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**Childhood Adversities and Post-traumatic Stress Disorder: Evidence for Stress
Sensitization in the World Mental Health Surveys***

Running title: Childhood adversities and PTSD

Katie A. McLaughlin, Karestan C. Koenen, Evelyn J. Bromet, Elie G. Karam, Howard Liu, Maria Petukhova, Ayelet Meron Ruscio, Nancy A. Sampson, Dan J. Stein, Sergio Aguilar-Gaxiola, Jordi Alonso, Guilherme Borges, Koen Demyttenaere, Romyana V. Dinolova, Finola Ferry, Silvia Florescu, Giovanni de Girolamo, Oye Gureje, Norito Kawakami, Sing Lee, Fernando Navarro-Mateu, Marina Piazza, Beth-Ellen Pennell, José Posada-Villa, Margreet ten Have, Maria Carmen Viana, Ronald C. Kessler

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Author Affiliations

Katie A. McLaughlin, PhD, Department of Psychology, University of Washington, Seattle, Washington, USA; **Karestan C. Koenen**, PhD, Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, Massachusetts, USA; **Evelyn J. Bromet**, PhD, Department of Psychiatry, Stony Brook University School of Medicine, Stony Brook, New York, USA; **Elie G. Karam**, MD, Department of Psychiatry and Clinical Psychology, Faculty of Medicine, Balamand University, Beirut, Lebanon; Department of Psychiatry and Clinical Psychology, St George Hospital University Medical Center, Beirut, Lebanon; Institute for Development Research Advocacy and Applied Care (IDRAAC), Beirut, Lebanon; **Howard Liu**, SM, Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts, USA; **Maria Petukhova**, PhD, Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts, USA; **Ayelet Meron Ruscio**, PhD, Department of Psychology, University of Pennsylvania, Philadelphia, Pennsylvania, USA; **Nancy A. Sampson**, BA, Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts, USA; **Dan J. Stein**, FRCPC, PhD, Department of Psychiatry and Mental Health, University of Cape Town, Cape Town, Republic of South Africa; **Sergio Aguilar-Gaxiola**, MD, PhD, Center for Reducing Health Disparities, UC Davis Health System, Sacramento, California, USA; **Jordi Alonso**, MD, DrPH, IMIM-Hospital del Mar Research Institute, Parc de Salut Mar; Pompeu Fabra University (UPF); CIBER en Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain; **Guilherme Borges**, DrSc,

Instituto Nacional de Psiquiatría, Calzada Mexico Xochimilco No 101- Col. San Lorenzo Huipulco, Mexico; **Koen Demyttenaere**, MD, PhD, Department of Psychiatry, University Hospital Gasthuisberg, Katholieke Universiteit Leuven, Leuven, Belgium; **Rumyana V. Dinolova**, MD, National Center of Public Health and Analyses, Sofia, Bulgaria; **Finola Ferry**, PhD, Bamford Centre for Mental Health and Wellbeing, Ulster University, Coleraine, United Kingdom; **Silvia Florescu**, MD, PhD, National School of Public Health, Management and Development, Bucharest, Romania; **Giovanni de Girolamo**, MD, Unit of Epidemiological and Evaluation Psychiatry, IRCCS -St. John of God Clinical Research Centre, Brescia, Italy; **Oye Gureje**, MD, PhD, FRCPsych, Department of Psychiatry, University College Hospital, Ibadan, Nigeria; **Norito Kawakami**, MD, DMSc, Department of Mental Health, School of Public Health, The University of Tokyo, Tokyo, Japan; **Sing Lee**, PhD, Department of Psychiatry, Chinese University of Hong Kong, Tai Po, Hong Kong; **Fernando Navarro-Mateu**, MD, PhD, UDIF-SM, Subdirección General de Planificación, Innovación y Cronicidad, Servicio Murciano de Salud; IMIB-Arrixaca; CIBERESP-Murcia, Murcia, Spain; **Beth-Ellen Pennell**, MA, Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, Michigan, USA; **Marina Piazza**, ScD, MPH, Universidad Cayetano Heredia; National Institute of Health, Lima, Peru ; **José Posada-Villa**, MD, Faculty of Social Sciences Colegio Mayor de Cundinamarca University, , Bogota, Colombia; **Margreet ten Have**, PhD, Trimbos-Instituut, Netherlands Institute of Mental Health and Addiction, Utrecht, Netherlands; **Maria Carmen Viana**, MD, PhD, Department of Social Medicine, Federal University of Espírito Santo, Vitoria, Brazil; **Ronald C. Kessler**, PhD, Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts, USA

Correspondence: Katie A. McLaughlin, Department of Psychology, University of Washington, Box 351525, Seattle, WA, 98195; Phone 206-616-7863; mclaughk@uw.edu

ABSTRACT

Background: Although childhood adversities (CAs) are known to predict increased risk of post-traumatic stress disorder (PTSD) after traumatic experiences (TEs), it is unclear whether this association varies by CA or TE types or by age.

