RESEARCH REPORT

Adverse childhood experiences and risk of physical violence in adolescent dating relationships

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ABSTRACT

Background This study evaluates associations of commonly co-occurring childhood adversities with physical violence in dating relationships to identify potential strategies for refining and targeting dating violence prevention programmes.

Methods Data on 5130 adult respondents to a nationally representative survey with at least one dating relationship before the age of 21 years were analysed. Logistic regression models assessed associations between 12 childhood adversities and physical dating violence (PDV).

Results Adjusting for the number of co-occurring adversities, 10 of the 12 childhood adversities were significantly associated with PDV perpetration or victimisation (OR 1.5—2.8). The population attributable risk proportion of PDV due to all 12 childhood adversities was 53.4%. Childhood adversities with the highest attributable risk proportions were sexual abuse (13.8%), interparental violence (11.6%) and parent mental illness (10.7%). Multivariate prediction equations ranked respondents by their childhood adversity risk profiles; 46.4% of PDV cases occurred in the top two risk deciles.

Conclusions Assessment of a broad range of childhood exposures to familial adversities may help to identify adolescents at particularly high risk of PDV and to guide prevention efforts.

Physical violence in dating relationships (physical dating violence; PDV) is common among adolescents and young adults in the USA.[1—3] Studies reporting associations of PDV with witnessing interparental violence in childhood support prevention efforts targeted to individuals with this particular adverse childhood experience.[4—8] Similar findings have been reported in studies of violence in adult intimate relationships, supporting theories of PDV as learnt behaviour.[9—18] However, the specificity of the effect of interparental violence on PDV has been called into question by studies examining a broader range of frequently co-occurring childhood adversities.[19 20] Several studies have found associations between PDV and maltreatment (including childhood physical and sexual abuse and neglect).[4 5 7 8 21] One study of adults found that the number of types of violent experiences in childhood, regardless of the particular types, was associated with relationship violence among adults.[22] In another study, which included the broadest assessment of childhood adversities, the association between interparental violence and subsequent

relationship violence among young adults was not significant in a multivariate model with statistical adjustment for the effects of co-occurring childhood adversities.[23] Taken together, these findings suggest that the increased PDV risk attributed to experiences of interparental violence may be due to a broader constellation of childhood adversities, some of which may be potential targets for refining PDV prevention programmes that focus on universal education. For example, a classroom-based PDV prevention programme has been found to have some effect in reducing boys' perpetration of PDV, with no significant effect on girls' PDV perpetration.[24] Identifying subgroups at increased risk of PDV may be useful for developing targeted interventions to supplement such universal prevention efforts.

The goal of this study is to examine the joint predictive effects on PDV of a broad range of childhood adversities, including interparental violence, in order to examine their implications for PDV prevention. The current study includes a larger, more diverse set of childhood adversities than previous studies and examines both the distinct association of each individual childhood adversities with PDV and modification of these associations when multiple childhood adversities co-occur. The contributions of each independent childhood adversity and all childhood adversities taken together to PDV prevalence are then estimated, taking into account each childhood adversity's unique association with PDV and its tendency to co-occur with other childhood adversities in the US population.

METHODS
Sample
Data come from the National Comorbidity Survey Replication (NCS-R), a survey of the prevalence and correlates of mental disorders in a nationally representative sample of the English-speaking adult (18+ years) non-institutionalised civilian population.[25—27] Computer-assisted face-to-face interviews were conducted by trained non-clinician interviewers. Field procedures, described in detail elsewhere,[25 27] were approved by the Human Subjects Committees of both Harvard Medical School and the University of Michigan. Data and documentation are available at http://www.icpsr.umich.edu/CPES.

All 9282 respondents were administered a part I core diagnostic interview, for a response rate of 71%, and a subsample of 5692 part I respondents

were administered a part II interview that assessed correlates and disorders of secondary focus. The sample was weighted to adjust for the differential within-household probability of selection and undersampling of hard-to-reach cases, as well as demographic and geographical distributions.[27] [28] The analyses presented here were carried out in the subset of part II respondents who were 21 years of age or older at the time of interview and reported having had at least one dating relationship before the age of 21 years (n=5130).

Measures
Physical violence in dating relationships
Dating relationships were defined as romantic relationships involving at least one date, with or without sexual activity. Respondents with at least one dating relationship before the age of 21 years were asked whether they ever were a victim or perpetrator of moderate ('pushed, grabbed or shoved, threw something, slapped or hit') or severe ('kicked, bit, or hit with a fist, beat up, choked, burned or scalded, or threatened with a knife or gun') physical violence in any of these relationships.[29] Methodological studies suggest that this instrument is limited in its ability to distinguish between victims and perpetrators of violence, as some respondents report actions taken in self-defence as perpetration of violence while other respondents underreport perpetration due to social undesirability.[7] [30] To address this limitation, we conducted parallel analyses of three outcomes: victimisation, perpetration, and either victimisation or perpetration.

