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Psychiatric predictors of first-onset suicidal thoughts and behaviors throughout preadolescence: longitudinal associations in a US population-based study

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Rates of suicidal thoughts and behaviors are increasing among preadolescent children, yet there is a paucity of longitudinal research among this developmental group. This study evaluated prospective associations between current and lifetime psychiatric disorders and first-onset suicidal ideation (SI), first-onset suicide attempts (SA), and the transition from SI to SA over the course of preadolescence, and estimated the prevalence of psychiatric treatment utilization among preadolescents with SI and SA. Data were drawn from the Adolescent Brain Cognitive Development study. Preadolescents ages 9–10 from 21 sites across the country completed follow-up assessments every 12 months. The sample was restricted to preadolescents under age 13 at their two-year follow-up ($n = 9940$). In multivariate models, current major depressive disorder (MDD OR = 2.14, [95% CI = 1.10–4.15]), obsessive-compulsive disorder (OCD OR = 1.42, 95%CI = [1.12–1.81]), attention-deficit/hyperactivity disorder (ADHD OR = 1.88, [95% CI = 1.49–2.36]), and binge eating disorder (BED OR = 2.42 [95% CI = 1.25–4.72]) were most robustly predictive of first-onset SI. Only lifetime depression predicted first-onset SA (OR = 2.52, [OR = 1.58–4.00]). No disorders predicted the transition from SI to SA. Rates of psychiatric treatment utilization were 29.38% and 53.91% for first-onset SI and SA, respectively. Based on their small effect sizes, MDD, OCD, ADHD and BED may offer modest value in ascertaining risk for SI. Clinicians and researchers may benefit from looking beyond psychiatric disorders to understand risk for SA. Many preadolescents with SI and SA do not present in psychiatric care settings. Widespread risk screenings in other settings (e.g., primary care) may facilitate early detection and reduce the treatment gap for children at risk for SI and SA.

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INTRODUCTION

Suicidal thoughts and behaviors (STB) were once considered primarily an issue of adolescence and adulthood, largely due to a widespread belief that children do not experience STB because they lack the cognitive capacity to comprehend death [1]. However, a recent meta-analysis [2] reported lifetime prevalence rates of suicidal ideation (SI) and suicide attempts (SA) among preadolescent children in the general community were 15.1 and 2.6%, respectively. Further, suicide rates among children ages 9–12 nearly tripled between 2001 (crude rate=0.4) and 2021 (crude rate=1.1), making suicide the sixth leading cause of death among preadolescents in 2021 [3]. However, little is known about risk factors temporally preceding preadolescent STB [4]. In a recent meta-analysis [2], only four sufficiently powered studies drawn from three unique samples evaluated temporal predictors of STB in preadolescents. Additionally, it cannot be assumed factors pertinent to other age groups generalize to this population [2, 5]. Reflecting the urgent need to address this knowledge gap, the National Institute of Mental Health convened meetings to identify priorities for research this area [6] and issued a call for longitudinal studies on temporal predictors of STB in pre-teens [7].

Emerging work in this area suggests biological (e.g., advanced pubertal timing) [8], interpersonal (e.g., cyber victimization) [9],

and sociocultural factors (e.g., intersectional marginalized identities) [10] are associated with increased risk for STB during this developmental period. However, none of the extant literature has evaluated diagnostic predictors of STB, which may be particularly relevant for providers in clinical settings. In cross-sectional studies, the strongest associations have been observed for major depressive disorder (MDD) and attention-deficit/hyperactivity disorder (ADHD) in relation to SI, whereas the evidence is mixed for MDD and ADHD in relation to SA [2, 11]. Anxiety, specifically social anxiety, emerged as a correlate of SA but not SI [2, 11]. However, these cross-sectional findings leave unclear which disorders temporally precede STB onset in this age group.

Additionally, cross-sectional studies of STBs typically do not separate out individuals with SA from SI, thus confounding indicators of risk for SI with those for SA [12, 13]. Grounded in ideation-to-action models of suicide risk, which posit that suicidal ideation most often precedes suicidal behavior [13–15], longitudinal studies examining temporal predictors of the transition from SI to SA are also rare across all age groups [12, 13]. This is particularly important for outpatient and related settings (e.g., therapy, primary care, schools), where SI is often the issue that prompts risk assessment, monitoring, and intervention [15].

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It is also critical to gain a clearer understanding of treatment utilization among this population. As earlier age of onset is associated with illness severity [16], it may be possible that a substantial percentage of preadolescents with STB present to treatment. However, it is also possible that the majority of preadolescents with STB go untreated because screenings are uncommon in this age group [17]. Prior meta-analytic work indicates that treatment rates for psychiatric disorders are largely comparable for children above and below 12 years old [18]. However, among children with lifetime SI or SA, just over one-third and one-half, respectively, receive any psychiatric treatment [11]. Understanding treatment utilization in this population is critical, because diagnostic risk factors are most actionable when children are engaged with care and being monitored.

