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Childhood adversities and adult psychopathology in the National Comorbidity Survey Replication (NCS-R) I: Associations with first onset of DSM-IV disorders

Jennifer Greif Green, Ph.D.,

Department of Health Care Policy, Harvard Medical School

Katie A. McLaughlin, Ph.D.,

Department of Health Care Policy, Harvard Medical School

Patricia A. Berglund, M.B.A.,

Institute for Survey Research, University of Michigan

Michael J. Gruber, M.S.,

Department of Health Care Policy, Harvard Medical School

Nancy A. Sampson, B.A.,

Department of Health Care Policy, Harvard Medical School

Alan M. Zaslavsky, Ph.D., and

Department of Health Care Policy, Harvard Medical School

Ronald C. Kessler, Ph.D.

Department of Health Care Policy, Harvard Medical School

Abstract

Context—Although significant associations of childhood adversities (CAs) with adult mental disorders have been documented consistently in epidemiological surveys, these studies generally have examined only one CA per study. As CAs are highly clustered, this approach results in overestimating the importance of individual CAs. Multivariate CA studies have been based on insufficiently complex models.

Objective—To examine the joint associations of 12 retrospectively reported CAs with first onset of DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R) using substantively complex multivariate models.

Design—Cross-sectional community survey with retrospective reports of CAs and lifetime DSM-IV disorders.

Setting/Participants—Nationally representative sample of 5,692 adults in the US household population.

Intervention—None

Corresponding author: RC Kessler, Department of Health Care Policy, Harvard Medical School, 180 Longwood Avenue, Boston, MA 02115. Tel. (617) 432-3587, Fax (617) 432-3588, kessler@hcp.med.harvard.edu.

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Main Outcome Measures—Lifetime prevalence of 20 DSM-IV anxiety, mood, disruptive behavior, and substance disorders assessed with the WHO Composite International Diagnostic Interview (CIDI).

Results—The CAs studied were highly prevalent and inter-correlated. CAs in a maladaptive family functioning (MFF) cluster (parental mental illness, substance disorder, and criminal behavior; family violence; physical abuse; sexual abuse; neglect) were the strongest correlates of disorder onset. The best-fitting model included terms for each type of CA, number of MFF CAs, and number of other CAs. Multiple MFF CAs had significant sub-additive associations with disorder onset. Little specificity was found for particular CAs with particular disorders. Associations declined in magnitude with life course stage and number of prior lifetime disorders, but increased with length of recall period. Simulations suggest that CAs are associated with 44.6% of all childhood-onset disorders and 25.9-32.0% of later-onset disorders.

Conclusions—The fact that associations increased with length of recall raises the possibility of recall bias inflating estimates. Even taking this into consideration, though, the results suggest that CAs have powerful and often sub-additive associations with onset of many types of largely primary mental disorders throughout the life course.

Significant associations of retrospectively reported childhood adversities (CAs) with adult illness have been documented in numerous studies.^{1, 2} The first such studies focused on only a single CA, such as parental death or neglect^{3, 4} and one mental disorder, most often depression.^{5, 6} Subsequent studies showed that retrospectively reported CAs are often highly clustered,^{7, 8} requiring examination of multiple CAs to avoid over-estimating associations involving particular CAs.^{2, 9, 10} These studies also found that CAs are often nonspecific in their associations with many different mental disorders,¹⁰⁻¹² making it useful to examine multiple outcomes to avoid overly-narrow interpretations.

Subsequent studies created summary CA scales and documented dose-response relationships with adult outcomes.¹³⁻¹⁵ However, such indices implicitly assumed that each CA has the same effect and that joint effects are additive. These assumptions are almost certainly incorrect.¹⁶ Indeed, a preliminary examination of these assumptions in the National Comorbidity Survey (NCS)¹⁷ showed clearly that some CAs have stronger associations with adult outcomes than others and that joint associations are nonadditive.¹⁰ That study also found that these associations sometimes attenuate with age, a specification generally, but not always,^{12, 18} ignored in subsequent studies.

The current report builds on these earlier NCS findings by analyzing the CAs assessed in the NCS Replication Survey (NCS-R).¹⁹ Although associations between retrospectively reported CAs and mental disorders can be upwardly biased due to recall failure, it is nonetheless useful to examine associations based on such retrospective data because they provide upper-bound estimates that avoid the problem of downward bias due to systematic sample attrition in estimates based on long-term prospective data. We examine associations of CAs with first onset of diverse DSM-IV disorders based on several competing multivariate models. A companion paper²⁰ examines associations of CAs with lifetime persistence of the same disorders.

Methods

Sample

The NCS-R was a face-to-face survey of English-speaking adults carried out between February 2001 and April 2003 in a multi-stage clustered area probability sample of the US household population.¹⁹ The response rate was 70.9%. Recruitment began with a letter and study fact brochure followed by in-person interviewer visits to explain study aims and procedures before

obtaining informed consent. Respondents were paid \$50 for participation. Recruitment and consent procedures were approved by the human subjects committees of Harvard Medical School and the University of Michigan.

The survey was administered in two parts. Part I included a core diagnostic assessment administered to all respondents ($n = 9,282$). Part II, which was generally administered on the same occasion as Part I, included questions about correlates and additional disorders administered to all Part I respondents who met lifetime criteria for any Part I disorder plus a probability sub-sample of other Part I respondents ($n = 5,692$). The Part I sample was weighted to adjust for differential probabilities of selection and intensity of recruitment effort among hard-to-recruit cases. The Part II sample, the focus of the current report, was additionally weighted for the lower selection probabilities of Part I respondents without a mental disorder. A final weight adjusted the sample to match the 2000 census population on the cross-classification of numerous geographic and socio-demographic variables. All analyses employed these weights. As a result, the socio-demographic characteristics of the weighted Part II sample closely match the population (e.g., 42% female, 71% Non-Hispanic White, 24% 18-29 years old, 21% 60+ years old). More detailed information on NCS-R sampling, design, weighting, and socio-demographic distribution is reported elsewhere.²¹

