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## **Mental Health Problems and Risk of Suicidal Ideation and Attempts in Adolescents**

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**Abbreviations.** ADHD, Attention-Deficit/Hyperactivity Disorder; MHPs, Mental Health Problems; QLSCD, Québec Longitudinal Study of Child Development; RRR, Risk Rate Ratio; SD, Standard deviation.

**Table of Contents Summary.** In this contemporary sample, we report the prevalence of suicide-related outcomes and associations with mental health problems from age 13 to 20 years.

**What's Known on This Subject.** Suicide-related outcomes are associated with a range of Mental Health Problems (MHPs) in adolescence, but the importance of different internalizing and externalizing MHPs may vary across adolescence and for different suicide-related outcomes (passive ideation, serious ideation, suicide attempt).

**What This Study Adds.** Suicide-related outcomes are common in adolescence, with stable rates of suicide attempt and increasing rates of suicidal ideation. Internalizing MHPs are independently associated with suicidal ideation (passive and serious), while externalizing and internalizing MHPs are independently associated with suicide attempt.

## **Contributors' Statement Page**

Drs Orri and Geoffroy conceptualized and designed the study, carried out the analyses, drafted the initial manuscript, reviewed and revised the manuscript, had full access to the data used in this study, and take responsibility for the integrity and accuracy of the data analysis.

Perret, Scardera, Bolanis and Dr Temcheff participated in the analysis and interpretation of data, drafted the initial manuscript, and reviewed and revised the manuscript for important intellectual content.

Drs Boivin, Tremblay, Côté, Séguin and Turecki designed the data collection instruments, obtained funding, coordinated and supervised data collection, contributed to data analysis and interpretation and reviewed and revised the manuscript for important intellectual content.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

## Abstract

**Background:** Obtaining recent estimates of the prevalence of suicide-related outcomes across adolescence, and its associated mental health problems (MHPs) is important for clinical practice. We estimated prevalence of suicide-related outcomes at ages 13, 15, 17 and 20y (2011-2018) in a contemporary population-based cohort and documented associations with MHPs throughout adolescence.

**Methods:** Data were from 1618 participants from the Quebec Longitudinal Study of Child Development. Internalizing (depression, anxiety) and externalizing (oppositional/defiance, conduct, attention deficit and/or hyperactivity) MHPs were assessed with validated questionnaires. Outcomes were self-reported passive and serious suicidal ideation, and suicide attempt.

**Results:** Lifetime prevalence for passive suicidal ideation (13-17y), serious suicidal ideation, and suicide attempt (13-20y) were 21.7%, 11.9%, and 6.7%, respectively. Prevalence was twice as high for females than for males. Overall, rates of passive (15y-to-17y, 11.80%-18.40) and serious ideation (13y-to-20y, 3.30%-9.50%) increased over time, but were stable for attempt (13y-to-20y, 3.50%-3.80%). In univariable analyses, all MHPs were associated with suicide-related outcomes at all ages (Risk Rate Ratios range: 2.57-3.10 for passive ideation to 2.10-4.36 for suicide attempt), and associations were similar for males and females (sex-interaction  $P_s > .05$ ). Magnitude of associations were generally stronger for more severe suicide-related outcomes (passive ideation < serious ideation < attempt). In multivariable analyses, internalizing problems were associated with suicidal ideation, while both depressive and conduct symptoms were associated with attempt.

**Conclusion:** Suicidal ideation and attempt were common, especially for females and youth presenting depressive and conduct problem symptoms. Clinicians should systematically assess suicidal risk in teens, especially in those presenting MHPs.

## Introduction

Suicide in adolescence is a leading public health concern worldwide, with approximately 140 000 youth aged 10-24 years who die by suicide every year.<sup>1,2</sup> In many countries, including Canada, suicide is the second most common cause of death in this age-group.<sup>1,3</sup> In addition to the thousands of youth who have died by suicide, many more have thought about suicide either passively or actively and/or have attempted suicide. In the U.S. National Co-morbidity Survey, 12.1% of adolescents reported serious thoughts of suicide, 4% developed a suicidal plan and 4.1% attempted suicide before reaching adulthood.<sup>4</sup>

Prior studies tracking the course of suicidal ideation and/or suicide attempt longitudinally reported that these suicide-related outcomes increase during adolescence, peak in mid-adolescence and decline during the transition into adulthood.<sup>5-8</sup> However, these studies were based on non-contemporary cohorts of youth, limiting the generalization of findings for today's adolescents. Documenting the course of suicidal ideation and suicide attempt in a population-based cohort of today's youth is important, especially in light of recent studies showing an increase in emergency visits for suicide attempt in recent years,<sup>9-11</sup> including in the Canadian province of Québec.<sup>12</sup>

Suicidal ideation and attempt are closely associated with mental health problems (MHPs),<sup>4,13,14</sup> with the vast majority of adolescents with suicidal ideation/suicide attempt meeting criteria for at least one MHP. Both internalizing (e.g., depression and anxiety) and externalizing (e.g., ADHD, oppositional defiant disorder, conduct disorder) problems have been associated with suicidal ideation/suicide attempt,<sup>15</sup> and the magnitude of associations tend to be stronger with increasing severity (e.g., stronger associations seen for attempt compared to ideation).<sup>4,14</sup> However, it is still unclear whether patterns of concurrent associations between MHPs and suicide-related outcomes

vary across age. Only few studies have documented associations between MHPs and suicide-related outcomes in different age groups.<sup>16-20</sup> Most studies were published before 2000; relied on cross-sectional designs and convenience samples; focused on suicide mortality (i.e., only one study examined MHPs correlates with suicide-related outcomes other than mortality<sup>20</sup>); used heterogeneous categorizations of younger vs older adolescents (e.g., <11 vs 11-14 years in one study,<sup>19</sup> <17 vs ≥17 in another study<sup>18</sup>), thus preventing comparisons across studies. These limitations suggest that longitudinal investigations among contemporary adolescents assessed at multiple time points would be helpful to clarify associations between MHPs and suicide-related outcomes.

Using a birth-cohort of individuals born in 1997-98 in the Canadian province of Québec, our first aim was to document the prevalence of suicidal ideation (passive/serious) and suicide attempt from early (age 13) to late (age 20) adolescence. The second aim was to describe MHP correlates of these suicide-related outcomes across different ages.

## **Methods**

### **Participants**

The Québec Longitudinal Study of Child Development (QLSCD) is an ongoing population-based study of a cohort of individuals born in 1997/98 in the Canadian province of Québec and followed until 20 years of age. The study is conducted by the Institut de la statistique du Québec. The Québec Master Birth Registry was used to select a representative sample of infants. The target population was singleton infants who were 59 or 60 weeks of gestational age, born to mothers residing in each geographic area of Québec, with the exception of Northern Québec, Cree Territory, Inuit Territory and Native reserves (2.2% of all births); because children from those remote regions were mostly out-of-reach. At its inception, 2120 families participated in

the first assessment, representing 94.5% of the target population. This cohort has had annual and bi-annual follow-ups from 5 months until 20 years of age. More details about the study design can be found online (<http://www.iamillbe.stat.gouv.qc.ca>).

In the present study, we included 1618 participants for whom measures of suicidal ideation/suicide attempt were available at either age 13, 15, 17 or 20 years (76% of the original cohort).

The Ethics Committee of the Institut de la Statistique du Québec and the Research Ethics Board of the Sainte-Justine Research Center approved each phase of the study, and informed consent was obtained at every time point from the participating adolescents and their parents.