Aims: To examine variation in associations of CAs with PTSD according to CA types, TE types, and life-course stage.

Method: Epidemiological data were analyzed from the World Mental Health Surveys (N=27,017).

Results: Four CAs (physical and sexual abuse, neglect, parent psychopathology) were associated with similarly increased odds of PTSD following TEs (OR=1.8), while the other 8 CAs assessed did not predict PTSD. CA-PTSD associations did not vary across TE types, but were stronger in childhood-adolescence and early-middle adulthood than later adulthood.

Conclusion: CAs are differentially associated with PTSD, with the strongest associations in childhood-adolescence and early-middle adulthood. Consistency of associations across TE types suggests that CAs are associated with generalized vulnerability to PTSD following TEs.

INTRODUCTION

Child maltreatment has repeatedly been shown to predict post-traumatic stress disorder (PTSD) among adults exposed to traumatic events (TEs)(1-5). Less evidence exists for whether or not a broader set of childhood adversities (CAs) are similarly associated with increased vulnerability to PTSD following TEs(6), although the associations of more general stressful life events with anxiety, mood, and substance disorders are known to be elevated among individuals who have experienced a wide range of CAs(6-12). Prior work has documented that CAs reflecting maladaptive family functioning (MFF)—including child maltreatment, parent psychopathology, and family violence—are more strongly associated with onset of mental disorders than other CAs and that the joint associations of MFF CAs with onset of mental disorders are sub-additive (i.e., the incremental associations of additional CAs decrease as the number of CAs increases) (13-16). Comparable analyses have not been carried out, though, with respect to the associations of CAs with subsequent onset of PTSD in the wake of TE exposure. It is also unclear whether CAs are associated with a generalized vulnerability to PTSD following any TE type or whether these associations are more pronounced for specific types of TEs. With regard to the latter possibility, it is known that PTSD risk varies markedly across TE types(17, 18) and that prior exposure to some TE types, most notably those involving physical violence victimization, are associated with elevated PTSD risk following subsequent TEs of the same type.(19) It is plausible in light of this evidence to think that the associations of CAs with PTSD might vary across TE types. Finally, although CAs have been shown to predict onset of anxiety, mood, and substance disorders similarly at every stage of the life-span(13-16), prior work has not examined whether vulnerability to PTSD among those with a history of CAs varies according to life-course stage.

In the current study, we analyze the general population epidemiological data in the WHO World Mental Health (WMH) Surveys, a cross-national series of community epidemiological surveys of the prevalence and correlates of common mental disorders, to examine whether CAs are associated with increased risk of PTSD after TE exposure. The large sample size of the WMH surveys allows us to consider variation in the associations of CAs with PTSD as a function of type of CA, type of TE, and life-course stage.

METHODS

Samples

Data come from the 20 WMH surveys in 18 countries that assessed CAs and used an expanded assessment of PTSD (described below) to examine PTSD associated with a *randomly-selected* TE. (Appendix Table 1) These surveys included 10 in countries classified by the World Bank(20) as high-income (national surveys in Belgium, France, Germany, Italy, the Netherlands, Northern Ireland, Spain and the United States along with a survey of metropolitan areas in Japan and the Murcia region of Spain), 7 in countries classified as upper-middle-income (national surveys in Bulgaria, Lebanon, Romania and South Africa along with a survey of all non-rural areas in Mexico and regional surveys in Sao Paulo Brazil and Medellin Colombia), and 3 in countries classified as lower-middle/low income (national surveys in Peru and Ukraine and a survey of all non-rural areas in Colombia). The two Colombia surveys were classified as being in different country-income groups because the World Bank ranking of Colombia's income-level changed between the times of the two surveys. All surveys were based on multi-stage clustered area probability samples of adult household residents. Response rates ranged from 45.9% (France) to 97.2% (Colombia) and had a weighted mean of 70.9% across surveys. A detailed description of sampling procedures is presented elsewhere(21).

Field procedures

Interviews were administered face-to-face in respondent homes after obtaining informed consent using procedures approved by local Institutional Review Boards. The interview schedule was developed in English and translated into other languages using a standardized WHO translation, back-translation, and harmonization protocol.(22) Training and field procedures were supervised by the WMH Data Collection Coordination Centre to guarantee cross-national consistency(22).

Interviews were administered in two parts. Part I, administered to all respondents, assessed core DSM-IV mental disorders (n=83,805). Part II was administered to all respondents who met lifetime criteria for any Part I disorder and a probability subsample of other Part I respondents (n=42,430). Part II assessed additional disorders and correlates. Questions about TEs and PTSD were included in Part II. Part II respondents were weighted to adjust for differential probabilities of selection and deviations between the sample and population demographic-geographic distributions. Details about WMH weighting are presented elsewhere(21). The subsample of Part II respondents who reported lifetime exposure to one or more TEs (n=27,017) is the focus of the current report.