Diagnostic Assessment

NCS-R lifetime diagnoses are based on the WHO Composite International Diagnostic Interview (CIDI),²² a fully-structured lay-administered interview that generates diagnoses according to the definitions and criteria of both the ICD-10 and DSM-IV systems. DSM-IV criteria are used here. The lifetime diagnoses include four broad classes of 20 specific disorders: Mood disorders [major depressive disorder, dysthymic disorder, bipolar I disorder (BP-I), BP-II, and sub-threshold BPD], anxiety disorders (panic disorder, agoraphobia without a history of panic disorder, generalized anxiety disorder, specific phobia, social phobia, post-traumatic stress disorder, separation anxiety disorder), disruptive behavior disorders (intermittent explosive disorder, attention-deficit/hyperactivity disorder, oppositional-defiant disorder, conduct disorder), and substance disorders (alcohol abuse, alcohol dependence with abuse, drug abuse, drug dependence with abuse). Diagnostic hierarchy rules and organic exclusion rules were used in making diagnoses. DSM-IV/CIDI disorder prevalence estimates in socio-demographic sub-samples are reported elsewhere www.hcp.med.harvard.edu/ncs. An NCS clinical reappraisal study²³ found generally good concordance between diagnoses based on the CIDI and those based on blinded clinical reinterviews with the Structured Clinical Interview for DSM-IV (SCID).²⁴

The CIDI assessed disorder age-of-onset (AOO) retrospectively. Based on evidence that retrospective age-of-onset reports are often erroneous,²⁵ a special question sequence was used to improve accuracy of reporting. This began with questions designed to emphasize the importance of accurate response: "Can you remember your exact age the *very first time* (emphasis in original) when you had (the symptom/the syndrome)?" Respondents who answered "no" were then probed for a bound of uncertainty by asking the earliest age they could clearly remember having the disorder. Onset was set at the upper end of the bound of uncertainty. Experimental research has shown that this approach yields more plausible AOO distributions than standard AOO questions.²⁶

Childhood Adversities

Twelve dichotomous CAs occurring before age 18 were assessed in the NCS-R. Selection of CAs was based on our reading of the literature. These include three types of interpersonal loss (parental death, parental divorce, other separation from parents or caregivers), four types of parental maladjustment (mental illness, substance abuse, criminality, violence), three types of

maltreatment (physical abuse, sexual abuse, neglect), and two other CAs (life-threatening respondent childhood physical illness, extreme childhood family economic adversity). The measures of parental death, divorce, and other separation (e.g., respondent foster care placement) focus only on biological parents, not step-parents or other caregivers. Respondents who were born to a single mother and never experienced any further disruption of this parenting arrangement were coded as not experiencing any parental separation. We did not include information about number of caregiver disruptions (e.g., multiple divorces) or separations (e.g., multiple foster care placements), but rather coded respondents dichotomously as having any versus no such disruptions because the rarity of multiple disruptions made estimates of dose-response relationships unstable.

Parental criminality, family economic adversity, and sexual abuse were assessed with short question series developed for the baseline NCS.¹⁰ Parental criminality was assessed with questions about whether a parent either engaged in criminal activities like burglary or selling stolen property or was ever arrested for criminal activity. Economic adversity was assessed with questions about whether the family received welfare or other government assistance and whether the family often lacked enough money to pay for basic necessities of living. Sexual abuse was assessed with questions about repeated fondling, attempted rape, or rape. Parental mental illness (major depression, generalized anxiety disorder, panic disorder, antisocial personality disorder) and substance abuse were assessed with the Family History Research Diagnostic Criteria (FHRDC) Interview²⁷ and its extensions.²⁸ Family violence and physical abuse of the respondent by parents were assessed with a modified version of the Conflict Tactics Scale.²⁹ Neglect was assessed with questions used in studies of child welfare about frequency of not having adequate food, clothing, or medical care, having inadequate supervision, and having to do age-inappropriate chores.³⁰ Life-threatening physical illness, finally, was assessed with a standard chronic conditions checklist.³¹

Analysis methods

Tetrachoric factor analysis (promax rotation) was used to examine inter-correlations among CAs. Associations of CAs with lifetime disorders were estimated using discrete-time survival analysis with person-years as the unit of analysis,³² controlling respondent age at interview, gender, race-ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, Other), and other DSM-IV/CIDI disorders with onsets prior to the age of onset of the disorder under investigation and up to age 17. The controls for early-onset disorders were included to adjust for the associations of CAs with temporally secondary disorders through earlier-onset disorders that influenced secondary disorders. Person-years began at age 4, the youngest age that we evaluated for possible disorder onset. Person-years were coded “0” on the dependent variables until the age of onset and “1” at the year of onset and were censored after the year of onset. A number of multivariate models were estimated, each including dummy predictor variables for CAs plus controls. The first model was additive: that is, it included a separate predictor variable for each of the 12 CAs without interaction terms. The second multivariate model included predictor variables for number of CAs without variables for types of CAs experienced. A third model included 12 predictors for type of CA and additional predictors for number of CAs, with the latter starting at exactly two rather than one because the variable for exactly one CA was perfectly predicted by the 12 dummy variables for the individual CAs. A variant on this third model distinguished between two types of CAs described below. Another variant included interactions between types of CAs and number of CAs. Finally, we considered more complex inherently nonlinear models, but these did not improve on the fit of the simpler models and are consequently not discussed here.

The Akaike Information Criterion (AIC)³³ was used to select the best multivariate model for the overall data array (i.e., the consolidated data file that stacked the 20 separate disorder-

specific person-year files and included 19 dummy predictor variables to distinguish among these files, thereby forcing the estimated slopes of disorders on CAs to be constant across disorders). This best-fitting model was then estimated again in sub-samples defined by disorder, class of disorder (mood, anxiety, disruptive behavior, and substance disorders), life course stage, and the conjunction of life course stage with class of disorder. Survival coefficients and their standard errors were exponentiated and are reported as odds-ratios (OR) and 95% confidence intervals (95% CI).

The population attributable risk proportion (PARP) of the outcomes was computed for the best-fitting model. PARP is the proportion of observed outcomes that would have been prevented in the absence of CAs if the ORs were due to causal effects of CAs.³⁴ In the more realistic case where the associations of CAs with outcomes are due partly to common causes, PARP reflects overall associations. PARPs were calculated using simulation methods to generate individual-level predicted probabilities of the outcome disorders from the coefficients in the best-fitting model with and without coefficients for CAs. PARP is one minus the ratio of the predicted prevalence estimates in the two specifications. PARP for a pooled dataset is the average PARP across all disorders included in the calculation based on a constant model across disorders.

