

# Risk and protective factors for childhood suicidality: a US population-based study



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## Summary

**Background** Childhood suicidal ideation and behaviours are poorly understood. We examined correlates of suicidality in a US population-based sample of children participating in the Adolescent Brain and Cognitive Development (ABCD) study. The ABCD study aims to examine trajectories of mental health from childhood to adulthood and collects information on multiple domains, including mental and physical wellbeing, brain imaging, behavioural and cognitive characteristics, and social and family environment. We sought to identify and rank risk and protective factors for childhood suicidal thoughts and behaviours across these multiple domains and evaluate their association with self-agreement and caregiver agreement in reporting suicidality.

**Methods** The ABCD sample comprises a cohort of 11875 children aged 9–10 years. The sociodemographic factors on which the sample was recruited were age, sex, race, socioeconomic status, and urbanicity. Participants were enrolled at 22 sites, the catchment area of which encompassed over 20% of the entire US population in this age group. Multistage sampling was used to ensure both local randomisation and representativeness of sociodemographic variation of the ABCD sample. The data used in this study were accessed from the ABCD Study Curated Annual Release 2.0. Suicidal thoughts and behaviours (suicidality) in each child were evaluated through independent child and caregiver reports based on the computerized Kiddie Schedule for Affective Disorders and Schizophrenia for DSM-5 (KSADS-5). We used bootstrapped logistic regression to quantify the association between suicidal ideation and behaviours, with measures of mental and physical wellbeing, behaviour, cognition, and social and family environment in participants from the ABCD study.

**Findings** Our study sample comprised 7994 unrelated children (mean age 9.9 years [SD 0.5]; 4234 [53%] male participants) with complete data on child-reported and caregiver-reported suicidal ideas and behaviours. Overall, 673 (8.4%) children reported any past or current suicidal ideation, 75 (0.9%) had any past or current suicidal plans, and 107 (1.3%) had any past or current suicidal attempts. According to caregivers, 650 (8.1%) of the children reported any past or current suicidal ideation, 46 (0.6%) reported any past or current suicidal plans, and 39 (0.5%) reported past or current suicidal attempts. However, inter-informant agreement was low (Cohen's  $\kappa$  range 0.0–0.2). Regardless of informant, child psychopathology (odds ratio [OR] 1.7–4.8, 95% CI 1.5–7.4) and child-reported family conflict (OR 1.4–1.8, 95% CI 1.1–2.5) were the most robust risk factors for suicidality. The risk of child-reported suicidality increased with higher weekend screen use time (OR 1.3, 95% CI 1.2–1.7) and reduced with greater parental supervision and positive school involvement (for both OR 0.8, 95% CI 0.7–0.9). Additionally, caregiver-reported suicidality was positively associated with caregiver educational level (OR 1.3, 95% CI 1.1–1.5) and male sex in children (1.5, 1.1–2.0), and inversely associated with the number of household cohabitants (0.8, 0.7–1.0).

**Interpretation** We identified risk and protective factors that show robust and generalisable associations with childhood suicidality. These factors provide actionable targets for optimising prevention and intervention strategies, support the need to identify and treat psychopathology in school-age children, and underscore the importance of school and family interventions for childhood suicidality.

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## Introduction

Suicide is a major worldwide public health concern<sup>1</sup> but is also a particular public health crisis in the USA, where suicide rates have been steadily increasing, even among children and adolescents.<sup>2</sup> In the USA, suicide is currently the second leading cause of death in those aged 10–14 years,<sup>2</sup> and the number of emergency clinic visits and hospitalisations for suicidal ideation and suicide attempts in this age group has doubled over the last

decade.<sup>3,4</sup> Suicidal ideas and behaviours in childhood predict adult psychiatric morbidity and mortality and thus serve as a marker of lifelong vulnerability to poor mental health.<sup>5,6</sup> Prompt identification of childhood suicidal ideas and behaviours and interventions to minimise childhood suicidal risk are crucial steps in shifting developmental trajectories to better functional outcomes.

Suicidality is currently understood as a spectrum that spans suicidal ideas, plans, and attempts, some of which

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### Research in context

#### Evidence before this study

We searched PubMed for studies published in English from inception to Dec 31, 2019, with the search terms (“suicidality” or “suicidal thoughts” OR “suicidal ideation” OR “suicidal behaviour” OR “suicide” OR “suicide attempt” AND either “children” or “childhood”), and examined citations and reference lists of relevant publications. This search confirmed the paucity of population-based studies on suicidal ideation and behaviours in childhood compared with older adolescents and adults. Psychopathology and psychosocial adversity emerged as consistent risk factors, but the evidence for protective factors was scarce or inconclusive.

#### Added value of this study

The strengths of this study are fourfold. First, to our knowledge, it is the largest population-based investigation to focus specifically on late childhood. Previous studies in this age group have relied on smaller or clinical samples. Second, our results highlight the poor agreement between a child’s self-report and their caregiver reports of suicidal ideation and behaviours. Third, the comprehensive characterisation of participants enabled the examination of a range of potential risk and

protective factors for childhood suicidal ideation and behaviours. Previous research typically examined a single or a restricted number of factors. Fourth, our investigation identified child psychopathology and child-reported family conflict as the most robust risk factors for suicidal ideation, whereas children reporting higher levels of parental supervision and more school engagement were less likely to ever have engaged in suicidal ideas or behaviours.

