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Exploring Independent and Cumulative Effects of Adverse Childhood Experiences on PTSD and CPTSD: A Study in Indian Adolescents

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Abstract

Background: Exposure to adverse childhood experiences (ACEs) is associated with a higher likelihood of developing psychological disorders among adolescents. The current study aimed to analyze the effect of independent and cumulative effects of ACEs exposure on the likelihood of Posttraumatic Stress Disorder (PTSD) and a Complex PTSD (CPSTD) diagnosis in Indian adolescents. Methods: A sample of 411 schoolchildren participated in the study. It was collected data on exposure to ACEs, PTSD, CPTSD, and attachment styles. Results: It was found that exposure to bullying and threats of violence was significantly associated with PTSD and CPTSD diagnosis, and exposure to physical violence and serious illness was associated with CPTSD diagnosis. Exposure to one ACE and exposure to 2 - 3 ACEs were associated with PTSD and CPTSD diagnosis, while exposure to 4 - 5 ACEs was associated with CPTSD diagnosis. Preoccupied and fearful attachment styles were significantly associated with PTSD and CPTSD diagnosis. Conclusion: The results of the study suggest that biological, psychological, and social factors interact and contribute to the differential prevalence of ACE, attachment styles, and PTSD/CPTSD. This study emphasizes the need of addressing childhood trauma as a public health priority in India.

Keywords

PTSD, Complex PTSD, Comorbidity, Adverse Childhood Experiences, Adolescence

1. Introduction

Adverse childhood experiences (ACEs) involve developmental experiences,

occurring before 18 years, encompassing violence and threat exposure (e.g., physical abuse), but also experience of deprivation and/or loss (e.g., parental death) [1] [2]. The uncontrollable nature of such experiences due to contextual factors associated with child development often results in high distress levels for the victims [3]. Exposure to ACEs is associated with negative mental health consequences, such as posttraumatic stress disorder (PTSD) symptoms and poor academic performance [4] [5]. However, there has been growing interest in recent years in understanding the relationship between the co-occurrence of multiple types of ACEs and the consequences for mental health. There has been growing interest in recent years in understanding the relationship between the co-occurrence of multiple types of ACEs and mental health consequences.

There is ample evidence that the exposure to multiple forms of ACEs is more prevalent than exposure to a single ACE [6] [7]. Exposure to different types of ACEs has been labelled as polytraumatization [8] [9]. Previous studies have shown that exposure to multiple types of ACEs has a more negative impact on one's mental health, namely PTSD, when compared to exposure to a single ACE [6] [10].

It is widely recognized that the experience of multiple forms of ACEs is particularly noticeable during adolescence [11] [12]. This period of development is characterized by a series of biopsychosocial changes and transformations that may lead to adolescents being more vulnerable to exposure to different types of ACEs. In particular, the changes taking place in young people's social relationships involve a gradual increase in time spent with peers for social support and intimacy and a decrease in time spent with the primary caregivers [13] that could intensify the occurrence of risk behaviours related to the developmental tasks specific to this period, such as substance abuse and/or unsafe sexual behaviours, which can put adolescents at a greater risk for exposure to multiple types of ACEs [14].

1.1. Posttraumatic Stress Disorder (PTSD) and Complex Posttraumatic Stress Disorder (CPTSD)

Exposure to ACEs increases the risk of mental health consequences, namely PTSD and complex posttraumatic stress disorder (CPTSD). PTSD and CPTSD are classified as mutually exclusive disorders specifically associated with stress [15]. PTSD diagnosis includes three symptom clusters: reexperience of the traumatic event or events in the present; avoidance of thoughts and memories of the event(s); and persistent perceptions of heightened current threat. CPTSD diagnosis includes the three PTSD clusters along with three additional clusters that reflect disturbances in self-organization (DSO): affective dysregulation; negative self-concept; disturbances in relationships.

In the study of the relationship between ACEs and trauma-related disorders, there are different conceptualizations and methodological approaches to polytraumatization. These are the hierarchical, cumulative, and categorical approaches. The hierarchical approach assumes that some types of ACEs are stronger predictors of negative mental health problems compared to other types of ACEs, e.g., sexual

abuse is a stronger predictor of PTSD compared to divorce [4] [16]. The cumulative approach holds that higher exposure to different types of ACEs increases the likelihood of mental health problems [17]. Finally, the categorical approach proposes that individuals who exceed an exposure threshold (e.g., 4 or more types of ACEs) are considered polytraumatized individuals and are more susceptible to psychological problems [7] [8].

There are divergent associations between ACEs exposure and PTSD and/or CPTSD according to the methodological approach. Earlier empirical studies that have adopted either cumulative or categorical approaches used indexes of ACEs, by summing up the number of events experienced, and found that the gradual increase in the number of ACEs to which an individual was exposed increased the likelihood of a PTSD diagnosis [1] [8]. Even though the cumulative approach is the most widely used and has provided the strongest evidence of the association between exposure to ACEs and the mental health of individuals, the analysis of the impact of exposure to different types of ACEs on both PTSD and CPTSD should be considered.

It is highly relevant to understand whether certain types of ACEs are associated with the diagnosis of PTSD and CPTSD. Previous studies that analysed the effect of cumulative exposure to ACEs found that individuals exposed to more different types of ACEs showed greater PTSD symptoms severity compared to individuals exposed to a single ACE [18] [19], namely among adolescents [12] [20]. Regarding the association between exposure to ACEs and diagnosis of PTSD and CPTSD, it was found higher risk of a CPTSD diagnosis among individuals exposed to six or more different types of ACEs, while there was a higher risk of PTSD than CPTSD in individuals exposed to less than four types of ACEs [21].

