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Are there sensitive periods when child maltreatment substantially elevates suicide risk? Results from a nationally representative sample of adolescents

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Background: Although child maltreatment is a well documented risk factor for suicidal behavior, little is known about whether the timing of child maltreatment differentially associates with risk of suicidal ideation, suicide plans, or suicide attempts. The goal of this study was to examine whether a first exposure to physical or sexual abuse during specific developmental periods significantly elevated risk for suicidal behavior in adolescents.

Methods: Data came from the National Comorbidity Survey Adolescent Supplement, a population-based sample of US adolescents aged 13–18 years old ($n = 9,272$). Using discrete time survival analysis, we assessed the association between timing of first abuse (early childhood: ages 0–5; middle childhood: ages 6–10; adolescence: ages 11–18) and suicidal ideation, plans, and attempts.

Results: Exposure to either physical or sexual abuse increased the odds of reporting suicidal ideation (odds ratio [OR] = 5.06 and OR = 3.56, respectively), plans (OR = 3.63 and OR = 3.58, respectively), and attempts (OR = 5.80 and OR = 4.21, respectively), even after controlling for sociodemographic covariates and psychiatric disorders. However, the timing of physical and sexual abuse exposure was unassociated with suicidal behavior (all p values >.05).

Conclusions: Exposure to child maltreatment is strongly associated with risk for adolescent suicidal behaviors, though this association did not vary based on the developmental timing of first exposure. These findings suggest that prevention efforts should be implemented throughout early development and target all children, regardless of when they were first exposed.

KEYWORDS
abuse, epidemiology, maltreatment, self-harm, trauma, sensitive periods

1 | INTRODUCTION

Suicide is currently the second leading cause of death among young people ages 10–24 years old (Sullivan, Annest, Simon, Luo, & Dahlberg, 2015). Although suicidal behaviors are rare among children (less than 1% for all *suicidal behaviors*) (Nock, Green, et al., 2013), the prevalence of these behaviors sharply rises during adolescence. Indeed, epidemiologic studies suggest the lifetime prevalence of suicidal behaviors among adolescents is 12.1% for *suicidal ideation* (i.e., serious thoughts of killing oneself), 4.0% for having a *suicide plan* (i.e., formulation of a plot to kill oneself), and 4.1% for having a *suicide attempt* (i.e., self-injury

with at least some intent to die) (Nock, Deming, et al., 2013; Nock, Green, et al., 2013). Given the tremendous burden of suicide on families and society (Corso, Mercy, Simon, Finkelstein, & Miller, 2007; Vigo, Thornicroft, & Atun, 2016), it is imperative to identify ways to predict and prevent suicidal behavior in adolescence.

Child maltreatment, including physical, sexual, and emotional abuse as well as neglect, is among the most important determinants of health throughout the lifespan (Buckingham & Daniolos, 2013; Norman, Byambaa, De, Butchart, Scott, & Vos, 2012; Schilling & Christian, 2014), and has been associated with adolescent suicide (Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013). Retrospective

population-based studies suggest that the odds of engaging in suicidal behaviors, including ideation and attempts, is at least three times higher for adolescents exposed to maltreatment, compared to those with no history of exposure (Bruffaerts et al., 2010; Duke, Pettingell, McMorris, and Borowsky, 2010; Eisenberg, Ackard, & Resnick, 2007; Riggs, Alario, & McHorney, 1990; Ryan, Kilmer, Cauce, Watanabe, & Hoyt, 2000). For example, in a statewide survey of 83,731 middle and high school students, Eisenberg et al. (2007) found that exposure to sexual abuse perpetrated by a family member doubled the odds of suicide attempts in girls and increased the odds in boys by fivefold after adjusting for sociodemographic and family-level characteristics. Similar results have also been observed among prospective population-based studies of adolescents for both suicidal ideation (Fergusson, Woodward, & Horwood, 2000; Miller, Jenness, Oppenheimer, Gottleib, Young, & Hankin, 2016) and suicide attempts (Guendelman, Owens, Galan, Gard, & Hinshaw, 2016; Hadland et al., 2015). Physical (Riggs et al., 1990; Ryan et al., 2000; Salzinger, Rosario, Feldman, & Ng-Mak, 2007) and sexual abuse (Brezo et al., 2007; Eisenberg et al., 2007; Esposito & Clum, 2002; McQuillan & Rodriguez, 2000; Riggs et al., 1990) are the two forms of maltreatment generally associated with increased risk of suicidal behaviors among adolescents.

Although several studies have examined how specific features of child maltreatment may relate to suicidal behavior, including the number of unique types of maltreatment exposures (Arata, Langhinrichsen-Rohling, Bowers, & O'Farrill-Swails, 2005; Greger, Myhre, Lydersen, & Jozefiak, 2015; Hahm, Lee, Ozonoff, & Van Wert, 2010; Ryan et al., 2000) and the frequency of exposure (de Wilde, Kienhorst, Diekstra, & Wolters, 1992; Soylu & Alpaslan, 2013), few studies have examined the impact of the age at first exposure. This is an important area of research because there may be "sensitive periods" when child maltreatment more greatly increases the risk of later suicidal behaviors. Identification of such sensitive periods would guide clinicians in determining when to optimally time interventions for at-risk and maltreated children and could assist child welfare agencies in creating policies to mitigate the harms caused by maltreatment.