All significance tests were evaluated using .05-level two-sided tests. As the NCS-R data are clustered and weighted, the design-based Taylor series method³⁵ implemented in the SUDAAN software system³⁶ was used to estimate standard errors of ORs.

Results

The prevalence and co-occurrence of childhood adversities

Some 53.4% of NCS-R respondents reported having at least one CA. (Table 1) The most common were parental divorce (17.5%), family violence (14.0%), family economic adversity (10.6%), and parental mental illness (10.3%). Multiple CAs were the norm among respondents with each CA, from 51.2% among those with death of a parent to 95.1% among those with parental neglect and a mean of 3.2 CAs among respondents with more than one.

The vast majority (94%) of the tetrachoric correlations between pairs of CAs are positive. (Detailed results are available on request.) Negative values are small (.01-.09). Positive values have a median of .11 and inter-quartile range (IQR; 25th-75th percentiles) of .04-.19. Factor analysis found three meaningful factors. (Table 1) Most CAs have significant loadings on the first factor of maladaptive family functioning (e.g., parental substance abuse, criminal behavior, domestic violence, abuse, and neglect), with factor loadings of .32-.67. The second factor represents parental death and other loss with associated economic adversity (factor loadings .50-.67). The third factor represents parental divorce with associated economic adversity (factor loadings .48-.83). The CAs in Factor 1 are referred to below as “maladaptive family functioning” (MFF) CAs and the remaining CAs as “other” CAs.

The associations of childhood adversities with first onset of DSM-IV/CIDI disorders

In the bivariate models (i.e., only one CA considered at a time) of the pooled associations of CAs with first onset of the 20 DSM-IV/CIDI, all but one CA (parental death) was significant, with ORs of 1.5-1.9 for MFF CAs and 1.1-1.5 for other CAs. (Table 2) ORs are generally smaller in the additive multivariate model, with eight CAs significant and ORs of 1.2-1.4 for MFF CAs and 1.2-1.3 for other CAs. The 12 degree of freedom χ^2 test for associations of all CAs is significant ($\chi^2_{12}=884.5$, $p<.001$) although ORs are substantively modest. We can reject the hypothesis that the ORs are the same for all CAs ($\chi^2_{11}=286.6$, $p<.001$).

The multivariate model that considers only number rather than type of CAs shows generally increasing ORs with number of CAs, from 1.3 for exactly one CA (compared to respondents

who had no CA) to highs of 3.4-3.2 for 6 and 7+ CAs. The χ^2 test for the joint associations is statistically significant ($\chi^2_7=822.0$, $p<.001$). The model that includes measures of both types of CAs and number of CAs fits the data better than the earlier models in terms of AIC, as indicated by the types-of-CA measures being significant after controlling for number of CAs ($\chi^2_{12}=86.9$, $p<.001$) and the number-of-CA measures being significant after controlling for types ($\chi^2_6=63.7$, $p<.001$). (Detailed results of model-fitting are available on request.) The hypothesis that the ORs are the same for all types of CAs can be rejected ($\chi^2_{11}=60.0$, $p<.001$). MFF CAs consistently having higher ORs than other CAs. The ORs associated with types are mostly higher than in the additive model, indicating that the additivity assumption led to a downward bias in the estimated associations of individual CAs with the outcome. The reason for this is that the ORs associated with number of CAs in the more complex model are for the most part less than 1.0 and become increasingly smaller as number of CAs increases. This means that although the odds of disorder onset increase with increasing number of CAs, they increase at a significantly *decreasing rate*.

We also evaluated more complex models, but found they generally did not fit as well as the model with types and number of CAs. One refinement did improve fit, though, by distinguishing number of MFF CAs from number of other CAs. The significant sub-additive interactions associated with number of CAs are found for MFF CAs ($\chi^2_6=61.7$, $p<.001$) but not other CAs ($\chi^2_3=5.2$, $p=.16$). (The test had only 3 degrees of freedom because no respondents had all 5 MFF CAs.) This was the model used in subsequent disaggregated analyses.

Differential associations by class of DSM-IV/CIDI disorder

Disaggregation shows that CAs are significantly associated with first onset of each class of disorders (mood, anxiety, disruptive behavior, substance). The ORs associated with types of CAs are always associated with increased odds ($\chi^2_{12}=44.5-193.7$, $p<.001$). Those for MFF are more consistently significant ($\chi^2_7=38.2-115.2$, $p<.001$) than others ($\chi^2_5=7.4-57.5$, $p=.19-<.001$). (Table 3) The ORs associated with number of CAs are always associated with decreased odds, although largely confined to MFF CAs ($\chi^2_6=19.4-50.9$, $p=.004-<.001$).

Close inspection finds what appears to be meaningful variation in the ORs associated with some MFF CAs, such as parent criminality consistently having its lowest OR and parental substance abuse its highest OR predicting respondent substance abuse. The more striking pattern, though, is that each MFF CA is significantly associated with each disorder class with rather consistent ORs. ORs of other CAs are less consistent, with only 25% significant at the .05 level. Again there appears to be some meaningful variation, most notably family economic adversity and respondent physical illness associated with anxiety but not mood disorders, but these differences are not statistically significant.

Differential associations by life course stage and number of prior disorders

Disaggregation by life course stage (childhood: ages 4-12, adolescence: ages 13-19, early adulthood: ages 20-29, middle-later adulthood: ages 30+) shows that the significant ORs of some, but not all, CAs persist throughout the life course. The ORs associated with other CAs decline with age, but these declines are generally not statistically significant. The exceptions are significant declines with age in ORs for parental death ($\chi^2_3=8.1$, $p=.040$), physical abuse ($\chi^2_3=22.9$, $p<.0001$), sexual abuse ($\chi^2_3=40.3$, $p<.0001$), and physical illness ($\chi^2_3=13.7$, $p=.003$). The persistence of the OR for other parental loss throughout the life course is striking in comparison to the OR for parental death being significant only in childhood. More highly disaggregated analyses showed that age-related declines involving sexual abuse were consistent across all disorder classes (although only significant for mood disorders), while

declines associated with physical abuse, parental death, and physical illness varied by class of disorder. (Detailed results are available on request.)