In studies with adolescent samples, it was found that Ugandan adolescents exposed to two or three ACEs were almost nine times more likely having a PTSD diagnosis, youth exposed to four or five ACEs were twice as likely to have a diagnosis of PTSD and two and a half times more likely to have a CPTSD diagnosis, whereas adolescents exposed to six or more ACEs were one and a half times more likely to be diagnosed with CPTSD [22]. However, a few studies noticed that exposure to ACEs was indirectly associated with PTSD and CPTSD symptoms, namely among adolescents [22] [23], and the indirect effect was greater for PTSD symptoms [24].

Regarding the effect of different types of ACEs on mental health, prior research noticed that different types of ACEs had different associations with PTSD and CPTSD. It was observed that the likelihood of developing PTSD symptoms was higher in individuals exposed to physical neglect, testimony of violence, and near drowning [25] [26]. In another study, the authors noticed that PTSD and CPTSD symptoms had stronger association with sexual abuse when compared to physical neglect. It was also observed that although both childhood sexual abuse and physical assault increased the likelihood of CPTSD and PTSD, both ACEs were stronger predictors of CPTSD [26].

In a study that used multivariable logistic regression for the independent effect of ACEs on PTSD and CPTSD, it was observed that witnessing other people being injured or killed, physical violence, and attempted suicide increased twofold the likelihood of a PTSD diagnosis; the experience of sexual abuse, bullying, threats of violence, and near-drowning increased twofold the likelihood of a CPTSD diagnosis among Ugandan adolescents [22].

1.2. Low- and Lower-Middle-Income Countries (LALMIC)

It should be noted that most studies on this topic have been conducted among adult samples from Western countries. This makes it difficult to generalize the results for other populations, such as adolescents from low- and lower-middle-income countries (LALMIC). Research on exposure to ACEs in LALMIC adolescent samples is particularly limited compared to other populations. This is particularly surprising given that most adolescents are from and live in LALMIC. For example, one-fifth of the world's under-18 population lives in India.

Furthermore, previous research has reported a higher prevalence of exposure to ACEs in LALMIC samples compared to Western samples [20] [27]. The high prevalence of exposure to ACEs in these countries may be due to the socio-economic context characteristic of most LALMIC. Childhood adversity in these countries can be fuelled by poverty, war, low educational levels, poor health care systems, high prevalence of serious diseases, but also cultural beliefs and practices [27] [28]. However, there is a dearth of studies on the association between exposure to ACEs and mental health problems among samples of LALMIC adolescents. India is one such country, and our study aimed to analyse the relationship between exposure to ACEs with both PTSD and CPTSD among Indian adolescents.

India is a LALMIC, with a population, according to the last Census, of 1.2 billion people. In addition to its large population, India is characterized by its diversity of cultures, languages, ethnic groups, and religions [29]. Unlike western societies, India is a collectivist society that promotes interdependence, with the family unit serving as the cornerstone of this social framework for emotional support, social interaction, and financial assistance [30] [31]. The family is considered the fundamental source of growth and development for Indian children, and therefore, it has a vital responsibility in safeguarding and providing them with support [32].

Nonetheless, India has a unique and complex socioeconomic and cultural context that constitutes a risk to the experience of adversity [33]. The Indian context is marked by extreme poverty, poor healthcare, cultural beliefs in harsh discipline, gender-based inequalities and violence, terrorism and political conflict, as well as natural disasters [34] [35]. Existing studies indicate that Indian adolescents are often exposed to different types of ACEs [36] [37]. A study with youth from Pune City found that 78.1% of the sample experienced at least one potentially traumatizing event, directly or indirectly. 35 Other studies found prevalence rates of

ACEs range between 33.7% - 91% for one ACE, and 24.6% - 50% for 3 or more ACEs [38] [39].

Another factor involved in increasing vulnerability to exposure to ACEs is related to internalized cultural norms in which certain practices and behaviours are seen as a part of the normal growing-up process within Indian society, potentially leading to underreporting of traumatic experiences. As an example, corporal punishment of children and adolescents is a disciplinary method employed by both parents and schoolteachers that is still accepted in Indian society and is therefore not regarded as a violent act [34] [35].

Regarding the mental health consequences of exposure to ACEs, prior research on PTSD in Indian samples has primarily focused on natural disasters and community violence [40]. In this regard, it was found that experience of cyclones [41], tsunami [42], motor vehicle accidents [43], childhood sexual abuse [44] were associated with PTSD symptoms among children and adolescents.

However, considering that both PTSD and CPTSD are exacerbated by exposure to multiple types of ACEs, there is a lack of research on the association between these variables in Indian samples. In this regard, it was found that the experience of multiple types of ACEs increased the risk of PTSD among Indian adults [45]. Meanwhile, studies with samples from other South Asia countries found a relationship between the number of ACEs and PTSD symptoms. It was reported a positive association between cumulative exposure to ACEs and PTSD in adult Nepalese and Sri Lankan samples [46] [47], Sri Lankan children and adolescents [46], and Afghan children and adolescents [48]. Additionally, it was observed that that exposure to three or more ACEs doubled the likelihood of PTSD symptoms and exposure to five or more ACEs increased this likelihood threefold [49].

1.3. Psychosocial Variables

The inconsistent findings regarding the association between exposure to ACEs and mental health problems have led to the consideration that other factors seem to be involved in the development of psychological disorders associated with exposure to traumatic and adverse experiences. Considering the occurrence of individual differences resulting from the experience of ACEs, and that not all individuals develop PTSD and/or CPTSD, it is likely that other factors are involved in the relationship between exposure to ACEs and both mental disorders.

One of the main risk factors identified in previous research is sex. There is previous evidence of sex differences in the exposure to specific trauma types, with females being more likely to be exposed to childhood sexual abuse [36] [50] and childhood physical violence [40], and males being more likely to be exposed to community and collective violence [36]. Individual factors linked to the family structure, such as the death of a parent, may exacerbate the vulnerability to these experiences [50]. It was also found that being a female was a risk factor for a positive diagnosis of PTSD [42] [51], with females being 6.35 times more likely to have PTSD than males among tsunami survivors [52].