Childhood adversities
Twelve childhood adversities were assessed in the NCS-R: (1) parental death; (2) parental divorce; (3) other long-term parental separation (eg, adopted after age 2 years, foster care, juvenile detention, lived with relatives for 6 months or more); (4) parent mental illness (major depression, generalised anxiety disorder, or panic disorder); (5) parental substance use disorder; (6) parental criminality; (7) interparental violence; (8) serious physical illness in childhood; (9) physical abuse; (10) sexual abuse; (11) neglect; and (12) family economic adversity. Parent mental illnesses and substance use disorders were assessed using the family history research diagnostic criteria, for either male or female adult caregiver.[31–33] Interparental violence and physical abuse were assessed as moderate physical violence between parents or adult caregivers or towards the respondent by a parent or adult caregiver, respectively, using the revised conflict tactics scale.[29] Neglect was assessed with a five-item scale developed for child welfare studies.[34] Parental criminality was assessed through questions about whether the respondent's parents were involved in criminal activities, arrested, or sent to prison. Sexual abuse was assessed with questions developed for the baseline National Comorbidity Survey[20] [35] about rape, sexual assault and molestation. Economic adversity was defined as having received welfare or not having a working parent as head of the household. Information on the timing of parental death, divorce, separation, serious physical illness, interparental violence and sexual abuse was used to determine whether these childhood adversities began before the initiation of dating relationships. Only those childhood adversities that began before the initiation of dating were examined as predictors of PDV.

Analysis procedures
Prevalence of PDV was estimated as the proportion of adults with at least one dating relationship before the age of 21 years who reported moderate or severe PDV. Sociodemographic correlates of PDV were examined in multivariate logistic regression models that included respondent sex, age, race-ethnicity (white, Hispanic, black and other, including Asian, Pacific Islander and Native American), nativity (two US-born parents versus one or more foreign-born parents, as no significant differences were found among respondents with one or no US-born parents), and parent education (highest level of education attained by either parent). Age of dating initiation was also examined as a predictor, as people who begin dating early have a longer period of potential exposure to dating relationships thus are at greater risk of PDV.

Clustering of the 12 childhood adversities was examined in a factor analysis of tetrachoric correlations. A series of logistic regression models was then estimated that examined the joint predictive effects of these childhood adversities on PDV, controlling for sociodemographic factors and age at initiation of dating. The first model examined the association of each individual childhood adversity with PDV (ie, one equation for each childhood adversity). The second model examined the additive multivariate effects of all 12 childhood adversities (ie, all 12 childhood adversities in one model). The third model examined the predictive effects of the number of childhood adversities (separate dummy predictor variables for exactly one, two, three, four, five, six and seven or more childhood adversities). The fourth model examined the joint predictive effects of the 12 types of childhood adversities in addition to the number of childhood adversities (separate dummy predictor variables for exactly two to seven or more childhood adversities). In the fourth model, coefficients for the individual childhood adversities represent distinct associations of each childhood adversities with PDV when that childhood adversities occurs in isolation. The coefficients for the number of childhood adversities in this model can be interpreted as interactions among the childhood adversities constrained to be constant for all combinations involving the same number of co-occurring childhood adversities.[36]

Associations between childhood adversities and PDV are presented as OR. CI and statistical tests were calculated using the Taylor series linearisation method as implemented in the SUDAAN software package to account for the complex sample design of the NCS-R.[37] Statistical significance was assessed consistently using two-sided 0.05 level tests.

Population attributable risk proportions (PARP)—the proportion of observed PDV that would not have occurred in the absence of childhood adversities (assuming that the OR represent causal effects of childhood adversities on PDV)—were estimated from the final logistic regression model by calculating the difference in predicted prevalence of PDV between the actual sample and a counterfactual sample in which all childhood adversities have been eliminated.

RESULTS
The prevalence of PDV and sociodemographic correlates in the US household population
Among respondents who dated before the age of 21 years, 16.0% reported either perpetration of or victimisation by PDV before the age of 21 years. The reported prevalence of PDV victimisation (13.9%) was higher than the prevalence of perpetration (8.1%). Women reported more physical violence victimisation (16.3% vs 11.2%) than men, with 9.2% of women reporting severe violence victimisation compared with 4.4% of men. A similar pattern was found for reports of physical violence perpetration in dating relationships (10.6% women vs 5.3% men).