Exposure to maltreatment could have time-varying effects, depending on when it first occurs. Studies have shown that negative experiences in early and middle childhood can impact the development of brain circuitry and increase vulnerability to mental health problems (McLaughlin, Fox, Zeanah, & Nelson, 2011; Sheridan, Fox, Zeanah, McLaughlin, & Nelson, 2012). Moreover, experiences of maltreatment can prevent children from developing secure attachments, learning to effectively regulate their emotions, and establishing successful peer relationships, which can increase the risk of developing psychopathology (Cicchetti & Toth, 1995). However, experiences of maltreatment later in development, such as during adolescence, could also have deleterious effects. It is theorized that the greater cognitive abilities of adolescents allow them to fully conceptualize the experiences of maltreatment (Garbarino, 1989). Additionally, stress response systems go through dramatic changes during adolescence, potentially amplifying the negative effects of maltreatment (Stroud et al., 2009). Based on these theories and findings, it is important to study the timing of maltreatment as a possible factor involved in the development of suicidal behavior in adolescents.

To our knowledge, only three studies have investigated the effects of developmental timing of child maltreatment on suicidal outcomes. In a longitudinal study of children followed from 4 to 16 years of age, Thompson et al. (2012) found that exposure to adversity (i.e., child abuse, neglect, caregiver instability, residential instability, family violence, nonfamily violence) during adolescence (12–16 years of age) predicted suicidal ideation during adolescence; however, there was no association between exposure to adversity during childhood (before 12 years of age) and suicidal behaviors in adolescence. Khan et al. (2015) showed, in a study of young adults retrospectively reporting childhood maltreatment, that parental verbal abuse at age 5 was the strongest predictor of suicidal ideation in young male adults and sexual abuse at 18 years was the strongest predictor of suicidal ideation in young female adults. Finally, in a large, population-based sample of young adults, Dunn, McLaughlin, Slopen, Rosand, and Smoller (2013) found that young adults first exposed to sexual abuse during preschool (ages 3–5 years) had 2.5 times the odds of suicidal ideation compared to those first exposed during adolescence; no significant differences emerged in risk for suicidal ideation among those first exposed to physical abuse at different developmental periods.

Collectively, these studies suggest that there may be developmental periods when children are most vulnerable to suicidal behaviors following exposure to abuse, but they are limited in a number of ways. First, prior studies examined suicidal outcomes in different age groups. Specifically, two of the three studies examined the association of child maltreatment and suicidal behaviors in young adults, but only one focused on adolescents. Given that suicidal behaviors commonly emerge during adolescence (Nock, Deming, et al., 2013a; Nock, Green, et al., 2013), there is a need to clarify the relationship between when maltreatment exposure occurs and suicidal behaviors among adolescents. Second, all three studies investigated only suicidal ideation, omitting other suicidal behaviors, such as suicide plans and attempts. It is important to distinguish among these various suicidal behaviors, as they have unique risk factors (Borges, Angst, Nock, Ruscio, & Kessler, 2008) and different responses to treatment (Brown, Ten Have, Henriques, Xie, Hollander, & Beck, 2005; Linehan et al., 2006). Third, only one study investigated specific developmental periods within childhood (Dunn et al., 2013); the other two studies either grouped all exposure before 12 years old into one developmental period or investigated specific ages rather than distinct developmental windows. Use of finer-grained measures of exposure during childhood are needed to identify more discrete time periods when exposure may be most harmful. The mixed results observed across these three studies also underscore the need to disentangle both the types and timing of maltreatment exposures that most strongly predict suicidal behaviors.

The current study aimed to address these gaps by using data from a nationally representative sample of adolescents to examine the association between age at first exposure to child maltreatment on suicidal ideation, plan, or attempts during adolescence. Based on prior research, we hypothesized that (1) youth exposed to child maltreatment at any age would have an increased risk of engaging in these suicide behaviors compared to their unexposed counterparts (Dunn et al., 2013; Khan et al., 2015; Thompson et al., 2012) and (2) that those first exposed to maltreatment early (between 0 and 5 years of age)

would have the highest risk of suicidal behavior compared to those first exposed in other developmental periods (Dunn et al., 2013).

2 | MATERIALS AND METHODS

2.1 | Sample and procedures

Data came from the National Comorbidity Survey: Adolescent Supplement (NCS-A), a population-based cross-sectional study of 10,148 US adolescents ages 13–18 years old. Briefly, the NCS-A study was conducted between February 2001 and January 2004 as an extension to the National Comorbidity Survey Replication (Kessler et al., 2009). The goal of the NCS-A was to provide nationally representative data about mental disorders among youth. Participants were recruited from households that participated in the NCS-R study (n = 904), as well as from 320 nationally representative schools in the United States (n = 9,244) (Kessler et al., 2009). Face-to-face interviews with adolescents were conducted in their homes (75.6% response rate) and self-administered questionnaires were completed by parents (63.0% response rate). Both the adolescent and their parent provided written informed consent prior to the completion of the interview.

Adolescents with complete data on sampling weights and all variables were included in the analytic sample (n = 9,272; 91.37% of the total sample). Adolescents in the analytic sample did not differ from those who were excluded (n = 876) with respect to their age at interview, race, gender, poverty level, urbanicity, or US region. However, parents of adolescents in the excluded sample were more likely than parents of adolescents in the included sample to have not completed high school (22.3% vs. 14.8%) and were less likely to have graduated college (27.0% vs. 36.1%).