We also examined differential associations of CAs with first onset of DSM-IV/CIDI disorders as a function of number of prior lifetime disorders. (Detailed results are available on request.) We found that the ORs associated with most CAs become smaller as the number of prior disorders becomes larger. This means that CAs are more strongly associated with the onset of temporally primary than secondary disorders. The sign pattern of the associations between types of CAs and onset of disorders remains largely positive (i.e., ORs greater than 1.0) when number of prior disorders is 0 (11/12 ORs greater than 1.0, 9/12 significant at the .05 level) 1 (7/12 ORs greater than 1.0, 0/12 significant at the .05 level), or 2+ (7/12 ORs greater than 1.0, 6/12 significant at the .05 level), but magnitude of ORs is considerably stronger when number of prior disorders is 0, with median and IQR of the ORs being higher when number of prior disorders is 0 [1.6 (1.2-1.7)] than either 1 [1.2 (1.1-1.2)] or 2+ [1.2 (1.1-1.3)]

The population-level associations of childhood adversities with disorder onset

We calculated PARPs associated with CAs based on the best-fitting model. Results show that CAs explain (in a predictive sense) 32.4% of all disorders, 32.4% of anxiety disorders, 26.2% of mood disorders, 41.2% of disruptive behavior disorders, and 21.0% of substance disorders. (Table 5) CAs explain a higher proportion of childhood-onset disorders (44.6%) than adolescent-onset disorders (32.0%) or adult-onset disorders (28.6%, 25.9%). This decline is largely explained by the PARPs for mood disorders decreasing with age from a high of 57.1% for childhood-onset cases to a low of 20.5% onsets in the age range 30+. PARPs also decrease with age for anxiety disorders, but less dramatically than for mood disorders (from 39.5% of childhood-onset cases to 29.8% of onsets in the age range 30+). PARPs do not decrease with age, in comparison, for substance disorders. The number of disruptive behavior disorders that occur for the first time in adulthood is so small that we could not calculate PARPs for these disorders beyond adolescence.

The effects of time to recall

The use of retrospective data introduces the possibility of recall bias. We investigated this possibility by examining age differences in the reported prevalence of CAs and in the ORs of CAs with disorder onset. (Detailed results are available on request.) Reported death of a parent when the respondent was a child was positively related to age, while parental divorce when the respondent was a child was inversely related to age. These patterns are consistent with historical trends. Respondent age was unrelated, in comparison, to reports of other parental loss, neglect, or life-threatening childhood physical illness. Respondent age 65+ was significantly related to low reports of parental mental illness, substance abuse, criminal behavior, family violence, physical abuse, and sexual abuse, while age was generally unrelated to these CAs in the age range 18-64. These patterns could be due to genuinely low prevalence of some CAs among older respondents, under-representation of elderly people with these CAs in the sample (due to early death or differential participation), under-reporting of these CAs among elderly respondents (due to differential recall or differential willingness to report). Although we have no way to know which of these processes are at work, any bias in prevalence estimates is likely conservative in the total sample because of lower reporting among the elderly.

Analysis of age differences in associations at given life course stages found generally good consistency between ORs estimated only in the youngest cohorts (ages 18-29 at interview) and the entire sample. Of the 48 coefficients for individual CAs (12 CAs associated with disorder onsets in the person-year ranges 4-12, 13-19, 20-29, and 30+), 36 were positive and 21 significant in the youngest cohorts compared to 41 positive and 31 significant in the total

sample. Median and IQR ORs were also similar in the youngest cohorts [1.3 (1.1-1.5)] and total sample [1.4 (1.2-1.7)]. There were 8 instances out of 48 where ORs differed significantly for youngest than older cohorts. The OR was significant but lower in magnitude in younger (1.2-1.8) than older (1.4-1.4) cohorts in three of these cases. The OR changed from greater than 1.0 (1.1-1.1) in older to less than 1.0 (0.7-0.9) in younger cohorts in two other cases but was insignificant in both. The OR was nonsignificant in the youngest cohorts (0.8-1.1) but significant in older cohorts (1.4-1.7) in the other three instances, which involved associations of childhood sexual abuse with disorder onsets in the age ranges 20-29 and 30+ and of parental substance abuse with disorder onsets in the age range 30+. These findings are not definitive, as recall failure could exist even for respondents with the shortest recall intervals, but they nonetheless show the results are quite stable across a range of recall times.

Comment

Despite the results shown in the last subsection, the study is limited by the retrospective nature of the data. Methodological research suggests that recall bias can lead to under-reporting of CAs,³⁸ which would be expected to make the estimates of PARPS conservative. However, bias could be anti-conservative in estimating ORs if the same respondents who failed to report CAs also under-reported disorders. A long-term prospective study is needed to resolve these uncertainties. Several such studies exist that could be used to evaluate our results,³⁹⁻⁴² but these studies generally have nontrivial attrition. If this attrition is systematic (i.e., respondents with highest risk of disorders also have highest attrition), estimates of CA effects could be biased downward. The best way to guard against this possibility is to think of retrospective and prospective studies as bounding the true values of associations (i.e., retrospective studies giving upper-bound estimates and prospective studies lower-bound estimates).

A second study limitation is that our list of childhood adversities, although larger than in most previous studies, is not exhaustive. We also failed to consider timing, sequencing, persistence, recurrence, or severity of individual CAs. In some cases, such as parental mental illness, there could be complex associations remaining to be discovered that involve number of ill parents, number of illnesses, and persistence as well as severity of these illnesses. A related limitation is that the analysis of joint CA effects did not include fine-grained evaluation of interactions, but focused only on broad interaction patterns. This broad-gauged approach is probably desirable as a first approximation, but inevitably misses important subtleties. For example, some research suggests that parental divorce is associated with *reduced* risk of subsequent psychopathology if it facilitates escape from exposure to maladaptive parenting.⁴³⁻⁴⁵ Future analyses need to examine such specifications against the backdrop of the broader preliminary patterns found in the current report.