In multivariate models including all sociodemographic predictors, PDV was higher among respondents who were women, young, had parents with low educational attainment,

Table 1 Associations of PDV* (victimisation, perpetration, either) with demographic characteristics and age at initiation of dating†

	Ever a victim of dating violence (n=874, 13.9%)‡ OR (95% CI)	Ever a perpetrator of dating violence (n=549, 8.1%) OR (95% CI)	Either victim or perpetrator of dating violence (n=1010, 16.0%) OR (95% CI)
Gender			
Female	1.0	1.0	1.0
Male	0.6 (0.5 to 0.7)	0.4 (0.3 to 0.5)	0.5 (0.4 to 0.6)
	$\chi^2_{(1)}$=40.4, p<0.001	$\chi^2_{(1)}$=75.13, p<0.001	$\chi^2_{(1)}$=81.03, p<0.001
Age, years			
21–32	1.0	1.0	1.0
33–43	0.7 (0.5 to 0.9)	0.6 (0.5 to 0.8)	0.7 (0.6 to 0.8)
44–55	0.4 (0.3 to 0.5)	0.5 (0.4 to 0.7)	0.5 (0.4 to 0.6)
56+	0.2 (0.2 to 0.3)	0.2 (0.2 to 0.3)	0.2 (0.2 to 0.3)
	$\chi^2_{(3)}$=104.5, p<0.001	$\chi^2_{(3)}$=8745, p<0.001	$\chi^2_{(3)}$=118.64, p<0.001
Race-ethnicity			
Hispanic	1.1 (0.8 to 1.4)	1.5 (1.1 to 2.1)	1.2 (0.9 to 1.6)
Black	1.4 (1.3 to 1.9)	2.7 (2.0 to 3.8)	1.6 (1.2 to 2.1)
Other	1.5 (0.8 to 2.8)	1.8 (1.0 to 3.4)	1.6 (0.9 to 2.7)
White	1.0	1.0	1.0
	$\chi^2_{(3)}$=6.7, p=0.081	$\chi^2_{(3)}$=40.30, p<0.001	$\chi^2_{(3)}$=11.95, p=0.008
Nativity			
<2 USB parent	1.0	1.0	1.0
2 USB parents	1.6 (1.2 to 2.3)	1.4 (1.0 to 1.9)	1.6 (1.1 to 2.2)
	$\chi^2_{(1)}$=8.0, p=0.005	$\chi^2_{(1)}$=5.04, p=0.025	$\chi^2_{(1)}$=8.00, p=0.005
Parent education			
<HS	1.0	1.0	1.0
HS	0.7 (0.6 to 0.9)	0.9 (0.7 to 1.3)	0.8 (0.6 to 1.0)
Some college	0.8 (0.6 to 1.1)	0.8 (0.6 to 1.1)	0.8 (0.6 to 1.1)
College graduate	0.6 (0.5 to 0.9)	0.5 (0.4 to 0.7)	0.7 (0.5 to 0.9)
	$\chi^2_{(3)}$=9.3, p=0.026	$\chi^2_{(3)}$=17.47, p=0.001	$\chi^2_{(3)}$=7.59, p=0.055
Age of first date, years			
12 or under	1.0	1.0	1.0
13–15	0.5 (0.4 to 0.8)	0.4 (0.3 to 0.7)	0.5 (0.4 to 0.7)
16–17	0.3 (0.2 to 0.5)	0.3 (0.2 to 0.5)	0.3 (0.2 to 0.5)
18 or over	0.2 (0.2 to 0.3)	0.2 (0.1 to 0.4)	0.2 (0.2 to 0.3)
	$\chi^2_{(3)}$=71.3, p<0.001	$\chi^2_{(3)}$=42.88, p<0.001	$\chi^2_{(3)}$=69.30, p<0.001

*Physical dating violence (PDV) defined as ever having been a victim or perpetrator of moderate or severe physical violence in a dating relationship that began before the age of 21 years.
†OR estimated in logistic regression models including all listed covariates.
‡Percentages are weighted, numbers are actual counts.
HS, high school; USB, US born.

and had both US-born parents (table 1). Non-Hispanic black individuals reported a higher prevalence of PDV perpetration than non-Hispanic white individuals. Early age at dating initiation also predicted higher odds of PDV.

Prevalence and co-occurrence of childhood adversities

Approximately half (52.9%) of NCS-R respondents reported having experienced at least one childhood adversity during their childhood, with the prevalence of individual childhood adversities ranging from a low of 4.2% (serious physical illness) to a high of 16.0% (parental divorce), numbers that are consistent with other nationally representative studies (table 2).[38] Among respondents with each adversity, the proportion reporting only one adversity ranges from 48.3% (death of a parent) to 5.1% (neglect).

