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RESEARCH

Adolescent suicidal distress and adult mental health: findings from a 25-year population based cohort

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Abstract

Suicidal distress is common during adolescence, yet its descriptive associations with adult mental health are not well characterized. Using 25 years of prospective data, we examined how adolescent suicidal ideation (and characteristics—recurrence, seriousness, onset) and suicide attempt are associated with self-reported and clinically diagnosed adulthood mental health. Participants were drawn from the Quebec Longitudinal Study of Child Development, a population-based cohort followed from birth (1997/98) to age 25 (n = 2,120). Adolescent suicidal ideation and attempt were self-reported at ages 13–17. Self-reported young-adult outcomes included depressive symptoms, anxiety symptoms, binge drinking, cannabis use, life satisfaction, non-suicidal self-injury, serious ideation, and attempt between ages 19–25. In addition, administrative records identified clinically diagnosed depression and anxiety, substance-related, and suicide-related disorders between ages 18–25. Associations were examined using generalized linear and logistic models adjusted for sex, race and ethnicity, and socioeconomic status. From ages 13–17, 35.6% (547/1538) of adolescents reported ideation and 5.6% (86/1538) reported an attempt. Adolescent suicidal distress was associated with poorer adult outcomes—including self-reported symptoms (standardized mean differences 0.22–0.65), clinically diagnosed depression/anxiety and substance-related disorders (ORs 1.82–2.97), and suicide-related behaviors (ORs 3.54–6.41). Among adolescents with ideation, recurrence was associated with higher depressive and anxiety symptoms and lower life satisfaction, while serious ideation was associated with persistent suicide-related behaviors. In this descriptive study, adolescent suicidal distress was associated with poorer adult mental health from symptoms to diagnoses. Findings underscore adolescence as a key period for supporting youth experiencing suicidal distress.

Keywords Suicidal behaviour · Mental health · Adolescence · Epidemiology · Longitudinal studies

Introduction

Adolescent suicidal distress (age 13–18 years)— an umbrella term encompassing both suicidal ideation and suicide attempt—is a major global health concern and contributes to substantial societal and healthcare burdens, through emergency department visits, hospitalisations, and mental health service use [1–3]. Although 20% (90 included studies; prevalence ranging from 4% to 49%) of young people report suicidal ideation and 7% (107 included studies; prevalence ranging from 0% to 34%) report a suicide attempt, some nonetheless feel that their suicidal distress is minimized or dismissed by families, peers, and even healthcare professionals [4–6].

Prior findings suggest that adolescent suicidal ideation is associated with poorer mental health in adulthood, but important gaps remain. A meta-analysis of 12 cohort studies published between 2002 and 2020 found that adolescent suicidal ideation was associated with adult depression and anxiety disorders, as well as adult suicide attempts, with odds ratios ranging from 1.4 to 4.3 [7]. However, evidence was largely inconclusive for other outcomes, including alcohol and substance misuse, and for associations between adolescent suicide attempt and adult mental health outcomes, except for adult suicide attempt (OR = 5.7) [7]. Evidence for sex differences also remains mixed: only two of six studies found that females appeared more vulnerable than males to

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poor adult mental health following adolescent suicidal ideation/attempt [7].

To fully capture the enduring associations between adolescent suicidal distress and adulthood mental health, studies must assess a broad range of outcomes including indicators of positive mental health. This aligns with the World Health Organization framework which conceptualises mental health along a continuum from general well-being to distress [8, 9]. In addition, studies should ascertain mental health outcomes through both self-reported symptoms, which capture individuals' perceptions of their symptoms along a continuum [10], and medical records of clinician-diagnosed psychiatric disorders that more closely align with functionally impairing conditions [9].

Clinically, adolescent suicidal ideation is not a present-or-absent state; it varies in recurrence, severity, and age of onset—characteristics that are essential to consider in clinical assessment [11], yet rarely examined in relation to adult mental health outcomes. To our knowledge, only a single longitudinal study of 506 high-school students (aged 12–21) has examined ideation characteristics and found that adolescents with recent—and particularly long, frequent, or serious—suicidal ideation were more likely to attempt suicide 4 to 6 years later than those whose ideation was non-serious, non-frequent, or shorter in duration, respectively [12]. However, no other mental health outcomes were investigated, thus limiting our comprehensive understanding of the long-term associations between adolescent suicidal distress with later mental health.

