Childhood Adversities and First Onset of Psychiatric Disorders in a National Sample of US Adolescents

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Context: Although childhood adversities (CAs) are known to be highly co-occurring, most research examines their associations with psychiatric disorders one at a time. However, recent evidence from adult studies suggests that the associations of multiple CAs with psychiatric disorders are nonadditive, arguing for the importance of multivariate analysis of multiple CAs. To our knowledge, no attempt has been made to perform a similar kind of analysis among children or adolescents.

Objective: To examine the multivariate associations of 12 CAs with first onset of psychiatric disorders in a national sample of US adolescents.

Design: A US national survey of adolescents (age range, 13-17 years) assessing *DSM-IV* anxiety, mood, behavior, and substance use disorders and CAs. The CAs include parental loss (death, divorce, and other separations), maltreatment (neglect and physical, sexual, and emotional abuse), and parental maladjustment (violence, criminality, substance abuse, and psychopathology), as well as economic adversity.

Setting: Dual-frame household-school samples.

Participants: In total, 6483 adolescent-parent pairs.

Main Outcome Measures: Lifetime *DSM-IV* disorders assessed using the World Health Organization Composite International Diagnostic Interview.

Results: Overall, exposure to at least 1 CA was reported by 58.3% of adolescents, among whom 59.7% reported multiple CAs. The CAs reflecting maladaptive family functioning were more strongly associated than other CAs with the onset of psychiatric disorders. The best-fitting model included terms for the type and number of CAs and distinguished between maladaptive family functioning and other CAs. The CAs predicted behavior disorders most strongly and fear disorders least strongly. The joint associations of multiple CAs were subadditive. The population-attributable risk proportions across *DSM-IV* disorder classes ranged from 15.7% for fear disorders to 40.7% for behavior disorders. The CAs were associated with 28.2% of all onsets of psychiatric disorders.

Conclusions: Childhood adversities are common, highly co-occurring, and strongly associated with the onset of psychiatric disorders among US adolescents. The subadditive multivariate associations of CAs with the onset of psychiatric disorders have implications for targeting interventions to reduce exposure to CAs and to mitigate the harmful effects of CAs to improve population mental health.

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CHILDHOOD ADVERSITIES (CAs) are among the most consistently documented risk factors for psychiatric disorders.[1-6] Research has shown that several different CAs, including parental death, abuse, neglect, and family violence, are strongly related to mental disorders.[6-10] Research has also shown that these diverse CAs often co-occur.[3,11-13] However, despite this evidence of co-occurrence, most research has focused on single CAs[7-9,14] or on a count of the number of CAs as predictors of mental disorders.[1,3,15] This has led to an overestimation of the effects of individual CAs and to the neglect of potentially important multivariate CA profiles. Recent studies[4,16] using retrospective CA reports among adults have tried to address this problem by investigating multivariate associations of numerous CAs with mental disorders. These studies documented strong nonadditive associations of CAs related to maladaptive family functioning, including maltreatment and parental maladjustment, with adult mental disorders. However, the use of retrospective reports of CAs in these studies could have introduced systematic recall bias into the results.[4,17,18] To our knowledge, no attempt has been made to perform a similar kind

of analysis among children or adolescents. We report such data in the present study based on analysis of the National Comorbidity Survey Replication Adolescent Supplement (NCS-A),[19] a national survey of the prevalence and correlates of *DSM-IV* disorders among US adolescents.

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METHODS

SAMPLE

As previously reported in more detail,[20] the NCS-A was performed between February 5, 2001, and January 31, 2004. Adolescents aged 13 to 17 years were interviewed face to face in dual-frame household-school samples.[20,21] The household sample included adolescents who were recruited from households that participated in the National Comorbidity Survey Replication (NCS-R).[22] A total of 879 school-attending adolescents participated in the household survey, with a response rate of 86.8% (conditional on adult participation in the NCS-R). The remainder of the sample included 9244 adolescents recruited from a representative sample of schools in NCS-R sample areas. The adolescent response rate in the school sample was 82.6% (conditional on school participation). The total NCS-A sample, combining household and school samples, included 10 123 adolescents. Although the proportion of initially selected schools that participated in the NCS-A was low (28.0%), replacement schools were carefully matched to the original schools. Comparison of household sample respondents from nonparticipating schools with school sample respondents from replacement schools demonstrated no evidence of bias in estimates of prevalence or correlates of mental disorders.[20]

One parent or guardian was asked to complete a self-administered questionnaire (SAQ) about the participating adolescent's developmental history and mental health. The SAQ response rates (conditional on adolescent participation) were 82.5% in the household sample and 83.7% in the school sample. Written informed consent was obtained from parents or guardians before approaching adolescents. Written adolescent assent was then obtained from adolescents before surveying adolescents or parents. Each respondent was given $50 for participation. These recruitment and consent procedures were approved by the human subjects committees of Harvard Medical School and the University of Michigan. This study focuses on 6483 adolescent-parent pairs for whom data were available from both adolescent interviews and SAQs.