Associations of childhood adversities with PDV

Associations of each individual childhood adversity with PDV, controlling for sociodemographics and age at initiation of dating, were consistently positive (table 3, model 1). Of the 36 OR estimated, 35 (97.2%) were greater than 1 and 28 (77.8%) were statistically significant at the 0.05 level. These OR were attenuated in the multivariate additive model that includes 12

childhood adversities simultaneously (model 2), in which 32 of the 36 coefficients (88.9%) were greater than 1 and 10 (27.8%) were statistically significant. A greater number of childhood adversities were positively and significantly associated with PDV victimisation (33.3% of OR significant, with a range of 1.5–2.2) than PDV perpetration (16.7%, OR significant, with a range of 1.4–1.7).

Model 3 includes only the number of childhood adversities. A single categorical variable indicating the total number of childhood adversities was used based on the factor analysis of the tetrachoric correlations among all 12 childhood adversities, which found a single factor with an eigenvalue greater than 1 (unrotated eigenvalues for first and second factors=3.9, 0.6, respectively). This model found a generally increasing odds of PDV associated with an increasing number of childhood adversities, with OR ranging from a low of 1.8 for respondents with exactly one childhood adversity (compared with respondents who had no childhood adversities) to highs of 6.0–8.2 for respondents with six or more childhood adversities. OR between the number of childhood adversities and the risk of victimisation versus perpetration were of similar magnitude.

In the final multivariate model that included indicators for both the type and number of childhood adversities (model 4), all

Table 2 Prevalence of childhood adversities and proportion of people with each childhood adversity who have multiple adversities*

	Any adversity N (%)	Death of a parent N (%)	Parent divorce N (%)	Other parent loss N (%)	Parent mental illness N (%)	Parent substance N (%)	Parent criminal N (%)	Interparent violence N (%)	Physical illness N (%)	Physical abuse N (%)	Sexual abuse N (%)	Neglect N (%)	Economic adversity N (%)
Prevalence of each adversity in the total sample	2679 (52.9)	484 (9.5)	813 (16)	321 (6.3)	511 (10.1)	449 (8.9)	334 (6.6)	694 (13.7)	212 (4.2)	434 (8.6)	527 (10.4)	296 (5.8)	502 (9.9)
Proportion with†													
One adversity	1324 (49.4)	234 (48.3)	297 (36.5)	64 (19.9)	127 (24.9)	69 (15.4)	53 (15.9)	82 (11.8)	87 (41.0)	58 (13.4)	155 (29.4)	15 (5.1)	83 (16.5)
Two adversities	628 (23.4)	126 (26)	200 (24.6)	94 (29.3)	106 (20.7)	86 (19.2)	59 (17.7)	172 (24.8)	48 (22.6)	64 (14.7)	113 (21.4)	38 (12.8)	149 (29.7)
Three adversities	324 (12.1)	60 (12.4)	129 (15.9)	56 (17.4)	86 (16.8)	84 (18.7)	57 (17.1)	147 (21.2)	35 (16.5)	83 (19.1)	93 (17.6)	44 (14.9)	98 (19.5)
Four adversities	178 (6.6)	21 (4.3)	77 (9.5)	29 (9)	68 (13.3)	82 (18.3)	62 (18.6)	102 (14.7)	16 (7.5)	75 (17.3)	53 (10.1)	60 (20.3)	66 (13.1)
Five adversities	123 (4.6)	18 (3.7)	61 (7.5)	29 (9)	62 (12.1)	57 (12.7)	44 (13.2)	99 (14.3)	14 (6.6)	72 (16.6)	50 (9.5)	60 (20.3)	51 (10.2)
Six adversities	51 (1.9)	11 (2.3)	22 (2.7)	23 (7.2)	28 (5.5)	31 (6.9)	23 (6.9)	45 (6.5)	6 (2.8)	36 (8.3)	26 (4.9)	37 (12.5)	20 (4)
Seven or more adversities	51 (1.9)	13 (2.7)	27 (3.3)	26 (8.1)	35 (6.8)	40 (8.9)	35 (10.5)	47 (6.8)	6 (2.8)	45 (10.4)	37 (7)	43 (14.5)	34 (6.8)

*Sample consists of National Comorbidity Survey Replication part II respondents aged 21 years or older with at least one dating relationship before the age of 21 years.
†Percentages represent proportions of people with the adversity who have the corresponding number of total adversities before age at first date.

36 OR associated with type were greater than 1, with 23 (63.9%) statistically significant (in the range 1.5–2.8). In this model, coefficients for the individual childhood adversities represent distinct associations of each childhood adversity with PDV when that childhood adversity occurs in isolation. Six childhood adversities were significantly associated with PDV in all three PDV outcomes: other parent loss, parent mental illness, interparental violence, physical abuse, sexual abuse and neglect. An additional statistical test was performed to examine the hypothesis that the distinct associations of all 12 childhood adversities are identical in magnitude. After accounting for having any single childhood adversity, the type of childhood adversity remained significantly associated with victimisation ($\chi^2_{(11)}$=59.98, p<0.001), perpetration ($\chi^2_{(11)}$=29.94, p=0.002) and any PDV ($\chi^2_{(11)}$=37.82, p<0.001).