This study drew on population-based longitudinal data from the Adolescent Brain Cognitive Development (ABCD) Study [19, 20] to determine the incidence of prospective first-onset SI and SA over the course of preadolescence (i.e., before age 13) and to evaluate which psychiatric conditions were prospectively associated with 1) first-onset SI in preadolescence (unconfounded by risk for SA), 2) first-onset SA during preadolescence, and 3) the transition from SI to SA. Additionally, this study aimed to determine rates of mental health treatment utilization among preadolescents with first-onset SI and SA.

METHODS

Sample

Data were drawn from data release 5.1 of the Adolescent Brain and Cognitive Development (ABCD) study, a longitudinal study of youth health and development [21]. ABCD Study data are publicly available. Youth ages 9–10 years old ($n = 11,876$) were enrolled in 2015 and assessed annually. Analyses utilized data from the baseline, one-year, and two-year assessments. Because this study's aim was to evaluate psychiatric risk factors for STBs during preadolescence, this study's sample was restricted to youth who were under age 13 at their two-year follow-up ($n = 9940$).

The ABCD cohort was recruited from 21 school-based catchment sites based on the sociodemographic composition of the US to create a population-based sample. The University of California, San Diego institutional review board approved all procedures. Parents and youth provided informed consent and assent, respectively. Further details regarding the ABCD study are reported elsewhere [19, 22, 23].

Measures

Demographics. Children's sex and age was ascertained from a questionnaire completed at baseline by the participating parent.

Suicidal thoughts and behavior. Current and lifetime SI and SA were measured using the computerized version of the Kiddie Schedule for Affective Disorders and Schizophrenia – Present and Lifetime Version for DSM-5 (K-SADS-PL DSM-5). At each time-point, children were asked about their lifetime and current (past two-week) SI and SA. Parents were asked the same questions about their child's lifetime and current SI and SA at baseline and year 2. Following standard practices for this age group [11, 24], SI and SA were coded as affirmative if either the child or parent endorsed the item.

DSM-5 psychiatric disorders. The computerized K-SADS-PL was administered to parents and children at baseline to determine whether children met criteria for lifetime or current (past two-week) psychopathology. The following disorders were included in the current study: MDD, psychosis, separation anxiety, social anxiety, specific phobia, generalized anxiety disorder, post-traumatic stress disorder, obsessive-compulsive disorder (OCD), ADHD, conduct disorder, oppositional defiance disorder, and binge eating disorder (BED). Parents reported on all modules of the K-SADS-PL, but children only provided information for MDD, social anxiety, and generalized anxiety. If the child met diagnostic criteria for a disorder based on either the parent or child interview, they were coded as having the condition [24, 25].

Psychiatric treatment utilization. Parents reported on youth treatment utilization. Lifetime mental health or substance use service utilization was

assessed at baseline, and at each follow-up, treatment utilization since the last time-point was assessed. Parents were asked whether their child received any type of mental health or substance use treatment, and if they responded affirmatively, they were asked what type(s) of treatment their child received (i.e., inpatient, outpatient, partial hospitalization, psychotherapy, medication, other).

Data analysis

Analyses were conducted in R (version 5.0). Code is available on OSF. For prospective analyses, participants with a lifetime history of SI or SA at baseline were excluded from analyses examining predictors of first-onset SI. Similarly, participants with a lifetime history of SA at baseline were excluded from analyses of first-onset SA, and analyses of the transition from SI to SA were restricted to preadolescents with a lifetime history of SI, but no SA, at baseline. The presence of the target outcomes (i.e., SI or SA during preadolescence) was considered affirmative if the lifetime occurrence was endorsed at either the one- or two-year follow-up (i.e., at age 11 or 12).

A series of logistic regression models were conducted in which psychiatric diagnoses were tested as focal predictors of the target outcomes (i.e., SI or SA). Psychiatric conditions were included in the logistic regression analyses only if 20 or more participants met diagnostic criteria based on parent- or self-reported information. These associations were evaluated in three sets of models: 1) bivariate, 2) models controlling age and sex, and 3) multivariate models including age, sex, and all psychiatric disorders. These analyses were conducted separately for lifetime diagnoses and current (at baseline) diagnoses. A Benjamini-Hochberg correction was applied to steps one and two to correct for multiple comparisons.

To evaluate the severity of lifetime and current psychiatric comorbidity as risk factors for first-onset SI, SA, and the SI to SA transition, the number of disorders were entered into logistic regression models for each outcome, with age and sex covaried.

Treatment utilization during the same year as the first onset of each outcome was calculated for each year of the follow-up period. Concurrent treatment was coded as affirmative if both the first onset of the target outcome and treatment were reported within the same one-year interval (i.e., either between baseline and year one, or between years one and two).

RESULTS

Descriptive information for full sample ($n = 9940$) is presented in Table 1.