2.2 | Measures

2.2.1 | Suicidal behavior

Suicidal behaviors were assessed using a modified version of the Suicide Behavior Module within the Composite International Diagnostic Interview (CIDI). The CIDI is a structured diagnostic interview designed to collect valid and reliable information about the prevalence and determinants of mental disorders in the general population (Kessler & Ustun, 2004). The suicide module queried respondents about their lifetime experience of suicidal behavior (ideation, plan, and attempts) as well as the age of onset of these behaviors. Ideation was captured with the item: "You seriously thought about committing suicide." If a participant endorsed this item, they were then asked about suicide plans and attempts. Plan was assessed with the item: "You made a plan for committing suicide," and attempts were assessed with the item: "You attempted suicide." Response options to each item were coded as "yes" or "no."

2.2.2 | Child maltreatment

Lifetime maltreatment exposure was determined using the Post-Traumatic Stress Disorder (PTSD) screener section of the CIDI. We examined three specific types of events assessed in this section: (1)

Rape: "someone either having sexual intercourse with you or penetrating your body with a finger or object when you did not want them to, either by threatening you or by using force"; (2) Other sexual violence: "Other than rape, ever sexually assaulted or molested"; and (3) Physical abuse: "Badly beaten up by parents or the people who raised you." Participants endorsing exposure to any of these events were asked at what age they first experienced the event. Age at first exposure to each type of maltreatment was assessed using question probes previously shown to increase recall accuracy among adults (Knäuper, Cannell, Schwarz, Bruce, & Kessler, 1999); these probes guided youth to determine the exact events and age of onset. Age at first exposure was characterized into three unique developmental timing windows, similar to prior studies (Dunn et al., 2013; Kaplow & Widom, 2007): (1) early childhood (between ages 0 and 5 years); (2) middle childhood (ages 6–10 years); and (3) adolescence (ages 11–18 years).

Given the rarity of the outcomes, we aimed to increase the sample size for these analyses. We thus constructed a single variable denoting exposure to "sexual abuse," as exposure to rape and sexual assault were highly correlated (tetrachoric correlation = .72) and because the timing of first onset to both exposures was also highly correlated (tetrachoric correlation between age at first exposure categories = .70). Specifically, among participants first exposed to sexual assault in early childhood, 70.6% also reported a first exposure to rape in early childhood. The concordance between first exposure to sexual assault and first exposure to rape was also high for the other time periods (middle childhood = 65.5%; adolescence 82.1%).

2.2.3 | Covariates

We adjusted for the following covariates in all models: *sex*, *age* (continuous), *highest level of parent education* (less than high school; high school; some college; college graduate), *poverty index ratio*, which was derived based on family size and the ratio of family income to the family's poverty threshold (≤ 1.5 = low income; >1.5 to 3 = low-middle income; >3 to ≤ 6 = high-middle income; and >6 = high income), *race/ethnicity* (non-Hispanic White; non-Hispanic Black; Hispanic; other), *region of the country* (Northeast; Midwest; South; West), and *urbanicity* (Major Metropolitan Area; other urbanized area; rural area).

2.2.4 | Statistical analyses

We began by conducting basic univariate and bivariate analyses to estimate the prevalence of maltreatment, as well as suicidal behaviors, among the sample and the demographic correlates of maltreatment exposure and suicidal behavior. Next, we performed discrete-time survival analyses using logistic regression to estimate odds ratios (ORs) and 95% confidence intervals (CIs) associated with exposure to physical abuse and sexual abuse on each of the suicidal behaviors (Singer & Willett, 2003). Person-period datasets were created by generating one observation per person for every year the individual was at risk of the outcomes. Participants who did not experience the outcome were censored at their age of interview. Exposure to maltreatment was coded as a time-varying variable from the age of first exposure to age of outcome or until censored.

In Model 1, we separately examined the effect of exposure to physical or sexual abuse (0 = never exposed; 1 = exposed) on the three outcomes: suicidal ideation, plans, and attempts. In Model 2, we examined the effect of timing of exposure to physical or sexual abuse on each suicidal behavior by coding age at first exposure to maltreatment as a categorical variable (0 = never exposed; 1 = exposed in early childhood; 2 = exposed in middle childhood; 3 = exposed in adolescence). In cases where the null hypothesis was rejected for this categorical timing variable (two-sided P value <.05) in Model 2, we then conducted post-hoc Tukey tests of homogeneity to evaluate, after adjustment for multiple testing, the specific developmental periods that were different from each other.

In a secondary analysis, we additionally adjusted for the presence (vs. absence) of any prior or co-occurring psychiatric disorder as assessed by the CIDI, which was also coded as a time-varying variable using the minimum age at disorder onset for any psychiatric disorder (see Supplementary Materials). Eighteen participants were excluded from these analyses due to incomplete data on one or more psychiatric disorders.

All analyses were conducted using the survey regression procedures available in SAS Version 9.4. We used sampling weights to adjust for the varying probabilities of selecting participants within schools, households, and country regions and to adjust for differences between the sample and the US population of adolescents on select demographic characteristics, making this sample nationally representative of the variables included in this analysis.