Within the context of these limitations, our results are consistent with previous studies in suggesting that most US children are exposed to childhood family adversities that are often clustered.^{7, 9} Neglect, in particular, virtually always appears with other CAs. Even the CAs most likely to be independent co-occur with at least one other CA in the majority of cases. Because of this high co-occurrence, it is critical for future research not to focus on one CA without considering others because bivariate analyses artificially inflate estimates of individual CA effects.¹³ There are implications as well for more subtle analyses. For example, some previous research suggested that childhood neglect exacerbates the predictive effects of other childhood adversities,¹¹ but our results raise the possibility that this finding is due to neglect being associated with an especially large number of other uncontrolled CAs rather than itself creating high risk of psychopathology.

Our finding that the multivariate structure of the associations between CAs and disorder onset is broadly sub-additive has to our knowledge never before been examined. This sub-additive

pattern has important implications for intervention because it means that prevention or amelioration of only a single CA among youth exposed to many CAs is unlikely to have very important preventive effects. The finding that this non-additivity is confined to MFF CAs is reminiscent of the finding in the child maltreatment literature that the most severe CAs tend to be chronic intra-familial adversities involving the use of physical force.⁴⁶ This finding also reinforces the importance noted above of considering CA persistence and severity in future research, as our finding that people exposed to a large number of co-occurring MFF CAs have very high risk of lifetime disorders might be due at least partly to the effects of unmeasured CA persistence-severity.

Despite considerable early theorizing to suggest unique effects of particular CAs on particular mental disorders, such as of childhood parental death on adult depression,⁴⁷ we found remarkably little specificity of this sort in the NCS-R data. Most CAs we studied, especially MFF CAs, were associated with all the disorder classes we considered. Importantly, this pattern was found even in the models that controlled for number of CAs, in which ORs associated with specific CA types can be interpreted under the model as the associations of pure CAs (i.e., having a particular one and only one CA versus none) with disorder onset, thereby removing the confounding effects of CA co-occurrences. We also controlled comorbid child-adolescent disorders to increase our ability to detect specificities of this sort. Previous studies found some evidence for specificity in predicting prevalent cases,^{48, 49} but inspection of coefficients in our best-fitting models both at the level of disorder class and the level of individual disorders (The latter results are available on request.) yielded very little evidence of specificity. The obvious implication is that the causal pathways linking CAs to onset of psychopathology are quite general.

It is important to note, in considering the theme of causal pathways, that these results do not confirm that CAs have causal effects. An alternative possibility is that unmeasured third variables caused both CAs and subsequent mental disorders. Genetic factors are possible confounding variables of this type. This is most obviously true for parental mental illness, which can predict respondent mental illness through genetic pathways that have nothing to do with childhood adversity, but the same might be true for other CAs to the extent that they are indicators of genetic liability. Gene-by-environment interactions could also be involved to the extent that the people exposed to CAs both have an elevated genetic risk of psychopathology and are exposed to stressful experiences related to their CAs that potentiate this genetic liability. Genetically informative designs (e.g., twin-family or adoption studies) are needed to evaluate these possibilities rigorously.

Another class of potentially important third variables are respondent behaviors and behavioral predispositions that elicit some CAs, such as abuse, and cause the subsequent onset of respondent mental disorders. Prospective studies that measure these proposed constructs repeatedly would be in the best position to evaluate this possibility. In the ideal case, such studies would have multiple informants to assess reporting bias.

A final noteworthy finding is that the associations of many, but not all, CAs with first onset of DSM-IV disorders persist into adulthood. Future research needs to investigate the causal pathways responsible for this specification. Although previous research has documented long-term associations of some CAs with adult disorders,^{15, 50} these studies almost entirely focused on prevalent cases rather than first onsets. It is much more striking to document, as we did here, that childhood adversities continue to be related to first onsets of DSM disorders beyond early adulthood. Indeed, the PARPs calculated here suggest that CAs are associated with more than one-fourth of all new disorders in adulthood. Although a number of hypotheses could be advanced to explain this finding,⁵⁰⁻⁵² nothing in our results sheds light on them. Our indirect retrospective documentation of long-term multivariate associations is nonetheless important

in providing an empirical justification for carrying out further analyses to explore such hypotheses to investigate mediators, developmental sequences, and dynamic relationships between CAs and adult-onset disorders.

As noted in the introduction, future research also needs to distinguish between associations of CAs with disorder onset and with disorder persistence. As reported in a companion paper,²⁰ we found rather different association of CAs with disorder persistence than reported here with disorder onset. In addition, future research should integrate the kind of broad-based analyses of joint effects presented here with more focused investigations of specific adversities^{53, 54} and important adversity clusters.^{2, 55} Future studies should also examine the moderating effects of early disorders on the associations of CAs with later disorders,⁵⁶ a line of study that could be important in focusing clinical attention in preventing onset of secondary disorders. Finally, future studies should try to identify risk and protective factors in adulthood (e.g., personality, social support, adult stressors) that mediate or modify the relationships of CAs with adult disorders.

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Table 1
Prevalence of retrospectively reported childhood adversities and promax rotated* tetrachoric factor loadings (standardized regression coefficients) of adversities based on a three-factor model (n = 5,692)

	Prevalence of individual CAs		The percent of respondents with a given CA who also had at least one other CA		Mean number of CAs among those with more than one		Factor Loadings		
	%	(se)	%	(se)	Mean	(se)	F I [†]	F II [‡]	F III [‡]
I. Interpersonal loss									
Parent died	9.9	(0.5)	51.2	(2.8)	3.1	(0.1)	-.09	.67	-.34
Parent divorce	17.5	(0.8)	63.2	(2.2)	3.4	(0.1)	-.02	.00	.83
Other parent loss	6.7	(0.4)	75.9	(2.7)	3.8	(0.1)	.07	.58	.09
II. Family psychopathology									
Parent mental illness	10.3	(0.6)	71.7	(2.1)	3.9	(0.1)	.62	-.14	-.20
Parent substance	8.5	(0.5)	85.5	(1.5)	4.1	(0.1)	.67	-.14	-.01
Parent criminal	7.2	(0.3)	85.3	(1.7)	4.1	(0.1)	.51	-.11	.19
Family violence	14.0	(0.7)	86.6	(1.8)	3.8	(0.1)	.59	.10	.18
III. Abuse and neglect									
Physical abuse	8.4	(0.5)	87.6	(2.4)	4.3	(0.1)	.62	.21	-.09
Sexual abuse	6.0	(0.2)	72.3	(3.3)	4.1	(0.1)	.32	.19	-.07
Neglect	5.6	(0.4)	95.1	(1.1)	4.6	(0.1)	.59	.24	-.04
IV. Other childhood adversities									
Physical illness	5.8	(0.5)	60.7	(4.2)	3.3	(0.1)	.14	.10	-.17
Economic adversity	10.6	(0.5)	83.4	(2.2)	3.5	(0.1)	-.01	.50	.48
Any adversity	53.4	(1.2)	49.6	(1.1)	3.2	(0.0)			

* Correlations among factors: F1-F2: .15; F1-F3: .24; F2-F3: .07.