Once the survey was completed, cases were weighted for variation in within-household probability of selection in the household sample and residual discrepancies between sample and population sociodemographic and geographic distributions. The household and school samples were then merged with sums of weights proportional to relative sample sizes adjusted for design effects in estimating disorder prevalence. These weighting procedures are detailed elsewhere.[20] The weighted sociodemographic distributions of the composite sample closely approximate those of the census population.[21]

MEASURES

Diagnostic Assessment

Adolescents were administered a modified version of the World Health Organization Composite International Diagnostic Interview (CIDI),[23] a fully structured interview administered by trained lay interviewers. Previous factor analysis of lifetime *DSM-IV* disorders in the NCS-A demonstrated that they differentiated into the following 4 disorder classes[24]: (1) fear disorders (social phobia, specific phobia, intermittent explosive disorder, panic disorder with or without agoraphobia, and agoraphobia without history of panic disorder), (2) distress disorders (separation anxiety disorder, generalized anxiety disorder, posttraumatic stress disorder (PTSD), and major depressive disorder or dysthymia), (3) behavior disorders (conduct disorder, oppositional defiant disorder, and attention-deficit/hyperactivity disorder), and (4) substance use disorders (alcohol abuse with or without dependence and drug abuse with or without dependence). Although our finding that internalizing disorders are best represented by separate fear and distress dimensions is consistent with previous research,[25,26] it is unclear how these dimensions will map onto the domains recently proposed in the National Institute of Mental Health research domain criteria.[27]

Parents provided information about adolescent symptoms of conduct disorder, oppositional defiant disorder, attention-deficit/hyperactivity disorder, and major depressive disorder or dysthymia, disorders for which parent reports have previously been shown to have a large role in diagnosis.[28,29] Parent and adolescent reports were combined at the symptom level using an "or" rule, such that a symptom was considered present if it was endorsed by either respondent. All the diagnoses were made using *DSM-IV* organic exclusion rules. All but 2 diagnoses were made using *DSM-IV* diagnostic hierarchy rules. The exceptions were oppositional defiant disorder, which was defined with or without conduct disorder, and substance abuse, which was defined with or without dependence.

In clinical reappraisal study,[30] a subsample of NCS-A respondents was blindly reinterviewed using the Schedule for Affective Disorders and Schizophrenia for School-Age Children–Present and Lifetime Version (K-SADS). As reported in more detail elsewhere,[31] concordance between lifetime CIDI or SAQ and K-SADS diagnoses was good, with areas under the receiver operating characteristic curve of 0.81 to 0.94 for fear disorders, 0.79 to 0.87 for distress disorders, 0.78 to 0.98 for behavior disorders, 0.56 to 0.98 for substance use disorders, and 0.87 for any disorder. Diagnoses of intermittent explosive disorder were not validated because this is not assessed in the K-SADS.

Childhood Adversities

The NCS-A interviews and parent SAQs assessed 12 CAs. 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 (mental illness, substance abuse, criminality, and family violence), 4 types of maltreatment (physical abuse, sexual abuse, emotional abuse, and neglect), and family economic adversity. Parental death and divorce were assessed only for biological parents, not stepparents or other caregivers. However, the measure of other loss of contact with parents or caregivers included any disruption of a relationship that lasted for 6 months or longer that involved a caregiver leaving the respondent's home (eg, the biological mother abandoned the family) or the respondent leaving home (eg, the individual was placed in foster care or was adopted). Respondents who were born to a single mother and never experienced any further disruption of this parenting arrangement were not coded as experiencing parental loss. We did not code separations from caregivers that involved the respondent being placed in a juvenile detention center or running away from home. We collected information on timing (ie, the respondent's age) for all parental loss events.

Physical and emotional abuse of the respondent by parents or caregivers was assessed using a modified version of the Conflict Tactics Scales.[32] Sexual abuse was assessed with questions from the CIDI about sexual assault, attempted rape, and rape.

Information was also collected on the age at which sexual abuse first occurred. Neglect was assessed with a battery of questions used in investigations of child welfare that asked about the frequencies of having inadequate supervision, being required to do chores that were age inappropriate, and not receiving adequate food, clothing, or medical care.[33] Parental criminality was assessed with questions in the CIDI and the SAQ about whether a parent had engaged in criminal activities like burglary or the sale of stolen property or had ever been arrested or sent to prison for criminal activity.[5] Parental mental illness (major depression, generalized anxiety disorder, panic disorder, and suicide attempt) and substance abuse were assessed using the Family History Research Diagnostic Criteria Interview[34] and its extensions,[35] as well as with items completed by parents in the SAQ. Family violence was assessed using the modified Conflict Tactics Scales and an item in the trauma section of the CIDI about the respondent's age when he or she first observed interparental violence. Economic adversity was assessed with questions in the SAQ about whether the respondent's family had received welfare or other government assistance or often did not have enough money to pay for basic necessities of living.

