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Trajectories of Suicide Attempts from Early Adolescence to Emerging Adulthood:

Prospective 11-year Follow-up of a Canadian Cohort

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Abstract

Background: Suicide is a leading cause of mortality in youth, yet the course of suicide attempts is poorly documented. We explored the vulnerable transition from adolescence to emerging adulthood to identify group trajectories and risk factors.

Methods: The National Longitudinal Survey of Children and Youth is a prospective representative cohort of Canadian children. We followed participants aged 7-11 years in 1994-95 to age 23 (2008-09). We modelled self-reported past-year suicide attempts (ages 12 to 23 years) using growth mixture models. We analyzed risk factors from self- and parent-report questionnaires at pre-adolescence (ages 10-11) and early adolescence (ages 12-13) using multinomial logistic regressions. Analyses were adjusted for sample nonresponse and attrition.

Results: In 2233 participants answering questions on teen and adult suicide attempts, we identified 3 trajectories: never attempted (96.0%), adolescence-limited (2.0%), and persisting into adulthood (2.0%). Girls, adolescents aged 12-13 with depression/anxiety symptoms, and with mothers experiencing depression had higher risks of adolescence limited than never-attempted (relative risk RR 9.27 (95% confidence interval: 1.7349.82); 2.03 (1.02-3.32), for each standard deviation increase; 1.07 (1.00-1.15); respectively). Preteen ADHD symptoms increased the risk of attempts persisting into adulthood as compared to never-attempted (RR 2.05 (1.29-3.28) for each standard deviation increase). Suicide death of schoolmate/acquaintance increased risks of an adulthood trajectory as compared to never-attempted and adolescence-limited (RR 8.41 (3.04-23.27) and 6.63 (1.29, 34.06), respectively).

Conclusion: In half the participants attempting suicide, attempts continued into adulthood. We stress the need for preventive strategies in early adolescence and differential clinical/educational interventions as identified for each trajectory.

Introduction

While adolescence is generally a period of good physical health, many young lives are lost prematurely to suicide (Hawton et al., 2012; Turecki & Brent, 2016). Suicide is one of the leading causes of mortality in young people worldwide, ranking second for ages 10-24 years and taking more lives than any one disease-related cause (Patton et al., 2009). While suicide is rare in childhood and early adolescence (Sheftall et al., 2016), there is a sharp increase in rates during mid-adolescence to young adulthood, especially in boys (Kõlves & De Leo, 2015; Malone et al., 2013; McLoughlin et al., 2015; Nock, Borges, Bromet, Cha, et al., 2008). Such a rapid increase suggests that the transition from adolescence to early adulthood is a period of heightened vulnerability to suicide.

Non-fatal suicide attempts are more common than deaths by suicide, with lifetime prevalence in youth rates around 4%-10.5% (Brezo et al., 2007; McLoughlin et al., 2015; Nock et al., 2013). Non-fatal suicide attempts are a risk factor for subsequent attempts and mortality (Bostwick et al., 2016; Ribeiro et al., 2016; Wang et al., 2019). Several longitudinal studies have reported that suicidal ideation and/or suicide attempts increase during adolescence, reach a peak in mid-adolescence, and decline by the end of adolescence and emerging adulthood, contrasting in pattern with the rise in actual suicide mortality observed during late adolescence/early adulthood (Dhossche et al., 2002; Lewinsohn et al., 2001; Nock, Borges, Bromet, Cha, et al., 2008; Rueter & Kwon, 2005; Steinhausen et al., 2006). While these studies inform on the overall prevalence of suicide attempts at the population level, they do not capture individual heterogeneity in the incidence and progression of suicide attempts over time. As far as we are aware, only one community-based study identified longitudinal developmental profiles of suicide attempts from mid-adolescence to young adulthood (Thompson & Swartout, 2018). The study identified two distinct trajectory profiles: an adolescence-limited profile

including youth with a high probability of suicide attempts in adolescence but not in adulthood (5%) and a persistent profile including youth with a high probability of suicide attempts lasting into young adulthood (1%). However, it is unclear which pre- and early-adolescent risk factors might predict trajectory. Clarifying whether these trajectories might be replicated in another population-based cohort and identifying independent markers in pre-and early adolescence could inform preventive intervention and help to better identify individuals at greater risk of suicide mortality.

Using a longitudinal representative sample, we aimed to: 1) identify trajectories of suicide attempts over an 11-year period spanning early adolescence (age 12) to emerging adulthood (age 23); and 2) identify pre- and early-adolescent risk factors at/before the onset of suicide attempts.

Methods

Participants

The National Longitudinal Survey of Children and Youth (NLSCY) is a prospective cohort of Canadian children followed from childhood to early adulthood. The first cycle started with children aged 0-11 years in 1994-95. The participants were followed every two years, including 8 cycles of data collection (Cycle 1 in 1994-95 to Cycle 8 in 2008-09). The cohort is considered nationally representative, with the exception of children living on First Nations reserves or Crown lands, in institutions, and in remote regions. Details about the cohort, including study design and response rates (above 80% for all cycles except cycle 8 in 2008-09) can be found online.

We studied participants age 7-11 in Cycle 1, with long-term follow-up to age 23 or Cycle 8, whichever came first. We excluded participants without an answer to the question on suicide attempts (yes or no) for at least two timepoints: once in adolescence (12-17 years) and once in

emerging adulthood (18-23 years). Cycles 2 to 8 were linked by age to obtain a dataset with information on suicide attempts from early adolescence at age 12 years to emerging adulthood at age 23 years.