[†] Factor 1 is referred to as Maladaptive Family Functioning.

[‡] Factors 2 and 3 are combined and referred to as Other Childhood Adversities.

Table 2
Bivariate and multivariate associations (odds-ratios) between childhood adversities and the subsequent first onset of DSM-IV/CIDI disorders¹ (n = 5,692)[†]

	Bivariate [‡]		Multivariate (Additive) [§]		Multivariate (Number of CAs)		Multivariate (Interactive) [¶]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
I. Maladaptive family functioning								
Parent mental illness	1.7*	(1.5-1.8)	1.3*	(1.2-1.4)	-	-	1.4*	(1.3-1.6)
Parent substance	1.8*	(1.6-1.9)	1.3*	(1.2-1.4)	-	-	1.4*	(1.2-1.6)
Parent criminal	1.5*	(1.4-1.7)	1.0	(1.0-1.2)	-	-	1.2*	(1.0-1.4)
Family violence	1.8*	(1.7-2.0)	1.4*	(1.2-1.5)	-	-	1.5*	(1.3-1.7)
Physical abuse	1.8*	(1.7-2.0)	1.2*	(1.1-1.4)	-	-	1.4*	(1.2-1.6)
Sexual abuse	1.8*	(1.6-2.0)	1.4*	(1.3-1.6)	-	-	1.6*	(1.4-1.9)
Neglect	1.9*	(1.7-2.1)	1.2*	(1.0-1.3)	-	-	1.4*	(1.2-1.6)
χ^2_7			411.2*				59.0*	
II. Other childhood adversities								
Parent died	1.0	(0.9-1.2)	1.0	(0.9-1.1)	-	-	1.1	(0.9-1.2)
Parents divorced	1.1*	(1.0-1.3)	1.0	(0.9-1.1)	-	-	1.1	(0.9-1.2)
Other parental loss	1.5*	(1.4-1.6)	1.2*	(1.1-1.3)	-	-	1.3*	(1.1-1.5)
Serious physical illness	1.3*	(1.2-1.5)	1.3*	(1.2-1.4)	-	-	1.4*	(1.2-1.6)
Family economic adversity	1.3*	(1.2-1.4)	1.0	(0.9-1.1)	-	-	1.1	(1.0-1.3)
χ^2_5			31.7*				21.9*	
χ^2_{12}			884.5*				86.9*	
III. Number of childhood adversities								
1	-	-	-	-	1.3*	(1.2-1.5)	-	-
2	-	-	-	-	1.8*	(1.6-2.0)	1.1	(0.9-1.3)
3	-	-	-	-	1.9*	(1.7-2.2)	0.8	(0.6-1.1)
4	-	-	-	-	2.4*	(2.1-2.7)	0.8	(0.5-1.1)
5	-	-	-	-	2.8*	(2.5-3.1)	0.6	(0.4-1.0)

	Bivariate [‡]		Multivariate (Additive) [§]		Multivariate (Number of CAs)		Multivariate (Interactive) [¶]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
6	-	-	-	-	3.4*	(2.8-4.1)	0.6	(0.3-1.1)
7+	-	-	-	-	3.2*	(2.8-3.6)	0.3*	(0.2-0.7)
χ^2_7	822.0*						$\chi^2_6 = 63.7^*$	

* Significant at the 0.05 level, two-tailed

[‡] A separate person-year file was created for each of the 20 disorders and these 20 files were then stacked.

The models were estimated in a discrete-time survival framework with person-year as the unit of analysis using this stacked dataset, thereby forcing the slopes to be constant across the 20 disorders. Each model controlled for person-year, age category, sex, 19 dummy variables for the outcome disorder category (i.e., for the 20 disorders in the stacked dataset), and controls for the prior onset of comorbid conditions that began up to age 17. The 5692 respondents had a total of 11,047 disorder onsets, ranging from a low of 101 onsets for Bipolar I disorder to a high of 1573 onsets for Major Depressive Disorder. A total of 4,700,780 non-case (i.e., not involving one of the 11,047 onsets) person-years existed across all disorders in the stacked dataset. A 10% stratified probability sub-sample of these person-years was used as controls, each with a weight of 10, in order to decrease computation time. No bias in the estimation of ORs is introduced by sampling on the outcome due to the fact that the sampling fraction cancels out in the estimation of ORs.³⁷ Estimates of PARP, though, are biased by sub-sampling. The weight of 10 (i.e., 1/10% = 10) was added to correct for this bias. Data on the prevalence of individual CAs and the distribution of number of CAs separately in person-years with and without onsets of the disorders are available on request. For person-years with an onset, these prevalence estimates range from a low of 9.0% (physical illness) to a high of 28.5% (family violence).

[‡] Models were estimated with one adversity at a time in addition to the controls noted in the previous footnote.

[§] The model was estimated with all 12 adversities in addition to the controls noted in the first footnote.

^{||} The model was estimated with dummy predictors for number of adversities without any information about the types of adversities. The same controls used in earlier models were included as well.

[¶] The model was estimated with dummy predictors for number of adversities as well as information about the types of adversities. The same controls used in earlier models were included as well.

