Data supplement to Dunn et al. Sensitive periods for the effect of childhood interpersonal violence on psychiatric disorder onset among adolescents. Br J Psychiatry doi: 10.1192/bjp.bp.117.208397

Supplement DS1

<u>Statistical analysis</u>

Our analysis proceeded in several steps. First, we conducted bivariate analyses of the association between adversity and psychiatric disorders in a person-level dataset in which every adolescent contributed one row of data. These analyses were conducted in the total sample and by exposure status (e.g., by the timing of first exposure to each adversity). Second, we generated, for each of the 19 psychiatric disorders, a "person-year" dataset in which every adolescent contributed multiple rows of data depending on whether and when they experienced a psychiatric disorder. In these 19 datasets, a time-varying psychiatric disorder variable was created, which took the coding of 0=no disorder or 1=experienced a psychiatric disorder. In each dataset, adolescents were censored at their current age if they did not experience a given psychiatric disorder; those with a given psychiatric disorder were censored at their age at first onset to that specific disorder. Then, for each disorder cluster (distress; fear; behavior; substance use), we stacked the person-year datasets for the constituent disorders. This produced four separate (stacked) person-year datasets corresponding to each disorder cluster. By stacking these datasets, we were able to adjust for prior and co-occurring psychopathology (both within and across disorder clusters) and create our time-varying outcome variable, which indicated the presence or absence of any disorder within the disorder cluster.

In each of these four person-year datasets, we then conducted discrete-time survival analyses using logistic regression (1) to estimate the odds of developing at least one disorder within the disorder cluster. These analyses were conducted first controlling for sex and then stratified by sex. Recognizing that the baseline hazard could differ across each of the constituent disorders within each disorder cluster, we modeled the baseline hazard for each disorder as flexibly as possible, including the linear, quadratic, and cubic terms of age, an indicator variable corresponding to the specific disorder in the stacked data file, and their interaction. Our model building proceeded as follows. Model 1 tested the time-varying association between exposure to each type of interpersonal violence, coded as 0=non-exposed and 1=exposed, and disorder

cluster. Each adversity was modeled separately after adjusting for covariates and prior or co-occurring disorders. These analyses were conducted to place the subsequent findings (from Model 2) in context and complement prior NCS-A work on child interpersonal violence and risk for psychiatric disorder (2), which only examined the subset of youth whose parents completed an interview. Model 2 tested the association between first-exposure to interpersonal violence in three different time periods and the disorder cluster. In these models, age at first exposure was coded through a set of time-varying indicators used in previous studies (3-5) to denote different developmental periods (1=*early childhood*, ages 0-5; 2=*middle childhood*, ages 6-10; and 3=*adolescence*, ages 11-18). For this time-varying exposure variable, person-years prior to first exposure were coded as 0. Thereafter, for participants reporting exposure, adversity was coded as either 1, 2, or 3 in the year of first exposure and in all subsequent person-years. Thus, the reference group for each analysis was based on a different denominator, corresponding to anyone who was unexposed during the current or prior developmental period. For Model 2, we conducted a test of homogeneity (df=2) to evaluate whether the beta coefficients (indicating the effect of age at first exposure relative to never exposed) were significantly different from each other. Within each exposure, these tests of homogeneity were Bonferroni corrected (alpha=0.01) to account for testing four outcomes. In cases where the null hypothesis was rejected ($p<0.05$), we then conducted post-hoc Tukey tests to evaluate, after adjustment for multiple testing, how the effect of exposure differed by developmental period.

Beta coefficients from these models were exponentiated and presented as odds ratios; (OR) and 95% confidence intervals (CI). All analyses were conducted using the survey regression procedures available in SAS Version 9.4 to account for the complex survey design. We used sampling weights to account for differential probability of selection of respondents within households (for the household subsample) as well as within schools, differential non-response, and adjust for differences between the sample and the US population on selected socio-demographic characteristics, which made each sample nationally representative of the US population on these variables.

We also performed one secondary analysis. To facilitate comparisons to previous studies, which have largely focused on individual disorders or symptoms, we examined the associations between timing of interpersonal violence with major depressive disorder/dysthymia, one of the most commonly studied outcomes of interpersonal violence.