Attachment style is another variable that has been proposed to be involved in

the relationship between AECs exposure with PTSD and CPTSD. Attachment theory holds that humans possess an inborn drive to seek proximity and reassurance from primary caregivers, particularly to cope with feelings of distress or threat [53]. The development of internal working models (IWM) of self and others depends on the quality of these early attachment experiences that will rule individual's future relationships [54].

The IWM are mental schemas or frameworks that guide individuals' expectations, perceptions, and behaviours towards attachment figures and close relationships. The development of IWM occurs by assimilation and organization of attachment-related information and experiences which constitute templates for appraising and behaving in social interactions throughout the lifespan. IWM encompasses beliefs about both oneself (e.g., self-worth, lovability) and others (e.g., trustworthiness, availability) which impact individual's interpersonal patterns, affective experiences, and coping strategies to deal with stressful events [55].

When individuals experience a loss or a threatening situation, the attachment system is usually activated to deal with the event. There are two primary strategies for regulating attachment-related distress: anxious and avoidant attachment. In attachment anxiety there is hyperactivation of the attachment system which gives rise to heightened concern about the availability of attachment figures, intense surveillance, and seeking proximity and reassurance from attachment figures. In contrast, attachment avoidance is characterized by the deactivation of the attachment system resulting in a devaluation of the importance of close relationships, avoidance of emotional intimacy, and behaviours of self-reliance and autonomy [55].

According to this theoretical framework, differences in the availability and responsiveness of care in the context of early attachment experiences result in different individual attachment styles. Four attachment styles are proposed: secure, preoccupied, dismissive, and fearful. Individuals with secure attachment style (low attachment anxiety and low attachment avoidance) possess positive beliefs about both themselves and others that make them feel comfortable with intimacy and prone to seek emotional closeness with others. Individuals with preoccupied attachment style (high attachment anxiety and low attachment avoidance) mainly adopt attachment anxiety strategies characterized by a strong concern with the unavailability and proximity of attachment figures which originate dependence on others for constant reassurance and external validation. Individuals with a dismissive attachment (low attachment anxiety and high attachment avoidance) mainly adopt avoidant strategies that result in denying the need of anyone's support leading to the suppression of their own emotions and the refusal to seek support from others. Finally, individuals with a fearful attachment style (high attachment anxiety and high attachment avoidance) usually exhibit inconsistent and often contradictory behaviors in close relationships by adopting anxious and avoidant behaviors, dissociative states, or other disordered behaviors [55].

Research on the relationship between exposure to ACEs, attachment styles and psychological disorders such as PTSD and CPTSD in Indian samples is lacking.

Meanwhile, studies conducted in other samples suggested the existence of a relationship between these variables. In a meta-analytic study, it was found that PTSD symptoms were positively related to both preoccupied and fearful attachment styles and negatively associated with a secure attachment style [56]. It was also found that a fearful attachment style increased the likelihood of having a PTSD diagnosis by almost three and a half times in Ugandan adolescents. [22] The lack of association between dismissive attachment style and PTSD may be due to under-report of psychological distress among these individuals [55].

Regarding the association between exposure to ACEs and attachment styles, there is also a lack of studies in Indian samples, particularly in adolescents. It was found that high levels of traumatic experiences were associated with insecure attachment styles among Indian adults [57]. In other samples, a systematic review addressing the association between the exposure to different ACEs and attachment style found that interpersonal trauma was strongly associated with insecure attachment styles compared to non-interpersonal trauma [56]. A study that examined the relation between attachment styles with both PTSD and DSO symptoms found that secure and fearful attachments were negatively and positively, respectively, associated with DSO symptoms, and dismissive attachment was positively associated with both PTSD and DSO symptoms [58].

1.4. Purpose of the Study

Most studies usually analyse the effect of either independent or cumulative exposure to ACEs on psychological disorders. There is a scarcity of studies that have examined the effect of both approaches at the same time. To the best of our knowledge, only a previous study analysed concurrently the effect of both independent or cumulative exposure to ACEs on both PTSD and CPTSD among Ugandan adolescents [22]. In the present study, a similar approach was adopted in a sample of Indian adolescents.

Moreover, it has been proposed that other variables, such as sex and attachment style, are involved in the association between ACEs exposure and psychological disorders, namely PTSD and CPTSD [22] [51]. In this study, the effect of sex, attachment styles, and living arrangements on both PTSD and CPTSD will be analysed. This study aims to provide a more comprehensive understanding of the associations between exposure to ACEs, attachment, PTSD, and CPTSD in Indian adolescents. Specifically, we intend to: a) identify the prevalence of exposure to ACEs, PTSD, CPTSD, and attachment styles; b) analyse the independent effects of each ACE on PTSD and CPTSD diagnosis; c) analyse the cumulative effect of ACEs exposure on PTSD and CPTSD diagnosis; and, d) analyse the effect of attachment style, sex, and living arrangements on PTSD and CPTSD diagnosis.

2. Methodology

2.1. Participants and Procedure

A sample of 411 schoolchildren participated in this study. The mean age of the

sample was 14.2 years and ranging from 13 to 16 years. The proportion of males (53.3%) was slightly higher than the proportion of females (46.7%). Almost all the participants lived with both parents (96.1%), 3.2% lived with one of their parents, and the remaining (0.7%) had other family arrangements.

Data was collected in 2012. This study was initially approved by the Institutional Review Board of Aarhus University. The participants in this study were from the city of Pune in the state of Maharashtra. Due to limited resources such as time and finances, data was only collected in Pune. For the same reason, only adolescents enrolled in private schools were selected for the study. Invitations to participate in the study were sent to five schools, prior to data collection, on a convenience basis, but only two accepted to participate in the study. The participants were mostly from middle- and upper-class background. Eight classes of students participated in the study.