3 | RESULTS

Table 1 presents basic descriptive statistics for the analytic sample. As shown, the sample was split equally by sex (51.41% male). The majority of the sample was White (65.81%). Most adolescents were from families earning high incomes (34.29%) and college educated parents (36.13%). Most adolescents were also living in metropolitan areas (47.27%).

Exposure to sexual abuse (4.80%) was more often reported than physical abuse (1.57%). Exposure to sexual abuse was more commonly reported by females and older adolescents. Reports of exposure to physical abuse were more commonly reported by participants who were generally older and by those who lived in metropolitan areas.

Suicidal ideation was more commonly reported by females, participants who were White, and older adolescents. Suicide plans were more commonly reported by females, older adolescents, and participants who lived in metropolitan areas. Suicide attempts were more commonly reported by females and participants who were White. Among participants who engaged in suicidal ideation (n = 869; 9.37% of the sample), one-quarter reported making a suicide plan (n = 218) compared to 15% who reported a suicide attempt (n = 134).

3.1 | Child maltreatment and suicidal behaviors

Table 2 presents results of the primary analysis, where we examined the association between child maltreatment and suicidal behaviors. Sexual abuse at any time period was associated with a signifi-

cant increase in suicidal ideation (OR = 4.89; 95% CI = 3.44–6.94), suicide plans (OR = 5.55; 95% CI = 3.47–8.90), and suicide attempts (OR = 6.88; 95% CI = 3.50–13.54) relative to those who were unexposed. Additionally, exposure to sexual abuse in each developmental timing period significantly increased the odds of suicidal ideation, plans, and attempts. However, these ORs were not different from one another (test of homogeneity P > .05), suggesting that there were no differences in risk for suicidal behaviors based on the developmental timing of sexual abuse.

For physical abuse, exposure also significantly increased the odds of suicidal ideation (OR = 6.71; 95% CI = 4.67–9.65), suicide plans (OR = 5.30; 95% CI = 1.73–16.23), and suicide attempts (OR = 8.62; 95% CI = 2.61–28.42). Additionally, a first exposure to physical abuse in most developmental periods was significantly associated with suicidal ideation, suicide plans, and suicide attempts (with the exception of exposure during middle childhood). However, these OR were not different from one another (test of homogeneity P > .05), again suggesting that there were no differences in risk for suicidal behaviors based on the developmental timing of physical abuse.

3.2 | Child maltreatment and suicidal behaviors, controlling for psychiatric disorder

Table 3 presents results of the secondary analyses, where we additionally controlled for psychiatric disorders. As shown, these results were generally consistent with those of the primary analysis.

4 | DISCUSSION

In this study, we investigated the association between age at first exposure to physical and sexual abuse on suicidal behaviors in adolescence. By conducting these analyses in a large, nationally representative sample of adolescents, we were able to generate results that can be applied to the general population of adolescents in the United States. Additionally, our study examined several forms of suicidal behaviors, which provided a more expansive and inclusive view on suicide unlike previous studies (Dunn et al., 2013; Khan et al., 2015; Thompson et al., 2012). These innovations help to expand the current literature on the role of timing of exposure to two types of child maltreatment on the development of suicidal behavior, a topic that has been only narrowly explored thus far.

Two major findings emerged from this study. First, we found that exposure to physical or sexual abuse increased the odds of engaging in suicidal ideation, plans, and attempts during adolescence. These results are in line with previous research, which has shown that exposure to physical or sexual abuse increases the risk of engaging in suicidal behavior (Ganz & Sher, 2012; Miller et al., 2013).

Second, and contrary to prior work (Dunn et al., 2013; Khan et al., 2015; Thompson et al., 2012), we did not observe significant variability in the magnitude of risk conferred for suicidal behaviors based on the developmental timing of first exposure to maltreatment. That is, for both physical and sexual abuse, first exposure during a specific time period (early childhood, middle childhood, or adolescence) did not result in significantly greater odds of engaging in suicidal ideation,

TABLE 1 Distribution of sociodemographic characteristics in the total sample and by exposure to abuse and suicide outcomes in the National Comorbidity Survey Adolescent Supplement

