.

	DERS	Effect	BootSE	BootLLCI	BootULCI
Conditional indirect effects	Effect 1 (M-1 SD)	0.046	0.010	0.028	0.067
	Effect 2 (M)	0.100	0.010	0.081	0.120
	Effect 3 (M + 1 SD)	0.153	0.014	0.127	0.183
Pairwise contrasts between conditional indirect effects	Effect 2 – effect 1	0.054	0.007	0.040	0.068
	Effect 3 – effect 1	0.107	0.014	0.080	0.137
	Effect 3 – effect 2	0.054	0.007	0.040	0.068

CTQ, total score of the Childhood Trauma Questionnaire-Short Form (CTQ-SF); BDI, depressive score using Beck Depression Inventory-II; DERS, total score of the Difficulties in Emotion Regulation Scale; M, mean; SD, standard deviation; BootSE, standard error of bootstrap; BootLLCI, lower limit of 95% confidence interval; BootULCI, upper limit of 95% confidence interval.

DISCUSSION

The current study investigated the potential pathway between childhood maltreatment and depressive symptoms in a sample of college students by assuming a moderated mediation model as shown in **Figure 1**. Consistent with our hypotheses, we first found a positive correlation between childhood maltreatment and QSC (Hypothesis 1). We then confirmed the mediating effect of QSC on the association between childhood maltreatment and depressive symptoms (Hypothesis 2), and the moderating effect of emotion regulation on the association between QSC and depressive symptoms (Hypothesis 3). These results contribute to a better understanding of the pathways by which childhood maltreatment impacts on individual depressive symptoms in college students. Implications for depression prevention and intervention are discussed.

Consistent with our hypotheses, we found a positive correlation between childhood maltreatment and QSC, while QSC partially mediated the association between childhood maltreatment and depressive score. First, consistent with prior studies (10, 15, 69–72), our results showed that childhood maltreatment was positively associated with depressive scores in college students (**Table 2**). This may suggest that those who experienced more neglect or abuse during childhood had a significantly increased risk of depression and more depressive symptoms in their adulthood. Furthermore, similar to previous studies (28, 32, 34, 35), we found a significantly positive correlation between QSC and depressive scores (**Table 2**), confirming that QSC is a predispositional and susceptible constitution of depression. Intriguingly, we found a significant gender effect on QSC as shown in **Table 2**. This result is consistent with the gender differences in the studied variables using independent-samples *t*-test (see **Supplementary Table 2**), which show that the level of QSC of female participants were significantly higher than those of male participants. These results are in line with previous epidemiological investigation of TCM constitution, which indicated that females were more likely to develop QSC compared to males (73–75). From the perspective of the psychological characteristics, females are more introverted, fragile, sentimental and possibly more vulnerable to negative

emotions, thus increasing the likelihood of Qi stagnation (73). Importantly, we found consistently positive correlations between the five types of childhood maltreatment and QSC (**Table 3**). One possible explanation by TCM is that the liver is capable of regulating Qi movement and balancing emotions. However, the liver functions can be affected by stress (32, 76–81). For example, animal studies have revealed that responses following psychosocial challenges involve transcriptional alterations in liver tissue (76); psychological stress preferentially induces a pro-inflammatory response in the liver (81). Moreover, acute stress made an immediate impact on liver lipid metabolism for rats (77). In addition, the growing evidence obtained from human studies has suggested that psychological stress can affect liver functions (78–80). A previous review (78) suggested that psychosocial stress might influence the initiation, course and outcome of liver diseases. Fukudo et al. (79) suggested that psychosocial stress may have an impact on exacerbation of alcoholic liver injury. Early clinical reports revealed that psychosocial stress significantly decreased hepatic blood flow (80). Stress (e.g., early life stress) is known as one of the most common contributors to liver Qi stagnation in TCM (52). According to the theory of TCM constitution, TCM constitution is largely determined by the congenital endowments including ethnicity and inheritance, which contribute to the specificity and relative stability of constitution. Nevertheless, this relatively stable specificity is not necessarily static. Instead, it could be dynamically changed with the effects of acquired factors, such as social and growth environment, lifestyles, emotion, diseases, and received treatments (82–84). Prof. Qi Wang, the founder of the TCM constitution, suggested that individuals with QSC may be more sensitive to stress and more easily enter into emotional frustration when they encounter more adverse life events (27). In fact, the relationships between QSC and adverse life events in childhood have already been observed by other theorists. For example, a review by Fu et al. (82) suggested that the formation of QSC was related to the adverse experiences in childhood, such as early deprivation, parental divorce, premature death of relatives, community violence and peer bullying. Providing a further empirical support for these theories, our study suggests that level of QSC tended to be higher among the individuals reporting severer childhood maltreatment. However, all the correlations were weak in nature, although QSC was significantly correlated with various types of childhood maltreatment. The correlation coefficients between QSC and various types of childhood maltreatment ranged between 0.181 and 0.352, representing small to moderate correlation between these two variables. Given more of the variability left unexplained, there must be one or more other relevant factors linked to QSC. Therefore, clinical practitioners must interpret cautiously whether these statistically significant relationships are of clinical significance in practical terms. Future studies shall pay more attention to the factors influencing the association between childhood maltreatment and QSC. This study takes a first step to explore the potential association between childhood maltreatment and level of QSC. Given childhood maltreatment may be a risk factor for biased QSC in young adulthood, it is important to develop early intervention

against childhood maltreatment to minimize the level of QSC.

More importantly, our results indicated that QSC played a mediating role between childhood maltreatment and depressive scores in college students (**Table 4-Model 3**). The significant mediating effect of QSC revealed that those who were subjected to severer childhood maltreatment raised their level of QSC, which, in turn, might lead to higher depressive scores. It shows that QSC acts as a risk-enhancing factor in depression among people with childhood maltreatment. Individuals with high levels of QSC show characteristics of emotional fragility and poor tolerance to mental stimulation, which may increase the vulnerability to depression (37). According to TCM theory, compared with those who do not experience an adverse life event, people who experience more adverse life events can suffer from more severe Qi stagnation in their liver, thus leading to worsened depression (32, 52). Although no research has directly shown the role of QSC in shaping the relationship between adverse childhood experiences and depression, a study by Liu et al. (32) indicated that current life stress could worsen the level of QSC thus leading to depression. As mentioned above, acquired factors may cause dynamic changes in constitution, leading to disease or health. The adjustability of constitution makes it possible to adjust and correct biased QSC, which facilitates early detection, prevention, and treatment of depression. In recent years, the theory of TCM constitution has been widely applied in clinical research and public health practices, establishing the prevention and treatment route of constitution-disease-intervention (85). TCM advocates the concept of early prevention, through reducing the level of individual QSC to prevent the development of depression. Mainstream approaches to clinical intervention for QSC include prescription, acupuncture, lifestyle modification and physical exercise, to name but a few (86). Integration of TCM constitution with western medicine is a potential alternative option toward health maintenance as well as depression prevention and alleviation (87). In general, our results may suggest childhood maltreatment as a risk factor for biased Qi-stagnation constitution, which is a potential mechanism underlying the negative effect of childhood maltreatment on depression in adulthood. This finding highlights the combined needs to strengthen family health education and carry out care interventions for maltreated individuals with high QSC to reduce risk of depression.

In addition, this study further investigated at what stage the DERS assessing emotion regulation worked regarding its moderating effect within the model. Our results revealed that DERS exerted no significant moderating effect on the association between childhood maltreatment and QSC, which may be attributed to the relatively stable TCM constitution as determined by the congenital genetic factors (27, 88). Formed in the process of individual growth and development, TCM constitution may not be easily affected by emotion regulation. However, our results indicated that the indirect effect of childhood maltreatment on depressive scores through QSC relied on the level of DERS (**Table 4-Model 4**). The result corresponded to previous studies showing that emotion regulation could predict depression severity (45, 89, 90) and that emotion dysregulation was an underlying factor affecting depressive symptoms in individuals

with adverse childhood experiences (39, 40, 50, 51). The capability of emotion regulation is developed early in life within the context of interpersonal emotional exchanges between the caregiver and child (91). A considerable body of studies have indicated that growing up with experiences of maltreatment may adversely affect a child's later ability to regulate emotions (92, 93). Emotion dysregulation linked to early life adversity appears to be relevant to the onset, maintenance, and treatment of depression (94). Our results extend these previous findings by showing that the association between QSC and depression symptoms relied on the level of DERS. According to the results of simple slope analyses, compared to those with lower emotion dysregulation, individuals with childhood maltreatment who tended to have QSC under higher emotion dysregulation were more likely to be scored high on depression (**Figure 3** and **Table 5**). It seems that emotion dysregulation may serve to strengthen the disadvantages associated with QSC, thus, causing the individuals with childhood maltreatment to suffer from depression. A plausible explanation by TCM is that Qi (vital energy), which is believed to be capable of vitalizing, propelling, and warming the body, depends on the regulation of the liver, which balances emotions (52, 95, 96). If the liver malfunctions, Qi gets blocked and induces emotional abnormalities and dysregulation, thus increasing the risk of depression (52). Our results are congruent with a prior study (32) demonstrating that rumination (a maladaptive emotion regulation strategy) may affect the relationship between QSC and depression in women. Researchers (32, 97) have proposed that maladaptive emotion regulation (e.g., rumination) will make individuals focus on their own negative emotions and negative events, reduce the efficiency of solving problems, and finally cause depression. Therefore, the level of depression is not only dependent on childhood adversity and QSC, but also on emotion regulation. Effective emotion regulation or low emotion dysregulation may serve as a protective factor against depression. The effective utilization of emotion regulation function as made possible through psychological counseling, can reduce the probability of depression in individuals with adverse childhood experiences and high QSC levels. Appropriate emotion regulation skills may mitigate the effect of QSC on depression from the perspective of clinical practice.

Limitations

Several limitations should be born in mind in this study. First, caution should be given to the interpretation of our results as the study population is restricted to general college students, which may limit the replicability of our findings to other depressive patients. The associations between childhood maltreatment, QSC, emotion regulation and depression in diverse samples such as clinically depressed patients should undergo further examinations in the future. Second, similar to previous studies (65–68), there was a gender imbalance in our sample as females outnumbered males. The skewed gender ratio toward female may be due to the fact that participants in the current study mainly came from medical universities in China, which have a gender ratio of men to women approaching 1:2. To remedy, we have controlled the effects of gender and age in our data analyses. In addition, we repeated the same analyses

with the male and female groups, respectively, to examine whether gender has an effect on our model. The results showed that the same pattern of results derived from all samples was found in both male and female groups (see **Supplementary Material**). Third, all variables were assessed with self-report questionnaires. Retrospective assessments rely on the accuracy of the participant's memory and may be prone to reporting bias. These could be improved in future studies through interviews with participants or using more accurate means of clinical assessment on childhood maltreatment, QSC, emotion regulation and depression instead of using self-report questionnaires. Fourth, this study only considered the overall severity of childhood maltreatment. We did not collect more detailed information about when and how long they were maltreated in childhood as well as the detailed demographic information of the participants, such as socioeconomic status (SES). Future research may benefit from collecting more comprehensive information about childhood maltreatment and demographic information to take into consideration potential confounding effects and to provide more specific conclusions about how different aspects of childhood maltreatment can contribute to depression. Fifth, this study did not consider the effects of different types of childhood maltreatment, which should be investigated in the future by recruiting more participants. Sixth, this study only examined the mediating role of QSC in the association between childhood maltreatment and depression. Since other TCM constitutions may also affect mental health, future studies should include other TCM constitutions and further analyze whether other TCM constitutions would mediate the link between childhood maltreatment and depression. Finally, the moderated mediation analyses conducted in this study are cross-sectional in nature, which limits any firm conclusions regarding causality or temporal onset of QSC, emotion dysregulation and depressive outcomes. While our results suggest the mediating role of QSC and the moderating effect of emotion regulation between childhood maltreatment and the level of depression, longitudinal prospective cohort studies and interventional studies assessing why and how childhood maltreatment can affect depression through QSC and emotion dysregulation would be informative to rule out alternative explanations of the observed effects. A longitudinal study with traumatized individuals would enable analyses of intraindividual and interindividual differences in the courses of the presumably affected variables.

CONCLUSION

This study provides empirical evidence for the mediating role of QSC between childhood maltreatment and depressive scores and the moderating effect of emotion regulation on the association between QSC and depressive scores among college students. These results contribute to a better understanding of the potential factors influencing the link between childhood maltreatment and depressive symptoms from interdisciplinary perspectives, which combined the theory of TCM constitution and psychological processes. The development of preventive strategies to ameliorate biased Qi-stagnation constitution and emotion dysregulation may help with the improvement of college

students' mental health and to strengthen the resilience of individuals to depression. In consideration of the limitations of cross-sectional studies, it is essential to verify the moderated mediation model by conducting prospective cohort studies and interventional studies in the future.

DATA AVAILABILITY STATEMENT

The datasets analyzed in this article are now not publicly available because the datasets are part of an unpublished database and the database is still being used for other manuscripts in preparation. Further enquires can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee of South China Normal University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HH, HP, and YS contributed to the conception and design of the study. YZ and WW collected and analyzed the data. HH and QS drafted the manuscript. HH, QS, JC, YZ, WW, BJ, JL, LM, YL, RZ, HP, and YS provided critical comments and revisions. All authors read and approved the final version of the manuscript for submission.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2022.825198/full#supplementary-material>

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The Italian Version of the International Trauma Questionnaire: Symptom and Network Structure of Post-Traumatic Stress Disorder and Complex Post-Traumatic Stress Disorder in a Sample of Late Adolescents Exposed to a Natural Disaster

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The 11th revision of the International Classification of Diseases has endorsed substantial changes in Post-Traumatic Stress Disorder (PTSD) and has introduced Complex PTSD (cPTSD). The objective of this study was to assess the symptom and network structure of PTSD and cPTSD using the International Trauma Questionnaire- Italian version (ITQ) and the prevalence of PTSD and cPTSD in a community sample of late adolescents enriched with exposure to a destructive earthquake. A 1,010 high school students participated to the study. Confirmatory Factor Analysis supports that a six first-order correlated factors was the best fitting model of ICD-11 PTSD/cPTSD. The network analysis supports a clear separation between core PTSD symptoms and disturbances in self-organization (DSO) symptoms, avoidance, and negative self-concept were the most central items. The prevalence of PTSD and cPTSD was 9.11 and 4.06%, respectively. Female participants reported higher rates of both PTSD and cPTSD. This is the first study to report on ICD-11 PTSD and cPTSD rates on an Italian adolescence community sample. Consistent with other community samples, we found higher rates of PTSD compared to cPTSD. The results confirmed the factorial validity of the ITQ. The network structure highlights the importance of negative self-concept in cPTSD and avoidance in PTSD.

Keywords: PTSD, ICD-11 cPTSD, International Trauma Questionnaire, factor structure, network analysis

INTRODUCTION

Exposure to traumatic experiences (TE) is common in the general population with 70% of people globally reporting at least one potential TE in their lifetime, and 30% reporting four or more TEs (1). The prevalence of different types of TE varies across regions of the world, and across other sociodemographic variables. In developed countries, the most frequent TEs are the sudden death of a loved one, technological accidents (in particular, motor vehicle accidents), and crime-related TE such as being robbed (1). Exposure to TE is associated with a wide range of adverse mental health outcomes, and it is a criterion for a diagnosis of Post-Traumatic Stress Disorder (PTSD). Interpersonal TEs, particularly those that are repeated and/or occur early in life are especially harmful TEs and are associated with a plethora of serious adverse mental health and functional outcomes.

The 11th revision of the World Health Organization's (WHO) International Classification of Diseases (ICD-11) included substantial changes to the “Disorders Specifically Associated with Stress” section, including a revised definition of PTSD and the introduction of Complex PTSD (cPTSD; (2)). In the ICD-11, PTSD is focused on a small set of core trauma symptoms grouped into three clusters (re-experiencing in the here and now, avoidance of traumatic reminders, and a sense of threat) (3). cPTSD includes the three symptom clusters of PTSD, plus three symptom clusters of Affective Dysregulation, Negative Self-Concept, and Disturbances in Relationships. Collectively, these three clusters are termed Disturbance in Self-Organization (DSO; (4)). DSO symptoms were selected to capture the pervasive disturbances that commonly arise from enduring interpersonal TEs from which escape or avoidance is difficult or impossible (5). In this respect, the Psychodynamic Diagnostic Manual (PMD-2; (6)) conceptualizes Complex PTSD as a developmental trauma disorder, emphasizing how traumatic events between birth and adulthood might compromise the optimal development of the individual's identity, self-worth, personality, emotional regulation and self-regulation. While the type of TE is not used to make a differential diagnosis, PTSD and cPTSD typically differ in the types of TE that precipitate their development. TD more often associated with interpersonal traumas and early life traumas, whereas PTSD is more often associated with non-interpersonal and later life traumas (7, 8). One key feature of a TE that could inform on the pathogenetic potential is the presence of the intention to harm. Interpersonal TEs such as abuse, violence, neglect, or aggression are, by definition, deliberate acts aiming to harm an individual. On the other hand, TEs such as natural disasters or accidents are events that occur either without any input from other person or any deliberate motive to cause of harm. An interesting feature of TEs that include an intention to cause harm is that they tend to be inter-related and are therefore likely to co-occur over an extended period of time (9).

The International Trauma Questionnaire (ITQ) (10) is a self-report measure developed to capture all elements of the ICD-11 diagnoses of PTSD and cPTSD. The psychometric properties of the ITQ have been extensively investigated in community (10–12) and clinical (13, 14) samples. Despite the widespread use and support for the psychometric properties of the ITQ

(for a review see Redican et al. (15)), most of this empirical support comes from the original English version of the ITQ. An explicit goal of the revisions to the ICD-11 was to maximize the global applicability of these diagnoses. Thus, it is essential that research be conducted to assess the psychometric properties of the translations of the ITQ.

This study has two main objectives. The first aim is to assess the factor and symptom structure model of the Italian version of the ITQ using a factor and network analysis. In recent years a number of studies have addressed the network structure of DSM-IV- and DSM-5-defined PTSD (16). Evidence regarding ICD-11 PTSD and cPTSD is more limited; however, converging evidence supports a clear separation between the core PTSD and the DSO symptoms (17), and negative self-concept items as central nodes in cPTSD (18, 19). Results regarding centrality in PTSD is more mixed, with hyperarousal (20) and re-experiencing (21) being reported more frequently as central nodes. Our aim is to extend these findings on a non-clinical sample of late adolescents. Our first hypothesis is that a clear factorial separation between core PTSD symptoms and DSO symptoms will be found in our sample, consistent with previous works.

The second purpose is to assess the prevalence of PTSD and cPTSD in a sample of Italian late adolescents exposed 10 years earlier to a destructive earthquake together with any gender differences. This population is characterized by collective exposure to an unintentional traumatic event in the form of a natural disaster during a critical developmental period. In this respect, we sought to extend upon current knowledge about the type of traumatic events that are associated with meeting the diagnostic criteria for PTSD and cPTSD by assessing the association between intentional and unintentional TEs with PTSD and cPTSD. In particular, the secondary hypothesis that intentional TEs would be more strongly associated with meeting criteria for cPTSD compared to unintentional TEs, which include the exposure to a natural disaster. Our expected results are that intentional TEs would exert a more relevant impact on PTSD and DSO symptoms, compared to unintentional TE.

METHODS

Participants and Procedure

The participants in the present study were enrolled in the first time point of the Dual Trauma study at the University of L'Aquila. Dual trauma is a longitudinal study started in 2019 that focused on a target population comprising all of the late adolescents and young adults attending the last year of high school in the province of L'Aquila, central Italy, during the academic year 2019–2020. The estimated target population size is 2000. This population is of particular interest as virtually all of the population from L'Aquila and its surroundings, estimated half of the total target population, were directly exposed to the 2009 earthquake when they were between 7 and 10 years old. Most of the remaining target population coming from the surroundings of Avezzano and Sulmona were not directly exposed to this event. Inclusion criteria were attending the last year of high school and being > 18 years old at the time of the enrollment. Enrollment

was limited to students > 18 who were chosen in order to not introduce any selection bias deriving from parental consensus. Exclusion criteria included being on supported teaching as a proxy of mild to severe cognitive impairment.

A clustered sampling was conducted based on geographical area (L'Aquila, Avezzano and Sulmona), school and class. In the area, 12 out of 14 high schools were identified and invited to participate; two schools did not provide consent to participate. In the remaining ten schools, 50 to 100% of the last-year classes were allowed to participate by the headmasters. Individual written consent was provided by the participants. Questionnaires were collected in paper and pencil form by the University staff.

The local ethics committee at the University of L'Aquila provided approval to the study (research number 49, 26/09/2019). This study adheres to the declaration of Helsinki.

Recruitment and data collection took place between November 2019 and January 2020. A total of 1010 adolescents participated in the study, 506 (50.15%) males, mean age 18.7 (sd = 0.65). Geographical area was distributed as follows: 418 (41.39%) from L'Aquila surroundings, 306 (30.30%) from Avezzano surroundings and 286 (28.32%) from Sulmona surroundings. 694 (68.71%) participants reported being directly exposed to the 2009 central Italy earthquake.

Of the 1,010 initial sample, eighteen participants had complete missing data on the ITQ and were thus excluded. The final analysis was performed on 992 subjects.

Measures

The International Trauma Exposure Measure (ITEM)

The ITEM (22) is a 21-items checklist capturing traumatic life events, and their associated features, in a manner consistent with the ICD-11 description of a TE. The ITEM measures exposure to TEs across three developmental periods (childhood, adolescence, adulthood). The ITEM is freely available at <https://www.traumameasuresglobal.com> to the research and clinical communities and may be used without permission. For the purpose of this study, the following modifications were introduced: for each TE, the respondent was asked to rate whether the TE had occurred during childhood, adolescence, or in the last 6 months. Each TE was classified as intentional or unintentional by two independent psychiatrists with expertise in trauma-related research that were blind to all the study objectives and variables. The results were checked and discussed with the original authors of the ITEM. During the classification process, three TE were excluded because deemed not pertinent as intentional nor unintentional TE. Full ITEM questions, their lifetime endorsement by participants, and their classification as intentional or unintentional are reported in **Table 1**.

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The Italian Version of the International Trauma Questionnaire

The ITQ (10) is a self-report questionnaire measuring all aspects of the ICD-11 diagnostic criteria for PTSD and cPTSD. The ITQ first asks a participant to identify their most distressing traumatic event and how long ago this event occurred. Participants are then instructed to answer all questions in relation to that event. The ITQ includes six items to measure each of the PTSD symptoms across the clusters of Re-experiencing in the Here and Now, Avoidance of internal and external reminders, and Sense of Current Threat (Hyperarousal). Participants report how bothered they have been by each symptom over the past month. Additionally, participants indicated how much these symptoms have interfered with their ability to function in life in the past month across three items. These are six items measuring each of the DSO symptoms across the clusters of Affective Dysregulation, Negative Self-Concept, and Disturbances in Relationships (Relational problems). Participants answer these questions in terms of how they typically feel, think about

TABLE 1 | Mean scores of ITQ items.

Factor	Variable	0 = Not at all	1 = A little	2 = Moderately	3 = Quite a lot	4 = Very much	Total mean	Std.
PTSD								
Re-experiencing	Re1 – Dreams	463 (47.1%)	266 (27.0%)	138 (14.0%)	79 (8.0%)	38 (3.9%)	0.99	1.15
	Re2 – Nightmares	338 (34.3%)	248 (25.2%)	176 (17.9%)	152 (15.4%)	71 (7.2%)	1.40	1.28
Avoidance	Av1 – Avoidance – internal	372 (37.8%)	233 (23.7%)	186 (18.9%)	118 (12.0%)	74 (7.5%)	1.34	1.29
	Av2 – Avoidance – external	427 (43.4%)	205 (20.8%)	157 (15.9%)	119 (12.1%)	77 (7.8%)	1.28	1.33
Hyperarousal	Hyp1 – Hyperarousal	463 (47.1%)	250 (25.4%)	127 (12.9%)	94 (9.6%)	50 (5.1%)	1.05	1.21
	Hyp2 – Easily startled	504 (51.3%)	209 (21.3%)	139 (14.2%)	80 (8.1%)	50 (5.1%)	1.00	1.21
DSO								
Emotional Dysregulation	Dys1 – Difficult calm down	156 (15.8%)	284 (28.7%)	263 (26.6%)	201 (20.3%)	85 (8.6%)	1.83	1.18
	Dys2 – Numbing	519 (52.5%)	216 (21.8%)	126 (12.7%)	82 (8.3%)	46 (4.7%)	0.97	1.20
Negative Self Concept	Nsc1 – Feel like a failure	723 (73.1%)	132 (13.3%)	66 (6.7%)	38 (3.8%)	30 (3.0%)	0.54	1.01
	Nsc2 – Worthlessness	729 (73.7%)	139 (14.1%)	58 (5.9%)	39 (3.9%)	24 (2.4%)	0.51	0.98
Relational problems	Rel1 – Feel cut from others	678 (68.6%)	190 (19.2%)	56 (5.7%)	46 (4.7%)	18 (1.8%)	0.55	0.95
	Rel2 – Difficult stay close to others	577 (58.3%)	238 (24.1%)	104 (10.5%)	53 (5.4%)	17 (1.7%)	0.72	1.00

themselves, and relate to others. There are also three items used to measure the extent to which these symptoms impair functioning in life over the last month. All items are based on a five-point Likert scale that ranges from 0 (Not at all) to 4 (Extremely).

A diagnosis of PTSD requires that a person was trauma exposed, the endorsement (defined as a score ≥ 2 on the Likert scale) of at least one of two symptoms in each one of the three symptoms cluster plus endorsement (defined as a score ≥ 2) of at least one indicator of functional impairment. A diagnosis of cPTSD requires the endorsement of one of two symptoms from each of the three PTSD symptoms clusters and one of two symptoms from each of the three Disturbances in Self-Organization (DSO) clusters. The functional impairment must be identified where at least one indicator of functional impairment is endorsed related to the PTSD symptoms, and one indicator of functional impairment is endorsed related to the DSO symptoms. An individual can receive either a diagnosis of PTSD or cPTSD, not both. In our sample, reliability was $\alpha = 0.88$ for the PTSD subscale and $\alpha = 0.88$ for the DSO subscale.

The translation process followed standard back-translation procedures, with two psychiatrists providing a draft English-to-Italian translation, a third psychiatrist produced a joint version of the two drafts, and a native English speaker provided a back-translated version that was approved by the authors. The English and Italian versions of the ITQ are freely downloadable at <https://www.traumameasuresglobal.com/itq>.

STATISTICAL ANALYSIS

The weighted least squares (WLS) Confirmatory Factor Analysis (CFA) was conducted to evaluate the fit of four different models already presented in the literature. WLS provides accurate parameter estimates, standard error and test statistics for ordinal indicators. Based on previous findings (10, 11, 23–29), we specified four different models of PTSD and cPTSD factor structure. Model 1 is a one-factor model where all of the ITQ items loaded onto a single cPTSD factor. Model 2 is a correlated six-factor (i.e., Re-experiencing in the Here and Now, Avoidance, Sense of Current Threat, Affective Dysregulation, Negative Self-Concept, and Disturbances in Relationships) model. Model 3 is a second-order model with six first-order factors and one second-order factor of cPTSD. Model 4 is a two factor second-order model with a second-order PTSD factor and a second-order DSO factor. Model fit for the CFA was evaluated using: a non-significant chi-square result indicates good model fit; Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) values ≥ 0.90 and ≥ 0.95 indicate adequate and excellent fit, respectively (30); and Root Mean Square Error of Approximation (RMSEA) values ≤ 0.08 and ≤ 0.06 indicate adequate and excellent fit. CFA analysis was performed using STATA® v.16 (StataCorp (31)).

A network analysis on the 12 ITQ symptoms items was conducted using an Extended Bayesian Information Criterion Graphical Least Absolute Shrinkage and Selection Operator (EBICglasso) estimator. EBICglasso (32) is a partial correlation regularized estimation method that estimates partial correlations

among all variables in the network, which use penalized maximum likelihood estimation to shrink parameters to zero, potentially removing them from the network. EBICglasso tuning parameter was set to 0.5. Centrality measures estimated included Betweenness (i.e., the number of shortest paths that pass through the node of interest), Closeness (i.e., the inverse of the sum of all shortest paths from the node of interest to all other nodes), and Strength (i.e., the sum of the absolute input weights of that node).

Finally, prevalence estimates for PTSD and cPTSD were estimated, together with gender differences. Association with traumatic experiences and a screened diagnosis of PTSD or cPTSD was assessed using multinomial logistic regression models, with ITQ categorical results (no diagnosis, PTSD and cPTSD) modeled as dependent variable, and intentional and unintentional TEs experienced during childhood, adolescence or during the last 6 months were jointly modeled as independent variables in order to correct their effects for each other. Afterward, analyses were adjusted by gender, parental education, and nationality.

All of the statistical analyses were conducted using Stata 16®, except for the network analysis that was conducted using JASP®.

RESULTS

Sample

A total of 1,010 subjects participated to the study, 999 of which provided complete data – 498 (49.85%) female and 501 (50.15%) males. Mean age was 18.7 (sd = 0.63). 418 (41.39%), 306 (30.30%), and 286 (28.32%) were, respectively, from the L'Aquila, Avezzano and Sulmona areas.

Confirmatory Factor Analysis

Confirmatory Factor Analysis goodness-of-fit statistics for the four models are presented in **Table 1**. Model 1 ($\chi^2 = 1903.43$, RMSEA = 0.188, CFI = 0.619, TLI = 0.535, SRMR = 0.109, CD = 0.868, BIC = 32985.043) and 3 ($\chi^2 = 517.447$, RMSEA = 0.101, CFI = 0.903, TLI = 0.867, SRMR = 0.076, CD = 0.942, BIC = 31640.318) showed poor fit indices, while Model 2 ($\chi^2 = 175.18$, RMSEA = 0.06, CFI = 0.972, TLI = 0.953, SRMR = 0.036, CD = 0.999, BIC = 31359.942) and 4 ($\chi^2 = 256.186$, RMSEA = 0.068, CFI = 0.957, TLI = 0.94, SRMR = 0.055, CD = 1, BIC = 31385.933) showed good fit indices, although the χ^2 statistic was significant due to the large sample size (33). Models 2 and 4 had very similar fit indices, with a $\Delta\text{BIC} = 25.99$. Model 2 should be preferred to Model 4 as it had lower BIC and $\Delta\text{BIC} > 10$, which is considered as a threshold for a significant difference.

Network Analysis

Network analysis and centrality plot are reported in **Figure 1**. From the visual inspection of the network structure, it appears that PTSD and DSO symptoms are organized in two separate clusters, and that the two nodes of each subdomain are strongly connected. The network was moderately sparse, with 46/60 non-zero edges and a sparsity of 0.31. Among the core PTSD symptoms, item Av1- “Avoidance of internal

reminders” had the highest betweenness and strength (betweenness = 1.294, closeness = 0.517, strength = 1.175). Centrality measures for the remaining core PTSD items were: Av2- “Avoidance – external” (betweenness = -0.904, closeness = -0.1, strength = 0.23); Reexperiencing, Re1- “Dreams” (betweenness = -1.042, closeness = -1.544, strength = -0.751) and Re2- “Nightmares” (betweenness = 0.469, closeness = -0.359, strength = 0.134); Hyp1- “Hyperarousal” (betweenness = -0.63, closeness = 0.519, strength = -0.602) and Hyp2- “Easily startled” (betweenness = 0.195, closeness = 1.1, strength = 0.677). Among the DSO symptoms, Dys2- “Numbing” had the highest betweenness and closeness (betweenness = 2.393, closeness = 1.604, strength = 0.853), and Nsc2 - “Worthlessness” had the highest strength (betweenness = -0.767, closeness = -1.161, strength = 1.532). For the remaining DSO items, centrality measures were: Dys1- “Difficult calm down” (betweenness = -0.08, closeness = 1.125, strength = -1.663); Nsc1- “Feel like a failure” (betweenness = -0.08, closeness = -0.919, strength = 1.255); Re1- “Feel cut from others” (betweenness = -0.63, closeness = -0.834, strength = -0.335); Re2- “Difficulty stay close to others” (betweenness = -0.218, closeness = 0.052, strength = -0.797). Items with the highest expected influence were both “negative self-concept” Nsc1- “feel like a failure” and Nsc2- “worthlessness” items, Av1- Avoidance of internal reminders and hyperarousal item Hyp2-easily startled. In the whole network, the most influential nodes were Dys2 - “Numbing” with the highest betweenness and closeness, and the two Nsc items.

Prevalence of Post-Traumatic Stress Disorder and Complex Post-Traumatic Stress Disorder and Association With Traumatic Experiences (TEs)

Detailed rates of traumatic experiences and psychopathology separated by gender are reported in **Table 2**. Overall, 914 (90.5%) of participants reported at least one lifetime traumatic experience, the most frequent being exposure to a natural disaster (597; 60.49%), and the least represented frequent being exposed to war or combat (2; 0.2%). No participant reported sexual abuse from a parent, while 32 participants (3.21%) reported a sexual assault by someone other than a parent. Females were more exposed to intentional TE compared to male participants ($\chi^2 = 19.847$, $p < 0.001$), while no gender differences were reported for unintentional TE. In particular, female participants reported higher rates of sexual assault and harassment, bullying, humiliation and neglect. Male participants reported higher rates of being threatened with a weapon and being physically assaulted by a non-parent.

International Trauma Questionnaire prevalence rates are reported in **Table 1**, while detailed descriptive statistics are reported in **Table 2**. According to the diagnostic algorithm, the prevalence of PTSD and cPTSD was 9.11% [7.54, 11.25] and 4.06% [2.98, 5.56], respectively. There was a significant gender effect, with female participants having higher rates of both PTSD and cPTSD (respectively, $\chi^2 = 15.712$, $p < 0.001$ and $\chi^2 = 10.897$, $p < 0.001$).

Logistic regression analyses are reported in **Table 3**. Unintentional TEs, independently of the age of occurrence, were not associated with a PTSD or a cPTSD diagnosis. Intentional TE, irrespectively of the age of occurrence, were associated with both PTSD and cPTSD. Association between childhood and recent intentional TE and PTSD did not hold after adjustment.

DISCUSSION

The present study is the first to report on prevalence rates of ICD-11 PTSD and cPTSD within an Italian late adolescent sample primarily exposed to trauma in the form of a natural disaster, and their association with different types of TEs. Additionally, this study adds to the existing literature on the factorial and network structure of the ICD-11 PTSD and cPTSD on an Italian late adolescent/young adult population.

The ITQ is a brief, highly reproducible instrument that allows to jointly screen for PTSD and cPTSD according to the ICD-11 criteria. In our sample, PTSD was nearly twice as frequent as cPTSD, and both diagnoses were more frequent among female participants. This finding is in line with previous reports from a nationally representative Israeli sample of a higher prevalence of PTSD compared to cPTSD (11). Other studies found opposite results, with cPTSD being more frequent than PTSD (3, 7, 10, 24, 34). However, these studies, except for the Chinese validation study and the United Kingdom general population study (10), focused on clinical populations rather than a general population, suggesting that cPTSD may be a more common issues among help-seeking populations compared to the general population (27). Concerning the Chinese validation study (34), PTSD and cPTSD prevalence were estimated only on the general population subsample that reported at least one adverse childhood experience (ACE), excluding those subjects that may have been exposed to unintentional or non-interpersonal TEs that may not qualify as an ACE that may endorse PTSD but not DSO criteria. The United Kingdom study focused on both a clinical and a community sample. However, in this case the community sample was an adult nationally representative one, while the present study reports on a late adolescence sample.

In the present study, regression analyses support that both intentional and unintentional TEs are associated with a diagnosis of cPTSD, although intentional TEs show a stronger association with cPTSD. Conversely, we failed to demonstrate an association between unintentional TE and a diagnosis of PTSD. These results could be explained by the fact that a TE screener such as the ITEM may effectively screen for the presence of any TE, but it may fail to separate those TE that had a relevant psychological impact from those that didn't. In our sample, which is enriched with youngsters that experienced a massively destructive earthquake during childhood, unintentional TE had a lifetime prevalence of 82% and a 6-months prevalence of 15.35%, compared to a PTSD prevalence of 9.11%. It follows that the vast majority of those experiencing unintentional TEs do not develop PTSD or, in other words, the vast majority of unintentional TE is not inherently

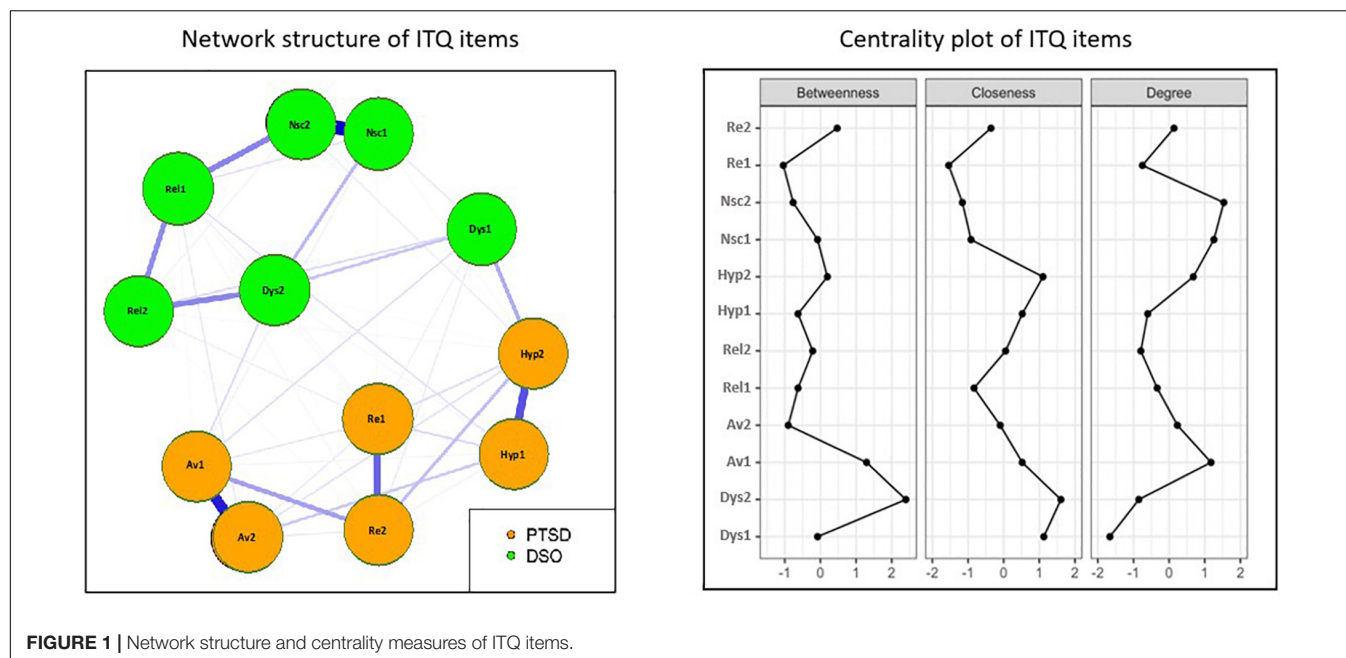


FIGURE 1 | Network structure and centrality measures of ITQ items.