OR associated with the number of childhood adversities in the model including both type and number of childhood adversities (model 4) show that the predictive effects of co-occurring childhood adversities are sub-additive. That is, each additional childhood adversity is associated with a smaller incremental increase in risk. This means, for example, that the OR for PDV victimisation associated with parental mental illness is 2.0 for a person with only one childhood adversity, but only 1.2 (2.0*0.6=1.2) for a person with three childhood adversities. Statistical interactions between gender and each individual childhood adversity were tested to assess for variation by gender in the association between childhood adversities and PDV. Of the 36 interactions, none were statistically significant (results available upon request).

Population attributable risk proportions

PARP were calculated using the model with indicators for both the type and number of childhood adversities (model 4). Across outcomes (victimisation, perpetration, either), PARP for individual childhood adversities ranged from 1.6% to 15.6% (table 4). Physical illness and parental death were associated with the smallest PARP. Parent mental illness, interparental violence and childhood sexual abuse were consistently associated with PARP greater than 10%. Physical abuse and economic adversity were associated with PARP greater than 10% in predicting PDV perpetration. The PARP for all childhood adversities combined ranged from 53.4% to 56.5%, suggesting that childhood adversities accounted for approximately half of all PDV cases.

In order to examine the clustering of PDV among people at high risk, respondents were ranked into deciles according to their predicted probability of any PDV based on the model with indicators for both the type and number of childhood adversities. The actual prevalence of PDV (either perpetration or victimisation) ranged from 2.1% to 45.3% between the lowest and highest risk deciles (see supplementaray table 1, available online only); 46.4% of PDV cases were in the top two deciles of risk and 57.9% were in the top three deciles of risk.

DISCUSSION

Our findings confirm that PDV in adolescence is common in the US population and is positively associated with a broad range of childhood adversities including, but not limited to, interparental violence. Previous studies have found that the relationship between interparental violence and later relationship violence is attenuated or null following adjustment for co-occurring adversities in multivariate additive models.[17 23 39] Our results suggest that those models do not adequately represent the association between childhood adversities and PDV. Due to clustering of childhood adversities, bivariate associations of individual childhood adversity with PDV are artificially inflated (table 3, model 1) while additive multivariate associations are artificially attenuated (table 3, model 2). A model that simply counts childhood adversities (table 3, model 3) offers no test of the influence of specific types of childhood adversity. The model developed in this study (table 3, model 4) allows for variation in the distinct effects of individual childhood adversity and for non-linear changes in the incremental effects of multiple childhood adversities. In this model, interparental violence re-emerges as a strong predictor of PDV, along with a broader range of childhood adversities, including sexual abuse and parent mental illness.[40 41]

The subadditive interactions between multiple co-occurring childhood adversities means that the magnitude of association between each individual childhood adversity and PDV is reduced by a fixed proportion from its estimated distinct effect when it co-occurs with other childhood adversities. The extent of reduction increases in magnitude with additional childhood adversities, in a non-linear fashion, so that PDV risk reaches a ceiling beyond which additional childhood adversities are not associated with further increases in risk. An implication of this pattern is that preventing one childhood adversity in a person with multiple childhood adversities may have a minimal impact on reducing the risk of PDV. One limitation of model 4 is the simplifying assumption that the interaction among multiple childhood adversities is diffuse,[36] ie, that the interaction depends