ANALYSIS

The associations of dichotomously scored CAs with first onset of psychiatric disorders were estimated using discrete-time survival analysis with person-years as the unit of analysis,[36] controlling for respondent sex, age at interview, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other), and additional *DSM-IV*/CIDI disorders with the onset before the focal disorder under investigation. The controls for earlier-onset disorders were included to adjust for the associations of CAs with previous disorders and the associations of these disorders with subsequent disorder onset. Several multivariate models were estimated using the modeling approach developed in earlier work on this topic.[4,16] Each model included dummy predictor variables for CAs and controls. Model 1 was a series of bivariate models (ie, one CA at a time predicting disorders). Model 2 was an additive model that included a separate predictor variable for each of 12 CAs. Model 3 included predictor variables for a number of CAs without variables for specific types of CAs. Model 4 included 12 predictors for the type of CA and additional predictors for the number of CAs, with the latter representing nonspecific interactions. Model 5 modified model 4 by including separate counts of CAs associated with indicators of maltreatment and parental maladjustment with other CAs. This distinction was based on evidence in our earlier adult study[4] that maltreatment and parental maladjustment, which we refer to collectively as indicators of maladaptive family functioning (MFF), were more important than other CAs in predicting psychiatric disorders. Model 6 modified the counts in model 5 to distinguish aspects of MFF associated with harsh treatment of the adolescent (physical abuse, sexual abuse, emotional abuse, and neglect) from other aspects of MFF (divorce, interparental violence, parent mental illness, substance use disorder, and criminality) based on the results of a factor analysis in the NCS-A that found this distinction in the data. Detailed results of the factor analysis are available on request. Model 7 included predictors not only for the type and number of CAs but also for interactions between the type and number.

The Akaike information criterion (AIC)[37] and the Bayesian information criteria (BIC)[38] were used to select the best multivariate model among models 2 through 7 to predict first onset of any disorder based on a consolidated data file that stacked 14 separate disorder-specific person-year data arrays and included 13 dummy variables to distinguish among these files, thereby forcing the estimated slopes of disorders on CAs to be constant across 14 disorders. This best-fitting specification was then used to predict first onset of psychiatric disorders within each of 4 *DSM-IV* disorder classes (fear, distress, behavior, and substance use disorders). Survival coefficients (standard errors [SEs]) were exponentiated and are reported as odds ratios (ORs) and 95% CIs.

The population-attributable risk proportions (PARPs) for the outcomes were computed for the best-fitting model to provide a sense of the overall importance of CAs in predicting adolescent psychiatric disorders. The PARP is the proportion of observed disorders that would not have occurred in the absence of CAs if the associations described in the survival coefficients reflect causal effects of CAs.[39] Although it is inappropriate to infer causality from nonexperimental data, the calculation of the PARP is nonetheless useful to provide a sense of the magnitude of the associations. The PARP was calculated using simulation methods to generate individual-level predicted probabilities of psychiatric disorders from the coefficients in the best-fitting model with and without coefficients for CAs. The PARP is equal to 1 minus the ratio of the predicted prevalence estimates in the 2 specifications. The PARP for the pooled data set is the mean PARP across all psychiatric disorders based on a constant model across disorders. All significance tests were evaluated using 2-sided $P < .05$. The design-based Taylor series method implemented in a software system (SUDAAN; Research Triangle Institute[40]) was used to estimate SEs.

PREVALENCE AND CO-OCCURRENCE OF CAs

More than half (58.3%) of NCS-A adolescent respondents reported exposure to at least 1 CA (**Table 1**). The most common CAs were parental divorce (28.4%), parental criminality (26.3%), family economic adversity (16.2%), and parental mental illness (15.6%). Most respondents with at least 1 CA reported exposure to multiple CAs, with the rates of co-occurrence ranging from 70.9% for parental divorce to 97.9% for neglect. The mean number of CAs among respondents with exposure to more than 1 CA was 3.2.

ASSOCIATIONS OF CAs WITH FIRST ONSET OF *DSM-IV* DISORDERS

In the bivariate models (model 1) that considered only one CA at a time, all 12 CAs were significant predictors of the *DSM-IV* disorders considered in pooled models, with ORs ranging from 1.7 to 2.2 for MFF CAs and from 1.3 to 1.6 for other CAs (**Table 2**). The ORs were attenuated in the additive multivariate model (model 2), which corrects for overestimation of the associations involving individual CAs in bivariate models. Nine CAs remained significant in model 2, with ORs ranging from 1.2 to 1.4 for MFF CAs and from 1.1 to 1.2 for other CAs. The test for the joint associations of all CAs in this model was significant ($\chi^2_{12} = 775.3$), as were the tests for the joint associations of MFF CAs ($\chi^2_8 = 291.8$) and other CAs ($\chi^2_4 = 28.0$) ($P < .001$ for all). A test for variation in ORs was also significant, indicating that the strength of the ORs varied across CAs ($\chi^2_{11} = 25.4$, $P = .008$).

The multivariate model that considered only the number and not the type of CAs (model 3) showed increas-

Table 1. Prevalence and Co-occurrence of Childhood Adversities (CAs) in the National Comorbidity Survey Replication Adolescent Supplement Among 6483 Adolescent-Parent Pairs