TABLE 2 | Lifetime traumatic experiences, psychopathology and gender differences in the sample.

Variable		Male		Female		Total		Statistics
		N/Mean	%/sd	N/Mean	%/sd	N/Mean	%/sd	
Lifetime victimization								
1. Life-threatening illness	Unint.	10	2.00%	16	3.22%	26	2.61%	1.471
2. Someone close died in an awful manner	Unint.	91	18.20%	154	30.99%	245	24.57%	21.983***
3. Someone close had a life-threatening illness or accident	Unint.	217	43.49%	247	49.70%	464	46.59%	3.860*
4. Threatened with a weapon	Int.	37	7.39%	17	3.41%	54	5.41%	7.704**
5. Physically assaulted by a parent or guardian	Int.	37	7.41%	41	8.23%	78	7.82%	0.231
6. Physically assaulted by non-parent or guardian	Int.	84	16.80%	45	9.05%	129	12.94%	13.274***
7. Sexually assaulted by a parent or guardian	Int.	0	0%	0	0%	0	0%	–
8. Sexually assaulted by non-parent or guardian	Int.	10	2.00%	22	4.42%	32	3.21%	4.698*
9. Sexually harassed	Int.	14	2.80%	66	13.25%	80	8.02%	36.972***
10. War or combat	Int.	2	0.40%	0	0.00%	2	0.20%	1.996
11. Held captive and/or tortured	Int.	2	0.40%	1	0.20%	3	0.30%	0.330
12. Caused extreme suffering or death to another person.	Excl.	7	1.40%	3	0.60%	10	1.00%	1.608
13. Witnessed another person experiencing suffering or death	Excl.	55	11.02%	80	16.06%	135	13.54%	5.412*
14. Technological accident	Unint.	89	17.84%	58	11.67%	147	14.76%	7.524**
15. Natural disaster	Unint.	288	57.95%	309	63.06%	597	60.49%	2.699
16. Man-made disaster	Unint.	30	6.02%	19	3.89%	49	4.96%	2.391
17. Stalked	Int.	35	7.06%	50	10.06%	85	8.56%	2.861
18. Bullied (online or offline)	Int.	60	12.07%	88	17.71%	148	14.89%	6.224*
19. Humiliated, put down, or insulted by another person	Int.	142	28.63%	194	39.03%	336	33.84%	12.005***
20. Made to feel unloved, unwelcome, or worthless	Int.	162	32.60%	249	50.20%	411	41.39%	31.720***
21. Neglected, ignored, rejected, or isolated	Int.	141	28.54%	199	40.28%	340	34.41%	15.085***
Lifetime Unintentional TE		404	80.64%	421	84.54%	825	82.58%	2.640
Lifetime Intentional TE		269	53.69%	336	67.47%	605	60.56%	19.847***
Lifetime TE		444	88.62%	461	92.57%	905	90.59%	4.5657*
Prevalence								
PTSD		28	5.63%	63	12.96%	91	9.26%	15.712***
cPTSD		10	2.01%	30	6.17%	40	4.07%	10.897***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE 3 | Association between PTSD, cPTSD and traumatic experiences (multinomial logistic regression).

	PTSD^a OR [95% CI]	cPTSD^a OR [95% CI]	PTSD^b OR [95% CI]	cPTSD^b OR [95% CI]
Intentional TE				
<i>Childhood</i>	1.75* [1.10, 2.76]	2.49* [1.20, 5.15]	1.57 [0.98, 2.51]	2.63* [1.23, 5.59]
<i>Adolescence</i>	2.43*** [1.51, 3.89]	3.53*** [1.67, 7.49]	2.36*** [1.45, 3.84]	3.48** [1.61, 7.52]
<i>6 months</i>	2.25** [1.36, 3.72]	4.46*** [2.25, 8.85]	2.19** [1.31, 3.66]	4.36*** [2.15, 8.83]
Unintentional TE				
<i>Childhood</i>	1.34 [0.79, 2.28]	0.65 [0.32, 1.31]	1.19 [0.69, 2.05]	0.77 [0.36, 1.63]
<i>Adolescence</i>	0.95 [0.60, 1.51]	1.34 [0.69, 2.61]	1.01 [0.62, 1.64]	1.38 [0.68, 2.78]
<i>6 months</i>	1.06 [0.59, 1.90]	1.17 [0.53, 2.60]	1.17 [0.65, 2.12]	1.41 [0.62, 3.19]

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. TE, traumatic experiences; OR, odds ratio; CI, confidence interval. ^aUnadjusted logistic regression; ^badjusted by gender, non-Italian nationality, parental education.

associated with a relevant psychological burden sufficient for a diagnosis of PTSD.

As opposite, intentional TEs were strongly associated with both PTSD and cPTSD.

The present CFA results support a latent structure representative of six first-order correlated factors. The second best-fitting model was a two-factor second-order model. According to a recent systematic review (15), these two models are those most often identified as the best fitting ones. The correlated six first-order factor model was supported in five community sample studies (26, 34–37), in which also the two-factor second-order model showed good fit. Two more studies found that the two models had equivalent fit (25, 38). Evidence from the literature seem to converge on the six first-order factor model as the best fitting model in community samples, while the two-factor second-order model being the best model in clinical samples (15). Furthermore, prevalence rates of PTSD and cPTSD are substantially lower in community samples, which may explain why the separation between PTSD and cPTSD is not so clear-cut in these samples.

Finally, using a network analysis approach, we replicated the network structure of ICD-11 PTSD and cPTSD previously presented in other studies with the ITQ (17, 19). Given the contrasting findings on the factor structure of ICD-11 PTSD and cPTSD, the not clear-cut separation of the two disorders, and their shared risk factors, a network approach gains a central importance in clarifying the mutual relationships among stress-related symptoms. A network approach is based on the idea that mental disorders are constituted by causal networks of functionally interconnected symptoms, as opposite to a “latent variable” representing the putative disorder that generates downstream symptoms (39). The network approach to PTSD and cPTSD is particularly useful as it allows to think of the effects of causal factors (i.e., traumatic events) as spreading throughout a network of interacting and mutually influencing symptoms. In the network structure presented in this study, the pairs of symptoms forming a factor according to the ICD-11 were strongly associated each other. Core PTSD symptoms and DSO form two broader clusters, reflecting the ICD-11 proposed criteria that separates core PTSD and DSO, consistently with previous literature evidence (17). Avoidance, numbing and both

negative self-concept (Nsc) were the most central items in the network. The centrality of Nsc items in ICD-11 cPTSD and DSM-5 PTSD has been found also in other network studies (19, 40, 41). Nsc can be thought both as negative moderators of the effect of a TE, and as a cognitive maintaining factor of the disorder. Furthermore, Nsc are among the strongest negative predictors of treatment outcomes (42). Concerning core PTSD symptoms, having internal avoidance as the most central item seems counterintuitive, as avoidance is generally considered a coping mechanism to anxiety. Its central position in this network may highlight its role as a maintaining factor.

This study has several limitations. First, one third of this sample consists of late adolescents that were exposed to a natural disaster during childhood, making the generalizability of these findings limited. Second, this study relies on self-report measures that could be affected by different biases. In particular, despite a TEs screener was available, too little is known about the putative TEs subsidizing the self-report measures of post-traumatic symptoms, in terms of subjective emotional impact and relative importance of the TEs. It is difficult to imagine how to overcome these issues connected with self-report measures. However, the ITEM checklist is a useful tool to separate childhood, adolescence and recent TEs and to classify them into different types (i.e., intentional/unintentional).

CONCLUSION

The present study reports a prevalence rate Post-Traumatic Stress Disorder (PTSD) and Complex PTSD (cPTSD) of 9.11 and 4.06%, respectively, in a sample of Italian adolescents exposed 10 years earlier to a destructive earthquake. The factor and network structure of the Italian version of the International Trauma Questionnaire (ITQ) confirmed the factorial validity of the questionnaire, highlighting the importance of avoidance in PTSD and negative self-concept in cPTSD.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Internal Review Board of the University of L'Aquila. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RR: conceptualization, methodology, software, validation, formal analysis, investigation, data curation, and writing – original draft.

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Associations of Childhood Maltreatment With Suicidal Behavior Among Chinese Adolescents: Does It Differ Based on Gender and Biological Rhythm?

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Background: The impact of biological rhythm disorder (BRD) on the association of childhood maltreatment (CM) and suicidal behavior in adolescents remains unclear. CM increases the risk of suicidal ideation (SI), suicidal planning (SP), and suicidal attempts (SAs). There is less investigation on gender differences in CM's effects on suicidal behavior. It is unknown whether the impacts vary with different levels of BRD.

Aims: To identify gender differences in CM's effects on suicidal behavior and to investigate these impacts at different levels of BRD.

Method: The analysis is based on data from 7,986 adolescents recruited from three cities in China between October and December 2019. All participants, aged 14.7 ± 2 years, filled out standard questionnaires involving CM, BRD, and suicidal behavior.

Results: A total of 22.9, 10.8, and 4.7% of the adolescents reported SI/SP/SAs in the past year. Girls are more likely to engage in SI and SP when exposed to the highest level of CM; boys are more likely to engage in SAs than girls. A significant relationship between moderate levels of CM and SI/SP/SAs was only observed in girls exposed to low BRD. Moderate CM is only significantly associated with SI in boys exposed to low BRD. The percentage of low-BRD adolescents who experienced high CM was 31.4%, whereas 58% of high-BRD adolescents experienced high CM in SI. Adolescents with high BRD were more likely to experience high levels of CM in SP and SAs.

Conclusions: Adolescents at high risk of suicidal behavior in relation to CM should be targeted accordingly. Improving biological rhythm in adolescents who experience CM could help prevent them from engaging in suicidal behavior.

Keywords: childhood maltreatment, adolescents, biological rhythm, suicidal planning, suicidal ideation, suicidal attempts

INTRODUCTION

Suicidal behavior—including suicidal ideation (SI), suicidal planning (SP), and suicide attempts (SAs)—is a leading cause of death and disability worldwide and a serious global public health issue. More than 800,000 people die from suicide each year around the world, which indicates that one person dies by suicide every 40 seconds (1). Suicidal behavior is prevalent among adolescents across the globe; the prevalence of SI and SAs in American adolescents was 15.8 and 8.9%, respectively, in 2019 (2), and the rates of SI/SP/SAs among adolescents in China were 17.2, 13.6, and 7.4%, respectively (3). Suicidal behavior is associated with significant disability and psychosocial impairment among adolescents. They may seek information about suicide through prolonged exposure to the Internet and electronic media, which may lead to impaired clinical outcomes (4). Therefore, it is crucial to explore the potential risk factors for suicidal behavior. The underlying factors of suicidal behavior in adolescents are complex, and identifying risk factors for suicidal behavior will help advance effective prevention and early intervention. A substantial body of research has demonstrated the impact of childhood maltreatment (CM) on suicidal behavior. For instance, a prospective cohort study with 660 street adolescents aged 14 to 26 from Canada found that CM was a robust predictor of SA (5). A 3-year longitudinal study of adolescents aged 11.83 ± 2.42 in the US suggests that emotional maltreatment contributes uniquely to the prospective prediction of SI (6). A cross-sectional study with a representative sample of 21,019 high school students from China revealed that physical neglect, emotional neglect, physical abuse, emotional abuse, and sexual abuse were all associated with an increased risk of SI and SAs (7). A meta-analysis based on 79 individual studies found that younger participants with experiences of sexual abuse had higher rates of SAs, and younger age was linked more strongly with SI (8). Studies on multifactorial etiological models have shown that biological and social risk factors may be responsible for suicidal behavior by moderating the relationship between the latter and CM (9).

Meanwhile, we found that the reported rate of suicidal behavior among girls was higher than that of boys (10). Biological sex may be a vital factor in the examination of suicidal behavior. Evidence suggests that gender is a potential moderator that impacts the relationship between CM and suicidal behavior, and CM in girls may be more consistently linked to suicidal behavior than in boys (11, 12). However, previous studies show inconsistent results of the association between CM and suicidal behavior among boys. Martin found that self-reported sexual abuse was strongly and independently linked with suicidal thoughts, plans, and SAs only in boys (13). Other studies have found no sex differences (14). In response to these inconsistent findings, more research is necessary to verify whether the association between CM and suicidal behavior varies based on gender.

Biological rhythm disorder (BRD) is a new risk factor for suicidal behavior that is not fully understood. Research on biological rhythms and suicide dates back to 1959, when Dreyer first reported seasonal variations in suicide (15). Since then,

researchers have found that vigorous circadian rhythm type appeared independently associated with SAs in individuals with bipolar disorder (16), and evening-type participants with major depressive disorder exhibited higher suicidal behavior (17). In addition, BRD promotes suicidal behavior in adolescents. A cross-sectional study with 1,667 adolescents (mean age: 14.8 ± 1.6 years old) in Hong Kong provides evidence that circadian issues are associated with SI (18). A substantial amount of literature has found a link between BRD and suicidal behavior, and current knowledge surrounding the association of BRD with suicidal behavior is predominantly derived from specific groups of people with various diseases and in Western countries. Although there are few international studies on the association between CM and BRD at present, existing research has reported that people who experience CM have an increased risk of circadian rhythm anomalies, which may be exhibited by abnormal cortisol secretion; CM may be associated with disturbances in cortisol secretion (19, 20). Despite a well-established link between CM and suicidal behavior, it is unknown whether the role of CM in this risk occurs through diverse and specific mechanisms (such as BRD).

Therefore, we hypothesized that gender and biological rhythm influence the association between CM and suicidal behavior. Our aims were to explore the impact of gender and biological rhythm on the relationship between CM and suicidal behavior through large-scale health survey data ($n = 8,082$) from typically developing adolescents in the Chinese cities of Shenzhen, Nanchang, and Shenyang.

METHODS

Study Design and Participants

We derived the study population from a health survey. We chose three cities—Shenzhen, Nanchang, and Shenyang located in southern, central, and northern China, respectively—as our field sites for data collection based on economic development and geographic distribution. These cities are broadly representative of the well-developed economies in southern, central, and northern China, and average population in China in terms of economic level and demographic composition. These cities cooperated well with us, thereby facilitating data collection. In each city, we randomly selected 4 large middle schools, from which we recruited participants using stratified cluster sampling. First, in each school, we stratified students by grade. Thereafter, in different grades, we selected multiple classes and took all students in the classes as participants. In China, there are approximately 45 students in a class. Consequently, we chose 5 classes in each grade for the survey. Exclusion criteria included a family history of mental illness, the inability to complete the questionnaire, and unwillingness to participate in the investigation.

In total, 8,082 middle school students were given anonymous paper-based questionnaires in the classroom setting. There were 96 invalid questionnaires due to incomplete data because of adolescents' unwillingness to fill them out. The effective response rate was 98.8%. After excluding invalid questionnaires, a representative sample of 7,986 adolescents completed the standardized questionnaire, including 3,866 (48.4%) boys and

4,120 (51.6%) girls. Both the design and data collection were approved and reviewed by the Ethics Committee of Anhui Medical University. We gathered our survey data from October to December 2019, and all adolescents and their parents signed informed consent forms before the survey was administered.

Measures

Sociodemographic Data

We collected sociodemographic data on each participant, including gender (boys or girls), age, registered residence (rural or urban), only child (yes or no), paternal and maternal education (<12 years or ≥12 years), and self-reported family economic status (high-income, middle-class, or low-income). In China, less than 12 years of schooling means that a person has not graduated from high school.

Childhood Maltreatment Experiences

We assessed CM with the Child Trauma Questionnaire (CTQ-SF), which is a standardized questionnaire for evaluating the history and frequency of CM in adolescents (21, 22). The CTQ-SF comprises 28 items (e.g., “My parents wish I had never been born,” “My family has said hurtful things to me,” “I have been hit hard enough to develop bruises,” and “I have worn dirty clothes”) and covers five categories, including emotional abuse, emotional neglect, physical abuse, physical neglect, and sexual abuse, three of which are calibration marks. Participants respond using a 5-point Likert scale (never true, rarely true, sometimes true, often true, and very often true). We classified the participants into tertiles of CTQ scores to identify individuals with severe exposure. The total scores ranged from 25 to 125, based on which we divided the participants into three groups according to the 67th and 33rd percentiles: a high level of CM, a moderate level of CM, and a low level of CM. The Cronbach's α coefficient of the CTQ-SF in this study was 0.867.

Biological Rhythm Disorder

We used the Self-Rating of Biological Rhythm Disorder for Adolescents (SBRDA) (23) to assess BRD in the participants. The SBRDA comprises 29 items (e.g., “I need an alarm clock or someone else to wake me up in the morning,” “I skip breakfast one or two days a week,” and “I stay up late to use digital media”) that include four dimensions: sleep, digital media use, eating habits, and activity. Participants respond using a 5-point Likert scale (completely inconsistent, basically inconsistent, somewhat consistent, basically consistent, and completely consistent). We used the 90th percentile of total scores as the cut-off point to measure adolescents' BRD as the Chinese norm. The Cronbach's α coefficient of SBRDA in this study was 0.950.

Suicidal Behavior

The Centers for Disease Control and Prevention used three questions to evaluate SI, SP, and SAs for the framework of the Youth Risk Behavior Survey System (YRBSS) (24):

“During the past year, have you ever considered suicide?”

“Have you made any plans about how to commit suicide in the last year?”

“Did you actually attempt suicide in the last year?”

All response options are coded as “yes” or “no.”

Confounding Variables

We included multiple variables based on their potential association with suicidal behavior, including gender, registered residence (rural or urban), only child (yes or no), paternal and maternal education (<12 years or ≥12 years), self-reported family economic status (high-income, middle-class, or low-income), and city (Nanchang, Shenyang, or Shenzhen).

Statistical Analysis

We performed all statistical analyses using SPSS version 23.0 (SPSS, Chicago, IL, USA). We conducted a chi-square test for categorical variables to compare the differences among behaviors. We employed binomial logistic regression models to assess the associations of the various behaviors with CM and adjusted for confounding variables. We fitted the adjusted logistic regression to identify determinants of suicidal behavior as the level of CM by BRD group and gender. We analyzed the interaction effects between CM with BRD and gender on suicidal behavior. We set statistical significance at $p < 0.05$ (two-tailed).

RESULTS

Characteristics of the Participants

Of the 7,986 adolescents, the mean age and standard deviation were 14.7 ± 2 years. The prevalence of suicidal behavior is detailed in **Table 1**. In total, 22.9, 10.8, and 4.7% of the adolescents reported SI/SP/SAs. A total of 31.9% of the participants' registered residence was rural, and there were differences in SI and SP ($p < 0.05$). Participants who reported being only children showed a significantly higher rate of SAs ($p < 0.05$). Self-reported family economic status fell into the following groups: 12.9% were low-income, 66.2% were middle-class, and 20.9% were high-income. Compared with adolescents from high-income and middle-class families, those from low-income families had significantly more suicidal behavior ($p < 0.001$ for each, **Table 1**). Participants reported lower CM scores, a lower level of BRD, and fewer suicidal behavior (including SI, SP, and SAs) ($p < 0.001$). The rates of SI (25.7%), SP (12.4%) and SA (6.3%) among adolescents in Shenyang were significantly higher than those in the other two cities (**Table 1**). In addition, suicidal behavior revealed no statistically significant differences based on parents' education level.

Association of Suicidal Behaviors With CM

There was a gradient association of CM with suicidal behavior (**Supplementary Table S1**). Adolescents with high CM had a greater risk of SI/SP/SAs. After adjusting for gender, registered residence, self-reported family economic status, and city, the odds ratios (ORs) for adolescents with moderate CM vs. low CM in SI and SP were 1.8, 95% CIs: 1.6–2.1, $p < 0.001$ and 1.7, 95% CIs: 1.3–2.1, respectively. We noted a greater risk of SI and SP in adolescents with high CM (4.2, 95% CIs: 3.6–4.8, $p < 0.001$; 5.6, 95% CIs: 4.1–6.2, respectively) vs. low CM. After adjusting for gender, only child, self-reported family economic status, and city, compared to low CM, the ORs for adolescents with moderate and

TABLE 1 | Descriptive statistics for variables.

Variables	Total N = 7,986(%)	SI n = 1,825(%)		SP n = 859(%)		SAs n = 378(%)	
		n (%)	P Value	n (%)	P Value	n (%)	P Value
Gender			<0.001		<0.001		<0.001
Boy	3,866 (48.4)	686 (17.7)		315 (8.1)		118 (3.1)	
Girl	4,120 (51.6)	1,139 (27.6)		544 (13.2)		260 (6.3)	
Registered residence			<0.05		<0.05		0.572
Rural	2,547 (31.9)	529 (20.8)		247 (9.7)		115 (4.5)	
Urban	5,439 (68.1)	1,296 (23.8)		612 (11.3)		263 (4.8)	
City			<0.001		<0.05		<0.001
Nanchang	3,085 (38.6)	671 (21.8)		324 (10.5)		124 (4.0)	
Shenyang	2,563 (32.1)	659 (25.7)		317 (12.4)		161 (6.3)	
Shenzhen	2,338 (29.3)	495 (21.2)		218 (9.3)		93 (4.0)	
Only child			0.614		0.225		<0.05
Yes	2,769 (34.7)	642 (23.2)		314 (11.3)		156 (5.6)	
No	5,217 (65.3)	1,183 (22.7)		545 (10.4)		222 (4.3)	
Paternal education			0.095		0.535		0.832
<12 years	3,427 (42.9)	752 (21.9)		360 (10.5)		160 (4.7)	
≥ 12 years	4,559 (57.1)	1,073 (23.5)		499 (10.9)		218 (4.8)	
Maternal education			0.365		0.367		0.114
<12 years	3,891 (48.7)	872 (22.4)		406 (10.4)		169 (4.3)	
≥ 12 years	4,095 (51.3)	953 (23.3)		453 (11.1)		209 (5.1)	
Self-reported family economy			<0.001		<0.001		<0.001
Bad	1,030 (12.9)	335 (32.5)		162 (15.7)		73 (7.1)	
General	5,284 (66.2)	1,137 (21.5)		523 (9.9)		205 (3.9)	
Good	1,672 (20.9)	353 (21.1)		174 (10.4)		100 (6.0)	
CM			<0.001		<0.001		<0.001
Low	2,727 (34.1)	338 (12.4)		130 (4.8)		45 (1.7)	
Moderate	2,468 (30.9)	489 (19.8)		184 (7.5)		86 (3.5)	
High	2,791 (34.9)	998 (35.8)		545 (19.5)		247 (8.8)	
BRD			<0.001		<0.001		<0.001
Low	7,174 (89.8)	1 419 (19.8)		646 (9.0)		257 (3.6)	
High	812 (10.2)	406 (50.0)		213 (26.2)		121 (14.9)	

SI, suicidal ideation; SP, suicidal planning; SAs, suicidal attempts; CM, childhood maltreatment; BRD, biological rhythm disorder. Statistical methods: Chi-square test.

high levels of CM in SAs were 2.4 (1.6–3.4) and 6.5 (4.7–9.0), $p < 0.001$, respectively. After further adjusting for BRD, the gradient associations remained; a moderate level of CM in SI involved ORs of 1.8 (1.5–2.1), $p < 0.001$, and for high CM the ORs were 3.7 (3.2–4.3), $p < 0.001$. In SP, the ORs were 1.2 (1.3–2.0), $p < 0.001$, and for high CM, they were 4.5 (3.7–5.5), $p < 0.001$. In SAs, the ORs were 2.3 (1.6–3.3), $p < 0.001$, and 5.5 (3.9–7.6), $p < 0.001$.

Interaction Effects Between CM With BRD and Gender on Suicidal Behavior

In the models, we tested the interaction effects between CM with BRD and gender on suicidal behavior. We observed significant interaction effects (see **Supplementary Tables S2, S3**). Compared to the reference group (low CM and low BRD), the interaction term of CM and BRD had an impact on suicidal behavior ($p < 0.001$). The higher the levels of CM and BRD, the greater the risk

of suicidal behavior (see **Supplementary Table S2**). Compared to the reference group (low CM and girls), girls who experienced both moderate and high levels of CM had an increased risk of suicidal behavior. Boys with moderate CM had no significant risk of suicidal behavior compared to girls with moderate CM. Compared to girls who experienced high CM, boys who experienced high CM had a lower risk of suicidal behavior (see **Supplementary Table S3**).

Association of Suicidal Behavior With CM in Boys and Girls

We further stratified the association between CM and suicidal behavior by gender and found that the higher risk of suicidal behavior in girls was upregulated with high CM (**Table 2**). Both moderate and high levels of CM in boys increased the risk of SI, whereas only high CM increased the risk in SP and SAs (**Table 2**).

TABLE 2 | Number, % and OR of suicidal behaviors by level of CM in boys and girls.

Variable		Yes n (%)	NO n (%)	P Value	Model 1 OR (95%CI) ^a	Model 2 OR (95%CI) ^b	Model 3 OR (95%CI) ^c
SI	CM (tertile score)						
	Boys			<0.001			
	Low	113 (9.3)	1,098 (90.7)		1.0	1.0	1.0
	Moderate	171 (14.1)	1,042 (85.9)		1.6 (1.2~2.1)**	1.6 (1.2~2.0)*	1.5 (1.2~2.0)*
	High	402 (27.9)	1,040 (72.1)		3.8 (3.0~4.7)**	3.6 (2.9~4.5)**	3.3 (2.6~4.1)**
	Girls			<0.001			
	Low	225 (14.8)	1,291 (85.2)		1.0	1.0	1.0
	Moderate	318 (25.3)	937 (74.7)		1.9 (1.6~2.4)**	2.0 (1.7~2.4)**	2.0 (1.6~2.4)**
	High	596 (44.2)	753 (55.8)		4.5 (3.8~5.4)**	4.5 (3.8~5.4)**	4.0 (3.3~4.8)**
SP	CM (tertile score)						
	Boys			<0.001			
	Low	44 (3.6)	1,167 (96.4)		1.0	1.0	1.0
	Moderate	59 (4.9)	1,154 (95.1)		1.4 (0.9~2.0)	1.3 (0.9~2.0)	1.3 (0.9~1.9)
	High	212 (14.7)	1,230 (85.3)		4.6 (3.3~6.4)**	4.4 (3.1~6.1)**	4.0 (2.8~5.6)**
	Girls			<0.001			
	Low	86 (5.7)	1,430 (94.3)		1.0	1.0	1.0
	Moderate	125 (10.0)	1,130 (90.0)		1.8 (1.4~2.4)**	1.9 (1.4~2.5)**	1.8 (1.4~2.4)**
	High	333 (24.7)	1,016 (75.3)		5.5 (4.2~7.0)**	5.4 (4.2~7.0)**	4.8 (3.7~6.2)**
SAs	CM (tertile score)						
	Boys			<0.001			
	Low	12 (1.0)	1,199 (99.0)		1.0	1.0	1.0
	Moderate	21 (1.7)	1,192 (98.3)		1.8 (0.9~3.6)	1.8 (0.9~3.8)	1.7 (0.8~3.5)
	High	85 (5.9)	1,357 (94.1)		6.3 (3.4~11.5)**	6.3 (3.4~11.7)**	5.4 (2.9~10.0)**
	Girls			<0.001			
	Low	33 (2.2)	1,483 (97.8)		1.0	1.0	1.0
	Moderate	65 (5.2)	1,190 (94.8)		2.5 (1.6~3.8)**	2.6 (1.7~4.0)**	2.5 (1.7~3.9)**
	High	162 (12.0)	1,187 (88.0)		6.1 (4.2~9.0)**	6.4 (4.3~9.5)**	5.4 (3.7~8.1)**

* $p < 0.05$, ** $p < 0.001$; SI, suicidal ideation; SP, suicidal planning; SAs, suicidal attempts; In SI and SP, a for crude model; ^bAdjusted for registered residence, self-reported family economy, cities; ^cAdjusted for registered residence, self-reported family economy, cities, and BRD. In SAs, a for crude model; b Adjusted for Only child, self-reported family economy, cities, and BRD.

Association of Suicidal Behavior With CM and BRD

Supplementary Table S4 shows stratified data analysis by BRD group in a crude model. According to **Supplementary Table S4**, there was a significant association of SI/SP/SAs with high CM in the low-BRD and high-BRD groups, but the relationship between high CM and suicidal behavior appeared stronger in these adolescents than in adolescents with low CM (all $p < 0.05$). As seen in **Table 3**, the results did not change significantly after further controlling for confounding factors. In SI and SP, adjusted for registered residence, self-reported family economic status, and city, we observed a significant association of high CM with suicidal behavior in low-BRD and high-BRD adolescents. In SAs, adjusted for only child, self-reported family economic status, and city, we witnessed the same positive association in high levels of CM and SA in the low-BRD and high-BRD groups. In both the crude and adjusted models, a moderate level of CM was positively correlated with SI/SP/SAs in the

low-BRD group. In the high-BRD group, moderate CM was not associated with SI/SP/SAs. The percentage of low-BRD adolescents who experienced high CM was 31.4%, whereas 58% of high-BRD adolescents experienced high CM in SI. Adolescents with high BRD were more likely to experience high levels of CM in SP and SAs. Detailed values can also be found in **Supplementary Table S4** and **Table 3**.

DISCUSSION

We drew upon data from a large school-based survey in China to illuminate the association of suicidal behavior with CM in girls and boys and its variation with the levels of BRD. To our knowledge, this is the first study to explore the association between CM and BRD with suicidal behavior in adolescents. A key and novel contribution of this study is that it illustrates the influence of BRD on the relationship between CM and SI, SP, and SAs. Our results indicate that both moderate and high CM

TABLE 3 | Number, % and adjusted OR of suicidal behaviors by level of CM and BR.

CM (tertile score)	LBRD ^a		HBRD ^b	
	n (%)	OR (95%CI)	n (%)	OR (95%CI)
SI				
Low	280 (10.9)	1.0	58 (37.9)	1.0
Moderate	406 (17.9)	1.8 (1.5~2.1)**	83 (41.1)	1.2 (0.8~1.8)
High	733 (31.4)	3.7 (3.1~4.3)**	265 (58.0)	2.3 (1.6~3.4)**
SP				
Low	109 (4.2)	1.0	21 (13.7)	1.0
Moderate	149 (6.6)	1.6 (1.2~2.0)**	35 (17.3)	1.4 (0.8~2.5)
High	388 (16.6)	4.4 (3.5~5.5)**	157 (34.4)	3.4 (2.0~5.6)**
SAs				
Low	31 (1.2)	1.0	14 (9.2)	1.0
Moderate	70 (3.1)	2.7 (1.8~4.2)**	16 (7.9)	0.9 (0.4~2.0)
High	156 (6.7)	6.0 (4.1~9.0)**	91 (19.9)	2.7 (1.5~5.0)*

* $p < 0.05$, ** $p < 0.001$; SI, suicidal ideation; SP, suicidal planning; SAs, suicidal attempts; LBRD, low biological rhythm disorder; HBRD, high biological rhythm disorder. In SI and SP, ^aAdjusted for registered residence, self-reported family economy, cities; In SAs, ^bAdjusted for Only child, self-reported family economy, cities.

levels were associated with suicidal behavior in adolescents with low BRD, whereas only high CM was associated with suicidal behavior in adolescents with high BRD. Furthermore, adolescents with high BRD were more likely to experience high CM, and adolescents with low BRD were less likely to experience CM. According to the stratification analyses, our data clarify that both male and female adolescents with high CM may have a higher risk of suicidal behavior (SI/SP/SAs). Compared to boys, girls are generally more likely to engage in SI and SP when exposed to the highest level of CM; however, boys are more likely to engage in SAs than girls. Moreover, CM, as a critical lifetime event, had a stronger effect on SI/SP/SAs among adolescents with low BRD than among adolescents with high BRD. We only observed a significant relationship between moderate levels of CM and SI/SP/SAs in girls exposed to low BRD. Moderate CM was only significantly associated with SI in boys exposed to low BRD.

Previous research has found that individuals with high CM have a greater risk of engaging in suicidal behavior, which is consistent with our results (25, 26). Data from a total of 10,148 US adolescents revealed that those who were exposed to either physical or sexual abuse had an increased risk of reporting SI/SP/SAs (27). A cross-sectional survey in South India among 13- to 14-year-old girls found that SI was independently linked to sexual abuse and low parental emotional support (28). Emotional neglect, physical abuse, and physical neglect increased the risk of SAs among adolescents and young adults (29). Our results of vulnerability among girls, especially those with the highest CM, are similar to those in former studies. There is a stronger positive relationship between physical abuse and SI among girls (30). Young girls with more adverse childhood experiences have a higher risk of SI and SP (31). Gallo asserted that girls are vulnerable to low self-esteem due to childhood abuse (32) and are therefore prone to mental health problems that can lead to SI and SP. Our findings suggest that boys who experience CM are more likely to engage in SAs, although the ORs were similar to

those of girls, possibly because adolescent boys are more likely to engage in impulsive behavior (33). A considerable proportion of SAs are made on impulse (34).

Overall, these findings offer cogent evidence of the relationship between CM and SI/SP/SAs across BRD groups in adolescents. Our study has advanced the literature by making three unique contributions. First, with a total of 7,986 adolescents, this is a representative large sample from three regions in China that exhibits ORs for the association between CM and SI/SP/SAs. Second, this study is the first, to our knowledge, to offer evidence of the strong link between CM and suicidal behavior among boys and girls. A third important contribution is the identification of a new perspective that moderates the association between CM and suicidal behavior in adolescents. In particular, we found that adolescents with high BRD were more likely to experience high CM, and CM was associated with suicidal behavior in girls who had high BRD and low BRD. This outcome has vital implications; in that, it highlights an urgent need to improve BRD as part of suicide behavior prevention and intervention strategies among adolescents who have experienced CM.

LIMITATIONS

There are several limitations to our study. First, the study had a cross-sectional design and we could not determine the priority of CM, BR, and suicidal behavior. Follow-up studies should be carried out to strengthen the validity of causal associations. Second, we did not analyze CM by category, but instead used comprehensive indicators of CM to explore the risk of suicide in different BRD groups. It may not be possible to tell which specific types of childhood abuse have a greater effect on suicidal behavior. Meanwhile, we used self-reported data, which has certain information bias. Third, the risk factors for suicidal behavior are complex. Although we fully considered gender

and biological rhythm, more comprehensive attention should be given to psychosocial factors, such as affective temperament (35), and further studies should be conducted on the impact of the interaction between psychosocial factors and biological rhythm on suicidal behavior. Despite these limitations, the large sample size deepens our understanding of the impact of gender and biological rhythm on the relationship between CM and suicidal behavior.

CONCLUSION

As a public health problem, suicidal behavior in adolescents merits discussion. Our results highlight the need to incorporate amelioration of CM's influence and the improvement of biological rhythm into suicidal behavior prevention strategies, and in efforts to raise public awareness. These findings have implications for the multifactorial etiological model in which biological and social risk factors, such as gender and biological rhythm, can moderate the relationship between CM and suicidal behavior. Thus, both male and female adolescents with BRD should be considered in the implementation of effective intervention programs related to suicide. It is crucial that public health policy in China encompasses planned intervention programs to reduce the rate of suicidal behavior.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Anhui Medical University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

YX, HX, and BW: conceptualization and formal analysis. YX, YW, and FT: writing original draft. YX, XW, YW, ST, and FT: investigation. YX and YW: methodology. FT: supervision, funding acquisition, and writing review and editing. All authors checked interpreted results and approved the final version.

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SUPPLEMENTARY MATERIAL

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Developmental trauma: Conceptual framework, associated risks and comorbidities, and evaluation and treatment

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Children exposed to adverse childhood experiences (ACEs) and pervasive interpersonal traumas may go on to develop PTSD and, in most cases, will further undergo a significant shift in their developmental trajectory. This paper examines contemporary research on Developmental Trauma (DT), which is inextricably linked to disruptions in social cognition, physiological and behavioral regulation, and parent-child attachments. Developmental trauma associated with early experiences of abuse or neglect leads to multi-faceted and longstanding consequences and underscores critical periods of development, complex stress-mediated adaptations, and multilevel, trans-theoretical influences in the diagnostic formulation and treatment of traumatized children, adolescents, and adults. Psychological and medical correlates of Developmental Trauma Disorder are considered, and directions for future research are discussed.

KEYWORDS

developmental trauma disorder, complex trauma, adverse childhood experiences, PTSD, Bronfenbrenner's

There has been much interest in understanding the prevalence and impact of adverse childhood experiences (ACEs), which refer to potentially traumatic events that occur in childhood and adolescence (e.g., abuse, rejection, and abandonment by caregivers; loss of a caregiver; interpersonal violence exposure). Recent developments suggest that multiple, repeated experiences of ACEs and interpersonal traumas have broad, cumulative, and lasting effects [e.g., (1, 2)]. Children are more likely than adults to lack the cognitive and behavioral capacities to understand and respond to traumatic circumstances effectively. Children affected by interpersonal trauma often experience more global and profound changes than adults who conceivably have more developed adaptations to stress and more cognitive resources to mitigate risks and promote resiliency. The current article provides discussion of how early, repeated interpersonal traumas can interrupt the development of secure attachment and precipitate the emergence of chronic and severe traumatic adaptations, followed by an analysis of contemporary research, conceptual and diagnostic issues, and assessment and treatment. The paper concludes with a discussion about future directions for research and practice.