Table 3 Four models of the association of 12 childhood adversities with PDV*

	Model 1†			Model 2‡			Model 3§			Model 4¶		
	Victimisation OR (95% CI)	Perpetration OR (95% CI)	Either OR (95% CI)	Victimisation OR (95% CI)	Perpetration OR (95% CI)	Either OR (95% CI)	Victimisation OR (95% CI)	Perpetration OR (95% CI)	Either OR (95% CI)	Victimisation OR (95% CI)	Perpetration OR (95% CI)	Either OR (95% CI)
Parent died	1.2 (0.9 to 1.7)	1.0 (0.6 to 1.6)	1.0 (0.7 to 1.5)	1.1 (0.8 to 1.6)	0.9 (0.5 to 1.5)	1.0 (0.7 to 1.4)				1.3 (1.0 to 2.0)	1.1 (0.7 to 1.8)	1.2 (0.8 to 1.8)
Parent divorce	1.2 (1.0 to 1.5)	1.3 (1.0 to 1.7)	**1.3 (1.1 to 1.6)**	1.0 (0.8 to 1.2)	1.0 (0.8 to 1.3)	1.1 (0.8 to 1.3)				1.2 (0.9 to 1.7)	1.3 (0.9 to 1.8)	1.3 (1.0 to 1.8)
Other parent loss	**2.4 (1.7 to 3.3)**	**2.0 (1.3 to 3.0)**	**2.1 (1.5 to 2.9)**	**1.7 (1.1 to 2.6)**	1.4 (0.8 to 2.5)	1.5 (0.9 to 2.3)				**2.2 (1.4 to 3.6)**	**1.9 (1.1 to 3.3)**	**2.0 (1.2 to 3.2)**
Parent mental illness	**2.3 (1.6 to 3.4)**	**2.4 (1.7 to 3.2)**	**2.5 (1.8 to 3.4)**	**1.6 (1.1 to 2.3)**	**1.7 (1.2 to 2.5)**	**1.7 (1.2 to 2.4)**				**2.0 (1.4 to 3.1)**	**2.2 (1.3 to 3.7)**	**2.2 (1.5 to 3.4)**
Parent substance	**2.0 (1.5 to 2.7)**	**1.8 (1.3 to 2.3)**	**2.0 (1.5 to 2.6)**	1.2 (0.8 to 1.6)	1.0 (0.7 to 1.5)	1.2 (0.8 to 1.6)				**1.5 (1.1 to 2.2)**	1.4 (0.8 to 2.2)	**1.6 (1.1 to 2.2)**
Parent criminal	**2.0 (1.4 to 2.8)**	**1.8 (1.3 to 2.6)**	**2.1 (1.5 to 2.9)**	1.2 (0.9 to 1.78)	1.1 (0.8 to 1.7)	1.3 (0.9 to 1.8)				**1.7 (1.2 to 2.6)**	1.6 (0.9 to 2.8)	**1.8 (1.2 to 2.8)**
Parental violence	**2.4 (1.8 to 3.2)**	**2.2 (1.6 to 2.9)**	**2.3 (1.8 to 2.9)**	**1.5 (1.1 to 2.0)**	1.4 (1.0 to 1.9)	**1.4 (1.1 to 1.8)**				**1.9 (1.4 to 2.6)**	**1.9 (1.2 to 2.8)**	**1.9 (1.4 to 2.7)**
Physical abuse	**2.6 (2.0 to 3.3)**	**2.4 (1.8 to 3.3)**	**2.6 (2.1 to 3.3)**	1.3 (1.0 to 1.7)	1.4 (0.9 to 2.0)	1.4 (1.0 to 1.8)				**1.8 (1.3 to 2.7)**	**2.0 (1.2 to 3.2)**	**2.0 (1.4 to 2.9)**
Sexual abuse	**3.0 (2.3 to 3.9)**	**2.0 (1.5 to 2.8)**	**2.7 (2.2 to 3.5)**	**2.2 (1.8 to 2.8)**	1.4 (1.0 to 2.1)	**2.0 (1.6 to 2.5)**				**2.9 (2.0 to 4.0)**	**1.9 (1.1 to 3.3)**	**2.7 (2.0 to 3.7)**
Neglect	**3.0 (2.0 to 4.3)**	**2.7 (2.0 to 3.6)**	**2.9 (2.1 to 4.0)**	1.4 (1.0 to 2.0)	1.3 (0.9 to 2.0)	1.4 (1.0 to 1.9)				**2.1 (1.4 to 3.1)**	**2.1 (1.2 to 3.6)**	**2.1 (1.4 to 3.3)**
Physical illness	1.3 (0.8 to 2.3)	1.3 (0.7 to 2.5)	1.4 (0.9 to 2.2)	1.1 (0.7 to 2.0)	1.2 (0.6 to 2.2)	1.2 (0.8 to 1.9)				1.5 (0.8 to 2.5)	1.5 (0.7 to 3.2)	1.6 (0.9 to 2.6)
Economic adversity	1.4 (1.0 to 1.9)	**2.0 (1.3 to 3.0)**	**1.5 (1.1 to 2.2)**	0.9 (0.7 to 1.3)	1.5 (0.9 to 2.4)	1.1 (0.7 to 1.6)				1.3 (0.8 to 1.9)	**2.0 (1.1 to 3.8)**	1.5 (0.9 to 2.4)
	$\chi^2_{(12)}=149.5$, p<0.001	**$\chi^2_{(12)}=215.7$, p<0.001**	**$\chi^2_{(12)}=149.5$, p<0.001**	**$\chi^2_{(12)}=147.7$, p<0.001**	**$\chi^2_{(12)}=215.7$, p<0.001**	**$\chi^2_{(12)}=149.5$, p<0.001**				**$\chi^2_{(12)}=90.7$, p<0.001**	**$\chi^2_{(12)}=41.3$, p<0.001**	**$\chi^2_{(12)}=67.2$, p<0.001**
No of adversities												
1							**1.7 (1.3 to 2.2)**	**1.7 (1.2 to 2.4)**	**1.8 (1.4 to 2.2)**	NA	NA	NA
2							**2.3 (1.7 to 3.2)**	**2.0 (1.2 to 3.4)**	**2.3 (1.6 to 3.3)**	0.8 (0.5 to 1.2)	0.7 (0.4 to 1.2)	0.8 (0.5 to 1.2)
3							**3.1 (2.2 to 4.2)**	**3.3 (2.3 to 4.7)**	**3.1 (2.4 to 4.1)**	0.6 (0.3 to 1.1)	0.6 (0.3 to 1.6)	0.5 (0.3 to 1.0)
4							**3.5 (2.5 to 4.8)**	**3.6 (2.5 to 5.2)**	**3.4 (2.5 to 4.6)**	**0.4 (0.2 to 0.9)**	0.4 (0.1 to 1.5)	**0.3 (0.1 to 0.8)**
5							**3.9 (2.3 to 6.7)**	**3.1 (1.8 to 5.3)**	**4.2 (2.6 to 6.8)**	**0.2 (0.1 to 0.7)**	**0.2 (0 to 0.9)**	**0.2 (0.1 to 0.6)**
6							**9.1 (3.5 to 23.4)**	**4.6 (2.1 to 9.0)**	**8.2 (3.2 to 20.9)**	0.3 (0.1 to 1.3)	0.2 (0 to 1.0)	0.2 (0 to 1.1)
7 or more							**5.9 (3.4 to 10.3)**	**6.5 (4.0 to 10.8)**	**6.0 (3.6 to 10.2)**	**0.1 (0 to 0.4)**	0.1 (0.01 to 1.00)	**0.1 (0 to 0.3)**
							$\chi^2_{(7)}=117.1$, p<0.001	**$\chi^2_{(7)}=106.0$, p<0.001**	**$\chi^2_{(7)}=137.2$, p<0.001**	**$\chi^2_{(6)}=18.5$, p=0.005**	**$\chi^2_{(6)}=21.3$, p=0.0016**	**$\chi^2_{(6)}=20.0$, p=0.0027**