## **Measures**

### ***Self-reported suicide-related outcomes (13, 15, 17, 20 years)***

Self-reported past-year passive suicidal ideation, serious suicidal ideation and suicide attempt were collected at 13, 15, 17 and 20 years of age. The three items that were used were: (1) “did you ever think about suicide?” (never to very often; this item was not available at 20y); if yes, they were asked (2) “did you ever seriously think of attempting suicide?” (yes/no); if yes, they were asked (3) “how many times did you attempt suicide?” Three suicide-related outcomes were derived based on participants’ responses: (a) passive suicidal ideation if they reported suicidal ideation, with no serious ideation or suicide attempt; available at 13, 15 and 17y only; (b) serious suicidal ideation if they reported serious ideation, with no attempt and (c) suicide attempt.

### ***Mental health problems (13, 15, 17, 20 years)***

Information on symptoms related to five MHPs were identified from validated and standardized self-report questionnaires: depression, anxiety, oppositional/defiance, conduct and attention deficit and/or hyperactivity problems. All measures, described in **Table 1**, were age-appropriate



and showed very satisfactory psychometric proprieties. Correlations among these measures are reported in supplementary table 1.

### **Statistical Analyses**

First, we described the prevalence of suicide-related outcomes (i.e., passive ideation, serious ideation, attempt) from ages 13 to 20 years in the whole sample and separately for males and females. Lifetime estimates were also calculated. Second, multinomial logistic regressions were used to identify univariable associations between each MHP and suicide-related outcomes across ages. Third, multivariable analyses were conducted entering all MHPs in a multinomial logistic regression model to estimate the independent contribution of each MHP to suicide-related outcomes across ages. All models were adjusted for sex. Interactions between MHPs and sex were tested, but none reached statistical significance ( $P > .05$ ). In these regressions, associations were expressed as Risk Rate Ratio (RRR), representing the increased risk of suicide-related outcomes for each standard deviation (SD) increase on the continuous MHPs indicators.

The maximum available sample size for each age was as follows:  $n=1225$  at 13 years;  $n=1428$  at 15 years,  $n=1228$  at 17 years and  $n=1235$  at 20 years. Missing data for participants included in the study sample ( $N=1618$ ) were imputed using multiple imputation by chained equations.<sup>21</sup>

Imputation models included all modelled variables plus key variables such as sex, maternal depressive symptoms, parental socioeconomic status, family structure, family functioning, peer victimization and childhood mental health symptoms (i.e., depression/anxiety, opposition, ADHD). All models were estimated across 50 imputed datasets and the results were pooled.

In addition, to account for baseline differences between participants included ( $N=1618$ ) in analyses and non-included ( $n=502$ ), we conducted analyses with inverse probability weights.

Weights represent participants' probabilities of being included in the study sample ( $N=1618$ )

conditional on variables related to differential attrition. These variables were the following: male sex (47.8% in included sample versus 61.1% in nonincluded sample,;  $p < .001$ ), family socioeconomic status, ( $M_{\text{included}} = -.01$  versus  $M_{\text{nonincluded}} = -.29$ ;  $p < .001$ ) and hostile-reactive parenting practices ( $M_{\text{included}} = 1.84$  versus  $M_{\text{nonincluded}} = 2.16$ ;  $p < .001$ ).

## **Results**

### *Lifetime estimates of self-reported suicide-related outcomes*

Lifetime estimates for passive suicidal ideation (13 to 17 years), serious suicidal ideation, and suicide attempt (both 13 to 20 years) were 21.7%, 11.9%, and 6.7%, respectively. Prevalence of all suicide-related outcomes were almost twice as high for females than for males: prevalence for passive suicidal ideation, serious suicidal ideation, and suicide attempt were 28.1%, 13.9%, 9.2% for females, and 14.7%, 9.7%, 4.0% for males.

### *Prevalence of self-reported suicide-related outcomes at 13, 15, 17 and 20 years*

In the whole sample, prevalence for passive suicidal ideation increased throughout adolescence (11.8%, 18.3%, 18.4%; 13, 15, 17 years, respectively). The prevalence for serious suicidal ideation also increased throughout adolescence (3.3%, 3.9%, 5.8%, 9.5%; 13, 15, 17, 20 years, respectively). However, the prevalence of suicide attempt was approximately 4% during this developmental period (3.7%, 3.5%, 3.8%, 3.5%; 13, 15, 17, 20 years, respectively) (**Figure 1**). Although the prevalence of self-reported suicide-related outcomes was generally higher in females than in males, the temporal trend was similar in males and females.

*Univariable associations between MHPs and self-reported suicide-related outcomes at age 13 years*

Results of all univariable analyses are shown in **Table 2**. At age 13, depressive symptoms was the MHP most strongly associated with all suicide-related outcomes, with RRRs (for each SD increase on the continuous MHPs indicators) for passive suicidal ideation, serious suicidal ideation and suicide attempt of 2.57 (2.15-3.07), 2.99 (2.25-3.99), and 2.93 (2.21-3.89), respectively. The association between suicide-related outcomes and anxiety was statistically significant but weaker in magnitude, with RRRs of 1.58 (1.35-1.85) for passive suicidal ideation, 1.65 (1.22-2.24) for serious suicidal ideation, and 1.80 (1.33-2.43) for suicide attempt. Among externalizing MHPs, RRRs were higher for suicide attempt than passive and serious suicidal ideation. Specifically, RRRs ranged from 1.66 (1.38-2.00 for ADHD symptoms) to 1.80 (1.50-2.15 for conduct problem symptoms) for passive suicidal ideation and from 1.85 (1.32-2.58 for oppositional/defiant symptoms) to 2.02 (1.54-2.65 for conduct problem symptoms) for serious suicidal ideation; for suicide attempt, RRRs ranged from 2.40 (1.75-3.28 for ADHD symptoms) to 2.85 (2.24-3.63 for conduct problem symptoms).

*Univariable association between MHPs and self-reported suicide-related outcomes at age 15 years*

At age 15, depressive symptoms were still the MHP most strongly associated with all suicide-related outcomes, with RRRs for passive suicidal ideation, serious suicidal ideation and suicide attempt of 3.10 (2.58-3.71), 4.68 (3.21-6.82) and 4.36 (3.00-6.33), respectively. Associations were significant for anxiety symptoms, although RRRs were smaller: 2.38 (2.01-2.81) for passive suicidal ideation, 2.90 (2.05-4.10) for serious suicidal ideation, and 3.16 (2.16-4.62) for suicide attempt. Associations between externalizing MHPs and suicide-related outcomes were

smaller in magnitude and similar across suicide-related outcomes compared to those for internalizing MHPs. RRRs ranged from 1.58 (1.38-1.82) for the association of oppositional/defiant symptoms with passive suicidal ideation to 2.15 (1.58-2.93) for the association of ADHD symptoms with suicide attempt.

*Univariable associations between MHPs and self-reported suicide-related outcomes at age 17 years*

At age 17, depressive and anxiety symptoms showed the strongest associations with all suicide-related outcomes. For depressive symptoms, RRRs for passive suicidal ideation, serious suicidal ideation and suicide attempt were 2.68 (2.21-3.25), 3.00 (2.24-4.02), 3.17 (2.19-4.58), respectively, while for anxiety symptoms they were 2.28 (1.90-2.74), 2.43 (1.83-3.22), and 2.28 (1.53-3.40), respectively. For externalizing MHPs, RRRs ranged from 1.49 (1.28-1.73) for the association of conduct problem symptoms with passive suicidal ideation to 2.11 (1.57-2.84) for the association of ADHD symptoms with suicide attempt.

*Univariable associations between MHPs and self-reported suicide-related outcomes at age 20 years*

Consistent with what we found for previous ages, strong associations with suicidal ideation and suicide attempt were found for internalizing MHPs (serious suicidal ideation: 2.42 (1.98-2.95) for depressive symptoms; 1.87 (1.56-2.25) for anxiety symptoms; suicide attempt: 2.10 (1.54-2.86) for depressive symptoms; 1.80 (1.35-2.39) for anxiety symptoms). In terms of externalizing MHPs, RRRs for serious suicidal ideation ranged from 1.48 (1.23-1.78) for ADHD symptoms to 1.52 (1.30-1.79) for conduct problem symptoms. In terms of suicide attempt, RRRs ranged from 1.39 (1.02-1.91) for ADHD symptoms to 1.58 (1.27-1.98) for conduct problem symptoms.