Trauma and PTSD

Children and adults who have experienced trauma and developed measurable mental health symptoms associated with the trauma may present with indications of posttraumatic stress disorder (PTSD) that warrant careful diagnostic evaluation. PTSD is a psychiatric disorder brought on by exposure to a highly stressful and potentially life-threatening event such as a natural disaster, motor vehicle accident, witnessing family or community violence, experiencing abuse and neglect, or losing a loved one. The symptoms of PTSD, as defined by the fifth version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, are characterized by persistent and intrusive thoughts, hyperarousal (i.e., heightened startle in response to unexpected sounds or movements), deliberate avoidance of trauma reminders, and alterations to conscious awareness (i.e., dissociation, derealization, and depersonalization). Persistent trauma symptoms (i.e., that last longer than a month after the traumatic event(s) and are accompanied by social, behavioral, and academic impairments) indicate the presence of PTSD and differentiate it from other psychiatric disturbances [e.g., (3)]. Healthcare providers widely use the DSM-5 to determine whether a person's symptoms are severe enough to warrant a diagnosis of PTSD.

However, individuals exposed to ACEs, pervasive interpersonal traumas, and polyvictimization [multiple, repeated ACEs; (4–8)] may not only go on to develop PTSD, but may also undergo significant shifts in their developmental trajectories. The changes are often widespread, adversely affecting their biological, social, cognitive, emotional, and spiritual/existential development (1, 9–11). Moreover, these experiences tend to threaten core beliefs and assumptions, including their self-esteem as well as their sense of lovability, vulnerability, and faith in family, friendships, and a higher power. Trauma survivors often face lifelong challenges in developing and maintaining trusting relationships; building and utilizing healthy coping strategies; and adjusting to school and, eventually, the workplace (12–14). For example, ACEs positively predict PTSD, recurrent depression, and repeated suicide attempts (15–17), and findings from several meta-analyses consistently link ACEs to enduring and debilitating psychiatric and physical health disorders (1, 18). It has been suggested that individuals who have experienced ACEs often view the world as unfair and to blame for their circumstances, resulting in reoccurring helplessness and hopelessness about life and relationships, including their ability to make a positive and meaningful impact. Indeed, retrospective studies with adults reveal that 50–60% of adults have a history of childhood abuse or neglect that has impacted their emotional development, their core assumptions about themselves and their worlds, and their functioning as adults (19, 20).

Children and PTSD

Research suggests that children and adolescents who experienced significant early interpersonal trauma often receive inaccurate or incomplete diagnoses later in life [thereby leading to various treatments for co-occurring psychiatric disorders that may not be effective; (21, 22)]. Scholars spanning a broad range of scientific disciplines have asserted that this is due to significant limitations in the DSM's PTSD classification system (23–28). Repeatedly traumatized children and adolescents share overlapping symptoms of PTSD; however, experiences of prolonged trauma during sensitive periods of development are more detrimental to children, given their age, limited cognitive capacities, and dependency on caregivers. A new conceptualization of trauma—specifically the construct of complex trauma—was developed for repeatedly traumatized children and adolescents who often have high comorbidities between trauma and other disorders, which are underestimated by PTSD diagnostic criteria (29–31).

From this perspective, the diagnosis of PTSD only accounts for a limited portion of the symptoms experienced by individuals who have experienced childhood trauma. These individuals often demonstrate broader and more severe health problems, social and economic adversity (including poverty and homelessness, psychiatric hospitalization, incarceration), and medical and psychiatric comorbidities as well as persistent negative views of themselves, others, and their life circumstances (32–34). In addition, they may re-enact their traumas through defensive (protective) expressions of anger and aggression (because they fear emotional vulnerability and experiencing additional traumas) and by coping with alcohol, drugs, and self-inflicted injuries to numb their emotional pain and suffering (35).

The differing presentations of trauma-related disorders that span a wide range of medical and psychological comorbidities frequently go unnoticed with classical PTSD diagnostic approaches, and, therefore, are often underreported and, in turn, untreated (36). Individuals who have experienced prolonged, repeated interpersonal traumas often present with overlapping symptoms of PTSD and a multiplicity of mental health conditions such as attention deficit hyperactive disorder (ADHD, including late-onset in adulthood), autism spectrum disorders (ASD, including social-communication disturbances), psychosis, and mood and personality disorders (37–42).

Complex post-traumatic stress disorder

The conceptualization of complex trauma emphasizes prolonged and unavoidable circumstances, regardless of one's age. Compared to those with PTSD, patients with complex PTSD (c-PTSD) consistently report cumulative traumas, including interpersonal violence exposure and sexual abuse (30, 43–50).

c-PTSD has been studied extensively in diverse samples, including racial and sexual minorities as well as human trafficking victims who have experienced repeated physical and sexual assault (51–54). Nevertheless, more studies of children with c-PTSD are needed [i.e., (55)].

Adolescents and adults who have experienced trauma and developed measurable mental health symptoms, as a result, may present with indications of c-PTSD that warrant careful diagnostic evaluation. As defined by ICD-11 criteria, the symptoms of c-PTSD are characterized by three PTSD symptom clusters: (1) persistent and intrusive thoughts, (2) hyperarousal (i.e., heightened startle in response to unexpected sounds or movements), and (3) deliberate avoidance of trauma reminders. c-PTSD is differentiated by a second higher-order measurement factor, characterized by disturbances in self-organization (DSO), which encompasses affective dysregulation, negative self-concept, and pervasive disturbances in relationships (56–58).

DSO is also highly prevalent in patients with borderline personality disorder [BPD; (59)]. More specifically, c-PTSD and BPD have overlapping symptoms of anxiety sensitivity, low psychological distress tolerance, dissociation, and relational problems originating from attachment insecurities and, in clinical contexts, parataxic distortions whereby patients re-enact interpersonal behaviors with healthcare providers that mirror past relationships (60–63). However, empirical findings suggest that BPD only accounts for a limited portion of the symptoms reported by individuals who have experienced childhood trauma and that characteristics of c-PTSD and BPD correlate with, and are distinct from, several other psychiatric disorders such as unipolar and bipolar depression, substance abuse, and functional neurological disorders [e.g., (59, 64–68)].

Developmental trauma: An overview

Developmental Trauma (DT) refers to the complex and pervasive exposure to life-threatening events that (1) occurs through sensitive periods of infant and child development, (2) disrupts interpersonal attachments, (3) compromises an individual's safety and security operations, (4) alters foundational capacities for cognitive, behavioral, and emotional control, and (5) often contributes to the development of complex PTSD in adulthood (69–74). DTD emerges from prolonged and cumulative interpersonal trauma that disrupts the development of secure attachments to caregivers and dramatically alters core assumptions and beliefs about one's vulnerability to danger in the world. DTD is theorized to develop from early interpersonal trauma. However, DTD may also result from the lack of a secure attachment relationship, which would have protected the developing individual during early trauma events. For example, a child who, within the context of a securely attached relationship with their caregiver, is exposed to abuse is likely to fare more positively than one

who is exposed to the same abuse, yet lacks a secure attachment. The diagnosis of DTD was proposed for inclusion in the DSM-5 as an alternative to PTSD to better address the timing in which traumatic events occur (e.g., during sensitive periods of brain development) and the impacts on children's self-regulation skills and relational capacities (75). DTD attempts to provide this differentiation by underscoring experiences of pervasive, complex traumas that occurred early in life for children, and for adults whose physical, psychological, social and emotional disturbances originated from these experiences, which may be repeatedly interfering with their relationships, quality of life, self-identity, and life satisfaction.

DT has been postulated to result in symptoms that extend beyond those of PTSD and that often occur when traumatized children and adolescents are exposed to developmental trauma(s). These symptoms may complicate or, in some cases, account for the mental health problems that lead to the diagnosis of several childhood/adolescent psychiatric disorders. This has been confirmed in a number of large-scale field trials, cross-sectional and longitudinal investigations, and comparative studies spanning diverse psychiatric groups (24, 31, 76, 77). It has been suggested that DTD is set apart from PTSD in that the former is precipitated by toxic stress, referring to prolonged activation of the stress response system, particularly the hypothalamic-pituitary-adrenal (HPA) axis, in the absence of treatments and supportive peers and adults (78, 79). In addition, attachment disturbances associated with DTD originate at the *beginning* of an individual's lifespan development (e.g., parental neglect and abandonment, parents addicted to alcohol and drugs, separation from caregivers. By comparison, the causal events that lead to PTSD can occur at any point (or points) in one's life cycle.

Investigations of individuals with DTD suggest that developmental trauma is often characterized by (1) poor self-identity development, (2) interpersonal sensitivity and consistent problems in relationships, including with peers, adults, and primary caregivers, (3) high rates of exposure to family and community violence, (4) high rates of psychiatric comorbidities, and (5) chronic and debilitating medical/neurological illnesses (24, 28, 34, 36, 80–82). Indeed, several studies have confirmed high comorbidities between PTSD and other disorders including depression, anxiety and panic/agoraphobia, psychotic disorders, and functional medical syndromes that might warrant differentiated assessment procedures and treatments (83–85). Studies of children living in pervasively abusive and neglectful circumstances indicate that children with characteristics of DTD commonly (often exclusively) rely on behavioral inhibition and cognitive dissociation; these responses are mediated by conditioned fear and physiological hypoarousal [i.e., the freezing adaptation of the stress response system; (86)].

Numerous studies suggest that individuals with complex traumas and DTD tend to cope with their traumas by

deliberately evading reminders of the original trauma and by denying that such events occurred, including on self-report trauma symptom measures (87, 88), thereby conferring additive risks (i.e., dissociation and traumatic amnesia, undermining mental health needs). These traumatic stress adaptations, in turn, can contribute to experiences of emotional numbing and low frustration tolerance and precipitate behavioral outbursts that result in refractory (treatment-resistant) mood disturbances, long-term psychiatric hospitalizations (and re-hospitalizations), removal from school, and placement in foster care and juvenile justice treatment centers (89–93).

The DSM-5 indicates that the sequelae of “prolonged, repeated, and severe traumatic events (e.g., child abuse)” include symptoms that are consistent with DTD: “difficulties in regulating emotions or maintaining stable interpersonal relationships, or dissociative symptoms” (p. 276). However, there is vigorous debate regarding the viability of this alternative designation, given that the criteria for other specified trauma and stress-related disorders are broad, lack specificity, include interpersonal and non-interpersonal antecedents, and require that providers first consider alternative-mainstream taxonomies. For example, DTD must be differentiated from PTSD, reactive and disinhibited attachment disturbances, and borderline personality disorder, the latter of which is marked by pervasive mood instability, impaired self-identity, dissociation, and provocative and confrontational interpersonal behaviors [often at extremes of the idealization and devaluation continuum; (60, 66, 68, 94)]. As such, several different approaches are used to diagnose persons who have experienced early, recurring stressors and are displaying indications of developmental trauma disorder.

Developmental trauma: Diagnostic issues

Researchers have developed objective procedures to diagnose children with indications of DTD (e.g., standardized interviews and psychometric instruments specifically designed to assess for trauma-mediated interpersonal and attachment disturbances). The Developmental Trauma Disorder - Semi-structured Interview (DTD-SI) is one such tool. DTD expert consensus guidelines and psychometric studies on the validity and reliability of the DTD criteria and the DTD-SI suggest that three factors differentiate DTD from other psychiatric disorders, including PTSD (24, 28, 34, 95, 96). These factors include emotion and physiological dysregulation (e.g., alexithymia, sensitivity to touch, functional neurological disorders), cognitive processing and behavioral problems (e.g., traumatic re-enactments, self-mutilation, dissociation, impaired attention, learning, memory), and poor self-other awareness (characterized by low self-esteem and self-hatred, insecure

attachment, experiences of interpersonal betrayal and persistent states of anger, resentment, and revenge).

PTSD preschool adaptation

Another approach to diagnosing children with trauma, especially for those who fail to meet the criteria for PTSD, is to revise the requirements of the DSM so that it is more developmentally sensitive to children. The American Psychiatric Association conferred a preschool subtype PTSD diagnosis for children between the ages of 0–6, as an alternative to the standard PTSD classification that originated from work with adults (3). The alternative set of criteria used for the preschool subtype PTSD includes several changes to the standard DSM PTSD criteria, ranging from adjustments to clinical thresholds (e.g., lowered from three to one avoidance symptom) to the removal of items deemed inappropriate for children (e.g., expression of immediate distress following the trauma; nightmares that necessarily include traumatic content; a sense of a foreshortened future, which requires complex cognitive skills). DSM-5 criteria for the preschool PTSD subtype require that the “duration of the disturbance [referring to trauma symptoms] is more than 1 month” (3, p. 273). The DSM preschool subtype is also more developmentally sensitive to children in that it emphasizes symptoms of trauma that are unique to younger individuals (e.g., traumatic reenactments in interactions with peers during playtime) and focuses more on trauma that is particularly relevant for children, such as harm to the wellbeing of caregivers or disruptions to the quality of the parent-child relationship (e.g., having a caregiver who is medically ill and unable to care for the child, foster care placement, loss of a primary caregiver). These revised criteria were designed with both assessment and treatment in mind, underscoring the recognition that symptoms of PTSD may naturally present themselves in children’s play behaviors and not necessarily in their verbal responses to the myriad of questions posed by assessors in standard clinical interviews. This revised DSM-5 taxonomy conceptualizes children with trauma as a single (or homogenous) group. In other words, it implies that children with trauma differ from adults with trauma and, at the same time, that they reliably differ from children who have not experienced trauma (or do not present with clinical symptoms as a result of trauma). Studies suggest that providers can identify and treat traumatized children more effectively using this revised classification (97–99).

The development of DTD: Bronfenbrenner’s multiple levels of analysis framework

As a multifactorial neurobehavioral disturbance, developmental trauma causes significant alterations to children’s

cognitive, emotional, physiological, and relational capacities, and as a result, they experience widespread disruptions to their academic, social, and occupational functioning (100–102). At the same time, mental health disturbances linked to the development of trauma are mediated and/or moderated by a broad range of factors, all of which have the potential to mitigate the longitudinal course of developmental trauma, associated psychiatric comorbidities, and functional impairments. This notion is supported by Bronfenbrenner's Socio-Ecological Model [SEM; (103)], which asserts that multiple levels of influence, specifically individual, interpersonal, organizational, community, and public policies, are needed to understand the diverse range of adaptations associated with interpersonal trauma, in that they can confer additive risks or, conversely, potentiate positive and resilient transformations in response to adverse childhood experiences.

The physiological, attachment, and meta-cognitive disturbances seen in traumatized children intersect at multiple levels of Bronfenbrenner's model. More specifically, children and adolescents who have experienced severe trauma and ACEs experience high rates of poverty, legal problems, and violence exposure (89, 104–106). Abusive parents often have experienced their own traumas and attachment disturbances (107–109), which are often compounded by high rates of substance abuse, depression, financial stress, and unemployment (12, 110–113). Racial, ethnic, sexual, and neurodiverse minorities are affected by developmental trauma at very high rates (114, 115), suggesting that systemic factors such as state and national policies, allocation of resources for prevention and intervention, discrimination, and stigma exert influence over, and significantly impact responses to, trauma and recovery.

Children with trauma live in persistent states of fear and terror, and recurring traumas become transformative developmental experiences that alter their global appraisals and future responses to stress (14, 49, 61, 116). This heightened fear propensity disrupts self-awareness, information processing, interpersonal communication, and mastery of age-appropriate developmental competencies [e.g., establishing healthy relationship parameters, identifying and expressing feelings appropriately, and tolerating ambiguity; (43, 90)] and causes individuals to have problems learning, making friends at school, and appreciating their strengths and unique abilities, which are often overshadowed by their social and behavioral difficulties.

Researchers have described several adverse physiological alterations underlying cognitive disturbances in children who have experienced early traumas (13, 117–124). These include, for example, stress-mediated changes to the organization and functioning of the amygdala, hippocampus, and prefrontal cortex, which exert influence over fear processing, including automatic (impulsive) behavioral responses to perceived threats (125–130), learning and memory [fear memories override attention, concentration, and, in turn, inhibit

learning of new information; (72, 131, 132)], and higher-order (complex) cognitive operations [e.g., problem-solving and learning from experience, stress appraisal and reappraisal, perceived controllability; (133–135)]. As an illustration of this, reinforcement and contingency learning studies indicate that children who had experienced severe adversity or developmental trauma are not able to adjust their behavior effectively to shifting environments or demands, regardless of threatening and non-threatening circumstances (136, 137). These findings suggest that individuals who have endured significant stress in their lives, especially during early childhood or adolescence, are at increased risk of experiencing avoidance, anger, frustration, and anxiety as primary ways of being in the world, regardless of their circumstances (138–140). These types of responses can be damaging to an individual's development and ability to function, particularly if their safety needs are undermined. Repeatedly traumatized children and adolescents become habituated to evaluating their surroundings for indications of threat that might render them vulnerable to additional traumas, given that they had limited opportunities to recover from the early and repeated abuse and neglect.

Researchers speculate that the mechanisms involved in the development of traumatic stress adaptations correlate with diverse, interrelated psychiatric symptoms and comorbidities often reported in studies of individuals who have experienced repeated abuse and neglect. This notion is consistent with a socio-ecological framework, the developmental trauma diagnosis, and trans-theoretical models that focus on far-reaching (cross-diagnostic) effects from critical and sensitive periods, attachment and social cognition (e.g., mentalizing and perspective taking), sleep, physiological stress, systemic inflammation, and mood and personality (141–143).

The role of attachment

Prolonged and cumulative interpersonal trauma disrupts the development of secure attachments to caregivers. According to attachment theorists, securely attached infants seek proximity to their caregivers to minimize anxiety and to form goal-directed partnerships, and/or interactional synchrony, where they mirror each other's communication patterns and learn to anticipate, express, and meet each other's needs. Through these interactions, children develop internal working models, which encompass individuals' core beliefs about their self-worth and lovability as well as their general expectations of others in relationships (144). Insecure attachment styles (e.g., anxious, avoidant, and disorganized) are frequently associated with interpersonal trauma (145–147). Studies have consistently linked attachment disturbances to the emergence (and maintenance) of developmental trauma symptoms, which may remain latent until interpersonal interactions later in life (e.g., peer conflicts, inadequate institutional responses to

trauma, workplace challenges) give rise to memories of early trauma (148). The combination of repeated childhood trauma and the absence of parental nurturing, support, and protection (e.g., parents who are addicted to alcohol and/or drugs, are homeless, or are living in severe poverty; family violence; parental incarceration) can be particularly devastating and can potentiate DT (34, 145, 149, 150).

Social cognition

Cognitive science researchers have expanded upon attachment concepts to include the construct of mentalizing, which is defined as the capacity to consider the mental states of others (e.g., inferring their needs, goals, interests, and intersubjective experiences) as distinct from one's own. Mentalizing has been described in the literature as reflective functioning, theory of mind, metacognition, insight, and perspective-taking (151). Mentalizing deficits have been reported in several clinical populations, including individuals diagnosed with borderline personality disorder, schizophrenia, autism, and more recently, developmental traumas (152–155).

Children and adolescents with DT demonstrate impaired mentalizing (i.e., reflecting functioning), referring to the capacity to effectively understand oneself (needs, strengths, and limitations) and others (e.g., that others may have worldviews that differ from one's own). Early interpersonal trauma and insecure attachment correlate with low reflective functioning (154, 156–158).

Scholars have surmised that these children are likely dissociating (and therefore undermining their intra/interpersonal awareness), fearful and anxious, and preoccupied with maintaining compulsive and highly ritualistic behaviors (41, 159). For example, in response to sexual trauma, victims often report experiencing contamination anxiety such as body shame and disgust and overwhelming fear, that being near others will result in contact contamination (160–162). These individuals, in turn, engage in social avoidance, excessive cleansing, handwashing, and relentless reassurance-seeking to make sure they don't increase the likelihood of illness or misfortune in others.

Executive functions and self-regulation capacities

Executive functions refer to diverse cognitive abilities including working memory, mental flexibility, and information processing that regulate attention, mood, and behavior; enable adaptive, goal-focused actions; and are instrumental to effective coping, problem solving, and success in school, work, and relationships (163). Traumatic stress is known to cause measurable adverse effects on executive functions

(121, 134, 164). For example, recent studies, including several meta-analyses, have found that trauma negatively correlates with working memory, inhibition, and mental flexibility; the adverse effects are often higher for children exposed to multiple traumas compared to those reporting isolated events (93, 165, 166). These executive functioning challenges often result in significant shifts in mood and energy that interfere with concentration, decision-making, and social-interpersonal functioning. Children and adolescents with symptoms consistent with DTD whose symptoms include reckless, disinhibited, and destructive behaviors are likely to have multiple and intersecting psychiatric disturbances, such as conduct disorder and antisocial personality traits, which are known to predict high incarceration rates and recidivism. In turn, these children may grow up feeling stigmatized, unprotected, and personally flawed, which further perpetuates their depression, anger, low self-esteem, and existential despair as well as their increased risk of learning disorders, vocational problems, and criminal records (12, 13, 167, 168).

Clinical assessment

Patients with DT present with signs of mood disturbances (e.g., poor frustration tolerance, emotional numbing, anger, rage), behavior disturbances (e.g., inflexible routines, self-injurious behaviors, impulsivity), and cognitive disturbances (e.g., inattention, disorganized thinking, poor problem solving), as well as sensory processing problems such as sensitivity to sound and touch as well as limited time and body awareness (169, 170). They often show signs of a heightened startle reflex, dissociation, fear, and anxiety and are often unable to be soothed by others (171–173). For example, studies of children who have experienced trauma and polyvictimization suggest that these children display greater physiological reactivity to threats such as traumatic reminders than children who have not experienced trauma (174–177).

Clinical signs and symptoms of DTD

Children and adolescents with DTD may react with either over-modulated or under-modulated behaviors. Over-modulated children appear hyperactive and aggressive, whereas under-modulated children appear depressed, withdrawn, and possibly dissociative. Children and adolescents with DTD may be highly reactive to their environment (e.g., hypersensitive to sounds, touch, lights) or appear to be relatively indifferent to their immediate surroundings (80, 178). They may react to perceived threats with avoidance, tantrums, or anger, especially when they feel emotionally vulnerable or disempowered.

When children or adolescents with symptoms consistent with DTD appear distractible, impulsive, and/or highly

aggressive, these children are likely to be classified with ADHD (hyperactive and impulsive or combined subtype), conduct disorder, bipolar disorder, and/or oppositional defiant disorder (179–182). These individuals may indeed meet diagnostic criteria for several of these psychiatric disorders, however, they may be secondary to DTD, and, as such, require different clinical evaluation and treatment approaches.

On the other hand, individuals with DTD who are anxious, withdrawn, dissociative, and rigid (adhering to strict behavioral routines) are more likely to be diagnosed (and sometimes misdiagnosed) with neurodevelopmental conditions such as autism spectrum disorders (ASD) because trauma symptoms such as emotional numbing, difficulty socializing with others, obsessive-compulsive behaviors, poor mentalizing (perspective taking), and poor verbal expression mirror characteristics of children with ASD (39, 41). Likewise, studies suggest that, when controlling for comorbid PTSD, individuals with DTD have higher rates of ADHD, social and separation anxiety disorders, panic disorders, severe mood and behavior disturbances, depression, and suicide (28, 183).

Children and adolescents with indications of DTD, such as those with multiple ACEs (i.e., polyvictimization), are more likely to display suicidal behaviors and make suicide attempts than individuals without early interpersonal traumas (16). Likewise, these children may have higher rates of school absenteeism and learning disorders due to DTD (184, 185). Children with DTD are affected across cognitive (e.g., learning, attention, and information processing), physiological (e.g., fight-or-flight, susceptibility to infections including from common colds and flu), emotional (e.g., depression and suicide, anger), and behavioral domains that span the continuum of internalizing and externalizing disturbances. Behavioral displays (or traumatic reenactments) that signal fear, emotional dysregulation, and vulnerability interfere with children's academic achievement, self-efficacy, and classroom behaviors.

When individuals with DTD move into young adulthood, they may struggle to manage independently and experience difficulty adjusting to new settings. If they attend college or university, they may find it hard to self-regulate and map out the steps needed to complete assignments and tasks successfully. They may question the value of education, learning, or effort, given persistent feelings of sadness, hopelessness, and existential despair. Some may drop out of school, experience inconsistent employment, or hold employment positions that are not satisfying (167, 186), likely because their vocational identity development was interrupted by chronic depression and anxiety (16, 187, 188) resulting from reoccurring abuse and neglect. Their lack of confidence and low self-esteem, along with high rates of addiction (189–191), can also lead to further increased anxiety, anger and hostility, and job instability (192, 193). They may feel worried about re-traumatization or being stigmatized because of their challenges. As a result, some will choose not to disclose personal

information to others who might help them, believing that the vulnerability could put them at a disadvantage for recruitment or advancement.

Clinicians and care supporters working with individuals who have experienced significant childhood trauma should be aware that DTD symptoms differ depending on the specific traumas experienced, the characteristics of the individuals involved, and the level of discordance between the individuals and their environments. Symptoms will also vary depending on each individual's degree of environmental support, perceived controllability of the stressful events, access to socioeconomic resources, and effective evaluations and treatments (194). Medical problems and somatic complaints may actually be the result of childhood trauma and a sign of DTD. In fact, a number of chronic, non-specific, or unexplained medical illnesses are associated with DTD (13, 56). In addition, lowered immunity, cardiac symptoms, and neurological disorders such as migraines and chronic fatigue are also signs to look for in patients who could potentially have DTD (195).

Clinicians working with early trauma survivors should also consider relational patterns corresponding to substantive behavioral changes, particularly personality disturbances. Individuals exposed to severe abuse, neglect, and violence may go on to develop long-lasting negative schemas about themselves and the world, including deep feelings of inferiority, fear, self-hatred, and distrust, all of which can give rise to maladaptive personality styles and, in some cases, clinically significant characterological disturbances (196). As adults, individuals with DTD may develop a broad range of personality and emotional disorders (60, 68, 197), which are associated with high rates of emergency room visits and inpatient hospitalizations (17, 198).

Treatment

Empirically validated treatments for children and adolescents with DTD are limited in scope. However, there is growing evidence for integrative treatment approaches and relationally focused interventions as effective treatments for DTD [e.g., (4, 199)]. Two such approaches include the Attachment, Regulation, and Competency (ARC) model and dyadic-developmental psychotherapy, which include individual and family counseling sessions designed to enhance interpersonal communication, attachment security, and emotion regulation, and co-regulation between the parent and child; (200, 201).

Concerning adolescents and adults with trauma, findings from recent systematic investigations and meta-analyses (202–204) suggest that a combination of psychotherapy (e.g., Trauma-Focused Cognitive Behavior Therapy) and antidepressant medication (205) are beneficial. However, more studies are needed as treatment effects were heterogeneous. Likewise, more studies are required to establish the long-term efficacy

and risk-to-benefit tradeoff for the use of antipsychotic agents (risperidone, quetiapine), especially for children and adolescents, as well as anticonvulsant drugs (206), which are limited in use due to their side effects.

Conclusions and future directions

While developmental trauma is commonly linked to PTSD, the DTD diagnosis captures a more chronic and pervasive form of trauma represented by a constellation of complex and interacting cognitive, emotional, and behavioral symptoms beyond that of PTSD alone. Several studies suggest that children, adolescents, and adults with DTD display a broad range of mental health symptom profiles [e.g., (30, 31, 178, 207, 208)]. These individuals demonstrate significant problems in many areas of their lives, but without accurate assessment, advocacy, and treatment, they may live in mental anguish, vacillating between self-injury, suicidal and antisocial behaviors, and a significant inability to cope with reality and enhance their strengths and resiliencies. The DTD diagnosis offers clinicians the opportunity to more comprehensively account for the multitude of what might otherwise be viewed as divergent symptoms and discrete mental health disorders.

The DTD diagnosis offers an all-encompassing conceptualization, within a single diagnostic, developmental syndrome, of the many different symptoms that may be experienced as a result of early trauma. The diagnosis may help limit the over-pathologizing of these individuals (i.e., they would receive a single diagnosis to capture their broad array of symptoms as opposed to three or more disparate diagnoses). More importantly, utilization of the DTD framework may increase the likelihood of more accurate assessment; appropriate symptom management; well-aligned, effective treatments; and better short- and long-term outcomes. Recognition of complex trauma may provide insights that could enhance the evaluation, treatment, and prognosis for these individuals and, at the same time, build or enhance their strengths (which are likely to be undermined if a positive psychology framework does not balance a traditional, deficit-driven approach). Application of the DTD diagnosis may help decrease inappropriate and inadequate treatment approaches by using multi-system and multidisciplinary approaches when working with individuals who have suffered repeated and severe early abuse.

Consistent with Bronfenbrenner's theoretical model, an appreciation of the pervasiveness and range of opportunities to reverse the adverse effects of DTD would allow for additional, coordinated efforts among educational, legal, medical, and political leaders and stakeholders. This type of understanding will be required for substantive change to occur for individuals diagnosed with this disorder. At the organizational level, systems must promote formal policies that acknowledge, respect, and de-stigmatize DTD. According to the Substance Abuse

and Mental Health Services Administration's Trauma-Informed Approach, this can be accomplished by engendering principles of neurodiversity, implementing social justice frameworks, and acknowledging the multiplicity of trauma associated with various minority statuses (209). Recommended system-wide policies and procedures include enhanced and coordinated evaluation protocols, formal response training, long-term care initiatives, and community engagement aimed at recognizing, supporting, and treating those with DTD (210–212).

In sum, research studies have established that developmental trauma confers significant risks to the health and wellbeing of those who have experienced early, repeated interpersonal traumas. Disturbances in attachment, emotion regulation, self-perception, and worldview assumptions are precipitated by trauma and cause a broad range of correlated psychological and medical disorders. Future studies are needed to reconcile several outstanding questions related to ACEs. For example, psychometric investigations of individuals who have experienced ACEs raise the possibility that additional typologies may be present [e.g., borderline personality and resilient subgroupings; (66, 213)]. Another avenue for research concerns the possibility that complex trauma is correlated with multiple sensitive periods, particularly for individuals who have been subjected to prolonged violence exposure. Lastly, although ACEs have been widely studied and consistently predict traumatic responses in adults, the construct encompasses a broad range of adversities, such as parent divorce, sexual assault, and neglect, which may confer different traumatic adaptations.

Author contributions

DC was responsible for the conceptualization, organization, and final draft of the manuscript. All authors contributed to the literature review, writing of the manuscript, project management, and approved the final manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Adverse childhood experiences and behavioral problems in early adolescence: An empirical study of chinese children

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The aim of the present study was to examine the relationships between ACEs and behavioral problems of children in their early adolescence in Chinese society. Results from bivariate analyses of 2,910 Chinese children in early adolescence indicated that children begin to exhibit behavioral problems being related to the exposure of adverse childhood experiences (ACEs). Compared to those with 0 ACEs, children with 4 or more ACEs were 4.45 times ($p < 0.001$), 4.44 times ($p < 0.001$), 7.80 times ($p < 0.001$), 4.49 times ($p < 0.001$), and 6.63 times ($p < 0.001$) more likely to demonstrate hyperactivity, peer communication problems, pro-social problems, emotional problems and conduct problems, respectively. Rural children, children of mothers with low education, and boys were particularly likely to have been exposed to multiple categories of ACE. This study evidenced that there was a strong association between exposure to ACEs and behavioral problems in early adolescence in China.

KEYWORDS

adverse childhood experiences, children, behavioral problems, experience study, Chinese children

Introduction

Adverse Childhood Experiences (ACEs) are potentially traumatic events that occur in childhood, such as experiencing violence, abuse, or neglect, witnessing violence at home and having a family member attempt to commit suicide (1). They also include aspects of a child's environment that can undermine their sense of safety, stability, and bonding, such as growing up in a household with substance abuse, mental health problems, or instability owing to parental separation, or the incarceration of a parent, sibling, or other member of a household (1). The current large-scale study on the relationship between ACEs and adult health was initiated based on the collaboration between the US Centers for Disease Control and Prevention and the Kaiser Permanente Health Assessment Clinic in San Diego. According to the Center's original ACE questionnaire, 7 types of ACEs: 3 types of child abuse (psychological, physical, and sexual) and 4 types of family dysfunction (violent treatment of mother, living without family members, drug abuse, mental health patients or suicide, or imprisonment) were assessed. Subsequent ACE studies incorporated neglect and parental divorce or

separation into the ACE index (2). A large number of studies have examined the relationship between ACEs and the risks of adult health issues. ACEs (such as child abuse and family dysfunction) that affect adult health problems (such as liver disease and depression) have been tested widely (3, 4). Numerous investigators have reported the link between ACE exposure and social and health problems, including cigarette smoking (5), autoimmune disease (6), depressive disorders (7), and use of psychotropic medications (8). Despite this growing body of literature, the proximal effects of ACEs on behavioral outcomes of early adolescence have been underestimated. The current study prospectively examine the relationships between ACEs and behavioral problems of nearly 3,000 children in their early adolescence in Chinese society.

ACEs and child behavior research

There is a significant positive correlation between childhood psychological abuse and adolescent aggressive behavior (9). The experience of child abuse is directly related to the aggression behavior in a university (10). Child emotional abuse, poor parent-child relationship patterns, and a father's strict parenting behaviors, all act as risk factors that provoke the augment against adolescent borderline personality disorder. ACEs can also cause Internet addiction and suicide among adolescents (11). The number of risk factors is closely related to the development outcome of children. The mental health disorder risks of individuals with two or four risk factors are 4–10 times that of individuals with no risk factors (12). The analysis of existing studies shows that ACEs has a certain correlation with adolescents' emotion, hyperactivity and aggressive behavior. Children with behavioral problems (including emotional symptoms, conduct problems, hyperactivity, peer communication, and pro-social factors) are more likely to encounter risks during adolescence, including smoking (13), substance abuse (14), and obesity (15), etc.

Differences exist in the risk of adversity in families across levels of socioeconomic advantage. Children are more likely to be victims of child maltreatment if they come from low-income or single-parent households (16). Children in socioeconomically disadvantaged families will have greater exposure to ACE categories compared to those of higher socioeconomic advantage (17).

Current research

Early adolescence can be described as a period of life, typically occurring between the ages of 10 and 15 years, in which the youth undergo rapid physical, cognitive, and social transformation (18). In recent years, children aged 12–14 are more likely to have behavioral problems in China. Chinese

experts in psychology, nursing, and other disciplines have drawn inspiration from the CDC-Kaiser ACE's link between ACE exposure and a wide range of physical and mental health outcomes to a certain extent. However, one weakness in these studies is the reliance on data in a certain school or a given area. This limited reliance is prone to a recall bias and a measurement error. Subgroup difference analyses are rare, so less is known about whether ACEs can have similar effects on more socially and economically diverse subgroups. These literatures that have linked childhood adversity to a wide range of health problems in adulthood overlooks the proximal effects of ACEs by primarily focusing on outcomes in adulthood. The research on the proximal relation can provide support for the precise intervention of youth social work in advance, so as to avoid further deterioration of adverse effects.

Methods

Data source and quality control

The data used in this study are from the survey data of the “high risk family child protection system research” in 2017. Entrusted by the National Social Science Fund, the project is jointly carried out by Policy Research Center of the Ministry of Civil Affairs of the People's Republic of China and Hunan Normal University. The total survey sample is 2,862 district and county junior high school students in the whole nation. The survey adopts multi-stage cluster random sampling method, based on the number of students in the district and county. First, 50 districts and counties were selected from all districts and counties in China by PPS method. Then a junior middle school was selected from each county according to the systematic random method. Furthermore, a class was randomly selected from each junior high school in Grade One, Grade Two and Grade Three of junior high school. Finally, we selected three rows according to the position of students' seats in the class (usually there are 5–6 rows in each class). The students with informed consent in this class were investigated. The final sample of the survey includes 57 classes of Grade one, 52 classes of Grade Two and 41 classes of Grade Three in 20 provinces and cities. A total of 3,000 questionnaires were distributed, and 2,950 were returned. After strict screening and elimination of invalid questionnaires (e.g., child abuse measurement scales with over three missing values in each indicator measurement), a total of 2,910 valid questionnaires were collected. The proportion of cases with missing data is 19%; therefore, multiple imputation is used to deal with the missing values in the analysis samples. In this study, all variables used in the statistical model were included in the multiple imputation calculation model, and 24 independent data sets were obtained after imputing missing values, than this data set was statistical analysis, and finally the analysis results were summarized. All the descriptive statistics

and model outputs in this paper are the results of missing value processing. The results of multiple interpolations are similar to those of direct deletion method.

To ensure the privacy of the respondents and to enhance the quality of investigation, the investigation team signed a confidentiality agreement with the schools and the respondents, and obtained the consent of the parents and children before collecting data. To ensure quality, the only those who were qualified to provide psychological consultation services were selected as investigators; the investigators underwent training on providing psychological and support services for children; the questionnaire was filled in the enclosed environment provided by the school in spare time and all completed questionnaires were collected by the investigators from the seat of the respondents with no interventions; and rigorous screenings were employed to remove questionnaires with missing values. The respondents are required to maintain a distance of 1 m between their positions when filling out the questionnaire. On the one hand, it is to protect the privacy of participants and prevent participants from being laughed at or labeled; On the other hand, it is also to obtain real data, so that the respondents can express their true situation and ideas in the context of respecting their privacy.

Measurement

After the CDC-Kaiser and domestic research in China, ACEs including 5 types of child abuse and 11 types of family dysfunction faced by children in early adolescence (12–14 years), were investigated in this study. Child abuse comprises emotional, physical, and sexual abuse, and emotional and physical neglect. Family dysfunction covers divorce, witnessing domestic violence, parental disability, parental alcohol abuse, parental drug abuse, parental suicidal intention, parents leaving home, poor living environment, scolding, parental gambling, and parental criminal records.