Covariate	Total (N = 9,272)		Exposed to sexual abuse (N = 445)				Exposed to physical abuse (N = 146)				Suicide ideation (N = 869)				Suicide plan (N = 218)				Suicide attempt (N = 134)			
	N	%	N	%	χ^2	P value	N	%	χ^2	P value	N	%	χ^2	P value	N	%	χ^2	P value	N	%	χ^2	P value
Age																						
13 years	1,502	14.94	28	0.21	26.41	<.0001	18	0.22	13.74	.02	78	0.74	36.49	<.0001	13	0.72	13.08	.02	6	0.39	9.25	.10
14 years	2,022	20.71	75	0.74			24	0.19			165	1.79			43	5.43			25	2.29		
15 years	1,741	20.78	78	0.93			21	0.30			166	1.95			29	3.59			20	2.52		
16 years	1,849	20.87	107	1.12			33	0.36			195	2.28			55	7.53			36	5.28		
17 years	1,616	17.15	124	1.23			36	0.47			198	2.25			59	6.88			39	3.70		
18 years	5,42	5.55	33	0.41			14	0.20			67	0.85			19	3.01			8	1.55		
Sex																						
Male	4,557	51.41	47	0.50	131.48	<.0001	65	0.87	0.03	.87	318	4.14	12.97	.0003	68	9.37	4.41	.04	30	3.72	9.76	.002
Female	4,715	48.59	398	4.14			81	0.87			551	5.73			150	17.79			104	12.01		
Race																						
White	5,177	65.81	224	2.84	3.90	.27	67	1.12	1.84	.61	514	6.83	10.45	.02	119	18.82	1.15	.77	69	10.39	11.47	.009
Hispanic	1,751	14.24	95	0.67			42	0.33			170	1.52			47	4.67			43	4.05		
Black	1,797	15.17	94	0.91			25	0.21			128	1.10			36	2.76			14	0.87		
Other	5,47	4.79	32	0.22			12	0.08			57	0.41			16	0.90			8	0.42		
Poverty category																						
Low income	1,550	14.59	78	0.70	5.53	.14	35	0.32	0.87	.83	135	1.26	1.65	.65	44	3.95	2.82	.42	29	2.46	4.93	.18
Second income	1,845	19.13	94	0.88			29	0.34			166	1.98			46	6.11			34	4.21		
Third income	2,851	31.99	160	1.82			37	0.51			263	3.29			60	9.69			35	5.23		
High income	3,026	34.29	113	1.24			45	0.57			305	3.33			68	7.41			36	3.83		
Parent education																						
Less than high school	1,463	14.76	89	0.85	4.01	.26	34	0.30	4.80	.19	126	1.23	4.83	.18	41	3.89	1.51	.68	29	2.28	4.82	.19
High school	2,831	29.87	136	1.39			42	0.60			257	2.76			69	7.74			49	5.75		
Some college	1,843	19.24	102	0.97			42	0.43			186	2.17			51	6.72			29	3.39		
College graduate	3,135	36.13	118	1.43			28	0.40			300	3.70			57	8.81			27	4.32		
Urbanicity																						
Metropolitan	4,117	47.27	207	2.29	0.35	.84	83	1.03	11.77	.003	409	5.07	2.43	.30	116	17.30	10.39	.01	68	8.68	0.54	.76
Other urban	3,045	37.97	150	1.65			46	0.61			290	3.41			69	7.42			48	4.87		
Rural	2,110	14.76	88	0.70			17	0.1			170	1.39			33	2.43			18	2.19		

Descriptive statistics are presented for the analytic sample. Chi-square (χ^2) analyses were performed for each exposure and outcome by covariate, with chi-square values and P values listed.

TABLE 2 Results of logistic regression analyses examining the effect of exposure and timing of first exposure to child maltreatment on suicidal behavior, adjusting for covariates

	Suicide ideation				Suicide plan				Suicide attempt			
	N	%	OR	95% CI	N	%	OR	95% CI	N	%	OR	95% CI
Any sexual abuse												
Unexposed	720	8.07	Referent		163	19.42	Referent		93	10.18	Referent	
Exposed	149	1.79	4.89	3.44–6.94	55	7.73	5.55	3.47–8.90	41	5.55	6.88	3.50–13.54
Timing of sexual abuse												
Early childhood (age 0–5)	31	0.31	5.42	2.75–10.67	9	1.09	5.19	1.50–17.95	5	0.75	6.22	1.79–21.61
Middle childhood (age 6–10)	37	0.62	5.54	3.01–10.18	13	3.21	7.34	3.95–13.65	11	2.13	8.51	3.99–18.17
Adolescence (age 11–18)	81	0.86	3.90	2.27–6.69	33	3.43	3.80	1.95–7.41	25	2.67	5.39	2.52–11.52
Any physical abuse												
Unexposed	823	9.06	Referent		198	23.86	Referent		121	13.45	Referent	
Exposed	46	0.80	6.71	4.67–9.65	20	3.30	5.30	1.73–16.23	13	2.29	8.62	2.61–28.42
Timing of physical abuse												
Early childhood (age 0–5)	18	0.36	6.54	4.61–20.70	9	1.48	5.41	1.21–24.28	6	0.98	7.69	1.93–30.69
Middle childhood (age 6–10)	20	0.32	6.16	3.64–10.41	6	1.14	3.25	0.82–12.90	3	0.83	7.19	1.52–34.00
Adolescence (age 11–18)	8	0.12	9.77	4.61–20.70	5	0.67	12.94	2.89–57.87	4	0.48	20.29	2.73–150.76

Cell entries are sample size (N and %), odds ratios (ORs), and 95% confidence intervals (CIs). The table presents results from Models 1 and 2 examining exposure to sexual and physical abuse (coded as 0 = unexposed; 1 = exposed) and age at first exposure (coded as 0 = unexposed; 1 = early childhood [ages 0–5]; 2 = middle childhood [ages 6–10]; 3 = adolescence [ages 11–18]) on suicide ideation, suicide plan, and suicide attempt. ORs and 95% CIs indicate effects for exposure and timing of exposure relative to the reference of never exposed in any developmental timing period.