Measures

Exposure to traumatic experiences: Part II respondents were asked about lifetime exposure to 27 different types of TEs in addition to two open-ended questions about exposure to “*any other*” TE and to any “*private*” TE the respondent did not want to discuss. Positive responses were followed by probes to assess number of lifetime exposures and age at first exposure to each TE type. Exploratory factor analysis in the WMH sample found 6 TE groups:(23) 5 reflecting exposure to organized violence (e.g., civilian in a war zone, relief

worker in a war zone, refugee); 5 related to participation in organized violence (e.g., combat experience, witnessed atrocities); 3 reflecting physical violence victimization (witnessed violence at home as a child; beaten by a caregiver as a child; victim of assault); 7 related to sexual violence (e.g., raped, sexually assaulted, beaten by a romantic partner); 6 involving accidents/injuries (e.g., natural disaster, toxic chemical exposure, motor vehicle accident); and 3 that were not strongly correlated with any other TEs (mugged or threatened with a weapon, manmade disaster other than chemical exposure, unexpected death of a loved one).

PTSD: Mental disorders were assessed with the Composite International Diagnostic Interview (CIDI)(24), a fully-structured interview administered by trained lay interviewers that assesses DSM-IV disorders. PTSD was assessed in relation to the lifetime TE the respondent identified as “worst” (i.e., as causing the most severe-persistent core symptoms of PTSD) and in response to one randomly-selected TE out of all TEs the respondent reported experiencing. The random TE could be the same as the TE selected as the worst. Population estimates of conditional risk of PTSD are over-estimated when assessed in relation to a respondent’s worst TE.(17, 18) Consequently, we focus here on PTSD associated with randomly-selected TEs.

As detailed elsewhere(25), blinded clinical reappraisal interviews with the Structured Clinical Interview for DSM-IV (SCID) conducted in four WMH countries found CIDI-SCID concordance for DSM-IV PTSD to be moderate ($AUC=.69$). Sensitivity and specificity were .38 and .99, respectively, resulting in a likelihood ratio positive (LR+) of 42.0, which is well above the threshold of 10 typically used to consider screening scale diagnoses definitive.(26) Consistent with the high LR+, the proportion of CIDI cases confirmed by the SCID was 86.1%. This means that the vast majority of CIDI/DSM-IV PTSD cases would be diagnosed with PTSD by a trained clinician.

Childhood adversities: Twelve CAs occurring before age 18 years were assessed. These included 3 types of interpersonal loss (parental death, parental divorce, and other loss of contact with parents or caregivers), 4 types of parental maladjustment (psychopathology, substance abuse, criminality, and family violence), 3 types of maltreatment (physical abuse, sexual abuse, neglect), respondent serious physical illness, and economic adversity. Parental death and divorce were assessed only for biological parents, but other loss of contact with caregivers included any disruption of a caregiving relationship that lasted six months or longer. Respondents born to a single mother or adopted at birth were not coded as experiencing parental loss.

Physical abuse of the respondent by caregivers was assessed with a modified version of the Conflict Tactics Scale (CTS)(27) and with an item from the TE section of the CIDI. Sexual abuse was assessed with questions from the CIDI regarding sexual assault, attempted rape, and rape. Neglect was assessed with questions used in studies of child welfare that assessed frequency of not having adequate food, clothing, or medical care, having inadequate supervision, and being required to do chores that were age-inappropriate.(28)

Parental criminality was assessed with questions about whether a parent engaged in criminal activities or was ever arrested or sent to prison. Parent psychopathology (major depression, generalized anxiety disorder, panic disorder, suicide attempt) and substance abuse were assessed with a revised version of the Family History Research Diagnostic Criteria Interview.(29, 30) Family violence was assessed with the modified CTS and an item in the TE section of the CIDI. Economic adversity was assessed with questions about whether the respondent's family received welfare or other government assistance or often did not have enough money to pay for basic necessities. Physical illness was assessed with a standard chronic conditions checklist.

Four of these CAs are also TEs: sexual abuse perpetrated by a family member; childhood physical abuse; witnessing family violence during childhood; and childhood physical illness. If the randomly-selected TE was one of these four CAs, it was not included among the CA measures. Several WMH countries omitted some CAs (neglect in South Africa; parental divorce and neglect in the six Western European countries). Rather than exclude these countries or exclude the missing CAs from analysis, we imputed individual-level missing values using multiple imputation.(31)

Prior factor analysis in this sample identified a cluster of highly-correlated CAs reflecting maladaptive family functioning (MFF) that included parent psychopathology, parent substance abuse, parent criminality, family violence, physical abuse, sexual abuse, and neglect.(13) We analyzed these MFF CAs separately from Other CAs (parental death and divorce, other parental loss, physical illness, economic adversity), which exhibit weaker inter-correlations.