To address these gaps, our descriptive study aimed to document associations between adolescent suicidal distress (ideation and attempt) and characteristics of ideation (recurrency, seriousness, and early-adolescence onset) with eleven adulthood outcomes: self-reported depressive symptoms, anxiety symptoms, binge drinking, cannabis use, life satisfaction, non-suicidal self-injury, serious suicidal ideation, suicide attempt, and medical records of diagnoses; common mental disorders (e.g. major depressive disorders and generalized anxiety disorders), substance-related disorders, and suicide-related behaviors. Analyses adjust for sex, race and ethnicity and parental socio-economic status, and test whether associations are moderated by sex. Childhood mental health was not included as a covariate to align with our aim of describing developmental associations rather than estimating putative causal associations.

Methods

The current observational study was preregistered on the Open Science Framework (OSF: https://osf.io/xgydt) [13] prior to data analysis. Any deviations from protocol are reported in Supplement Methods 1. Reporting followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement, and The Reporting of Studies conducted using observational routinely-collected health data (RECORD) statement (see table S1).

Participants

The Quebec Longitudinal Study of Child Development (QLSCD), is an ongoing, longitudinal population-based representative cohort, managed by Institut de la Statistique du Québec, including 2120 singleton births (1080 males, 1040 females) in Quebec, Canada, in 1997–1998. Selection was through a stratified random sample from the Quebec Master birth register, excluding extremely pre-term (before 24 weeks) and post-term (after 42 weeks) births and families whose first language was not English or French. Data collection covered all regions, except for Cree and Inuit territories and other Indigenous communities due to differences in institutional services and socio-cultural context. The study encompasses a representative socioeconomic and ethnocultural profile, with 90% of participants identifying as White, reflecting the dominant racial demographic of Quebec in 1997–1998. Procedures and questionnaires are available at https://www.jesuisjeserai.stat.gouv.qc.ca/ and in the cohort profile [14]. De-identified linkage with medical records was completed for 2,082 participants (98%); early-life characteristics did not differ from the original cohort. Participants were eligible to partake in this study if they completed at least one of the 13/15/17-year assessments (adolescent suicidal distress) and at least one of the 18 to 25-year assessments (adult mental health outcomes).

Measures

Suicidal distress in adolescence (13–17 years)

Suicidal distress was self-reported at ages 13, 15, and 17 using three past-year items. Participants were first asked: "How often have you thought about killing yourself?" with response options never, rarely, fairly often, or very often. Participants who endorsed any suicidal ideation were then asked whether they had "seriously considered taking [their] own life" (no/yes). Those who endorsed serious suicidal ideation were then asked how many times they had tried to take their own life, with response options never, once, or more than once. Thus, items were administered sequentially, with questions on serious ideation and suicide attempt asked only when the preceding item was endorsed.

Five adolescent suicidal distress indicators were derived across ages 13, 15, and 17: any history of suicidal ideation, defined as reporting suicidal ideation at least "rarely" at one or more assessments; recurrent suicidal ideation, defined as reporting suicidal ideation at least "rarely" at two or more

assessments; serious suicidal ideation, defined as reporting serious suicidal ideation at least once; early-onset suicidal ideation, defined as reporting suicidal ideation at age 13; and history of suicide attempt, defined as reporting attempt at least "once".

Participants were classified as having a history of suicidal ideation/attempt, if they reported so at least once during any age assessment, and missing only if responses were missing at all assessments. Full coding details are provided in the Supplementary Methods2 and missingness in suicidal distress items across ages 13, 15, and 17 is described in Table S2.

Participants were assured of confidentiality, which is essential to obtain reliable self-reports of suicidal distress and were provided with mental health resources if needed [15].

Mental health in adulthood (18–25 years)

Adulthood mental health outcomes were assessed both continuously and categorically in alignment with the World Health Organization's dimensional mental health framework [8, 9].

Self-report outcomes

Mental health outcomes were self-reported at multiple assessments at ages 19, 20, 21, 22, 23 and/or 25 using standardized questionnaires with validated measurement properties. Mental health outcomes included depressive symptoms (Centre for Epidemiological Studies-Depression Scale, short form [16, 17]; 12 items referring to the past week), anxiety symptoms (Generalized Anxiety Disorder 7-item scale [18]; 7 items referring to the past 2 weeks), binge drinking (Canadian Community Health Survey [19] (CCHS); 1 item referring to the past 12 months), cannabis use (Marijuana Motives Measure [20]; 1 item referring to the past 12 months), and life satisfaction (CCHS [19]; 1 item referring to the present). Scores were averaged across available assessments to compute an overall score for each mental health outcome and converted into z scores (mean of 0, and standard deviation of 1).