TABLE 3 Results of logistic regression analyses examining the effect of exposure and timing of first exposure to child maltreatment on suicidal behavior, adjusting for covariates and any prior or co-occurring psychiatric disorder

	Suicide ideation				Suicide plan				Suicide attempt			
	N	%	OR	95% CI	N	%	OR	95% CI	N	%	OR	95% CI
Any sexual abuse												
Unexposed	719	8.08	Referent		163	19.49	Referent		93	10.21	Referent	
Exposed	148	1.78	3.56	2.54–4.98	54	7.58	3.58	2.10–6.11	40	5.40	4.21	2.19–8.09
Timing of sexual abuse												
Early childhood (0–5)	31	0.32	3.97	2.14–7.37	9	1.09	3.39	0.98–11.72	5	0.76	4.11	1.26–13.41
Middle childhood (6–10)	37	0.62	4.30	2.59–7.14	13	3.23	5.04	2.53–10.01	11	2.13	5.35	2.46–11.64
Adolescence (11–18)	80	0.85	2.61	1.52–4.48	32	3.26	2.15	1.15–4.03	24	2.51	2.92	1.58–5.40
Any physical abuse												
Unexposed	821	9.05	Referent		197	23.76	Referent		120	13.32	Referent	
Exposed	46	0.81	5.06	3.35–7.63	20	3.31	3.63	1.13–11.64	13	2.29	5.80	1.73–19.39
Timing of physical abuse												
Early childhood (0–5)	18	0.36	4.72	2.96–7.53	9	1.49	3.43	0.76–15.42	6	0.98	4.63	1.19–17.96
Middle childhood (6–10)	20	0.32	6.16	2.55–8.57	6	1.14	2.39	0.60–9.56	3	0.83	5.40	1.25–23.29
Adolescence (11–18)	8	0.12	9.77	3.10–23.91	5	0.67	10.61	1.59–71.00	4	0.48	16.23	1.41–186.29

Cell entries are sample size (N and %), odds ratios (ORs), and 95% confidence intervals (CIs). The table presents results from Models 1 and 2 examining exposure to physical and sexual abuse (coded as 0 = never exposed; 1 = exposed) and age at first exposure (coded as 0 = unexposed; 1 = early childhood [ages 0–5]; 2 = middle childhood [ages 6–10]; 3 = adolescence [ages 11–18]) on suicide ideation, suicide plan, and suicide attempt. The total analytic sample for these analyses is 9,254, after excluding those who did not have data on psychiatric disorder. ORs and 95% CIs indicate effects for exposure and timing of exposure relative to the reference of never exposed in any developmental timing period.

plan, or attempt. Our inability to identify a sensitive period when abuse significantly elevated risk for suicide behaviors could be due to several factors. For example, there were small cell sizes in this study, as relatively few adolescents endorsed suicide plans and attempts and reported being exposed to maltreatment across each of the three developmental periods. However, the prevalence of suicide ideation and sexual abuse was very similar in our study compared to a prior population-based study of young adults where a sensitive period was found (Dunn et al., 2013). Thus, the lack of heterogeneity of effects could be due to the true absence of a sensitive period or could be

related to the shortened length of time between first occurrence of maltreatment and onset of suicidal behaviors. Nevertheless, these findings suggest that exposure to child maltreatment, regardless of when it occurs, is harmful and that efforts to mitigate the negative consequences of adversity should occur throughout the lifespan.

Several limitations are noted. First, adolescents retrospectively reported whether and when they were exposed to abuse. Retrospective reports, especially of age at first exposure, could be less reliable and valid compared to prospective reports, due to memory lapses or unwillingness to disclose personal information (Hardt & Rutter, 2004). However, retrospective and prospective studies produce similar effect estimates for psychiatric disorders (Scott, McLaughlin, Smith, & Ellis, 2012). Further, the retrospective recall period was brief, as adolescents were reporting about their exposures during childhood and adolescence. Second, although we imitated a prospective study by ensuring that the child maltreatment reports preceded the suicide behavior outcomes, truly prospective studies are needed to ensure temporality. Third, although our study was conducted in almost 10,000 adolescents, relatively few reported both suicidal behaviors and maltreatment. Fourth, the use of single items to measure suicidal behaviors in this study could result in misclassification (Millner, Lee, & Nock, 2015). Future studies of much larger samples or more targeted samples of those most at risk for suicide are needed.

5 | CONCLUSION

Results of this study suggest that physical and sexual abuse are important determinants of engagement in suicidal behaviors during adolescence, but that risk for these behaviors does not vary based on the developmental timing of first exposure to child maltreatment. These findings suggest that prevention efforts should be implemented throughout the life course and target all maltreated children, regardless of when they were first exposed.

CONFLICTS OF INTEREST

All authors declare that they have no conflicts of interest.

REFERENCES

Arata, C. M., Langhinrichsen-Rohling, J., Bowers, D., & O'Farrill-Swails, L. (2005). Single versus multi-type maltreatment: An examination of the long-term effects of child abuse. *Journal of Aggression, Maltreatment & Trauma*, 11, 29–52.

Borges, G., Angst, J., Nock, M. K., Ruscio, A. M., & Kessler, R. C. (2008). Risk factors for the incidence and persistence of suicide-related outcomes: A 10-year follow-up study using the National Comorbidity Surveys. *Journal of Affective Disorders*, 105, 25–33.

Brezo, J., Paris, J., Tremblay, R., Vitaro, F., Hebert, M., & Turecki, G. (2007). Identifying correlates of suicide attempts in suicidal ideators: A population-based study. *Psychological Medicine*, 37, 1551–1562.

Brown, G. K., Ten Have, T., Henriques, G. R., Xie, S. X., Hollander, J. E., & Beck, A. T. (2005). Cognitive therapy for the prevention of suicide attempts: A randomized controlled trial. *JAMA*, 294, 563–570.