First, the research protocol was presented to the headmasters and the boards of the schools which reviewed and approved the study. Before data collection, a pilot study was conducted with seven respondents at the age of 13 - 14 years. As is the case in most school studies in the middle- and high-income countries, passive consent was applied, *i.e.*, the parents are informed about the study and have the right to refuse the participation of their child. Moreover, Indian parents trust the school system and the teachers who are in parentis loco, *i.e.*, they are granted the position to act in the best interests of their children.

Students were also introduced to the research protocol both verbally and by letter. The participation was voluntary and those accepting to participate gave their informed consent directly. The students filled in the questionnaire in the classroom with the supervision of a team researcher assisted by two Hindi speaking Indian psychology students, who explained the purpose of the study, the principles of confidentiality and practicalities in answering the questionnaire. The youth were informed that their answers were anonymous, and they were asked to answer as openly as possible, despite the somewhat uncomfortable subject. All students present accepted to participate in the study.

The headmasters of the schools requested one or more teachers to be present in each class. Although the students did not seem uncomfortable answering the questions, the teachers encouraged them to answer honestly and tell everything. The teachers are the steady figures in the lives of the children and available to them daily. Besides their teaching, they are also aware of the plight of their students and react if they observe them to be distressed. There were no psychosocial services available in the rural district. The study contributes to the future establishment of psychosocial services in the district and therefore is in the best interest of the children if any of them are distressed, even if only temporarily. This is an accepted scientific value that contributes to the wellbeing of children.

2.2. Measures

The experience of ACEs was assessed through a questionnaire in which the

participants were asked whether they had, or not, been directly and/or indirectly exposed to a list of 20 life-threatening experiences (e.g., rape) and stressful family conditions (e.g., neglect). The list of events was selected from scientific literature and clinical experience [59]. This is a measure widely used in cross-cultural studies and in adolescent samples from LALMIC. 20 Because of the similarity of some events a procedure like that used in previous studies was adopted in which a list of 15 grouped ACEs was compiled and analyzed [60]. As an example, bullying and threats of violence, which were answered as different events, given their similarity, were combined into a single category in the analysis of results.

The Revised Adult Attachment Scale (RAAS) [61] was used to assess participants' attachment style. The RAAS is an 18-item self-report measure to which respondents answer on a 5-point Likert scale (from "not at all characteristic of me" = 1 to "very characteristic of me" = 5). The measure evaluates three dimensions: closeness attachment which assesses the extent to which a person is comfortable with closeness and intimacy ("I find it relatively easy to get close to people"), dependency attachment which evaluates the extent to which a person feels he/she can depend on others to be available when needed ("I am comfortable depending on others"), and anxious attachment which assesses the extent to which a person is worried about being abandoned or unloved ("I often worry that other people won't want to stay with me"). The sum of items in the anxious dimension was used as the index score of attachment anxiety orientation. The mean of the sum of index scores of both closeness and dependency dimensions was used as the index score of attachment avoidance orientation. The RAAS is a widely used measure for attachment dimensions and attachment styles among adolescents and it has been in used in studies with adolescents from LALMIC [62]. The values on the dimensions of anxiety and avoidance were used on the distribution of the participants among the categorical attachment styles: participants with secure attachment had low scores on both anxiety and avoidance dimensions; participants with a preoccupied attachment had high scores on the anxiety dimension and low scores on the avoidance dimension; participants with a dismissing style had low scores on the anxiety dimension and high scores on the avoidance dimension; participants with a fearful attachment had high scores on both anxiety and avoidance dimensions. High is defined as being above the midpoint on the 5-point scale, and low as below the midpoint. The reliability of the attachment anxiety scale ($\alpha = 0.76$) and the attachment avoidance scale ($\alpha = 0.73$) were satisfactory.

Lifetime PTSD was assessed through an item set [63]. PTSD symptoms were assessed through six items retrieved from the Harvard Trauma Questionnaire: Part IV (HTQ-IV) [64] which are answered on a 4-point Likert scale (from "not present" = 1, to "very often present" = 4). PTSD diagnosis was performed using ICD-11 criteria. A diagnosis of PTSD entails the endorsement of one of two symptoms from three symptom clusters: re-experience, avoidance, and sense of current threat, plus endorsement of at least one indicator of functional impairment associated with these symptoms. Endorsement of a symptom or functional

impairment item is defined as a score equal or higher than 2. The reliability of the scale ($\alpha = 0.82$) was good.

Lifetime CPTSD was equally assessed through an item set [63]. CPTSD symptoms were assessed by six items retrieved from the HTQ-IV and the Trauma Symptom Checklist.26 (TSC-26) [65]. The items in this last measure are answered on a 4-point Likert scale (from "never" = 0, to "very often" = 3). Five items from the TSC and one item from the HTQ were retrieved from the CPTSD item set to assess the CPTSD clusters (affective dysregulation, negative self-concept, and disturbances in relationships). A diagnosis of CPTSD requires the endorsement of one of two symptoms from each of the three PTSD symptoms clusters (re-experience, avoidance, and sense of current threat) and one of two symptoms from each of the three DSO symptom clusters: affective dysregulation, negative self-concept, and disturbances in relationships. The reliability of the scale ($\alpha = 0.78$) was satisfactory.

Finally, participants provided information on sociodemographic data such as sex, age, and current living arrangements.

2.3. Data Analysis

Data analysis was conducted using the IBM SPSS Statistics for Windows (version 29). Descriptive analyses were conducted to present sample characteristics. The prevalence of ACEs was calculated, and it was performed a series of Chi-square tests for comparison of both sexes on exposure to different types of ACEs. Subsequently, two multivariate logistic regression analyses were conducted to test the research questions of the current study, namely the independent and cumulative impacts of ACEs on the PTSD and CPTSD diagnosis.