Additional references

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Table DS1. Distribution of timing of exposure to interpersonal violence by age of respondents

Exposure to interpersonal violence	Younger Adolescents (N=5671)		Older Adolescents (N=4277)		
	N	%	N	%	p-value
Any interpersonal violence	449	8.1	539	13.3	<0.001
Early childhood	60	1.1	82	2.0	
Middle childhood	143	2.5	137	3.9	
Adolescence	246	4.5	320	7.5	
Parent physical violence	69	1.2	93	2.6	0.003
Early childhood	22	0.4	36	1.1	
Middle childhood	32	0.6	36	1.0	
Adolescence	15	0.2	21	0.5	
Other physical violence	232	4.2	237	5.8	0.06
Early childhood	7	0.2	7	0.1	
Middle childhood	76	1.3	42	1.4	
Adolescence	149	2.8	188	4.3	
Rape	93	1.6	159	3.4	<0.001
Early childhood	17	0.3	22	0.3	
Middle childhood	22	0.3	35	0.8	
Adolescence	54	1.0	102	2.2	
Sexual assault/molestation	136	2.6	193	5.0	0.002
Early childhood	18	0.4	33	0.8	
Middle childhood	33	0.6	57	1.7	
Adolescence	85	1.6	103	2.5	

Cell entries are frequencies (percentages) and sample sizes (N) generated from models that used sampling weights to account for the differential probability of selection of respondents within households and schools, differential non-response, and adjust for differences between the sample and the US population on selected socio-demographic characteristics. Younger adolescents were defined as those ages 13-15. Older adolescents were defined as those ages 16-18. Rao-Scott chi-square p-values are shown.

Table DS2. Distribution of covariates in the total sample by presence of psychiatric disorder in the National Comorbidity Survey Replication Adolescent Supplement (N=9,948)

Covariates	Experienced Any Disorder			Fear Disorder			Distress Disorder			Behavior Disorder			Substance Disorder		
	N	%	p-value	N	%	p-value	N	%	p-value	N	%	p-value	N	%	p-value
Sex			0.13			<0.001			<0.001			<0.001			0.01
Male	2641	54.4		1200	25.7		884	17.7		1671	34.3		641	12.5	
Female	2874	56.9		1647	32.7		1437	29.4		1441	27.7		473	10.2	
Age			0.004			0.99			<0.001			0.69			<0.001
13	800	51.5		443	29.5		290	17.5		469	29.4		30	1.8	
14	1128	51.8		633	29.7		441	19.6		651	30.2		87	4.9	
15	1003	53.7		524	28.7		456	24.7		575	30.7		155	9.2	
16	1120	58.9		554	28.7		487	25.7		649	32.7		280	14.7	
17	1085	60.8		522	29.1		487	28.6		582	33.2		378	20.9	
18	379	60.3		171	28.5		160	25.1		186	28.2		184	28.8	
Race			0.79			0.003			0.82			0.20			<0.001
Hispanic	1085	55.7		588	30.8		493	24.3		555	29.0		246	13.2	
Black	1105	57.7		629	34.2		434	22.6		656	34.6		104	5.2	
Other	341	54.2		182	32.5		148	22.1		184	28.0		69	10.5	
White	3011	55.2		1448	27.3		1246	23.5		1717	31.0		695	12.4	
Parent education			0.005			0.03			0.06			<0.001			0.05
Less than high school	925	57.9		539	30.5		390	22.1		532	34.1		185	10.9	
High school	1729	56.5		939	31.4		717	23.3		961	30.6		349	12.3	
Some college	1162	59.6		554	31.2		488	26.6		689	35.1		264	13.3	
College graduate	1699	51.7		815	25.5		726	22.4		930	28.0		316	9.8	
Parent income			0.54			0.02			0.87			0.87			0.12
Low	951	55.3		532	32.0		415	24.0		567	32.0		157	8.8	
Low-middle	1118	57.5		579	28.7		471	24.5		632	31.5		205	10.2	
High-middle	1691	56.0		887	30.7		696	23.0		945	31.3		357	12.0	
High	1755	54.4		855	26.5		742	23.0		968	30.3		395	12.5	
Urban			0.16			0.43			0.36			0.46			0.18
Metro	2479	56.2		1301	30.0		1055	24.1		1357	31.0		559	12.6	
Other urban	1911	56.4		992	28.9		812	23.6		1112	32.1		345	10.3	
Rural	1125	51.5		554	26.7		454	20.8		643	28.9		213	9.9	

Table DS2. Distribution of covariates in the total sample by presence of psychiatric disorder in the National Comorbidity Survey Replication Adolescent Supplement (N=9,948) (continued)

Cell entries are frequencies (row percentage by psychiatric disorder status) and sample sizes (N) generated from models that used sampling weights to account for the differential probability of selection of respondents within households and schools, differential non-response, and adjust for differences between the sample and the US population on selected socio-demographic characteristics. Adolescents were coded as having experienced any disorder if they met diagnostic criteria for any psychiatric disorder. Rao-Scott chi-square p-values are shown.