#### Implications of all the available evidence

Suicidal ideas and behaviours are experienced by eight in every 100 children aged 9–10 years. Low caregiver and child agreement in reporting indicates problems with disclosure and awareness that should be considered when assessing suicide risk in young children. This also underscores the importance of considering the informant in future studies of childhood suicidal ideas and behaviours. The identification of robust risk and protective factors indicates that optimising interventions that aim to treat childhood psychopathology, increase school engagement, and provide family support might assist in mitigating the risk of suicide in this age group.

may be fatal.<sup>1</sup> Suicidal attempts and non-suicidal self-injury sometimes involve similar acts, but differ specifically in that non-suicidal self-injury does not involve any desire to die.<sup>7,8</sup> Nevertheless, both behaviours are associated with personal and family distress and raise professional concerns. Although non-suicidal self-injury is associated with an increased risk of subsequent suicide attempts,<sup>7</sup> the two phenomena are not equivalent but equally complex and understudied in children. Here, we focus on identifying personal, family, and environmental factors associated with suicidal thoughts and behaviours, given their contribution to childhood mortality.

Previous research in adults has identified multiple risk factors for suicidal ideas and behaviours that generally reflect higher levels of psychosocial adversity, psychopathology, and medical morbidity.<sup>9</sup> Similar risk factors apply to adolescents in whom epidemiological studies have implicated higher levels of psychopathology (distress, disruptive, or impulsive behaviour), psychiatric morbidity (mainly anxiety, depression, and substance disorders), and social stressors (negative life events and interpersonal conflict).<sup>10–16</sup> However, there is a paucity of large-scale epidemiological studies in younger children. This knowledge gap is important because age could substantially influence how suicidal ideas and behaviours are reported and the nature of risk and protective factors involved. For example, age seems to influence the association between cognition and suicidal ideation and suicide attempts.<sup>17,18</sup> Moreover, the agreement between self-reported and parent-reported suicidality is generally low in younger children, but increases with age during

adolescence.<sup>19–21</sup> Over the past few years, new putative risk factors have emerged relating to the use of digital media by young children. In the USA, an estimated almost 98% of children aged 8 years or younger have access to internet-connected devices and have over 2 h of screen time per day.<sup>22</sup> Evidence from meta-analyses and population-based cohorts<sup>23–25</sup> suggests a positive correlation between screen time and youth psychopathology that could theoretically extend to suicidality. Finally, it is essential that protective factors that might mitigate suicide risk in school-age children are identified, as these are as important as risk factors in formulating early intervention strategies.

The Adolescent Brain and Cognitive Development (ABCD) study provides a unique opportunity to study childhood suicidal thoughts and behaviours in the largest currently available nationally-representative population-based sample of 9–10 year-olds living in the USA. The ABCD study aims to examine trajectories of mental health from childhood to adulthood and collects information on multiple domains, including mental and physical wellbeing, brain imaging, behavioural and cognitive characteristics, and social and family environment. Harnessing the power of the ABCD cohort, we sought to identify and rank risk and protective factors for childhood suicidal thoughts and behaviours across these multiple domains and evaluate their association with self-agreement and caregiver agreement in reporting suicidality. We were specifically interested in identifying factors that are reproducible and robust to demographic and site variation to maximise the relevance of the study

For more on the Adolescent Brain and Cognitive Development (ABCD) study see <https://abcdstudy.org/>

findings to national or international public health initiatives that aim to improve mental health in children. We hypothesised that suicidal thoughts and behaviours in children would generally be associated with adverse clinical, behavioural, and social characteristics, but that factors relevant to emotional wellbeing in childhood, such as the quality of family life, might be of greater predictive value in this age group.

## Methods

### The ABCD study

The ABCD sample comprises a cohort of 11875 children aged 9–10 years, recruited to match national socioeconomic variation as captured by the American Community Survey, which is done annually by the US Census Bureau, and annual 3rd and 4th grade school enrolment data, which is maintained by the National Center for Education Statistics. The sociodemographic factors on which the sample was recruited were age, sex, race, socioeconomic status, and urbanicity. Participants were enrolled at 22 sites, the catchment area of which encompassed over 20% of the entire US population in this age group. Multistage sampling was used to ensure both local randomisation and representativeness of sociodemographic variation of the ABCD sample (appendix p 2).<sup>26</sup> The data used in this study were accessed from the ABCD Study Curated Annual Release 2.0 and are available on request from the National Institute of Mental Health data archive. The University of California at San Diego (San Diego, CA, USA) Institutional Review Board is responsible for the ethical oversight of the ABCD study.

### Procedures

Suicidal thoughts and behaviours in each child were evaluated via independent child and caregiver reports based on the computerised Kiddie Schedule for Affective Disorders and Schizophrenia for DSM-5 (KSADS-5). The KSADS-5 assesses the following features: passive suicidal ideation, active but non-specific suicidal ideation, suicidal ideation with a specific method, active suicidal ideation with an intent, active suicidal ideation with a plan, preparatory actions toward imminent suicidal behaviour, interrupted suicidal attempts, aborted suicidal attempts, and suicidal attempts (appendix p 3–4). Items relating to self-injurious behaviour without suicidal intent were not included.