Bruffaerts, R., Demyttenaere, K., Borges, G., Haro, J. M., Chiu, W. T., Hwang, I.,… Nock, M. K. (2010). Childhood adversities as risk factors for onset and persistence of suicidal behaviour. *British Journal of Psychiatry*, 197, 20–27.

Buckingham, E. T., & Daniolos, P. (2013). Longitudinal outcomes for victims of child abuse. *Current Psychiatry Reports*, 15, 342.

Cicchetti, D., & Toth, S. L. (1995). A developmental psychopathology perspective on child abuse and neglect. *Journal of American Academy of Child and Adolescent Psychiatry*, 34, 541–565.

Corso, P. S., Mercy, J. A., Simon, T. R., Finkelstein, E. A., & Miller, T. R. (2007). Medical costs and productivity losses due to interpersonal and self-directed violence in the United States. *American Journal of Preventive Medicine*, 32, 474–482.

de Wilde, E. J., Kienhorst, I. C., Diekstra, R. F., & Wolters, W. H. (1992). The relationship between adolescent suicidal behavior and life events in childhood and adolescence. *American Journal of Psychiatry*, 149, 45–51.

Duke, N. N., Pettingell, S. L., McMorris, B. J., & Borowsky, I. W. (2010). Adolescent violence perpetration: Associations with multiple types of adverse childhood experiences. *Pediatrics*, 125, e778–e786.

Dunn, E. C., McLaughlin, K. A., Slopen, N., Rosand, J., & Smoller, J. W. (2013). Developmental timing of child maltreatment and symptoms of depression and suicidal ideation in young adulthood: Results from the National Longitudinal Study of Adolescent Health. *Depression and Anxiety*, 30, 955–964.

Eisenberg, M. E., Ackard, D. M., & Resnick, M. D. (2007). Protective factors and suicide risk in adolescents with a history of sexual abuse. *Journal of Pediatrics*, 151, 482–487.

Esposito, C. L., & Clum, G. A. (2002). Social support and problem-solving as moderators of the relationship between childhood abuse and suicidality: Applications to a delinquent population. *Journal of Traumatic Stress*, 15, 137–146.

Fergusson, D. M., Woodward, L. J., & Horwood, L. J. (2000). Risk factors and life processes associated with the onset of suicidal behaviour during adolescence and early adulthood. *Psychological Medicine*, 30, 23–39.

Ganz, D., & Sher, L. (2012). Adolescent suicide in New York City: Plenty of room for new research. *International Journal of Adolescent Medicine and Health*, 24, 99–104.

Garbarino, J. (1989). Troubled youth, troubled families: The dynamics of adolescent maltreatment. In D. Cicchetti & V. Carlson (Eds.), *Child maltreatment: Theory and research on the causes and consequences of child abuse and neglect* (pp. 685–706). New York, NY: Cambridge University Press.

Greger, H. K., Myhre, A. K., Lydersen, S., & Jozefiak, T. (2015). Previous maltreatment and present mental health in a high-risk adolescent population. *Child Abuse & Neglect*, 45, 122–134.

Guendelman, M. D., Owens, E. B., Galan, C., Gard, A., & Hinshaw, S. P. (2016). Early-adult correlates of maltreatment in girls with attention-deficit/hyperactivity disorder: Increased risk for internalizing symptoms and suicidality. *Development and Psychopathology*, 28, 1–14.

Hadland, S. E., Wood, E., Dong, H., Marshall, B. D., Kerr, T., Montaner, J. S., & DeBeck, K. (2015). Suicide attempts and childhood maltreatment among street youth: A prospective cohort study. *Pediatrics*, *136*, 440–449.

Hahm, H. C., Lee, Y., Ozonoff, A., & Van Wert, M. J. (2010). The impact of multiple types of child maltreatment on subsequent risk behaviors among women during the transition from adolescence to young adulthood. *Journal of Youth and Adolescence*, *39*, 528–540.

Hardt, J., & Rutter, M. (2004). Validity of adult retrospective reports of adverse childhood experiences: Review of the evidence. *Journal of Child Psychology and Psychiatry*, *45*, 260–273.

Kaplow, J. B., & Widom, C. S. (2007). Age of onset of child maltreatment predicts long-term mental health outcomes. *Journal of Abnormal Psychology*, *116*, 176–187.

Kessler, R. C., Avenevoli, S., Costello, E. J., Green, J. G., Gruber, M. J., Heeringa, S., … Zaslavsky, A. M. (2009). Design and field procedures in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *International Journal of Methods in Psychiatric Research*, *18*, 69–83.

Kessler, R. C., & Ustun, T. B. (2004). The World Mental Health (WMH) Survey Initiative Version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research*, *13*, 93–121.

Khan, A., McCormack, H. C., Bolger, E. A., McGreenery, C. E., Vitaliano, G., Polcari, A., & Teicher, M. H. (2015). Childhood maltreatment, depression, and suicidal ideation: Critical importance of parental and peer emotional abuse during developmental sensitive periods in males and females. *Frontiers in Psychiatry*, *6*, 42.

Knäuper, B., Cannell, C. F., Schwarz, N., Bruce, M. L., & Kessler, R. C. (1999). Improving the accuracy of major depression age of onset reports in the US National Comorbidity Survey. *International Journal of Methods in Psychiatric Research*, *8*(1), 39–48.