Suicide-related behaviors were self-reported at ages 20, 23, and 25 referring to the past 12 months and included non-suicidal self-injury (NSSI), serious suicidal ideation, and suicide attempt. NSSI was assessed using the item "Did you ever deliberately harm yourself but not mean to take your life?" (never/rarely/often/very often); serious suicidal ideation was assessed with the item "Did you ever seriously consider taking your own life or killing yourself?" (yes/no); and suicide attempt was assessed using the item "How many times did you actually try to take your own life?" (never/once/more than once). Participants were classified as having non-suicidal self-injury, serious suicidal ideation, and/or suicide attempt, if they reported so at least once during any age assessment. See Supplement Methods 3 for full coding details for self-reported outcomes.

Mental health diagnosis in medical records

Mental health diagnoses were extracted from data linkage (using participants' unique health insurance numbers) with three anonymized administrative medical care databases, including outpatient physician claims (*Regie de l'assurance maladie du Québec*), inpatient discharge records (*Maintenance et exploitation des données pour l'étude de la cientèle hospitalière*), and emergency room admissions (*Banque de données communes des urgences*). Diagnoses encompassed common mental disorders (including depressive, anxiety, or adjustment disorders), substance-related disorders (alcohol-, cannabis-, and other drug-related disorders), and suicide-related behaviors, defined using validated ICD codes and reasons for visit from Martinez et al. [21]; see Table S3 for coding details.

Covariates

Sex, assigned at birth, was drawn from participant's medical record. Parental socio-economic status (SES) at 5 months was measured with an aggregate of 5 items regarding parental education, parental occupation, and annual gross income [22–24]. Race and ethnicity at birth was self-reported by parental identification of the child within one of 12 categories, responses were coded as a binary outcome (White vs. Non-White) [7, 25, 26].

Statistical analysis

To assess selection bias from attrition, early-life characteristics at 5 months (sex, race or ethnicity, parental socioeconomic status, single-parent household, maternal mental health) were compared between included and excluded participants using crosstab (chi-square test) and t tests.

Associations of adolescent suicidal distress (ideation, attempt) and ideation characteristics (recurrency, seriousness, early onset; ages 13–17) with adult outcomes (ages 18–25) were tested using generalized linear models (GLMs) for continuous outcomes (i.e. self-reported depressive and anxiety symptoms, binge drinking, cannabis use, life satisfaction), logistic models for binary outcomes (i.e. self-reported non-suicidal self-injury, serious ideation, attempt, and diagnosed common mental disorders, substance-related disorders and suicide-related behaviors). Models used robust (sandwich-type) variance estimates. To test for sex moderation, interaction terms (e.g., ideation × sex) were added to the models. For interpretation, adjusted standardized mean differences (ΔM) are reported for continuous outcomes and

adjusted odds ratios (ORs) for binary outcomes. Models were adjusted for sex, race and ethnicity, and parental SES.

Missing data on self-reported outcomes ($n=96$ for binge drinking to 157 for non-suicidal self-injury) and covariates ($n=2$ for race and ethnicity, and $n=4$ for parental SES) were imputed across 100 datasets using multiple imputations by chained equations [27], incorporating all mental health symptoms in the model, along with additional variables associated with missingness, i.e., adolescent mental health (13–17 years) [28, 29]. We accounted for selective attrition using sampling weights provided by the ISQ, applied to the models using inverse probability weighting. A 2-sided P value <0.05 and 95% confidence interval that did not cross 0 (for mean difference) or 1 (for odd ratio) was considered statistically significant. Data were analyzed from April 2025 to December 2025. All analyses were conducted in SPSS (version 30) and Mplus (version 8.11).

Results

Sample characteristics

Of the 2120 participants at cohort inception, 1540 (72.6%) completed at least one of the age 13, 15, and 17-year suicidal distress assessments. However, 2 participants did not consent to data linkage, therefore the final analytic sample was 1538 participants. Among these, 803 (52.2%) were female and 735 (47.8%) were male (see Table 1). In comparison to participants excluded ($n=582$) from the analyses due to missing information on adolescent's suicidal distress, those who were included ($n=1538$) were more likely to be female, White, from an intact or blended household, with no maternal depression, and with higher parental socio-economic status ($p<.05$, see Table 2). Descriptive statistics of adulthood mental health and suicide-related behaviors are presented in Table S4.