Table 3
Multivariate associations (odds-ratios) between childhood adversities (CAs) and the subsequent first onset of DSM-IV/CIDI classes of disorders based on a simple interactive model (n=5,692)[†]

	Mood		Anxiety		Substance		Disruptive behavior [‡]		All	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
I. Maladaptive family functioning										
Parent mental illness	1.8*	(1.4-2.3)	1.7*	(1.5-2.0)	1.4*	(1.0-1.9)	1.8*	(1.4-2.3)	1.7*	(1.5-1.9)
Parent substance abuse	1.7*	(1.4-2.1)	1.4*	(1.2-1.6)	2.3*	(1.7-3.1)	2.0*	(1.5-2.5)	1.7*	(1.5-1.9)
Parent criminality	1.3*	(1.0-1.7)	1.3*	(1.2-1.5)	1.4*	(1.1-2.0)	1.7*	(1.2-2.3)	1.4*	(1.2-1.7)
Family violence	1.4*	(1.1-1.8)	1.6*	(1.4-1.9)	1.8*	(1.4-2.4)	2.0*	(1.6-2.6)	1.7*	(1.5-2.0)
Physical abuse	1.5*	(1.2-1.8)	1.6*	(1.3-1.8)	1.6*	(1.2-2.1)	2.0*	(1.6-2.6)	1.6*	(1.4-1.9)
Sexual abuse	2.1*	(1.6-2.6)	1.9*	(1.6-2.4)	1.7*	(1.1-2.4)	1.6*	(1.2-2.1)	1.8*	(1.5-2.2)
Neglect	1.8*	(1.3-2.4)	1.6*	(1.3-1.9)	1.8*	(1.3-2.5)	1.8*	(1.3-2.4)	1.7*	(1.4-2.0)
χ^2_7	46.4*		115.2*		38.2*		53.0*		88.0*	
II. Other childhood adversities										
Parent died	1.0	(0.8-1.2)	1.2	(1.0-1.4)	1.0	(0.8-1.3)	1.0	(0.8-1.2)	1.1	(0.9-1.2)
Parents divorce	1.0	(0.9-1.2)	1.0	(0.8-1.1)	1.0	(0.8-1.2)	1.1	(0.9-1.3)	1.0	(0.9-1.1)
Other parent loss	1.1	(0.9-1.4)	1.1	(1.0-1.3)	1.5*	(1.1-2.0)	1.6*	(1.3-2.1)	1.3*	(1.1-1.4)
Serious physical illness	1.2	(1.0-1.5)	1.5*	(1.3-1.7)	1.0	(0.8-1.4)	1.5*	(1.2-1.9)	1.3*	(1.2-1.5)
Family economic adversity	1.1	(0.9-1.4)	1.2*	(1.0-1.5)	0.9	(0.6-1.2)	1.0	(0.8-1.3)	1.1	(1.0-1.3)
χ^2_5	7.5		57.5*		7.4 (.190)		36.4*		35.3*	
χ^2_{12}	52.5*		193.7*		44.5*		84.2*		120.3*	
III. Number of maladaptive family functioning CAs										
0-1	-		-		-		-		-	
2	0.7	(0.5-1.1)	0.8*	(0.6-1.0)	0.6*	(0.4-0.9)	0.6*	(0.4-0.8)	0.7*	(0.6-0.9)
3	0.5*	(0.3-0.9)	0.6*	(0.5-0.9)	0.4*	(0.2-0.7)	0.4*	(0.2-0.8)	0.5*	(0.4-0.7)
4	0.4*	(0.2-0.8)	0.4*	(0.3-0.7)	0.2*	(0.1-0.5)	0.3*	(0.2-0.6)	0.4*	(0.2-0.6)
5	0.3*	(0.1-0.7)	0.4*	(0.2-0.7)	0.2*	(0.1-0.6)	0.2*	(0.1-0.5)	0.3*	(0.1-0.5)

	Mood		Anxiety		Substance		Disruptive behavior [‡]		All	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
6	0.1*	(0.0-0.4)	0.3*	(0.1-0.6)	0.1*	(0.0-0.3)	0.1*	(0.0-0.3)	0.2*	(0.1-0.3)
7+	0.0*	(0.0-0.2)	0.2*	(0.1-0.3)	0.0*	(0.0-0.2)	0.1*	(0.0-0.3)	0.1*	(0.0-0.2)
χ^2_6	39.8*		50.9*		19.4*		23.9*		61.7*	
IV. Number of other CAs										
0-1	-		-		-		-		-	
2	0.7*	(0.5-1.0)	0.8*	(0.7-1.0)	0.9	(0.7-1.3)	1.0	(0.7-1.2)	0.8*	(0.7-1.0)
3	0.8	(0.5-1.3)	0.7*	(0.5-1.0)	1.0	(0.6-1.7)	0.9	(0.6-1.4)	0.8	(0.6-1.0)
4+	0.7	(0.3-1.6)	1.3	(0.6-2.6)	0.6	(0.2-1.8)	0.5	(0.2-1.2)	0.9	(0.6-1.3)
χ^2_3	4.7 (.20)		13.3 (.004)		1.2 (.75)		3.0 (.39)		5.2	
χ^2_{21}	316.9*		1727.0*		206.2*		465.6*		2184.8*	

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

[†] See footnote 2 to Table 2 for a description of the dataset and overall modeling approach. The model used here was estimated with predictors for both types of adversities and number of adversities (distinguishing number of Maladaptive Family Functioning adversities from number of other adversities) in addition to the controls used in the models described in Table 2. Note that no term was included in the model for having exactly 1 CA. This means that the coefficients for types of CAs can be interpreted as the associations of *pure* CAs (i.e., having one and only one particular type of CA compared to having none) with onset, whereas the associations with number of CAs represent the extent to which the *incremental* associations of co-occurring CAs (i.e., the added risk an additional CA among respondents who are otherwise equivalent in terms of the number of other CAs they experienced controlling for the types of those other CAs) differ from the associations of pure CAs. The 5,692 respondents had a total of 11,047 disorder onsets, including 2,357 onsets of a mood disorder, 4,545 of an anxiety disorder, 1,621 of a disruptive behavior disorder, and 2,366 of a substance disorder. Data on the prevalence of individual CAs and the distribution of number of CAs separately in person-years with and without onsets of the disorders are available on request. For person-years with an onset, these prevalence estimates range from a low of 7.7% (physical illness associated with onset of a substance disorder) to a high of 33.5% (family violence associated with onset of a disruptive behavior disorder).