CA	Weighted No.	% (SE) Prevalence of CA	Proportion of Respondents With CA Who Had >1 CA	No. of Other CAs Among Respondents With CA, Mean (SE)
Parental death	472	7.3 (0.6)	73.5 (4.4)	3.5 (0.1)
Parental divorce	1841	28.4 (1.2)	70.9 (1.7)	3.2 (0.1)
Other parental loss	318	4.9 (0.6)	84.6 (2.6)	4.2 (0.3)
Parental mental illness	1011	15.6 (0.8)	89.0 (1.3)	3.8 (0.1)
Parental substance abuse	691	10.7 (0.7)	97.8 (0.8)	4.2 (0.1)
Parental criminality	1703	26.3 (1.1)	84.1 (2.1)	3.6 (0.1)
Family violence	545	8.4 (0.5)	90.2 (4.1)	4.2 (0.1)
Physical abuse	274	4.2 (0.5)	96.4 (1.5)	5.1 (0.3)
Sexual abuse	282	4.4 (0.4)	90.3 (1.9)	3.9 (0.2)
Emotional abuse	379	5.9 (0.7)	83.7 (2.6)	4.5 (0.2)
Neglect	145	2.2 (0.5)	97.9 (0.9)	5.4 (0.3)
Family economic adversity	1050	16.2 (1.1)	75.0 (2.7)	3.7 (0.1)
Any	3781	58.3 (1.3)	59.7 (1.9)	3.2 (0.1)

Table 2. Bivariate (Model 1) and Multivariate (Models 2, 3, and 4) Models of the Associations Between Childhood Adversities (CAs) and First Onset of *DSM-IV* Disorder Classes Among 6483 Adolescent-Parent Pairs[a]

Variable	Odds Ratio (95% CI) Model 1[b]	Model 2[c]	Model 3[d]	Model 4[e]
Maladaptive Family Functioning CAs				
Emotional abuse	1.9 (1.7-2.2)[f]	1.4 (1.2-1.6)[f]	...	1.3 (1.1-1.6)[f]
Physical abuse	2.1 (1.7-2.6)[f]	1.2 (1.0-1.4)	...	1.1 (0.9-1.4)
Sexual abuse	2.2 (1.9-2.6)[f]	1.7 (1.4-2.1)[f]	...	1.7 (1.4-2.0)[f]
Neglect	2.2 (1.6-3.0)[f]	1.3 (1.0-1.7)[f]	...	1.4 (1.1-1.7)[f]
Parental mental illness	1.7 (1.6-1.9)[f]	1.4 (1.2-1.5)[f]	...	1.2 (1.1-1.7)[f]
Parental substance abuse	1.7 (1.4-2.0)[f]	1.0 (0.8-1.2)	...	1.0 (0.8-1.2)
Parental criminality	1.8 (1.6-2.0)[f]	1.4 (1.2-1.5)[f]	...	1.2 (1.0-1.4)[f]
Family violence	2.0 (1.8-2.2)[f]	1.4 (1.2-1.6)[f]	...	1.4 (1.2-1.6)[f]
	...	$\chi^2_8 = 291.8$[f]	...	$\chi^2_8 = 49.7$[f]
Other CAs				
Parental death	1.3 (1.1-1.6)[f]	1.2 (1.0-1.5)[f]	...	1.2 (1.0-1.4)
Parental divorce	1.4 (1.3-1.5)[f]	1.2 (1.1-1.3)[f]	...	1.1 (1.0-1.2)[f]
Other parental loss	1.6 (1.2-2.1)[f]	1.2 (1.0-1.5)[f]	...	1.2 (1.0-1.5)
Family economic adversity	1.3 (1.1-1.6)[f]	1.1 (1.0-1.2)	...	1.0 (0.9-1.5)
	...	$\chi^2_4 = 28.0$[f]	...	$\chi^2_4 = 7.1$
	...	$\chi^2_{12} = 775.3$[f]	$\chi^2_{12} = 63.8$[f]	$\chi^2_{12} = 63.8$[f]
No. of Maladaptive Family Functioning CAs				
0	...	...	...	...
1	...	...	1.8 (1.6-2.2)[f]	...
2	...	...	2.4 (2.0-2.8)[f]	1.3 (1.1-1.6)[f]
3	...	...	2.6 (2.1-3.1)[f]	1.5 (1.2-1.8)[f]
4	...	...	3.0 (2.5-3.6)[f]	1.4 (1.1-1.8)[f]
5	...	...	3.8 (2.9-5.0)[f]	1.3 (1.0-1.8)
6	...	...	4.6 (3.5-6.0)[f]	1.4 (0.9-2.3)
≥7	...	...	1.4 (1.2-1.6)[f]	1.4 (0.8-2.4)
	...	...	$\chi^2_7 = 320.6$[f]	$\chi^2_7 = 30.0$[f]

[a] Models were estimated using discrete-time survival analysis with person-years as the unit of analysis. A separate person-year file was created for each of 14 disorders, and survival analysis was performed using the pooled set of all 14 of these data files, thereby forcing the slopes to be constant across 14 disorders. Each model controlled for person-years and age, sex, race/ethnicity, and 13 dummy variables for the outcome disorder category and included controls for the previous onset of comorbid conditions.

[b] Models were estimated with one CA at a time and the controls noted in the first footnote.

[c] The model was estimated with all 12 CAs and the controls noted in the first footnote.

[d] The model was estimated with dummy variables for the number of CAs without any information about CA type and the controls in the first footnote.

[e] The model was estimated with dummy variables for both the type and number of CAs and the controls noted in the first footnote.