Predictors of first-onset suicidal ideation

Of the participants without a history of SI or SA at baseline, 12.10% ($SE = 0.36$) experienced prospective first-onset SI before reaching adolescence. Results of the univariate and multivariate logistic regression analyses for lifetime psychiatric predictors of first-onset SI-only (i.e., prospective SI with no lifetime SA at follow-up) are presented in Table 2. In bivariate models and models covarying age and sex, all lifetime diagnoses except social anxiety were predictive of SI. Effect sizes were in the small to medium range, ranging from $OR = 1.32$ (95% $CI = 1.14–1.52$) for specific phobia to 2.65 (95% $CI = 1.40–5.01$) for BED. In the multivariate model testing the effects of all diagnostic categories simultaneously, lifetime MDD, OCD, ADHD, and ODD remained significant with small effect sizes.

Results of analyses testing current diagnostic status as predictors of first-onset SI are also presented in Table 2. All current psychiatric disorders except psychosis, social anxiety, and GAD were also predictive of first-onset SI prior to covarying all other diagnoses. Effect sizes ranged from small ($OR = 1.47$ [95% $CI = 1.19–1.83$] for specific phobia) to medium-to-large ($OR = 3.07$ [95% $CI = 1.60–5.89$] for BED). These findings remained largely unchanged after covarying age and sex. The model testing the unique effects of all disorders relative to each other indicated that current MDD, specific phobia, OCD, ADHD, and BED were all predictive of first-onset SI during preadolescence. The strongest effects were observed for BED ($OR = 2.42$ [95% $CI = 1.25–4.72$; medium range) and MDD ($OR = 2.14$ [95% $CI = 1.10–4.15$; small-to-medium range).

Table 1. Baseline sociodemographic and clinical characteristics.

	% (n)
Sex (female)	47.49% (4719)
Race/ethnicity ^a	
Non-Hispanic White	53.57% (5305)
Hispanic	19.86% (1974)
Non-Hispanic Black	14.28% (1419)
Non-Hispanic Asian	2.02% (201)
Multiracial/other	10.47% (1041)
Family Income	
Less than \$25,000	14.01% (1283)
\$25,000–\$49,999	14.51% (1328)
\$50,000–74,999	13.76% (1260)
\$75,000 to \$99,999	14.91% (1365)
\$100,000 to \$199,999	31.22% (2858)
\$200,000 and more	11.59% (1061)
Parental marital status	
Not married	30.85% (3047)
Married	69.15% (6830)
Comorbidity	
Number of current disorders ^a	
Zero	75.38% (7473)
One	15.85% (1571)
Two	5.46% (541)
Three or more	3.32% (329)
Number of lifetime disorders	
Zero	52.58% (5213)
One	24.27% (2406)
Two	10.86% (1077)
Three or more	12.29% (1218)

Total sample size was 9940. Due to missing data for some variables, the denominator varied for these descriptive data.

^aDue to rounding, cumulative percentages exceed 100.

Predictors of first-onset suicide attempts

In total, 1.45% (SE = 0.12) of participants with no history of SA at baseline experienced prospective first-onset SA during the follow-up. Of the preadolescents with first-onset SA during the follow-up, 47.48% had a lifetime history of SI at baseline, 49.64% experienced first lifetime onset of SI during the follow-up, and 2.88% reported no lifetime SI ever.

Table 3 shows lifetime diagnostic predictors of first-onset SA. Eight of the 13 lifetime diagnoses tested were predictive of SA in bivariate models, but after adding sex and age as covariates and applying a Benjamini-Hochberg correction, only MDD and ADHD remained significant. The effect size for lifetime MDD was medium (OR = 2.79 [95% CI = 1.77–4.39]), whereas the effect size for lifetime ADHD was small-to-medium (OR = 1.90 [95% CI = 1.29–2.79]). A lifetime MDD diagnosis was the only diagnostic predictor of first-onset SA in the multivariate model evaluating all disorders simultaneously (OR = 2.52 [95% CI = 1.58–4.00]).

Results of analyses testing *current* diagnostic status as predictors of first-onset SA are also presented in Table 3. All current externalizing disorders and OCD were associated with SA when accounting for sex and age and the false discovery rate. When all disorders were entered into a single model, none were predictive of first-onset SA.

Predictors of the transition from suicidal ideation to suicide attempts

Only 295 preadolescents with prospective data had current SI without a history of SA at baseline; the incidence of first lifetime SA among this subsample was 7.46% (SE = 1.53). Given the low rate of current SI without SA at baseline relative to prospective rate of SA, it was not possible to conduct analyses of the transition from current SI to prospective SA. Therefore, only analyses of diagnostic predictors of the transition from lifetime SI to prospective SA were conducted (see Table 4). Of the preadolescents with lifetime SI-only at baseline (i.e., a lifetime history of SI, but no SA at baseline), 5.15% (SE = 0.62) had a first prospective SA during the follow-up interval. Findings from these models testing diagnostic predictors of the transition from any lifetime SI to first SA are in Table 4. In bivariate models and after covarying age and sex, lifetime MDD was the only disorder found to predict transitioning to SA during preadolescence (OR = 1.86 [95% CI = 1.05–3.31]), but this finding was no longer significant after applying the Benjamini-Hochberg correction. None of the current psychiatric disorders predicted the transition from SI to SA.