[‡] Disruptive Behavior Disorders are restricted to respondents ≤ 44 years of age at interview

Table 4
Multivariate associations (odds ratios) between childhood adversities (CA) and the subsequent first onset of NCS-R/DSM-IV disorders in four life course stages based on a simple interactive model[†]

	Childhood (Ages 4-12)		Adolescence (Ages 13-19)		Young adulthood (Ages 20-29)		bottom-later adulthood (Ages 30+)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
I. Maladaptive family functioning								
Parent mental illness	1.8*	(1.5-2.2)	1.7*	(1.4-2.1)	1.5*	(1.3-1.9)	1.6*	(1.3-1.9)
Parent substance abuse	1.6*	(1.3-1.9)	1.8*	(1.5-2.2)	1.8*	(1.2-2.6)	1.7*	(1.3-2.1)
Parent criminality	1.4*	(1.1-1.8)	1.6*	(1.2-2.0)	1.4*	(1.1-1.8)	1.2	(0.9-1.6)
Family violence	1.6*	(1.4-1.9)	1.8*	(1.4-2.2)	1.8*	(1.5-2.3)	1.8*	(1.3-2.4)
Physical abuse	1.9*	(1.6-2.2)	1.8*	(1.4-2.2)	1.5*	(1.2-1.9)	1.3	(1.0-1.6)
Sexual abuse	2.3*	(1.9-2.7)	1.8*	(1.4-2.3)	1.7*	(1.3-2.2)	1.4*	(1.1-1.9)
Neglect	1.6*	(1.3-2.0)	1.8*	(1.4-2.3)	1.9*	(1.4-2.6)	1.4*	(1.0-2.0)
χ^2_7	139.1*		49.3*		49.5*		42.3*	
II. Other childhood adversities								
Parent died	1.2*	(1.0-1.4)	1.0	(0.8-1.2)	1.0	(0.8-1.4)	1.1	(0.9-1.3)
Parents divorce	1.0	(0.9-1.2)	1.0	(0.9-1.2)	1.0	(0.8-1.2)	1.0	(0.8-1.2)
Other parent loss	1.3*	(1.1-1.5)	1.2*	(1.0-1.5)	1.2	(0.9-1.6)	1.4*	(1.1-1.8)
Serious physical illness	1.6*	(1.4-1.9)	1.2	(1.0-1.4)	1.1	(0.8-1.4)	1.3	(1.0-1.7)
Family economic adversity	1.2*	(1.0-1.4)	1.0	(0.8-1.2)	1.2	(0.9-1.5)	1.2	(0.9-1.6)
χ^2_5	71.1*		12.9*		4.2		10.3	
χ^2_{12}	342.6*		85.9*		61.7*		81.8*	
III. Number of maladaptive family functioning CAs								
0-1								
2	0.8	(0.6-1.0)	0.7*	(0.5-0.9)	0.6*	(0.4-0.8)	0.7	(0.5-1.1)
3	0.6*	(0.4-0.9)	0.5*	(0.3-0.7)	0.4*	(0.2-0.8)	0.5*	(0.3-0.8)
4	0.4*	(0.3-0.8)	0.3*	(0.1-0.5)	0.3*	(0.1-0.5)	0.5*	(0.2-0.9)

	Childhood (Ages 4-12)		Adolescence (Ages 13-19)		Young adulthood (Ages 20-29)		bottom-later adulthood (Ages 30+)	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
5	0.3*	(0.2-0.7)	0.2*	(0.1-0.4)	0.2*	(0.1-0.7)	0.4	(0.2-1.1)*
6	0.2*	(0.1-0.5)	0.1*	(0.0-0.2)	0.2*	(0.1-0.5)	0.3*	(0.1-0.9)
7+	0.1*	(0.0-0.4)	0.0*	(0.0-0.2)	0.1*	(0.0-0.3)	0.2*	(0.0-0.8)
χ^2_6	37.2*		47.8*		26.4*		8.4	
IV. Number of other CAs								
0-1								
2	0.9	(0.8-1.1)	0.8	(0.6-1.0)	0.7	(0.5-1.0)	0.8	(0.5-1.2)
3	0.8	(0.6-1.1)	0.8	(0.5-1.2)	0.7	(0.4-1.2)	0.6	(0.3-1.2)
4+	1.0	(0.4-2.4)	0.5	(0.2-1.2)	0.4	(0.1-1.3)	0.8	(0.3-2.4)
χ^2_3	2.6		4.9		5.4		2.6	
χ^2_{21}	1167.8*		182.4*		472.0*		163.0*	

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

† See footnote 2 to Table 2 for a description of the dataset and overall modeling approach. The model used here was estimated with predictors for both types of adversities and number of adversities (distinguishing number of Maladaptive Family Functioning adversities from number of Other adversities) in addition to the controls used in the models described in Table 2. See the second footnote in Table 3 for a description of the interpretation of the joint effects of type and number of CAs. The 5,692 respondents had a total of 11,047 disorder onsets, including 3,550 in the age range 4-12, 3,401 in the age range 13-19, 2,093 in the age range 20-29, and 1,845 in the age range 30+. Data on the prevalence of individual CAs and the distribution of number of CAs separately in person-years with and without onsets of the disorders are available on request. For person-years with an onset, these prevalence estimates range from a low of 7.7% (physical illness associated with onsets in the age range 20-29) to a high of 31.0% (family violence with onsets in the age range 4-12).

Table 5
Population attributable risk proportions (PARPs)* of lifetime DSM-IV/CIDI disorder types associated with childhood adversities by life course stage

	Overall	Childhood (ages 4-12)	Adolescence (ages 13-19)	Early adulthood (ages 20-29)	Middle-later adulthood (ages 30+)
Mood	26.2	57.1	30.5	24.7	20.5
Anxiety	32.4	39.5	28.7	31.3	29.8
Substance	21.0	— [†]	26.1	25.6	32.1
Disruptive behavior [‡]	41.2	34.4	38.9	— [†]	— [†]
Any	32.4	44.6	32.0	28.6	25.9

* 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 disorder among those exposed to CAs) and the second time assuming that the coefficients associated with the CAs were all zero (probability of disorder among those unexposed). One minus the ratio of the predicted prevalence estimates in the two specifications was then used to calculate PARP. In the pooled dataset, the PARP value is the average PARP across all disorders included in the calculation based on a constant model across disorders.

[†] Too few cases available in cells to estimate PARP.

[‡] Disruptive Behavior Disorders are restricted to respondents ≤ 44 years of age at interview