Child abuse

In this study, childhood trauma questionnaire (CTQ) was used to examine maltreatment (19). The Chinese version of the questionnaire has good reliability and validity, and is widely used to measure child abuse (20, 21). The CTQ was split into five factors (emotional, physical, and sexual abuse, and emotional and physical neglect). Each factor table covered five items. Each item adopted a 5-point Likert scale type score (0 = “never,” 1 = “occasionally,” 2 = “sometimes,” 3 = “often,” and 4 = “always”) (19). The five factor scores for each item were summed and then converted into dichotomous variables (if the total score is 0, variable value will be defined as 0; if the total score is 1 or more, variable value will be defined as 1). The

statistical results showed that the reliability and validity of the scale were less affected by the re-evaluation. Emotional abuse was measured using five items, such as “someone in the family calls me ‘stupid guy’ and ‘I think my parents hate me’ ($\alpha = 0.775$)”. Physical abuse was measured using five items, such as “someone hits me at home heavily,” and “I have to go to the hospital,” etc. ($\alpha = 0.793$). Sexual abuse was measured using five items, such as “someone intimidates or tempts me to do sexual things with him/her” ($\alpha = 0.776$). Emotional neglect was measured using five items, such as “someone in the family makes me feel unimportant” ($\alpha = 0.802$). Physical neglect was measured using five items, such as “I am not eating enough,” and “I often wear dirty clothes” ($\alpha = 0.708$). The scale can be used to measure the abuse that happened to the respondents before age 10.

Family dysfunction

Family dysfunction refers to the functional failure of family in the process of care and education of children, which mainly includes: absence of family role (such as divorce of parents), incompetence of role (such as drug abuse of parents), rejection of role (such as guardians who cannot fulfill their parenting obligations in reorganizing families) and role conflict (such as families in the conflict of employment and work) (22). According to the situation in China, there are 11 types of family dysfunction. A total of 11 problems in children’s growth (0 = “yes” and 1 = “no”) were measured. The questions focused on divorce, quarrels and fights (witnessing domestic violence), parental disability, parental alcohol abuse, parental drug abuse (narcotic drugs), parental suicidal intentions, parents leaving home with no news of their whereabouts, messy living environment, scolding, parental gambling, and parental criminal records. To ensure the validity and reliability of the measurement, On the one hand, the expert evaluation method is used to test the validity. Five experts were invited to judge the consistency between the questionnaire title and the original content scope. The five experts are Ling Hui (engaged in personality disorder research), Xiao Han Shi (engaged in child psychology research), Chen Dan (engaged in child abuse research), Ou Yang Yan Wen (engaged in domestic violence research) and Zhao Lan (engaged in drug addiction and abuse research). The results showed that the questionnaire had good content validity. On the other hand, using Alpha Reliability coefficient method to test reliability. Alpha Reliability coefficient is tested to be 0.682.

Behavioral problems

Behavioral problems in children were measured using the student version of the Strengths and Difficulties Questionnaire (SDQ) (23). The questionnaire has been used widely in China

and has good reliability and validity. Chinese scholars have tested the reliability and validity of the questionnaire and found that it satisfied the requirements of psychological measurement (24). The student version comprised five factors (including emotional symptoms, conduct problems, hyperactivity, peer communication, and pro-social factors). Each factor included 5 items, each of which adopted a level 3-level score (0 = “no compliance,” 1 = “part compliance,” and 2 = “full compliance”). There were 25 entries in all. Items 7, 11, 14, 21, and 25 had to be scored in reverse. The total score was converted into dichotomous variables. Whereas, 0 marked the normal level, 1 marked the abnormal level. The five factor calculation criteria included:

- (1) 5 measurement items for emotional symptom factors, such as “I am often worried, unhappy, and heavy-laden” ($\alpha = 0.703$), where 0–6 points represent the normal level (defined as 0) and 7–10 points indicate the abnormal level (defined as 1);
- (2) 5 measurement items for conduct problem factors (e.g., “I am often angry, lose my temper, often argue with others, and lie”) ($\alpha = 0.683$), where 0–4 points represent the normal level (defined as 0) and 5–10 points indicate the abnormal level (defined as 1);
- (3) 5 measurement items for hyperactivity factors, such as “I cannot settle down,” “I am often restless and uneasy” ($\alpha = 0.736$), where 0–6 points represent the normal level and 7–10 points indicate the abnormal level.
- (4) 5 measurement items for peer communication factors (e.g., “I often stay alone, usually play by myself”) ($\alpha = 0.769$), where 0–5 points represent the normal level (defined as 0) and 6–10 points indicate the abnormal level (defined as 1).
- (5) 5 measurement items for pro-social factors (e.g., “I try to be friendly to others”) ($\alpha = 0.701$), where 5–10 points represent the normal level (defined as 0), and 0–4 points indicate the abnormal level (defined as 1).

Behavioral problems measure the performance of respondents in the last week.

Analytical strategy

This study used SPSS 22.0 for statistical analysis. It first conducted a descriptive analysis which presented the results between behavioral problems in early adolescence and the ACE factors in the overall samples. We estimated the ordinary least squares, and linear and logistic regressions to investigate various components of the associations between ACEs and behavioral problems in early adolescence. In the first set of regression models, we examined whether there was a positive association between the quantity of adverse exposures experienced and

behavioral problems. Next, we examined whether there were differential associations between ACE exposure and child behavioral outcomes across registered residence, gender, and maternal education subgroups. In each regression, we tested the statistical equivalence of the coefficients for each variable across equations. Finally, we investigated the relationship between ACE categories and behavioral problems.

Results

There are 1,083 students in the sample, accounting for 37.2%; 982 students in grade two, accounting for 33.7%; 845 students in grade three, accounting for 29.0%. There are 1,488 boys in the sample, accounting for 51.8%; 1,385 girls, accounting for 48.2%. Emotional neglect (39.76%) and abuse (35.36%), and physical abuse (26.38%) and neglect (25.37%) were the top four factors that influenced ACE incidence rates. Rural children had a higher ACE incidence than urban children. The incidence among children whose mothers had lower levels of education was higher than among children whose mothers had a higher level of education. Boys are more vulnerable to physical abuse, emotional and physical neglect. Girls are more vulnerable to emotional abuse, as seen in Table 1.

The results showed that 28.2% of children had not suffered any adverse experiences (including 5 types of child abuse and 11 types of family dysfunction); 71.8% had suffered adverse experiences, of which 23.4% faced 1 ACE, 18.4% faced 2 ACEs, 11.9% faced 3 ACEs, and 18.1% faced 4 to 16 ACEs. Except for physical and emotional abuse ($r = 0.573$, $p < 0.01$), emotional and physical neglect ($r = 0.618$, $p < 0.01$), the correlation coefficients between each adversity factor were below 0.5, and there was only a weak correlation between the factors. The results of the total sample analysis revealed that ACEs were significantly associated with adolescent conduct, peer communication, and pro-social problems (Table 2). Compared to those with 0 ACEs (the reference group), children with 1 ACE had roughly 1.77 times the odds of demonstrating the level of child conduct problems ($p < 0.05$), children with 2 ACEs had 3.55 times the odds ($p < 0.001$), children with 3 ACEs had 6.04 times the odds ($p < 0.001$), and children with 4 or more ACEs had 6.63 times the odds ($p < 0.001$). Similarly, Children with 1 ACE had roughly 1.69 times the odds of demonstrating the level of peer communication problems ($p < 0.05$), children with 2 ACEs had 2.46 times the odds ($p < 0.01$), children with 3 ACEs had 1.80 times the odds ($p < 0.05$), and children with 4 or more ACEs had 4.44 times the odds ($p < 0.001$) when compared to children who had never faced any ACEs. Children with 1 ACE had roughly 2.64 times the odds of demonstrating the level of pro-social conduct problems ($p < 0.01$), children with 2 ACEs had 4.83 times the odds ($p < 0.001$), children with 3 ACEs had 6.33 times the odds ($p < 0.001$), and children with 4 or more ACEs had 7.80 times the odds ($p < 0.001$).

TABLE 1 Prevalence of adverse childhood experiences.

	Full sample (%)	Household registration		Gender		Maternal education		
		Urban (%)	Rural (%)	Boys (%)	Girls (%)	<HS (%)	HS(%)	>HS(%)
Child abuse								
Emotional abuse	35.36 (0.009)	33.09 (0.013)	37.44 (0.013)	32.21 (0.012)	38.44 (0.013)	38.62 (0.013)	34.97 (0.020)	28.24 (0.017)
Physical abuse	26.38 (0.008)	23.27 (0.011)	28.89 (0.012)	29.69 (0.012)	22.62 (0.011)	28.8 (0.012)	24.96 (0.018)	21.3 (0.015)
Sexual abuse	14.06 (0.007)	11.87 (0.009)	16.13 (0.010)	16.3 (0.010)	11.45 (0.009)	15.44 (0.009)	12.26 (0.014)	11.34 (0.012)
Emotional neglect	39.76 (0.009)	35.51 (0.013)	43.79 (0.014)	40.17 (0.013)	38.83 (0.013)	44.14 (0.013)	36.88 (0.020)	32.23 (0.017)
Physical neglect	25.37 (0.008)	21.04 (0.011)	28.8 (0.012)	28.02 (0.012)	22.37 (0.011)	28.84 (0.012)	21.16 (0.017)	20.79 (0.015)
Family dysfunction								
Divorce	13.65 (0.006)	13.49 (0.009)	14.46 (0.010)	14.96 (0.009)	12.26 (0.009)	14.18 (0.009)	11.09 (0.013)	13.29 (0.013)
Witnessing of domestic violence	6.00 (0.005)	4.91 (0.006)	7.77 (0.007)	6.28 (0.006)	6.44 (0.007)	7.84 (0.007)	4.66 (0.009)	4.86 (0.008)
Parental disability	5.00 (0.004)	3.18 (0.005)	6.42 (0.007)	4.32 (0.005)	5.07 (0.006)	6.3 (0.006)	2.94 (0.007)	2.3 (0.006)
Parental alcohol abuse	7.00 (0.005)	4.19 (0.005)	9.25 (0.008)	7.83 (0.007)	5.35 (0.006)	8.96 (0.007)	4.33 (0.008)	3.92 (0.007)
Parental drug abuse	1.00 (0.002)	0.94 (0.003)	0.96 (0.003)	1.42 (0.003)	0.58 (0.002)	1.13 (0.003)	0.69 (0.003)	0.95 (0.004)
Parental suicidal intention	2.00 (0.003)	2.02 (0.004)	1.7 (0.004)	2.16 (0.004)	1.66 (0.003)	1.93 (0.004)	1.04 (0.004)	2.16 (0.005)
Leaving home for parents	1.00 (0.002)	1.23 (0.003)	1.41 (0.003)	1.28 (0.003)	1.45 (0.003)	1.46 (0.003)	1.21 (0.005)	1.08 (0.004)
Poor living environment	2.00 (0.002)	1.52 (0.003)	2.14 (0.004)	1.96 (0.004)	1.59 (0.003)	1.79 (0.003)	1.38 (0.005)	1.49 (0.004)
Scolding	11.00 (0.006)	7.51 (0.007)	13.28 (0.009)	12.54 (0.009)	8.24 (0.007)	13.92 (0.009)	8.12 (0.011)	5.41 (0.008)
Parental gambling	7.00 (0.005)	3.61 (0.005)	9.32 (0.008)	7.22 (0.007)	5.79 (0.006)	8.96 (0.007)	5.87 (0.010)	2.03 (0.005)
Parental criminal records	1.00 (0.002)	0.65 (0.002)	1.03 (0.003)	0.81 (0.002)	0.87 (0.002)	0.93 (0.002)	1.04 (0.004)	0.54 (0.003)
Behavior issues								
Emotional problems	4.71 (0.004)	4.78 (0.006)	4.59 (0.006)	3.55 (0.005)	5.84 (0.006)	4.98 (0.006)	3.83 (0.008)	4.63 (0.008)
Hyperactivity	5.05 (0.004)	4.71 (0.006)	5.25 (0.006)	6.1 (0.006)	3.84 (0.005)	5.65 (0.006)	5.66 (0.010)	3.57 (0.007)
Conduct problems	7.99 (0.005)	7.61 (0.007)	8.44 (0.008)	10.44 (0.008)	5.29 (0.006)	8.39 (0.007)	6.82 (0.011)	7.54 (0.010)
Peer communication problems	7.23 (0.005)	6.65 (0.007)	7.7 (0.007)	8.61 (0.007)	5.63 (0.006)	8.02 (0.007)	4.51 (0.009)	7.13 (0.010)
Pro-social problems	9.54 (0.005)	6.31 (0.007)	12.51 (0.009)	13.05 (0.009)	5.82 (0.006)	11.85 (0.008)	7.64 (0.011)	6.11 (0.009)

N = 2,910.

HS, High School Percentages and means (standard errors in parentheses) are presented.

when compared to children who had never faced any ACEs. The emotional problems and hyperactivity exhibit a similar positive and increasing association, although the influence of ACE exposure is not as strong. Compared to children with 0 ACEs, children with 3, and 4 or more ACEs had 2.75 times ($p < 0.01$) and 4.49 times ($p < 0.001$) the odds, respectively, of having emotional problems. Similarly, among children who faced 3, and 4 or more ACEs, the incidence probability of hyperactivity was 3.95 times ($p < 0.001$) and 4.45 times ($p < 0.001$), respectively, when compared to children who had never faced any ACEs.

These subsequent regression models investigate whether there were differences in the associations between ACE exposure and behavioral outcomes across children's area of residence gender, and level of maternal education. The results of the analysis suggested the following. First, the high exposure to ACE increases the probability of hyperactivity, and emotional, conduct, peer communication, and pro-social problems among children living in urban areas. Compared to those with 0 ACEs (the reference group), the odds of urban children with four or more ACEs demonstrating high levels of hyperactivity, and

conduct, peer communication, and pro-social problems was 6.38 times ($p < 0.001$), 5.55 times ($p < 0.001$), 9.35 times ($p < 0.001$), and 9.22 times ($p < 0.001$), respectively. Compared with rural children who did not have ACEs, the probability of emotional problems among rural children with four or more ACEs was 3.28 times ($p < 0.01$), hyperactivity was 3.50 times ($p < 0.001$), conduct problems was 4.29 times ($p < 0.001$), peer communication problems was 2.46 times ($p < 0.01$), and pro-social problems was 5.34 times ($p < 0.001$). Second, the high exposure of ACE increases the probability of girls' hyperactivity and conduct, peer communication, and pro-social problems. Compared with girls without any adverse experiences, for girls with 4 or more ACE factors, the probability of hyperactivity was 8.30 times ($p < 0.001$), conduct problems was 8.47 times ($p < 0.001$), peer communication problems was 4.81 times ($p < 0.001$), and pro-social problems was 9.01 times ($p < 0.001$). Third, the high exposure to ACE increases the probability of emotional, conduct, peer communication, and pro-social problems among children whose mothers had a junior college or higher educational background. Compared with children

TABLE 2 Logistic regression models estimating the association of ACEs on behavioral problems from 12 to 14 years old.

	Emotional problems	Hyperactivity	Conduct problems	Peer communication problems	Pro-social problems
	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)
Panel 1: full sample					
(0)					
1	0.76 (0.00 , 1.57)	1.51 (0.79, 2.88)	1.77 (0.96, 3.26)*	1.69 (1.00, 2.87)*	2.64 (1.51, 4.61)**
2	1.22 (0.61, 2.43)	1.66 (0.85, 3.25)	3.55 (2.01, 6.29)***	2.46 (1.46, 4.13)**	4.83 (2.83, 8.26)***
3	2.75 (1.46, 5.19)**	3.95 (2.11, 7.38)***	6.04 (3.40, 10.72)***	2.80 (0.97,3.35)*	6.33 (3.63, 11.03)***
4+	4.49 (2.61, 7.71)***	4.45 (2.51, 7.89)***	6.63 (3.89, 11.32)***	4.44 (2.75,7.18)***	7.80 (4.66, 13.05)***
Constant	0.03***	0.02***	0.03***	0.03***	0.03***
Panel 2: household registration					
Urban registered residence					
(0)					
1	0.80 (0.29, 2.23)	1.08 (0.42, 2.78)	1.97 (0.83, 4.67)*	2.82 (1.25, 6.35)*	3.23 (1.23, 8.49)*
2	1.82 (0.75, 4.44)	1.65 (0.66, 4.12)	5.26 (2.40, 11.51)***	4.27 (1.91, 9.54)***	6.76 (2.69, 16.99)***
3	3.68 (1.49, 9.05)**	4.16 (1.72, 10.05)**	6.51 (2.77, 15.28)***	1.19 (0.32, 4.46)	10.44 (3.99, 27.33)***
4+	6.38 (2.97, 13.72)***	5.55 (2.54, 12.12)***	9.35 (4.32, 20.23)***	9.03 (4.16, 19.59)***	9.22 (3.63, 23.38)***
Constant	0.02***	0.01***	0.02***	0.02***	0.01***
Rural registered residence					
(0)					
1	0.65 (0.21, 2.00)	1.64 (0.63, 4.30)	1.53 (0.64, 3.64)	1.13 (0.54, 2.39)	1.83 (0.90, 3.71)*
2	0.63 (0.19, 2.13)	1.28 (0.44, 3.71)	2.21 (0.95, 5.14)*	1.49 (0.71, 3.13)	2.93 (1.47, 5.83)**
3	1.84 (0.70, 4.87)	3.16 (1.23, 8.08)**	4.42 (1.99, 9.86)***	1.68 (0.78, 3.63)	3.45 (1.72, 6.95)***
4+	3.28 (1.45, 7.44)**	3.50 (1.47, 8.34)**	4.29 (2.02, 9.14)***	2.46 (1.28, 4.74)**	5.34 (2.84, 10.02)***
Constant	0.03***	0.03***	0.03***	0.05***	0.05***
Panel 3: gender					
Boys					
(0)					
1	1.06 (0.26, 4.27)	1.61 (0.71, 3.65)	1.67 (0.77, 3.63)	1.62 (0.82, 3.19)	2.60 (1.30, 5.20)**
2	2.35 (0.68, 8.12)	1.92 (0.84, 4.39)	3.82 (1.87, 7.80)***	2.24 (1.15, 4.37)*	4.22 (2.13, 8.33)***
3	1.92 (0.48, 7.79)	3.39 (1.50, 7.66)**	4.54 (2.16, 9.56)***	0.79 (0.30, 2.07)	6.60 (3.32, 13.14)***
4+	7.00 (2.36, 20.76)***	2.63 (1.20, 5.77)**	5.79 (2.92, 11.51)***	3.78 (2.03, 7.05)***	7.24 (3.78, 13.87)***
Constant	0.01***	0.03***	0.04***	0.05***	0.04***
Girls					
(0)					
1	0.77 (0.32, 1.87)	1.37 (0.44, 4.29)	1.82 (0.63, 5.31)	1.51 (0.63, 3.61)	2.80 (1.04, 7.55)*
2	1.02 (0.42, 2.46)	1.18 (0.33, 4.24)	3.07 (1.10, 8.56)*	2.58 (1.13, 5.92)*	6.38 (2.52, 16.13)***
3	3.82 (1.81, 8.06)***	5.37 (1.91, 15.06)***	9.31 (3.56, 24.34)***	3.56 (1.48, 8.59)**	5.45 (1.94, 15.29)***
4+	4.58 (2.37, 8.84)***	8.30 (3.32, 20.72)***	8.47 (3.40, 21.06)***	4.81 (2.24, 10.30)***	9.01 (3.63, 22.32)***
Constant	0.04***	0.02***	0.02***	0.03***	0.02***
Panel 4: maternal education					
<HK					
(0)					
1	0.92 (0.34, 2.50)	2.44 (0.86, 6.94)*	1.66 (0.69, 4.02)	1.10 (0.57, 2.15)	1.43 (0.71, 2.86)
2	0.97 (0.35, 2.71)	2.26 (0.76, 6.69)*	2.79 (1.20, 6.48)*	1.26 (0.64, 2.47)	3.22 (1.69, 6.11)***
3	1.75 (0.66, 4.61)	6.02 (2.20, 16.52)***	5.27 (2.32, 12.01)***	1.33 (0.64, 2.77)	3.51 (1.79, 6.86)***
4+	3.95 (1.78, 8.76)***	5.58 (2.11, 14.74)***	5.35 (2.45, 11.66)***	2.25 (1.23, 4.10)**	4.27 (2.31, 7.89)***
Constant	0.03***	0.02***	0.03***	0.06***	0.05***

(Continued)

TABLE 2 Continued

	Emotional problems	Hyperactivity	Conduct problems	Peer communication problems	Pro-social problems
	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)	Odds ratio (95%CI)
HK					
(0)					
1	0.36 (0.07, 1.76)	1.55 (0.46, 5.18)	1.82 (0.56, 5.85)	1.72 (0.38, 7.81)	3.35 (1.03, 10.94)*
2	0.27 (0.03, 2.25)	2.01 (0.57, 7.15)	2.46 (0.73, 8.30)	3.41 (0.80, 14.63)*	3.09 (0.85, 11.26)*
3	1.62 (0.40, 6.51)	4.13 (1.14, 14.94)*	4.05 (1.12, 14.65)*	1.26 (0.13, 12.40)	10.28 (3.00, 35.17)***
4+	2.37 (0.83, 6.77)*	3.86 (1.25, 11.89)**	3.78 (1.23, 11.66)*	4.90 (1.23, 19.43)*	7.99 (2.55, 25.10)***
Constant	0.04***	0.03***	0.03***	0.02***	0.02***
>HK					
(0)					
1	0.90 (0.16, 4.96)	0.26 (0.03, 2.10)	1.44 (0.38, 5.45)	3.48 (1.14, 10.59)*	15.10 (1.87, 121.92)**
2	3.95 (1.13, 13.73)**	0.94 (0.24, 3.70)	6.16 (2.15, 17.69)***	6.21 (2.16, 17.83)***	28.21 (3.63, 219.52)***
3	8.72 (2.54, 29.90)***	1.71 (0.43, 6.78)	8.92 (2.94, 27.05)***	1.58 (0.30, 8.33)	25.13 (2.97, 212.38)**
4+	11.67 (3.53, 38.51)***	5.18 (1.81, 14.86)**	15.47 (5.38, 44.46)***	18.02 (6.36, 51.08)***	41.59 (5.17, 334.67)***
Constant	0.02***	0.03***	0.02***	0.02***	0.01***

N = 2,910.

*p < 0.05.

**p < 0.01.

***p < 0.001.

without any adverse experiences whose mothers had a junior college or higher educational background, the probability of emotional problems among children with 4 or more ACE factors was 11.67 times ($p < 0.001$), conduct problems was 15.47 times ($p < 0.001$), peer communication problems was 18.01 times ($p < 0.001$), and pro-social problems was 41.59 times ($p < 0.001$).

Our final set of regressions examined the relative association of each specific type of adverse event with behavioral problems after controlling for covariates for the full sample (Table 3). All results were correlated with more than one ACE. Although particular ACEs were found to have larger associations with behavioral outcomes when compared to others, associations between each ACE and outcome were not nearly as large as the associations found between cumulative ACEs and behavioral problems.

Discussion

Several studies have focused on the relationship between ACEs and adult health issues, whereas very few ones have focused on ACEs and behavioral problems in early adolescence. Based on existing research, this study took 16 factors to build a measure of ACEs. Statistics have suggested that the incidence of ACE was high, and 71.8% of children have faced at least one ACE. In other studies in China, the proportion of children who faced at least one ACE was 66.22% (25). The CDC-Kaiser ACE study found that 64% of American

children faced at least one ACE, by studying the retrospective data from adults (6). Some studies have also concluded that 75% of American children have faced at least one ACE based on children's 5-year-old sequence data (2). The top four common adverse experiences in this study are emotional neglect (39.76%), emotional abuse (35.36%), physical abuse (26.38%), and physical neglect (25.37%), which are consistent with the top three types of emotional neglect (26.65%), emotional abuse (24.25%), and physical neglect (21.52%) identified by Nie Junyan in China (25). The ACE factors and proportion of children in the current study are uniformed with those in the existing research. The main conclusions of this study are as follows.

We examined whether children exposed to ACEs in early adolescence were associated with behavioral problems. We found that there was a strong association between exposure to ACEs and behavioral problems in early adolescence. The accumulation of ACE factors has a "threshold effect" on early childhood problems (26). Studies have shown that after the accumulation of ACE factors, especially 3, 4, or more, the probability of early childhood behavioral problems will multiply. Compared with children who faced no ACEs, the probability of conduct problems in children with 4 or more factors was 6.04 times, of peer communication problems was 4.44 times, of pro-social problems was 6.33 times, of hyperactivity was 4.45 times, and of children's emotional problem was 4.49 times. The possibility of behavioral problems among children aged between 12 and 14 years with 4 or more ACE factors is 4–6 times that

TABLE 3 Logistic regression models estimating associations of specific types of ACEs experienced with behavioral problems from 12 to 14 years old.

	Emotional problems Odds ratio (95%CI)	Hyperactivity Odds ratio (95%CI)	Conduct problems Odds ratio (95%CI)	Peer communication problems Odds ratio (95%CI)	Pro-social problems Odds ratio (95%CI)
Emotional abuse	2.35 (1.50, 3.67)***	2.09 (1.38, 3.16)***	1.56 (1.09, 2.23)**	1.15 (0.79, 1.66)	1.02 (0.73, 1.41)
Physical abuse	0.94 (0.77, 1.16)	0.97 (0.80, 1.19)	1.14 (0.97, 1.34)*	1.08 (0.91, 1.28)	1.10 (0.95, 1.28)
Sexual abuse	1.32 (1.08, 1.61)**	0.93 (0.74, 1.18)	1.34 (1.14, 1.58)***	1.14 (0.95, 1.37)	0.98 (0.82, 1.17)
Emotional neglect	1.18 (0.77, 1.82)	1.41 (0.93, 2.12)*	1.20 (0.85, 1.70)	1.26 (0.89, 1.80)	2.41 (1.75, 3.31)***
Physical neglect	1.48 (0.95, 2.29)*	1.47 (0.97, 2.23)*	1.41 (0.99, 2.00)*	1.29 (0.89, 1.87)	1.90 (1.39, 2.60)***
Divorce	0.88 (0.49, 1.58)	0.93 (0.54, 1.61)	1.22 (0.80, 1.88)	1.13 (0.73, 1.76)	1.48 (1.02, 2.13)*
Witnessing of domestic violence	1.57 (0.84, 2.90)	0.99 (0.50, 1.96)	1.51 (0.90, 2.54)*	1.40 (0.80, 2.43)	1.35 (0.82, 2.23)
Parental disability	0.94 (0.42, 2.12)	1.03 (0.45, 2.33)	1.05 (0.54, 2.03)	1.35 (0.71, 2.56)	1.20 (0.66, 2.17)
Parental alcohol abuse	1.18 (0.61, 2.27)	1.46 (0.79, 2.67)	1.38 (0.82, 2.34)	1.06 (0.60, 1.88)	0.77 (0.44, 1.36)*
Parental drug abuse	0.32 (0.05, 2.10)	0.78 (0.13, 4.55)	0.52 (0.12, 2.14)	1.95 (0.61, 6.23)*	1.98 (0.65, 6.05)
Parental suicidal intention	2.09 (0.82, 5.34)*	1.45 (0.49, 4.35)	1.39 (0.59, 3.31)	1.25 (0.50, 3.13)	0.99 (0.41, 2.40)
Leaving home for parents	1.77 (0.57, 5.52)	0.52 (0.10, 2.80)	0.87 (0.29, 2.63)	1.19 (0.41, 3.43)	1.40 (0.54, 3.63)
Poor living environment	1.48 (0.53, 4.18)	0.49 (0.12, 1.98)	0.95 (0.37, 2.43)	1.37 (0.55, 3.40)	2.57 (1.17, 5.64)*
Scolding education	1.64 (0.97, 2.76)*	1.79 (1.08, 2.96)*	1.76 (1.15, 2.69)**	1.48 (0.94, 2.34)*	1.33 (0.88, 2.03)
Parental gambling	0.81 (0.40, 1.64)	1.18 (0.64, 2.19)	0.71 (0.40, 1.27)	1.14 (0.66, 1.98)	0.65 (0.37, 1.17)*
Parental criminal records	0.29 (0.03, 3.04)	3.00 (0.88, 10.22)*	1.30 (0.37, 4.60)	1.04 (0.28, 3.87)	2.22 (0.73, 6.73)
Constant	0.02***	0.03***	0.02***	0.04***	0.04***
Observations	2,910	2,910	2,910	2,910	2,910

*p < 0.05.

**p < 0.01.

***p < 0.001.

of children without any adverse experiences. To the best of our knowledge, our study is the first to investigate the relationship between ACE factors and behavioral problems among children aged between 12 and 14 years.

Investigation of subgroup differences indicated that children living in urban areas are less likely to suffer from adversity than those living in rural areas. Children whose mothers have higher levels of education are less likely to suffer from adversity than those whose mothers have lower levels of education. Girls are less likely to suffer from adversity than boys. However, children living in urban areas, those whose mothers have higher education levels and girls with high exposure to ACEs have a higher probability of facing problems in their early youth, which keeps constant with the conclusion drawn by (author?) (2) that American children whose mothers have high school or higher levels of education are more likely to show behavioral problems after exposure to ACEs. According to the differential susceptibility hypothesis, Children have differential susceptibility to rearing environments' influence. Some children are not only more vulnerable than others to the negative effects of adversity, but also to the beneficial effects of a rich upbringing environment (27). The interaction between children and their surroundings is shaping individual susceptibility. Inferior environment may reduce individual susceptibility, while superior environment may also improve individual susceptibility. Children living in rural areas with less educated mothers may be at a greater social and economic disadvantage, but some of them can develop their resilience in adversity, making them less vulnerable to behavioral problems. Some people are is not only more vulnerable to the positive impact of the positive environment, but also more vulnerable to the negative impact of the adverse environment. Children who live in urban areas and whose mothers have a higher level of education have less social and economic disadvantages, but are more sensitive to problems and more vulnerable to impact. Once they are highly exposed, children living in urban areas and whose mothers have high levels of education will have a higher probability of behavioral deviation. Gender differences are associated with the learning environments of boys and girls. Boys' academic performance in school is usually worse than that of girls, creating what is known as the "boy crisis". Boys are growing up with less-involved fathers and are more likely to drop out of school, drink, be addicted to drugs, become delinquent, and end up in prison (28). Boys are more influenced by peer culture. When their peers do not agree with the academic performance, boys are more likely to get anti-school attitudes and behaviors (29). Girls generally have good academic performance, but they also face greater peer competition pressure. These growing environments make it easier for boys to become a low susceptibility group and girls to become a high susceptibility group. Girls are more sensitive than boys, and are more inclined to have problems when exposed. To the best of our knowledge, this is the first study to

investigate differences in the relation of ACEs across household registration subgroups.

Though an exploratory study was conducted on the proximal effects of ACEs in early adolescence, the following shortcomings remain. First, the retrospective research design was limited. Compared with the longitudinal study design, data reliability and validity obtained through retrospective research in this study were relatively insufficient. Although there was no significant difference in grade and age, the difference between parents (and their children) who chose to participate and not participate was not considered. Second, the independent variables were hardly exhausted. According to the existing research and domestic conditions, ACE factors are expanded to 16, and there may be unmeasured variables related to ACE behavior problems. Other adversities in the CDC-Kaiser study include personal victimization, financial hardship, and discrimination. Future research should examine a wider range of ACEs that are probably associated with different populations, leading to poor health or behaviors (30). Third, the existing studies provide limited explanations for the formation of stress resistance. This study focused on the interpretation of ACEs with respect to early childhood behavioral problems. The positive explanatory power for ACEs was limited. However, according to relevant research, in the tracking study of 698 cases of victims born in poverty, stress, abuse, and neglect conditions, 2/3 were found to be well-functioning adults (31).

Despite these shortcomings, this study has made a vital contribution to the existing literature on adverse situations faced by children. By analyzing the proximal effects of ACE exposure, this study has extended the range of ACE effects. The results indicated that children in early adolescence begin to show behavioral problems after exposure to ACEs. Finally, to understand how these groups are affected by ACEs in China, the observations of previous ACE studies were extended to populations in urban and rural areas, of different genders, and with different maternal educational backgrounds.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Biomedical Research Ethics Committee of Hunan Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for

the publication of any potentially identifiable images or data included in this article.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Epistemic trust and personality functioning mediate the association between adverse childhood experiences and posttraumatic stress disorder and complex posttraumatic stress disorder in adulthood

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Background: Adverse childhood experiences (ACEs) are associated with posttraumatic and complex posttraumatic stress disorder symptoms in adulthood (PTSD/cPTSD), as well as reduced epistemic trust (trust in the authenticity and personal relevance of interpersonally transmitted information) and impaired personality functioning. The present work aims to investigate the predictive value of epistemic trust—the capacity for social learning—on the mediating effect of personality functioning in the association of ACEs and PTSD/cPTSD.

Methods: We conducted structural equation modeling (SEM) based on representative data of the German population ($N = 2,004$). Personality functioning (OPD-SQS) was applied as a mediator between ACEs and PTSD/cPTSD (ITQ), while epistemic trust (ETMCQ) was added as predictor for OPD-SQS. TLI, CFI, and RMSEA (95%-CI) determined the models' fit.

Results: $N = 477$ (23.8%) participants reported at least one ACE and $n = 218$ (10.9%) reported ≥ 4 ACEs. Fit indices were good for both PTSD (TLI = 0.96;

CFI = 0.99; RMSEA = 0.06; 95%CI: 0.041–0.078) and cPTSD (TLI = 0.96; CFI = 0.99; RMSEA = 0.06; 95%CI: 0.043–0.081). ACEs were significantly associated with cPTSD ($\beta = 0.44$, $p < 0.001$) and PTSD ($\beta = 0.29$, $p < 0.001$), explaining 20 and 8% of its variance. Adding personality functioning as a mediator increased the explained variance of cPTSD and PTSD to 47 and 19% while the direct association between ACEs and cPTSD/PTSD decreased ($\beta = 0.21/\beta = 0.17$), thus, indicating a partial mediation. Including epistemic trust substantially increased the explained variance for personality functioning (41%) compared to ACEs as a single predictor (16%).

Conclusion: We add to previous research emphasizing the association between ACEs and PTSD/cPTSD symptoms. Offering insights on underlying mechanisms, we show that epistemic trust and personality functioning are relevant mediators. Since both are modifiable by psychotherapy, knowledge about the role of these constructs can inform research on psychotherapeutic interventions and prevention.

KEYWORDS

adverse childhood experiences, complex posttraumatic stress disorder, epistemic trust, mediator, personality functioning, posttraumatic stress disorder

Introduction

Adverse childhood experiences (ACEs) including child maltreatment and household dysfunction are a worldwide phenomenon (1), estimated to affect over 55 million children in Europe alone (2), and more specifically in Germany, about 44% (3) of the general population, making ACEs a global and highly prevalent problem. ACEs are defined as “childhood events, varying in severity and often chronic, occurring in a child’s family or social environment that cause harm or distress, thereby disrupting the child’s physical or psychological health and development” (4). There is a large body of evidence suggesting a close association between adverse experiences as a child and the development of physical health problems (5–8) and mental disorders (including psychological distress) (8–12) in adulthood.

With regard to mental disorders, posttraumatic stress disorder (PTSD) and borderline personality disorder (BPD) are most often associated with ACEs (13–17). However, specific symptoms often found in persons with PTSD and a history of ACEs led to significant conceptual changes. The ICD-11 considers different PTSD syndromes by adding a new diagnosis referred to as complex posttraumatic stress disorder (cPTSD), which is associated with repeated or prolonged experiences of traumatic events, resulting in specific additional symptoms such as impaired affect regulation, negative self-concept, and interpersonal problems (18, 19). The variety of PTSD symptoms (e.g., re-experiencing, avoidance, hyperarousal), additional

specific cPTSD symptoms (e.g., impaired affect regulation), as well as frequent comorbidities (e.g., depressive symptoms or substance abuse) result in a very heterogeneous population of patients with PTSD and cPTSD, causing intense individual distress and are closely linked to serious disability as well as increased morbidity and mortality (20–24).

The close association between ACEs and the development of PTSD and cPTSD during adolescence or in adulthood emphasizes the importance of broadening our understanding of the underlying pathways through which ACEs and mental health issues are linked. Research focusing on ACEs and how they increase the risk for adult psychopathology proposed various potential mechanisms including brain structure and function, epigenetic processes, gene expression to neuroendocrine, immune and neurotransmitter systems, as well as social cognition (25–27). Another focus has been on personality development which has gained much interest in recent empirical research. Patients with a history of ACEs often show e.g., impaired identity perception, interpersonal difficulties, or altered affect regulation (28). Given that experiences made in early childhood are essential for the development of personality functioning by shaping basic mental capacities or adaptive coping behaviors (29–32), personality functioning might be a pathway linking ACEs and adult psychopathology. Personality functioning (also referred to as “structure”) describes a person’s abilities directed toward the self (identity perception, self-regulation) and others (empathy, intimacy) in four domains related to capacities

of cognition/perception, regulation, communication, and attachment (33). Since personality disorders are closely linked to impaired personality functioning, the concept of personality functioning has been included as a dimensional measure of basic psychological capacities in both the DSM-5 (34) as well as the ICD-11 (35–37). The ICD-11 represents a radical change in the classification of personality disorders where former categorical descriptions are now replaced by a dimensional structure. Diagnoses of personality disorders are conducted in two stages by assessing (1) the severity level and (2) domain traits. Here, special regard has been given to the borderline concept that can be optionally assigned as a “borderline pattern” after severity levels have been determined (35). With regard to the also newly introduced diagnosis cPTSD, this becomes particularly interesting as both diagnoses show substantial overlaps, specifically in terms of self- and interpersonal problems (38). The ICD-11 allows for this by making it possible to assign both diagnoses at the same time. While both are strongly associated with ACEs, the diagnosis of cPTSD actually requires the presence of trauma and PTSD symptoms. Both diagnoses are to be distinguished by specific elements. While cPTSD “typically involves stable and persistent patterns of negative self-perception while emphasizing avoidant interpersonal patterns,” the borderline pattern differs by allowing “an unstable or internally contradictory sense of self, which may involve both overly negative and overly positive self-views” (38).