The original Cycle 1 cohort included 8698 participants aged 7-11 years. Of these, we excluded 6465 from our study sample for lack of answers to the suicide attempts question. This left 2233 participants for analysis. As compared to the excluded group, analyzed participants were less likely to be male (46.5% vs. 52.9%; $X2 = 27.21$; $p < .001$); to have a mother who did not complete high school (13.4% vs. 18.2%; $X2 = 27.43$; $p < .001$); or to come from low-income families, as defined by Statistics Canada lowincome cut-offs (13.7% vs. 24.3%; $X2 = 111.38$; $p < .001$). We weighted all estimates to account for sampling design and non-response.

The NLSCY protocol was approved by Statistics Canada and the Social Sciences and Humanities Research Council of Canada. Written informed consent was obtained for all participants, from their mothers (or persons most knowledgeable) for child participants, and from the same participants as young adults.

Measures

Suicide attempts. Participants who had seriously considered suicide in the past 12 months were asked: “During the past 12 months, how many times did you attempt suicide?” The answer was coded as “Never” or “At least one attempt”.

Pre-and early adolescent risk factors. We selected a wide range of risk factors based on their association with suicide attempts in previous studies (Franklin et al., 2017; Mars et al., 2019a). These included sociodemographic factors, mental health symptoms, and adverse experiences (see Table 1).

Statistical analysis

Statistical analysis was a 4-step process. We first described the prevalence of suicide attempts from ages 12-23 years. Second, we used growth mixture modelling with the Mplus statistical modelling program (Muthén & Muthén, 2000) to identify distinct trajectories of suicide attempts. We estimated a series of models including 1-5 trajectory groups. We identified the best-fitting model using Bayesian information criteria, LoMendell-Rubin adjusted likelihood ratio tests (LMR-LRT), and entropy. Third, we conducted univariable logistic regressions adjusting for sex to determine associations between risk factors and trajectory. Fourth, we conducted multivariable multinomial logistic regressions to determine risk factors independently associated with trajectory. Risk factors with $p<.10$ in univariate analyses were selected for multivariable analyses. In all analyses, missing data were handled using the full information maximum likelihood method.

Results

Trajectories: Developmental course of suicide attempts

The percentage of adolescents who attempted suicide in the past year increased from 3.6% at ages 12-13 years to 5.6% at ages 14-15 years. These numbers decreased gradually during the transition to adulthood, with 1.0% of young adults reporting attempted suicide at ages 22-23 years (Figure 1).

Using the criteria described in the Methods section, we obtained a 3-group model as the best fit to represent distinct trajectories of suicide attempts from early adolescence to emerging adulthood (Figure 2). Most individuals (96.0%) had never attempted suicide, 2.0% had an adolescence-limited trajectory, and 2.0% had a trajectory of suicide attempts persisting into adulthood. In the adolescence-limited trajectory, the risk of attempted suicide peaked at ages 14-15 years, decreasing gradually to 0 by young adulthood. In the persisting into adulthood

trajectory, the risk of attempted suicide increased steadily during adolescence and remained high in the transition to adulthood. The age of participants in Cycle 1 (i.e. 7, 8, 9, 10 or 11 years) was not associated with trajectory profile ($p > .05$).

Univariable analysis of risk factors

Table 2 shows univariable associations between pre- and early adolescent risk factors and trajectory profile, adjusted for sex. Of all risk factors investigated, 10 were associated ($p < .10$) with adolescence-limited and/or suicide attempts persisting into adulthood, as compared to the never-attempted trajectory. Of note, participant mental health problems reported by the mother in pre-adolescence (ages 10-11 years), such as depression/anxiety, conduct disorders, attention deficit and hyperactivity/impulsivity (ADHD) symptoms, were associated with persisting suicide attempts, but not with adolescence-limited suicide attempts. Overall, the identified risk factors tended to be more strongly associated with a trajectory persisting into adulthood than with an adolescence-limited trajectory.

Multivariable analysis of risk factors

When sex and the 10 risk factors were entered simultaneously in a multivariable multinomial logistic regression model, females were about 10 times more likely than males (RR 9.27; 95% CI: 1.73-49.82) to be in the adolescence-limited trajectory than in the never-attempted trajectory (Table 3). However, no sex differences were observed between the persisting into adulthood profile and the never attempted profile. After adjustment for sex and other factors, participants who reported symptoms of depression and/or anxiety at ages 12-13 were more likely to be in the adolescence-limited trajectory than in the never attempted, with a 2.03-fold (95% CI: 1.02-3.32) higher risk for each standard deviation increase on the depression/anxiety symptoms scale. Adolescents whose mothers were depressed also had a slightly higher risk of being in the adolescence only trajectory than in the never attempted (RR

1.07; 95% CI: 1.00-1.15). The strongest observed association in the trajectory of suicide attempts persisting into adulthood was exposure to the suicide of a schoolmate or acquaintance (RR 8.41; 95% CI: 3.04-23.27; as compared to never attempted). Further, exposure to someone's suicide distinguished individuals in the adolescence-limited trajectory from those in the persisting trajectory (RR 6.63; 95% CI: 1.29, 34.06). Finally, pre-adolescents reported by their mothers as having ADHD symptoms at ages 10-11 were at greater risk of being in the trajectory of attempts persisting into adulthood than in the never attempted (RR 2.05; 95% CI: 1.293.28; for each standard deviation increase in ADHD symptoms).