A multivariate logistic regression model is valuable to test the impact of independent variables on a nominal dependent variable, here, diagnostic criteria or not, for PTSD and/or CPTSD. The sample size was large enough to conduct multivariate logistic regression since it requires a minimum of 10 cases per independent variable. The Nagelkerke R^2 [66] was adopted to obtain the R^2 in multivariate logistic regression, because it adjusts the Cox-Snell R^2 [67] by dividing Cox-Snell R^2 by its upper bound, for a more intuitive interpretation of R^2, such as R^2 in the linear regression model.

The first multivariable logistic regression model included the following independent variables: individual ACEs items, sex (female or not), living arrangements (child lives with both parents or not), secure attachment (yes or no), preoccupied attachment (yes or no), dismissing attachment (yes or no), and fearful attachment (yes or no), PTSD diagnosis (yes or no), and CPTSD diagnosis (yes or no). The second regression model had a cumulative index of ACEs (*i.e.*, categories of ACEs) instead of individual ACEs items and the remaining variables that were included in the first regression model. The odds ratios indicate the expected increase/decrease in the likelihood of scoring positively on a given variable compared with the reference group for each independent variable.

3. Results

3.1. Prevalence of Adverse Childhood Experiences

The most common event was serious accidents (46.7%), followed by death of someone close (41.4%), and serious illness (27.5%), which were reported by a large proportion of the participants. Least prevalent events were attempted suicide (2.4%) and divorce (2.4%), followed by and sexual abuse (3.2%) and pregnancy/abortion (3.4%). A series of Chi-square analyses were performed to analyse the associations between sex and prevalence of ACEs. It was found that there were significant Chi-square statistics between both sexes on serious accidents, physical violence, sexual abuse, witnessing other people injured or killed, bullying and threats of violence, near-drowning, robbery/theft, and serious illness. Specifically, the proportion of exposure to those ACEs was higher in males compared to females (Table 1).

Table 1. Chi-square analyses between group membership and exposure to adverse childhood experiences.

Event	Sex of the participants		
	Females (n = 192) Count (%)	Males (n = 219) Count (%)	χ^2
Serious accidents	61 (31.8%)[a]	131 (59.8%)	32.33***
Physical violence	11 (5.7%)	38 (17.4%)	13.16***
Sexual abuse	2 (1.0%)	11 (5.0%)	5.29*
Witnessed other people injured or killed	22 (11.5%)	54 (24.7%)	11.83***
Came close to being injured or killed	32 (16.7%)	43 (19.6%)	0.60
Bullying and threats of violence	22 (11.5%)	52 (23.7%)	10.46***
Near-drowning	6 (3.1%)	29 (13.2%)	13.44***
Attempted suicide	2 (1.0%)	8 (3.7%)	2.94
Robbery/theft	11 (5.7%)	34 (15.5%)	10.07**
Pregnancy/abortion	4 (2.1%)	10 (4.6%)	1.92
Serious illness	42 (21.9%)	71 (32.4%)	5.71*
Death of someone close	78 (40.6%)	92 (42.0%)	0.08
Divorce	2 (1.0%)	8 (3.7%)	2.94
Childhood neglect	6 (3.1%)	12 (5.5%)	1.35
Absence of a parent	23 (12.0%)	31 (14.2%)	0.10

*P value < 0.05; **P value < 0.01; ***P value < 0.001.

3.2. Attachment Styles, and Lifetime PTSD and CPTSD Diagnosis

As can be seen in Table 2, secure attachment had the highest proportion, followed by dismissing style. The least prevalent attachment style was preoccupied attachment. Around ten percent of the participants met the criteria for a lifetime diagnosis of PTSD, and 4.6% of the participants met the criteria for a lifetime diagnosis of CPTSD.

Table 2. Proportion of participants on attachment styles, and PTSD and CPTSD diagnosis.

Category	Proportion of participants
	Count (%)
Attachment style	
Secure	227 (55.2%)
Preoccupied	51 (12.4%)
Dismissing	79 (19.2%)
Fearful	54 (13.1%)
Diagnosis	
PTSD	39 (9.5%)
CPTSD	19 (4.6%)

3.3. Independent and Cumulative Effects of ACEs on PTSD Diagnosis

The first multinomial logistic regression model was implemented to analyse the association between independent ACEs and PTSD diagnosis. Odd ratios and Confidence Intervals associated with each predictor are presented in Table 3. None of the sociodemographic characteristics was significantly associated with PTSD diagnosis. Regarding the categorical attachment styles, only the preoccupied attachment style was significantly associated with PTSD diagnosis. Indian adolescents with a preoccupied attachment style were more than three and a half times more likely of having a PTSD diagnosis. Regarding the independent ACEs, it was observed that only exposure to bullying and threats of violence, and near-drowning were significantly associated with PTSD diagnosis. Adolescents exposed to bullying and threats of violence were nearly two and a half times more likely to have a PTSD diagnosis, and adolescents exposed to near drowning were almost three times more likely to have a PTSD diagnosis.

The second multivariate logistic regression model was implemented to examine the relationship between cumulative exposure to ACEs and PTSD diagnosis. Odd Ratios and Confidence Intervals associated with each predictor are presented in Table 4. Likewise, none of the sociodemographic characteristics was significantly associated with PTSD diagnosis. Regarding the categorical attachment styles, only preoccupied attachment style was significantly associated with PTSD diagnosis. Adolescents with a preoccupied attachment style were three times more likely of having a PTSD diagnosis. Regarding the cumulative exposure to ACEs, exposure to one ACE, exposure to 2 - 3 ACEs, and exposure to 4 - 5 ACEs were significantly associated with PTSD diagnosis. Indian adolescents exposed to one ACE were seven times more likely to have a PTSD diagnosis, exposure to 2 - 3 ACEs increased the likelihood of PTSD diagnosis by more than two and a half times, and teenagers exposed to 4 - 5 ACEs were almost four and a half times more likely to have a PTSD diagnosis.

Table 3. Results of the multinomial logistic regression for PTSD: Independent ACEs and attachment styles.