*OR estimated in logistic regression models adjusted for age, gender, parental education, nativity, race/ethnicity and age at first date. Sample includes National Comorbidity Survey Replication part II respondents aged 21 years or older with at least one dating relationship before the age of 21 years. Values in bold are significant at the p=0.05 level.
†Model 1 is estimated with one adversity at a time in addition to the controls noted in the previous footnote.
‡Model 2 is estimated with all 12 adversities in addition to the controls noted in the first footnote.
§Model 3 is estimated with dummy predictors for number of adversities, without any information about the types of adversities. The same controls used in earlier models were also included.
¶Model 4 is 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 also included.
PDV, physical dating violence.

Table 4 Attributable risk for physical dating violence due to 12 childhood adversities*

	Victimisation			Perpetration			Either		
	Average predicted probability of PDV	Sum of probabilities of PDV	% Change in probability of PDV	Average predicted probability of PDV	Sum of probabilities of PDV	% Change in probability of PDV	Average predicted probability of PDV	Sum of Probabilities of PDV	% Change in Probability of PDV
Actual sample	0.162	827.99		0.095	487.48		0.185	946.56	
Adversity type†									
Parent died	0.158	807.82	2.4%	0.094	479.60	1.6%	0.182	931.48	1.6%
Parent divorce	0.155	794.48	4.0%	0.090	457.71	6.1%	0.175	896.80	5.3%
Other parent loss	0.152	774.83	6.4%	0.089	452.80	7.1%	0.176	897.51	5.2%
Parent mental illness	0.146	745.33	10.2%	0.084	427.21	12.6%	0.166	846.60	10.7%
Parent substance	0.153	782.84	5.5%	0.090	462.28	5.2%	0.175	895.59	5.4%
Parent criminal	0.154	788.14	4.8%	0.090	460.52	5.5%	0.176	898.92	5.0%
Interparental violence	0.142	723.20	12.7%	0.081	416.52	14.6%	0.164	837.00	11.6%
Physical abuse	0.149	763.64	8.2%	0.086	438.88	10.5%	0.170	870.08	8.5%
Sexual abuse	0.137	699.18	15.6%	0.084	431.44	11.5%	0.160	815.44	13.9%
Neglect	0.152	775.95	6.3%	0.088	451.75	7.3%	0.174	890.76	5.9%
Physical illness	0.159	814.39	1.6%	0.093	476.93	2.2%	0.182	929.10	1.8%
Economic adversity	0.157	800.36	4.0%	0.085	433.89	12.4%	0.176	900.07	5.7%
All 12 childhood adversities	0.075	383.39	53.7%	0.041	211.92	56.5%	0.086	440.72	53.4%