Secure relationships and attachments alongside adequate emotional mirroring processes facilitate the development of personality functioning in early childhood (39). Given that personality functioning develops at a young age (29, 40, 41), it becomes obvious that ACEs (e.g., in form of maltreatment carried out by care-givers or attachment disruptions) might hamper and disrupt this developmental processes (42, 43), and thus, result in impaired personality functioning. Based on pioneering work by Sperber et al. (44) and Wilson and Sperber (45), Fonagy and Allison emphasize that secure attachment relationships are not only highly relevant for the development of personality functioning in infancy, but also for the development of the capacity of epistemic trust (46–48). Epistemic trust describes the “trust in the authenticity and personal relevance of interpersonally transmitted knowledge about how the social environment works and how best to navigate it” (49), or in other words, an “individual’s willingness to consider new knowledge from another person as trustworthy, generalizable, and relevant to the self,” in short: for social learning (47). In case of ACEs—especially if they occur in severe and regular form—a child’s early environment is characterized by unreliable or even malevolent caregiving experiences causing disrupted learning about the social world, and thus, resulting in a breakdown or underdevelopment of epistemic trust. Epistemic mistrust can cause uncertainty and continued epistemic vigilance that can manifest as the overinterpretation of other people’s motives

(48, 49). In a state of epistemic hypervigilance, one will assume that the other’s intentions are deviating from those declared, having them treat the source of the information as not deferential (48). Also, the content of the information may be rejected and its meaning confused or misinterpreted as being malignant. Such failings in social communication might originate from epistemic hypervigilance, epistemic mistrust, or even epistemic freezing, with the latter describing the inability to trust others as a source of information regarding the world and its workings (49). In short, “epistemic mistrust manifests as the misattribution of intention and the assumption of malevolent motives behind another person’s actions, and therefore treating them with epistemic hypervigilance (or conversely, in some instances, excessive inappropriate epistemic trust or credulity)” (48). Fonagy and colleagues suggest that these might be characteristics of many patients with trauma and personality problems, and that many “types of psychopathology might be characterized by temporary or permanent disruption of epistemic trust and the social learning process it enables” (49).

Following this line of thinking, epistemic trust might have a relevant predictive influence on a person’s level of personality functioning. However, to our knowledge there is no research assessing the role of epistemic trust in the association between ACEs, personality functioning and PTSD and cPTSD respectively. Therefore, the present work aims to investigate the predictive value of reduced epistemic trust on the mediating effect of impaired personality functioning in the association between ACEs and PTSD and cPTSD. We hypothesize, (I) that in line with previous research, experiences of ACEs relate to higher rates of PTSD and cPTSD in the general population, (II) that ACEs correspond to greater impairment in personality functioning and epistemic trust, and finally (III) that personality functioning is a mediator regarding the association between ACEs and PTSD as well as cPTSD, and that epistemic trust will be a relevant predictor for personality functioning.

Materials and methods

Sample and setting

The present study is based on data from a representative sample of the German population collected by the independent demography research institute USUMA Berlin. Face-to-face interviews and self-report questionnaires were administered by trained interviewers between December 2020 and March 2021, yielding a total of $N = 2,519$ participants. Households within 258 predefined regions were selected by a random route procedure. In households with multiple persons, one person was randomly selected using the Kish-Selection-Grid. Inclusion

criteria were sufficient German language skills, an age ≥ 16 and informed consent before taking part in the study (in the case of minors, informed consent was also obtained from a parent/legal guardian). The survey was conducted in accordance with the Declaration of Helsinki and fulfilled the ethical guidelines of the International Code of Marketing and Social Research Practice of the International Chamber of Commerce and the European Society of Opinion and Marketing Research. Regarding the beginning Covid-19-pandemic in Germany, all applicable hygiene regulations at that time were followed. Ethical approval was obtained by the Ethics Committee of the Medical Faculty of the University of Leipzig (no. 474/20-ek).

Measures

Adverse childhood experiences questionnaire

ACEs were assessed using the ACEs Questionnaire (50), which is a widely used self-report tool for retrospectively evaluating numerous early childhood adversities. It comprises 10 items regarding abuse (emotional, physical, and sexual), neglect (emotional and physical), separation of a parent, violence against the mother, as well as problems of a household member (substance use, mental disorder, and prison stay). Each item is answered with either yes (1) or no (0), resulting in a sum score between 0 and 10. The German version of the ACE has shown acceptable reliability, with Cronbach's $\alpha = 0.76$ (51). In our sample, a good internal consistency of the ACE items could be observed ($\alpha = 0.81$).

International trauma questionnaire

The ITQ is a brief self-report questionnaire to measure PTSD and cPTSD symptoms after a stressful life experience, also assessing whether diagnostic criteria of PTSD and cPTSD diagnoses according to ICD-11 are fulfilled (52). It comprises 18 items with response options ranging from 0 = "not at all" to 4 = "extremely." The three PTSD core symptom clusters (re-experiencing, avoidance, and sense of threat) and the additional three areas related to disturbances in self-organization (DSO) (affective dysregulation, negative self-concept, and problematic relationships) are measured by two items each. For a dimensional assessment, the three items for the PTSD core symptom clusters and DSO, respectively, can be summed up resulting in an ITQ-PTSD sum score and an ITQ-cPTSD sum score, respectively, ranging from 0 to 24. To assess a probable PTSD diagnosis, functional impairment for the PTSD core symptoms are considered with additional three items. A probable PTSD diagnosis is met if at least one item in each core symptom cluster and one item of functional impairment for PTSD is answered with ≥ 2 ("moderately"). A probable cPTSD diagnosis is met, if PTSD criteria are satisfied and additionally at least one item in each DSO area is answered with ≥ 2 as well as and one item of functional impairment for DSO is answered

with ≥ 2 . According to ICD-11 diagnostic guidelines, a person may receive a possible diagnosis for PTSD or cPTSD, but not both. For both scales, reliability was good with $\alpha = 0.84$ for the PTSD scale and $\alpha = 0.88$ for the cPTSD scale (53). The German version has been validated in a representative population-based sample and can be used for research and clinical practice (54). In our sample, good internal consistency was observed for both the PTSD ($\alpha = 0.89$) and cPTSD scale ($\alpha = 0.87$).

Operationalized psychodynamic diagnosis structure questionnaire-short form

The Operationalized Psychodynamic Diagnosis Structure Questionnaire-Short Form (OPD-SQS) (55) is a 12-item self-report questionnaire to assess the level of personality functioning. A total score ranging from 0 to 48 and a score for each of the three subscales (self-perception, interpersonal contact, and relationship model) ranging from 0 to 12 can be calculated. Higher values indicate more severe deficits in personality functioning. Good validity and reliability have been reported for the total scale, with Cronbach's $\alpha = 0.88$ (55). In our sample, good internal consistency was observed for the OPD-SQS total score ($\alpha = 0.91$).

Epistemic trust, mistrust and credulity questionnaire

The German Version of the Epistemic Trust, Mistrust and Credulity Questionnaire (ETMCQ) (56, 57) was used to assess the participants' levels of trust in communicated knowledge, i.e., epistemic trust. The ETMCQ consists of 15 items to measure the three independent subscales of the epistemic trust construct: epistemic trust, mistrust, and credulity. Examples for the respective scales are "I find information easier to trust and absorb when it comes from someone who knows me well" for epistemic trust, "If you put too much faith in what people tell you, you are likely to get hurt" for epistemic mistrust, and "When I speak to different people, I find myself easily persuaded even if it is not what I believed before" for epistemic credulity. Each item has a response option ranging from 1 = "strongly disagree" to 7 = "strongly agree," resulting in a sum score from 15 to 105. High trust reflects a persons' ability to be open to opportunities for social learning in relationships, while high mistrust indicates a tendency to treat information sources as unreliable and to rather avoid being influenced by communication from others. High credulity reflects a persons' lack of clarity about its own position, which can lead to high vulnerability to misinformation and exploitation by others. For the ETMCQ, good reliability and validity have been reported, with the internal consistency for the full scale ranging from Cronbach's $\alpha = 0.71$ to $\alpha = 0.78$. In our sample, good internal consistency was observed for the ETMCQ trust ($\alpha = 0.81$) and credulity ($\alpha = 0.80$) subscale, while the values for the mistrust subscale were somewhat questionable ($\alpha = 0.69$).

Statistical analyses

Demographics for the sample are presented with means and standard deviations (SD). Patients with >50% missing items in the ITQ, ACE scale, OPD-SQS or ETMCQ were excluded from the analysis. Sociodemographic and clinical data of the excluded sample was compared to the study sample using independent sample *t*-tests and χ^2 -tests. The effect of group differences was estimated using Hedges g' for metric and ϕ for nominal data. Values of $g' = 0.2/\phi = 0.1$, $g' = 0.5/\phi = 0.3$ and $g' = 0.8/\phi = 0.5$ represent small, medium and large effect sizes, respectively.

The relationships between ACEs, epistemic trust, personality functioning, and PTSD/cPTSD symptoms were investigated with structural equation models (SEM; see [Figure 1](#)). Missing data (<50% missing items) was imputed using the full information maximum likelihood (FIML) estimation, which is the default approach in AMOS. In model A, the direct influence of ACEs on PTSD/cPTSD symptoms in adulthood was tested. In model B, personality functioning as measured by the OPD-SQS total score was added to the model as a mediator for this relationship and the epistemic trust subscales were added as predictors for personality functioning. For sensitivity analyses, the model was also tested (a) in the complete sample with the assumption that all missing values equal the lowest possible symptom score and (b) in all participants without missing data in the ITQ cPTSD scale with the assumption that missing values in the ITQ PTSD scale represent the lowest possible symptom score.

To account for non-normal distribution of data, bootstrapped confidence intervals [5,000 samples, 95%

confidence interval (CI)] were calculated to evaluate the statistical significance of all included paths in the SEM. To determine the model's goodness of fit, Pearson's chi-squared test (χ^2), the comparative fit index (CFI), Tucker-Lewis Index (TLI), and root mean square error of approximation (RMSEA) with lower and higher bounds of the 95%-CI were calculated. To evaluate whether the empirical data was closely fitting the theoretical model, the *p*-value of Close Fit (PCLOSE) was calculated based on the RMSEA values, with values of $p > 0.05$ indicating close fit and $p < 0.05$ indicating worse than close model fit. Acceptable goodness of fit was defined as RMSEA values of <0.08 and CFI/TLI values >0.90. *p*-values < 0.05 (two-sided) were considered statistically significant. Statistical analyses were performed with IBM SPSS (v22.0) and SPSS AMOS (v24.0).

Results

A total of 2,519 persons participated in the study. Of these, $n = 515$ participants (20.4%) were excluded because of missing data in the ITQ (mainly the PTSD symptom scale), the ACE questionnaire, the OPD-SQS, or the ETMCQ. The remaining $n = 2,004$ patients were included in the final analysis. Participants' mean age was 51.3 years. The majority was female (52.5%), married (45.5%), had an education ranging from 10 to 13 years of school (57.1%), and were employed full time (41.4%). Most participants earned a net monthly household income between 1,500 and 2,499 € (31.7%). For more details on sociodemographic characteristics see [Table 1](#).

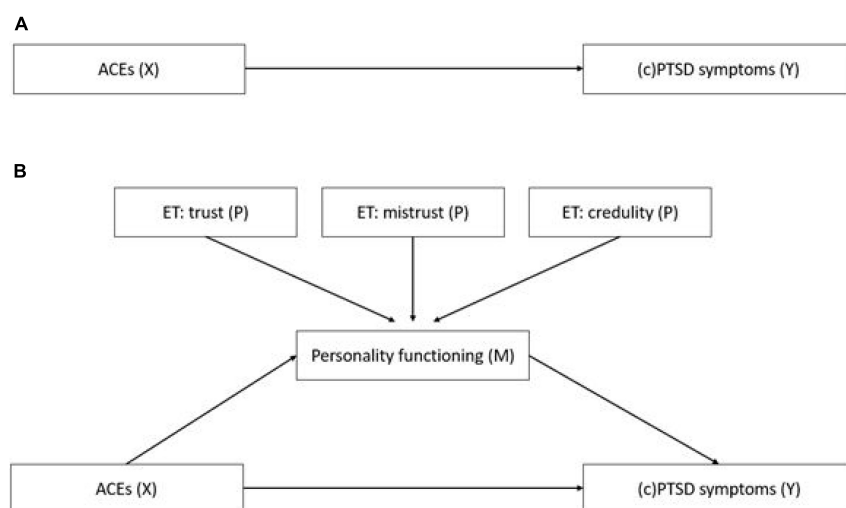


FIGURE 1

Structural equation models to test the mediation effect of personality functioning and epistemic trust on the relationship of ACEs with PTSD/cPTSD symptoms in adulthood. **(A)** Direct association of ACEs (X) and PTSD symptoms (Y). **(B)** Association of ACEs (X) and PTSD/cPTSD symptoms (Y), mediated by personality functioning (M), which was predicted by epistemic trust (P). Model A depicts the direct association of the independent variable ACEs (X) with the dependent variables PTSD and cPTSD respectively (Y). Model B depicts the model with personality functioning as a mediator (M) and the three epistemic trust subscales as predictors (P) for the mediator variable.

TABLE 1 Sociodemographic characteristics— $N = 2,004$.

	<i>N</i>	(%)
Sex		
Male	947	(47.3)
Female	1,053	(52.5)
Diverse	4	(0.2)
Age ($M = 51.3$; $SD = 18.1$)		
<30	325	(16.2)
30–39	245	(12.2)
40–49	307	(15.3)
50–59	418	(20.9)
60–69	348	(17.4)
> 70	361	(18.0)
Education		
<10 years	605	(30.2)
10–13 years	1,145	(57.1)
> 13 years	202	(10.1)
Other qualification	35	(1.7)
Missing	17	(0.8)
Relationship		
Married	911	(45.5)
Single	574	(28.6)
Divorced	291	(14.5)
Widowed	221	(11.0)
Missing	7	(0.3)
Employment status		
Full time	830	(41.4)
Part time	250	(12.5)
Unemployed	161	(8.0)
In training	112	(5.6)
Retired	626	(31.2)
Missing	25	(1.2)
Monthly net household income		
<1,500 €	471	(23.5)
1,500–2,499 €	636	(31.7)
2,500–3,499 €	457	(22.8)
> 3,500 €	440	(22.0)

Excluded patients were significantly younger (46.3 vs. 51.3 years; $p < 0.001$; $g' = 0.28$), more often full time employed (51.0 vs. 41.6%) and less often retired (19.3 vs. 31.4%) ($\chi^2 = 33.35$, $p < 0.001$; $\phi = 0.12$), more often single (35.6 vs. 28.7%) and less often widowed (4.3 vs. 11.1%) ($\chi^2 = 26.08$, $p < 0.001$; $\phi = 0.10$), had been in school longer ($\chi^2 = 11.66$, $p = 0.009$; $\phi = 0.07$), and reported less ACEs (0.6 vs. 1.0; $p < 0.001$; $g' = 0.24$). However, all differences were of small effect size. No significant difference was observed for gender ($\chi^2 = 1.06$, $p = 0.59$; $\phi = 0.20$) and monthly net household income ($\chi^2 = 19.14$, $p = 0.12$; $\phi = 0.09$).

In addition, Table 2 shows the mean number of ACEs experienced by the participants of the included sample as well mean values regarding personality functioning, epistemic trust, and PTSD and cPTSD symptoms.

TABLE 2 Mean numbers of ACEs as well as mean values of ITQ (symptoms of PTSD and cPTSD, respectively), OPD-SQS (personality functioning), and ETMCQ (epistemic trust)— $N = 2,004$.

	<i>M</i>	(<i>SD</i>)
ACE	1.0	(1.8)
ITQ		
PTSD	2.8	(4.2)
cPTSD	4.2	(5.7)
OPD-SQS		
total score	24.1	(9.4)
self-perception	6.3	(3.1)
interpersonal contact	7.9	(3.4)
relationship model	10.0	(4.3)
ETMCQ		
trust	24.7	(5.4)
mistrust	14.5	(4.5)
credulity	12.5	(5.1)

ACE, Adverse Childhood Experiences Questionnaire; ITQ, International Trauma Questionnaire; PTSD, posttraumatic stress disorder; cPTSD, complex posttraumatic stress disorder; OPD-SQS, Operationalized Psychodynamic Diagnosis Structure Questionnaire-Short Form; ETMCQ, Epistemic Trust, Mistrust and Credulity Questionnaire.

Prevalence and association of adverse childhood experiences and posttraumatic stress disorder as well as complex posttraumatic stress disorder in adulthood

A total of 1,309 (65.3%) participants reported no ACEs, while 477 (23.8%) had experienced 1–3 ACEs and the remaining 218 (10.9%) four or more ACEs [i.e., polytraumatized persons (58)]. The rates for PTSD and cPTSD symptoms above the cut-off were quite similar with a prevalence of 4.4% ($n = 88$) and 4.1% ($n = 83$), respectively.

A higher ACE score was significantly associated with higher scores for symptoms of PTSD ($r = 0.31$, $p < 0.001$) and cPTSD ($r = 0.44$, $p < 0.001$). Patients who were polytraumatized (i.e., four or more ACEs) in their childhood had 7.0-times increased likelihood to develop clinically relevant PTSD-symptoms (95%-CI: 4.0–12.1; $p < 0.001$) and a 14.8-times increased risk for clinically relevant cPTSD symptoms (95%-CI: 8.2–26.6; $p < 0.001$).

The association between personality functioning and epistemic trust with adverse childhood experiences and posttraumatic stress disorder as well as complex posttraumatic stress disorder in adulthood

In our sample, ACEs were significantly associated with lower personality functioning as well as higher scores for

epistemic mistrust and epistemic credulity as well as lower scores for epistemic trust. Additionally, participants with lower personality functioning reported higher PTSD and cPTSD scores. As for the epistemic trust subscales, higher epistemic credulity and mistrust were both significantly associated with higher PTSD and cPTSD symptoms. However, while lower epistemic trust was also associated with higher cPTSD symptoms, there was no significant association with PTSD symptoms (see also Table 3).

Personality functioning and epistemic trust as mediators of the relationship of adverse childhood experiences with posttraumatic stress disorder and complex posttraumatic stress disorder symptoms in adulthood

In the first step, the direct associations of ACEs with PTSD and cPTSD symptoms in adulthood were investigated by calculation of a SEM. ACEs significantly predicted PTSD ($p < 0.001$, $\beta = 0.31$, 95%-CI: 0.26–0.36) and cPTSD ($p < 0.001$, $\beta = 0.44$, 95%-CI: 0.39–0.49) symptoms and explained 8 and 20% of the variance, respectively. Since the number of distinct sample moments was equal to the number of distinct parameters to be estimated (i.e., resulting in zero degrees of freedom), no model fit indices could be calculated.

In the second step, the OPD-SQS total score was added as a mediator of the relationship between ACEs and PTSD/cPTSD symptoms, respectively, and the ETMCQ subscales were added as predictors for personality functioning. The overall explained variance substantially increased for PTSD (19%) and cPTSD (47%) and the direct association of ACEs with both PTSD ($\beta = 0.17$, 95%-CI: 0.12–0.23; $p < 0.001$) and cPTSD symptoms ($\beta = 0.21$, 95%-CI: 0.16–0.26; $p < 0.001$) was weakened. Epistemic mistrust ($\beta = 0.23$, 95%-CI: 0.18–0.28; $p < 0.001$) and epistemic

credulity ($\beta = 0.33$, 95%-CI: 0.29–0.38; $p < 0.001$) significantly predicted the OPD-SQS total score and explained 41% of the variance (for details, see Figures 2, 3).

A good model fit was found for the model with PTSD ($\chi^2 = 31.56$, $p < 0.001$; CMIN/DF = 7.89; CFI = 0.99; TLI = 0.96; RMSEA = 0.059, 95%-CI: 0.041–0.078; PCLOSE = 0.20) and cPTSD as dependent variables ($\chi^2 = 34.13$, $p < 0.001$; CMIN/DF = 8.53; CFI = 0.99; TLI = 0.96; RMSEA = 0.061, 95%-CI: 0.043–0.081; PCLOSE = 0.14).

For sensitivity analyses, both models were also calculated with (a) all missing items imputed as lowest possible score on the ITQ scales and (b) missing ITQ-PTSD items imputed as lowest possible scores for all participants with complete ITQ-cPTSD items. Since these calculations showed no difference in results, the initial analyses were considered reliable.

Discussion

Based on data of a representative survey of the German population, we examined the role of epistemic trust in the association between ACEs, personality functioning and PTSD as well as cPTSD, respectively.

Our results show that a third of our sample suffer from ACEs (about 24% had one to three and about 11% four or more ACEs), and about 4.1 and 4.4% fulfilled self-reported PTSD and cPTSD criteria, respectively. Higher ACE scores were significantly associated with higher scores for symptoms of PTSD and even more so for symptoms of cPTSD. In addition, multiple experiences of ACEs (>4 ACEs) were associated with a severely increased risk to develop PTSD (7.0-times) and cPTSD (14.8-times) in adulthood. We add to previous research demonstrating an association of ACEs and PTSD as well as cPTSD, emphasizing the importance of a persons' history of child maltreatment and adverse experiences for developing these psychopathologies (13, 15, 17, 59).

Consistent with our second hypothesis, we show that ACEs do indeed correspond to impairments in personality functioning but also higher epistemic mistrust and epistemic credulity, as well as reduced epistemic trust. Moreover, we demonstrate that impaired personality functioning as well as higher epistemic mistrust and epistemic credulity were significantly associated with increased PTSD and cPTSD scores, implying the possible importance of these constructs for the development of such psychopathology. With regard to personality functioning, this is in line with previous research demonstrating associations between personality functioning and PTSD and cPTSD that were also more pronounced for cPTSD than PTSD (60).

Following our initial line of thinking that the underlying pathway of the association between ACEs and PTSD as well as cPTSD might involve constructs such as personality functioning or epistemic trust, we included both variables in a SEM in order to explore the mediating and predictive characteristics of

TABLE 3 Correlations between the ETMCQ, ACE, OPD-SQS, ITQ-PTSD, and ITQ-cPTSD scales.

	ACE	ITQ-PTSD	ITQ-cPTSD
ETMCQ: trust	-0.10***	-0.03	-0.16***
ETMCQ: mistrust	0.19***	0.14***	0.32***
ETMCQ: credulity	0.25***	0.24***	0.39***
OPD-SQS: total score	0.41**	0.40**	0.66**
OPD-SQS: self-perception	0.37***	0.45***	0.67***
OPD-SQS: interpersonal contact	0.37***	0.34***	0.61***
OPD-SQS: relationship model	0.34***	0.29***	0.49***

** $p < 0.01$; *** $p < 0.001$. ETMCQ, Epistemic Trust, Mistrust and Credulity Questionnaire; OPD-SQS, Operationalized Psychodynamic Diagnosis Structure Questionnaire-Short Form; ACEs, Adverse Childhood Experiences Questionnaire; ITQ, International Trauma Questionnaire; PTSD, posttraumatic stress disorder; cPTSD, complex posttraumatic stress disorder.

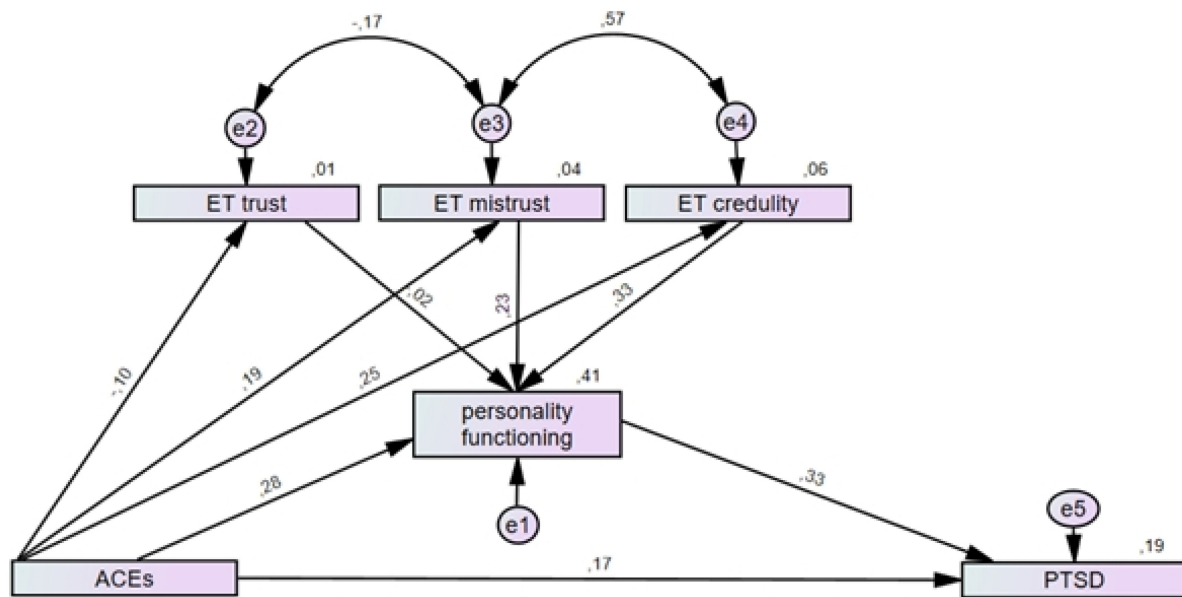


FIGURE 2

Structural equation models for the mediation effect of personality functioning and epistemic trust on the relationship of ACEs with PTSD symptoms. Personality functioning was added as a mediator for the association between ACEs and PTSD and the three epistemic trust subscales as predictors of personality functioning. Rectangles represent variables (ACEs, Adverse Childhood Experiences measured by the ACE; personality functioning measured by the OPD-SQS; ET, epistemic trust measured by the ETMCQ; PTSD, posttraumatic stress disorder symptoms measured by the ITQ) and circles represent error terms (e). Numbers next to arrows in the model represent standardized estimates, numbers next to factors represent the R^2 , i.e. the explained variance.

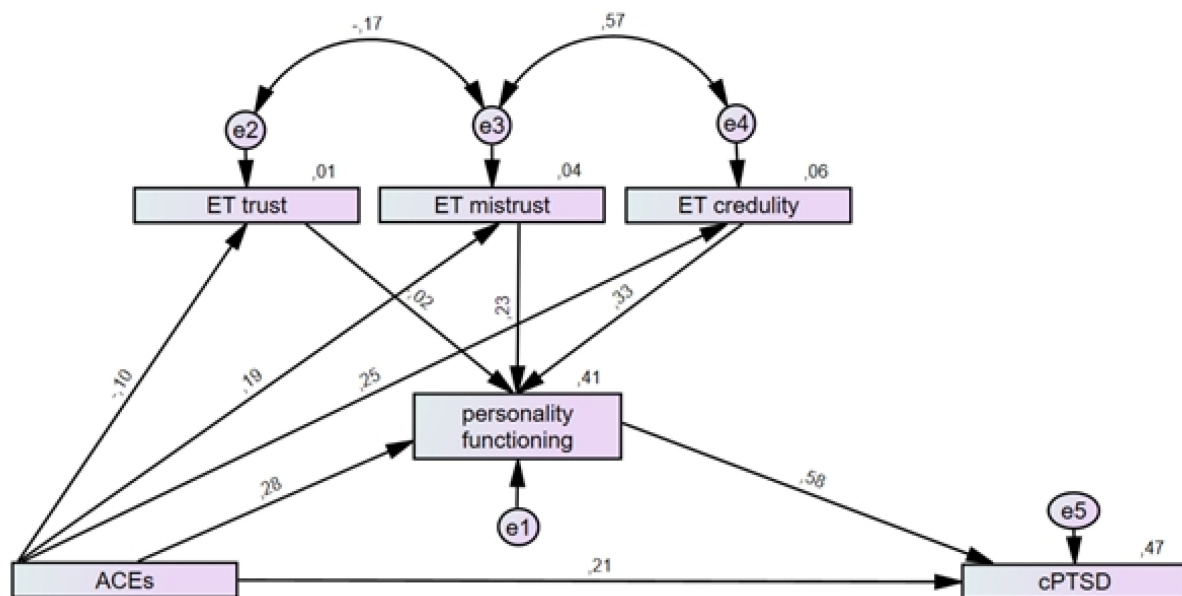


FIGURE 3

Structural equation models for the mediation effect of personality functioning and epistemic trust on the relationship of ACEs with cPTSD symptoms. Personality functioning was added as mediator for the association between ACEs and cPTSD and the three epistemic trust subscales as predictors of personality functioning. Rectangles represent variables (ACEs, Adverse Childhood Experiences measured by the ACE; personality functioning measured by the OPD-SQS; ET, epistemic trust measured by the ETMCQ; cPTSD, complex posttraumatic stress disorder symptoms measured by the ITQ) and circles represent error terms (e). Numbers next to arrows in the model represent standardized estimates, numbers next to factors represent the R^2 , i.e. the explained variance.

these constructs. For PTSD, the explained variance increased notably from 8 to 19% when including personality functioning as a mediator in the direct association between ACEs and PTSD. For cPTSD, the relationship was even stronger with the explained variance increasing from 20 to 47%. To our knowledge, this is the first study to investigate this association. Whilst previous research has focused on isolated and specific mechanisms such as affect regulation (28) or attachment (61), we assessed different but intertwined psychological functions comprising self-regulation, self-perception, and interpersonal difficulties in the form of personality functioning. Scarce research already including personality functioning focused on different psychopathologies in adulthood. For example, a similar pathway was found for depression and anxiety where personality functioning (partially) mediated the association between child maltreatment and depression and anxiety symptoms, respectively (12, 25). Personality functioning appears to be a relevant underlying mechanism in adults with different psychopathologies including PTSD and especially cPTSD and a history of ACEs.

We also included epistemic trust in our SEM to empirically test the predictive value of this construct. In line with our third hypothesis, our results show that, compared to ACEs as a single predictor, the inclusion of epistemic trust substantially increased the explained variance of personality functioning from 16 to 41%. These results suggest that epistemic trust or rather disruptions of epistemic trust have an important influence on personality functioning, and thus, might play a role in better understanding the implications of ACEs in those with PTSD and cPTSD. There is the possibility that the disruption of the system of trusting socially conveyed information might lead to problems of personality functioning because updating knowledge about the self becomes a challenge. In other words, the risk of PTSD and cPTSD increases because the person is less connected to their social network so that adequate personality functioning—which assumes a free-flow of information within a social network—becomes compromised. Yet, notably stronger associations for cPTSD compared to PTSD have to be considered with respect to the different diagnostic requirements: while cPTSD is normally associated with prolonged or multiple ACEs, PTSD can be caused by a variety of single stressful or threatening events. That ACEs might cause disruptions in epistemic trust and therefore impairments in personality functioning—an assumption that requires further research—might in part explain the specific symptoms accompanying cPTSD, namely impaired affect regulation, low self-esteem, and interpersonal problems (18, 19, 62).

Even though future research has to validate our findings, we believe knowledge about constructs such as personality functioning and specifically epistemic trust—both modifiable by psychotherapy (47, 62–64)—should inspire further research on psychotherapeutic prevention and intervention when addressing PTSD and more importantly cPTSD but also when

considering adult psychopathology in general and personality disorders in particular.

Strengths and limitations

A major strength of this study was the availability of representative data from a face-to-face survey which included information about participants' psychological, physical, personal and socio-demographic characteristics. In addition, to our knowledge this is the first study to empirically examine the role of epistemic trust in the direct context of ACEs and PTSD as well as cPTSD in adulthood. While standardized clinical diagnoses are certainly the gold standard, we consider it a strength of the study that the layout of the ITQ allows for potential classification of diagnosis by assessing the specific diagnostic criteria of PTSD and cPTSD according to ICD-11 (52). Nevertheless, the ITQ is a self-report measure that does not resemble the quality of a clinical diagnosis. Moreover, there are potential limitations that should be considered with regard to the study results. While overall quality of the data is high (unbiased general population based data), the cross-sectional study design limits the interpretation of the results in terms of causality. From a developmental perspective, ACEs could have also immediately resulted in disrupted trust and attachments, and therefore, PTSD or cPTSD in childhood, which in turn could have impaired a healthy personality development during late childhood and adolescence. While we examined epistemic trust in relation to personality functioning, we did not include attachment which might offer even further insights on the involved pathways of ACEs and adult psychopathology (43). In addition, we did not conduct separate analyses for different subtypes of ACEs that might yield further insights on the role of a specific type of ACEs—e.g., sexual abuse—in relation to adult psychopathology.

Conclusion

Our results add to the body of evidence demonstrating the mediating effect of personality functioning in the association of ACEs and adult psychopathology. Our findings imply that personality functioning might play an important role in developing PTSD and even more importantly cPTSD symptoms in adulthood following ACEs. Theory driven and based on preliminary research in the area of personality research, we included epistemic trust as a new and potentially relevant element for this association, showing that epistemic trust had indeed a predictive influence on a persons' level of personality functioning. This knowledge helps us to better understand the underlying pathways resulting in psychopathology following ACEs but also might inform psychotherapeutic treatment

planning by considering and addressing the interfering role of e.g., epistemic mistrust within the therapeutic relationship.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Medical Faculty of the University of Leipzig (474/20-ek). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

HK, DR, JK, AL, and TN participated in the research design. PF offered the conceptual framework of the epistemic trust construct. EB collected the data. DR conducted the formal statistical analyses. JK and AL supervised the study. HK and DR wrote the original draft of the manuscript. NH, LK, TN, and SZ

contributed to the writing of the manuscript. NH, EB, CS, JK, AL, SG, PF, TN, LK, and SZ reviewed and edited the manuscript. All authors approved the final version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Childhood maltreatment, depression and their link to adult economic burdens

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Background: Adult depression is a common consequence of adverse childhood experiences. There is also a higher likelihood of being affected by economic burdens after having experienced a traumatic event in childhood. As depression has been associated with economic burden, these long-term sequelae of childhood adversity are likely to interact.

Goals: We investigated depression and economic consequences, such as unemployment, lower level of education, lower income as long-term sequelae of adverse childhood experiences in adulthood and their interaction.

Methods: Childhood Maltreatment was measured by the German version of the Adverse Childhood Experience (ACE) questionnaire. Depression was measured by the Patient Health Questionnaire (PHQ-2). Logistic regressions were applied to investigate the risks of suffering economic burdens, with depression as a moderator.

Results: Depressive symptoms increased with the number of ACEs and were highest in those reporting four or more ACEs, especially amongst those who experienced sexual and emotional abuse, as well as neglect. Moderation analysis showed a significant effect of depression increasing almost all economic burdens. Migration background additionally increased the risk of unemployment and working in a blue-collar job. Female gender decreased the risk of unemployment and working in a blue-collar job, but increased the risk of low income and part-time employment.

Conclusion: The moderation effect of depression increased the negative impact of exposure to multiple ACEs on economic life in adulthood. Prevention of ACEs and early intervention are needed to prevent the mental health and economic consequences.

KEYWORDS

adverse childhood experiences (ACE), depression, economic burdens, poverty, unemployment, education

Introduction

Adverse Childhood Experiences (ACEs) are a common phenomenon. In representative studies up to 43.7% of respondents of the German population reported having experienced at least one adverse childhood experience, which includes emotional, physical and sexual abuse, as well as neglect and household dysfunction, such as domestic violence and drug abuse (1). Most respondents who have experienced an adverse event in their childhood have also been exposed to at least another adverse event, with 8.9% reporting at least four or more ACEs (1). Studies repeatedly showed that having experienced one ACE increased the risk of experiencing another one. For example, Clemens et al. (2) reported that having witnessed domestic violence increased the risks of sexual abuse by 4.4 times, of emotional neglect 6.5 times, of physical abuse 8.8 times, and the risk of physical neglect even by 10.3 times. In another study, Clemens et al. (3) found that having grown up in a family with mental illness or substance abuse history increased the risk of child maltreatment 5.07–5.63 times and the risk of physical abuse by 6.81 times as well as the risk of physical neglect by 6.91 times.

Additionally, studies have also found strong associations between the occurrence of ACEs and negative psychological, emotional, social, health and economic outcomes (1, 4–8). Adverse events in childhood have been consistently identified as risk factors for depression in the past decades (3, 9–11). Being exposed to any ACE increased the likelihood of experiencing depression by almost three (12) to four (1) times. A cumulative experience of multiple ACEs lead to stronger associations, increasing the ratios for depression up to OR = 7.8 (95% confidence interval: [5.45; 11.13]) (1). Furthermore, having experienced traumatic experiences in childhood has been associated with higher risks of anxiety, negative repetitive thinking, dysfunctional metacognitive beliefs, stress systems dysregulations, as well as advanced biological aging (13–16).

According to stress sensitization theory, having experienced adversity in childhood can reduce a person's coping ability in stressful times, leading to greater reactivity and more depressive reactions compared to people who did not experience such events (17). This may lead to a so called “ripple effect” from early consequences of childhood trauma, such as, for example, an increased risk of lower educational achievement due to increased stress and/or mental health issues, to a decrease in one's economic productivity in later adult life. This includes increased unemployment, reduced working hours, working lower paid jobs, or permanent sick leave and may contribute to negative economic long-term consequences and lower social class membership (3, 4, 6, 18–22). More studies described a “greater risk of sickness absence, having less assets, requiring income related support, experiencing financial insecurity and belonging to lower social class (odds ratios ranged from 1.73 to 2.98)” [(23), p. 129]. Fergusson et al. (24) also showed that lower gross income and welfare dependency were significantly

associated with childhood sexual abuse, though the effect on income became insignificant when covariates were added. This effect remained significant among women, maybe because they are more likely to experience sexual abuse than men (22). Thus, gender seems to play a significant role in the manifestation of economic burdens for people with childhood trauma. For example, even after controlling for family SES and other variables, a significant negative effect of abuse on employment emerges, but only for women (20). Additionally, it has been observed that women in particular face a greater risk of suffering from economic stress later in life following a variety of ACEs (6). Physical maltreatment of women was significantly associated with reduced SES (25, 26). In contrast, in another study, men reported lower income and working hours following severe physical abuse in childhood; the effect was not significant for women (27).

In addition to these personal economic consequences following the experience of childhood maltreatment, researchers also began to evaluate the overall average economic lifetime costs of nonfatal childhood trauma and maltreatment in terms of medical costs, productivity losses and even in criminal justice costs. Fang et al. (28), for example, estimated total costs of all childhood trauma victims in the US as approximately \$124 billion in 2008. Peterson et al. (29) updated these estimates from \$210,012 to around \$830,928 per non-fatal child maltreatment victim across their lifetimes, which raises the total costs of all non-fatal maltreatment cases to \$428 billion. For Germany, the estimates of the same year ranged between 11.1 and 28.8 billion Euros (30).