Discussion

Using a population-based cohort of Canadian youth, our study captured the course of suicide attempts over an 11-year period from early adolescence to young adulthood, identifying various risk factors. We confirmed three trajectory profiles: never attempted, adolescence-limited suicide attempts, and suicide attempts persisting into adulthood. The 4% of individuals with attempted suicide at ages 12-23 years were about evenly split, with half reporting attempts persisting into adulthood. These were more likely to exhibit higher levels of ADHD symptoms in pre-adolescence and to have been exposed to someone else suicide. Individuals in the adolescence-limited profile were more likely to be female, to show high levels of depression/anxiety symptoms in early adolescence, and at age 10-11, to have a mother with depressive symptoms. Compared to retrospective or single-point studies, our prospective study revealed the heterogeneity of suicide profiles during this important transition from childhood to adulthood.

Interpretation of findings

As previously reported, we found the prevalence of suicide attempts to peak at mid-adolescence and then decrease gradually to adulthood, similarly to that of suicidal ideation

(Boeninger et al., 2010; Rueter & Kwon, 2005, Goldston et al., 2015; Kerr et al., 2008; Nkansah-Amankra, 2013; Nock, Borges, Bromet, Alonso, et al., 2008). Our results are also consistent with the number of emergency department visits for self-inflicted injuries at all ages of life, peaking at ages 15-19 years (Canner et al., 2018). Taken

.together, these findings suggest mid-adolescence to be a vulnerable period for suicide risk (Goldston et al., 2015; Kerr et al., 2008; Nkansah-Amankra, 2013; Nock, Borges, Bromet, Alonso, et al., 2008). It is noteworthy that adolescence is also a time of maturation of the developing brain; particularly, the prefrontal cortex is involved in impulse control/inhibition and risk-averse decision-making (Dahl, 2004; Mann, 2003). This may explain the higher likelihood of younger adolescents to attempt suicide as compared to older adolescents and young adults (Figure 1). Further, adolescence to emerging adulthood is associated with the onset of certain mental disorders (Kessler et al., 2007) which in turn may be associated with suicide attempts (Gili et al., 2018).

We identified three developmental trajectories in young people with attempted suicide, similarly to previous studies of suicidal ideation and/or suicide attempts (Adrian et al., 2016; Rueter et al., 2008; Thompson & Swartout, 2018). Our trajectories are consistent with those of Thompson & Swartout (2018), who used data from the U.S. National Longitudinal Study of Adolescent Health: a low-risk group (94%), an adolescence-limited group (5%), and a persistent group (1%) with about 50% probability of attempting suicide into adulthood (Thompson & Swartout, 2018). Our 2% adolescence-limited rate vs. Thompson's 5% may reflect methodological differences such as age of reporting (we included younger adolescents).

Our adolescence-limited trajectory group included more females than males, while both sexes were equally represented in the trajectory of suicide attempts persisting into adulthood. A recent review showed no sex differences in the prediction of repeated suicide attempts (Beghi

et al., 2013), while Thompson and Swartout's study found that females were more at risk in both (Thompson & Swartout, 2018).

We explored other risk factors as markers of trajectory. Depression/anxiety symptoms and maternal depression were more in keeping with an adolescent-limited profile than with a never-attempted profile. A recent meta-analysis of longitudinal studies also showed that depression indeed conferred a risk for later suicide attempts (Ribeiro et al., 2018). Depression/anxiety symptoms were not associated with the persisting into adulthood profile. Thompson & Swartout (2018) also found a stronger association of depressive symptoms in mid-adolescence (mean age 15 years) with the adolescentlimited trajectory than the persistently high trajectory. It is noteworthy that in our sample, depression/anxiety symptoms in early adolescence were predictive also of a suicide attempts trajectory extending into adulthood (Table 2); the association was no longer significant, however, when risk factors such as externalizing symptoms entered into the model. This is consistent with prior studies reporting that depressive/anxious mood during childhood was predictive for young adult suicidality only when combined with disruptive behaviours (Brezo et al., 2008). Interestingly, self-reported depression/anxiety symptoms at age 12-13 years, but not as reported by the mother at 1011 years, were predictive of an adolescent-limited trajectory vs. a never-attempted trajectory. While we were unable to distinguish between rater and timing effects, prior research indicates that parents tended to be unaware of psychological distress in their child (Jones et al., 2019) or that the onset of depressive symptoms along with the transition to high school might be particular distressing (Mesman & Koot, 2000).

After mental health symptoms such as depression/anxiety and conduct were taken into account, ADHD symptoms remained associated with a trajectory of suicide attempts persisting into adulthood. Prior studies including systematic reviews in both adults and adolescents

reported that mental health comorbidities largely explained the ADHD suicide attempts link (Balazs & Kereszteny, 2017; Conejero et al., 2019; Impey & Heun, 2012). Our results partly align with a population-based study of insurance claims showing stronger associations between ADHD diagnosis and repeated suicide attempts (hazard ratio 6.5), than for any attempts (hazard ratio 3.8), above and beyond comorbidities (Huang et al., 2018). To date, the nature of suicidal associations with ADHD is unclear. Our study did not include a clinical ADHD assessment. An earlier study showed that early childhood ADHD, with or without the inattention component, predicted later suicide attempts (Chronis-Tuscano et al., 2010), highlighting the role of impulsivity (Conejero et al., 2019). Other factors common to both ADHD and attempted suicide, such as irritability and emotional liability (Maire et al., 2020) and deficits in executive functioning (Keilp et al., 2013) should be investigated as potential mediators.