*Multivariable associations between MHPs and self-reported suicide-related outcomes from 13 to 20 years*

RRRs for the independent associations of each MHP with suicide-related outcomes are reported in **Table 3**. After mutually adjusting for all examined MHPs, internalizing problems (i.e., depression at age 13, 15, and 20, and anxiety at 15 and 17 years) were independently associated with passive and serious suicidal ideation, while no independent significant associations were observed for any of the externalizing problems. For suicide attempt, independent associations were observed for both internalizing problems (i.e., depression at 13 and 20 years) and externalizing problems (i.e., conduct problems at 13, 15, and 20 years). No independent significant associations were observed at 17 years for serious suicidal ideation and suicide attempt, although conduct problems was marginally significant for suicide attempt.

### **Discussion**

Our results using a representative cohort of today's adolescents from the Canadian province of Québec provide information on prevalence and MHPs correlates of suicide-related outcomes from early to late adolescence. We estimated that 11.9% of adolescents experienced serious suicidal ideation and 6.7% attempted suicide by 20 years of age. These estimates are consistent with the National Comorbidity Survey Replication Adolescent Supplement (NCS-A); a large survey of 6483 US adolescents aged 13 to 18 years in 2001-2004<sup>4</sup> and the Ontario Child Health Study, a cohort of 2396 adolescents aged 14-17 years in 2014.<sup>22</sup> The lifetime prevalence of passive suicidal ideation was 21.7% indicating that many adolescents think about suicide without a serious desire of attempting suicide. Although direct comparisons of prevalence are hindered by differences in measurement of suicidal ideation, our estimate is in line with meta-analytic data reporting lifetime prevalence of suicidal ideation of 29.9% in adolescents<sup>23</sup> and 22.2% in college

students.<sup>24</sup> As reported elsewhere,<sup>25-28</sup> females were more likely than males to experience suicidal ideation or to attempt suicide. These sex differences in suicidal ideation and suicide attempt might be attributed to various factors such as mental health (e.g., higher prevalence of depression in females) or social stigma (e.g., greater stigma around suicide in males than females).<sup>29</sup> Our study extends prior knowledge by showing that sex differences are observed throughout adolescence, from ages 13 to 20 years.

To our knowledge, this is the first epidemiological study with repeated assessments of suicide-related outcomes over 7 years in today's generation of youth. The few longitudinal studies based on past generations of youth reported that suicidal ideation and suicide attempt peak in mid-adolescence and decrease in late adolescence or early adulthood.<sup>5-8,30</sup> Here, the 12-month prevalence of suicide attempt was relatively stable across adolescence (from 13 to 20 years). Further, we noticed a 40% increase in the 12-month prevalence of serious suicidal ideation in late adolescence (17 to 20 years). Future studies are needed to confirm our results and to better understand reasons for such increases in rates of serious suicidal ideation in late adolescence.

Our univariable findings also demonstrate that all MHPs were associated with outcome variables with magnitude of associations increasing in strength with the severity of the suicide-related outcomes. However, in multivariable analyses adjusting for all MHPs simultaneously, depressive symptoms were most consistently associated with passive and serious suicidal ideation. While having a major depressive episode is a well-known risk factor of suicidal ideation and suicide attempt,<sup>1,31</sup> our study adds to the general body of knowledge by showing associations with suicide-related outcomes across the full spectrum of depressive symptoms. This suggests that

youth presenting with depressive symptoms (and not solely those who are clinically depressed), may be more likely to experience suicidal ideation or attempt suicide. Contrary to the hypothesis that passive suicidal ideation might not be reflective of psychopathology given its high prevalence,<sup>23,24</sup> here we found that anxiety and depressive symptoms were associated with increased risk of passive suicidal ideation.

In univariable analyses, externalizing problems (e.g., conduct, oppositional/defiance and attentional/hyperactivity symptoms) were associated with passive suicidal ideation, serious suicidal ideation and suicide attempt at all four time points, with stronger associations in younger adolescents. In multivariable analyses, none of the externalizing problems were significantly associated with passive or serious suicidal ideation. However, externalizing problems remained associated with suicide attempt in these multivariable analyses. This indicates that the most consistent predictor of suicide attempt across development was conduct problems, even after depressive symptoms were taken into account. This finding is consistent with previous longitudinal studies suggesting that both internalizing and externalizing problems independently predict suicidal behaviors, and showing the unique contribution of externalizing problems on suicidal acts.<sup>32-34</sup>

### **Limitations**

This study is based on a well-established longitudinal cohort with repeated measures of suicide-related outcomes and MHPs throughout adolescence. Additionally, the data included in this study have been recently collected (last data collection was in 2018), thus representing today's generation of youth. Despite these strengths, the following limitations must be acknowledged. First, because of sample attrition (e.g., emigration, loss to follow-up and refusal), our analyses

were conducted on 1618 of 2120 individuals (76%) of the initial sample. To minimize attrition biases, analyses were performed using sample weights accounting for the probability of being missing at follow-up. Second, although instruments used to measure MHPs all showed satisfactory psychometric proprieties, different instruments were used in early (13 years) and late (20 years) adolescence. This may introduce a bias in the magnitude of associations when different time points are compared. Third, passive suicidal ideation was not measured at age 20 years. Therefore, all participants received the question on serious suicidal ideation, which differs from previous data collection in which only participants endorsing suicidal ideation were asked about serious suicidal ideation. Consequently, the rate of serious suicidal ideation at age 20 years may be overestimated. Fourth, although we examined a comprehensive set of MHPs, other problems (such as substance use<sup>35</sup>, psychotic symptoms<sup>36</sup>) associated with suicide-related outcomes were not examined in this study. Fifth, the instruments used to assess MHPs are not diagnostic tools, therefore we could not determine if the endorsed symptoms met criteria for a mental disorder as defined by the DSM. Moreover, as self-reports were also used to assess suicide-related outcomes, these may have been influenced by recall bias and participants' interpretation of the questions. Finally, the variation in the prevalence of suicide-related outcomes from 13 to 20y of age may be partially influenced by the overall increase in emergency visits for suicidal risk,<sup>9,11</sup> including in Québec,<sup>12</sup> and not uniquely due to age differences.

## **Conclusion**

Suicide is a leading cause of death among youth<sup>2</sup> and rates of death by suicide and emergency visits/hospitalization for suicide attempt<sup>12</sup> have increased over the past few years, especially among females.<sup>12,37,38</sup> In this cohort of today's youth, we found that serious suicidal ideation and suicide attempt were relatively common (lifetime prevalence ~18% combined), Additionally, one



youth out of five has thought about suicide without serious desire of attempting suicide during adolescence. MHPs were important correlates of suicide-related outcomes, with both depressive and conduct problem symptoms being independently associated with suicidal risk. These findings suggest that suicide risk should be systematically assessed in adolescents presenting with mental health symptoms and not solely in those adolescents with clinically diagnosed mental disorders.