Predictor	Statistics	
	Odds ratio	CI interval
Sex (female)	1.72	(0.76, 3.88)
Living arrangements (one parent or other arrangements)	1.68	(0.27, 10.27)
Secure	0.84	(0.25, 2.90)
Preoccupied	3.71**	(1.45, 9.47)
Dismissing	1.38	(0.35, 5.47)
Fearful	1.19	(0.35, 4.07)
Serious accidents	1.70	(0.75, 3.86)
Physical violence	0.75	(0.25, 2.31)
Sexual abuse	0.35	(0.03, 4.20)
Witnessed other people injured or killed	0.77	(0.31, 1.92)
Came close to being injured or killed	0.92	(0.35, 2.47)
Bullying and threats of violence	2.35*	(1.02, 5.43)
Near-drowning	2.82*	(1.05, 7.57)
Attempted suicide	4.50	(0.60, 33.90)
Robbery/theft	1.12	(0.41, 3.06)
Pregnancy/abortion	1.09	(0.18, 6.74)
Serious illness	0.94	(0.41, 2.14)
Death of someone close	1.73	(0.82, 3.62)
Divorce	0.94	(0.11, 8.45)
Childhood neglect	1.38	(0.19, 10.08)
Absence of a parent	0.51	(0.12, 2.14)

Reference group = None, n = 419. Nagelkerke $R^2 = 0.15$. *P value < 0.05; **P value < 0.01.

Table 4. Results of the multinomial logistic regression for PTSD: Cumulative ACEs and attachment styles.

Predictor	Statistics	
	Odds ratio	CI interval
Sex (female)	1.63	(0.76, 3.50)
Living arrangements (one parent or other arrangements)	0.97	(0.19, 4.90)
Secure	0.97	(0.30, 3.12)
Preoccupied	3.01*	(1.22, 7.40)
Dismissing	1.53	(0.43, 5.44)
Fearful	1.04	(0.32, 3.33)
ACE (1)	7.07**	(1.77, 28.24)
ACE (2 - 3)	2.70*	(1.04, 7.63)
ACE (4 - 5)	4.31**	(1.55, 12.00)
ACE ($\geq$6)	1.91	(0.70, 5.23)

Reference group = None, n = 419. Nagelkerke $R^2 = 0.14$. *P value < 0.05; **P value < 0.01.

3.4. Independent and Cumulative Effects of ACEs on CPTSD Diagnosis

A similar procedure was conducted to analyse the association between exposure to ACEs and CPTSD diagnosis. First, it was analysed the relationship between independent ACEs and CPTSD diagnosis. Odd Ratios and Confidence Intervals associated with each predictor are presented in Table 5. Sex was the only sociodemographic characteristic that was significantly associated with CPTSD diagnosis. Females were three and a half more likely to have a diagnosis of CPTSD. Regarding the categorical attachment styles, only fearful attachment style was significantly associated with CPTSD diagnosis. Adolescents with a fearful attachment style were almost seven and a half times more likely to have a CPTSD diagnosis. Regarding the independent ACEs, only serious illness was significantly associated with CPTSD diagnosis. Serious illness increased the risk of having a CPTSD diagnosis fourfold.

Table 5. Results of the multinomial logistic regression for CPTSD: Independent ACEs and attachment styles.

Predictor	Statistics	
	Odds ratio	CI interval
Sex (female)	3.58*	(1.02, 13.04)
Living arrangements (one parent or other arrangements)	4.12	(0.42, 40.04)
Secure	0.36	(0.12, 1.08)
Preoccupied	2.16	(0.37, 12.70)
Dismissing	1.50	(0.34, 6.65)
Fearful	7.30**	(1.80, 29.60)
Serious accidents	0.45	(0.13, 1.60)
Physical violence	1.44	(0.34, 6.15)
Sexual abuse	1.32	(0.09, 4.84)
Witnessed other people injured or killed	0.99	(0.29, 3.45)
Came close to being injured or killed	0.43	(0.10, 1.87)
Bullying and threats of violence	2.60	(0.75, 8.94)
Near-drowning	0.81	(0.17, 3.74)
Attempted suicide	1.07	(0.82, 3.94)
Robbery/theft	2.36	(0.56, 9.92)
Pregnancy/abortion	0.76	(0.17, 3.51)
Serious illness	3.89*	(1.17, 12.94)
Death of someone close	1.98	(0.66, 5.96)
Divorce	0.12	(0.01, 2.99)
Childhood neglect	3.30	(0.41, 16.52)
Absence of a parent	0.49	(0.07, 3.70)

Reference group = None, n = 419. Nagelkerke $R^2 = 0.29$. *P value < 0.05.

Finally, it was analysed the relationship between cumulative exposure to ACEs and CPTSD diagnosis by conducting a multivariate logistic regression model. Odd Ratios and Confidence Intervals associated with each predictor is presented in Table 6. Likewise, sex was the only sociodemographic variable that was significantly associated with CPTSD diagnosis. Being a female increased the likelihood of a CPTSD diagnosis twofold. Regarding the categorical attachment styles, only fearful attachment styles were significantly associated with CPTSD diagnosis. Participants with a fearful attachment style were more than five and a half times more likely to have a CPTSD diagnosis. Regarding the cumulative exposure to ACEs, all categories were associated with a diagnosis of CPTSD. Exposure to one ACE increased more than eleven and a half times the likelihood of CPTSD diagnosis, exposure to 2 - 3 ACEs increased the probability of a CPTSD diagnosis by almost four and a half times, exposure to 4 - 5 ACEs increased the likelihood of a CPTSD diagnosis more than three and half times, and exposure to six or more ACEs increased the likelihood of CPTSD diagnosis by six times.

Table 6. Results of the multinomial logistic regression for CPTSD: Cumulative ACEs and attachment styles.