[f] Significant at 2-sided $P < .05$.

ing ORs with the number of CAs, ranging from 1.8 for exactly 1 CA to 4.6 for 6 CAs. The test for the joint associations of the number of CAs was significant ($\chi^2_7 = 320.6$, $P < .001$). However, subsequent models that included information about both the type and number of CAs had better measures of fit based on the AIC and

Table 3. Multivariate Associations Between Childhood Adversities (CAs) and First Onset of *DSM-IV* Disorder Classes Based on Model 5 Among 6483 Adolescent-Parent Pairs[a]

Variable	*DSM-IV* Disorder Class, Odds Ratio (95% CI)				
	Fear	Distress	Behavior	Substance Abuse	All
Maladaptive Family Functioning CAs					
Emotional abuse	1.1 (0.8-1.3)	1.9 (1.4-2.7)[b]	1.7 (1.2-2.3)[b]	2.3 (1.3-4.1)[b]	1.5 (1.2-1.8)[b]
Physical abuse	1.1 (0.7-1.5)	1.4 (1.0-2.1)	1.3 (0.8-2.0)	2.0 (0.8-4.7)	1.3 (1.0-1.6)[b]
Sexual abuse	2.0 (1.4-2.9)[b]	1.7 (1.2-2.4)[b]	1.5 (0.8-2.8)	4.8 (2.2-10.2)[b]	1.9 (1.6-2.2)[b]
Neglect	1.8 (1.2-2.5)[b]	1.4 (1.0-2.0)	1.6 (1.0-2.5)[b]	2.7 (1.1-6.8)[b]	1.5 (1.2-2.0)[b]
Parental mental illness	1.2 (0.9-1.6)	1.6 (1.3-1.9)[b]	1.5 (1.1-2.0)[b]	1.8 (1.2-2.8)[b]	1.4 (1.2-1.7)[b]
Parental substance abuse	1.0 (0.8-1.2)	0.9 (0.7-1.3)	1.3 (0.8-2.1)	2.4 (1.0-5.5)[b]	1.1 (0.9-1.3)
Parental criminality	1.2 (1.0-1.6)	1.5 (1.1-1.9)[b]	1.3 (1.0-1.6)[b]	2.6 (1.8-3.6)[b]	1.4 (1.1-1.6)[b]
Family violence	1.4 (1.0-2.0)[b]	1.4 (1.1-1.9)[b]	1.6 (1.2-2.4)[b]	2.4 (1.3-4.3)[b]	1.5 (1.3-1.8)[b]
	$\chi^2_8 = 28.3^b$	$\chi^2_8 = 51.7^b$	$\chi^2_8 = 12.8$	$\chi^2_8 = 42.4^b$	$\chi^2_8 = 58.4^b$
Other CAs					
Parental death	0.8 (0.6-1.1)	1.4 (0.9-2.0)	1.3 (1.0-1.6)	1.1 (0.6-2.2)	1.2 (0.9-1.4)
Parental divorce	1.1 (0.9-1.3)	1.3 (1.1-1.6)[b]	1.2 (0.9-1.4)	1.0 (0.6-1.6)	1.1 (1.0-1.3)[b]
Other parental loss	1.4 (1.1-1.7)[b]	0.9 (0.6-1.3)	1.4 (1.1-1.8)	0.8 (0.4-1.6)	1.2 (0.9-1.4)
Family economic adversity	1.1 (0.8-1.4)	0.7 (0.6-0.9)	1.4 (1.1-1.7)	0.5 (0.2-1.0)[b]	1.0 (0.8-1.1)
	$\chi^2_4 = 10.4$	$\chi^2_4 = 22.1^b$	$\chi^2_4 = 28.2^b$	$\chi^2_4 = 7.9$	$\chi^2_4 = 9.5^b$
	$\chi^2_{12} = 54.7^b$	$\chi^2_{12} = 158.1^b$	$\chi^2_{12} = 42.0^b$	$\chi^2_{12} = 60.5^b$	$\chi^2_{12} = 113.4^b$
No. of Maladaptive Family Functioning CAs					
0					
1					
2	1.0 (0.7-1.6)	1.1 (0.8-1.5)	1.2 (0.8-1.9)	0.6 (0.3-1.2)	1.0 (0.8-1.4)
3	1.0 (0.6-1.8)	0.9 (0.5-1.5)	1.2 (0.6-2.4)	0.2 (0.1-0.6)[b]	0.9 (0.6-1.4)
4	0.8 (0.4-1.5)	0.8 (0.4-1.6)	1.0 (0.4-2.3)	0.1 (0.0-0.6)[b]	0.8 (0.5-1.3)
5	1.0 (0.4-2.5)	0.6 (0.2-1.6)	0.9 (0.3-3.1)	0.1 (0.0-0.7)[b]	0.8 (0.4-1.3)
6	0.4 (0.2-1.2)	0.6 (0.2-2.1)	1.0 (0.2-4.3)	0.0 (0.0-0.4)[b]	0.6 (0.3-1.1)
≥7	0.3 (0.1-1.2)	0.9 (0.3-2.8)	0.5 (0.1-4.4)	0.0 (0.0-0.3)[b]	0.4 (0.2-0.8)
	$\chi^2_6 = 17.8^b$	$\chi^2_6 = 11.6$	$\chi^2_6 = 6.7$	$\chi^2_6 = 14.7^b$	$\chi^2_6 = 24.1^b$
No. of Other CAs					
0					
1					
2	1.1 (0.9-1.4)	1.6 (1.0-2.4)[b]	1.1 (0.9-1.5)	1.5 (0.7-3.4)	1.2 (1.0-1.4)[b]
3	1.0 (0.7-1.6)	1.4 (0.7-3.0)	1.2 (0.8-2.0)	2.4 (0.5-11.7)	1.2 (0.9-1.6)
≥4					
	$\chi^2_2 = 0.8$	$\chi^2_2 = 4.6$	$\chi^2_2 = 1.0$	$\chi^2_2 = 1.5$	$\chi^2_2 = 5.6$