Table 1 Prevalence of suicidal distress and characteristics of suicidal ideation during adolescence, by sex

Exposure	Total	Female	Male	P-value for sex differences
Suicidal distress	$N=1538$	$N=803$	$N=735$	
Suicidal ideation (ever)	547 (35.6%)	362 (45.1%)	185 (25.2%)	<0.001
Suicide attempt (ever)	86 (5.6%)	66 (8.2%)	20 (2.7%)	<0.001
Characteristics of suicidal ideation*	$N=547$	$N=362$	$N=185$	
Recurrent (>1 age assessment)	211 (38.6%)	156 (43.1%)	55 (29.7%)	<0.001
Serious	181 (33.1%)	128 (35.4%)	53 (28.6%)	<0.001
Early onset (≤12/13 years)	178 (32.5%)	122 (33.7%)	56 (30.3%)	<0.001

Among the 1538 participants who completed the Thoughts and Ideas About Suicide Questionnaire at least once during adolescence

*Among participants who reported suicidal ideation (ever)

Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2015), ©Gouvernement du Québec, Institut de la Statistique du Québec

Prevalence of adolescence suicidal distress

As shown in Tables 1 and 35.6% ($n=547$) of adolescents reported ever experiencing suicidal ideation and 5.6% ($n=86$) reported a suicide attempt. Among adolescents reporting suicidal ideation, 38.6% ($n=211$) reported recurrent ideation, 33.1% ($n=181$) reported serious ideation, and 32.5% ($n=178$) reported early-onset ideation. Across

Table 2 Early life characteristics of the included and excluded participants

Characteristics	Included ($N=1538$)	Excluded ($N=542$)	p
Sex assigned at birth			< 0.001
Male	735 (47.8%)	326 (59.9%)	
Female	803 (52.2%)	218 (40.1%)	
Race and ethnicity[a]			<0.001
White	1422 (92.6%)	454 (83.6%)	
Non-White	114 (7.4%)	89 (16.4%)	
Parental socio-economic status at participant age 5 months[b] M(SD)	0.07 (0.97)	−0.21 (1.05)	<0.001
Single parent household at participant age 5 months			0.010
Yes	110 (7.2%)	58 (10.8%)	
No	1426 (92.8%)	480 (89.2%)	
Maternal depression at participant age 5 months, Mean (SD)[c]			0.006
Yes	237 (15.5%)	112 (20.7%)	
No	1296 (84.5%)	429 (79.3%)	

Unweighted

[a]As per parental identification of the children to one of 12 categories

[b]Standardized index based on annual gross income, parental education level and occupational prestige [25]

[c]12-item version of The Center for Epidemiologic Studies – Depression (CES-D) questionnaire, with scores rescaled to range 0–10 [18]

Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2023), ©Gouvernement du Québec, Institut de la Statistique du Québec

all indicators of suicidal distress, females reported higher percentages than males; for example, 45.1% of females endorsed suicidal ideation compared with 25.2% of males (p <.001) (see Table 1).

Associations with adulthood mental health outcomes

Both indicators of suicidal distress in adolescence (age 13–17) — suicidal ideation, and suicide attempt—were associated with poorer self-reported and medical records of mental health outcomes in adulthood (age 18–25) (see Table S5). Among self-reported mental health, adjusted significant mean differences for suicidal ideation and attempt, respectively, were 0.54 (95% CI: 0.43–0.65) and 0.40 (95% CI: 0.18–0.63) standard deviations for anxiety symptoms, 0.65 (95% CI: 0.54–0.76) and 0.43 (95% CI: 0.19–0.68) for depressive symptoms, 0.22 (95% CI: 0.11–0.33) and 0.26 (95% CI: 0.01–0.51) for cannabis use, and −0.51 (95% CI: −0.62 – −0.41) and −0.38 (95% CI: −0.59 – −0.17) for life satisfaction, with no associations observed for binge drinking (see Fig. 1). Among medical records of mental health diagnoses, adjusted odd ratios (OR) for suicidal ideation and attempt, respectively, were 2.90 (95% CI: 2.20–3.81) and 1.79 (95% CI: 1.11–2.87) for common mental disorders, 2.59 (95% CI: 1.64–4.09) and 2.95 (95% CI: 1.46–5.95) for substance-related disorders, and 4.93 (95% CI: 2.77–8.78) and 4.70 (95% CI: 2.43–9.07) for suicide-related behaviors (see Fig. 2). Adolescent suicidal ideation and attempts were associated with higher odds of self-reported non-suicidal self-injury (OR = 3.62; 95% CI: 2.50–4.74 and OR = 3.81; 95% CI: 1.95–5.68), serious ideation (OR = 4.73; 95% CI: 3.23–6.24 and OR = 3.54; 95% CI: 1.80–5.27), and suicide attempts (OR = 6.41; 95% CI: 1.87–10.95 and trend association; OR = 3.96; 95% CI: 0.80–7.12) by age 25 (see Fig. 3).