Predictor	Statistics	
	Odds ratio	CI interval
Sex (female)	3.13*	(1.02, 10.59)
Living arrangements (one parent or other arrangements)	2.15	(0.39, 11.75)
Secure	0.37	(0.13, 1.04)
Preoccupied	2.08	(0.47, 9.20)
Dismissing	1.73	(0.45, 6.63)
Fearful	5.63**	(1.59, 19.50)
ACE (1)	11.66*	(1.34, 36.41)
ACE (2 - 3)	4.30*	1.03, 17.91)
ACE (4 - 5)	3.61*	(1.06, 12.35)
ACE (≥6)	6.00*	(1.15, 31.30)

Reference group = None, n = 419. Nagelkerke R^2 = 0.15. *P value < 0.05; **P value < 0.01.

4. Discussion

The main purpose of the current study was to investigate the effect of the independent and cumulative approaches of exposure to ACEs on both PTSD and CPTSD diagnosis in Indian adolescents. Other sociodemographic and psychosocial variables, namely, sex, living arrangements, and attachment styles were considered as predictors in performing multivariate logistic regression analyses. Prevalence rates of PTSD found in this study were similar to other previous studies with adolescent samples [68] [69]. These rates indicate that Indian adolescents exposed to ACEs present a higher risk of both PTSD and CPTSD [4] [5].

Independent effect of ACEs on PTSD/CPTSD

The analysis of the effect of independent ACEs on PTSD and CPTSD through multivariate logistic regression diverges from previous studies. However, some differences were observed in the types of ACEs associated with a PTSD or CPTSD diagnosis. It was found that bullying and threats of violence increased the likelihood of PTSD diagnosis, increasing almost two and a half times the likelihood of the disorder. Near-drowning increased the risk of a PTSD diagnosis threefold, and serious illness increased the likelihood of a CPTSD diagnosis fourfold.

The current results are in accordance with previous literature which indicates that bullying increased the risk for the development of PTSD symptoms among adolescents [70]. Since bullying involves social exclusion, betrayal, or victimization by peers repeatedly and for a long time, it can exacerbate posttraumatic symptoms [71] [72]. On the other hand, the experience of physical violence has been consistently observed in Indian adolescents [36] [40], and is considerably reported by the males in our sample, suggesting that the context of community violence in India is a risk factor for the development of PTSD among adolescents [40].

Near drowning was also found to be a risk factor for PTSD in prior research [26]. This experience is likely to awaken an intense fear of water and constant disturbing thoughts resulting in physical and emotional responses that characterise PTSD [73]. Furthermore, the high prevalence of infectious diseases such as tuberculosis and malaria [74] and respiratory infections in LALMIC [75], namely in India, may explain the high prevalence of adolescents who reported the experience of a serious illness, whose threatening nature and length of time may explain the increased risk of CPTSD.

Cumulative effect of ACEs on PTSD/CPTSD

It was not found a linear relationship between cumulative exposure to ACEs and a diagnosis of PTSD and/or CPTSD found in prior research [48]. The current results indicate that the association of cumulative exposure to ACEs with either PTSD or CPTSD varies according to the number of ACEs the adolescents were exposed to, as found in previous studies [21] [76], namely in LALMIC adolescent samples [22]. It was noticed that exposure to one ACE increased the risk of PTSD diagnosis sevenfold and it increased the risk of CPTSD diagnosis more than eleven and half times. Exposure to 2 - 3 ACEs increased the risk of PTSD diagnosis more than two and a half times and it increased the risk of CPTSD diagnosis nearly four and a half times. Exposure to 4 - 5 ACEs increased the risk of PTSD diagnosis nearly four and a half times and it increased the risk of CPTSD diagnosis more than three and a half times. Exposure to six of more ACEs only increased the risk of CPTSD diagnosis which increased sixfold.

The current findings follow evidence from previous studies according to which youth exposed to ACEs are at higher risk of posttraumatic disorders compared to adolescents with no exposure to ACEs [6] [10]. As found in previous studies, our results also suggest that Indian adolescents exposed to fewer than five types of ACEs are more likely to be diagnosed with PTSD, and higher levels of exposure

to different types of ACEs increases the risk of a diagnosis of CPTSD [21] [22].

Sex, living arrangements and attachment style

The current results indicate that being a female increased the likelihood of a CPTSD diagnosis threefold. Despite most previous studies found no differences in CPTSD prevalence between females and males, a prior study found higher levels of CPTSD symptoms among females [77]. Although the males in our sample reported higher rates of exposure to ACEs, it can be proposed that stronger internalized cultural norms in women may have resulted in the under-reporting of some experiences such as corporal punishment or childhood sexual abuse [34] [35], which are typically associated with a positive diagnosis of CPTSD [58].

Contrary to our expectations, living arrangements did not significantly impact the odds of a PTSD or CPTSD diagnosis. These results can be explained by the concurrent effects of social variables in the adolescent context, specifically those related to the family setting. Most participants in our study lived with both parents while prior research while previous research showed that living in a lived in a single-parent home exacerbates the risk of exposure to ACEs and the consequent risk of post-traumatic disorders [50] [78]. Moreover, there is prior evidence that both family functioning and family structure are stronger predictors of PTSD and CPTSD [78].

Regarding the distribution of the attachment styles, it was observed that more than half of the participants had a secure attachment style. Regarding non-secure attachment styles, dismissing attachment style had a higher proportion, while preoccupied and fearful attachment styles had a similar lesser proportion. The current results suggest that the distribution of attachment styles in Indian adolescents follows the prevalence identified in previous studies [79] [80]. The high prevalence of secure attachment, more than half of the participants, found in this study could be due to cultural factors that shape attachment styles [81]. India is primarily a collectivist society in which the family is the basis of the social framework and is responsible for providing support for the development and growth of children [32], creating the foundations for the development of a secure attachment relationship [82].