Psychiatric comorbidity and first-onset STB

Psychiatric comorbidity was most notably associated with first-onset SI (Table 5). The odds of developing SI during preadolescence increased as the number of concurrent diagnoses increased. For example, the presence of one lifetime disorder was associated with an OR = 1.27 (95% CI = 1.07–1.49) increased risk for first lifetime SI, whereas the odds ratios for two disorders and three or more disorders were OR = 1.68 [95% CI = 1.36–2.08] and OR = 2.67 (95% CI = 2.20–3.24), respectively. Comorbidity was not consistently associated with first-lifetime SA, nor the transition from SI to SA.

Treatment utilization among preadolescents with first-onset STB

Of preadolescents experiencing first-onset SI (without any lifetime SA) between the baseline and two-year follow-up, 29.38% (SE = 1.50) received some type of mental health treatment during the year of SI onset. The most common treatment setting was outpatient (18.25%, SE = 1.27), and only 1.62% (SE = 0.44) received intensive treatment (i.e., inpatient or partial hospitalization). A total of 8.75% (SE = 0.93) received medication and 7.45% (SE = 0.86) received psychotherapy.

Of preadolescents endorsing first lifetime SA, 53.91% (SE = 4.41) received some form of mental health treatment within the year of their first SA. Just over one third received outpatient treatment (35.38%, SE = 4.19), and 16.92% (SE = 3.29) were treated in intensive care facilities. Rates of same-year medication use and psychotherapy were 22.31% (SE = 3.65) and 18.46% (SE = 4.50), respectively.

DISCUSSION

To our knowledge, this was the first prospective study of psychiatric risk factors for first-onset SI and SA, and escalation from SI to SA, across preadolescence in a large population-based sample. Several findings are particularly worth noting. First, the most robust risk factors for first-onset SI were MDD, ADHD, and OCD, which is generally consistent with a meta-analysis of primarily cross-sectional studies of preadolescence that found the two diagnoses most strongly linked to SI were MDD and ADHD [2]. However, the meta-analysis reported medium and large pooled effect sizes for the ADHD and MDD, respectively, whereas the current study found the prospective associations are more attenuated, with small and small-to-medium effect sizes. These reduced effect sizes are not surprising, as longitudinal associations are generally less robust than cross-sectional ones and speak to the challenges of prospective prediction and prevention [26]. Also

Table 2. Lifetime and current diagnostic predictors of first-onset suicidal ideation.