Based on previous literature regarding risk factors for suicidal ideation and behaviours,<sup>11–19,25,27</sup> we selected variables pertaining to neighbourhood environment, parental characteristics, and family function and to the prenatal and obstetric history, physical and mental wellbeing, cognitive ability, and behavioural traits of the children. Details of the procedures and instruments used in the ABCD study have been previously published.<sup>28–30</sup> Briefly, these comprise study-specific questionnaires and widely used instruments including, in addition to

KSADS-5, the Child Behavior Checklist (CBCL), PhenX, and the Children's Report of Parental Behavioral Inventory. A detailed definition of each variable and the instrument used for its assessment is provided in the appendix (pp 5–8). The total problem score of the CBCL was highly correlated with the externalising ( $\rho=0.84$ ) and internalising ( $\rho=0.82$ ) subscales, as well as with the other CBCL-derived subscales (anxious/depressed, withdrawn/depressed, somatic complaints, aggressive behaviour, rule-breaking behaviour, attention, social, and thought problems subscales;  $\rho$  range 0.56–0.83).

### Statistical analysis

Complete data were available for all suicidality features. Missing data for personal, family, and social characteristics (range 0.1%–9.0%) were imputed using expectation maximisation implemented using SPSS version 23. The expectation maximisation algorithm maximises the log-likelihood of the available data, with missing data marginalised so that the log-likelihood for the full data (available plus missing) is greater than that for the available data alone.

We assessed agreement between child and caregiver reports for each feature of suicidality using Cohen's  $\kappa$  (implement in R-cran with the *kappa2* function). Following convention,  $\kappa$  values below 0.20 indicated poor child–caregiver agreement.

We tested group differences in personal, family, and social characteristics between children who were never suicidal and those who endorsed suicidality with Welch's *t* tests, implemented using the *t* test function in R, which allows for unequal sample sizes. Results are reported as significant at  $p<0.001$  following Bonferroni correction.

We used logistic regression analyses (implemented in R-cran, version 3.5.3 using the *glm* function) to quantify statistically significant associations between participants' personal, family, and social characteristics and suicidal thoughts and behaviours. We standardised continuous variables to create z-scores with a mean of 0 and a SD of 1. We excluded collinear variables using a conservative variation inflation factor cutoff greater than 2.5. Although the CBCL total problems score was used in the main regression analyses, we also tested each subscale of the CBCL separately. We used a bootstrapping approach to establish generalisability across sites, address the unequal sample size of the groups, and correct for multiple comparisons. Each regression analysis was thus repeated 10000 times and in each reiteration the never-suicidal group was resampled to create 10000 random subgroups, each matching the size of groups reporting suicidality. For each reiteration, we extracted the Nagelkerke  $R^2$  and *p* value of the overall model and the  $\beta$ , Wald statistic, *p* value, and odds ratio (OR) and corresponding 95% CI for each variable. Adjustments for multiple comparisons were implemented first at the level of the overall model and then at the level of the individual predictor variables to ensure that the results were robust

For more on the American Community Survey see <https://www.census.gov/programs-surveys/acs>

See Online for appendix

To request ABCD study data from the National Institute of Mental Health data archive see <https://data-archive.nimh.nih.gov/abcd>

	Child-reported suicidality (n=684)	Caregiver-reported suicidality (n=654)	Cohen's $\kappa$
<b>Past</b>			
Passive suicidal ideation	469 (5.8%)	550 (6.9%)	0.05
Active but non-specific suicidal ideation	294 (3.7%)	270 (3.4%)	0.2
Suicidal ideation with a specific method	75 (0.9%)	70 (0.9%)	0.06
Active suicidal ideation with an intent	47 (0.6%)	30 (0.4%)	0.05
Active suicidal ideation with a plan	29 (0.4%)	10 (0.1%)	0
Preparatory actions toward imminent suicidal behaviour	34 (0.4%)	38 (0.5%)	0
Interrupted suicidal attempts	10 (0.1%)	5 (<0.1%)	0
Aborted suicidal attempts	24 (0.3%)	8 (0.1%)	0
Suicidal attempts	59 (0.7%)	23 (0.3%)	0.2
<b>Current</b>			
Passive suicidal ideation	98 (1.2%)	48 (0.6%)	0.05
Active but non-specific suicidal ideation	126 (1.6%)	93 (1.2%)	0.08
Suicidal ideation with a specific method	47 (0.6%)	14 (0.2%)	0.03
Active suicidal ideation with an intent	25 (0.3%)	7 (0.1%)	0.06
Active suicidal ideation with a plan	20 (0.3%)	3 (<0.1%)	0
Preparatory actions toward imminent suicidal behaviour	17 (0.2%)	6 (0.1%)	0
Interrupted suicidal attempts	4 (0.1%)	0	0
Aborted suicidal attempts	16 (0.2%)	1 (<0.1%)	0
Suicidal attempts	15 (0.2%)	5 (0.1%)	0.1
Any of the above past or current suicidality features	684 (8.6%)	654 (8.2%)	0.2

Data are n (%) unless otherwise indicated. Percentages use the total analysis group as the denominator (n=7994). More than one suicidality feature was present in some children.

**Table 1: Suicidal thoughts, plans, and behaviours in the child-reported suicidality group and caregiver-reported suicidality group**

and generalisable across sites. The overall model of each reiteration was considered significant at  $p < 0.05$  following Bonferroni correction for multiple comparisons. We reported individual predictor variables if they made statistically significant contributions to more than 60% of the significant models (appendix p 8). The statistical significance of a variable was defined by the number of iterations that reported  $p < 0.05$  for this variable, and thus was explicitly corrected for multiple comparison against the 10 000 random subsamples. We recomputed all analyses in the complete sample and separately for boys and girls.

### Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

### Results

The study sample comprised 7994 unrelated children (mean age 9.9 years [SD 0.5]; 4234 [53%] male participants) with complete data on child-reported and caregiver-reported suicidal ideas and behaviours. A

flowchart of participant selection is shown in the appendix (p 2). The study sample was similar to the full ABCD sample (appendix p 9).