As most of the current research is on non-German samples, this study aims to add to the growing research on the association between adverse childhood experiences and negative economic (as well as academic) outcomes in later life for Germany to understand better this complex interplay and to potentially aid in finding solutions to this big social, mental health and economic issue for a considerable part of the German population. We hypothesize, based on existing research, that ACEs negatively affect a person's mental health, increasing the risk of depression. We further hypothesize, that there is also an association between ACEs and economic burdens, such as lower levels of education and unemployment. Finally, due to the abovementioned “ripple effect” ACEs have on depression and depression on economic outcomes, we hypothesize that the associations between ACEs and economic burdens are moderated by depression. Finally, we assume gender effects regarding the negative psychological and economic outcomes.

Materials and methods

Data

A nationwide representative survey conducted by the independent institute for polling and social research (USUMA

Berlin) was performed between December 2020 and February 2021. In total, 2,519 participants were included. However, we excluded all participants under the age of 25 since, by this time, they have finished their early adulthood stage and typically have become economically independent. This left us with a sample of 2,288 respondents (90.8% of the total sample).

Measures

Sociodemographic information such as age, level of education, occupational status, times of unemployment, current occupation, net household income and migration background were asked of all participants of this study. Additionally, the equivalized income was calculated according to the Organization for Economic Co-operation and Development (OECD) (31). Adverse childhood experiences were surveyed using the German version of the ACE Questionnaire which consists of 10 items that inquire about child maltreatment and problems at home in childhood using yes/no answer categories (4, 32). Depression was measured using the Patient Health Questionnaire-4 (PHQ-4) which includes two items from the PHQ-9 and two items from the General Anxiety Disorder Screener (GAD-7) (33). Study participants were asked to assess how much they were impacted by the symptoms during the past 2 weeks on a 4-point scale ranging from 1 = *not at all* to 4 = *almost every day*. The subscale of PHQ-4 (PHQ-2) exhibits sufficient reliability (Cronbach's alpha = 0.72). In order to estimate the prevalence of depression, we used the validated cut-off value of ≥ 3 (34).

Statistical analysis

First, we examine if we find a cumulative effect among the ACEs on depression by correlating the frequencies of ACEs (0, 1, 2, 3, 4+) with depression (PHQ-2), and with economic burdens [lower level of education, occupational status, blue collar occupation, frequency of unemployment and having an equivalized income of less than 1,126€, which is defined to be the 2020 at-risk-of-poverty threshold in Germany by the German Federal Office of Statistics (35)] using odds ratios. Second, we performed structural equation modeling (SEM) with the same variables as outcomes and added interaction terms to test if depression moderates the associations between ACEs and economic burdens. Before computing the interaction terms, we centered the predictors around their means (36). We then controlled for gender and migration background.

All calculations were performed using the statistical program R (version 4.1.2, packages: psych, naniar, polCA, tidyLPA, tidyverse, lavaan).

Results

Demographics

One thousand ninety-one (47.7%) of the respondents were male with a mean age of 53.3 years ($SD = 16.1$). The full description of the sample can be found in Table 1. One thousand five hundred twenty-nine (66.8%) of the respondents reported having suffered no ACEs, 759 (33.2%) reported at least one. Compared to respondents without ACEs, more participants who reported ACEs had no academic degree (4.4 vs. 1.2%, $p < 0.001$). Furthermore, they had graduated less from secondary school (middle educational level; 39.3 vs. 45.4%, $p = 0.007$) and were less likely to hold a university degree (9.1 vs. 12.7%, $p = 0.013$). Regarding their current occupational status, respondents with ACEs were less likely employed full-time (37.7 vs. 49.0%, $p < 0.001$) but rather part-time employed (14.1 vs. 9.5%, $p = 0.001$) or currently unemployed (9.6 vs. 4.1%, $p < 0.001$) than their counterparts. Additionally, they were also more likely to have been unemployed at least twice (twice: 17.4 vs. 11.4%, $p < 0.001$; three times: 9.0 vs. 5.4%, $p = 0.002$; four times or more: 10.1 vs. 4.4%, $p < 0.001$). Participants with ACEs more frequently reported to be working blue collar jobs than participants without ACEs (26.8 vs. 22.7%, $p = 0.039$) and their mean household income was significantly lower (2,532.5 [$SD = 1,538.3$] vs. 2,859.5 [$SD = 1,569.4$], $p < 0.001$). Respondents with ACEs were more likely to have a migration background (15.5 vs. 9.7%, $p < 0.001$). And finally, they also exhibited significantly more likely symptoms of depression (15.9 vs. 10.3%, $p < 0.001$).

A total of 262 (11.5%) reported to have experienced one ACE, 138 (6.0%) two, 119 (5.2%) three, and 240 (10.5%) four or more ACEs. Emotional abuse was cited the most (363, 15.9%), followed by parental separation or divorce (324, 14.2%), physical abuse (288, 12.6%), substance abuse in the home (285, 12.5%), and emotional neglect (283, 12.4%). Incarceration of a family member (67, 2.9%) and sexual abuse (86, 3.8%) were mentioned least frequently.

Associations between number of ACEs, depression and economic burdens

For individual ACEs, as well as multiple ACEs, we found significant moderate to strong associations with depression, income, level of education, current unemployment, blue collar education and higher risk of unemployment (see Table 2). The associations between the individual ACEs and depression ranged from $OR = 2.80$ (parental separation) to $OR = 6.35$ (sexual abuse). However, the highest associations were found for the cumulation of ACEs (ACE load) on depression. Additionally, no ACEs showed a significantly lower chance of depression ($OR = 0.17$) compared to the occurrence of four or more ACEs ($OR = 10.20$).

TABLE 1 Descriptive overview of social demographics of respondents who reported ACEs and those who did not.

	Sample N = 2,288	With ACE N = 759, 33.2%	No ACE N = 1,529, 66.8%	p-Value
Gender (men)	1,091 (47.7%)	360 (47.4%)	731 (47.8%)	0.900
Age				
25–35	364 (15.9%)	120 (15.8%)	244 (16.0%)	0.976
36–45	399 (17.4%)	134 (17.7%)	265 (17.3%)	0.894
46–55	411 (18.0%)	154 (20.3%)	257 (16.8%)	0.047
56–65	487 (21.3%)	150 (19.7%)	337 (22.1%)	0.230
66–75	390 (17.0%)	125 (16.5%)	265 (17.3%)	0.647
>75	237 (10.4%)	76 (10.0%)	161 (10.5%)	0.757
Education				
Without a degree	52 (2.3%)	33 (4.4%)	19 (1.2%)	0.000
Secondary general school	651 (28.7%)	236 (31.4%)	415 (27.3%)	0.047
Secondary school	984 (43.3%)	295 (39.3%)	689 (45.4%)	0.007
Academic secondary school	318 (14.0%)	118 (15.7%)	200 (13.2%)	0.114
Tertiary education	261 (11.5%)	68 (9.1%)	193 (12.7%)	0.013
Other	4 (0.2%)	1 (0.1%)	3 (0.2%)	1.000
Occupational status				
Full-time employment	1,028 (45.2%)	285 (37.7%)	744 (49.0%)	0.000
Part-time employment	252 (11.1%)	107 (14.1%)	145 (9.5%)	0.001
Unemployed	135 (5.9%)	73 (9.6%)	62 (4.1%)	0.000
Other	860 (37.8%)	292 (38.6%)	568 (37.4%)	0.616
Frequency of unemployment				
0	1,168 (51.7%)	300 (40.2%)	868 (57.6%)	0.000
1	498 (22.1%)	174 (23.3%)	324 (21.2%)	0.337
2	302 (13.4%)	130 (17.4%)	172 (11.4%)	0.000
3	149 (6.6%)	67 (9.0%)	82 (5.4%)	0.002
≥4	140 (6.2%)	75 (10.1%)	65 (4.4%)	0.000
Occupation				
Never been employed	28 (1.2%)	12 (1.6%)	16 (1.1%)	0.360
Blue collar workers	545 (24.1%)	200 (26.8%)	345 (22.7%)	0.039
White collar workers	1,350 (59.6%)	429 (57.4%)	921 (60.7%)	0.147
Civil servants	113 (5.0%)	33 (4.4%)	80 (5.3%)	0.437
Other	228 (10.1%)	73 (9.8%)	155 (10.2%)	0.797
Net household income (in Euro)	2,751.8 (1,566.4)	2,532.5 (1,538.3)	2,859.5 (1,569.4)	0.000
Equalized household income				
≤1,000€	221 (9.9%)	108 (14.6%)	113 (7.5%)	0.000
≤2,000€	1,055 (47.1%)	363 (49.2%)	692 (46.1%)	0.179
≤3,000€	613 (27.3%)	177 (24.0%)	436 (29.0%)	0.014
>3,000€	351 (15.7%)	90 (12.2%)	261 (17.4%)	0.002
Migration background (yes)	267 (11.7%)	118 (15.5%)	149 (9.7%)	0.000
Depression (yes)	166 (7.3%)	120 (15.9%)	46 (3.0%)	0.000

Significant ($p \leq 0.05$) group differences in bold. p-Values were calculated using Pearson's Chi-squared test.
Depression according to PHQ-2 cut-off at ≥ 3 .

Looking at the economic burdens, we found a higher risk of unemployment within the high-risk group of 4+ ACEs (OR = 3.99). Having reported four or more ACEs was also highly

associated with having an equalized income of under 1,126€ and current unemployment (OR = 3.19 and OR = 3.75). For individual ACEs, the ratios ranged between OR = 1.70

TABLE 2 Prevalence of combined adverse childhood experiences (ACEs), odds ratios and 95% confidence intervals for depression, income, education, working hours, occupation, and risk of unemployment.

	Total sample	Depression ^a	Equivalized income ≤1,126€	Lower level of education ^b	Part-time working	Currently unemployed	Blue collar occupation	Higher risk of unemployment ^c
Number of ACEs (N = 2,288)								
0	1,529 (66.8%)	1	1	1	1	1	1	1
1	262 (11.5%)	3.57 [2.14–5.86]	1.56 [1.06–2.26]	0.90 [0.66–1.21]	1.28 [0.83–1.91]	1.55 [0.85–2.66]	0.98 [0.71–1.33]	1.37 [0.90–2.02]
2	138 (6.0%)	4.57 [2.67–8.55]	1.71 [1.03–2.73]	0.80 [0.52–1.19]	2.44 [1.53–3.78]	2.07 [1.01–3.90]	0.85 [0.54–1.30]	1.36 [0.77–2.27]
3	119 (5.2%)	5.74 [3.13–10.13]	2.56 [1.59–4.01]	1.80 [1.22–2.63]	1.38 [0.75–2.36]	2.90 [1.48–5.30]	1.51 [0.99–2.27]	2.02 [1.19–3.28]
≥4	240 (10.5%)	10.20 [86.73–15.55]	3.19 [2.27–4.44]	1.68 [1.26–2.23]	1.52 [1.00–2.25]	3.75 [2.37–5.83]	1.72 [1.28–2.31]	3.99 [2.87–5.52]
ACEs (N = 2,288)								
Emotional abuse	363 (15.9%)	5.21 [3.74–7.25]	2.45 [1.85–3.23]	1.72 [1.35–2.17]	1.39 [0.99–1.92]	2.87 [1.95–4.16]	1.66 [1.30–1.12]	2.81 [2.11–3.71]
Physical abuse	288 (12.6%)	4.53 [3.19–6.39]	3.07 [2.28–4.10]	2.13 [1.65–2.75]	0.97 [0.64–1.42]	3.48 [2.34–5.10]	2.12 [1.62–2.75]	2.56 [1.87–3.46]
Sexual abuse	86 (3.8%)	6.35 [3.82–10.28]	2.61 [1.55–4.25]	1.88 [1.20–2.92]	1.60 [0.85–2.81]	1.95 [0.89–3.80]	0.80 [0.45–1.35]	2.83 [1.70–4.57]
Emotional neglect	283 (12.4%)	5.27 [3.73–7.42]	2.40 [1.76–3.24]	1.28 [0.98–1.67]	1.07 [0.71–1.56]	2.44 [1.59–3.67]	1.47 [1.11–1.93]	2.15 [1.56–2.94]
Physical neglect	107 (4.7%)	4.94 [3.04–7.82]	2.83 [1.67–4.05]	2.19 [1.47–3.25]	1.13 [0.59–1.98]	2.34 [1.22–4.16]	1.80 [1.18–2.69]	3.35 [2.15–5.12]
Parental separation/divorce	324 (14.2%)	2.80 [1.94–3.97]	1.77 [1.30–2.39]	0.84 [0.64–1.10]	1.75 [1.25–2.41]	1.98 [1.28–2.96]	0.99 [0.75–1.31]	2.03 [1.49–2.75]
Witnessing domestic abuse	150 (6.6%)	4.03 [2.59–6.13]	2.72 [1.84–3.97]	1.92 [1.36–2.69]	1.18 [0.70–1.91]	3.49 [2.12–5.55]	1.71 [1.19–2.43]	2.58 [1.72–3.78]
Case of addiction in household	285 (12.5%)	3.68 [2.56–5.23]	2.14 [1.56–2.91]	1.46 [1.12–1.89]	1.84 [1.30–2.57]	3.27 [2.19–4.82]	1.15 [0.86–1.52]	3.10 [2.29–4.17]
Mental illness in household	179 (7.8%)	3.39 [2.21–5.10]	1.70 [1.13–2.49]	0.84 [0.59–1.18]	1.35 [0.84–2.07]	1.64 [0.92–2.76]	0.83 [0.56–1.20]	2.07 [1.40–3.00]
Incarceration of family member	67 (2.9%)	6.03 [3.40–10.32]	3.45 [2.02–5.75]	2.00 [1.21–3.28]	2.01 [1.03–3.63]	3.73 [1.85–6.92]	1.39 [0.80–2.34]	4.45 [2.62–7.40]

Significant ($p \leq 0.05$) odds ratios in bold.^aDepression according to PHQ-2 cut-off at ≥ 3 .^bLower level of education includes graduates from secondary general school (Volks- and Hauptschule).^cHigher risk of unemployment contains those respondents who were unemployed for at least three times.

(mental illness in household) and OR = 3.45 (incarceration of family member) for the equivalized income of under 1,126€ and between OR = 1.98 (parental separation or divorce) and OR = 3.73 (incarceration of family member) for current unemployment. Working a part-time job was associated with the incarceration of a family member (OR = 2.01), parental separation or divorce (OR = 1.75) and drug or alcohol abuse in household (OR = 1.84).

Cumulative effect of ACEs on depression and economic burdens

When put in linear structural equation models, we find significant associations between depression and all economic burdens, except for low level of education and part-time working (see Tables 3, 4). The coefficients ranged from $B = 0.017$ ($p = 0.031$, [0.002–0.032]) for working a blue-collar job

TABLE 3 Results of the structural equation models for low income, low level of education and part-time working with 95% confidence intervals.

	Low income (<i>N</i> = 2,232)				Low level of education ^a (<i>N</i> = 2,261)				Part-time working (<i>N</i> = 2,267)			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	<i>CFI</i> = 1.000		<i>CFI</i> = 0.992		<i>CFI</i> = 1.000		<i>CFI</i> = 0.990		<i>CFI</i> = 1.000		<i>CFI</i> = 0.994	
	<i>TLI</i> = 1.000		<i>TLI</i> = 0.945		<i>TLI</i> = 1.000		<i>TLI</i> = 0.933		<i>TLI</i> = 1.000		<i>TLI</i> = 0.960	
	<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.029		<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.028		<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.024	
	<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.008		<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.008		<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.007	
	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value
Number of ACEs												
1 ACE	0.176 (0.055)	0.090	0.033 (0.031)	0.145	−0.024 (−0.017)	0.429	−0.025 (−0.018)	0.410	0.021 (0.021)	0.331	0.024 (0.024)	0.245
	[−0.027 to 0.380]		[−0.012 to 0.078]		[−0.084 to 0.036]		[−0.085 to 0.035]		[−0.021 to 0.062]		[−0.017 to 0.065]	
2 ACEs	0.167 (0.038)	0.227	0.027 (0.018)	0.384	−0.056 (−0.029)	0.173	−0.059 (−0.031)	0.153	0.106 (0.080)	0.000	0.111 (0.084)	0.000
	[−0.104 to 0.437]		[−0.034 to 0.088]		[−0.136 to 0.025]		[−0.139 to 0.022]		[0.050 to 0.161]		[0.056 to 0.165]	
3 ACEs	0.408 (0.089)	0.003	0.092 (0.059)	0.005	0.123 (0.061)	0.005	0.119 (0.059)	0.006	0.025 (0.018)	0.405	0.034 (0.024)	0.246
	[0.138 to 0.677]		[0.028 to 0.156]		[0.038 to 0.208]		[0.034 to 0.204]		[−0.034 to 0.084]		[−0.024 to 0.092]	
4+ ACEs	0.476 (0.141)	0.000	0.108 (0.096)	0.000	0.102 (0.069)	0.002	0.097 (0.066)	0.004	0.034 (0.033)	0.143	0.028 (0.028)	0.213
	[0.272 to 0.679]		[0.058 to 0.158]		[0.037 to 0.168]		[0.031 to 0.163]		[−0.011 to 0.079]		[−0.016 to 0.073]	
Depression	0.135 (0.154)	0.000	0.034 (0.116)	0.000	0.009 (0.023)	0.309	0.009 (0.024)	0.284	0.006 (0.024)	0.293	0.004 (0.014)	0.539
	[0.084 to 0.185]		[0.021 to 0.047]		[−0.008 to 0.026]		[−0.008 to 0.026]		[−0.005 to 0.018]		[−0.008 to 0.015]	
Moderation												
Depression × 1	0.065 (0.020)	0.000	0.017 (0.015)	0.004	0.004 (0.003)	0.314	0.005 [−0.004 to	0.290	0.003 (0.003)	0.299	0.002 (0.002)	0.540
ACE	[0.035 to 0.095]		[0.009 to 0.024]		[−0.004 to 0.013]		0.013]		[−0.003 to 0.009]		[−0.004 to 0.008]	
Depression × 2	0.094 (0.022)	0.000	0.024 (0.016)	0.006	0.006 (0.003)	0.314	0.006 [−0.005 to	0.289	0.004 (0.003)	0.299	0.003 (0.002)	0.540
ACEs	[0.053 to 0.135]		[0.013 to 0.035]		[−0.006 to 0.018]		0.018]		[−0.004 to 0.013]		[−0.006 to 0.011]	
Depression × 3	0.110 (0.024)	0.000	0.028 (0.018)	0.006	0.007 (0.003)	0.313	0.007 [−0.006 to	0.288	0.005 (0.004)	0.298	0.003 (0.002)	0.540
ACEs	[0.063 to 0.157]		[0.015 to 0.041]		[−0.007 to 0.021]		0.021]		[−0.004 to 0.015]		[−0.006 to 0.012]	
Depression × 4+	0.174 (0.052)	0.000	0.044 (0.039)	0.009	0.011 (0.008)	0.310	0.012 [−0.010 to	0.285	0.008 (0.008)	0.294	0.005 (0.004)	0.539
ACEs	[0.107 to 0.240]		[0.027 to 0.061]		[−0.010 to 0.033]		0.033]		[−0.007 to 0.023]		[−0.010 to 0.019]	
Total effect of ACEs moderated by depression												
Depression × 1	0.241 (0.075)	0.021	0.050 (0.046)	0.023	−0.020 (−0.014)	0.512	−0.021 [−0.080 to	0.496	0.024 (0.024)	0.257	0.026 (0.026)	0.207
ACE	[0.037 to 0.446]		[0.005 to 0.095]		[−0.079 to 0.039]		0.039]		[−0.017 to 0.065]		[−0.014 to 0.066]	
Depression × 2	0.261 (0.060)	0.060	0.051 (0.035)	0.031	−0.050 (−0.026)	0.220	−0.052 [−0.132 to	0.198	0.110 (0.083)	0.000	0.113 (0.085)	0.000
ACEs	[−0.011 to 0.532]		[−0.010 to 0.111]		[−0.129 to 0.030]		0.027]		[0.055 to 0.165]		[0.059 to 0.167]	

(Continued)

TABLE 3 Continued

	Low income ($N = 2,232$)				Low level of education ^a ($N = 2,261$)				Part-time working ($N = 2,267$)			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	$CFI = 1.000$		$CFI = 0.992$		$CFI = 1.000$		$CFI = 0.990$		$CFI = 1.000$		$CFI = 0.994$	
	$TLI = 1.000$		$TLI = 0.945$		$TLI = 1.000$		$TLI = 0.933$		$TLI = 1.000$		$TLI = 0.960$	
	$RMSEA = 0.000$		$RMSEA = 0.029$		$RMSEA = 0.000$		$RMSEA = 0.028$		$RMSEA = 0.000$		$RMSEA = 0.024$	
	$SRMR = 0.000$		$SRMR = 0.008$		$SRMR = 0.000$		$SRMR = 0.008$		$SRMR = 0.000$		$SRMR = 0.007$	
	<i>Coef.</i>	<i>p-Value</i>	<i>Coef.</i>	<i>p-Value</i>	<i>Coef.</i>	<i>p-Value</i>	<i>Coef.</i>	<i>p-Value</i>	<i>Coef.</i>	<i>p-Value</i>	<i>Coef.</i>	<i>p-Value</i>
Depression \times 3	0.518 (0.113)	0.000	0.120 (0.077)	0.032	0.130 (0.064)	0.002	0.126	0.003	0.030 (0.021)	0.311	0.037 (0.026)	0.202
ACEs	[0.252 to 0.783]		[0.056 to 0.183]		[0.046 to 0.214]		[0.042 to 0.210]		[−0.028 to 0.089]		[−0.020 to 0.094]	
Depression \times 4+	0.649 (0.193)	0.000	0.152 (0.134)	0.024	0.114 (0.077)	0.000	0.109	0.001	0.042 (0.041)	0.055	0.033 (0.032)	0.126
ACEs	[0.456 to 0.842]		[0.105 to 0.199]		[0.052 to 0.175]		[0.047 to 0.171]		[−0.001 to 0.084]		[−0.009 to 0.075]	
Control variables												
Gender (Ref.: Men)			0.026 (0.038)	0.068			−0.015 (−0.016)	0.433			0.133 (0.211)	0.000
			[−0.002 to 0.054]				[−0.052 to 0.022]				[0.108–0.158]	
Migration			0.114 (0.106)	0.000			0.047 (0.033)	0.114			−0.003 (−0.004)	0.864
background			[0.070 to 0.157]				[−0.011 to 0.105]				[−0.043 to 0.036]	

Significant ($p \leq 0.05$) coefficients in bold.

Standardized coefficient and 95% confidence interval in brackets.

^aLower level of education includes graduated from secondary general school (Volks- and Hauptschule).

TABLE 4 Results of the structural equation models for current unemployment, blue collar employment and higher risk of unemployment with 95% confidence intervals.

	Currently unemployed (<i>N</i> = 2,267)				Blue collar job (<i>N</i> = 2,255)				Higher risk of unemployment ^a (<i>N</i> = 2,249)			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	<i>CFI</i> = 1.000		<i>CFI</i> = 0.994		<i>CFI</i> = 1.000		<i>CFI</i> = 0.994		<i>CFI</i> = 1.000		<i>CFI</i> = 0.991	
	<i>TLI</i> = 1.000		<i>TLI</i> = 0.959		<i>TLI</i> = 1.000		<i>TLI</i> = 0.959		<i>TLI</i> = 1.000		<i>TLI</i> = 0.942	
	<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.024		<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.029		<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.029	
	<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.007		<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.008		<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.008	
	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value
Number of ACEs												
1 ACE	0.006 (0.008)	0.712	0.005 (0.006)	0.771	−0.011 (−0.008)	0.715	−0.019 (−0.014)	0.495	0.016 (0.015)	0.478	0.015 (0.014)	0.494
	[−0.025 to 0.037]		[−0.026 to 0.035]		[−0.067 to 0.046]		[−0.072 to 0.035]		[−0.028 to 0.060]		[−0.028 to 0.059]	
2 ACEs	0.019 (0.019)	0.367	0.016 (0.016)	0.438	−0.032 (−0.018)	0.410	−0.043 (−0.024)	0.239	0.008 (0.006)	0.793	0.004 (0.003)	0.897
	[−0.022 to 0.060]		[−0.025 to 0.057]		[−0.108 to 0.044]		[−0.115 to 0.029]		[−0.051 to 0.066]		[−0.054 to 0.062]	
3 ACEs	0.044 (0.042)	0.049	0.040 (0.037)	0.078	0.073 (0.038)	0.078	0.050 (0.026)	0.204	0.056 (0.037)	0.079	0.050 (0.033)	0.115
	[0.000 to 0.088]		[−0.004 to 0.083]		[−0.008 to 0.154]		[−0.027 to 0.126]		[−0.006 to 0.118]		[−0.012 to 0.112]	
4+ ACEs	0.058 (0.076)	0.001	0.055 (0.072)	0.001	0.097 (0.069)	0.002	0.103 (0.074)	0.001	0.165 (0.151)	0.000	0.155 (0.142)	0.000
	[0.025 to 0.091]		[0.022 to 0.089]		[0.035 to 0.159]		[0.044 to 0.162]		[0.117 to 0.212]		[0.107 to 0.203]	
Depression	0.031 (0.155)	0.000	0.032 (0.159)	0.000	0.010 (0.029)	0.203	0.017 (0.046)	0.031	0.030 (0.107)	0.000	0.031 (0.109)	0.000
	[0.023 to 0.040]		[0.023 to 0.041]		[−0.006 to 0.026]		[0.002 to 0.032]		[0.018 to 0.043]		[0.019 to 0.043]	
Moderation												
Depression × 1	0.016 (0.021)	0.000	0.016 (0.022)	0.000	0.005 (0.004)	0.211	0.008 (0.006) [0.000	0.040	0.015 (0.015)	0.000	0.016 (0.015)	0.000
ACE	[0.009 to 0.022]		[0.010 to 0.022]		[−0.003 to 0.013]		to 0.016]		[0.008 to 0.023]		[0.008 to 0.023]	
Depression × 2	0.022 (0.022)	0.000	0.022 (0.022)	0.000	0.007 (0.004)	0.211	0.011 (0.006)	0.040	0.021 (0.015)	0.000	0.022 (0.015)	0.000
ACEs	[0.013 to 0.030]		[0.014 to 0.031]		[−0.004 to 0.018]		[0.001 to 0.022]		[0.011 to 0.032]		[0.011 to 0.032]	

(Continued)

TABLE 4 Continued

	Currently unemployed (<i>N</i> = 2,267)				Blue collar job (<i>N</i> = 2,255)				Higher risk of unemployment ^a (<i>N</i> = 2,249)			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	<i>CFI</i> = 1.000		<i>CFI</i> = 0.994		<i>CFI</i> = 1.000		<i>CFI</i> = 0.994		<i>CFI</i> = 1.000		<i>CFI</i> = 0.991	
	<i>TLI</i> = 1.000		<i>TLI</i> = 0.959		<i>TLI</i> = 1.000		<i>TLI</i> = 0.959		<i>TLI</i> = 1.000		<i>TLI</i> = 0.942	
	<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.024		<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.029		<i>RMSEA</i> = 0.000		<i>RMSEA</i> = 0.029	
	<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.007		<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.008		<i>SRMR</i> = 0.000		<i>SRMR</i> = 0.008	
	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value	<i>Coef.</i>	<i>p</i> -Value
Depression × 3	0.025 (0.024)	0.000	0.026 (0.024)	0.000	0.008 (0.004)	0.209	0.014 (0.007)	0.038	0.025 (0.016)	0.000	0.025 (0.017)	0.000
ACEs	[0.016 to 0.034]		[0.016 to 0.035]		[−0.005 to 0.022]		[0.001 to 0.026]		[0.013 to 0.036]		[0.013 to 0.037]	
Depression × 4+	0.039 (0.051)	0.000	0.040 (0.052)	0.000	0.013 (0.009)	0.205	0.021 (0.015)	0.032	0.039 (0.035)	0.000	0.039 (0.036)	0.000
ACEs	[0.027 to 0.051]		[0.028 to 0.052]		[−0.007 to 0.034]		[0.002 to 0.040]		[0.022 to 0.055]		[0.023 to 0.055]	
Total Effect of ACEs moderated by depression												
Depression × 1	0.021 (0.029)	0.172	0.021 (0.028)	0.189	−0.005 (−0.004)	0.850	−0.010 (−0.008)	0.701	0.031 (0.030)	0.160	0.031 (0.029)	0.165
ACE	[−0.009 to 0.052]		[−0.010 to 0.051]		[−0.062 to 0.051]		[−0.064 to 0.043]		[−0.012 to 0.075]		[−0.013 to 0.074]	
Depression × 2	0.041 (0.041)	0.052	0.038 (0.039)	0.066	−0.025 (−0.014)	0.517	−0.032 (−0.018)	0.382	0.029 (0.021)	0.325	0.025 (0.018)	0.389
ACEs	[−0.000 to 0.082]		[−0.002 to 0.079]		[−0.100 to 0.050]		[−0.103 to 0.039]		[−0.029 to 0.087]		[−0.032 to 0.083]	
Depression × 3	0.069 (0.065)	0.002	0.065 (0.062)	0.003	0.081 (0.042)	0.046	0.063 (0.033)	0.102	0.080 (0.053)	0.011	0.075 (0.050)	0.017
ACEs	[0.025 to 0.113]		[0.022 to 0.109]		[0.001 to 0.161]		[−0.013 to 0.139]		[0.019 to 0.142]		[0.013 to 0.136]	
Depression × 4+	0.097 (0.127)	0.000	0.095 (0.124)	0.000	0.110 (0.079)	0.000	0.124 (0.089)	0.000	0.203 (0.186)	0.000	0.194 (0.178)	0.000
ACEs	[0.065 to 0.129]		[0.063 to 0.127]		[0.051 to 0.168]		[0.068 to 0.180]		[0.158 to 0.248]		[0.149 to 0.239]	
Control variables												
Gender (Ref.: Men)			−0.032 (−0.068)	0.001			−0.278 (−0.325)	0.000			−0.007 (−0.010)	0.610
			[−0.051 to −0.013]				[−0.312 to −0.245]				[−0.034 to 0.020]	
Migration background			0.035 (0.047)	0.022			0.025 (0.019)	0.352			0.081 (0.077)	0.000
			[0.005 to 0.065]				[−0.027 to 0.077]				[0.038 to 0.123]	

Significant ($p \leq 0.05$) coefficients in bold.

Standardized coefficient and 95% confidence interval in brackets.

^aHigher risk of unemployment contains those respondents who were unemployed for at least three times.

to $B = 0.034$ ($p < 0.000$, [0.021–0.047]) for having a low income. Furthermore, both reporting 3 and 4+ ACEs was significantly associated with reporting any economic burden, with an increased effect of 4+ ACEs compared to 3 ACEs. The largest coefficients amongst participants who reported three ACEs were found for low income ($B = 0.092$, $p = 0.005$, [0.028–0.156]) and low level of education ($B = 0.119$, $p = 0.006$, [0.034–0.204]). Working a blue collar or part-time job and experiencing a higher risk of unemployment or being currently unemployed were not significantly associated with reporting three ACEs. The largest coefficients amongst participants who reported four or more ACEs were found for low level of education ($B = 0.097$, $p = 0.004$, [0.031–0.163]), low income ($B = 0.108$, $p < 0.001$, [0.058–0.158]), and higher risk of unemployment ($B = 0.155$, $p < 0.001$, [0.107–0.203]). Only part-time working was not significantly associated with reporting four or more ACEs, but was associated with reporting 2 ACEs ($B = 0.111$, $p < 0.001$, [0.056–0.165]).

The interaction terms between depression and number of ACEs were mostly significant, except for the cases of low level of education and part-time working. We found the largest moderation effects amongst those who reported four or more ACEs, indicating that demonstrating signs of depression amongst this population increased the total effect of number of ACEs by up to $B = 0.044$ (low income, $p = 0.009$, [0.027–0.061]). Additionally, we also found gender effects as well as effects of having a migration background for almost all economic burdens when including gender and migration as control variables. Being a woman decreased the risk of being unemployed ($B = -0.032$, $p = 0.001$, [−0.051 to −0.013]) and working in a blue-collar job ($B = -0.278$, $p < 0.001$, [−0.312 to −0.245]), but increased the risk of working part-time ($B = 0.133$, $p < 0.001$, [0.108–0.158]). Having a migration background increased the risk of being currently unemployed ($B = 0.035$, $p = 0.022$, [0.005–0.065]) and being at greater risk of unemployment in general ($B = 0.081$, $p < 0.001$, [0.038–0.123]), as well as having a lower income ($B = 0.114$, $p < 0.001$, [0.070–0.157]).

Discussion

In this study, we investigated the (co-)occurrence of ACEs and their correlations to negative economic outcomes, such as lower income, lower level of education, type of occupation and unemployment, as well as depression. In total, 33.2% reported at least one ACE, including 10.5% reporting four or more. The most common ACE was emotional abuse, followed by parental separation or divorce. Least common were incarceration of a family member and sexual abuse. These findings were largely in line with other findings of representative studies in Germany, in which the prevalence of child maltreatment ranged from 31.0% (22) to 43.7% (1). The prevalence of adverse childhood experiences mirrored findings from a previous representative cross-sectional study of German samples (1, 2, 37), in which the frequencies for physical and emotional abuse were reported

to be significantly higher and frequencies for sexual abuse were reported significantly lower than those of previous studies (22, 37, 38).

Association with depression and role as moderator

We found that each individual ACE showed a strong association to depression with odds ratios ranging from OR = 2.80 (parental separation) to OR = 6.35 (sexual abuse). These findings were significantly higher than those of, for example, Witt et al. (1), who found (unadjusted) odds ranging from OR = 2.04 (parental separation) to OR = 3.94 (sexual abuse). The relatively high odds for depressive symptoms after experiencing sexual trauma in childhood is a common and widely discussed phenomenon in literature (39, 40). Though, more recent studies conclude, above all, neglect and emotional abuse to have the strongest and the most relevant associations to depression while sexual and physical abuse may be less strongly associated (40). The association between adverse experiences and depression might be result of a higher sensitivity to stress, a heightened emotional vulnerability and engagement with repetitive negative thinking after the experience of adverse events in childhood (13, 14, 16).

We found that having experienced 3 or 4+ ACEs increased the risk for depressive symptoms. This result is in accordance with previous studies indicating an association between cumulative ACEs and negative psychological outcomes (1, 23, 39). Not only were the odds of depression higher amongst those who reported multiple, or more specifically 4+ ACEs, even after controlling for gender and migration background. This might be due to negative metacognitive beliefs resulting from adverse experiences in childhood that are associated with high levels of depression. Researchers have found that a low confidence in one's own memory was associated with low work ability (41). When adjusting in a structural equation model, the significant associations for depression were lowest for working a blue-collar job and highest for being currently unemployed. Depression had no significant association with low level of education and part-time working, indicating that depression, on itself, does not increase the risk of those factors (3).

As for economic burdens and the occurrence of ACEs, we found a generally higher risk of occurrence of economic burdens in one's life the more ACEs the person has experienced, except for people who worked part-time. Respondents who suffered four or more ACEs, for example, were more likely to be at risk of poverty with an equivalized income of under 1,126€ and a blue-collar job. Furthermore, they were also more likely to be currently unemployed and to be at greater risk of unemployment, in general. This mirrors results from previous studies (4, 6, 18–22, 42). Additionally, when investigating the moderating effect of depression, we found that almost all

interaction terms were significantly moderating and increasing the effects of number of ACEs on economic burdens. The largest effects were found amongst those who reported four or more ACEs, further cementing the negative cumulative impact of ACEs on adult economic life. Our findings on the relation of ACEs, depression and economic performance in adult life have serious clinical implications: The importance of the role of depression after having experienced childhood adversities on adulthood economic outcomes, it is crucial to be able to identify possible depressive symptoms early in order to induce psychological intervention, such as, for example, metacognitive psychotherapy (14, 43).

The role of gender and migration background

Finally, the role of gender needs to be addressed. We found a lower likelihood for women to be affected by current unemployment or working a blue-collar job compared to men. Instead, we found that women were more likely to live at risk of poverty with an equivalized income of under 1,126€ and to work part-time jobs. This might be due to gender roles in traditional family constellations where women typically work part-time jobs in addition to caring for children while their husband is typically working full-time. This might also explain the lower income and the insignificant results for part-time working in the structural equation models for ACEs.

Additionally, we have to consider migration background as an important factor when investigating economic burdens. Our analysis showed a significant association between having a migration background and an increased risk of being unemployed or being at risk of poverty. As this analysis showed by the increasing moderation effect of depression, this association might be due to the increased risks of depressive symptoms in those with migration background compared to non-migrants (44–46). However, this discrepancy in depression prevalence has been heavily disputed by contradicting findings from other researchers who found no differences between migrants and German natives [see for example (47, 48)]. Self-attribution of being a migrant might also play a role in demonstrating depressive symptoms (48). It also needs to be mentioned that these economic burdens can also be affected by one's own socioeconomic status as a child: A lower socioeconomic status is not only associated with the prevalence of ACEs, it also affects the likelihood of a person having a lower education and, in turn, work a lower paid job (23, 49, 50).

Strengths and limitations

A strength of this study is the large and representative sample size of 2,288 participants. To measure adverse childhood experiences, we used the well-established ACE questionnaire.

This measure has been discussed because of its reliability (since it's a retrospective self-reporting measure) and bias (23). However, the biggest benefit of using the ACE questionnaire is that it leaves little room for misinterpretation with its binary questions. The possibility of false-negative statements due to suppression or concealment out of shame has also been discussed extensively in the literature [see for example Harft (51)]. Furthermore, it is possible that this sample excludes participants who are at a higher risk of experiencing sexual trauma, as previous studies showed higher rates of sexual abuse (52). And finally, as previous research showed, childhood maltreatment can be “both a cause and consequence of poverty” [(23), p. 122], making it difficult to test for a definite causal relationship, especially with cross-sectional data. In the same vein, a high risk of being unemployed and generally being more vulnerable to unemployment when suffering depression has been widely discussed (53, 54). Though, it might also be plausible that unemployed respondents suffer from depressive symptoms because of their unemployment, as evidence from many studies leads to suggest (55, 56).