Regarding suicidal ideation characteristics (see Table S6), recurrent ideation (> 1 age assessment vs. 1 age assessment) was associated with higher self-reported depressive and anxiety symptoms (ΔM = 0.33; 95% CI: 0.16–0.51 and ΔM = 0.19; 95% CI: 0.02–0.37), lower life satisfaction (ΔM=–0.19; 95%CI: −0.36 – −0.01), and higher odds of serious ideation (OR = 1.67; 95%CI: 1.02–2.33) (see Figure S1 and Figure S2). Serious ideation (vs. non-serious) was associated with persistence of serious ideation (OR = 2.15; 95%CI: 1.28–3.02), and trend towards significance for non-suicidal self-injury (OR = 1.60; 95%CI: 0.95–2.25) (see Figure S2). Early onset (age 13 or earlier vs. age 15 or 17) was associated with higher self-reported depressive symptoms only (ΔM = 0.19; 95%CI: 0.00–0.38) (see Figure S1).

Sex differences

Associations did not differ by sex for any outcomes except suicidal ideation and self-reported depressive symptoms, as well as life satisfaction (sex interaction terms, p <.05), for which mean differences were larger for males (depression symptoms; ΔM = 0.79; 95% CI: 0.61–0.97; life satisfaction; ΔM=−0.65; 95% CI: −0.83 – −0.46) than for females (depression symptoms; ΔM = 0.54; 95% CI: 0.41–0.67; life satisfaction; ΔM=−0.41; 95% CI: −0.54 – −0.28) (see Table S7, Figure S3 and Figure S4).

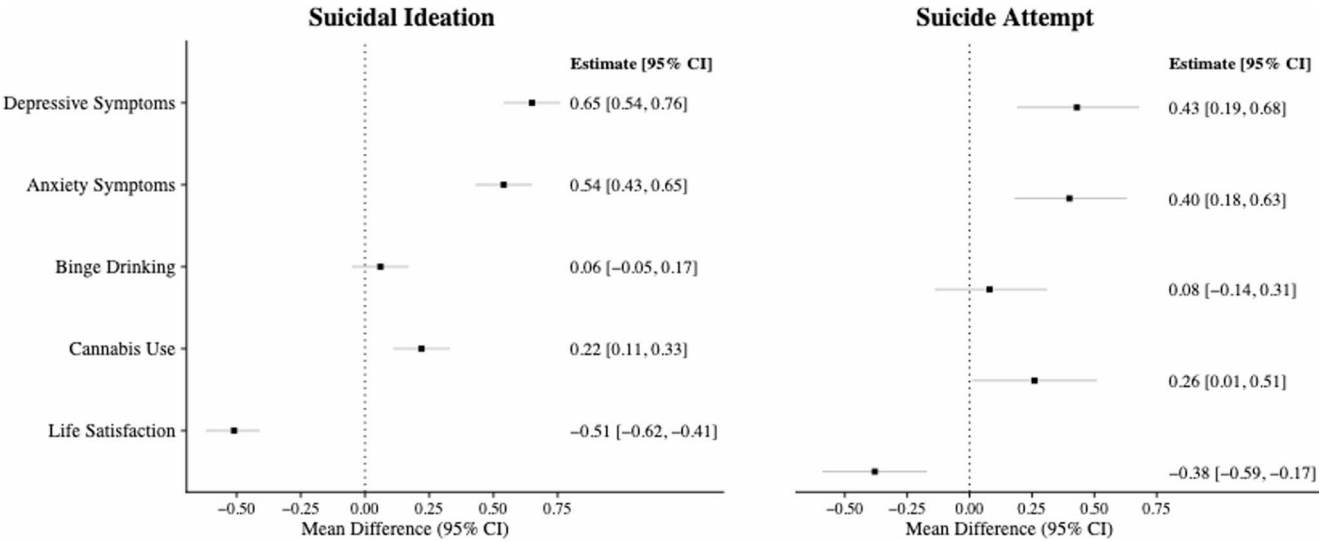


Fig. 1 Mean differences and 95% confidence intervals in self-reported mental health symptoms by age 25 according to suicidal distress indicators during adolescence (Ages 13–17; N = 1538). Note. Imputed; Weighted; adjusted for sex, race and ethnicity, parental socio-economic status Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2023), ©Gouvernement du Québec, Institut de la Statistique du Québec