Most caregivers were mothers. Agreement between child and caregiver reports for each feature of suicidality was generally low (mean Cohen's  $\kappa$  0.05 [SD 0.06]; range 0.0–0.2; table 1; and appendix p 10).

Overall, 673 (8.4%) children reported any past or current suicidal ideation, 75 (0.9%) had any past or current suicidal plans, and 107 (1.3%) had any past or current child-reported suicidal attempts (table 1). According to caregivers, 650 (8.1%) children reported any past or current suicidal ideation, 46 (0.6%) reported any past or current suicidal plans, and 39 (0.5%) reported past or current suicidal attempts (table 1). At the time of writing, no deaths by suicide had occurred in participants in the ABCD study. Since the proportions of suicidal plans and attempts were low, we did not analyse these features separately but grouped them together with suicidal ideation. For the sake of brevity, we refer collectively to suicidal ideas and behaviours as suicidality.

The divergence of self-reports and caregiver reports prompted us to examine child-reported and caregiver-reported suicidality separately. The child-reported suicidality group comprised 684 children who self-reported any suicidal feature either in the past or currently. The caregiver-reported suicidality group comprised 654 children who had any suicidal feature either in the past or currently, according to their caregiver. Individuals that overlapped between the previous two groups comprised the concordantly-reported suicidality group. The never-suicidal group comprised 6854 children who had never expressed any suicidal feature based on concordant self-reports and caregiver reports (table 2). Groups reporting suicidality generally had higher levels of personal and parental psychopathology and social adversity compared with the never-suicidal group (table 2).

Because of low inter-informant agreement, we estimated separate regression models with child-reported suicidality, caregiver-reported suicidality, and concordantly-reported suicidality as dependent variables. All models were significant ( $p < 0.0001$  for all), explaining a mean of 24% of the variance in child-reported suicidality, 38% of the variance in caregiver-reported suicidality, and 57% of the variance in concordantly-reported suicidality. Figure 1 highlights the results for child-reported suicidality as shown in table 3. Figure 2 is a visual representation of the reproducibility of the statistically significant associations between each predictor variable with child-reported, caregiver-reported, and concordantly-reported suicidality across all bootstrapped regression models. Regardless of informant, child psychopathology—as captured by the CBCL total score—and child-reported family conflict were the most robust risk factors for suicidality (table 3). Similar results were obtained when substituting the CBCL total score with any