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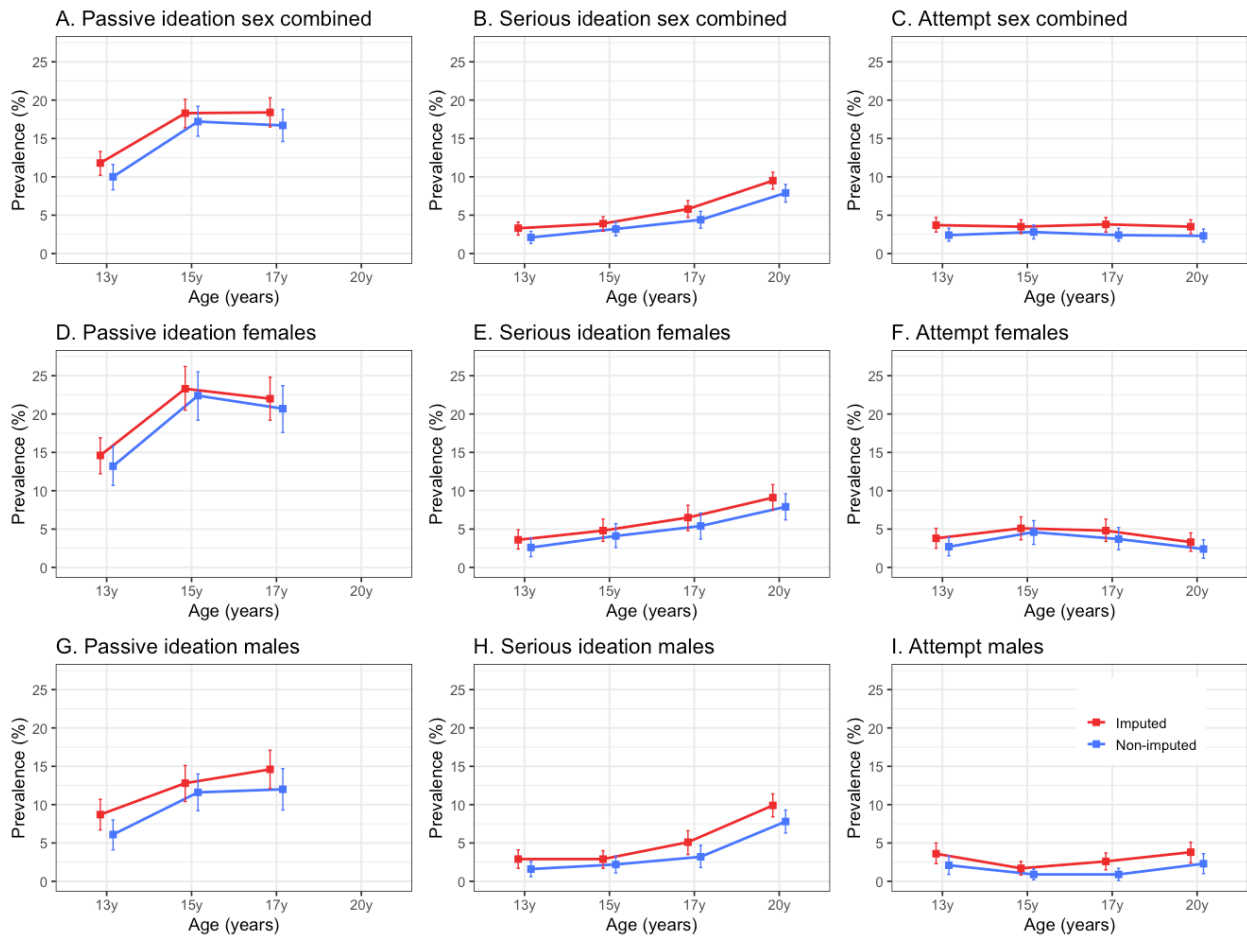
## References

1. Hawton K, Saunders KE, O'Connor RC. Self-harm and suicide in adolescents. *The Lancet*. 2012;379(9834):2373-2382.
2. Glenn CR, Kleiman EM, Kellerman J, et al. Annual Research Review: A meta-analytic review of worldwide suicide rates in adolescents. *J Child Psychol Psychiatry*. 2019.
3. Skinner R, McFall S. Suicide among children and adolescents in Canada: trends and sex differences, 1980–2008. *Can Med Assoc J*. 2012;184(9):1029-1034.
4. Nock MK, Green JG, Hwang I, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: results from the National Comorbidity Survey Replication Adolescent Supplement. *JAMA Psychiatry*. 2013;70(3):300-310.
5. Steinhausen HC, Bösiger R, Metzke CW. Stability, correlates, and outcome of adolescent suicidal risk. *J Child Psychol Psychiatry*. 2006;47(7):713-722.
6. Rueter MA, Kwon HK. Developmental trends in adolescent suicidal ideation. *J Res Adolesc*. 2005;15(2):205-222.
7. Lewinsohn PM, Rohde P, Seeley JR, Baldwin CL. Gender differences in suicide attempts from adolescence to young adulthood. *J Am Acad Child Adolesc Psychiatry*. 2001;40(4):427-434.
8. Dhossche D, Ferdinand R, van der Ende J, Hofstra MB, Verhulst F. Diagnostic outcome of adolescent self-reported suicidal ideation at 8-year follow-up. *J Affect Disord*. 2002;72(3):273-279.
9. Plemmons G, Hall M, Doupnik S, et al. Hospitalization for suicide ideation or attempt: 2008–2015. *Pediatrics*. 2018;141(6):e20172426.
10. Mojtabai R, Olfson M, Han B. National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*. 2016;138(6):e20161878.
11. Burstein B, Agostino H, Greenfield B. Suicidal attempts and ideation among children and adolescents in US emergency departments, 2007-2015. *JAMA Pediatr*. 2019;173(6):598-600.
12. Levesque P, Pelletier É, Perron P-A. Le suicide au Québec: 1981 à 2017- Mise à jour 2020. In. Québec: Bureau d'information et d'études en santé des populations, Institut national de santé publique au Québec; 2020:25.
13. Gili M, Castellvi P, Vives M, et al. Mental disorders as risk factors for suicidal behavior in young people: A meta-analysis and systematic review of longitudinal studies. *J Affect Disord*. 2018.
14. Foley DL, Goldston DB, Costello EJ, Angold A. Proximal psychiatric risk factors for suicidality in youth: the Great Smoky Mountains Study. *Arch Gen Psychiatry*. 2006;63(9):1017-1024.
15. Goldston DB, Daniel SS, Erkanli A, et al. Psychiatric diagnoses as contemporaneous risk factors for suicide attempts among adolescents and young adults: Developmental changes. *J Consult Clin Psychol*. 2009;77(2):281.
16. Brent DA, Baugher M, Bridge J, Chen T, Chiappetta L. Age-and sex-related risk factors for adolescent suicide. *J Am Acad Child Adolesc Psychiatry*. 1999;38(12):1497-1505.
17. Grøholt B, Ekeberg Ø, Wichstrøm L, Haldorsen T. Suicide among children and younger and older adolescents in Norway: a comparative study. *J Am Acad Child Adolesc Psychiatry*. 1998;37(5):473-481.