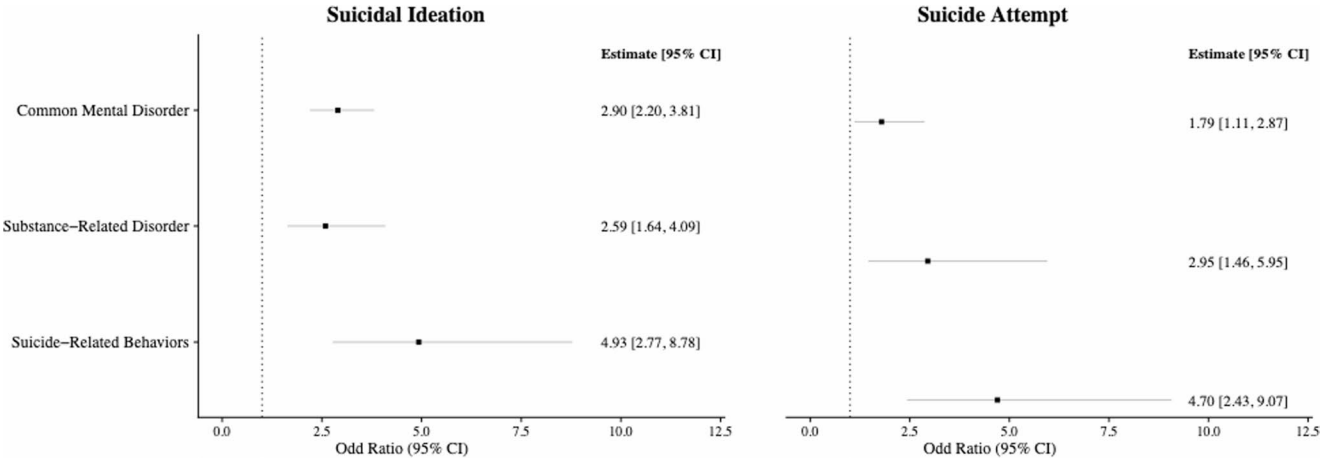


Fig. 2 Odds ratios and 95% confidence intervals for mental health diagnoses by age 25, according to suicidal distress indicators during adolescence (Ages 13–17; $N = 1538$). Note. Imputed; Weighted; adjusted for sex, race and ethnicity, parental socio-economic status Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2023), ©Gouvernement du Québec, Institut de la Statistique du Québec

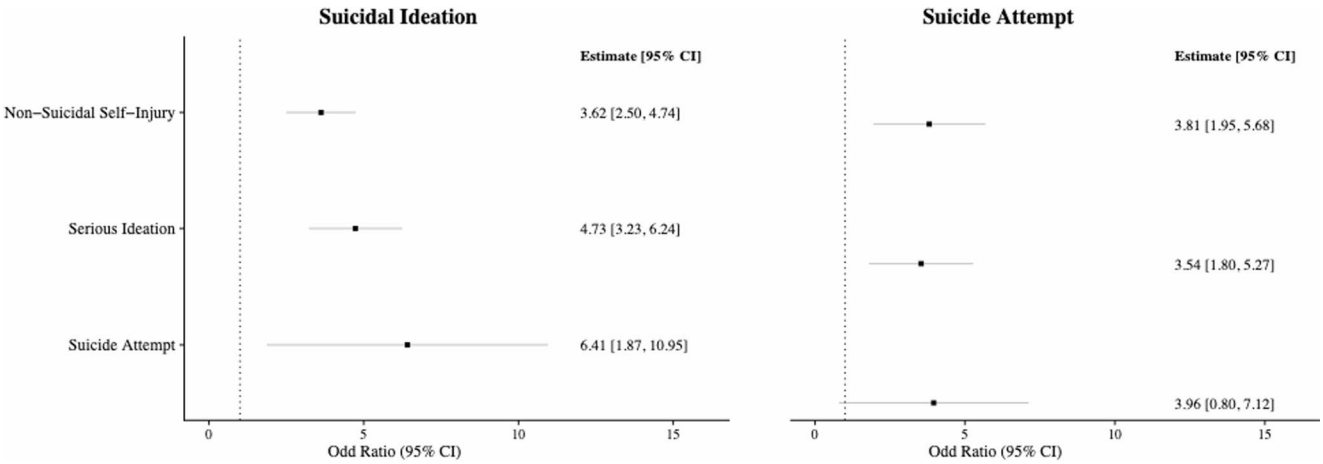


Fig. 3 Odds ratios and 95% confidence intervals for self-reported suicide-related behaviors by age 25, according to suicidal distress indicators during adolescence (Ages 13–17; $N = 1538$). Note. Imputed; Weighted; adjusted for sex, race and ethnicity, parental socio-economic status Data were compiled from the final master file of the Quebec Longitudinal Study of Child Development (1998–2023), ©Gouvernement du Québec, Institut de la Statistique du Québec

Discussion

While suicidal distress affects millions of young people worldwide [2], findings from this population-based longitudinal cohort of 1538 young Canadians suggest that those who reported suicidal ideation or attempts during adolescence (ages 13–17) were more likely to experience poor mental health, ranging from lower life satisfaction to functionally impairing diagnoses, for both males and females. Among adolescents with a history of suicidal ideation, those with recurrent and serious ideation were more likely to experience depression, anxiety, and poorer life satisfaction, and serious ideation in adulthood, respectively, whereas earlier versus later onset did not differentiate outcomes.