Analysis Methods

As each respondent had only one randomly-selected TE no matter how many lifetime TEs they experienced, TEs that occurred to respondents who experienced a high number of TEs were under-represented. We corrected for this by weighting the randomly-selected TE by the inverse of its probability of selection and then multiplying this weight by the Part II weight to generate a sample representative of all TEs experienced by all respondents. These weighted data no longer represent the population of *respondents* but the population of *all TEs* experienced in the population. The consolidated weight was standardized in each survey to equal the number of respondents assessed for randomly-selected TEs.

Cross-tabulations were used in this weighted-standardized dataset to estimate prevalence of exposure to CAs associated with randomly-selected TEs. Associations of these CAs with

PTSD in the full sample of randomly-selected TEs were then estimated using logistic regression models controlling sex, age, TE type, and history of prior TEs of the same type as the randomly-selected TE for TEs where our previous work shows that prior exposure significantly predicts PTSD risk.(19) Dummy predictor variables were included for survey to adjust for between-survey differences in aggregate PTSD prevalence. A series of multivariate models was then estimated using a modeling approach we have employed previously(13, 15, 16) that distinguishes between MFF and Other CAs and evaluates separate and joint associations of multivariate CA profiles with PTSD onset after TE exposure. We began with a series of bivariate models (M1) examining each CA separately. We then estimated an additive multivariate model that included a separate predictor variable for each of the 12 CAs (M2) followed by a model that included predictor variables for number of CAs without variables for specific CA types (M3). The latter model included one variable for the number of MFF CAs (range: 0-4) and two dummy variables indicating exposure to exactly 1 or 2+ Other CAs. Only MFF CAs that were significant in the bivariate models were included in the 0-4 count. We then estimated a model that included dummy variables for CA types in addition to variables for number of MFF and Other CAs (M4). The next model deleted the 4 MFF CA type variables that were included in the MFF CA count variable but retained the other type variables (M5). The next model (M6) included the same CA type variables as M5 but included dummy variables for exact numbers of MFF CAs rather than the count variable. A final model (M7) included only the MFF CA count variable and dropped all other CA variables.

Inspection of mean-squared error (MSE) and area under the receiver operating characteristic curve (AUC) based on replicated 10-fold cross-validation with 10 replications was used to select the best multivariate model among M2-M7 to predict PTSD in response to the

randomly-selected TE. Additional models examined whether associations of CAs with PTSD varied by TE type and timing of TE exposure with interaction terms added to the best-fitting model. Composite TE measures used in these interactions were based on prior analysis showing that odds of PTSD in response to the randomly-selected TE were equivalent for all but 8 TE types.(19) Here, we included predictor variables for those 8 TE types and one variable for all other TE types. Given that all respondents were exposed to one randomly-selected TE, the indeterminacy of the solution created by including an odds-ratio (OR) for each TE type was resolved by scaling the product of all TE-specific ORs to 1.0. Any TE-specific ORs significantly different from 1.0 can be interpreted as having significantly higher- or lower-than-average odds of PTSD; each TE type was given equal weight in computing this average. Interactions between CAs and age of exposure to the randomly-selected TE classified age into 5 groups (0-12, 13-24, 25-44, 45-59, and 60+ years).

Logistic regression coefficients and standard errors were exponentiated and are reported as ORs with 95% confidence intervals (CIs). Statistical significance was evaluated using .05-level two-sided tests based on the design-based Taylor series method(32) implemented in the SAS software system(33) to adjust for the weighting and clustering of observations.

RESULTS

CA Prevalence

Prevalence estimates of CAs associated with representative TEs are shown in Table 1. The proportions of TEs occurring to individuals with a history of CAs range from 3.8% (sexual abuse) to 20.9% (physical abuse). It is noteworthy that all prevalence estimates in the *sample of TEs* are higher than in the *sample of respondents*, indicating that CAs are positively associated with number of TEs experienced. For example, 10.7% of respondents reported exposure to

physical abuse, but 20.9% of all TEs occurred to individuals exposed to physical abuse. The most dramatically elevated CA prevalence estimates in the TE sample relative to the sample of respondents involve the MFF CAs of family violence, physical abuse, and sexual abuse.