*Predicted probabilities of adolescent PDV estimated in logistic regression models with controls for age, gender, nativity, parental education, race/ethnicity and age at first date. Results for the actual sample reflect the actual distribution of all exposures in the dataset. Attributable risk proportions were estimated by calculating the predicted probability of dating violence using the same logistic regression model and a modified dataset in which the values for each exposure were set to 0='no exposure'.
†Figures in each row show the estimated risk of PDV when the listed adversity is removed from the sample.
PDV, physical dating violence.

only on the number of co-occurring childhood adversities rather than the specific co-occurring childhood adversities. Estimates of diffuse interactions may be affected by the patterns of co-occurrence of childhood adversities in this population and thus the specific parameter estimates may not be generalisable across populations in which these patterns differ. However, the pattern of subadditivity is likely to be similar across populations, as evidenced by recent cross-national analyses of associations between childhood adversities and psychiatric disorders employing this model.[42]

PARP estimated from this model suggest that the 12 childhood adversities together account for more than half of PDV cases in this population. While not an exhaustive list of childhood familial adversities, this dataset offers a broad assessment of childhood adversities in a nationally representative sample. Realistically, the estimated associations of childhood adversities with PDV are unlikely to represent purely causal effects, due to common causes as well as other unmeasured factors; however, the analysis provides valuable information for prevention efforts. First, the large magnitude of the PARP for all 12 childhood adversities taken together suggests that attention to childhood adversities, whether as risk markers or as causes of PDV, can help prospectively identify a large proportion of youth at risk of PDV. Second, the finding that a diverse group of childhood adversities accounts for comparable proportions of PDV suggests that prevention programmes that address pathways specific to particular adversities may have limited impact. Programmes that aim to address multiple adversities or common mediating pathways have greater potential for reducing the occurrence of PDV. For instance, programmes providing social support targeted to at-risk adolescents may address a range of vulnerabilities with common origins in dysfunctional childhood family environments. Specific targeted intervention strategies to address children exposed to multiple adverse childhood experiences (such as trauma-informed cognitive behavioural therapy and parent—child interaction therapy) may be viable strategies for reducing the risk of physical violence in subsequent adolescent relationships in addition to universal PDV prevention

programmes. The importance of addressing multiple childhood adversities through prevention efforts is further underlined by the finding that nearly half (46.36%) of all PDV in the population is concentrated among people in the top 20% of PDV risk as estimated in this model.

Results should be considered in the light of several limitations. First, the assessment of PDV in this survey does not include sexual violence nor emotional abuse.[3 43] Future studies should investigate whether the patterns identified here apply to adolescent dating violence more generally. Second, epidemiological surveys have limited capacity to differentiate between

What is already known on this subject

► Physical violence in dating relationships is common and is associated with adverse childhood experiences.
► This study examined the joint predictive effects of a broad range of childhood adversities on PDV, including witnessing interparental violence, in order to examine their implications for PDV prevention.
► Identifying subgroups at increased risk of PDV may be useful for developing targeted interventions to supplement universal prevention efforts.

What this study adds

► Physical violence in dating relationships is positively associated with a broad range of childhood adversities including, but not limited to, childhood sexual abuse, interparental violence and parent mental illness.
► The findings add support to prevention strategies that address the shared impact of multiple childhood adversities reflective of dysfunctional family environments.

PDV victimisation and perpetration; most respondents report both, and perpetration is likely to be underreported.[7 30 44 45] The results reported here, similar across the three outcomes, should be interpreted in terms of the risk of being in a dating relationship in which physical violence occurs. Third, data on both childhood adversities and PDV are retrospective, and their association may be affected by recall bias, including family history. Our findings are similar to those of prospective studies, when similar analytical models are compared, but the potential for recall bias remains a concern. Fourth, reporting of PDV may differ between men and women, and this dataset does not include information about contexts or motivations for PDV. Statistical interactions between gender and each individual childhood adversity were tested, but none of these interactions was statistically significant (results available on request). Therefore, childhood adversities are associated with elevated PDV risk for both men and women, but whether this association occurs through similar pathways cannot be discerned from these data.

The findings add support to prevention strategies that address the shared impact of multiple childhood adversities reflective of dysfunctional family environments. In addition to primary prevention efforts that focus on strengthening families, the findings suggest the utility of testing targeted PDV interventions for adolescents with known exposure to multiple childhood adversities.

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