In our population-based cohort, suicidal distress was common: 35.6% of adolescents reported suicidal ideation and 5.6% had attempted suicide, with females consistently reporting higher rates than males (ideation: 45.1% vs. 25.2%; attempts: 8.2% vs. 2.7%). These figures align with global estimates from a systematic review showing 4–49% (point estimate: 20%) of youth report suicidal thoughts and 0–34% (point estimate: 7%) report attempts [2]. Substantial heterogeneity exists across included studies, likely reflecting differences in measurements [2]. Together, these estimates underscore that suicidal distress is a widespread and pressing global concern.

The high prevalence of adolescent suicidal distress underscores the importance of not minimizing it; as this longitudinal study suggests it is associated with a likelihood

of poorer mental health by age 25. Our findings align with those of Cantor and colleagues,[6] whose systematic review demonstrated enduring associations between adolescent suicidal ideation and later depression, anxiety, and suicide-related behaviors. Consistent with this evidence, we found that adolescents who reported suicidal ideation experienced poorer self-reported depressive and anxiety symptoms, higher odds of clinically diagnosed common mental disorders—including depressive, anxiety, and adjustment disorders—and markedly elevated odds of suicide-related behaviors, whether assessed through self-reports or medical records. In addition, lower life satisfaction in adulthood further underscores the long-term emotional burden associated with adolescent suicidal ideation.

Among adolescents who had suicidal ideation, certain characteristics further signaled poorer long-term outcomes: serious (vs. non-serious) ideation was associated with persistent serious ideation and showed a trend association with non-suicidal self-injury in adulthood, and recurrent (vs. non-recurrent) ideation was associated with more depressive and anxiety symptoms, and poorer life satisfaction. These findings suggest that features of adolescent suicidal ideation may help identify youth who may be especially vulnerable—other studies indeed suggest that serious ideation may potentially reflect greater lethality of distress [11], while recurrent ideation may indicate chronic vulnerability associated with enduring internalizing problems [30, 31].

In the review by Cantor and colleagues [7], findings for adulthood outcomes associated with adolescent suicide attempts were less consistent, except for adult suicide attempts. In contrast, we found that adolescent suicide attempt was associated with all indicators of suicide-related behaviors in adulthood—including clinically diagnosed and self-reported non-suicidal self-injury, serious ideation, and suicide attempt—along with nearly all adult mental health symptoms and diagnoses. One notable difference from Cantor and colleagues' review is that their pooled estimates for adolescent suicide attempt were derived from studies that adjusted for sex, and concurrent adolescent mental health problems (in addition to age) [7]. In our study, we adjusted for sex, race and ethnicity, and parental SES and did not adjust for adolescent mental health, given that nearly all adolescents experiencing suicidal distress also exhibit concurrent mental health symptoms [32]. Nevertheless, despite these methodological differences, our findings aligned, as associations were significant albeit slightly larger in the present study. This may reflect a dose–response relationship, whereby greater severity of suicidal distress is intertwined with more severe underlying concurrent and future mental health symptoms [30].

Cantor and colleagues[6] also identified two studies focused on adolescent suicidal ideation and two on suicide attempts—that examined later substance-related disorders. Findings were inconclusive, likely due to heterogeneity in assessment tools, follow-up duration, and definitions of substance use outcomes. In our study, both adolescent suicidal ideation and suicide attempts were associated with substance-related disorders identified in medical databases and with self-reported cannabis use, but not with binge drinking. As substance use may serve as a coping mechanism for adolescents experiencing suicidal distress, growing evidence suggests a reciprocal association, whereby distress leads to substance use, and substance use can, in turn, exacerbate distress [33].