Linehan, M. M., Comtois, K. A., Murray, A. M., Brown, M. Z., Gallop, R. J., Heard, H. L.,… Lindenboim, N. (2006). Two-year randomized controlled trial and follow-up of dialectical behavior therapy vs therapy by experts for suicidal behaviors and borderline personality disorder. *Archives of General Psychiatry*, *63*, 757–766.

McLaughlin, K. A., Fox, N. A., Zeanah, C. H., & Nelson, C. A. (2011). Adverse rearing environments and neural development in children: The development of frontal electroencephalogram asymmetry. *Biological Psychiatry*, *70*, 1008–1015.

McQuillan, C. T., & Rodriguez, J. (2000). Adolescent suicide: A review of the literature. *Boletin de la Asociacion Medica de Puerto Rico*, *92*, 30–38.

Miller, A. B., Esposito-Smythers, C., Weismoore, J. T., & Renshaw, K. D. (2013). The relation between child maltreatment and adolescent suicidal behavior: A systematic review and critical examination of the literature. *Clinical Child and Family Psychology Review*, *16*, 146–172.

Miller, A. B., Jenness, J. L., Oppenheimer, C. W., Gottleib, A. L. B., Young, J. F., & Hankin, B. L. (2016). Childhood emotional maltreatment as a robust predictor of suicidal ideation: A 3-year multi-wave, prospective investigation. *Journal of Abnormal Child Psychology*, *45*(1), 105–116.

Millner, A. J., Lee, M. D., & Nock, M. K. (2015). Single-item measurement of suicidal behaviors: Validity and consequences of misclassification. *PLoS ONE*, *10*, e0141606.

Nock, M. K., Deming, C. A., Fullerton, C. S., Gilman, S. E., Goldenberg, M., Kessler, R. C., … Ursano, R. J. (2013). Suicide among soldiers: A review of psychosocial risk and protective factors. *Psychiatry*, *76*, 97–125.

Nock, M. K., Green, J. G., Hwang, I., McLaughlin, K. A., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2013). Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: Results from the National Comorbidity Survey Replication Adolescent Supplement. *JAMA Psychiatry*, *70*, 300–310.

Norman, R. E., Byambaa, M., De, R., Butchart, A., Scott, J., & Vos, T. (2012). The long-term health consequences of child physical abuse, emotional abuse, and neglect: A systematic review and meta-analysis. *PLoS Medicine*, *9*, e1001349.

Riggs, S., Alario, A. J., & McHorney, C. (1990). Health risk behaviors and attempted suicide in adolescents who report prior maltreatment. *Journal of Pediatrics*, *116*, 815–821.

Ryan, K. D., Kilmer, R. P., Cauce, A. M., Watanabe, H., & Hoyt, D. R. (2000). Psychological consequences of child maltreatment in homeless adolescents: Untangling the unique effects of maltreatment and family environment. *Child Abuse & Neglect*, *24*, 333–352.

Salzinger, S., Rosario, M., Feldman, R. S., & Ng-Mak, D. S. (2007). Adolescent suicidal behavior: Associations with preadolescent physical abuse and selected risk and protective factors. *Journal of the American Academy of Child & Adolescent Psychiatry*, *46*, 859–866.

Schilling, S., & Christian, C. W. (2014). Child physical abuse and neglect. *Child and Adolescent Psychiatric Clinics of North America*, *23*, 309–319, ix.

Scott, K. M., McLaughlin, K. A., Smith, D. A., & Ellis, P. M. (2012). Childhood maltreatment and DSM-IV adult mental disorders: Comparison of prospective and retrospective findings. *British Journal of Psychiatry*, *200*, 469–475.

Sheridan, M. A., Fox, N. A., Zeanah, C. H., McLaughlin, K. A., & Nelson, C. A., III (2012). Variation in neural development as a result of exposure to institutionalization early in childhood. *Proceedings of the National Academy of Sciences of the United States of America*, *109*, 12927–12932.

Singer, J. D., Willett, J. B. (2003). Applied longitudinal data analysis: Modeling change and event occurrence. New York, NY: Oxford University Press.

Soylu, N., & Alpaslan, A. H. (2013). Suicidal behavior and associated factors in sexually abused adolescents. *Children and Youth Services Review*, *35*, 253–257.

Stroud, L. R., Foster, E., Papandonatos, G. D., Handwerger, K., Granger, D. A., Kivlighan, K. T., & Niaura, R. (2009). Stress response and the adolescent transition: Performance versus peer rejection stressors. *Development and Psychopathology*, *21*, 47–68.

Sullivan, E. M., Annest, J. L., Simon, T. R., Luo, F., & Dahlberg, L. L. (2015). Suicide trends among persons aged 10–24 years—United States, 1994–2012. *MMWR. Morbidity and Mortality Weekly Reports*, *64*, 201–205.

Thompson, R., Litrownik, A. J., Isbell, P., Everson, M. D., English, D. J., Dubowitz, H., … Flaherty, E. G. (2012). Adverse experiences and suicidal ideation in adolescence: Exploring the link using the LONGSCAN samples. *Psychology of Violence*, *2*, 211–225.

Vigo, D., Thornicroft, G., & Atun, R. (2016). Estimating the true global burden of mental illness. *Lancet Psychiatry*, *3*, 171–178.

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