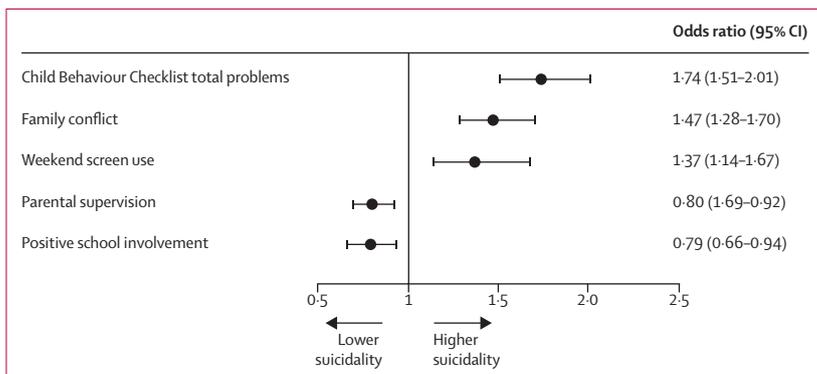
	Child-reported suicidality (n=684)	Caregiver-reported suicidality (n=654)	Concordantly- reported suicidality (n=198)	Never suicidal (n=6854)
<b>Child characteristics</b>				
Age (months)	118.6 (7.3)	118.8 (7.4)	120.3 (7.3)*†	118.5 (7.2)
Sex				
Male	407 (59.5%)*†	421 (64.4%)*†	131 (66.2%)*†	3538 (51.6%)
Female	277 (40.5%)	233 (35.6%)	67 (33.8%)	3316 (48.4%)
Race				
White	325 (47.5%)	332 (50.8%)	102 (51.5%)	3367 (49.1%)
Black	112 (16.4%)	76 (11.6%)*	24 (12.1%)	1058 (15.4%)
Hispanic	142 (20.8%)	137 (20.9%)	41 (20.7%)	1560 (22.8%)
Asian	21 (3.1%)	19 (2.9%)	5 (2.5%)	171 (2.5%)
Other	84 (12.3%)	90 (13.8%)*	26 (13.1%)	698 (10.2%)
Fluid intelligence	94.9 (18.1)	93.9 (17.5)*	93.0 (16.9)*	95.6 (17.2)
Crystallised intelligence	106.7 (18.2)	106.4 (17.8)	107.8 (18)	106.6 (18.7)
Child Behavior Checklist total problems (t score)	52.0 (11.6)*†	57.8 (11.0)*†	59.7 (10.7)*†	45.3 (10.8)
Positive school involvement	12.1 (2.7)*†	12.3 (2.7)*†	11.7 (3)*†	13.2 (2.3)
School disengagement	4.1 (1.6)*†	4.1 (1.6)*†	4.2 (1.7)*†	3.7 (1.3)*†
Positive view of school environment	18.8 (3.3)*†	19.0 (3.4)*†	18.3 (3.6)*†	20.0 (2.8)
Screen time during weekdays (h per day)	4.2 (3.5)*†	3.9 (3.4)*†	4.2 (3.6)*†	3.4 (3.1)*†
Screen time during weekends (h per day)	5.9 (4.2)*†	5.3 (4.1)*†	6.0 (4.6)*†	4.6 (3.6)
Experienced stressful events	286 (41.8%)*†	321 (49.1%)*†	98 (49.5%)*†	2355 (34.4%)
Any caregiver reported common childhood medical condition	311 (45.5%)	328 (50.2%)*†	97 (49.0%)	2898 (42.3%)
Any caregiver reported lifetime psychiatric diagnosis	530 (77.5%)*†	588 (89.9%)*†	185 (93.4%)*†	4308 (62.9%)
<b>Pregnancy and birth</b>				
Pregnancy was planned	367 (53.7%)*	349 (53.4%)*	104 (52.6%)	4037 (58.9%)
Maternal medical conditions during pregnancy	0.7 (1)	0.7 (1.1)	0.6 (1)	0.6 (1)
Mother used medication during pregnancy	85 (12.4%)	94 (14.4%)*	31 (15.7%)*	756 (11.0%)
Mother used alcohol or substances during pregnancy	89 (13.0%)*†	90 (13.8%)*†	28 (14.1%)*	574 (8.4%)
Born prematurely	75 (11.0%)	75 (11.5%)	15 (7.6%)	697 (10.2%)
Obstetric complications	0.4 (1)*	0.4 (0.8)*†	0.5 (1)*†	0.3 (0.7)
Birth weight (ounces)	117 (20.7)	118.1 (19.4)	118.8 (19)	117.9 (19.7)
<b>Parent or caregiver characteristics</b>				
Primary caregiver education level	16.5 (2.7)	16.8 (2.5)*	17.0 (2.4)*	16.5 (2.9)
Primary caregiver in full employment	466 (68.1%)	414 (63.3%)	130 (65.7%)	4736 (69.1%)
Maternal age when child was born (years)	28.8 (6.3)*	29.0 (6.5)	28.7 (6.4)	29.3 (6.3)
Paternal age when child was born (years)	31.2 (7.1)	31.2 (7.2)	30.7 (7.1)	31.7 (7.1)
Parental help-seeking for mental health problems (one parent only)	204 (29.8%)*	230 (35.2%)*†	69 (34.8%)*	1723 (25.1%)
Parental help-seeking for mental health problems (both parents)	111 (16.2%)*	144 (22.0%)*†	50 (25.3%)*†	814 (11.9%)
<b>Family environment</b>				
Family income level in the preceding 12 months	7.1 (2.3)	7.1 (2.3)	7.2 (2.1)	7.2 (2.4)
Number of household cohabitants	4.3 (1.4)*	4.2 (1.4)*†	4.2 (1.4)*	4.5 (1.5)
Primary caregiver cohabiting with partner	476 (69.6%)*	445 (68.0%)	134 (67.7%)*	5053 (73.7%)
Family conflict (caregiver report)	2.8 (2.1)*†	3.4 (2.1)*†	3.3 (2.2)*†	2.4 (1.9)
Family conflict (child report)	2.8 (2.2)*†	2.6 (2.1)*†	3.1 (2.3)*†	1.9 (1.9)
Parental supervision	4.2 (0.6)*†	4.3 (0.6)*†	4.1 (0.6)*†	4.4 (0.5)
Perceived primary caregiver's warmth	2.7 (0.4)*†	2.7 (0.4)*†	2.7 (0.4)*†	2.8 (0.3)
Perceived secondary caregiver's warmth	2.6 (0.4)*†	2.6 (0.4)*†	2.5 (0.5)*†	2.7 (0.4)

(Table 2 continues on next page)

	Child-reported suicidality (n=684)	Caregiver-reported suicidality (n=654)	Concordantly-reported suicidality (n=198)	Never suicidal (n=6854)
(Continued from previous page)				
<b>Neighbourhood environment</b>				
Area Deprivation Index	41.1 (27.3)	40.5 (27)	40.0 (27)	39.4 (27.6)
Area level of pollution	7.6 (2.7)	7.5 (2.6)	7.4 (2.6)	7.5 (2.5)
Neighbourhood security (caregiver report)	3.7 (1)*	3.7 (1)*	3.7 (1)*	4.0 (1.1)
Neighbourhood security (child report)	3.8 (1.2)*†	3.9 (1.2)*	3.8 (1.2)*	4.0 (1.1)

Data are mean (SD) or n (%). Definitions of all variables are in the appendix (pp 5–8). \*Denotes group differences at  $p < 0.05$  (uncorrected) between the never-suicidal group and each of the groups that endorsed suicidality. †Denotes group differences at  $p < 0.001$  following Bonferroni correction between the never-suicidal group and each of the groups that endorsed suicide.

**Table 2: Descriptive statistics of the study sample**



**Figure 1: Risk and protective factors for child-reported suicidality**  
Mean odds ratios and 95% CIs of bootstrapped logistic regression models for child-reported suicidality

CBCL subscale in the regression models. Additionally, the risk of child-reported suicidality increased with higher weekend screen use time (OR 1.3, 95% CI 1.2–1.7) and reduced with greater parental supervision and school involvement (for both OR 0.8, 95% CI 0.7–0.9; table 3). Furthermore, caregiver-reported suicidality was positively associated with caregiver educational level (OR 1.3, 95% CI 1.1–1.5) and male sex in children (1.5, 1.1–2.2), and inversely associated with the number of household cohabitants (0.8, 0.7–1.0; table 3).