Methodological considerations

First, despite the large sample size, prevalence of some indicators, such as suicide attempt in adolescence was low ($n=66$ [8.2%] for female and $n=20$ [2.7%] for male), limiting our capacity to detect significant sex interactions. Second, more than 25% of participants were lost to attrition potentially introducing bias due to the loss of the most vulnerable individuals over time [34]; however, survey weights were applied to minimize such bias. Third, suicidal distress indicators and suicidal ideation characteristics were assessed with a single item, which may lead to misclassification bias as single items lack the detail to capture the nuances of suicidal ideation and attempts, thus increasing the likelihood of statistical errors (with previous research revealing an 11% false positive rate and 10% false negative rate among those with suicidal ideation). [35] To minimize this bias, suicidal distress indicators and suicidal ideation characteristics were assessed repeatedly across adolescence and missing time points classified as no suicidal ideation/attempt. However, this approach is likely to underestimate the prevalence of suicidal distress and may have attenuated associations with adult outcomes. Fourth, mental health encompasses many domains, and we were unable to examine associations between adolescent suicidal distress indicators and other key adult mental health outcomes, such as personality disorders (e.g., borderline personality disorder), and trauma-related conditions (e.g., posttraumatic stress disorder). Fifth, both adolescent suicidal distress indicators and most adult outcomes were self-reported, which may have introduced shared method bias and inflated effect sizes. However, this concern was mitigated by including adulthood mental health diagnoses extracted from medical administrative databases. Sixth, administrative databases only capture individuals who sought healthcare offered by physicians covered by Quebec's provincial health insurance program, not including psychotherapy/counselling or private medical care, thus likely underestimating the true prevalence of mental health diagnoses. Seventh, suicidal distress may serve as a proxy for broader underlying vulnerability,

potentially reflecting unmeasured factors such as childhood maltreatment [36] and bullying [37]. Thus, observed associations should not be interpreted as causal. Lastly, the vast majority of participants identified as White (92.6%), and while this may reflect the demographic profile of Quebec in 1997–1998, associations found may not be generalizable to other ethnocultural groups, including indigenous communities who were excluded from the sample due to differences in institutional services and socio-cultural context.

Conclusion

Our descriptive study highlights that adolescent suicidal distress should not be minimized, as it is associated with poorer mental health in adulthood. Early prevention and treatment is therefore paramount. School-based interventions—such as youth mental health literacy—have been shown, in a large European randomized trial, to reduce suicidal ideation and attempts by half at 12 months follow-up [38]. Evidence also indicates that treatments such as indirect psychotherapies targeting co-occurring mental health problems can lessen suicidal ideation in adolescence [39], whereas dialectical behavior therapy is particularly effective for severe presentations of distress, improving self-harm and suicide attempts. [40, 41] Future observational studies should also examine protective factors, such as school connectedness [42] and peer/family support [43], to guide the development of novel prevention strategies.

Supplementary information The online version contains supplementary material available at https://doi.org/10.1007/s00787-026-03183-4.

Author contributions A.C., M.C.G., I.C., and B.D.T., contributed to the conceptualization of the manuscript. A.C., E.C., and M.C.G., contributed to methodology.E.C., aided with data curation.A.C., and E.C., conducted data analysis. E.C., and M.C.G., provided validation.M.C.G. aided with project administration, resources, and provided supervision. A.C. wrote the original manuscript text and prepared all figures and tables.All authors reviewed & edited the manuscript.

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Data availability The data analyzed in this study were obtained from the Institut de la statistique du Québec. Requests to access these data can be directed to the Institut de la statistique du Québec's Data Access Services ([Services for researchers - Home (https:/can01.safelinks.protection.outlook.com/?url=https%3 A%2F%2Fstatistique.quebec.ca%2Fen%2Fservices-recherche%2Frdahome&data=05%7C02%7Calessia.civita%40mail.mcgill.ca%7Cd46b754f01354416c02d08de4e2a65e6%7Ccd31967152e74a68afa9fcf8f89f09ea%7C0%7C0%7C639034141152460072%7CUnknown%7CTWFpbGZsb3d8eyJFbXB0eU1hcGkiOnRydWUsIlYiOiIwLjAuMDAwMCIsIlAiOiJXaW4zMiIsIkFOIjoiTWFpbCIsIldUIjoyfQ%3D%3D%7C0%7 C%7 C%7 C&sdata=sYipFlhdfxrdRgzrQt8Tv1QX787QD5CWqNLmxOOASsE%3D&reserved=0)). Data access requests must meet the required criteria to be approved.

Declarations

Role of funders The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

Ethical information Written informed consent or assent was obtained from participants and/or their parents at each wave of data collection. Ethical approval for the original QLSCD cohort was obtained from ISQ, the CHU Sainte-Justine Hospital, and the Montreal West Island Integrated University Health and Social Services Centre. Ethical approval for the present study was obtained from McGill University, Faculty of Medicine and Health Sciences Institutional Review Board (IRB) on April 30th, 2025 (eRAP Number: 25-03-026, IRB Assurance Number: FWA 00004545).

Competing interests The authors declare no competing interests.

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