Of note, we found a strong association between exposure to someone's suicide and the trajectory of attempts persisting into adulthood, even after accounting for other factors. Individuals exposed to suicide have increased likelihoods of suicidal ideation and/or attempted suicide (Maple et al., 2017; Mars et al., 2019b; Swanson & Colman, 2013). This was confirmed by a prior study by Swanson and Colman (2013) based on the same cohort as ours, with stronger associations the younger the exposure. Our study extends these findings by showing that exposure to a schoolmate's or acquaintance's death by suicide is associated with a trajectory of suicide attempts persisting into adulthood more than with an adolescent-limited trajectory. We were unable to assess whether this association differed for exposure to suicide in family relatives vs. schoolmates, but Swanson and Colman (2013) reported that a classmate's suicide was a stronger predictor of outcome than suicide by someone else personally known by the adolescent.

In summary, our study suggests that suicide attempts in emerging adulthood are mostly made by individuals who had already attempted suicide in adolescence. This is especially relevant considering that: (1) a prior prospective study of adolescents after psychiatric hospitalization found that intent to die increased with number of attempts (Goldston et al., 2015); and (2) repeated suicide attempts were associated with greater risk of mortality (Hawton & Fagg, 1988). Our results highlight the need to recognize that in half the participants, suicide attempts did not stop at adolescence. We stress the importance of preventive strategies in early adolescence.

Strengths and limitations

This population-based cohort study has a number of strengths including its prospective design with repeated measures of suicide attempts over an 11-year period, enabling the identification of distinct trajectories of suicide attempts varying in onset and persistence over time. The National Longitudinal Survey of Children and Youth (NLSCY) constitutes a large, representative sample of Canadian children and teenagers moving forward into adulthood, ensuring dependability and generalizability of results. Further, NLSCY data include both self-reported and mother-reported assessments of key putative risk factors in pre- and early adolescence.

Nonetheless, there were certain limitations. First, despite the large sample size, the number of individuals who attempted suicide was low, limiting the statistical power to investigate further interactions between risk factors; e.g. risk of attempted suicide in girls with ADHD (Nigg, 2013). Second, suicide attempts in childhood or later adulthood were not documented, precluding a description over a lifetime. Third, as in all prospective cohorts, attrition may have entailed under-representation of the most vulnerable individuals; however, population weights were used to minimize such biases. Fourth, data were collected from 1994-

95 to 2008-09. We recognize that in the decade since 2008-09, the prevalence of suicide attempts in young people is increasing (Burstein et al., 2019) and new risk factors have arisen, such as social media (Chassiakos et al., 2016) and cyberbullying (Perret et al., 2020). While the internet and social media offer opportunities for learning and support (Frost & Casey, 2016), a recent systematic review of cross-sectional studies reported an association between heavy social media/internet use and increased suicide attempts (Sedgwick et al., 2019). Unfortunately, information on social media/internet use was not available in the cohort data. Fifth, our measure of exposure to someone else's suicide was limited to deaths by suicide; exposure to nonfatal suicide attempts was not assessed. A prior study showed an increased risk of attempted suicide after exposure to suicide attempts by a peer (Randall et al., 2015). Concerns have also been raised about the contagion effect through social media (Chassiakos et al., 2016), including suicide announcements and Facebook bereavement pages. Further research is needed to examine these questions. Sixth, we measured suicide attempts in individuals who are still alive. As approximately 60% of suicide fatalities occur at the first attempt (Bostwick et al., 2016), risk factors for fatal and non-fatal suicide attempts in young people may differ.

Implications

This study suggests that there is a group of youth that is likely to make repeated suicide attempts into adulthood, with different characteristics from those who attempted suicide in adolescence only. More specifically, risk factors for attempts persisting into adulthood include high ADHD symptoms and exposure to suicide. For other adolescents, especially girls, the risk of attempting suicide appears to be restricted to adolescence and to be exacerbated by depressive symptoms (either personal or maternal). Clinically and in school programs, these two groups of attempters may benefit from differential interventions. Future studies should investigate

whether and how these two profiles differ in terms of neurodevelopment, genetics, and functional outcome in adulthood.

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FIGURE LEGENDS

Figure 1. Proportion of past-year suicide attempts from early adolescence to emerging adulthood (N=2233). Bars represent 95% confidence intervals.
All estimates are weighted to adjust for sample non-response and attrition.

Figure 2. Three trajectories of attempted suicide from early adolescence to emerging adulthood (N = 2233).

Figure 2. Fit indices for modelling were the following: 1-trajectory model (Bayesian information criteria [BIC] = 2602.908; entropy, not applicable; Lo-Mendell-Rubin likelihood ratio test [LMR-LRT], not applicable); 2-trajectory model (BIC = 2431.152; entropy = 0.896; LMR-LRT, p = .0004); 3-trajectory model (BIC = 2425.258; entropy =
0.942; LMR-LRT, p = .230); 4-trajectory model (BIC = 2426.666; entropy = 0.972;
LMR-LRT, p not available); 5-trajectory model (BIC = 2440.824; entropy = 0.877; LMR-LRT, p not available). All estimates are weighted to adjust for sample non-response and attrition.