18. Shaffer D, Gould MS, Fisher P, et al. Psychiatric diagnosis in child and adolescent suicide. *Arch Gen Psychiatry*. 1996;53(4):339-348.
19. Sheftall AH, Asti L, Horowitz LM, et al. Suicide in elementary school-aged children and early adolescents. *Pediatrics*. 2016;138(4).
20. Gould MS, King R, Greenwald S, et al. Psychopathology associated with suicidal ideation and attempts among children and adolescents. *J Am Acad Child Adolesc Psychiatry*. 1998;37(9):915-923.
21. Azur MJ, Stuart EA, Frangakis C, Leaf PJ. Multiple imputation by chained equations: what is it and how does it work? *Int J Methods Psychiatr Res*. 2011;20(1):40-49.
22. Georgiades K, Boylan K, Duncan L, et al. Prevalence and correlates of youth suicidal ideation and attempts: evidence from the 2014 Ontario Child Health Study. *Can J Psychiatry*. 2019;64(4):265-274.
23. Evans E, Hawton K, Rodham K, Deeks J. The prevalence of suicidal phenomena in adolescents: a systematic review of population-based studies. *Suicide Life Threat Behav*. 2005;35(3):239-250.
24. Mortier P, Cuijpers P, Kiekens G, et al. The prevalence of suicidal thoughts and behaviours among college students: a meta-analysis. *Psychol Med*. 2018;48(4):554-565.
25. Voss C, Ollmann TM, Miché M, et al. Prevalence, onset, and course of suicidal behavior among adolescents and young adults in Germany. *JAMA Netw Open*. 2019;2(10):e1914386-e1914386.
26. Rhodes AE, Boyle MH, Bridge JA, et al. Antecedents and sex/gender differences in youth suicidal behavior. *World J Psychiatry*. 2014;4(4):120.
27. Miranda-Mendizabal A, Castellví P, Parés-Badell O, et al. Gender differences in suicidal behavior in adolescents and young adults: systematic review and meta-analysis of longitudinal studies. *Int J Public Health*. 2019;64(2):265-283.
28. Klonsky ED, May AM, Saffer B. Suicide, suicide attempts, and suicidal ideation. *Annu Rev Clin Psychol*. 2016;12:307-330.
29. Canetto SS, Sakinofsky I. The gender paradox in suicide. *Suicide Life Threat Behav*. 1998;28(1):1-23.
30. Geoffroy M, Orri, M., Girard, A., Perret, LC., Turecki, G. . Developmental trajectories of suicide ttempts from early-adolescence to emerging-adulthood: A 11-year follow-up of a Canadian cohort. *Psychol Med*. in press.
31. Hawton K, i Comabella CC, Haw C, Saunders K. Risk factors for suicide in individuals with depression: a systematic review. *J Affect Disord*. 2013;147(1-3):17-28.
32. Geoffroy M-C, Gunnell D, Power C. Prenatal and childhood antecedents of suicide: 50-year follow-up of the 1958 British Birth Cohort study. *Psychol Med*. 2014;44(6):1245-1256.
33. Sourander A, Klomek AB, Niemelä S, et al. Childhood predictors of completed and severe suicide attempts: findings from the Finnish 1981 Birth Cohort Study. *Arch Gen Psychiatry*. 2009;66(4):398-406.
34. Orri M, Galéra C, Turecki G, et al. Pathways of association between childhood irritability and adolescent suicidality. *J Am Acad Child Adolesc Psychiatry*. 2019;58(1):99-107. e103.
35. Pompili M, Serafini G, Innamorati M, et al. Substance abuse and suicide risk among adolescents. *Eur Arch Psychiatry Clin Neurosci*. 2012;262(6):469-485.

36. Kelleher I, Corcoran P, Keeley H, et al. Psychotic symptoms and population risk for suicide attempt: a prospective cohort study. *JAMA Psychiatry*. 2013;70(9):940-948.
37. Simon T. Suicide Rates\*, for Teens Aged 15–19 Years, by Sex—United States, 1975–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66(30):816.
38. Ruch DA, Sheftall AH, Schlagbaum P, Rausch J, Campo JV, Bridge JA. Trends in suicide among youth aged 10 to 19 years in the United States, 1975 to 2016. *JAMA Netw Open*. 2019;2(5):e193886-e193886.

**Figure 1.** Prevalence of Self-Reported Suicide-Related Outcomes at 13, 15, 17 and 20 Years in Overall Sample, and in Females and Males Separately. <sup>a</sup>



a. Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998-2018), ©Gouvernement du Québec, Institut de la statistique du Québec  
 NA=information on passive suicidal ideation was not available at 20 years.

Note: Prevalence of suicide-related outcomes were estimated based on imputed and weighted sample (N=1618) and on maximum available sample (N=1225 to 1428).

## Supplementary material

Supplementary Table 1: Correlation matrix for MHPs for the entire sample (A), for females (B) and males (C) <sup>a</sup>

### Entire sample (A)

|                           | 1    | 2    | 3    | 4    | 5     | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   |
|---------------------------|------|------|------|------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>1. Depression 13y</b>  | 1    | 0.44 | 0.39 | 0.31 | 0.45  | 0.36 | 0.33 | 0.23 | 0.40 | 0.19 | 0.18 | 0.03 | 0.36 | 0.24 | 0.24 | 0.33 | 0.26 | 0.28 | 0.20 |
| <b>2. Depression 15y</b>  | 0.44 | 1    | 0.59 | 0.38 | 0.35  | 0.74 | 0.55 | 0.34 | 0.25 | 0.37 | 0.28 | 0.13 | 0.28 | 0.43 | 0.35 | 0.27 | 0.59 | 0.39 | 0.27 |
| <b>3. Depression 17y</b>  | 0.40 | 0.60 | 1    | 0.45 | 0.28  | 0.51 | 0.74 | 0.39 | 0.20 | 0.20 | 0.39 | 0.10 | 0.22 | 0.27 | 0.43 | 0.25 | 0.38 | 0.60 | 0.32 |
| <b>4. Depression 20y</b>  | 0.32 | 0.39 | 0.45 | 1    | 0.19  | 0.33 | 0.41 | 0.66 | 0.20 | 0.15 | 0.16 | 0.13 | 0.20 | 0.22 | 0.25 | 0.19 | 0.24 | 0.30 | 0.39 |
| <b>5. Anxiety 13y</b>     | 0.44 | 0.36 | 0.31 | 0.18 | 1     | 0.37 | 0.32 | 0.23 | 0.27 | 0.08 | 0.08 | 0.02 | 0.28 | 0.13 | 0.14 | 0.39 | 0.24 | 0.22 | 0.19 |
| <b>6. Anxiety 15y</b>     | 0.37 | 0.74 | 0.51 | 0.31 | 0.38  | 1    | 0.59 | 0.35 | 0.16 | 0.26 | 0.21 | 0.06 | 0.2  | 0.31 | 0.27 | 0.19 | 0.48 | 0.32 | 0.26 |
| <b>7. Anxiety 17y</b>     | 0.33 | 0.55 | 0.73 | 0.40 | 0.36  | 0.60 | 1    | 0.4  | 0.17 | 0.21 | 0.29 | 0.10 | 0.18 | 0.24 | 0.33 | 0.21 | 0.35 | 0.50 | 0.33 |
| <b>8. Anxiety 20y</b>     | 0.21 | 0.33 | 0.39 | 0.66 | 0.22  | 0.34 | 0.40 | 1    | 0.13 | 0.11 | 0.14 | 0.10 | 0.16 | 0.19 | 0.25 | 0.15 | 0.21 | 0.29 | 0.39 |
| <b>9. Conduct 13y</b>     | 0.40 | 0.26 | 0.22 | 0.19 | 0.29  | 0.16 | 0.16 | 0.09 | 1    | 0.48 | 0.36 | 0.22 | 0.51 | 0.37 | 0.35 | 0.47 | 0.34 | 0.32 | 0.18 |
| <b>10. Conduct 15y</b>    | 0.23 | 0.37 | 0.22 | 0.13 | 0.12  | 0.25 | 0.21 | 0.08 | 0.49 | 1    | 0.59 | 0.33 | 0.33 | 0.59 | 0.45 | 0.25 | 0.54 | 0.32 | 0.15 |
| <b>11. Conduct 17y</b>    | 0.19 | 0.29 | 0.39 | 0.14 | 0.10  | 0.20 | 0.28 | 0.11 | 0.38 | 0.62 | 1    | 0.39 | 0.28 | 0.44 | 0.63 | 0.23 | 0.39 | 0.55 | 0.18 |
| <b>12. Conduct 20y</b>    | 0.01 | 0.14 | 0.11 | 0.12 | -0.02 | 0.03 | 0.08 | 0.08 | 0.18 | 0.32 | 0.43 | 1    | 0.15 | 0.30 | 0.30 | 0.15 | 0.25 | 0.29 | 0.16 |
| <b>13. Opposition 13y</b> | 0.35 | 0.30 | 0.25 | 0.21 | 0.28  | 0.21 | 0.20 | 0.15 | 0.52 | 0.35 | 0.29 | 0.15 | 1    | 0.38 | 0.34 | 0.48 | 0.36 | 0.32 | 0.20 |
| <b>14. Opposition 15y</b> | 0.27 | 0.44 | 0.27 | 0.17 | 0.16  | 0.32 | 0.23 | 0.16 | 0.39 | 0.60 | 0.47 | 0.28 | 0.38 | 1    | 0.58 | 0.30 | 0.62 | 0.41 | 0.21 |
| <b>15. Opposition 17y</b> | 0.23 | 0.34 | 0.43 | 0.20 | 0.16  | 0.26 | 0.32 | 0.21 | 0.35 | 0.49 | 0.63 | 0.31 | 0.36 | 0.59 | 1    | 0.31 | 0.46 | 0.61 | 0.28 |
| <b>16. Adhd13y</b>        | 0.33 | 0.27 | 0.25 | 0.22 | 0.38  | 0.19 | 0.20 | 0.15 | 0.48 | 0.24 | 0.24 | 0.15 | 0.49 | 0.29 | 0.32 | 1    | 0.45 | 0.43 | 0.30 |
| <b>17. Adhd 15y</b>       | 0.27 | 0.60 | 0.38 | 0.21 | 0.24  | 0.49 | 0.33 | 0.20 | 0.35 | 0.55 | 0.41 | 0.28 | 0.37 | 0.63 | 0.46 | 0.44 | 1    | 0.56 | 0.35 |
| <b>18. Adhd 17y</b>       | 0.29 | 0.40 | 0.60 | 0.29 | 0.25  | 0.31 | 0.49 | 0.28 | 0.33 | 0.35 | 0.56 | 0.32 | 0.35 | 0.43 | 0.61 | 0.46 | 0.57 | 1    | 0.47 |
| <b>19. Adhd 20y</b>       | 0.21 | 0.26 | 0.32 | 0.39 | 0.19  | 0.25 | 0.33 | 0.42 | 0.16 | 0.13 | 0.16 | 0.14 | 0.19 | 0.20 | 0.30 | 0.31 | 0.34 | 0.46 | 1    |