	Lifetime Diagnosis				Current Diagnosis									
	Lifetime Diagnosis (n)	First-onset SI (bivariate) OR (95% CI)	p	First-onset SI ^a (with covariates) OR (95% CI)	p	First-onset S ^b (multivariate) OR (95% CI)	p	Current Diagnosis (n)	First-onset SI (bivariate) OR (95% CI)	p	First-onset SI ^a (with covariates) OR (95% CI)	p	First-onset S ^b (multivariate) OR (95% CI)	p
	257	1.99 (1.46–2.70)	<0.001	1.98 (1.45–2.69)	<0.001	1.48 (1.07–2.05)	0.02	49	2.64 (1.40–5.00)	<0.01	2.64 (1.40–5.01)	<0.01	2.14 (1.10–4.15)	0.02
Psychosis	70	2.17 (1.24–3.81)	<0.01	2.20 (1.25–3.86)	<0.01	1.53 (0.86–2.74)	0.15	48	1.92 (0.95–3.87)	0.07	1.95 (0.97–3.93)	0.06	1.37 (0.67–2.80)	0.40
Anxiety Disorder (any)	2653	1.41 (1.23–1.61)	<0.001	1.40 (1.22–1.60)	<0.001			771	1.34 (1.09–1.65)	<0.01	1.34 (1.09–1.65)	<0.01		
Separation Anxiety	660	1.45 (1.17–1.81)	<0.001	1.46 (1.17–1.81)	<0.001	1.01 (0.79–1.28)	0.94	19						
Social Anxiety	376	1.32 (0.98–1.76)	0.06	1.31 (0.98–1.75)	0.07	0.93 (0.69–1.27)	0.67	82	0.78 (0.38–1.63)	0.51	0.78 (0.37–1.62)	0.50	0.63 (0.30–1.32)	0.22
Specific Phobia	2098	1.32 (1.15–1.53)	<0.001	1.32 (1.14–1.52)	<0.001	1.09 (0.94–1.27)	0.27	659	1.47 (1.19–1.83)	<0.001	1.48 (1.19–1.83)	<0.001	1.26 (1.00–1.58)	<0.05
GAD	285	2.13 (1.60–2.84)	<0.001	2.12 (1.59–2.83)	<0.001	1.30 (0.95–1.80)	0.10	70	1.67 (0.91–3.05)	0.10	1.67 (0.91–3.05)	0.10	0.89 (0.47–1.70)	0.73
PTSD	105	2.43 (1.55–3.80)	<0.001	2.43 (1.55–3.80)	<0.001	1.32 (0.82–2.12)	0.26	4						
OCD	682	1.84 (1.50–2.25)	<0.001	1.86 (1.52–2.28)	<0.001	1.36 (1.09–1.69)	<0.01	547	1.76 (1.41–2.21)	<0.001	1.78 (1.42–2.24)	<0.001	1.42 (1.12–1.81)	<0.01
Externalizing Disorder (any)	1583	1.98 (1.71–2.30)	<0.001	2.03 (1.75–2.36)	<0.001		-	869	2.01 (1.68–2.41)	<0.001	2.06 (1.71–2.47)	<0.001		
ADHD	1025	2.17 (1.83–2.56)	<0.001	2.24 (1.89–2.66)	<0.001	1.72 (1.42–2.09)	<0.001	575	2.21 (1.79–2.73)	<0.001	2.29 (1.86–2.83)	<0.001	1.88 (1.49–2.36)	<0.001
CD	167	2.11 (1.45–3.06)	<0.001	2.16 (1.49–3.14)	<0.001	1.25 (0.84–1.85)	0.27	166	2.05 (1.41–2.98)	<0.001	2.10 (1.44–3.06)	<0.001	1.36 (0.90–2.04)	0.14
ODD	941	1.92 (1.61–2.29)	<0.001	1.94 (1.63–2.32)	<0.001	1.33 (1.08–1.63)	<0.01	354	1.88 (1.44–2.47)	<0.001	1.89 (1.44–2.48)	<0.001	1.30 (0.96–1.75)	0.09
BED	49	2.64 (1.40–5.00)	<0.01	2.65 (1.40–5.01)	<0.01	1.76 (0.91–3.42)	0.09	44	3.07 (1.60–5.89)	<0.001	3.06 (1.60–5.88)	<0.001	2.42 (1.25–4.72)	<0.01

Analytic sample was restricted to children under 13 years old at follow-up with suicidal ideation data at the three relevant timepoints and no history of suicidal ideation or suicide attempts at baseline ($n = 8297$). Analyses were not conducted on disorders with fewer than 20 endorsements (i.e., panic disorder, substance use disorder, current separation anxiety, current PTSD, anorexia nervosa, bulimia nervosa).

SI suicidal ideation, SA suicide attempt, ADHD attention-deficit/hyperactivity disorder, BED binge eating disorder, CD conduct disorder, CI confidence interval, GAD generalized anxiety disorder, MDD major depressive disorder, OCD obsessive-compulsive disorder, ODD oppositional defiance disorder, OR odds ratio, PTSD post-traumatic stress disorder. All models remained significant after applying a Benjamini-Hochberg correction.

^aModel controlled for sex and age at baseline.

^bModel controlled for sex, age at baseline, and all other disorders in the prior step.

Table 3. Lifetime and current diagnostic predictors of first-onset suicide attempts.

	Lifetime Diagnosis				Current Diagnosis			
	Lifetime Diagnosis (n)	First-onset SA (bivariate) OR (95% CI)	p	First-onset SA ^a (with covariates) OR (95% CI)	p	First-onset SA ^b (multivariate) OR (95% CI)	p	First-onset SA ^b (multivariate) OR (95% CI)
MDD	463	5.21 (3.40–7.97)	<0.001	2.79 (1.77–4.39)	<0.001	2.52 (1.58–4.00)	<0.001	1.96 (0.77–5.03)
Psychosis	89	2.39 (0.75–7.66)	0.14	1.91 (0.58–6.26)	0.29	1.50 (0.44–5.11)	0.52	1.82 (0.43–7.74)
Anxiety Disorder (any)	3233	1.59 (1.13–2.22)	<0.01	1.29 (0.92–1.82)	0.15		0.11	1.13 (0.69–1.84)
Panic Disorder	22	3.24 (0.43–24.28)	0.25	1.84 (0.24–14.26)	0.56	1.07 (0.12–9.24)	0.95	
Separation Anxiety	856	1.52 (0.92–2.51)	0.10	1.17 (0.70–1.95)	0.55	0.81 (0.46–1.44)	0.48	4.02 (1.17–13.84)
Social Anxiety	496	2.08 (1.19–3.63)	0.01	1.58 (0.89–2.79)	0.12	1.20 (0.64–2.22)	0.57	1.21 (0.30–4.96)
Specific Phobia	2507	1.44 (1.01–2.06)	0.04 [†]	1.28 (0.89–1.83)	0.18	1.08 (0.74–1.58)	0.68	1.49 (0.89–2.48)
GAD	431	2.82 (1.66–4.79)	<0.001	1.69 (0.98–2.92)	0.06	1.26 (0.68–2.32)	0.47	2.38 (0.86–6.53)
PTSD	170	1.65 (0.60–4.52)	0.33	0.88 (0.32–2.46)	0.81	0.49 (0.16–1.46)	0.20	
OCD	860	2.03 (1.29–3.20)	<0.01	1.70 (1.07–2.70)	0.02 [†]	1.34 (0.81–2.20)	0.25	2.19 (1.36–3.55)
Externalizing Disorder (any)	2102	2.22 (1.57–3.13)	<0.001	1.61 (1.12–2.32)	<0.01 [†]		<0.001	1.86 (1.14–3.03)
ADHD	1377	2.53 (1.75–3.66)	<0.001	1.90 (1.29–2.79)	<0.01	1.52 (0.97–2.38)	0.07	1.82 (1.14–2.89)
CD	268	3.38 (1.85–6.19)	<0.001	2.13 (1.14–3.99)	0.02 [†]	1.53 (0.78–3.02)	0.21	2.13 (1.14–4.00)
ODD	1307	2.42 (1.66–3.52)	<0.001	1.65 (1.11–2.45)	0.01 [†]	1.17 (0.73–1.87)	0.51	2.04 (1.24–3.37)
BED	66	1.04 (0.14–7.57)	0.97	0.71 (0.10–5.28)	0.74	0.51 (0.07–3.86)	0.51	1.19 (0.16–8.66)