Table 1. Risk factors documented in NLSCY data

Risk factors	Participant's age in years at assessment	Informant	Description of measure used	Coding
Demographics				
Sex	Birth	Mother	Sex of child	Male or female
Maternal education level	10-11	Mother	1 item: "Highest level of education and schooling obtained"; answered by selecting from "Less than high school" to "Doctorate degree"	Dichotomized as having obtained a high school diploma or not
Family income	10-11	Mother	Low income cut-offs as defined each year by Statistics Canada: threshold below which a family is likely to spend a significantly higher proportion of its income to purchase necessities such as food, shelter and clothing than the average family; calculated based on family size and area of residence	Dichotomized as being above or below Statistics Canada low-income cut-off
Mother's age at childbirth	7-11	Mother	1 item: "Years of age at birth of child"	Age in years
Participant's mental health status				
Pre-adolescence				
Depression/anxiety symptoms	10-11	Mother	CBQ-7 items; e.g. "Your child seems to be unhappy or depressed"	Z-scores
ADHD symptoms	10-11	Mother	CBQ-9 items; e.g. "Your child can't sit still, is restless/hyperactive"	Z-scores
Conduct disorder symptoms	10-11	Mother	CBQ-10 items; e.g. "Your child gets into many fights"	Z-scores
Early adolescence				
Depression/anxiety symptoms	12-13	Self	CBQ-8 items; e.g. "I am unhappy, sad or depressed"	Z-scores
ADHD symptoms	12-13	Self	CBQ-8 items; e.g. "I can't sit still, am restless or hyperactive"	Z-scores
Conduct disorder symptoms	12-13	Self	CBQ-5 items; e.g. "I get into many fights"	Z-scores
Alcohol abuse	12-13	Self	1 item: "How often did you drink in the 12 months?" answered on a scale of 0 = "Do not drink alcohol" to 5 = "Every day"	Z-scores
Mother's mental health status				
Depressive symptoms	10-11	Mother	CES-D, 12 items in past week; e.g. "I felt depressed"	Z-scores

Psychological factors				
Self-esteem	12-13	Self	SDQ, 4 items; e.g. "A lot of things about me are good"	Z-scores
Adverse experiences				
Bullying in school	10-11	Self	2 items: "Bullied in school or on my way to/from school" answered as "Never", "Rarely", "Some", "Most" or "All of the time"	Dichotomized as No or Yes (≥ some of the time)
Exposure to suicide	12-13	Self	2 items: "Has anyone in your school committed suicide?" (schoolmate's suicide) and "Has anyone that you knew personally committed suicide?" (personally known suicide)	Dichotomized as No or Yes (within the last year, more than a year ago)
Number of life events	12-13	Mother	14 items; e.g. "Has your child ever experienced any event or situation that has caused him/her a great amount of worry or unhappiness: death of parents, death in family, divorce/separation?"	Dichotomized as No or Yes (≥ 1 event)

Note:
CBQ: Children's Behaviour Questionnaire (CBQ, Child and Parent form) is a validated scale incorporating items from the Child Behaviour Checklist (Achenbach et al., 1987), the Ontario Child Health Study (Offord et al., 1989), and the Preschool Behaviour Questionnaire (Tremblay et al., 1987). All items were rated on a 3-point scale (0 = "Never or not true"; 1 = "Sometimes or somewhat true"; 2 = "Often or very true").

CES-D: Center for Epidemiologic Studies Depression Scale (CES-D, self-report) assessed depressive symptoms in the general population (Radloff, 1977). All items were rated (0 = "Rarely or never"; 1 = "Some of the time"; 2 = "Occasionally", 3 = "Most of the time").

SDQ: Self-Description Questionnaire (SDQ, General self scale) assessed adolescents' self-perception, level of self-confidence and self-respect, and level of pride and satisfaction with themselves as individuals (Marsh et al., 1983). All items were on rated on a 5–point scale (0 = "False", 1 = "Mostly false", 2 = "Sometimes false/sometimes true", 3 = "Mostly true", 4 = "True").

ADHD, Attention-deficit/hyperactivity disorder.
NLSCY, National Longitudinal Survey of Children and Youth.

Table 2. Univariable associations between suicide attempts trajectory and pre- and early adolescence risk factors