Lower diagonal reports estimates on the imputed dataset, upper diagonal reports estimates on the non-imputed dataset

a. Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998-2018), ©Gouvernement du Québec, Institut de la statistique du Québec

Females (B)

|                           | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>1. Depression 13y</b>  | 1    | 0.42 | 0.36 | 0.31 | 0.47 | 0.38 | 0.30 | 0.22 | 0.43 | 0.21 | 0.23 | 0.04 | 0.41 | 0.27 | 0.27 | 0.38 | 0.27 | 0.27 | 0.16 |
| <b>2. Depression 15y</b>  | 0.42 | 1    | 0.55 | 0.36 | 0.30 | 0.74 | 0.51 | 0.30 | 0.26 | 0.38 | 0.32 | 0.13 | 0.32 | 0.48 | 0.43 | 0.31 | 0.62 | 0.43 | 0.24 |
| <b>3. Depression 17y</b>  | 0.39 | 0.55 | 1    | 0.40 | 0.24 | 0.45 | 0.73 | 0.30 | 0.20 | 0.18 | 0.41 | 0.11 | 0.22 | 0.28 | 0.47 | 0.30 | 0.38 | 0.61 | 0.30 |
| <b>4. Depression 20y</b>  | 0.32 | 0.35 | 0.42 | 1    | 0.16 | 0.31 | 0.36 | 0.66 | 0.22 | 0.18 | 0.18 | 0.12 | 0.23 | 0.26 | 0.27 | 0.24 | 0.28 | 0.32 | 0.37 |
| <b>5. Anxiety 13y</b>     | 0.46 | 0.32 | 0.28 | 0.16 | 1    | 0.31 | 0.24 | 0.18 | 0.31 | 0.08 | 0.08 | 0.05 | 0.30 | 0.13 | 0.15 | 0.42 | 0.22 | 0.20 | 0.13 |
| <b>6. Anxiety 15y</b>     | 0.39 | 0.74 | 0.45 | 0.30 | 0.34 | 1    | 0.53 | 0.27 | 0.20 | 0.30 | 0.30 | 0.10 | 0.27 | 0.37 | 0.37 | 0.25 | 0.51 | 0.35 | 0.21 |
| <b>7. Anxiety 17y</b>     | 0.31 | 0.51 | 0.73 | 0.37 | 0.29 | 0.53 | 1    | 0.30 | 0.16 | 0.21 | 0.35 | 0.10 | 0.20 | 0.27 | 0.42 | 0.26 | 0.35 | 0.53 | 0.28 |
| <b>8. Anxiety 20y</b>     | 0.21 | 0.29 | 0.33 | 0.66 | 0.17 | 0.28 | 0.33 | 1    | 0.14 | 0.12 | 0.11 | 0.12 | 0.19 | 0.21 | 0.22 | 0.18 | 0.24 | 0.26 | 0.34 |
| <b>9. Conduct 13y</b>     | 0.44 | 0.28 | 0.24 | 0.22 | 0.30 | 0.21 | 0.19 | 0.10 | 1    | 0.48 | 0.39 | 0.18 | 0.54 | 0.36 | 0.35 | 0.50 | 0.34 | 0.34 | 0.20 |
| <b>10. Conduct 15y</b>    | 0.23 | 0.38 | 0.19 | 0.14 | 0.10 | 0.29 | 0.21 | 0.06 | 0.49 | 1    | 0.64 | 0.35 | 0.33 | 0.59 | 0.48 | 0.23 | 0.56 | 0.34 | 0.14 |
| <b>11. Conduct 17y</b>    | 0.22 | 0.32 | 0.41 | 0.17 | 0.09 | 0.26 | 0.34 | 0.10 | 0.41 | 0.66 | 1    | 0.40 | 0.32 | 0.47 | 0.62 | 0.24 | 0.44 | 0.57 | 0.18 |
| <b>12. Conduct 20y</b>    | 0.03 | 0.15 | 0.14 | 0.13 | 0.00 | 0.06 | 0.14 | 0.10 | 0.15 | 0.33 | 0.41 | 1    | 0.14 | 0.31 | 0.30 | 0.12 | 0.24 | 0.28 | 0.12 |
| <b>13. Opposition 13y</b> | 0.39 | 0.32 | 0.25 | 0.20 | 0.29 | 0.25 | 0.20 | 0.13 | 0.55 | 0.36 | 0.33 | 0.13 | 1    | 0.40 | 0.38 | 0.50 | 0.37 | 0.36 | 0.23 |
| <b>14. Opposition 15y</b> | 0.29 | 0.49 | 0.27 | 0.22 | 0.17 | 0.38 | 0.26 | 0.18 | 0.38 | 0.61 | 0.49 | 0.28 | 0.40 | 1    | 0.62 | 0.29 | 0.65 | 0.42 | 0.20 |
| <b>15. Opposition 17y</b> | 0.25 | 0.40 | 0.45 | 0.26 | 0.19 | 0.35 | 0.40 | 0.21 | 0.35 | 0.50 | 0.61 | 0.29 | 0.38 | 0.62 | 1    | 0.32 | 0.50 | 0.61 | 0.27 |
| <b>16. Adhd13y</b>        | 0.39 | 0.33 | 0.32 | 0.26 | 0.43 | 0.25 | 0.28 | 0.17 | 0.50 | 0.23 | 0.24 | 0.09 | 0.50 | 0.28 | 0.31 | 1    | 0.45 | 0.45 | 0.30 |
| <b>17. Adhd 15y</b>       | 0.29 | 0.63 | 0.39 | 0.27 | 0.24 | 0.51 | 0.35 | 0.22 | 0.37 | 0.58 | 0.45 | 0.26 | 0.39 | 0.66 | 0.50 | 0.45 | 1    | 0.60 | 0.34 |
| <b>18. Adhd 17y</b>       | 0.29 | 0.41 | 0.62 | 0.34 | 0.24 | 0.31 | 0.52 | 0.26 | 0.36 | 0.35 | 0.56 | 0.31 | 0.36 | 0.43 | 0.60 | 0.47 | 0.60 | 1    | 0.47 |
| <b>19. Adhd 20y</b>       | 0.19 | 0.21 | 0.31 | 0.37 | 0.15 | 0.19 | 0.30 | 0.38 | 0.17 | 0.10 | 0.16 | 0.11 | 0.19 | 0.18 | 0.30 | 0.30 | 0.33 | 0.47 | 1    |