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions. The dataset is not publicly available. Requests to access these datasets should be directed at: EB, Elmar.Braehler@medizin.uni-leipzig.de.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Medical Department of the University of Leipzig (Ref. No. 474/20-ek). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

EB, JF, CS, and MB were involved in the study design. JP performed the statistical analysis and wrote the manuscript. A-CS, EB, MB, JF, and CS provided ideas as well as guidance and critical feedback to the final version of the manuscript. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Mediating pathways of neuroticism and social anxiety in the relationship between childhood trauma and the fear of missing out among Chinese college students

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Recent research has identified various risk factors for fear of missing out. However, studies on the potential influence of childhood trauma on the fear of missing out remain scarce, and little is known regarding the mediating mechanisms underlying this relationship. In this study, we examine the predictive role of childhood trauma on the fear of missing out among college students and investigate whether neuroticism and social anxiety mediate the relationship between childhood trauma and the fear of missing out. A sample of 1,266 Chinese college students completed questionnaires regarding childhood trauma, neuroticism, social anxiety, and the fear of missing out. The results indicated that (a) childhood trauma is positively associated with the fear of missing out, (b) both neuroticism and social anxiety mediate the relationship between childhood trauma and the fear of missing out, and (c) neuroticism and social anxiety sequentially mediate the relationship between childhood trauma and the fear of missing out. These findings have crucial implications for the prevention and intervention of the fear of missing out among college students.

KEYWORDS

childhood trauma, neuroticism, social anxiety, fear of missing out, college students

Introduction

Smartphones have become an inseparable part of life (1). More than 36% of people worldwide are smartphone users (Statista: Number of smartphone users worldwide from 2014 to 2020). Further, in China, smartphone users comprise 99.7% of the entire Chinese population. According to the 47th Statistical Report on Internet Development in China,

as of December 2020, smartphone internet users in China reached 989 million. Owing to the increase in the time spent and the frequency of accessing social media through smartphones, users may worry about or fear missing information posted by others as well as responses to their messages. This attribute results in the failure to benefit from social media as well as in negative emotions, such as anxiety and worry. This state of smartphone users is called the fear of missing out (FOMO) (2). Previous studies have demonstrated that a high degree of FOMO among college students has a negative effect on the state of their studies (3, 4). College students with high levels of FOMO can be characterized as those afraid of missing important information. In the long term, such individuals rely excessively on social media and can even develop addictive tendencies. Such tendencies result in adverse effects on the mental health of college students (5). Moreover, distracted driving and higher alcohol consumption, which are unsafe behaviors, may be associated with high levels of FOMO among college students (6, 7).

Recent studies have proven that psychological factors, such as personality traits and psychological needs, are closely related to FOMO (8). High levels of neuroticism and social anxiety have positive predictive effects on the levels of FOMO among college students (9–11). Lifthia reports that FOMO among college students was associated with neuroticism, extraversion, and agreeableness and not with conscientiousness and openness (12). Blackwell finds that neuroticism can predict FOMO, but extraversion cannot (8). Sabah believes that high levels of neuroticism among individuals have positive predictive effects on their FOMO (9). Jiang reports that neuroticism, extraversion, and conscientiousness have significant associations with FOMO, whereas agreeableness and openness do not (13). It seems that neuroticism is more strongly associated with FOMO than other personality dimensions; thus, we focus on neuroticism. Moreover, individuals suffering from social anxiety are susceptible to problems in interpersonal relationships and find it significantly difficult to interact directly with people in face-to-face contexts (14, 15). Such individuals use mobile phone calls or text messages to reduce interpersonal anxiety, and this approach provides them with an elevated sense of control over communication (14). If their feelings of anxiety are not regulated, such individuals will spend additional time on their phones and become dependent. Additionally, individuals that overuse mobile phones have a higher sense of social isolation (16). Notably, a positive correlation exists between social anxiety and smartphone overuse (17). Social anxiety mediates the relationship between anxiety and smartphone addiction (11). Further, significant positive correlations exist among neuroticism, social anxiety, and FOMO (11).

Childhood trauma results from acts of abuse or neglect, often committed by parents or caregivers, and are likely to “harm or threaten a child” (18). Child abuse involves various types of physical, emotional, and sexual abuse as well as physical and emotional neglect. According to a worldwide meta-analysis of randomized controlled trials associated with the prevention of child maltreatment, the prevalence levels of sexual abuse, physical neglect, emotional neglect, physical abuse, and emotional abuse were estimated at 12.7, 16.3, 18.4, 22.6, and 36.3%, respectively (19). According to other studies on childhood experiences and trauma, 45.5% of Chinese college students reported unpleasant childhood experiences (20). People who experience emotional trauma exhibit tendencies of hopelessness, low self-esteem, reduced feelings of social support, and poor satisfaction with life (21). Bock et al. find that young people with trauma are more likely to develop negative emotions, though they did not distinguish among the types of trauma in their study (22). This suggests that such individuals may find it challenging to identify and express their emotions, which can result in interpersonal problems among individuals who have experienced emotional or physical trauma. Meanwhile, the versatility, portability, and timeliness of mobile phone-based communication can satisfy these individuals’ need for communication with their peers (23), resulting in their excessive reliance on social media, which may further contribute to their FOMO. Moreover, recent studies have demonstrated that although mobile phone addiction is associated with FOMO, emotional abuse and emotional neglect during childhood are associated with addiction to the Internet (24), and physical and emotional neglect have a prominent positive predictive effect on mobile phone addiction (25). Such studies show that both physical and emotional trauma can predict problematic usage of the Internet or phones, indicating that a relationship between childhood trauma and FOMO may exist. To the best of our knowledge, studies that investigate the exact relationship between these factors are yet to be conducted.

Various studies have established that childhood trauma among college students is significantly and positively correlated with social anxiety (10, 26). It is well known that childhood trauma has a significant impact on personality (22, 26, 27). People who experience childhood trauma tend to exhibit neuroticism (28–32), and individuals with neurotic personalities are highly prone to social anxiety (19). However, the relationship between childhood trauma and FOMO as well as the role of neuroticism and social anxiety with regard to childhood trauma and FOMO are yet to be clarified.

In this study, we hypothesize that (a) childhood trauma is positively correlated with FOMO, (b) neuroticism and social anxiety play mediating roles between childhood trauma and FOMO, and (c) neuroticism and social anxiety moderate the relationship between childhood trauma and FOMO sequentially.

Abbreviations: FOMO, fear of missing out; CTQ-SF, Chinese version of the Childhood Trauma Questionnaire; IAS, Interaction Anxiousness Scale; BFI, Big Five Inventory.

Materials and methods

Participants and procedures

We conducted a cross-sectional study through an online survey between July 25 and August 1, 2021. For this survey, we randomly selected one campus among the eight campuses of Shandong University, after which we selected 24 classes on this campus through the random sampling method. To facilitate unified management, all of the selected classes had class-specific WeChat groups, which included all of the enrolled undergraduate students. All of the participants provided informed consent online, and they were informed about the purpose of the study in accordance with Chinese legislation. The study was approved by the Ethics Committee of the School of Basic Medical Sciences of Shandong University [No. ECSBMSSDU 2021-1-096].

The applet with the questionnaires, including the Social Media FOMO Scale, the brief version of the Childhood Trauma Questionnaire, the Interaction Anxiousness Scale, and the Big Five Inventory, was delivered to the undergraduates in their WeChat groups. The participants who volunteered to take the online survey and completed the questionnaire received compensation for research assistance. A total of 1,400 questionnaires were sent out, and 1,266 questionnaires were valid. Among them, 540 (42.7%) were completed by males, and 726 (57.3%) were completed by females.

Measures

Fear of missing out

The Social Media FOMO Scale (Chinese version) compiled by Zhao et al. (33) was used to measure FOMO levels. The questionnaire comprises 17 items measuring four dimensions: psychological motivation, cognitive motivation, behavioral performance, and emotional dependence. The items were rated using a 5-point Likert scale (1 = disagree completely, 5 = completely agree). The higher the total score, the higher levels of the FOMO. The internal consistency coefficient of the questionnaire used in this study was 0.979.

Childhood trauma

The brief Chinese version of the Childhood Trauma Questionnaire (CTQ-SF) compiled by Zhao et al. (34) was used to evaluate individuals' childhood trauma experiences. The scale comprises 28 items, including 25 clinical and three validity items. This scale is divided into five subscales: emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. The entire scale was used to analyze trauma level in the present study. Fu and Yao (35) verified the reliability and validity of the scale using college students as the subjects; the results showed that the scale had good reliability and validity,

and it had specific applicability in the context of Chinese cultural backgrounds. In this study, the internal consistency coefficient of the questionnaire was 0.856.

Social anxiety

The Chinese version of the Interaction Anxiousness Scale (IAS) (36, 37) was used to determine levels of social anxiety. The scale comprises 15 items rated using a 5-point scale (1 = disagree completely, 5 = completely agree). Higher scores indicated higher levels of social anxiety. The scale has a satisfactory measurement index and is suitable for Chinese college students. In this study, the internal consistency coefficient of the questionnaire was 0.969.

Personality

The Chinese version of the Big Five Inventory (BFI) (38–40) was used to evaluate the personality traits of college students. The scale comprises 60 items, including five dimensions: neuroticism, extraversion, openness, conscientiousness, and agreeableness. The scale was rated using a 5-point scale (1 = disagree completely, 5 = completely agree). Only neuroticism was analyzed in the present study. The coefficients of internal consistency for each sub-questionnaire used in this study were 0.757, 0.761, 0.698, 0.862, and 0.976.

Results

Correlation between childhood trauma, neurotic personality, social anxiety, and the fear of missing out

Pearson correlations between the variables are shown in [Table 1](#). First, childhood trauma is positively correlated with neuroticism and social anxiety and negatively correlated with openness, extraversion, agreeableness, and conscientiousness. Second, neuroticism is positively correlated with social anxiety, whereas openness, extraversion, agreeableness, and conscientiousness are negatively correlated. Third, neuroticism, social anxiety, and FOMO demonstrated a positive correlation. In view of the high correlation between neuroticism and social anxiety ($r = 0.913$, $P < 0.01$) and between neuroticism and FOMO ($r = 0.855$, $P < 0.01$), neuroticism is likely more representative than other dimensions in the BFI used in this study, which is consistent with the content related to personality mentioned in the introduction. Therefore, other dimensions are not discussed further.

Stepwise regression analysis

We performed stepwise regression analysis, with FOMO as the dependent variable and childhood trauma, neuroticism,

and social anxiety as the predictive variables. First, only childhood trauma was used as the predictive variable (Model 1). Neuroticism and social anxiety were placed in the second layer (Models 2 and 3). Neuroticism was placed in the second layer, and social anxiety was placed in the third layer (Model 4). The results are listed in [Table 2](#).

In Model 1, childhood trauma significantly predicted FOMO ($\beta = 0.526$, $P < 0.001$). Therefore, Hypothesis (a) was supported. The variables in Model 4 accounted for 78.2% of FOMO, better than the variables in Model 1 (27.6%), Model 2 (73.6%), and Model 3 (76.5%). The performance levels of Models 2, 3, and 4 were confirmed through stepwise regression analysis, but the mediation effect needs to be verified further.

Mediation analysis

Mediating roles of neuroticism and social anxiety in the relationship between childhood trauma and the fear of missing out

We used AMOS24.0 to test the mediating role of neuroticism in the relationship between childhood trauma and FOMO. Bootstrapping was applied to verify the mediation effect, as shown in [Table 3](#). We established that the indirect and direct effects were significant, indicating that the mediation effect was partial rather than complete. Therefore, neuroticism partially mediates the relationship between childhood trauma and FOMO (indirect effect = 0.446, SE = 0.033, 95% CI = [0.409, 0.482]). Mediating effects accounted for 84.79% of the total effect of neuroticism and FOMO.

Similar procedures were conducted to evaluate the mediating role of social anxiety in the relationship between childhood trauma and FOMO. Consequently, social anxiety was found to partially mediate the relationship between childhood trauma and FOMO (indirect effect = 0.413, SE = 0.031, 95% CI = [0.392, 0.473]). The mediation effect accounted for 82.32% of the total effect of social anxiety and FOMO. Therefore, Hypothesis (b) was supported.

Examining the multiple mediation model

As shown in [Figure 1](#) and [Table 3](#), all pathways were significant. The sequential pathway of “childhood trauma → neuroticism → social anxiety → FOMO” was significant (indirect effect = 0.413, SE = 0.030, 95% CI = [0.377, 0.449]). This multiple mediation model accounted for a significant amount of variance regarding FOMO levels among college students (total effect = 0.507). Therefore, Hypothesis (c) was supported.

In conclusion, all three hypotheses were supported; the results are as follows: (a) childhood trauma is positively associated with FOMO, (b) both neuroticism and social anxiety mediate the relationship between childhood trauma and FOMO, and (c) neuroticism and social anxiety sequentially mediate the relationship between childhood trauma and FOMO.

Discussion

In this study, we explored the predictive role of childhood trauma on FOMO and the mediating role of neuroticism and social media in this relationship with a sample of students from a Chinese college. The results showed that childhood trauma positively predicted FOMO, and this relationship was sequentially mediated by neuroticism and social anxiety.

Consistent with our hypotheses, this study showed that neuroticism, a personality trait, plays a mediating role in the relationship between childhood trauma and FOMO among college students. In other words, childhood trauma can be used to predict neuroticism, which, in turn, facilitates FOMO among college students. Therefore, neuroticism is an outcome affected by childhood trauma, and it is also an internal motivation for FOMO. The results of our investigation corroborate the conclusions of previous studies proving the existence of significant positive correlations between childhood trauma and personality traits. Additionally, various types of childhood trauma may have different effects on the development of personality dimensions (19). Moreover, previous studies have demonstrated that childhood trauma is positively associated

TABLE 1 Correlation between childhood trauma, neuroticism, social anxiety, and the fear of missing out (FOMO).

Variables	$\bar{x} \pm SD$	1	2	3	4	5	6	7	8
1 Childhood trauma	37.49 ± 10.21	1							
2 Neuroticism	37.43 ± 16.58	0.550**	1						
3 Openness	44.35 ± 6.64	-0.305**	-0.110**	1					
4 Extraversion	42.78 ± 6.71	-0.265**	-0.019	0.661**	1				
5 Agreeableness	44.23 ± 6.59	-0.316**	-0.158**	0.630**	0.523**	1			
6 Conscientiousness	47.38 ± 7.58	-0.348**	0.010	0.671**	0.622**	0.689**	1		
7 Social anxiety	48.98 ± 17.50	0.526**	0.913**	-0.250**	-0.175**	-0.280**	-0.122**	1	
8 FOMO	53.53 ± 19.75	0.526**	0.855**	-0.125**	0.008	-0.202**	-0.095**	0.871**	1

** $p < 0.01$.

TABLE 2 Results of stepwise regression analysis.

Model	Dependent variable	Predictive variable	β	t	R^2	P
1	FOMO	Constant		8.560		<0.001
		Childhood trauma	0.526	21.984	0.276	<0.001
2	FOMO	Constant		10.607		<0.001
		Childhood trauma	0.080	4.610		<0.001
		Neuroticism	0.811	46.885	0.736	<0.001
3	FOMO	Constant		1.248		0.212
		Childhood trauma	0.093	5.821		<0.001
		Social anxiety	0.822	51.253	0.765	<0.001
4	FOMO	Constant		4.371		<0.001
		Childhood trauma	0.061	3.894		<0.001
		Neuroticism	0.335	10.198		<0.001
		Social anxiety	0.533	16.528	0.782	<0.001

FOMO, fear of missing out.

TABLE 3 Pathways of the mediation model using bootstrapping.

Model	Effect type	Pathway	Effect	95% CI lower	95% CI upper
2	Direct	Childhood trauma→neuroticism	0.550**	0.507	0.591
		Neuroticism→FOMO	0.811***	0.781	0.840
		Childhood trauma→FOMO	0.080**	0.039	0.121
	Indirect	Childhood trauma→neuroticism→FOMO	0.446***	0.409	0.482
3	Direct	Childhood trauma→social anxiety	0.526**	0.479	0.574
		Social anxiety→FOMO	0.822***	0.789	0.851
		Childhood trauma→FOMO	0.093***	0.058	0.130
	Indirect	Childhood trauma→social anxiety→FOMO	0.433***	0.392	0.473
4	Direct	Childhood trauma→neuroticism	0.550**	0.507	0.591
		Neuroticism→social anxiety	0.913**	0.902	0.923
		Social anxiety→FOMO	0.824***	0.791	0.852
		Childhood trauma→FOMO	0.094***	0.058	0.130
	Indirect	Childhood trauma→neuroticism→social anxiety→FOMO	0.413***	0.377	0.449

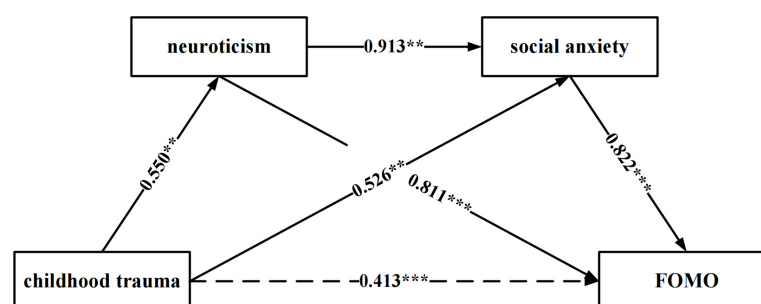
FOMO, fear of missing out. ** $p < 0.01$; *** $p < 0.001$.

FIGURE 1

The multiple mediation model. The link between childhood trauma and FOMO is mediated by neuroticism and social anxiety. Path values are the path coefficients. ** $p < 0.01$; *** $p < 0.001$.

with neuroticism (21), and neuroticism positively affects FOMO (20). In this study, significant positive correlations among childhood trauma, neuroticism, and FOMO were established, corresponding with studies conducted by Kumari and Wan. Additionally, neuroticism is a mediator in the

relationship between childhood trauma and FOMO among college students.

Similarly, social anxiety is an outcome affected by childhood trauma, and it is also an internal motivation for FOMO. Previous studies have proven that children who suffer from

negative childhood experiences often fail to form secure attachments and suffer from high levels of social anxiety throughout adulthood (20). Social anxiety levels can predict FOMO among such individuals (11). In this study, we examined the relationship between childhood trauma, social anxiety, and FOMO simultaneously, and we primarily focused on the mediating role of social anxiety. Consistent with our hypotheses, social anxiety is a mediator in the relationship between childhood trauma and FOMO among college students.

Finally, the results showed that the role of neuroticism and social anxiety in mediating the association between childhood trauma and FOMO among college students is parallel and sequential. Previous studies have reported that social anxiety acts as a mediator between neuroticism and FOMO among teenagers and college students (11). In this study, through the multiple mediation model (Model 4), we further determined a positive correlation between neuroticism and social anxiety, and we established that neuroticism and social anxiety play mediating roles sequentially. Our findings support the notion that childhood trauma affects multiple psychological functions throughout life, including personality traits (41–43). Neurotic individuals often display obvious emotional traits, such as suspicion (44), sensitivity (26), and anger (22), which induce social interaction problems, such as social anxiety. As a result of neuroticism and social anxiety among such individuals, online communication through mobile phone-based social media applications becomes an alternative to face-to-face communication and provides opportunities for improved expression and a heightened sense of communication control (45). In the long run, the communication employed by such individuals through social media replaces offline communication. Moreover, because of their sensitive, neurotic personalities, they pay significant attention to messages, and eventually, their FOMO is manifested.

In conclusion, through a multiple mediation model, this study provides a complex understanding of the way in which childhood trauma affects FOMO. We established three mediating pathways of neuroticism and social anxiety in the relationship between childhood trauma and FOMO among Chinese college students. Moreover, neuroticism and social anxiety sequentially mediate the relationship between childhood trauma and FOMO.

This study has limitations that must be considered when interpreting the results. First, the data were obtained through self-assessment *via* online surveys, which means that some deviations must exist. Through Harman's single-factor test, it can be concluded that the surveys are not significantly affected by the deviation of standard methods. Therefore, further studies using clinical interviews are required to ensure a highly comprehensive assessment. Second, causal reasoning was limited because of the cross-sectional data used in this study. In our future studies, we will use a longitudinal design to evaluate the performance of the multiple mediation model used in this

study. Third, some detailed mechanisms that connect childhood trauma to FOMO remain unclear. Such mechanisms include the shortest path from a specific subtype of trauma to a specific subtype of FOMO.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the School of Basic Medical Sciences of Shandong University (No. ECSBMSSDU 2021-1-096). The patients/participants provided their written informed consent to participate in this study.

Author contributions

JS: conceptualization, data curation, and writing—original draft preparation. WL: conceptualization, formal analysis, and writing—original draft preparation. FP: validation, project administration, and writing—reviewing and editing. CH and JH: investigation. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Adverse childhood experiences growing up in East or West Germany or abroad

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Background: Adverse childhood experiences (ACEs) are potentially traumatic events that occur before the age of 18. The term encompasses various adverse childhood experiences, e.g., physical, psychological, and sexual abuse, physical and psychological neglect, and family dysfunction. Prevalence estimates for a broad spectrum of ACEs against the background of where childhood and adolescence were spent are scarcely available in Germany. This study examines the frequencies of adverse childhood experiences, considering growing up in East or West Germany or abroad and interacting with different age cohorts and gender.

Methods: A total of 5,018 individuals (51.4% female) aged 14 years and older were retrospectively assessed on adverse childhood experiences using questionnaires “adverse childhood experiences” (ACE). Logistic regression models were used to analyze the association between birth cohort, gender, and where a person grew up. Descriptive statistics and univariate analyses were used to calculate frequencies, proportions, and unadjusted associations for each variable.

Results: 37.4% ($N = 1,878$) of respondents reported experiencing at least one form of ACE. Individuals who grew up abroad report significantly more adverse childhood experiences than individuals in East or West Germany. Men and women who grew up in East Germany reported a lower rate of ACEs. We found significant effects for all predictors: Where childhood and adolescence were predominantly spent, year of birth, and gender. Significant differences in the prevalence of adverse childhood experiences within the gender groups were only found for sexual and physical abuse and substance dependence in the household.

Conclusion: The results suggest that the socio-political context plays an essential role in the experience of adverse childhood experiences, both in frequency and risk. Thus, child abuse and neglect studies should increasingly focus on societal risk and protection mechanisms.

KEYWORDS

adverse childhood experiences, immigration, socio-political context, child abuse, child neglect, East and West Germany

Introduction

Adverse childhood experiences (ACE) are potentially traumatic events that occur in the age of 0–17 years and include abuse and neglect and household dysfunction (1). The manifestations of ACEs are manifold and include physical, sexual, or emotional abuse, physical and psychological neglect, and family dysfunction such as domestic violence or separation from a parent. ACEs can negatively impact health and life satisfaction, cause substance use in adulthood, and reduce career opportunities and earning potential (1, 2).

The consequences and effects are diverse: Somatic symptoms, general health status, and mental illnesses are among the consequences of ACEs, as well as social consequences for affected individuals (3). These include chronic pain, musculoskeletal disorders, obesity, diabetes, cancer, and stroke (4–6). ACEs have been associated with mental illnesses such as depression, anxiety, sleep and eating disorders, substance-related disorders, personality disorders, and post-traumatic stress disorder (7). In addition, ACEs are associated with a tenfold increased risk for suicide attempts, alcohol, and drug abuse (8–10). Importantly, persons who have experienced maltreatment during childhood are at higher risk of maltreating their children (11). According to Fox et al. (12), each additional negative experience leads to a >35% likelihood of becoming violent and delinquent in adolescence. International meta-analyses show high prevalence rates of 22.6% (85% CI: 20.3–25.1) for physical abuse, 36.3% (85% CI: 30.2–42.9) for emotional abuse, and 7.6% (85% CI: 6.4–8.5) for sexual abuse of boys and 18.0% (85% CI: 16.9–19.2) of girls worldwide (13). In a national study, 4.3% (95% CI: 3.5–5.1) of respondents reported experiencing childhood sexual abuse. Parental divorce/separation 19.4% (95% CI: 17.7–20.9) and alcohol and drug abuse in the home 16.7% (95% CI: 15.1–18.3) were among the most commonly reported household dysfunction (14). However, it should be noted that prevalence varies internationally (13); this indicates the political-social context.

Quite a few studies deal with a victim-perpetrator reversal and the assumption of transgenerational transmission of trauma, i.e., the transmission of experiences of the members of one generation to the members of a subsequent generation (11). However societal, and legal-preventive structures play an equally crucial role, especially in relation to neglect and emotional abuse. For example, a German study on authoritarianism and the transgenerational transmission of corporal punishment shows that participants who affirmed authoritarian submission were significantly more likely to endorse a slap or spanking (15).

For instance, recent studies show that social policies can increase and decrease child maltreatment rates (16, 17). For example, economic guidelines can reduce household income, which may be associated with increased maltreatment rates (18, 19). Results show that discrimination against women, gender

inequality, and disparities can be associated with adult advocacy to hit a child with an object (severe physical abuse) (17). Conversely, women's positively impacts child development (17, 20, 21). A study by Fiala and LaFree (22) shows that countries that offer women more opportunities, such as tertiary education, have lower rates of child abuse. Gartner (23) also shows that disempowered women can less protect their children from third-party abuse. Policies such as paid parental leave, earned income tax credits, increases in the minimum wage, and more generous welfare benefits have also reduced child maltreatment (24, 25). Limited options thus create more stress and frustration for women, which can impact violence in childrearing.

With its divided past of two different countries but shared history and culture, Germany is an excellent research subject to investigate the consequences of different socio-political environments. The divided past begins with the end of the Second World War in 1945 and the Potsdam Agreement, which was decided in August 1945 to divide Germany into four occupation zones. The three western zones became democratic, and free elections took place. In the Soviet-administered zone, a Soviet-dependent communist dictatorship developed: the GDR (German Democratic Republic). Although per capita income was higher in West Germany than in neighboring East Germany, the economic and societal inequality was higher in West Germany (26). Despite the constitution's stipulation of gender equality, the GDR, in particular, failed to implement it (27). In East Germany, for example, both genders had the same right to work, which was made possible by the government through out-of-home childcare from an early age (28). State differences in the legal framework of child-rearing should also be mentioned; While corporal punishment of children was still considered acceptable in West Germany until 1973, it was banned in East Germany as early as 1949 with the founding of the state (29).

Reunification in 1989 was followed by a period of individualization and autonomy. The remaining social inequalities were relativized, and life forms and lifestyles seemed freely selectable (30). Despite the attempt to equalize living conditions after reunification, there is still a considerable difference between the levels of living in East and West Germany (31).

Studies already show the socio-political context as a determinant of child abuse (32, 33). However, our study also included individuals who did not spend their childhood and adolescence in Germany and was therefore considered a comparison group independent of German history.

The present study aims to shed light on underlying socio-political mechanisms for ACEs by investigating the prevalence of ACEs depending on where most of the childhood (East or West Germany or abroad) was spent. In doing so, this work focuses on the undercurrents of different types of abuse and neglect and other adverse childhood experiences. Furthermore, we are also considering the interaction of different age cohorts and gender.

Materials and methods

The independent Institute for Opinion and Social Research (USUMA, Berlin) conducted the nationwide data collection. A total of two representative samples were examined. The first data collection occurred between February and March 2020, followed by April and June 2020. In addition to sufficient German language skills, a minimum age of 14 years was required for participation. The sample, which was representative of age, gender, education, and region of residence, was selected using the random route method with a default starting address. Using a specific street and house number, every third household was personally contacted by study staff and invited to participate in the study through interviews. In households with more than one person, the selection was made through the Kish selection grid, a random selection of respondents in multi-person households.

Information about the study and consent to participate was obtained from all participants by the interviewers. The study staff first collected sociodemographic information in a personal interview.

Subsequently, the participants were given a questionnaire to be completed independently and returned to the interviewers in a sealed envelope. The interviewers were not in the room but could help with comprehension problems. In the subsequent questionnaire analysis, the previously collected demographic data was linked to the completed questionnaire without names or other identifying information. The study was conducted by the Declaration of Helsinki and approved by the Ethics Committee of the Medical Faculty of Leipzig University.

Sample description

A total of 5,018 people from two representative surveys ($N = 2,503$; $N = 2,515$) were included in the study. 4,935 were over 18 years of age, (N). Participants were on average 49.93 years old [standard deviation (SD) = 17.78] of whom 2,578 (51.4%) were women. A large proportion of respondents reported having grown up predominantly in West Germany 3,711 (74.0%). Study participants who grew up predominantly abroad were underrepresented in this sample, at 5.5%, compared with the general population (proportion of the population with a migration background as of 1.10.2021 26.7%). Detailed information on the sample is presented in [Table 1](#).

Instruments

Sociodemographic data such as age, gender, marital status, employment, and school-leaving qualifications were collected from all participants. In order to record where childhood and adolescence were spent, participants indicated in which country they predominantly grew up or in which federal state

TABLE 1 Sample description.

	Average (SD)
Age (years)	
Male	49.60 (17.58)
Female	50.25 (17.97)
Quantity (valid %)	
Gender	
Male	2,440 (48.6)
Female	2,578 (51.4)
Living with a partner	
Yes	2,182 (43.5)
No	2,823 (56.2)
Nationality	
German	4,831 (96.3)
Not German	184 (3.7)
Highest level of education	
No school-leaving qualification	109 (2.2)
School-leaving qualification	3,440 (68.5)
(Technical) Baccalaureate	830 (16.5)
University/technical college degree	531 (10.6)
Monthly household income	
<1,250 €	635 (12.6)
1,250–2,500 €	2,030 (40.5)
>2,500 €	2,260 (45.0)
Predominantly grown up	
West Germany	3,711 (74.0)
East Germany	1,015 (20.2)
Abroad	276 (5.5)
Age cohorts	
Until 1945	469 (9.3)
1946–1967	1,912 (38.1)
1968–1989	1,778 (35.4)
From 1990	859 (17.1)

(The GDR comprised the territory of the present-day states of Brandenburg, Mecklenburg-Western Pomerania, Saxony, Saxony-Anhalt, and Thuringia).

Various forms of adverse childhood experiences were assessed using the German version of the Adverse Childhood Experiences Questionnaire. The questionnaire comprised 10 items and was first used by Felitti et al. (34). Each item represents one form of ACE: emotional, physical, and sexual abuse, emotional and physical neglect, separation from a parent, violence against the mother, substance dependence in the household, mental illness, and incarceration of a household member. The questions were answered “yes” and “no” on a dichotomous response scale and were for sexual abuse, for example: Did an adult or person at least 5 years older ever touch or fondle you in a sexual way or cause you to touch their body in

a sexual way? Or attempted to have or had oral, anal, or vaginal intercourse with you?"

Statistical analyses

Statistical analyses were performed using R, version 4.1.0 (35) and the dplyr (36), haven (37), and ggplot2 (38) packages and SPSS version 27. Descriptive calculations were used to determine the prevalence rates of each ACE. The Chi-square test was used to compare categorical variables, including demographic and ACE data between groups. Group comparisons were made by gender and ethnicity. We also examined prevalence rates in different age cohorts to account for social phenomena.

A binary logistic regression model was applied to determine independent relationships between gender, origin (West-East Germany or abroad), and age. The reference categories were male sex, predominantly those who grew up in West Germany, and the age cohort born before 1945. A p -value of <0.05 was considered statistically significant.

Results

Frequencies of adverse childhood experiences

Overall, $N = 1,815$ (37.3%) reported at least one ACE, and 493 (5.5%) participants reported experiencing four or more ACEs.

Specifically, 1,533 (30.5%) participants reported experiencing emotional and/or physical and/or sexual abuse, and $N = 903$ (18.0%) reported experiencing emotional and/or physical neglect. Loss of a parent through death or separation was experienced by $N = 949$ (18.9%). Family dysfunction such as domestic violence, substance abuse, or mentally ill persons in the household, as well as whether a family member had been incarcerated, were affirmed by 1,604 (31.9%) participants.

Table 2 provides an overview of the cohorts measured by the number of ACEs experienced. For example, 42 (15.5%) of the predominantly foreign-raised respondents reported having experienced more than four ACEs, significantly more than the comparison group. The trend that foreign-born reported more ACEs runs through all age cohorts, except for the 1968–1989 age cohorts and those born after 1990 who grew up predominantly in East Germany: For example, over half (56.1%) of those who grew up in East Germany and were born in 1968–1989 reported having experienced at least one ACE. In comparison, those who grew abroad report less than half, 43.5%. In the cohort from 1990 onwards, the number of respondents who had at least four adverse childhood experiences was highest, with $N = 15$ (10.8%) of respondents who grew up predominantly in eastern Germany.

Frequencies of adverse childhood experiences in West and East Germany and abroad in gender comparison

The frequencies of the various ACEs in a gender comparison are shown in Table 3. Figure 1 illustrates the differences between West and East Germany and other countries.

Women reported more often adverse childhood experiences than men. Statistically significant differences between men and women were only found in the experience of sexual abuse $\chi^2(1) = 68.80$, $p = < 0.001$, and in the question of whether someone from the household had alcohol problems or used drugs, $\chi^2(1) = 9.45$, $p = < 0.002$.

Separation of parents is the most frequently reported ACE in Germany and the only item that does not register a significant difference between West and East Germany. Differences in gender perception are also evident in the experience of violence against the mother. Male participants report fewer experiences than women, and there are no differences between participants who grew up in West or East Germany or those who spent most of their childhood and youth abroad. The frequency of experiences of violence against the mother is higher among women who grew up abroad than among the female comparison groups $\chi^2(2) = 12.74$, $p = < 0.002$.

Frequencies of adverse childhood experiences in West and East Germany and abroad in the different age cohorts

Table 4 shows differences between the various age cohorts. The age cohort born up to 1945 represents the war generation of the Second World War, which ended on September 2nd, 1945. The second cohort, 1946–1967, is considered the post-war generation. Also significant is the founding of the GDR on October 7th, 1949. The third cohort, 1968–1989, begins with times of upheaval and worldwide protests and ends with the fall of the Berlin Wall on October 3rd, 1989. The third cohort, born after 1990, was raised in the period of numerous political changes and German reunification.

Significant differences in the frequencies of ACE within West and East Germany and abroad were found primarily in the cohorts 1946–1967 and 1968–1989. Emotional abuse, physical abuse, emotional and physical neglect, and a household member's substance dependence as well as mental illness show highly significant differences ($p = < 0.001$). Respondents who spent most of their childhood and adolescence in East Germany report less emotional abuse, physical abuse, neglect, and substance dependence. The mental illness of a household member is most frequently written by persons who grew up predominantly in West Germany. Participants born up to 1945 show highly significant differences only in

TABLE 2 Frequencies of adverse childhood experiences in West-East Germany in persons predominantly raised abroad (number *N* and corresponding percentage).

	Number ACE	Total	West Germany	East Germany	Abroad
Total		<i>N</i> = 4,892	<i>N</i> = 3,637	<i>N</i> = 984	<i>N</i> = 271
	0	3,077 (62.7)	2,193 (60.3)	736 (74.8)	142 (52.4)
	1	741 (15.2)	568 (15.6)	122 (12.4)	42 (15.5)
	2	327 (6.7)	269 (7.4)	34 (3.5)	23 (8.5)
	3	270 (5.5)	220 (6.0)	28 (2.8)	22 (8.1)
	>4	493 (10.1)	387 (10.6)	64 (6.5)	42 (15.5)
Cohort until 1945		<i>N</i> = 456	<i>N</i> = 302	<i>N</i> = 136	<i>N</i> = 17
	0	285 (62.5)	184 (60.9)	91 (66.9)	10 (58.2)
	1	80 (17.5)	44 (14.6)	31 (22.8)	4 (23.5)
	2	23 (5.0)	18 (6.0)	5 (3.7)	0 (0.0)
	3	20 (4.4)	18 (6.0)	1 (0.7)	1 (5.9)
	>4	48 (10.5)	38 (12.6)	8 (5.9)	2 (11.8)
Cohort 1946–1967		<i>N</i> = 1,862	<i>N</i> = 1,349	<i>N</i> = 413	<i>N</i> = 93
	0	1,178 (63.2)	821 (60.9)	311 (75.3)	44 (47.3)
	1	273 (14.6)	207 (15.3)	48 (11.6)	13 (14.0)
	2	123 (6.6)	99 (7.3)	14 (3.3)	10 (10.7)
	3	100 (5.4)	76 (5.6)	15 (3.6)	9 (6.7)
	>4	188 (10.1)	146 (10.8)	25 (6.0)	17 (18.3)
Cohort 1968–1989		<i>N</i> = 1,748	<i>N</i> = 1,310	<i>N</i> = 296	<i>N</i> = 138
	0	1,088 (62.2)	777 (59.3)	130 (43.9)	78 (56.5)
	1	240 (13.7)	191 (14.6)	30 (10.1)	18 (13.0)
	2	120 (6.9)	98 (7.5)	11 (3.7)	11 (8.0)
	3	105 (6.0)	86 (6.6)	9 (3.0)	10 (7.2)
	>4	195 (11.2)	158 (12.1)	16 (5.4)	21 (15.2)
Cohort from 1990		<i>N</i> = 842	<i>N</i> = 676	<i>N</i> = 139	<i>N</i> = 23
	0	526 (62.5)	411 (60.8)	104 (74.8)	10 (43.5)
	1	148 (17.6)	126 (18.6)	13 (9.3)	7 (30.4)
	2	61 (7.2)	54 (8.0)	4 (2.9)	2 (8.7)
	3	45 (5.3)	40 (5.9)	3 (2.2)	2 (8.7)
	>4	62 (7.4)	45 (6.7)	15 (10.8)	2 (8.7)

the case of separation of a parent, especially among East Germans; the number is 29.4%, significantly higher than the comparison groups ($p < 0.001$). Physical neglect is highly significant in the youngest age cohort ($p < 0.002$). Here, West Germans report less physical neglect than persons who grew up predominantly abroad ($p < 0.002$). Physical and sexual abuse, emotional neglect, and mental illness of a household member, also show significance ($p < 0.05$).

Predictors of experiencing adverse childhood experiences

The logistic regression results are shown in Table 5. Sociopolitical context emerges as a predictor across

almost all ACEs. An increased likelihood of experiencing adverse childhood experiences among those raised abroad is especially evident for the ACEs of emotional and physical abuse [odds ratio (OR) = 1.693, $p < 0.001$; OR = 2.208, $p < 0.001$], and physical neglect (OR = 2.920, $p < 0.001$). Coming from East Germany decreases the likelihood of having experienced adverse childhood experiences.