The results of our analyses in the complete sample recapitulated our findings in the imputed sample (appendix pp 11–18). We observed the same pattern in sex-specific analyses (appendix pp 19–20). Childhood psychopathology and child-reported family conflict remained the most robust risk factors for suicidality for boys and girls, regardless of informant. We noted sex-related variation in the consistency of some associations. Screen time and parental supervision were more consistently associated with suicidality in boys than in girls.

### Discussion

To our knowledge, this is the largest study to date to investigate risk and protective factors associated with suicidal thoughts and behaviours in a sample comprised

exclusively of children aged 9–10 years. The key findings are that around eight in every 100 children in this age group experience suicidality; child–caregiver concordance in suicidality reporting is low across the spectrum of suicidal features and indicates that suicidality in children cannot be reliably assessed by parental report alone; and after modelling a wide range of factors, child psychopathology and child-reported family conflict showed the most consistent and robust associations with suicidality. Furthermore, child-reported suicidality was associated with greater screen time. Greater parental supervision and positive school engagement emerged as protective factors as they appeared to mitigate the likelihood of child-reported suicidality.

The results of this study provide additional support for societal concerns of suicidality in people as young as 9–10 years. The rates of suicidal ideation, suicidal plans, and suicide attempts in the ABCD sample indicate that suicidality in this age group is dominated by suicidal thoughts, but suicide attempts are rare. The rates of self-reported suicidal ideation observed in this study are similar to those found in the Philadelphia Neurodevelopmental Cohort (PNC), a community US sample of 6151 individuals aged 11–21 years, in which 8% of pre-pubertal participants endorsed suicidal thoughts.<sup>17</sup> However, suicidality rates reported in community samples of older adolescents, when suicidality is known to begin peaking, are generally higher.<sup>11,12,14,16,17</sup> For example, in the National Comorbidity Survey Replication Adolescent Supplement the rates of suicidal ideation, suicidal plans, and suicide attempts in 6483 adolescents aged 13–18 years, were 12.1%, 4.0%, and 4.1%, respectively.<sup>12</sup>

Agreement between child-reported and caregiver-reported suicidality was low, which has major implications regarding the assessment of suicide risk in this age group. Child–caregiver agreement ranged between a Cohen’s  $\kappa$  of almost 0 for the different types of suicidal ideation to 0.2 for previous suicide attempts. These values are substantially lower than those reported in older adolescents in the PNC, in which  $\kappa$  for youth–parent concordance for suicidal thoughts was 0.17 and 0.46 for suicide attempts.<sup>19</sup> Child–caregiver divergence is

	Odds ratio	95% CIs		$\beta$	Wald statistic	Proportions of regression models when variable was significant
		Lower	Upper			
<b>Child-reported suicidality</b>						
Child Behavior Checklist total problems	1.7 (0.1)	1.5 (0.1)	2.0 (0.1)	0.6 (0.1)	7.6 (0.6)	100.0%
Family conflict (child report)	1.4 (0.1)	1.3 (0.1)	1.7 (0.1)	0.4 (0.1)	5.4 (0.7)	100.0%
Screen use during the weekends	1.3 (0.1)	1.2 (0.1)	1.7 (0.1)	0.3 (0.1)	3.3 (0.6)	96.8%
Parental supervision	0.8 (0.1)	0.7 (0.03)	0.9 (0.04)	-0.2 (0.1)	-3.1 (0.6)	93.4%
Positive school involvement	0.8 (0.04)	0.7 (0.03)	0.9 (0.04)	-0.2 (0.1)	-2.7 (0.5)	74.1%
<b>Caregiver-reported suicidality</b>						
Child Behavior Checklist total problems	3.3 (0.2)	2.8 (0.2)	4 (0.3)	1.2 (0.1)	13 (0.4)	100.0%
Family conflict (child report)	1.3 (0.1)	1.1 (0.1)	1.6 (0.1)	0.3 (0.1)	3.5 (0.7)	98.1%
Male sex (child)	1.5 (0.1)	1.1 (0.1)	2 (0.1)	0.4 (0.1)	2.8 (0.5)	80.7%
Number of household cohabitants	0.8 (0.03)	0.7 (0.03)	1 (0.04)	-0.2 (0.04)	-2.7 (0.5)	73.5%
Primary caregiver education level	1.3 (0.1)	1.1 (0.04)	1.5 (0.1)	0.2 (0.04)	2.6 (0.4)	61.0%
<b>Concordantly-reported suicidality</b>						
Child Behavior Checklist total problems	4.8 (0.8)	3.2 (0.5)	7.4 (1.5)	1.6 (0.2)	7.4 (0.4)	100.0%
Family conflict (child report)	1.8 (0.2)	1.2 (0.1)	2.5 (0.4)	0.5 (0.1)	3 (0.6)	88.9%

Data are mean (SD) across all significant regression models.