Lower diagonal reports estimates on the imputed dataset, upper diagonal reports estimates on the non-imputed dataset  
a. Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998-2018),  
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Males (C)

|                           | 1    | 2    | 3    | 4    | 5     | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   |
|---------------------------|------|------|------|------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>1. Depression 13y</b>  | 1    | 0.42 | 0.36 | 0.31 | 0.47  | 0.38 | 0.3  | 0.22 | 0.43 | 0.21 | 0.23 | 0.04 | 0.41 | 0.27 | 0.27 | 0.38 | 0.27 | 0.27 | 0.16 |
| <b>2. Depression 15y</b>  | 0.43 | 1    | 0.55 | 0.36 | 0.30  | 0.74 | 0.51 | 0.30 | 0.26 | 0.38 | 0.32 | 0.13 | 0.32 | 0.48 | 0.43 | 0.31 | 0.62 | 0.43 | 0.24 |
| <b>3. Depression 17y</b>  | 0.37 | 0.54 | 1    | 0.40 | 0.24  | 0.45 | 0.73 | 0.30 | 0.20 | 0.18 | 0.41 | 0.11 | 0.22 | 0.28 | 0.47 | 0.30 | 0.38 | 0.61 | 0.30 |
| <b>4. Depression 20y</b>  | 0.27 | 0.34 | 0.41 | 1    | 0.16  | 0.31 | 0.36 | 0.66 | 0.22 | 0.18 | 0.18 | 0.12 | 0.23 | 0.26 | 0.27 | 0.24 | 0.28 | 0.32 | 0.37 |
| <b>5. Anxiety 13y</b>     | 0.39 | 0.31 | 0.26 | 0.15 | 1     | 0.31 | 0.24 | 0.18 | 0.31 | 0.08 | 0.08 | 0.05 | 0.30 | 0.13 | 0.15 | 0.42 | 0.22 | 0.20 | 0.13 |
| <b>6. Anxiety 15y</b>     | 0.29 | 0.65 | 0.43 | 0.22 | 0.33  | 1    | 0.53 | 0.27 | 0.20 | 0.30 | 0.30 | 0.10 | 0.27 | 0.37 | 0.37 | 0.25 | 0.51 | 0.35 | 0.21 |
| <b>7. Anxiety 17y</b>     | 0.28 | 0.45 | 0.66 | 0.35 | 0.36  | 0.55 | 1    | 0.3  | 0.16 | 0.21 | 0.35 | 0.10 | 0.20 | 0.27 | 0.42 | 0.26 | 0.35 | 0.53 | 0.28 |
| <b>8. Anxiety 20y</b>     | 0.15 | 0.25 | 0.35 | 0.63 | 0.20  | 0.29 | 0.39 | 1    | 0.14 | 0.12 | 0.11 | 0.12 | 0.19 | 0.21 | 0.22 | 0.18 | 0.24 | 0.26 | 0.34 |
| <b>9. Conduct 13y</b>     | 0.38 | 0.31 | 0.25 | 0.18 | 0.28  | 0.17 | 0.17 | 0.11 | 1    | 0.48 | 0.39 | 0.18 | 0.54 | 0.36 | 0.35 | 0.50 | 0.34 | 0.34 | 0.20 |
| <b>10. Conduct 15y</b>    | 0.21 | 0.39 | 0.25 | 0.12 | 0.13  | 0.23 | 0.21 | 0.08 | 0.49 | 1    | 0.64 | 0.35 | 0.33 | 0.59 | 0.48 | 0.23 | 0.56 | 0.34 | 0.14 |
| <b>11. Conduct 17y</b>    | 0.16 | 0.30 | 0.43 | 0.10 | 0.11  | 0.17 | 0.27 | 0.13 | 0.35 | 0.57 | 1    | 0.40 | 0.32 | 0.47 | 0.62 | 0.24 | 0.44 | 0.57 | 0.18 |
| <b>12. Conduct 20y</b>    | 0.02 | 0.22 | 0.15 | 0.16 | -0.03 | 0.06 | 0.09 | 0.10 | 0.20 | 0.32 | 0.45 | 1    | 0.14 | 0.31 | 0.30 | 0.12 | 0.24 | 0.28 | 0.12 |
| <b>13. Opposition 13y</b> | 0.30 | 0.29 | 0.26 | 0.22 | 0.26  | 0.17 | 0.20 | 0.17 | 0.5  | 0.34 | 0.24 | 0.18 | 1    | 0.4  | 0.38 | 0.50 | 0.37 | 0.36 | 0.23 |
| <b>14. Opposition 15y</b> | 0.24 | 0.45 | 0.28 | 0.11 | 0.14  | 0.28 | 0.21 | 0.14 | 0.41 | 0.59 | 0.45 | 0.29 | 0.35 | 1    | 0.62 | 0.29 | 0.65 | 0.42 | 0.20 |
| <b>15. Opposition 17y</b> | 0.21 | 0.34 | 0.45 | 0.16 | 0.14  | 0.21 | 0.29 | 0.23 | 0.36 | 0.47 | 0.65 | 0.32 | 0.33 | 0.57 | 1    | 0.32 | 0.50 | 0.61 | 0.27 |
| <b>16. Adhd13y</b>        | 0.33 | 0.35 | 0.29 | 0.23 | 0.39  | 0.24 | 0.25 | 0.20 | 0.46 | 0.25 | 0.26 | 0.19 | 0.49 | 0.30 | 0.33 | 1    | 0.45 | 0.45 | 0.30 |
| <b>17. Adhd 15y</b>       | 0.24 | 0.62 | 0.37 | 0.13 | 0.22  | 0.48 | 0.31 | 0.15 | 0.34 | 0.51 | 0.38 | 0.31 | 0.35 | 0.60 | 0.42 | 0.46 | 1    | 0.60 | 0.34 |
| <b>18. Adhd 17y</b>       | 0.29 | 0.43 | 0.64 | 0.24 | 0.27  | 0.33 | 0.51 | 0.31 | 0.31 | 0.34 | 0.56 | 0.33 | 0.34 | 0.43 | 0.61 | 0.46 | 0.54 | 1    | 0.47 |
| <b>19. Adhd 20y</b>       | 0.21 | 0.27 | 0.29 | 0.39 | 0.20  | 0.27 | 0.33 | 0.43 | 0.15 | 0.17 | 0.17 | 0.20 | 0.19 | 0.21 | 0.30 | 0.36 | 0.34 | 0.44 | 1    |

Lower diagonal reports estimates on the imputed dataset, upper diagonal reports estimates on the non-imputed dataset

a. Data were compiled from the final master file of the Québec Longitudinal Study of Child Development (1998-2018), ©Gouvernement du Québec, Institut de la statistique du Québec



## Appendix

### DEPRESSION SYMPTOMS

#### **Children's Depression Inventory (CDI); 10 items; 13 years**

**Please pick out the sentence that describes you best in the past 2 weeks:**

I do most things ok/I do many things wrong/I do everything wrong.