Analytic sample was restricted to children under 13 years old at follow up with suicide attempt data at the three relevant timepoints and with no lifetime history of suicide attempts at baseline (n = 9557). Analyses were not conducted on disorders with fewer than 20 endorsements (i.e., current panic disorder, substance use disorder, current PTSD, anorexia nervosa, bulimia nervosa).

SI suicidal ideation, SA suicide attempt, ADHD attention-deficit/hyperactivity disorder, BED binge eating disorder, CD conduct disorder, CI confidence interval, GAD generalized anxiety disorder, MDD major depressive disorder, OCD obsessive-compulsive disorder, ODD oppositional defiance disorder, ODD odds ratio, PTSD post-traumatic stress disorder. All analyses pertaining to current diagnoses remained significant after Benjamini-Hochberg correction was applied.

[†]Not significant after Benjamini-Hochberg correction applied.

^aModel controlled for sex, age at baseline, and any lifetime SI at baseline.

^bModel controlled for sex, age at baseline, any lifetime SI at baseline, and all other disorders in the prior step.

Table 4. Lifetime and current diagnostic predictors of transition from any lifetime suicidal ideation to first-onset suicide attempt.

	Lifetime Diagnosis			Current Diagnosis		
	Lifetime Diagnosis (n)	First-onset SA (bivariate) OR (95% CI)	p	First-onset SA ^a (with covariates) OR (95% CI)	p	First-onset SA ^a (with covariates) OR (95% CI)
MDD	206	1.89 (1.06–3.34)	0.03 [†]	1.86 (1.05–3.31)	0.03 [†]	0.83 (0.20–3.51)
Anxiety (any)	589	1.19 (0.72–1.95)	0.50	1.16 (0.71–1.91)	0.55	0.86 (0.43–1.71)
Separation Anxiety	198	0.98 (0.49–1.95)	0.95	0.98 (0.49–1.96)	0.95	0.85 (0.42–1.69)
Social Anxiety	121	1.56 (0.75–3.23)	0.24	1.55 (0.74–3.23)	0.24	
Specific Phobia	418	1.04 (0.61–1.75)	0.90	1.03 (0.61–1.75)	0.90	1.24 (0.29–5.28)
GAD	148	1.58 (0.81–3.08)	0.19	1.57 (0.80–3.08)	0.19	0.77 (0.34–1.71)
PTSD	65	0.89 (0.27–2.90)	0.84	0.80 (0.24–2.63)	0.71	1.16 (0.35–3.82)
OCD	178	0.85 (0.40–1.81)	0.67	0.85 (0.40–1.81)	0.67	0.79 (0.33–1.86)
Externalizing Disorder (any)	526	1.56 (0.95–2.57)	0.08	1.55 (0.94–2.55)	0.09	1.59 (0.94–2.68)
ADHD	356	1.63 (0.98–2.72)	0.06	1.60 (0.95–2.69)	0.07	0.78 (0.33–1.84)
CD	101	1.42 (0.63–3.19)	0.40	1.43 (0.63–3.24)	0.39	1.62 (0.95–2.74)
ODD	371	1.33 (0.79–2.25)	0.28	1.30 (0.77–2.20)	0.32	0.59 (0.27–1.29)
						1.27 (0.63–2.54)
						1.53 (0.84–2.78)
						1.42 (0.63–3.19)
						1.25 (0.62–2.50)
						0.53 (0.27–1.05)
						0.16 (0.08–0.28)
						0.40 (0.23–0.68)
						0.51 (0.31–0.81)

Analytic sample was restricted to children under 13 years old at follow up with suicide attempt data at the three relevant timepoints and with a lifetime history of SI at baseline and no lifetime history of suicide attempts at baseline (n = 1282). Analyses were not conducted on disorders with fewer than 20 endorsements (i.e., psychosis, panic disorder, current separation anxiety, substance use disorder, current PTSD, anorexia nervosa, bulimia nervosa, binge eating disorder).