(Table 1 here)

Associations of childhood adversities with PTSD

In bivariate models (M1) that considered one CA at a time, only MFF CAs were significant predictors of PTSD after the randomly-selected TE, with ORs in the range of 1.6-2.2. (Table 2) MFF CAs associated with PTSD included physical and sexual abuse, neglect, and parent psychopathology. The ORs for incremental associations of these 4 MFF CAs with PTSD were lower in the additive multivariate model (M2) that included all CA types. Three of the four MFF CAs remained significant in that model (parent psychopathology, sexual abuse, neglect), with ORs in the range of 1.8-2.0. MFF CAs, as a set, were significantly associated with PTSD in M2 ($\chi^2_7=40.8$, $p<.001$), but Other CAs were not ($\chi^2_5=5.8$, $p=.33$). In addition, the strength of the ORs varied significantly across the different types of MFF CAs ($\chi^2_6=18.5$, $p=.005$) but not Other CAs ($\chi^2_4=5.8$, $p=.22$).

(Table 2 here)

In multivariate model M3, which considered only number and not type of CAs, the number of MFF CAs was significantly associated with PTSD (OR=1.7, $p<.001$), but the number of Other CAs was not ($\chi^2_2=0.4$, $p=.84$). (Table 2)

Subsequent models (M4-M6) included information about both type and number of CAs. We examined models including variables for number of MFF and Other CAs as well as type variables for all CAs (M4), and type variables for CAs excluding the 4 MFF CAs included in the count variable (M5). We also examined a model that included variables for exactly 1, 2, 3, and 4

MFF CAs rather than the 0-4 count (M6). However, the best-fitting model (M7) included only the count variable for the 4 individually-significant MFF CAs (Table 2). Consistent with M7 being the best model, neither the other MFF CAs not included in the count variable nor Other CAs were associated with PTSD in M5 or M6, indicating an absence of meaningful associations of CAs other than physical and sexual abuse, neglect, and parent psychopathology with PTSD. (Table 2) In the best-fitting model (M7), number of MFF CAs was significantly associated with PTSD (OR=1.8, $p < .001$).

Differential associations by TE type and timing of TE exposure

To determine whether the association of number of MFF CAs with PTSD varied as a function of the type of TE, we added interactions between this variable and 9 indicators for TE type to the best-fitting CA model (M7). The association of number of MFF CAs with PTSD did not vary across TE types ($\chi^2_8 = 13.9$, $p = .08$). The ORs for the interaction term were in the range of 0.8-1.6 with the exception of natural disaster (OR=0.3), witnessing atrocities (OR=0.4), and being kidnapped (OR=3.1). (Table 3)

(Table 3 here)

Next, we examined interactions between number of MFF CAs and timing of TE exposure. Here, the association of number of MFF CAs with PTSD varied depending on age of TE exposure ($\chi^2_4 = 16.4$, $p = .002$). Specifically, coefficients were positive and significant for TEs occurring during childhood (OR=1.6, $p = .007$), adolescence (OR=1.8, $p = .001$), and adulthood through age 44 (OR=1.9, $p < .001$) but not for TEs occurring in later-middle age (ages 45-59; OR=1.5, $p = .16$), and the OR was significantly negative among respondents aged 60+ (OR=0.1, $p < .001$). (Table 3)

DISCUSSION

We found that exposure to some, but not all, types of CAs is associated with increased odds of developing PTSD. Of the wide range of CAs examined, only physical and sexual abuse, neglect, and parent psychopathology were associated with elevated odds of developing PTSD following a TE. These findings extend prior work documenting higher prevalence of past-year PTSD following a past-year TE among individuals with high levels of CA exposure(6) and greater risk of developing PTSD among individuals who were maltreated as children(1-5) by documenting parental psychopathology as a CA associated with PTSD in addition to maltreatment and by documenting that these vulnerabilities do not extend to the other CA types considered here. Our finding of an association of parental psychopathology with PTSD is broadly consistent with evidence that parent psychopathology has robust but largely non-specific associations with offspring psychopathology(34, 35) that are likely mediated by both genetic and environmental factors.(36) Unlike prior work suggesting that the associations of CAs with mental disorders are sub-additive, such that the incremental effects of additional CAs get relatively smaller as the number of CAs increases,(14-16) our results indicate that the associations of CAs involving maltreatment and parent psychopathology with PTSD are additive. That is, each additional exposure to these specific CAs is associated with increased odds of developing PTSD following a TE that is relatively consistent as the number of CAs increases.

The association of CAs involving child maltreatment and parent psychopathology with PTSD did not vary across a wide range of TE types. This is surprising, given extensive previous research showing that conditional risk of PTSD varies considerably across TE types.(17-19) Prior work on stress sensitization has produced conflicting findings in terms of whether vulnerability to stressors among individuals with a history of CAs is general or specific to certain

types of stressors. Some studies have shown that relatively mild stressors are more likely to trigger depression among those with a history of CA than those without,(10, 37) whereas other work indicates that CA exposure magnifies the association between relatively severe stressors and psychopathology.(6) Our failure to document variation in in the associations of CAs with PTSD as a function of TE type indirectly suggests that CAs produce a generalized vulnerability to PTSD following TEs.