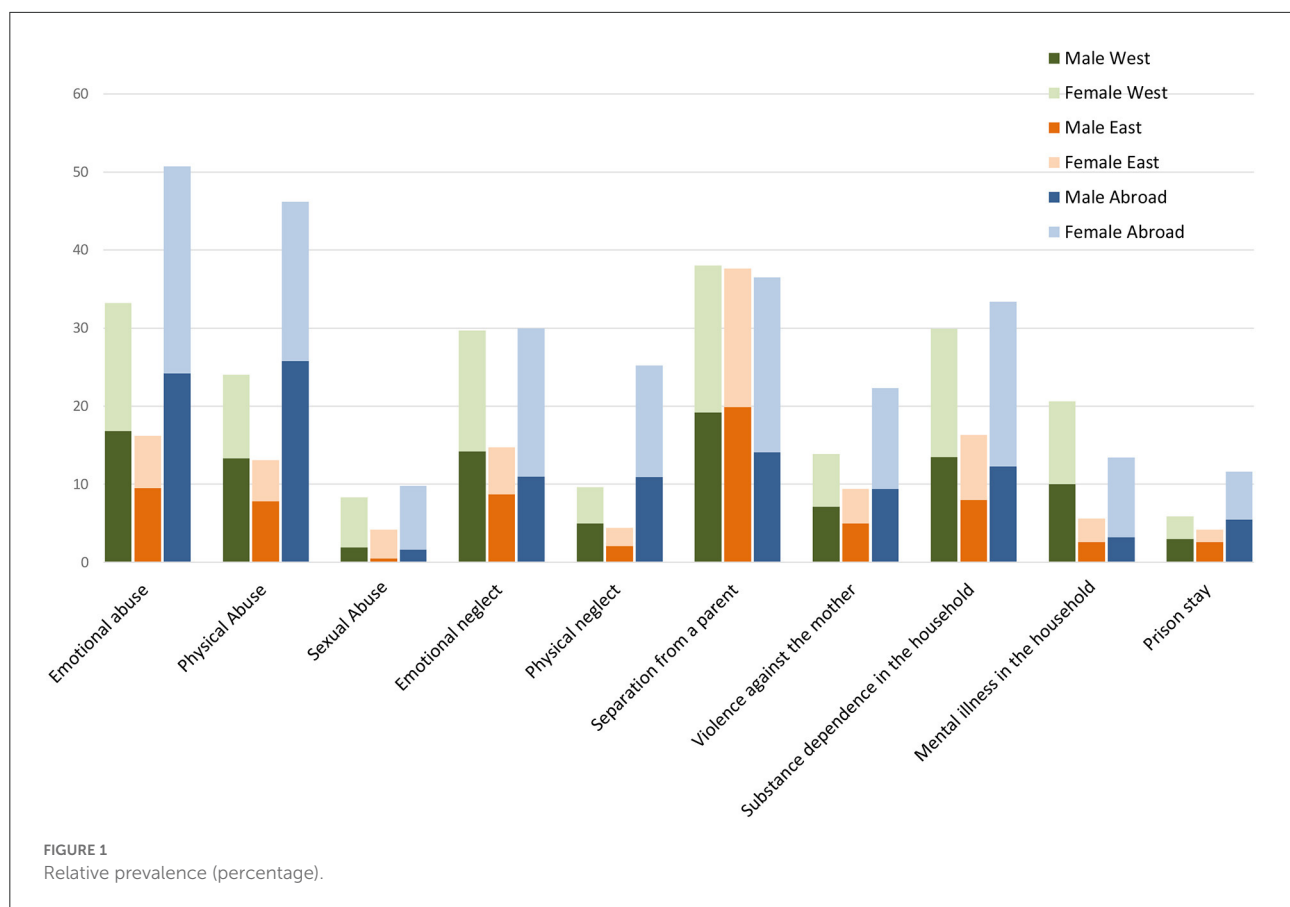
A strong negative influence on physical neglect is evident between all age cohorts (1946–1967: OR = 1.590, $p > 0.001$; 1968–1989: OR = 1.1909, $p < 0.001$; from 1990: OR = 2.190, $p < 0.001$).

Women were more likely to be victims of sexual abuse (OR = 4.071, $p < 0.001$) and less likely than men to be at risk of physical abuse (OR = 0.755, $p < 0.002$).

	Male				Female				Total						
	West	East	Abroad	χ^2	West	East	Abroad	χ^2	West	East	Abroad	χ^2	Male	Female	χ^2
Emotional abuse	16.8	9.5	24.2	25.47***	16.4	6.7	26.5	41.266***	16.6	8.3	25.5	64.70***	15.4	15.3	0.02
Physical abuse	13.3	7.8	25.8	32.81***	10.7	5.3	20.4	28.42***	11.9	6.7	22.9	58.66***	12.6	10.3	6.56
Sexual abuse	1.9	0.5	1.6	5.12	6.4	3.7	8.2	5.95*	4.3	1.9	5.1	13.72**	1.5	6.0	68.80***
Emotional neglect	14.2	8.7	11.0	12.20**	15.5	6.0	19.0	29.39***	14.9	7.5	15.3	37.65***	12.7	14.1	2.04
Physical neglect	5.0	2.1	10.9	20.47***	4.6	2.3	14.3	35.27***	4.8	2.2	12.7	53.89***	4.6	4.8	0.05
Separation from a parent	19.2	19.9	14.1	2.32	18.8	17.7	22.4	1.60	19.0	18.9	18.5	0.03	19.2	18.8	0.10
Violence against the mother	7.1	5.0	9.4	4.45	6.8	4.4	12.9	12.74**	7.0	4.8	11.3	15.51***	6.7	6.7	0.00
Substance dependence in the household	13.5	8.0	12.3	13.54**	16.4	8.3	21.1	22.23***	15.0	8.1	18.5	37.55***	12.3	15.3	9.45**
Mental illness in the household	10.0	2.6	3.2	36.59***	10.6	3.0	10.2	24.06***	10.3	2.8	7.0	57.89***	7.9	9.3	2.95
Prison stay	3.0	2.6	5.5	2.97	2.9	1.6	6.1	8.11*	2.9	2.2	5.8	10.07**	3.0	2.8	0.11

Discussion

A lack of awareness of sexual violations of boundaries is caused by socially propagated permissive sexual education. Thus, sexual education in the GDR was seen as part of personality education, which was the responsibility of all state educational institutions (43). From an epidemiological perspective, however, these cases of affected children were minor. They are also unlikely to have occurred more frequently than other forms of institutional violence in West Germany, such as in Catholic boarding schools or Welfare institutions for children's recovery or prevention. Dreßing et al. (44) showed that sexual abuse happened quite frequently within the catholic clergies. Since the catholic church did not have much power and societal interweaving in the former GDR, it might be that this



may be an explanation for the higher prevalence rates in West Germany.

Another German cohort study shows that parental separation may be associated with psychological impairment in adulthood (45). However, the results of our study show no significant difference for separation from one parent. This suggests that children in the former GDR have not felt the separation of a parent more often than children in the FRG.

Findings by Austin et al. (16) suggest that sociopolitical policies can reduce child maltreatment rates. For example, corporal punishment was banned in the former GDR as early as 1949. A study on remembered parental parenting behavior underpins this assumption: People from East Germany reported significantly less rejection and punishment by mother and father than the West German comparison group (46). In West Germany, corporal punishment was still tolerated until 1973, and in Bavaria until 1983. This could express a greater acceptance of physical discipline strategies in West Germany, associated with greater use of physical violence against children and higher prevalence rates (47). This view can be confirmed by the dramatic decrease in corporal punishment in Sweden after the ban of this educational measure in 1979 (48). Germany also showed a significant decrease in corporal punishment against

children and adolescents after children's right to a non-violent upbringing was enshrined in law in the Civil Code in 2000 (15). Another reason for more violent and abusive parenting behavior could be the greater acceptance of parenting advice widely used in the "Third Reich," such as the parenting books by Johanna Haarer. Such books were banned in the former GDR. For example, the author (49) recommends leaving the child alone in a room day and night, not responding to the child's crying, limiting food intake, and starving the child if necessary.

Highly pronounced maternal depressive symptomatology is a risk factor for child physical abuse and neglect (50–52). Adverse effects and emotions have a significant influence on the child's development. Thus, self-experienced negative childhood experiences of the mother can be directly related to internalized and externalized difficulties in the children and thus complicate the positive mother-child relationship (53). Another risk factor for childhood abuse seems to be the wellbeing of the woman and mother, which is related, among other things, to the opportunity for education and gender equality (23, 54). Thus, there is a broad consensus that improving the position of women and mothers positively impacts the wellbeing of their children (17, 20, 21). The importance and impact of maternal wellbeing on child health are illustrated by an experimental

TABLE 4 Relative frequency (percent) of individual adverse childhood experiences in West and East Germany and abroad and age cohorts.

	Until 1945				1946–1967				1968–1989				From 1990			
	West	East	Abroad	χ^2	West	East	Abroad	χ^2	West	East	Abroad	χ^2	West	East	Abroad	χ^2
Emotional abuse	19.4	7.0	11.1	11.86**	18.4	8.7	34.0	42.30***	16.6	6.3	23.0	26.96***	11.8	12.8	16.7	0.59
Physical abuse	16.8	6.3	11.1	9.23**	13.2	7.7	28.7	31.51***	11.3	4.3	20.1	26.04***	8.3	9.2	25.0	0.00*
Sexual abuse	2.6	0.7	–	2.27	4.5	2.1	5.3	5.23	4.8	2.0	4.3	4.76	3.6	2.1	12.5	6.30*
Emotional neglect	15.5	7.9	11.1	4.96	15.0	8.0	17.0	14.68***	16.3	6.7	13.0	18.77***	11.7	7.8	25.0	6.25*
Physical neglect	9.2	6.4	16.7	2.50	4.9	2.3	13.8	22.45***	4.4	1.0	11.5	24.88***	3.2	–	12.5	12.14**
Separation from a parent	13.2	29.4	16.7	17.14***	16.0	16.3	21.3	1.79	22.1	17.6	18.7	3.51	21.4	19.3	8.3	2.61
Violence against the mother	9.5	3.5	–	6.67*	7.9	5.7	16.0	11.44**	6.9	3.0	10.1	9.40**	4.1	7.1	8.3	3.12
Substance dependence in the household	12.8	2.8	16.7	12.01**	15.1	8.7	24.5	19.77***	17.0	7.6	17.3	16.94***	12.1	12.8	4.2	1.47
Mental illness in the household	6.6	0.7	5.9	7.33*	9.8	2.1	2.2	31.26***	10.7	3.7	10.1	14.17***	12.2	5.0	8.7	6.35*
Prison stay	2.6	2.1	5.6	0.78	2.5	1.9	4.3	1.86	3.8	2.0	6.5	5.51	2.2	3.5	8.3	4.11

***p < 0.001, **p < 0.01, *p < 0.05.

TABLE 5 Binary logistic regression to examine the association between adverse childhood experiences (dependent variable¹) and gender, origin, and age (independent variables) for the entire sample (N = 5,018) as odds ratios and 95% confidence intervals.

	Gender Ref = Male	Raised Ref = West Germany		Age cohorts Ref = Until 1945		
	Female	East Germany	Abroad	1946–1967	1968–1989	From 1990
Emotional abuse	0.94 [0.80–1.09]	0.43*** [0.34–0.55]	1.69*** [1.26–2.22]	1.05 [0.89–1.41]	0.88 [0.66–1.19]	0.69* [0.49–0.96]
Physical Abuse	0.75** [0.63–0.90]	0.49*** [0.37–0.64]	2.20*** [0.37–2.96]	0.86 [0.64–1.18]	0.68 [0.50–0.93]	0.57 [0.40–0.82]
Sexual Abuse	4.07*** [2.86–5.94]	0.49** [0.29–0.78]	1.17 [0.63–1.99]	2.26* [1.18–4.89]	2.28* [1.19–4.94]	1.96 [0.96–4.43]
Emotional neglect	1.07 [0.91–1.26]	0.46*** [0.35–0.59]	1.00 [0.70–1.40]	1.00 [0.74–1.36]	1.04 [0.77–1.42]	0.79 [0.56–1.12]
Physical neglect	0.95 [0.72–1.24]	0.40*** [0.24–0.61]	2.92*** [1.95–4.26]	0.48*** [0.33–0.72]	0.40*** [0.27–0.61]	0.29*** [0.17–0.48]
Separation from a parent	0.98 [0.84–1.13]	1.02 [0.85–1.22]	0.95 [0.69–1.30]	0.87 [0.67–1.14]	1.19 [0.92–1.56]	1.16 [0.87–1.56]
Violence against the mother	0.97 [0.77–1.21]	0.64** [0.46–0.87]	1.67** [1.10–2.45]	1.02 [0.73–1.53]	0.81 [0.55–1.22]	0.59 [0.63–0.95]
Substance dependence in the household	1.12** [1.06–1.47]	0.51*** [0.40–0.65]	1.24 [0.89–1.69]	1.46 [1.06–2.06]	1.56** [1.12–2.20]	1.17 [0.81–1.71]
Mental illness in the household	1.13 [0.92–1.38]	0.26*** [0.17–0.38]	0.65 [0.38–1.02]	1.50* [1.02–2.02]	1.90** [1.23–3.10]	2.19** [1.37–3.63]
Prison stay	0.92 [0.66–1.28]	0.74 [0.45–1.17]	1.95* [1.09–3.27]	0.92 [0.50–1.85]	1.33 [0.74–2.63]	0.97 [0.48–2.05]

¹Reference category = “No.”

Odds ratio (OR) and 95% confidence interval (95% CI); ***p < 0.001, **p < 0.01, *p < 0.05.

The bold values show the significant values.

study by Maccari et al. (55); for example, stress during pregnancy decreases motherly guidance during early childhood, which can have lifelong effects on emotional behavior and increased susceptibility to age-related disorders.

Almost all ACEs decreased with the increasing birth year of the respondents. For example, physical abuse was reported in 13.3% of those born up to 1945 and decreased to 8.9% in the 1990 and older age cohort. The increase could be due to the growing awareness of these societal issues (56). However, the results are striking on whether a household member was depressed, mentally ill, or had ever attempted suicide. This shows a significant increase from 4.7 to 10.9% between all age cohorts [$\chi^2(3) = 18.05; p = < 0.001$]. There are numerous reasons for this; social inequality, higher workloads, and increased sensitivity are just some of them (57, 58). Interestingly the prevalence differences of ACEs between East and West Germany almost disappeared in the generations born after the unification. This finding supports our hypothesis of the importance of socio-political factors in the occurrence of ACEs, as with an alignment of socio-political environments after the unification, the prevalence rates of ACEs also do align.

Conclusion

Adverse childhood experiences are a fundamental public health problem. In order to ensure a safe and stable environment for children, it is crucial to consider societal circumstances and influences in addition to family risk factors. The role of motherhood in society and politics should also be emphasized here (23, 51). Thus, the mother's wellbeing is positively related to adverse childhood experiences. This aspect can be of great importance for preventing child abuse and neglect as well as for the treatment, e.g., psychotherapeutic support of the mother. A large body of research confirms the effectiveness of various interventions regarding adverse childhood experiences at individual and family levels (59, 60). However, it can be assumed that prevention interventions focusing on social-political risk factors would significantly affect the prevalence of adverse childhood experiences.

Limitations and strengths

Our study has several strengths, including the use of nationally representative data. Also noteworthy is the precise description of the different items for adverse childhood experience. However, it cannot be excluded that cultural or contextual differences played a role in the response behavior and may have impacted prevalence rates.

However, some limitations of the present research must also be considered. For example, the available data do not provide precisely where a person spent childhood and adolescence

exactly. This is primarily a limitation for the participants who were raised abroad since we cannot further differentiate the participant's countries and regions. Also, internal migration was not considered in the present work. Domestic isolation might have had an impact on the psychological condition and thus might have had an effect on the response behavior of the respondents. Memory and social desirability biases may be limited data on severe abuse and neglect (61). Furthermore, the data collection period should be mentioned as a possible limitation of the study, which was collected in the first Covid wave.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Medical Faculty of Leipzig University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

A-CS and EB designed and directed the project. A-CS processed the data, performed the analysis, drafted the manuscript, and designed the figures. CK and EB contributed to the interpretation of the results. EB, CK, MB, JF, and VC contributed to the writing of the manuscript and supervised the work. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Childhood maltreatment affects depression and anxiety: The mediating role of benign envy and malicious envy

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The influence of childhood maltreatment on depression and anxiety has been reported in many studies, and the mechanism of this influence has been described from different perspectives. However, few research has explored the influence of child maltreatment on depression and anxiety from the perspective of benign/malicious envy. Given that, based on social comparison theory, this study explored the mediating effect of benign envy/malicious envy on child maltreatment, depression, and anxiety. The sample of this study consisted of 2,691 Chinese adolescents. The results showed that benign and malicious envy both played a significant role in mediating the relation between childhood maltreatment and depression and anxiety. Interestingly, we found that there were different mechanisms of benign and malicious envy in this relationship, namely, malicious envy promoted the effects of childhood maltreatment on depression and anxiety, whereas benign envy inhibited the effects of childhood maltreatment on depression and anxiety. These findings not only reveal the different mechanisms between the two socially comparable emotions of benign/malicious envy in the early adverse environment and depression and anxiety, but also provide a specific reference for individuals to regulate the depression and anxiety caused by childhood maltreatment and envy.

KEYWORDS

childhood maltreatment, depression, anxiety, benign envy, malicious envy

Introduction

Today, childhood maltreatment is a major concern around the world and a focus of international child protection (1). Childhood maltreatment is defined as actual or potential harm caused by caregivers or others during childhood, including physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect (2). Several studies have shown that childhood maltreatment affects not only the physical health of an individual (3–6), but can also lead to mental health problems (7–9), such as depression (the main manifestation is low mood) and anxiety (the main manifestation is panic) (10). The relationship between childhood maltreatment and depression and anxiety has been studied in numerous studies. As an example, Wright et al. (11) studied the direct

effects of childhood maltreatment on depression and anxiety from an attachment and cognitive perspective; Huh et al. (12) explored the underlying mechanisms of childhood maltreatment and depression and anxiety from the perspective of emotion regulation. In spite of this, few studies have investigated the influence mechanism of childhood maltreatment on these two typical mental health problems from the perspective of social comparison. In the process of upward social comparison, that is, comparison with others who are better than oneself, the individual develops the negative emotion of envy (13). Moreover, depending on perceptions and motivations, envy under social comparison can be classified as either benign or malicious (14–16), and these two types may have different impacts on depression and anxiety. In view of this, this study will explore the mediating role of benign and malicious envy between childhood maltreatment and depression and anxiety based on social comparison theory, in order to provide a theoretical basis for interventions to promote individuals' mental health and reduce their negative emotions.

The link between childhood maltreatment and mental health has been established in previous studies (17, 18). Depression and anxiety, as two typical mental health problems, have also been shown to be influenced by this early adverse environment. For example, Li et al. (19) used the meta-analysis revealed that that individuals abused early in their lives were more likely to have depressive and anxious tendencies; Fergusson et al. (20) demonstrated through a longitudinal study that individuals with early experiences of abuse exhibit stronger tendencies toward depression and anxiety; In a clinical study, Heim and Nemeroff (21) found that childhood maltreatment can lead to partial neurological overactivity, which may increase an individual's risk of developing depression or anxiety disorders. Additionally, previous studies have demonstrated the relationship between childhood maltreatment and depression and anxiety from various perspectives. According to Bernet and Stein (22), abuse during childhood predicts the probability of adult depression; Nanni et al. (23), in a clinical study, found that depressed individuals who suffered abuse in childhood had relapses and remained depressed longer. Furthermore, research has shown that childhood maltreatment makes individuals more prone to anxiety (24, 25). Based on above, we propose the first hypothesis of this study (H1): childhood maltreatment is positively related to depression and anxiety.

Furthermore, from the perspective of social comparison, benign and malicious envy may function as mediators between depression and anxiety. According to the Social Comparison Theory (SCT), individuals have an innate tendency to compare themselves to others (26). Depending on the object of comparison, these comparisons can be categorized as upward or downward social comparisons (27, 28). Individuals who have experienced childhood maltreatment tend to be insecure and more concerned with what others have that they do not (29), and thus more prone to upward social comparison.

In upward social comparisons, individuals are prone to the negative emotion of envy (13). In previous research, it has been shown that envy, as a negative emotion generated by social comparison, can lead to a wide variety of mental health disorders in individuals (30). Moreover, studies have shown that envy can be divided into benign envy and malicious envy (14–16), and these two kinds of envy may have different effects on individual mental health. Based on previous research, it has been found that individuals who develop benign envy in upward social comparisons are hopeful, more likely to have relatively positive cognitive styles and emotional experiences, and tend to self-improve in comparisons with others to achieve their desired goals, believing that they can work hard to get what the envied person has (31), so that they are less likely to fall into depression and anxiety. In contrast, individuals who are maliciously envy psychologically perceive themselves as unable to achieve desired goals through self-improvement, while they tend to be destructive and intent on preventing the success of others (32) and reinforce this behavioral tendency through constant social comparison, leading to higher levels of depression and anxiety. Therefore, benign envy may lead to less depression and anxiety, while malicious envy may lead to more depression and anxiety. In addition, previous research using university students has also found that childhood maltreatment is associated with both benign and malicious envy. For example, Zhao et al. (33) found that childhood maltreatment positively predicted malicious envy and negatively predicted benign envy; Li and Xiang (34) explored the mechanisms of influence of childhood maltreatment on benign and malicious envy based on the framework of learned helplessness theory; He and Xiang (35) also confirmed that there is a relationship between childhood maltreatment and benign and malicious envy. Thus, from a social comparison perspective, childhood maltreatment may also affect benign and malicious envy. Individuals who have experienced childhood maltreatment are prone to distrust the outside world and are more willing to choose destructive ways to destroy others' victories in social comparison to achieve their success. As a result, they are more prone to malicious envy than benign envy, which leads to more depression and anxiety. Give that, we suggest a second hypothesis for this study (H2): Benign and malicious envy may play a mediating role between childhood maltreatment and depression and anxiety. And, on the basis of mediating effect, we further hypothesize that: On the one hand, childhood maltreatment can aggravate an individual's tendency to depression and anxiety by increasing malicious envy. On the other hand, it can aggravate an individual's tendency to depression and anxiety by suppressing benign envy.

In summary, this study aims to examine the impact of childhood maltreatment on depression and anxiety from a social comparison perspective and the mediating role that benign and malicious envy plays between them. To this end, we propose two research hypotheses. H1: Childhood maltreatment is positively correlated with depression and anxiety; and H2:

Benign envy and malicious envy mediate the relationship between childhood maltreatment and depression and anxiety, meaning that childhood maltreatment can increase depression and anxiety by increasing malicious envy, as well as by decreasing benign envy.

Method

Participants

This study was conducted in two elementary schools, two middle schools and one high school in a coastal city using cluster sampling. The total number of questionnaires distributed was 2,749. After excluding incomplete and apparently random questionnaires, 2,691 questionnaires were returned. Grade characteristics of the subjects were: 1,303 primary school students (grades 4–6), 673 junior high school students (grades 7–8) and 715 high school students (grade 10); gender characteristics were: 1,504 male students and 1,187 female students. The participants ranged in age from 9 to 17 years, with a mean age of 12.50 ± 2.00 years. Detailed participants demographic data can be found in Table 1. After detailed instruction, participants independently completed a series of questionnaires, which included, Childhood Trauma Questionnaire, Benign and Malicious Envy Scale, and Depression Anxiety Stress Scales. The study was approved by the ethics committee of Hunan Normal University (2021, No. 076). The consent procedures followed were consistent with those mentioned in the study protocol submitted for ethical approval. The consent process followed by the Institute is set out below. Firstly, in view of the young age of the participants, the informed consent was communicated to the guardians of the children studying at school, i.e., the teachers concerned, and the parents were informed verbally through the teachers. Therefore, informed consent was obtained from teachers and parents for this study. Secondly, prior to completing the questionnaire, all participants were fully informed of their right to participate in the study, including voluntary participation and withdrawal at

any time, and that participation was not associated with merit assessments. Therefore, informed consent was obtained from the participants.

Measures

Childhood maltreatment

Childhood Trauma Questionnaire (CTQ) was developed by Bernstein et al. (2) and subsequently revised by Xiang et al. (36). Considering the sensitivity of sexual abuse in the Chinese culture, the study used a revised version of Xiang et al. (36), which removed five items associated with the sexual abuse subscale, leaving 23 items divided into four dimensions, including emotional abuse, physical abuse, emotional neglect, and physical neglect. Each subscale contains five items and an additional three items are set as validity evaluation. The four subscales' Cronbach's alpha coefficients were as follows: 0.69 for emotional abuse, 0.77 for physical abuse, 0.79 for emotional neglect, and 0.61 for physical neglect in the present study. An example of an item is: someone in my family called me "stupid," "lazy" or "ugly". All items are scored by a five-point Likert-type scale, ranging from 1 "never" to 5 "always." The scale has been shown to be appropriate for upper elementary, middle and high school samples (35). The full scale (excluding the sexual abuse subscale) had a Cronbach's alpha of 0.898 in this study.

Benign envy and malicious envy

This study used the Benign and Malicious Envy Scale (BeMaS) developed by Lange and Crusius (37), which consists of two scales, Benign Envy and Malicious Envy, each consisting of five items, all items were rated on a six-point Likert scale from 1 "strongly disagree" to 6 "strongly agree." Example of an item: I want people who are better than me to lose their competitive edge. The scales has been validated for upper elementary and middle and high school students (35), and in this study the Cronbach's alpha was 0.737 for the Benign Envy subscale and 0.786 for the Malicious Envy subscale.

Depression and anxiety

The Depression Anxiety Stress Scales (DASS) were developed by Lovibond and Lovibond (38) and adapted by Gong et al. (39). Only two of the subscales, depression and anxiety, were used in this study, comprising a total of 14 items. All items were rated on a four-point Likert scale, with 1 representing "never" and 4 representing "always," and the higher the score (up to 4), the greater the degree of anxiety or depression. In this study, Cronbach's alpha for the depression and anxiety dimensions were 0.867 and 0.810, respectively. Due to the fact that the scale has only been used in middle and high schools and adult samples previously (40), its

TABLE 1 Demographic data of the sample population ($N = 2,691$).

Grade	Sample			Age (years)	
	Total	Male	Female	Male	Female
Grade 4	390	195	195	9.91 ± 0.68	9.77 ± 0.65
Grade 5	496	295	201	10.84 ± 0.68	10.72 ± 0.61
Grade 6	417	222	195	11.69 ± 0.65	11.60 ± 0.61
Grade 7	327	179	148	12.65 ± 0.62	12.47 ± 0.60
Grade 8	346	201	145	13.59 ± 0.63	13.39 ± 0.64
Grade 10	715	412	303	15.15 ± 0.60	15.06 ± 0.55

Age are expressed as means \pm standard deviations.

reliability in upper elementary grades was separately examined in this study. The reliability coefficients for depression and anxiety were 0.859 and 0.811, respectively, for the upper elementary students.

Statistical analysis

The data for this study was analyzed using SPSS24.0 and AMOS24.0 software. Firstly, we performed a descriptive analysis using SPSS 24.0 to measure correlations between the potential variables based on the hypotheses of this study. Secondly, a measurement model was constructed using AMOS 24.0 to examine the predictive effect of the observed variables on the latent variables. On this basis, the structural equation model is further constructed. For testing the fit of the model, the Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA) were used (41). Finally, we used a bias-corrected percentile Bootstrap method with a sample size of 2,000 times and a confidence interval of 95% to examine the mediating effect of benign envy/malicious envy between childhood maltreatment and depression and anxiety. In addition, it is important to note that in the structural equation modeling construct, the observed variables of benign envy/malicious envy, depression and anxiety are each packaged as two variables according to Little et al. (42), which takes into account item balance.

Results

Measurement model

The measurement model consists of five potential variables: childhood maltreatment, benign envy, malicious envy, depression and anxiety. The results show that the measurement model showed a good fitness: $\chi^2_{(44,2691)} = 495.075, p < 0.001$; RMSEA = 0.062; SRMR = 0.0387; CFI = 0.973.

Meanwhile, Table 2 presents the mean (M), standard deviation (SD) and the correlation between the two variables. The results revealed that all variables studied were significantly correlated with each other, except for benign envy, which was not significantly correlated with malicious envy.

Structural model

In the absence of benign and malicious envy as mediating variables, childhood maltreatment predicts depression ($\beta = 0.18, p < 0.001$) and anxiety ($\beta = 0.16, p < 0.001$). Based on this, model 1 was constructed based on the research hypothesis. By controlling for grade and gender in this model, childhood

maltreatment directly and positively predicted depression and anxiety, while childhood maltreatment also positively predicted depression and anxiety by decreasing benign envy and positively predicted depression and anxiety by increasing malicious envy (Figure 1). The results showed that the fitting degree of model 1 was good [$\chi^2_{(64)} = 898.359, p < 0.001$; RMSEA = 0.070; SRMR = 0.039; CFI = 0.952] (Table 3).

Mediation variable significance

This study used the Bootstrap method to test the significance of the mediating role of benign and malicious envy. We investigated 2,000 bootstraps from the original data, and determined that benign envy mediated the relationship between the impact of childhood maltreatment on depression [95% CI (0.01, 0.03)] and anxiety [95% CI (0.004, 0.02)]. Moreover, childhood maltreatment was associated with depression [95% CI (0.03, 0.05)] and anxiety [95% CI (0.03, 0.05)] through malicious envy (Table 4).

Discussion

Based on the social comparison theory, this study examined how childhood maltreatment affects depression and anxiety, as well as the mediating role played by benign and malicious envy. Our results indicated that benign envy inhibited the negative effects of childhood maltreatment on both negative emotions, whereas malicious envy facilitated this relationship mechanism. These findings not only have important theoretical support for the interventions that aim to improve mental health of individuals, but also provide an empirical foundation for practical activities to prevent negative emotions in individuals such as anxiety and depression.

First of all, the results of the study tested hypothesis 1, which suggests that childhood maltreatment positively predicts depression and anxiety. In fact, previous studies using adults as subjects have shown that childhood maltreatment is associated with persistent negative effects on mental health. For example, Springer et al. (10) showed that individuals who were physically abused in childhood displayed more mental health problems in middle age; Thoma et al.'s (43) involving older adults indicated that childhood maltreatment had a negative impact on individuals' mental health throughout their lifetime. Similarly, the study found that childhood maltreatment affected individuals' psychological wellbeing, indicating that childhood maltreatment increased depression and anxiety among adolescents. Moreover, the findings are consistent with those of previous studies involving adults, including Brown et al.'s (44) findings demonstrating that child maltreatment is a significant predictor of depression and anxiety symptoms in adults. The findings of this study, which used adolescent groups

TABLE 2 Descriptive statistics and bivariate correlations for all measures.

	M	SD	1	2	3	4	5
1. Childhood maltreatment	32.87	11.89	1.00				
2. Benign envy	22.46	4.75	−0.24***	1.00			
3. Malicious envy	11.95	5.49	0.31***	−0.003	1.00		
4. Depression	10.95	3.97	0.53***	−0.27***	0.35***	1.00	
5. Anxiety	11.56	3.81	0.50***	−0.16***	0.33***	0.78***	1.00

*** p < 0.001.

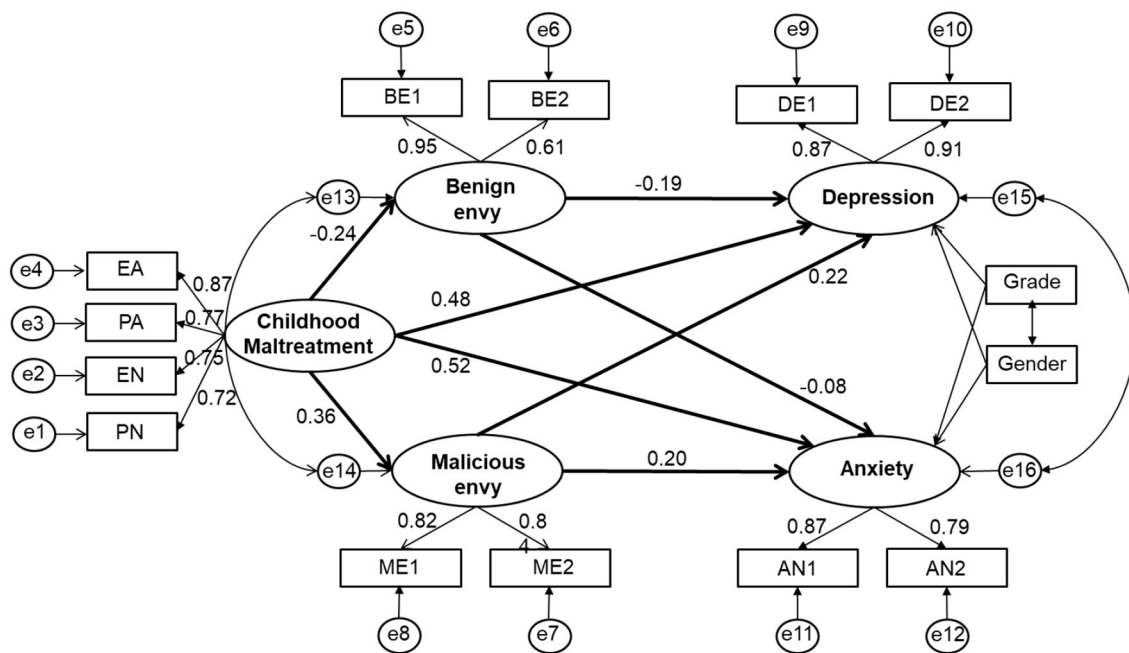


FIGURE 1 The mediation model. Factor loadings are standardized. EA, PA, EN, PN are the four observed variables of childhood maltreatment (CM). BE1 and BE2 are the two observation variables of benign envy (BE), and ME1 and ME2 are the two observed variables of malicious envy (ME). DE1 and DE2 are the two observed variables of depression (DE), and AN1 and AN2 are the two observed variables of anxiety (AN).

TABLE 3 Fit indices of model 1.

	χ^2	df	CFI	RMSEA	SRMR	GFI	AGFI	TLI
Model 1	898.359	64	0.952	0.070	0.039	0.953	0.923	0.932

RMSEA, root-mean-square error of approximation; SRMR, standardized root means square residual; CFI, comparative fit index; AIC, Akaike information criterion; ECVI, expected cross-validation index.

as subjects, actually provide further evidence that childhood maltreatment has a negative impact on depression and anxiety in individuals across generations and in a stable manner. And, this result can also be explained by social comparison theory. Individuals who have experienced childhood maltreatment tend to feel more insecure (45) and are prone to envy in social comparisons of what others have that they do not have, leading to depression and anxiety. As a result, individuals who

are abused early on are more likely to develop depression and anxiety.

Furthermore, consistent with Hypothesis 2, the results indicate that benign envy and malicious envy play an important mediating role between childhood maltreatment and depression and anxiety, but that there are different mechanisms of action in this relationship. In the case of malicious envy, childhood maltreatment increased malicious envy and consequently

TABLE 4 Standardized indirect effects and 95% confidence intervals.

Pathways	Estimate	Lower	Upper	Effect size (%)
CM → BE → DE	0.022	0.010	0.032	3.56
CM → BE → AN	0.010	0.004	0.018	1.62
CM → ME → DE	0.039	0.029	0.051	6.31
CM → ME → AN	0.039	0.030	0.050	6.31

CM, childhood maltreatment; BE, benign envy; ME, malicious envy; DE, depression; AN, anxiety.

depression and anxiety in individuals, and this finding is congruent with previous research. As He et al. (35) found that adolescents who suffered childhood maltreatment had higher levels of malicious envy, which, as a negative emotion, can potentially lead to an individual developing psychological symptoms such as obsessions, fears, depression, and anxiety (46). The present study with adolescents as subjects further confirms that malicious envy plays an important mediating role between childhood maltreatment and depression and anxiety. Moreover, the results of this study are consistent with social comparison theory. From the perspective of social comparison theory, individuals who feel maliciously envy are often prone to a negative state of fear of failure due to their unfavorable social comparison (47), which makes them more likely to develop depression and anxiety. Therefore, individuals who have experienced abuse during childhood are more vulnerable to developing malicious envy, which can lead to depression and anxiety.

In the case of benign envy, however, the study found a completely different mechanism from malicious envy, in that benign envy suppressed the effect of childhood maltreatment on depression and anxiety. As previous research has found, individuals who have suffered childhood maltreatment hold a negative perception of life (34, 48) and are more likely to develop malicious envy than benign envy (33). The present study found that individuals who were less abused in childhood tend to develop benign envy and are thus less likely to fall into depression and anxiety. The reason might be due to the fact that individuals with benign envy demonstrate relatively positive cognitive styles (15), behave more positively when social comparisons occur, believe that the gap between them and the envied person can be closed through self-improvement, and are optimistic about life (49), and thus are less likely to become depressed or anxious. As a result, individuals who experience childhood maltreatment are likely to develop less benign envy, and are more prone to depression and anxiety.

However, there are some limitations to this study. In the construct model, we used depression and anxiety as a single variable to explain the underlying mechanisms of depression and anxiety, which may have caused some bias in the results. Therefore, the role of benign and malicious envy in the

relationship between childhood maltreatment and depression and anxiety remains to be studied, and further research should consider the different mechanisms of depression and anxiety.

In summary, this study examines the mechanisms of how childhood maltreatment affects depression and anxiety from the perspective of social comparison theory. While previous studies have examined the effects of childhood maltreatment on individuals' negative emotions from a positive psychology and Big Five personality perspective (46, 50), this study expands the understanding of the mechanisms of childhood maltreatment on negative emotions under a social comparison theoretical perspective. Interestingly, the two types of envy, benign and malicious, play different roles in this mechanism. These results not only contribute to the theoretical study of the effects of childhood abuse on an individual's mental health, but also provide some reference for individuals to regulate depression and anxiety caused by childhood maltreatment and envy.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This research was approved by the scientific research project of the Medical Ethics Committee of Hunan Normal University. The project is titled "The Neural Associations of Benign/Malicious Envy and the Mechanism of Mindfulness Intervention". The consent procedures followed were consistent with those mentioned in the study protocol submitted for ethical approval. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

XJ and XL: data collection. XL and LT: data analysis. XL, LT, and XJ: paper revising. LT: paper writing. XJ: study designing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

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