SI suicidal ideation, SA suicide attempt, ADHD attention-deficit/hyperactivity disorder, CD conduct disorder, CI confidant interval, ED eating disorder, GAD generalized anxiety disorder, MDD major depressive disorder, OCD obsessive-compulsive disorder, ODD oppositional defiance disorder, OR odds ratio, PTSD post-traumatic stress disorder. None of the findings were significant after the Benjamini–Hochberg correction was applied.

^aModel controlled for sex and age at baseline.

[†]Not significant after Benjamini–Hochberg correction applied.

Table 5. Prospective associations between comorbid psychopathology and first-onset suicidal ideation and suicide attempts.

	Suicidal Ideation ^a			First-onset Suicide Attempts ^b			Transition from Suicidal Ideation to Suicide Attempts ^c					
	Lifetime		Current	Lifetime		Current	Lifetime		Current			
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p		
One disorder	1.27 (1.07–1.49)	<0.01	1.47 (1.24–1.76)	<0.001	1.34 (0.85–2.10)	0.21	1.49 (0.98–1.29)	0.06	2.04 (1.00–4.17)	0.05	1.28 (0.70–2.32)	0.42
Two disorders	1.68 (1.36–2.08)	<0.001	1.76 (1.34–2.33)	<0.001	1.67 (0.99–2.82)	0.05	1.76 (0.98–3.18)	0.06	1.40 (0.60–3.26)	0.43	1.48 (0.69–3.16)	0.31
Three or more disorders	2.67 (2.20–3.24)	<0.001	3.29 (2.36–4.58)	<0.001	2.24 (1.41–3.54)	<0.001	2.19 (1.15–4.15)	0.02	2.15 (1.07–4.33)	0.02	0.96 (0.37–2.53)	0.94

All models controlled for sex and age at baseline.

CI confidence interval, OR odds ratio.

^aAnalytic sample was restricted to children under 13 years old at follow-up with suicidal ideation data at the three relevant timepoints and with no history of suicidal ideation or suicide attempts at baseline (n = 8290).

^bAnalytic sample was restricted to children under 13 years old at follow up with suicide attempt data at the three relevant timepoints and with no lifetime history of suicidal ideation or suicide attempts at baseline (n = 9549). Model also controlled for lifetime history of suicidal ideation at baseline.

^cAnalytic sample was restricted to children under 13 years old at follow up with suicide attempt data at the three relevant timepoints and with a lifetime history of suicidal ideation at baseline and no lifetime history of suicide attempts at baseline (n = 1281).

worth noting, more associations were found for individual disorders and SI when analyses were restricted to current psychopathology than lifetime history of disorders. These findings highlight the importance of understanding and specifying the most relevant timescale when assessing non-static risk factors; current psychopathology may be a better proximal risk factor for first-onset SI insofar as preadolescents in remission are less imminently at risk. Additionally, although most individual disorders were not predictive of SI, we found a prospective association between number of disorders and SI onset, suggesting that general severity of psychopathology may be a marker of risk.

Also noteworthy, current BED prospectively predicted first-onset SI, with the largest effect (medium range) in multivariate analyses of SI onset. This finding parallels that observed in adolescent literature, in which BED was also associated with SI [27]. Further, given that preadolescent BED is most strongly associated with MDD of all psychiatric disorders (medium-to-large and large effects) [28], the fact that the observed effect for current BED with SI held after accounting for concurrent MDD speaks to the robustness of this latter finding; early-onset BED may be a particularly strong indicator of proximal risk for SI onset. Emotion dysregulation, emotion reactivity, and self-criticism are transdiagnostic features associated with both SI and BED, which may contribute to the observed link between SI and BED [29–32].

Findings for predictors of SA and the transition from SI to SA were generally consistent in that, with the exception of lifetime MDD in relation to first-onset SA, no psychiatric disorder emerged as a significant risk factor in multivariate analyses. This aligns with the position that depression is amongst the strongest predictors of SI, but does not increase risk for SA beyond its association with SI [13]. Our analyses of psychiatric comorbidity in relation to SA onset yielded largely similar results. These findings are also consistent with cross-sectional findings in adults suggesting that psychiatric diagnoses more broadly are more relevant to SI than SA [33]. Additionally, a recent study of suicide decedents between the ages 10–14 found that over 60% of children who died by suicide did not have a documented mental health diagnosis [34]. Similarly, in a large multi-national study of youth, the majority of preadolescents with STB had generally low levels of psychopathology [35]. Collectively, these findings are of relevance for treatment providers seeking to mitigate SA risk among children, particularly those endorsing SI. Results highlight the need to look beyond diagnoses for understanding risk for SA.