The associations of CAs and PTSD varied by life-course stage, with the associations observable during childhood, adolescence, and early-middle adulthood, but not during late-middle age or later adulthood. We are unaware of prior research examining this specification, though it is noteworthy that most prior studies documenting an interaction between CAs and later stressors in predicting mental disorders focused on adolescence or young adulthood.(10-12, 37, 38) There are two possible interpretations of this finding. The first is that the association of CAs with PTSD wanes later in life due to increased temporal distance from the CA, variations in the features of TEs across the lifespan, or protective factors that increase in later life. Alternatively, it might reflect recall biases in CA reports that are strongest among older adults, where the recall interval is longest. Under-reporting of CAs would attenuate CA-PTSD associations in the oldest group if PTSD symptoms are not under-reported. The fact that CAs were negatively associated with PTSD among older adults might be due to selection of especially resilient individuals with CA histories into the later years of life.

Why might exposure to child maltreatment and parent psychopathology influence vulnerability to PTSD? And why were only these specific MFF CAs associated with PTSD? One potential mechanism involves heightened salience of threat cues and magnified emotional reactions to potential threats. Child maltreatment is associated with elevated emotional reactivity

to negative stimuli, as measured using self-report,(39, 40) ecological momentary assessments of daily responses to stressful life events,(41) and amygdala response to negative stimuli.(42-45) Similar patterns have been observed in children of parents with psychopathology.(46, 47) Heightened amygdala reactivity to threat may be a key pathway through which maltreatment and parent psychopathology influence later risk for PTSD. Prospective studies in both adolescents and military samples have shown that elevated amygdala response to threat cues assessed *prior* to trauma exposure predicts the subsequent onset of PTSD symptoms following a TE.(48, 49) Amygdala reactivity to threat cues decreases in older age,(50) which may have contributed to the lack of CA-PTSD associations in older adults, although it is unclear if this would account for the negative CA-PTSD association among older respondents. The specificity of this pattern of neural response to CAs involving direct exposure to threat(51) or parent psychopathology(46, 47) may explain, in part, why CAs involving interpersonal loss and economic adversity were not associated with PTSD vulnerability. Other mechanisms are also likely to play a role the associations of these specific MFF CAs with PTSD, including habitual use of maladaptive emotion regulation strategies (e.g., rumination) and low social support, each of which is associated with child maltreatment and parent psychopathology as well as risk for PTSD.(1, 39, 52-54)

This study is limited by retrospective reports of CAs, trauma exposure, and PTSD symptoms. Recall bias of CAs primarily involves under-reporting,(55-57) which likely attenuated associations of CAs with PTSD. The absence of CA associations with PTSD in the oldest respondents could reflect under-reporting that was most pronounced among respondents with the longest recall periods.(15) Additionally, assessment of PTSD with a fully-structured diagnostic interview rather than clinician-administered interview likely introduced imprecision.

The CIDI diagnoses were relatively conservative, meaning that low-severity cases of PTSD may have been missed. Our focus on a randomly-selected TE reduced biases associated with assessing PTSD in relation to a respondent's perceived worst TE,⁽¹⁷⁾ although it is possible that focusing on an average trauma underestimated CA-PTSD associations. The absence of variation in CA-PTSD associations across TE types reduces this concern somewhat, although it is possible that these associations would have been stronger had we focused on the perceived worst TE.

Despite these limitations, we replicate prior work indicating that child maltreatment is associated with heightened vulnerability to PTSD following TEs occurring later in development. We extend earlier findings by showing that a similar association exists with regard to parent psychopathology but not other forms of CA, that the association of CAs involving child maltreatment and parent psychopathology with PTSD are additive and do not vary across TE types, and that CA-PTSD associations are limited to childhood, adolescence, and early-middle adulthood. These results build on a growing body of evidence indicating that early experiences of adversity increase vulnerability to psychopathology following stressors later in development and suggest that CAs involving child maltreatment and parental psychopathology are associated with heightened risk for PTSD following a TE.

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A complete list of all within-country and cross-national WMH publications can be found at <http://www.hcp.med.harvard.edu/wmh/>

Declaration of Interest

In the past 3 years, RCK received support for his epidemiological studies from Sanofi Aventis; was a consultant for Johnson & Johnson Wellness and Prevention, Shire, Takeda; and served on an advisory board for the Johnson & Johnson Services Inc. Lake Nona Life Project. Kessler is a co-owner of DataStat, Inc., a market research firm that carries out healthcare research.

In the past 3 years, KD has received personal fees from Lundbeck, Servier and Johnson & Johnson.