**Table 3: Significant and reproducible risk and protective factors for suicidality in mid-childhood**

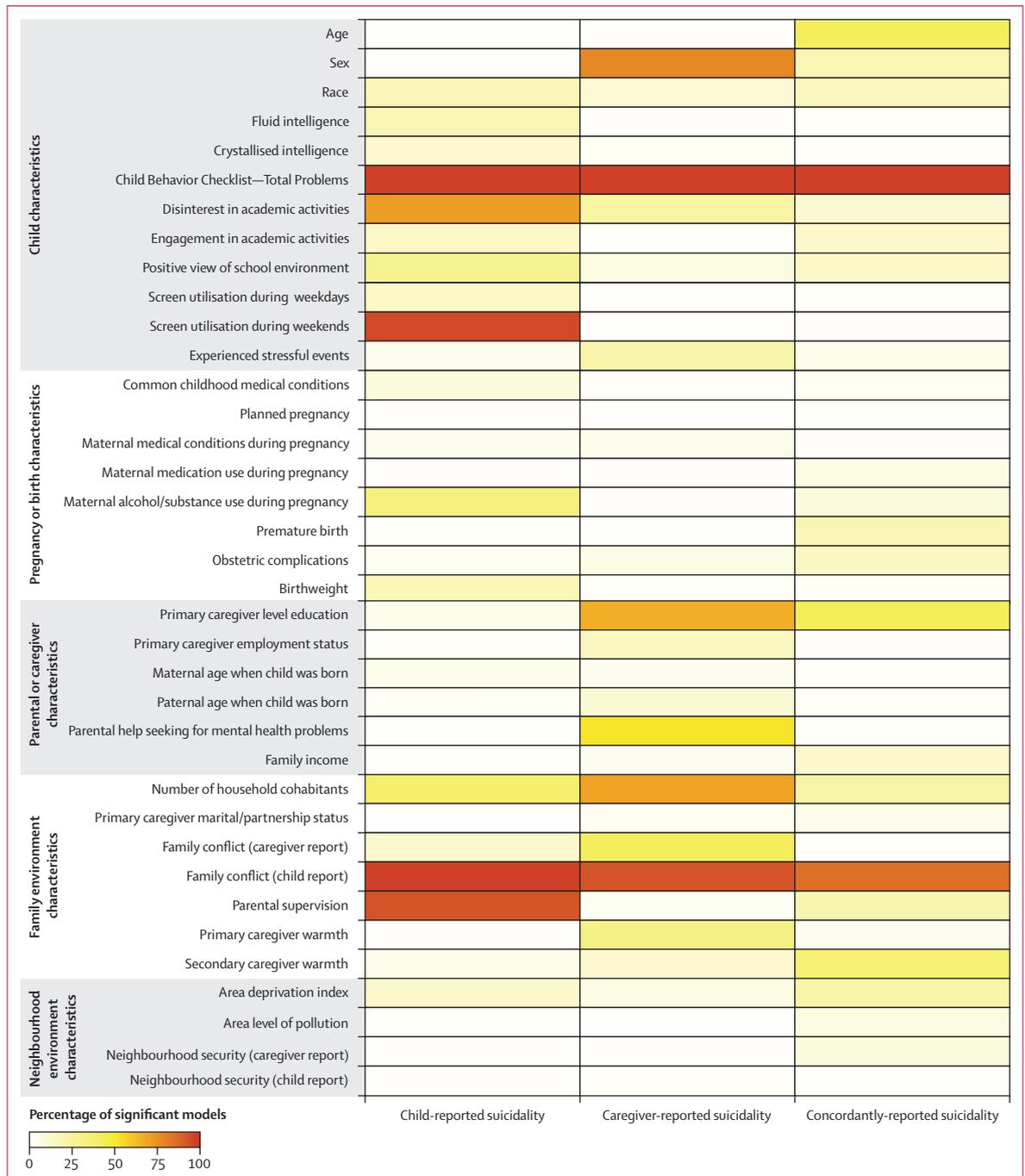
not uncommon, and the reasons might vary depending on the issue being assessed. Studies in adolescents and young adults suggest that non-disclosure of suicidality mainly involves fears of stigmatisation, communication difficulties, and inadequate social and family support.<sup>31</sup> Collectively, this evidence underscores the need for separate and independent assessment of suicidality in parents and children.

The pattern emerging from simple comparisons between never-suicidal children and children who experience suicidality (regardless of informant) suggests that suicidality is associated with various factors reflecting personal, family, and social adversity. Child psychopathology and family conflict emerged as the most robust risk factors for suicidality, regardless of informant. The link between higher psychopathology and suicidality is well documented in young people<sup>11,12,14,16,17</sup> and adults.<sup>9</sup> Psychopathology in this study was associated with up to an almost five-times increase in the likelihood of suicidality, regardless of whether the CBCL scores for total, internalising, or externalising problems were used in the analyses. It could be the degree rather than the precise nature of psychopathology that is important for suicidality in this age group. Given the rarity of suicide attempts in this sample, the present results primarily inform about the correlates of suicidal ideation in 9–10-year-olds. Previous research in adolescents found that individuals who had attempted suicide differed from those who only experienced suicidal ideation in two respects: those attempting suicide were more likely to have been diagnosed with depressive, behavioural, or anxiety disorders and were more likely to have been

exposed to self-harming behaviour in a friend or family member.<sup>11</sup> Personal psychopathology (at the syndromal and symptom level) could be a powerful common predictor of suicidal thoughts and attempts, the latter being more likely with increasing severity and persistence of the mental health problems.

Young people rely on their family for general support and for the development of healthy patterns of attachment and emotional self-regulation.<sup>32</sup> Even after accounting for psychopathology, children who reported family conflict were 30–75% more likely to experience suicidality. This observation reinforces previous reports that showed consistent associations between family dysfunction, suicide risk, and death by suicide in children.<sup>33</sup> We did not observe a robust association between suicidality and any ethnic origin despite previous reports of increased risk of death by suicide in black youth.<sup>33,34</sup> Therefore, it is possible that, unlike death by suicide, suicidal ideation and non-fatal attempts might not be influenced by race. Further studies could be helpful to investigate whether higher levels of suicide in black young people are mediated by factors relating primarily to help-seeking behaviour and access to support.