[a] See the first footnote 1 in Table 2 for a description of the overall modeling approach. The model shown herein was estimated with predictors for the types of CAs and the numbers of CAs (distinguishing the number of maladaptive family functioning CAs from the number of other CAs) in addition to the controls used in the models in Table 2. Note that no term was included in the model for having exactly one CA. This means that the coefficients for the types of CAs can be interpreted as the associations of pure CAs (ie, having one and only one particular type of CA compared with having none) with the onset, whereas the associations with the number of CAs represent the extent to which the incremental associations of co-occurring CAs (ie, the added risk of an additional CA in respondents who are otherwise equivalent in terms of the number of other CAs, controlling for the types of other CAs) differ from the associations of pure CAs.

[b] Significant at 2-sided $P < .05$.

BIC. The best-fitting model (model 5) distinguished MFF CAs from other CAs but did not further delineate the MFF CAs into those directed at the adolescent (ie, abuse or neglect) vs those that involved parental maladjustment. Detailed results of model fitting are available on request. In this model, the types of CAs were significant as a set after controlling for the numbers of CAs ($\chi^2_{12} = 113.4$), and the numbers of MFF CAs were significant as a set after controlling for the types of CAs ($\chi^2_6 = 24.1$) ($P < .001$ for both) (**Table 3**). However, the joint test for the number of other CAs was not significant ($\chi^2_2 = 5.6$, $P = .06$). As in the additive model, this model showed variation in the strength of the ORs across CA types ($\chi^2_{11} = 34.0$, $P < .001$), with MFF CAs having consistently higher ORs than other CAs. The ORs associated with CA types in this model were generally higher than those in the additive model, indicating that the additivity assumption led to a downward bias in the estimated associations of individual CAs with psychiatric disorders. This bias occurred because the ORs associated with the number of CAs in the more complex model were generally less than 1.0 and became increasingly smaller as the number of CAs increased. This pattern of subadditive interactions indicates that the odds of disorder onset increased at a significantly decreasing rate as the number of CAs increased. This best-fitting model is the one used in subsequent disaggregated analyses.

DIFFERENTIAL ASSOCIATIONS BY CLASS AND TYPE OF *DSM-IV* DISORDER

A test for variation in 20 CA coefficients (12 for the types of CAs and 8 for the numbers of CAs) across 4 *DSM-IV* disorder classes was significant ($\chi^2_{60} = 704.6$, $P < .001$),

indicating that the associations of CAs with psychiatric disorder onsets varied across disorder classes. The types of CAs were always associated with increased odds of disorder onset jointly (range, $\chi^2_{12} = 42.0$ to $\chi^2_{12} = 158.1$, $P < .001$). Eight types of CAs were associated with the onset of behavior and substance use disorders, 6 with distress disorders, and 4 with fear disorders. The MFF CAs were significantly associated with the onset of fear, distress, and substance use disorders (range, $\chi^2_8 = 28.3$ to $\chi^2_8 = 51.7$, $P < .001$) but not with behavior disorders ($\chi^2_8 = 12.8$, $P = .12$). In contrast, other CAs were associated with the onset of fear, distress, and behavior disorders (range, $\chi^2_4 = 10.4$ to $\chi^2_4 = 28.2$; range, $P = .04$ to $P < .001$) but not with substance use disorders ($\chi^2_4 = 7.9$, $P = .09$) (Table 3). The ORs associated with the number of MFF CAs were associated with significantly decreased odds (again indicating the existence of subadditive interactions) of fear and substance use disorders (range, $\chi^2_6 = 14.7$ to $\chi^2_6 = 17.8$; range, $P = .02$ to $P = .007$) but not with distress and behavior disorders (range, $\chi^2_6 = 6.7$ to $\chi^2_6 = 11.6$; range, $P = .35$ to $P = .07$). The ORs associated with the number of other CAs were not significant for any outcome.

The joint associations of 20 CA coefficients with individual psychiatric disorder onsets also varied within each of the *DSM-IV* disorder classes (range, $\chi^2_{20-100} = 136.9$ to $\chi^2_{20-100} = 390.6$; $P < .001$). Detailed results are available from the authors on request. For fear disorders, CAs were most consistently associated with social phobia, specific phobia, and intermittent explosive disorder and were unrelated to agoraphobia or panic disorder. For distress disorders, CAs were most strongly and consistently associated with PTSD, followed by major depressive disorder or dysthymia; they were related less consistently to generalized anxiety disorder and were largely unrelated to separation anxiety disorder. For behavior disorders, CAs were associated most consistently with attention-deficit/hyperactivity disorder. Finally, CAs for substance use disorders were more consistently associated with alcohol abuse or dependence than with substance abuse or dependence.