Our results indicated that preoccupied attachment style amplified the odds for PTSD diagnosis by more than two and a half times in the independent ACEs model and threefold in the cumulative ACEs model. The current findings also indicated that fearful attachment style increased the risk of CPTSD diagnosis almost seven and a half times in the independent ACEs model and more than five and a half times in the cumulative ACEs model. The current results are in accordance with previous evidence regarding greater vulnerability to post-traumatic disorders in individuals with a preoccupied and fearful attachment style [22] [58].

It seems that Indian adolescents who possess more negative models of the self have more difficulties in coping and emotional regulation because of exposure to ACEs, particularly cumulative exposure, which increases the risk of PTSD [83]. These results also indicate that adolescents who possess more negative models of

both the self and others shaped in inconsistent and contradictory relationships with caregivers appear to be more vulnerable to development of CPTSD [84].

Regarding the model fit for the models, Model 3 showed a moderate relationship between the predictors and the outcome, while the remaining models showed a weak relationship between the predictors and the outcomes. These results suggest that other variables, such as the initial age of exposure to ACE or coping styles, may be associated with the development of PTSD and CPTSD. Future studies could, therefore, include these variables as predictors of both disorders.

The current study had the following limitations. First, this study had a cross-sectional design which disallows inference of causality. Second, self-report measures were used to assess the study variables, which entails the risk of a reporting bias. Third, report of ACEs exposure was performed retrospective which can be biased by memory issues. Fourth, assessment of direct exposure to ACEs did not account for the reoccurrence of specific events. Fifth, the data were collected in 2012. Thus, there may have been changes in the level of exposure to adverse events suffered by adolescents associated with temporal changes in the context of exposure to ACEs. Sixth, exposure to ACEs, PTSD, and DSO symptoms were not assessed through validated measures. Future studies should use validated measure to assess those variables. It is recommended that future studies explore the intracultural differences within LALMIC.

The current results propose that exposure to ACEs has a detrimental effect on Indian adolescents' mental health, namely a robust relationship between ACEs exposure with both PTSD and CPTSD. It is well established that the experience of multiple types of ACEs can have enduring negative effects on mental health outcomes, namely among adolescents from LALMIC due to the lack of resources to deal with mental health problems. Considering the high prevalence of exposure to multiple types of ACEs in LALMIC adolescents, also found in our sample of Indian adolescents, the development of childhood adversity prevention and intervention programs is highly necessary.

Moreover, the considerable proportion of adolescents exposed to multiple types of ACEs indicates that the development of interventions tailored to these adolescents particularly relevant. This is particularly relevant in LALMIC, such as India, where a noteworthy proportion of the global youth population lives. The lack of research addressing exposure to multiple ACEs and mental health in LALMIC, such as India, makes this goal more difficult to achieve. This study fills a gap in research while providing the basis for implementing community-based initiatives in these regions.

The analysis of the independent effects of different types of ACEs on the development of PTSD and CPTSD does not indicate the existence of a causal relationship. On the contrary, our results suggest that adolescents who have experienced specific types of ACEs are more likely to develop PTSD and/or CPTSD. It can be proposed that Indian adolescents who present a pattern of greater likelihood of exposure to these events are at greater risk of developing both disorders.

Moreover, the considerable proportion of adolescents exposed to multiple types of ACEs makes the need to develop interventions tailored to these adolescents particularly relevant. This is particularly relevant in LALMIC, such as India, where a noteworthy proportion of the global youth population lives. This study fills a gap in research while providing the basis for implementing community-based initiatives in these regions.

Overall, this study underlines the need of interventions to prevent and cope with childhood trauma as a public health priority in India. Designing effective approaches that address exposure to multiple types of ACEs entails comprehensive interventions tailored to the sociocultural context and specific needs of the youth. Strengthening community systems and increasing awareness about polytraumatization are essential first steps in mitigating its prevalence. Schools are well-positioned to identify at-risk adolescents and address their concerns by providing social support and implementing interventions such as school-based skills training and social skills programmes aimed at symptom reduction [85].

Furthermore, it is important for healthcare professionals to assess not only the most significant traumatic events but focus on the entire traumatic background. Moreover, it was found that attachment, namely preoccupied and fearful attachment styles, played a key role on the development of both PTSD and CPTSD. Therefore, the developing more positive IWM of themselves and others should be a target of clinical intervention to promote a better adjustment to exposure to multiple types of ACEs. In the case of adolescents with a preoccupied attachment, clinicians should promote the development of greater security with the availability of attachment figures in order to reduce feelings of helplessness that could activate PTSD symptoms.

In the case of adolescents with a fearful attachment, the integration of dissociated mental states will be key to preventing disruption in the development of identity. Overall, these findings underscore the relevance of addressing social determinants of health and promoting supportive environments, including family, school, and community systems, to prevent and mitigate the impact of ACEs and facilitate recovery from exposure to ACEs.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

Table A1. Items representing PTSD and DSO symptoms.

Cluster	Test items
PTSD symptoms	HTQ 2. Feeling as though the event is happening again.
	HTQ 3. Recurrent nightmares.
	HTQ 6. Being jumpy or easily startled.
	HTQ 9. Feeling on guard.
	HTQ 11. Avoiding activities that remind you of the traumatic or hurtful event.
	HTQ 15. Avoiding thought or feelings associated with the traumatic or hurtful events.
DSO symptoms	TSC 16. Temper outburst that you could not control.
	TSC 14. Crying easily.
	TSC 28. Feelings of inferiority or insecurity.
	TSC 29. Blaming yourself.
	TSC 6. Feeling isolated from other people.
	HTQ 27. Feeling that you have no one to rely upon.

Note. PTSD = Post-Traumatic Stress Disorder; DSO = Disturbances in Self-Organization.

Table A2. Items representing PTSD and DSO symptoms.

Cluster	Test items

Note. PTSD = Post-Traumatic Stress Disorder; DSO = Disturbances in Self-Organization.