	Suicide attempts trajectory, ages 12-23 years			Adjusted RR (95% CI)*					
	Never attempted (96.0%)	Adolescence-limited (2.0%)	Persisting into adulthood (2.0%)	Adolescence-limited vs. never attempted	P	Persisting into adulthood vs. never attempted	P	Persisting into adulthood vs. adolescence-limited	P
Demographics ***(assessed at participant age 7-11 years)***									
Maternal education level, not beyond high school – No. (%)	713 (33.5)	14 (32.3)	14 (30.7)	0.77 (0.18, 3.31)	.602	0.72 (0.24, 2.17)	.556	0.98 (0.20, 4.75)	.975
Low family income, as defined by Statistics Canada – No. (%)	339 (16.1)	10 (22.2)	12 (27.3)	2.11 (0.26, 17.28)	.160	2.56 (0.86, 7.66)	.092	1.07 (0.22, 5.36)	.932
Mother's age at childbirth – years, mean (SD)	28.16 (4.81)	27.05 (4.48)	28.14 (4.63)	0.87 (0.48, 1.60)	.602	1.00 (0.61, 1.64)	.999	1.13 (0.58, 2.20)	.716
Participant's mental health status									
(Maternal report at age 10-11 years)									
Depression/anxiety symptoms, Z-score, mean (SD)	-0.01 (0.99)	0.17 (1.15)	0.40 (1.08)	1.16 (0.78, 1.74)	.233	1.48 (1.08, 2.04)	.016	1.23 (0.82, 1.85)	.320
ADHD symptoms, Z-score, mean (SD)	-0.01 (0.99)	0.13 (0.91)	0.69 (1.12)	1.06 (0.64, 1.77)	.356	2.20 (1.52, 3.20)	.000	1.83 (1.08, 3.09)	.025
Conduct symptoms, Z-score, mean (SD)	-0.01 (0.99)	0.25 (1.20)	0.52 (1.23)	1.44 (0.71, 2.94)	.247	1.52 (1.18, 1.95)	.001	1.13 (0.66, 1.94)	.663
(Adolescent report at age 12-13 years)									
Depression/anxiety symptoms, Z-score, mean (SD)	-0.01 (1.00)	0.19 (0.82)	0.48(1.09)	1.81 (1.10, 2.99)	.019	1.66 (1.19, 2.32)	.003	0.92 (0.5, 1.64)	.766
ADHD symptoms, Z-score, mean (SD)	-0.01 (0.99)	0.02 (0.87)	0.88 (1.12)	1.25 (0.60, 2.28)	.476	1.45 (0.87, 2.42)	.160	1.16 (0.53, 2.54)	.710
Conduct symptoms, Z-score, mean (SD)	-0.01 (1.00)	0.15 (1.05)	0.49 (1.08)	1.40 (1.02, 1.93)	.036	1.43 (1.05, 1.95)	.023	1.02 (0.67, 1.56)	.926
Alcohol use, Z-score, mean (SD)	0.00 (1.00)	0.35 (1.20)	-0.01 (0.85)	1.27 (0.87, 1.86)	.220	0.94 (0.58, 1.52)	.799	0.74 (0.40, 1.36)	.333
Mother's mental health status at participant age 10-11 years									

Depression symptoms, Z-score, mean (SD)	-0.01 (0.99)	0.79 (1.71)	-0.02 (0.71)	1.47 (0.94, 2.28)	.089	0.94 (0.52, 1.72)	.848	0.64 (0.31, 1.33)	.235
Psychological factors at age 12-13 years									
Self-esteem, Z-score, mean (SD)	0.01 (0.99)	-0.40 (1.11)	-0.28 (1.37)	0.76 (0.58, 1.00)	.051	0.78 (0.45, 1.36)	.380	1.02 (0.56, 1.87)	.938
Adverse experiences									
Bullying in school at age 10-11 years – No. (%)	652 (34.3)	16 (38.5)	21 (49.0)	1.14 (0.40, 3.23)	.811	2.53 (0.93,6.93)	.071	2.23 (0.53, 9.33)	.273
Exposed to someone's suicide at age 12-13 years – No. (%)	312 (16.7)	20 (47.7)	20 (47.7)	1.45 (0.43, 4.85)	.545	7.28 (2.75, 19.31)	< .000	5.02 (1.09, 23.18)	.039
Life events at age 12-13 years (maternal report) – No. (%)	780 (38.0)	19 (42.0)	19 (42.0)	1.83 (0.67, 5.02)	.242	1.33 (0.49, 3.65)	.575	0.73 (0.18, 3.00)	.662

N = 2233 participants; All analyses are weighted to adjust for sample non-response and attrition.

RR, risk ratio; CI, confidence interval; No., number; SD, standard deviation.

ADHD, attention-deficit/hyperactivity disorder.

*Adjusted for sex.

Descriptive statistics for risk factors are weighted by trajectory posterior probabilities.

Unadjusted estimates for sex were not available, because a cell was based on fewer than 5 participants.

Table 3. Multivariable analysis of pre- and early adolescence risk factors and suicide attempts trajectory

	Adjusted RR (95% CI)*		
	Adolescence-limited vs. never attempted	Persisting into adulthood vs. never attempted	Persisting into adulthood vs. adolescence-limited
Female	**9.27 (1.73, 49.82)**	2.50 (0.74, 8.43)	0.27 (0.03, 2.17)
Maternal education – none beyond high school, at participant age 10-11 years	0.61 (0.18, 2.03)	0.65 (0.21, 1.96)	1.06 (0.21, 5.27)
Depression/anxiety symptoms at 10-11 years	0.86 (0.50, 1.49)	1.05 (0.66, 1.65)	1.21 (0.61, 2.41)
Conduct symptoms at 10-11 years	1.15 (0.70, 1.88)	1.10 (0.60, 4.23)	0.96 (0.45, 2.06)
ADHD symptoms at 10-11 years	1.09 (0.64, 1.84)	**2.05 (1.29, 3.28)**	1.89 (0.95, 3.74)
Depression/anxiety symptoms at 12-13 years	**2.03 (1.02, 3.32)**	1.21 (0.73, 2.01)	0.66 (0.31, 1.40)
Conduct symptoms at 12-13 years	1.16 (0.79, 1.71)	1.03 (0.67, 1.58)	0.88 (0.50, 1.55)
ADHD symptoms at 12-13 years	0.75 (0.38, 1.51)	1.27 (0.62, 2.58)	1.68 (0.64, 4.45)
Maternal depression symptoms at participant age 10-11 years	**1.07 (1.00, 1.15)**	0.96 (0.85, 1.09)	0.90 (0.78, 1.03)
Poor self-esteem at 12-13 years	0.90 (0.64, 1.27)	1.00 (0.51, 1.97)	1.12 (0.54, 2.34)
Bullying in school at 10-11 years	0.94 (0.31, 2.49)	1.60 (0.61, 4.23)	1.71 (0.40, 7.29)
Exposed to someone's suicide at 12-13 years	1.27 (0.34, 4.74)	**8.41 (3.04, 23.27)**	**6.63 (1.29, 34.06)**

N = 2233 participants. All analyses are weighted to adjust for sample non-response and attrition.
RR, risk ratio; CI, confidence interval.