DIFFERENTIAL ASSOCIATIONS BY SEX AND RACE/ETHNICITY

To evaluate whether the associations of CAs with psychiatric disorder onsets differed for male vs female respondents, we added interactions between sex and both the type and the number of CAs to the best-fitting model. The BIC indicated that the additive model fit the data best, while the AIC indicated that the interactive model fit best. Global χ^2 tests for the overall significance of interactions between CAs and sex were significant in predicting any disorder, as well as each of 4 *DSM-IV* disorder classes (range, $\chi^2_{20} = 47.4$ to $\chi^2_{20} = 413.9$; $P < .001$). Inspection of individual interactions found 12.0% to be significant at $P < .05$. However, no clear pattern of results was apparent overall or for particular classes of CAs or disorders. Detailed results are available on request.

We also added interactions between race/ethnicity (non-Hispanic black and Hispanic vs others) and both the type and number of CAs. The AIC and the BIC indicated that the interactive model fit best. Overall interactions between CAs and race/ethnicity were significant in predicting any disorder, as well as each of 4 classes of disorders (range, $\chi^2_{20} = 59.6$ to $\chi^2_{20} = 401.9$ for non-Hispanic black respondents and $\chi^2_{20} = 77.2$ to $\chi^2_{20} = 169.0$ for Hispanic respondents; $P < .001$ for both). However, inspection of individual interactions revealed no clear pattern of results, and only 6.0% of interactions were significant at $P < .05$. Detailed results are available on request.

POPULATION-LEVEL ASSOCIATIONS OF CAs WITH DISORDER ONSET

The PARPs for the outcomes associated with CAs based on the best-fitting model showed that CAs explain (in a predictive rather than a causal sense) 28.2% of all psychiatric disorders, 15.7% of fear disorders, 32.2% of distress disorders, 40.7% of behavior disorders, and 34.4% of substance use disorders (**Table 4**). The MFF CAs were more important than other CAs (23.7% vs 6.4%). The most important individual CAs were parental criminality (9.2%) and parental mental illness (6.8%).

COMMENT

The results herein are limited in several ways. First, although recall bias is expected to be less extreme in a survey of adolescents than adults, recall bias is still a possibility in NCS-A retrospective reports of CAs and lifetime disorders. Special procedures shown experimentally to improve the accuracy of reporting the age at onset of depression[41] were used to address this problem, but recall bias is impossible to eliminate completely. Second, our analysis focused on the sample of adolescents for whom we were able to obtain parent SAQs. It is possible that parents of adolescents with higher exposure to CAs were less likely to provide these SAQs, resulting in underestimation of CA prevalence. Third, the NCS-A assessed only the timing of discrete CAs (parental loss events and sexual abuse), which means that some psychiatric disorder onsets may have occurred before the CAs that we used as predictors. Reverse causation is a particular concern for behavior disorders because disruptive behavior problems are known to increase the likelihood of harsh parenting.[42,43] This limitation is especially important because the associations of CAs with psychopathology may vary depending on the timing of exposure.[44,45] Fourth, the NCS-A lacks information on the frequency or severity of CAs. The stronger associations for MFF CAs than for other CAs might, at least in part, be owing to this limitation. Fifth, our definition of CA was not exhaustive. We focused specifically on family-related adversities, consistent with previous work,[12,15] but numerous other adversities are associated with elevated risk for early-onset psychopathology.[46-48]

Within the context of these limitations, the NCS-A results suggest the following: that most US adolescents have been exposed to at least 1 of the CAs considered herein, that exposure to multiple CAs is the norm among those exposed, that many of these CAs are significant correlates of child-adolescent mental disorders, that MFF CAs

Table 4. Population-Attributable Risk Proportions (PARPs) Across Lifetime *DSM-IV* Disorder Classes Associated With Childhood Adversities (CAs) Among 6483 Adolescent-Parent Pairs[a]

Variable	*DSM-IV* Disorder Class				
	All	Fear	Distress	Behavior	Substance Abuse
Maladaptive family functioning CAs	23.7	11.8	26.6	32.1	37.0
Emotional abuse	3.1	0.4	5.2	4.4	4.9
Physical abuse	1.5	0.2	2.1	1.5	2.9
Sexual abuse	2.5	1.9	2.5	1.3	8.0
Neglect	1.4	1.3	1.0	1.8	2.6
Parental mental illness	6.8	2.7	8.8	9.2	9.4
Parental substance abuse	1.3	−0.4	−1.2	4.4	9.0
Parental criminality	9.2	5.0	10.7	8.8	21.7
Family violence	3.7	2.0	3.4	4.5	7.7
Other CAs	6.4	4.6	8.0	13.6	−4.6
Parental death	0.6	−0.6	1.7	1.1	0.6
Parental divorce	3.1	1.3	6.8	3.1	0.1
Other parental loss	0.7	1.3	−0.7	1.8	−1.1
Family economic adversity	−0.4	1.5	−5.7	6.4	−9.8
All CAs	28.2	15.7	32.2	40.7	34.4

[a] The PARPs were calculated using simulation methods to generate individual-level predicted probabilities of the outcome disorders twice from the coefficients in the best-fitting model, the first time using all the coefficients in the model (probability of the disorder in those exposed to CAs) and the second time assuming that the coefficients associated with CAs were all zero (probability of the disorder in those unexposed). One minus the ratio of the predicted prevalence estimates in the 2 specifications was then used to calculate the PARPs.

are of special importance in this regard, and that the joint associations of multiple CAs are subadditive. These results are consistent with the findings in parallel studies[4,16] of adults. The NCS-A results are similar for boys and girls and for adolescents from different racial/ethnic backgrounds, a finding that is consistent with some previous studies.[49,50] We did not investigate whether the associations vary as a function of socioeconomic status or other sociodemographic characteristics of respondents. This is a subject for future research.