We identified additional risk factors that were dependent on informant. Child-reported suicidality was associated with greater time using a computer during weekends, which extends previous reports of an association between screen time and psychopathology in youth.<sup>23–25</sup> For example, in the Avon Longitudinal Study of Parents and Children, a UK-based prospective cohort study of 14666 young people, the risk for depression was positively associated with screen use (watching television,



**Figure 2: Stability of predictor variables for suicidality**  
Heatmap showing the percentage of times (columns) that the contribution of each predictor variable (rows) was statistically significant in bootstrapped logistic regression models for child-reported, caregiver-reported, and concordantly-reported suicidality. Further details in the appendix (pp 16–18).

using a computer, and texting).<sup>23</sup> The data available through the ABCD study do not allow us to comment on the underlying mechanisms, which may be causal (eg, increased exposure to cyberbullying or negative social comparisons) or correlative (eg, associated with social withdrawal or avoidance). Caregivers with higher

educational levels were more likely to report suicidality; this effect was not found for child-reported suicidality, suggesting that caregiver education could be linked to parental awareness. Univariate analyses showed an over-representation of boys in both child-reported and caregiver-reported suicidality groups. Further studies are

needed to clarify whether this finding represents true male disadvantage or increased disclosure by boys. The association between male sex and suicidality was significant for caregiver reports, which accords with similar findings in the PNC study, showing that parental reports of suicidality were more likely for young boys than for young girls.<sup>19</sup>

The richness of the ABCD dataset enabled us to identify factors that mitigate the risk of reported suicidality. Higher levels of parental supervision and more positive school engagement were associated with reduced likelihood of a child endorsing suicidality. The measure of parental supervision used in the ABCD study captured parental oversight (ie, knowing where the children are, what they are doing, and with whom) and the frequency of parent–child contact.<sup>30</sup> Positive school environment, as measured in the ABCD study, reflects a child's perception of achievement and involvement in school activities.<sup>30</sup> These results, together with similar findings in adolescents,<sup>35–38</sup> confirm that positive parental and school-based experiences are robust sources of protection against youth suicidality, as they promote development of identity, self-esteem, and resilience in school-age children and adolescents.<sup>32</sup> Additionally, living in households with more cohabitants reduced the likelihood of caregiver-reported suicidality. This association might reflect greater opportunities for support and positive social interactions within the child's household. Alternatively, the higher number of cohabitants might dilute caregivers' awareness of a child's emotional states, including suicidality.

This study has many strengths and limitations. The size and representativeness of the sample and range of domains assessed in the ABCD study are unique strengths, which enabled us to quantify the effect of an array of predictors and identify those with robust and reliable positive and negative influences on childhood suicidal thoughts and behaviours. Limitations include the exclusion of measures regarding non-suicidal self-injury, possible recall bias in reporting previous suicidal thoughts or behaviours, and insufficient detail regarding the nature, timing, and frequency of life events. Additionally, the rarity of suicide attempts in the ABCD sample precluded the meaningful examination of correlates of suicidality in those who have attempted suicide compared with those who only endorsed suicidal ideation. The current study is based on cross-sectional data and thus we cannot assume that the associations reported are causal. Nevertheless, the ABCD sample presents an unprecedented resource for improving understanding of the evolution of suicidality and its correlates. The present study sets the foundation for future analyses using data from the planned follow-up assessments. Such analyses will inform about the temporal stability of the observed associations and their prognostic value for emerging suicide risk and death by suicide as the sample enters adolescence.

In conclusion, the findings reported here have immediate and practical implications as risk factors

(childhood psychopathology, family conflict, and screen use) and protective influences (higher parental supervision and positive school engagement) are actionable and modifiable. The optimal way of offering support to children at risk is unclear.<sup>30</sup> Nevertheless, meta-analytic evidence suggests that school-based awareness programmes could be the most successful public health interventions for reducing both suicidal behaviours and suicidal ideation.<sup>40</sup> Therefore, this study provides further support for initiatives such as the Mental Health Packs for Schools from the Royal College of Psychiatrists in the UK, which aim to increase mental health awareness in young people. Increasing school and parental awareness of child psychopathology and providing parenting education and family support could be clear and attainable targets for early intervention and prevention strategies.

#### Contributors

All authors conceived and designed the analyses. DJ, GED, and SF did the analyses and drafted the output. All authors interpreted the data. GS, BL, MP, DAB, and SF critiqued the output and contributed important intellectual content. All authors have read and approved the final version of the manuscript. SF serves as guarantor for the content of this paper.

#### Declaration of interests

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#### Data sharing

The Adolescent Brain Cognitive Development data used in this report are available online on request. We used open source functions from the Comprehensive R Archive Network (version 3.5.3) and SPSS version 23.

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For more on **Mental Health Packs for Schools** see [www.rcpsych.ac.uk/mental-health/order-mental-health-packs-for-schools](http://www.rcpsych.ac.uk/mental-health/order-mental-health-packs-for-schools)

For the **Adolescent Brain Cognitive Development (ABCD) data used in this report** see <https://nda.nih.gov/study.html?id=721>

For the **full list of ABCD study supporters** see <https://abcdstudy.org/federal-partners.html>

For a **list of participating sites and study investigators in the ABCD study** see [https://abcdstudy.org/Consortium\\_Members.pdf](https://abcdstudy.org/Consortium_Members.pdf)

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