ADHD, attention-deficit/hyperactivity disorder.

*Fully adjusted for multivariable analysis.

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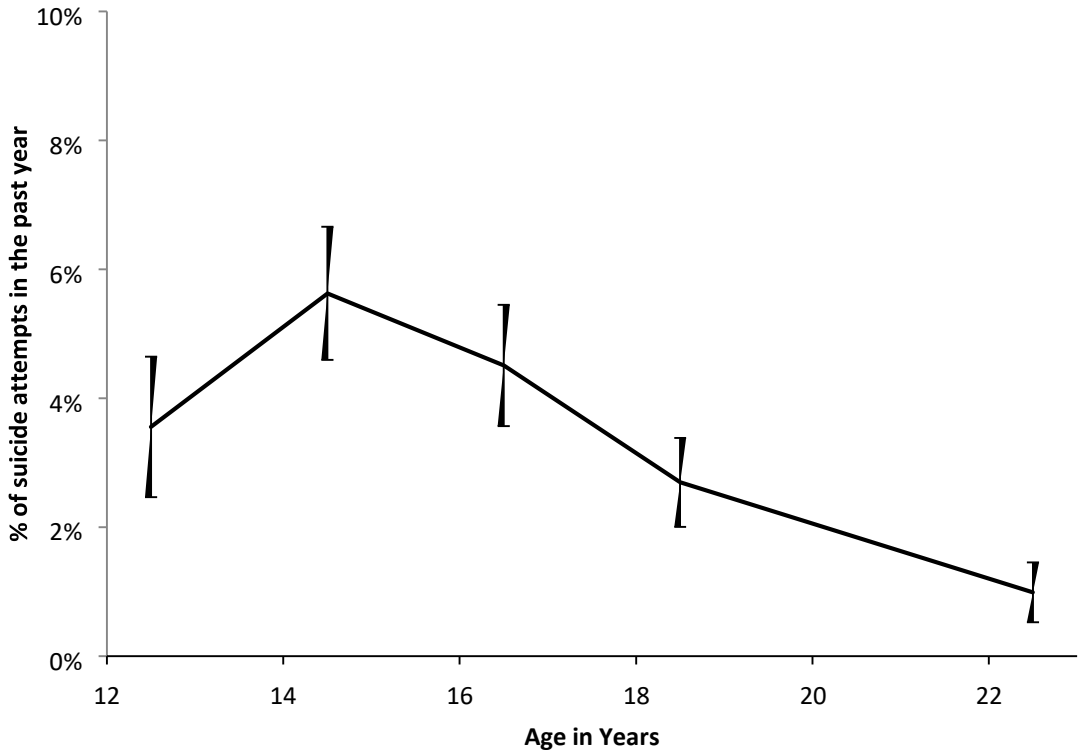
Figure 1. Proportion of past-year suicide attempts from early adolescence to emerging adulthood (N = 2233). Bars represent 95% confidence intervals.



All estimates are weighted to adjust for sample non-response and attrition.

Figure 2. Three trajectories of attempted suicide from early adolescence to emerging adulthood (N = 2233).