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Ethical Standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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Table 1. Prevalence of childhood adversities (CAs) in the WHO World Mental Health Surveys (n=27,017)

	Proportion of TEs occurring to respondents with a history of each CA ¹		Proportion of respondents with a history of each CA ²	
	%	(SE)	%	(SE)
Maladaptive Family Functioning (MFF)				
CAs				
Parent Psychopathology	13.7	(0.6)	9.5	(0.3)
Parent Substance Abuse	7.8	(0.4)	6.0	(0.2)
Parent Criminality	6.5	(0.4)	4.0	(0.2)
Family Violence	16.3	(0.6)	9.7	(0.3)
Physical Abuse	20.9	(0.7)	10.7	(0.3)
Sexual Abuse	3.8	(0.2)	1.9	(0.1)
Neglect	8.2	(0.3)	5.7	(0.2)
Other CAs				
Parent Death	14.4	(0.5)	13.3	(0.3)
Parent Divorce	9.7	(0.5)	8.0	(0.3)
Other Parent Loss	7.7	(0.4)	6.0	(0.2)
Serious Physical Illness	6.3	(0.4)	3.5	(0.2)
Economic Adversity	6.1	(0.3)	4.7	(0.2)

MFF, maladaptive family functioning; CAs, childhood adversities; TE, traumatic event

¹ Given that randomly-selected were weighting by the inverse of their probabilities of selection and then multiplied by the Part II weight, the weighted sample of traumatic events (TEs) represents the population of all TEs experienced in the population.

² Prevalence of CAs among the 27,017 respondents included in the analysis.

Table 2. Multivariate associations (odds-ratios) between CAs and PTSD in response to a randomly-selected traumatic event (TE) in the WHO World Mental Health Surveys (n=27,017)¹

	M1 ²		M2 ³		M3 ⁴		M4 ⁵		M5 ⁶		M6 ⁷		M7 ⁸	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Maladaptive Family Functioning (MFF) CAs														
Parent Psychopathology	2.2*	(1.6-3.0)	2.0*	(1.5-2.7)	--	--	--	--	--	--	--	--	--	--
Parent Substance Abuse	1.2	(0.9-1.7)	0.9	(0.6-1.3)	--	--	0.9	(0.6-1.3)	0.9	(0.6-1.3)	0.9	(0.6-1.3)	--	--
Parent Criminality	1.4	(0.9-2.3)	1.1	(0.7-1.9)	--	--	1.1	(0.7-1.9)	1.1	(0.7-1.9)	1.1	(0.7-1.9)	--	--
Family Violence	1.1	(0.7-1.7)	1.0	(0.6-1.5)	--	--	1.0	(0.6-1.5)	1.1	(0.7-1.7)	1.1	(0.7-1.7)	--	--
Physical Abuse	1.6*	(1.1-2.3)	1.3	(0.9-2.0)	--	--	0.7	(0.4-1.1)	--	--	--	--	--	--
Sexual Abuse	2.0*	(1.2-3.4)	1.8*	(1.1-3.0)	--	--	0.9	(0.5-1.5)	--	--	--	--	--	--
Neglect	2.2*	(1.4-3.2)	1.9*	(1.2-2.8)	--	--	0.9	(0.6-1.5)	--	--	--	--	--	--
χ^2_7	--	--		40.8*										
χ^2_6				18.5*			3.4		$\chi^2_3 = 0.3$		$\chi^2_3 = 0.3$			
Other CAs														
Parent Death	1.4	(0.9-2.4)	1.4	(0.8-2.3)	--	--	1.4	(0.8-2.4)	1.4	(0.7-2.4)	1.4	(0.7-2.4)	--	--
Parent Divorce	0.9	(0.6-1.2)	0.9	(0.6-1.2)	--	--	0.9	(0.6-1.3)	0.8	(0.6-1.3)	0.9	(0.6-1.3)	--	--
Other Parent Loss	0.9	(0.6-1.4)	0.9	(0.5-1.2)	--	--	0.7	(0.4-1.3)	0.7	(0.4-1.3)	0.7	(0.4-1.3)	--	--
Serious Physical Illness	1.1	(0.8-1.7)	1.1	(0.7-1.5)	--	--	1.0	(0.7-1.6)	1.0	(0.6-1.6)	1.0	(0.7-1.6)	--	--
Economic Adversity	1.3	(0.8-2.0)	1.3	(0.7-1.8)			1.1	(0.6-1.9)	1.1	(0.6-2.0)	1.1	(0.6-2.0)	--	--
χ^2_5	--	--		5.8		--	6.1		6.7		6.8			
χ^2_4				5.8		--	5.8		6.3		6.4			
χ^2_{12}	--	--		63.8*		--	9.3		6.9		6.9			
Number of MFF CAs														
0 – 4 ⁹	--	--	--	--	1.7*	(1.5-2.1)	2.0*	(1.5-2.7)	1.8*	(1.5-2.1)	--	--	1.8*	(1.5-2.1)
1	--	--	--	--	--	--	--	--	--	--	1.6*	(1.1-2.2)	--	--
2	--	--	--	--	--	--	--	--	--	--	2.8*	(1.8-4.4)	--	--
3	--	--	--	--	--	--	--	--	--	--	5.4*	(2.7-10.6)	--	--
4	--	--	--	--	--	--	--	--	--	--	13.7*	(3.6-51.4)	--	--
χ^2_4	--	--		--		--	--		--		36.3*			
χ^2_3	--	--		--		--	--		--		19.6*			
Number of Other CAs														
1	--	--	--	--	1.1	(0.8-1.6)	--	--	--	--	--	--	--	--
2+	--	--	--	--	1.1	(0.8-1.7)	1.1	(0.6-2.1)	1.1	(0.6-2.2)	1.1	(0.6-2.2)	--	--
χ^2_2	--	--		--		0.4		--						
Mean-squared error ¹⁰				0.039214		0.039162		0.039232		0.039206		0.039278		0.039146
AUC ¹⁰				0.738		0.741		0.737		0.737		0.734		0.743