The NCS-A results diverge in one way from previous adult studies,[4,16] in that the latter investigations found little evidence of differential CA associations by disorder type. However, substantial variation of this sort is apparent in the NCS-A because CAs are associated most strongly with behavior and substance use disorders and least strongly with fear disorders. The particularly strong associations with substance use disorders and behavior disorders may reflect the relationships of CAs with the development of brain areas related to impulsivity,[51,52] a possibility that warrants additional investigation in future research. One explanation for the more specific pattern of associations in adolescents than in adults is that many of the disorders unassociated with CAs in the NCS-A typically begin after adolescence.[53] To evaluate this possibility, we conducted a more detailed analysis examining the associations of CAs with individual disorders and found that the CAs considered herein generally have the strongest associations within *DSM-IV* disorder classes with the disorders that have early ages at onset.[53] For example, within the fear disorders, CAs are more strongly associated with specific phobia and social phobia than with panic disorder or agoraphobia. This means that CAs are especially important in promoting the onset of temporally primary disorders that, in turn, predict subsequent onsets of temporally secondary disorders.[24] The one exception to this pattern is distress disorders, in which CAs are un-

related to separation anxiety disorder, the disorder shown in previous research to have the earliest onset,[24] and are associated most strongly with PTSD, a condition with the latest onset. The especially strong associations of CAs with PTSD in the NCS-A are consistent with prospective evidence indicating that CAs have particularly strong predictive associations with this disorder.[54]

With regard to differential associations across CAs, previous research identified stronger associations of sexual abuse than other CAs with subsequent onset of psychiatric disorders after accounting for other CAs.[9,55-57] This pattern was observed in the NCS-A as well. Indeed, the OR associated with sexual abuse was the largest or second largest in predicting 3 (fear, distress, and substance abuse) of 4 *DSM-IV* disorder classes, as well as for 6 individual disorders in these classes. Behavior disorders were the only outcomes for which sexual abuse was not among the strongest predictors. This pattern is consistent with our findings from an adult study.[4]

The evidence of strong co-occurrence among CAs is also consistent with previous work in adult samples[4,16] and with prior studies[12,58,59] of CAs in children and in adults. This high degree of co-occurrence suggests that previous studies focused on single CAs likely overestimated the importance of those CAs. Furthermore, although the magnitude of the associations of individual CAs with psychiatric disorders is uniformly attenuated after adjustment for co-occurring CAs, virtually all the CAs continue to have significant associations with disorders in multivariate models. This documents that no single CA or small group of CAs captures the full range of CA effects.

The results of the PARP analysis show that CAs are associated with a substantial proportion of child-adolescent psychiatric disorder onsets, including more than 40% of behavior disorder onsets and one-third of distress and substance use disorder onsets. This is consistent with previous work in adult samples,[4,16] although

CAs are associated with larger proportions of distress disorders (32.2% vs 26.2%) and substance use disorders (34.4% vs 21.0%) among adolescents vs in the adult NCS-R data. Because distress and substance use disorders have later ages at onset,[53] this pattern suggests that CAs may have a larger role in predicting child-adolescent onset variants of certain distress and substance use disorders. In contrast, CAs are associated with a smaller proportion of anxiety disorders in adolescents vs in the adult data (15.7% vs 32.4%), despite the fact that CAs are associated more strongly with early-onset than later-onset anxiety disorders. The large PARPs in the NCS-A suggest that CAs are important as determinants of child-adolescent onsets of psychiatric mental disorders (causal risk factors) or as markers of other determinants (risk markers).[60] As such, they represent promising targets for intervention efforts.

The NCS-A data cannot distinguish between the possibility that CAs are causal risk factors rather than merely risk markers. Only experimental studies can provide definitive adjudication between these 2 possibilities. However, experiments that randomly assign youth to exposure to CAs are virtually nonexistent, and interventions that randomly assign youth to interventions aimed at ameliorating the effects of these exposures are rare. The existence of subadditive interactions among co-occurring CAs has important implications for intervention planning because the presence of these interactions implies that interventions aimed at protecting high-risk youth exposed to many CAs are unlikely to have strong effects if they target only a subset of the adversities to which these youth are exposed. The ameliorative effects of incremental reductions in CAs would be expected to be small if harmful effects of incremental increases in CAs are small. We would consequently expect interventions that address a large number of CAs (eg, home visiting programs aimed at preventing many different types of child maltreatment[61] or foster care[62]) to have much more powerful effects than interventions targeted at only one CA.[63,64] Alternatively, given the strong co-occurrence of the CAs examined herein with parental psychopathology, interventions aimed at treating parents with psychiatric disorders may also result in reductions in other CAs, such as maltreatment, criminal behavior, and family violence. Indeed, some evidence suggests that successful treatment of parental disorders can reduce psychopathology in children.[65] We are unaware of any attempts to measure CAs among youth in such interventions, but this would be useful information to obtain to allow an assessment of the extent to which intervention effects vary as a function of the number and type of CAs.

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