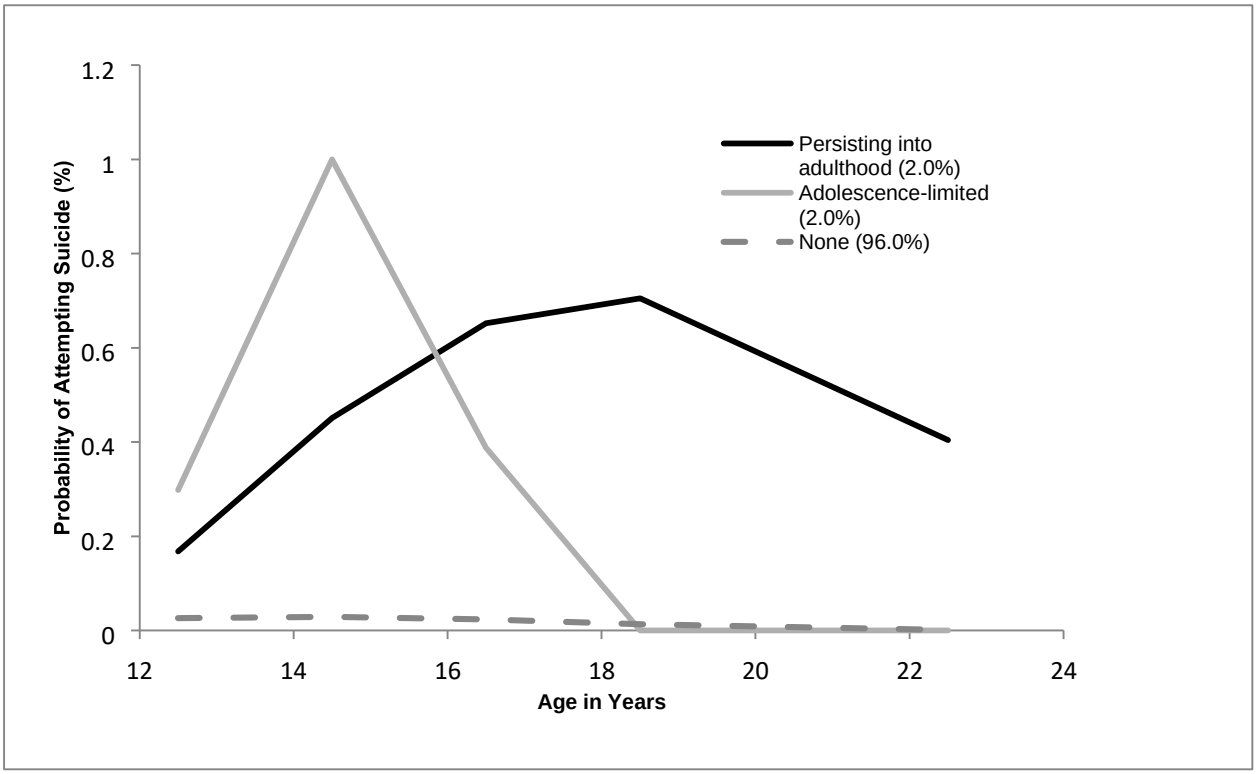


Figure 2. Fit indices for modelling were the following: 1-trajectory model (Bayesian information criteria [BIC] = 2602.908; entropy, not applicable; Lo-Mendell-Rubin likelihood ratio test [LMR-LRT], not applicable); 2-trajectory model (BIC = 2431.152; entropy = 0.896;
LMR-LRT, p = .0004); 3-trajectory model (BIC = 2425.258; entropy = 0.942; LMR-LRT, p = .230); 4-trajectory model (BIC = 2426.666; entropy = 0.972; LMR-LRT, p not available); 5-trajectory model (BIC = 2440.824; entropy = 0.877; LMR-LRT, p not available). All estimates are weighted to adjust for sample non-response and attrition.

Appendix Mental Health Questionnaires

Self-reports (age 12-13 years)

Depressive/anxiety symptoms – Children's Behavior Questionnaire (CBQ) (8 items)

Responses: Never or not true, Sometimes or somewhat true, Often or very true

1. I am unhappy, sad or depressed
2. I am not as happy as other people my age
3. I am too fearful or anxious
4. I am worried
5. I cry a lot
6. I feel miserable, unhappy, tearful, or distressed
7. I am nervous, high-strung or tense
8. I have trouble enjoying myself

Attention deficit hyperactivity disorder (ADHD) symptoms – CBQ (8 items)

Responses: Never or not true, Sometimes or somewhat true, Often or very true

1. I can't sit still, am restless or hyperactive
2. I am distractible, have trouble sticking to any activity
3. I fidget
4. I can't concentrate, can't pay attention
5. I am impulsive, act without thinking
6. I have difficulty awaiting my turn in games or groups
7. I cannot settle to anything for more than a few moments
8. I am inattentive, have difficulty paying attention to someone

Conduct disorder symptoms – CBQ (5 items)

Responses: Never or not true, Sometimes or somewhat true, Often or very true

1. I get into many fights
2. I assume, when another kid accidentally hurts me (such as bumping into me), that the other kid meant to do it, and then react with anger and fighting
3. I physically attack people, I threaten people
4. I am cruel, bully, or am mean to others
5. I kick, bite, hit other people my age

Psychological factors

Self-esteem – Self Description Questionnaire (SDQ) *(4 items)*

Responses: False, Mostly false, Sometimes false/sometimes true, Mostly true, True

1. In general, I like the way I am
2. Overall, I have a lot to be proud of
3. A lot of things about me are good
4. When I do something, I do it well

Mother's reports (for participants age 10-11 years)

Depressive/anxiety symptoms – CBQ (7 items)

Responses: Never or not true, Sometimes or somewhat true, Often or very true

How often would you say that your child:

1. Seems to be unhappy
2. Is not as happy as other children
3. Is too fearful or anxious
4. Is worried
5. Cries a lot
6. Is nervous, high-strung or tense
7. Has trouble enjoying himself

ADHD symptoms – CBQ (9 items)

Responses: Never or not true, Sometimes or somewhat true, Often or very true

1. Can't sit still, is restless/hyperactive
2. Has trouble sticking to any activity
3. Fidgets
4. Can't concentrate, can't pay attention for long
5. Is impulsive, acts without thinking
6. Difficulty awaiting turn in games/groups
7. Gives up easily
8. Stares into space
9. Is inattentive

Conduct disorder symptoms – CBQ (10 items)

Responses: Never or not true, Sometimes or somewhat true, Often or very true

1. Destroys his/her own things
2. Steals at home
3. Gets into many fights
4. Is disobedient at school
5. Tells lies or cheats
6. Physically attacks people
7. Vandalizes
8. Threatens people
9. Is cruel, bullies or is mean to others
10. Steal outside the home

Mother's mental health status

Depressive symptoms – Center for Epidemiologic Studies Depression Scale (CES-D) (12 items)

Responses: Rarely or none of the time (less than 1 day), Some or a little of the time (1-2 days), Occasionally or a moderate amount of time (3-4 days), Most or all of the time (5-7 days)

How often have you felt or behaved this way during the past week:

1. I did not feel like eating; my appetite was poor
2. I felt that I could not shake off the blues even with help from my family or friends
3. I had trouble keeping my mind on what I was doing
4. I felt depressed
5. I felt that everything I did was an effort
6. I felt hopeful about the future
7. My sleep was restless
8. I was happy
9. I felt lonely
10. I enjoyed life
11. I had crying spells
12. I felt that people disliked me