Table DS3. Odds of experiencing each psychiatric disorder by exposure to interpersonal violence

Exposure to interpersonal violence	Fear Disorder OR (95% CI)	homogeneity p-value *	Distress Disorder OR (95% CI)	homogeneity p-value *	Behavior Disorder OR (95% CI)	homogeneity p-value *	Substance Disorder OR (95% CI)	homogeneity p-value *
Any interpersonal violence	**1.73 (1.40, 2.13)**	0.33	**2.47 (1.94, 3.16)**	0.97	**1.82 (1.49, 2.22)**	0.01	**2.39 (1.88, 3.02)**	0.47
Early childhood	1.39 (1.00, 1.93)		**2.43 (1.65, 3.57)**		**1.87 (1.33, 2.63)**		**2.46 (1.33, 4.56)**	
Middle childhood	**2.08 (1.39, 3.09)**		**2.55 (1.79, 3.64)**		**1.46 (1.19, 1.80)**		**1.99 (1.34, 2.94)**	
Adolescence	1.51 (0.93, 2.47)		**2.41 (1.84, 3.14)**		**2.37 (1.69, 3.34)** [a]		**2.66 (2.02, 3.51)**	
Beaten by parents	0.83 (0.49, 1.42)	0.06	**1.99 (1.35, 2.95)**	0.20	**1.63 (1.15, 2.30)**	0.95	**2.36 (1.37, 4.04)**	0.30
Early childhood	0.52 (0.27, 0.99)		**2.41 (1.36, 4.28)**		1.61 (0.94, 2.74)		**3.04 (1.34, 6.91)**	
Middle childhood	1.47 (0.69, 3.15)		1.37 (0.80, 2.35)		**1.70 (1.11, 2.60)**		2.22 (0.91, 5.42)	
Adolescence	0.55 (0.17, 1.80)		**3.37 (1.39, 8.18)**		1.42 (0.56, 3.57)		1.16 (0.45, 2.95)	
Beaten by other person	**1.79 (1.19, 2.71)**	0.80	**1.73 (1.22, 2.47)**	0.13	**1.59 (1.09, 2.33)**	0.003	**2.18 (1.57, 3.02)**	0.01
Early childhood	1.45 (0.63, 3.36)		3.30 (0.70, 15.50)		0.80 (0.29, 2.23)		0.75 (0.37, 1.54)	
Middle childhood	1.96 (1.15, 3.35)		**2.30 (1.51, 3.52)**		1.07 (0.65, 1.74)		1.22 (0.54, 2.76)	
Adolescence	1.55 (0.66, 3.63)		1.18 (0.67, 2.05)		**2.44 (1.57, 3.79)** [a]		**2.77 (1.94, 3.96)** [b]	
Rape	**2.19 (1.27, 3.78)**	0.99	**1.96 (1.28, 3.02)**	0.23	**1.53 (1.13, 2.07)**	0.19	**2.01 (1.22, 3.32)**	0.86
Early childhood	**2.20 (1.43, 3.38)**		1.25 (0.55, 2.83)		**2.32 (1.21, 4.45)**		1.92 (0.53, 7.01)	
Middle childhood	2.25 (0.77, 6.53)		2.24 (1.01, 4.97)		1.11 (0.67, 1.83)		2.60 (0.99, 6.85)	
Adolescence	2.09 (1.01, 4.33)		**2.39 (1.52, 3.77)**		1.44 (0.99, 2.09)		1.76 (0.73, 4.23)	
Sexual assault/molestation	**1.53 (1.11, 2.11)**	0.76	**2.52 (1.83, 3.46)**	0.70	**1.51 (1.19, 1.92)**	0.89	1.55 (0.98, 2.47)	0.69
Early childhood	1.68 (0.93, 3.02)		**2.16 (1.36, 3.42)**		1.65 (0.95, 2.86)		1.94 (1.00, 3.77)	
Middle childhood	1.31 (0.80, 2.15)		**2.66 (1.58, 4.49)**		1.32 (0.71, 2.49)		1.32 (0.75, 2.31)	
Adolescence	1.92 (0.83, 4.45)		**2.61 (1.61, 4.23)**		1.62 (0.96, 2.74)		1.62 (0.65, 4.07)	

Cell entries are odds ratios and 95% confidence intervals estimating the association between exposure to interpersonal violence (exposed vs. unexposed) and timing of exposure to interpersonal violence (e.g., exposed during early childhood vs. unexposed). Statistically significant odds ratios ($p<0.05$) indicated in bold. Models were adjusted for sex, age, highest level of parent education, poverty index ratio, race/ethnicity, region of country, urbanicity, and co-occurring psychiatric disorder.