Treatment utilization was markedly low. Over 70% of preadolescents with SI and approximately 45% with SA were undetected and unsupported by the psychiatric healthcare system. This is particularly concerning given that the percentage of youth who received clinical intervention *because* of STB risk and youth who received treatment *because* of STB onset, respectively, are an even smaller subsets of the percentage of youth who received treatment at all. This means a concerning high percentage of youth do not receive psychiatric care even after attempting suicide. This also means preventive screening in psychiatric care settings for youth with recent SI onset prior to SA will miss a large majority of these children because they do not present in these settings. It remains unclear what drives this disparity. Preadolescents may not be disclosing these thoughts to caregivers or other adults. Consistent with this notion, another study using the present sample found low parent–child concordance for suicidal thoughts and behaviors [36]. Specifically, 77% of parents of children reporting SI and 88% of parents of children reporting SA indicated that they were unaware of these experiences [36]. Interestingly, concordance was positively associated with symptom severity. Taken together, these findings suggest there may be a subset of children with STB who do not overtly signal other psychiatric distress and therefore go undetected. In addition, limited provider availability for preadolescents, particularly in rural areas where few clinicians have

competency in this age group, may further contribute to low treatment utilization [37].

Findings regarding treatment utilization speak to a need to consider screening in alternative settings. Seeing that over 85% of adolescents with past-year SI have a primary care visit within the same year [38], risk-screening in this setting may be most effective for detecting those in need of treatment. Indeed, in a nationally representative study of pediatricians, 93% had experiences with suicidal patients and 81% had patients attempt or die by suicide [39]. Within this context, it is worth noting that the National Action Alliance for Suicide Prevention advocates for universal suicide risk screening within healthcare systems [40], yet the American Academy of Pediatrics recommends screening children ages 8–11 only when “clinically indicated.” [41] Given our finding that 12% of youth experience first-onset SI during preadolescence, broadening screening recommendations may improve detection and prevention, which has important public health implications insofar as early treatment is associated with better outcomes [42].

Several limitations of this study are worth noting. Only a subset of K-SADS modules was administered directly to youth, meaning that parent reports served as the primary source for diagnostic information for the majority of disorders. This approach may have led to underestimation of psychiatric conditions that were assessed exclusively through parent report. Further, the diagnosis of ADHD was based solely on K-SADS parent report and did not incorporate neurocognitive testing or teacher reports. Although this approach has been used widely [11, 43, 44], it may have produced upwardly biased estimates. Despite the large sample size that uniquely facilitated analyses of first STB onset, an even larger sample size is needed to investigate risk factors for the transition from *current* SI to SA, which is important for clinicians assessing risk and determining the appropriate level of care for high-acuity youth. Given sample size limits, we were unable to stratify analyses by sociodemographic factors, like racial-ethnic identity. Addressing this limitation is particularly important, given the demonstrated racial disparity in child suicide, particularly the increasing suicide rates among Black children [45, 46]. Additionally, due to the nature of the treatment utilization data, we were only able to examine same-year mental health treatment utilization. A clearer understanding of the temporal relationship between treatment utilization and STB endorsement would allow us to determine whether treatment was initiated before or after the onset of STB, and in turn, inform strategies to optimize care. More details about the nature of treatment, and whether STB were a primary focus would also be important next steps for future research.

Findings suggest that MDD, ADHD, OCD, and BED may contribute to SI risk, but their relatively modest effect sizes indicate that psychiatric disorders alone should not be relied upon for identifying preadolescents at risk for SI onset. The relative lack of psychiatric risk factors for SA or the transition from SI to SA suggests that psychiatric disorders offer limited predictive utility for prospective SA, especially after SI onset. Therefore, risk screenings for SA should not be based solely on the presence of psychiatric diagnoses. Finally, STB risk screening may benefit from a focus in non-psychiatric clinical settings (e.g., primary care). Significant work remains to reduce the treatment gap for children at risk for STB.

DATA AVAILABILITY

The ABCD dataset is publicly available at the National Institute of Mental Health Data Archive (NDA) (<https://nda.nih.gov/>). NDA study and data information for the current study is available online at <https://nda.nih.gov/study.html?id=1791>.

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AUTHOR CONTRIBUTIONS

RW: conceptualization, formal analysis, writing – original draft; AS: Formal analysis, writing – original draft; TB: conceptualization, writing – review & editing; RL: conceptualization, writing – review & editing.

COMPETING INTERESTS

Richard Liu currently serves as a consultant for Relmada Therapeutics.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The ABCD study was approved by the ethical committees of each institution involved. All parents/legal guardians gave written informed consent as well as permission for youth to participate. Youth gave written assent. No identifiable images from human research participants were involved in the current study.

ADDITIONAL INFORMATION

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