MFF, maladaptive family functioning; CAs, childhood adversities; TE, traumatic event

*Significant at the .05 level, two-sided test

¹Models were estimated using logistic regression with PTSD in response to a randomly-selected TE as the outcome variable. Each model controlled for survey, age, sex, 9 dummy variables for TE type, and 6 dummy variables for prior exposure to the same TE type for trauma types shown in prior analysis to influence later risk of PTSD in response to a TE of the same type (see citation 19 for details)

²Models were estimated with one CA at a time and the controls noted in footnote 1.

³The model was estimated with all 12 CAs and the controls noted in footnote 1.

⁴The model was estimated with dummy variables for the number of CAs without any information about CA type and the controls in footnote 1.

⁵The model was estimated with dummy variables for both number and type of CAs plus the controls noted in footnote 1.

⁶The model was estimated with dummy variables for both number and type of CAs, removing the variables for CA type for the 4 MFF CAs included in the 0-4 count variable (see footnote 9), plus the controls noted in footnote 1.

⁷The model was estimated with dummy variables for both number and type of CAs, removing the variables for CA type for the 4 MFF CAs included in the 0-4 count variable (see footnote 9), plus the controls noted in footnote 1.

⁸The model was estimated with the 0-4 count variable (see footnote 9), plus the controls noted in footnote 1.

⁹The 0-4 variable is a count of the number of the following CAs experienced by the respondent: physical abuse, sexual abuse, neglect, and parent psychopathology.

¹⁰These measures are based on replicated 10-fold cross-validation with 10 replications.

Table 3. Variation in the associations (odds-ratios) of CAs and PTSD in response to a randomly-selected traumatic event (TE) by TE type and age of TE exposure in the WHO World Mental Health Surveys (n=27,017)¹

	Variation by TE Type ²		Variation by Age of TE Exposure ³	
	OR	(95% CI)	OR	(95% CI)
Interaction of Number of MFF CAs with TE Types				
Civilian in a war zone	0.8	(0.3-2.3)	--	--
Civilian in a region of terror	1.1	(0.7-2.0)	--	--
Kidnapped	3.1*	(1.2-7.7)	--	--
Witnessed death	1.6*	(1.0-2.6)	--	--
Saw atrocities	0.4	(0.1-1.6)	--	--
Sexual violence	1.2	(0.8-1.8)	--	--
Natural disaster	0.3*	(0.1-0.9)	--	--
Unexpected death of a loved one	1.4	(0.9-2.3)	--	--
All other TEs	1.2	(0.8-1.7)	--	--
χ^2_8		13.9		--
Interaction of Number of MFF CAs with Age of TE Exposure				
0-12 years	--	--	1.6*	(1.1-2.3)
13-24 years	--	--	1.8*	(1.3-2.6)
25-44 years	--	--	1.9*	(1.3-2.7)
45-59 years	--	--	1.5	(0.9-2.6)
60+	--	--	0.1*	(0.0-0.3)
χ^2_4		--		16.5*
Interaction of Number of MFF CAs with Country-Income Group				
High	--	--	--	--
Other	--	--	--	--
χ^2_1		--		--

MFF, maladaptive family functioning; CAs, childhood adversities; TE, traumatic event

*Significant at the .05 level, two-sided test

¹See Footnote 1 in Table 2 for a description of the overall modeling approach. CA and control variables are based on the best-fitting model of CAs in predicting PTSD in response to a randomly-selected TE (M7, Table 1).

²The model included 9 dummy variables for the interaction of the 0-4 MFF CA count variable with TE types in addition to CA and control variables from M7, Table 2. TE types are based on prior factor analysis in this sample (see Methods section for details).

³The model included 5 dummy variables for the interaction of the 0-4 MFF CA count variable with age at TE exposure in addition to CA and control variables from M7, Table 2.

⁴The model included 2 dummy variables for the interaction of the 0-4 MFF CA count variable with country-income group in addition to CA and control variables from M7, Table 2.