* p-values from the test of homogeneity after Bonferroni correction (0.05/4=0.01), which corrected for the testing of four outcomes within each exposure.

[a] refers to a significant difference in the odds of the psychiatric disorder ($p<0.05$) between exposure in middle childhood versus adolescence, based on the Tukey post-hoc test.

[b] refers to a significant difference in the odds of the psychiatric disorder ($p<0.05$) between exposure in early childhood versus adolescence, based on the Tukey post-hoc test.

Table DS4. Odds of experiencing each psychiatric disorder by the timing of exposure to interpersonal violence among males and females

Exposure to interpersonal violence	Fear Disorder OR (95% CI)	homogeneity p-value	Distress Disorder OR (95% CI)	homogeneity p-value	Behavior Disorder OR (95% CI)	homogeneity p-value	Substance Disorder OR (95% CI)	homogeneity p-value
Males								
Any interpersonal violence	**1.91 (1.28, 2.84)**	0.20	**1.77 (1.23, 2.54)**	0.83	**1.58 (1.14, 2.21)**	0.35	**2.16 (1.45, 3.22)**	0.25
Early childhood								
Middle childhood								
Adolescence								
Females								
Any interpersonal violence	**1.67 (1.30, 2.15)**	0.60	**2.84 (2.11, 3.81)**	0.60	**2.05 (1.59, 2.64)**	0.13	**2.78 (2.02, 3.83)**	0.84
Early childhood								
Middle childhood								
Adolescence								

Cell entries are odds ratios and 95% confidence intervals estimating the association between exposure to interpersonal violence (exposed vs. unexposed) and timing of exposure to interpersonal violence (e.g., exposed during early childhood vs. unexposed). Thus, the referent group for each analysis is those unexposed to interpersonal violence. Statistically significant odds ratios ($p < 0.05$) indicated in bold. Models were adjusted for age, highest level of parent education, poverty index ratio, race/ethnicity, region of country, urbanicity, and co-occurring psychiatric disorder.

Table DS5. Odds of experiencing major depressive disorder or dysthymia by exposure to interpersonal violence

Exposure to interpersonal violence	N	%	Model 1 [*] OR (95% CI)	homogeneity p-value	Model 2 [**] OR (95% CI)	homogeneity p-value
Any interpersonal violence	361	3.9	**3.39 (2.72, 4.24)**	0.63	**1.59 (1.28, 1.98)**	0.27
Early childhood	63	0.6				
Middle childhood	106	1.3				
Adolescence	192	2.0				

Cell entries are odds ratios and 95% confidence intervals estimating the association between exposure to interpersonal violence (exposed vs. unexposed) and timing of exposure to interpersonal violence (e.g., exposed during early childhood vs. unexposed). Thus, the referent group for each analysis is those unexposed to interpersonal violence. Statistically significant odds ratios (p<0.05) indicated in bold.

[*] Model adjusted for sex, age, highest level of parent education, poverty index ratio, race/ethnicity, region of country, and urbanicity.

[**] Model adjusted for the variables in Model 1 plus co-occurring psychiatric disorders.

Table DS6. Odds of experiencing major depressive disorder or dysthymia by exposure to maltreatment (vs. unexposed) among males and females, after adjusting for covariates

Exposure to interpersonal violence	Males		Females	
	OR (95% CI)	homogeneity p-value	OR (95% CI)	homogeneity p-value
Any interpersonal violence	**1.50 (1.00, 2.25)**	0.11	**1.67 (1.25, 2.22)**	0.30
Early childhood				
Middle childhood				
Adolescence				

Cell entries are odds ratios and 95% confidence intervals estimating the association between exposure to maltreatment (exposed vs. unexposed) and timing of exposure to maltreatment (e.g., exposed during early childhood vs. unexposed). Thus, the referent group for each analysis is those unexposed to maltreatment. Statistically significant odds ratios (p<0.05) indicated in bold. Models were adjusted for age, highest level of parent education, poverty index ratio, race/ethnicity, region of country, urbanicity, and co-occurring psychiatric disorder.