I hate myself/I don't like myself/I like myself.

I do not feel alone/I feel alone many times/I feel alone all the time.

Nobody really loves me/I am not sure if anybody loves me/I am sure that someone loves me.

I am sad once in a while/I am sad many times/I am sad all the time.

Nothing will ever work out for me/I am not sure if things will work out for me/Things will work out for me OK.

I feel like crying everyday/I feel like crying many days/I feel like crying once in a while.

Things bother me: All the time/Many times/Once in a while.

I look: Ok/there are some bad things about my looks/I look ugly.

I have plenty of friends/I have some friends but I wish I had more/I do not have any friends.

#### **Depression subscale from Mental Health and Social Inadaptation Assessment for Adolescents (MIA); 8 items; 15 and 17 years**

Nothing was fun for me, I wasn't interested in anything.

I felt sad and unhappy.

I lacked energy or felt tired.

I lost interest in things I usually like.

I felt I couldn't do anything well.

I felt I wasn't as good-looking or as smart as other people.

Doing even little things made me feel really tired.

I had trouble thinking clearly.

#### **Center for Epidemiologic Studies Depression Scale (CES-D); 13 items; 20 years**

I did not feel like eating; my appetite was poor.

I felt that I could not shake off the blues even with help from my family or friends.

I had trouble keeping my mind on what I was doing.

I felt depressed.

I felt that everything I did was an effort.

I felt hopeful about the future.

My sleep was restless.

I was happy.

I felt lonely.

I enjoyed life.

I had crying spells.

I felt that people disliked me.

I have felt scared or panicky for no very good reason.

## **GENERALIZED ANXIETY SYMPTOMS**

### **Anxiety subscale from Behavior Questionnaire; 3 items; 13 years**

I am too fearful or nervous.

I worry a lot.

I am nervous, highstrung or tense.

### **Anxiety subscale from Mental Health and Social Inadaptation Assessment (MIA) for Adolescents; 9 items; 15 and 17 years**

I was too fearful or nervous.

I had worries that interfered with my everyday life.

I worried about my past behaviour.

I worried about my school work.

I worried about my own health.

I worried about my loved ones (family, friends).

I worried about my relationships with my friends (i.e. making and keeping friends).

I was concerned about my appearance or weight.

I found it difficult to control the worry.

### **Generalized Anxiety Disorder 7-item (GAD-7); 7 items; 20 years**

Feeling nervous, anxious or on edge.

Not being able to stop or control worrying.

Worrying too much about different things.

Trouble relaxing.

Being so restless that it's hard to sit still.

Becoming easily annoyed or irritable.

Feeling afraid as if something awful might happen.

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## **ATTENTION DEFICIT HYPERACTIVITY SYMPTOMS**

### **ADHD subscale from Behavior Questionnaire; 7 items; 13 years**

I can't sit still, I am restless.

I am impulsive, I act without thinking.

I have difficulty waiting for my turn in games or group activities.

I cannot settle to anything for more than a few moments.

I am easily distracted. I have trouble sticking to any activity.

I am inattentive, I have difficulty paying attention to someone

I can't concentrate, I can't pay attention.

### **ADHD subscale from Mental Health and Social Inadaptation Assessment (MIA) for Adolescents; 16 items; 15 and 17 years**

I was impulsive (reacted quickly without thinking).

I said things before thinking them through.

I did or said things without stopping to think.

I had difficulty waiting for my turn in games or group activities.

I often blurted out the answer to a question that hadn't yet been completely asked.  
I got into trouble because I did things without thinking.  
I felt very restless, I was constantly on the move.  
I often stood up in class or in other situations where I was supposed to remain seated.  
I often had trouble staying calm during games or leisure activities.  
I moved my hands and feet, I wriggled in my chair.  
I was inattentive, I had difficulty paying attention to what someone was saying or doing.  
I completed all of my tasks or homework, I was able to stay focused.  
I had trouble keeping my mind on what I was doing for more than a few minutes.  
I forgot what I was supposed to be doing or what I had planned to do.  
I avoided doing things where I needed to pay attention for a long time.  
I made a lot of mistakes because it was hard for me to do things carefully.

### **Adult ADHD Self-Report Scale (ASRS-v1.1); 18 items; 20 years**

Do you have trouble wrapping up the final details of a project, once the challenging parts have been done?

Do you have difficulty getting things in order when you have to do a task that requires organization?

Do you have problems remembering appointments or obligations?

When you have a task that requires a lot of thought, do you avoid or delay getting started?

Do you fidget or squirm with your hands or feet when you have to sit down for a long time?

Do you feel overly active and compelled to do things, like you were driven by a motor?

Do you make careless mistakes when you have to work on a boring or difficult project?

Do you have difficulty concentrating on what people say to you, even when they are speaking to you directly?

Do you misplace or have difficulty finding things at home or at work?

Are you distracted by activity or noise around you?

Do you leave your seat in meetings or other situations in which you are expected to remain seated?

Do you feel restless or fidgety?

Do you find yourself talking too much when you are in social situations?

When you're in a conversation, do you find yourself finishing the sentences of the people you are talking to, before they can finish them themselves?

Do you have difficulty waiting your turn in situations when turn taking is required?

Do you interrupt others when they are busy?

Do you have difficulty keeping your attention when you are doing boring or repetitive work?

Do you have difficulty unwinding and relaxing when you have time to yourself?

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### **OPPOSITIONAL/DEFIANT SYMPTOMS**

#### **Oppositional/defiant subscale from Behavior Questionnaire; 4 items; 13 years**

I am defiant or refuse to comply with adults' requests or rules.

After I have misbehaved, I don't feel sorry (feel guilty).

I have temper tantrums or easily get angry.

Punishment doesn't make me change my behavior.

**Oppositional/defiant subscale from Mental Health and Social Inadaptation Assessment (MIA) for Adolescents; 9 items; 15 and 17 years**

I refused to do what my parents or my teacher were telling me to do.

I felt sorry after doing something wrong.

I had temper tantrums.

I lost my temper easily.

I was mean to certain people.

I got even with someone by trying to hurt them.

I got even with someone by telling lies about them.

I blamed someone else when I got caught doing something wrong.

I did some things just to annoy people or make them angry.

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**CONDUCT PROBLEM SYMPTOMS**

**Conduct subscale from Behavior Questionnaire; 7 items; 13 years**

I destroy my own things.

I destroy things belonging to my family or other young people.

I vandalize.

I steal at home.

I steal outside my home.

I tell lies or cheat.

When I am mad at someone, I say to others: "let's not be with him/her".

**Conduct subscale from Mental Health and Social Inadaptation Assessment (MIA) for Adolescents; 16 items; 15 and 17 years**

I cheated in order to succeed at school.

I cheated in order to make some money.

I cheated in order to win a competition.

I told lies in order to get things or favours from others.

I told lies in order to get out of doing things I was supposed to do.

I stole money or objects from home.

I stole money or objects from school or from stores.

I used a weapon in order to steal.

I entered a house, a building or a car without permission in order to steal.

I broke down a door or a window in order to get into a place and take something.

I stayed out at night much later than I was allowed to.

I stayed out all night without my parents' permission.

I ran away from home.

I skipped school without reason (cut class).

I deliberately started a fire.

I deliberately destroyed someone else's property.

**Self-Reported Delinquency Questionnaire- 7 items; 20 years**

Have you gone into a place without paying when payment was required?

Have you stolen something from a store?

Have you threatened to hit someone in order to force them to do something they didn't want to do?

Have you gotten into a fist fight with someone else?

Have you lied or given false information to get what you wanted (an object, an advantage, permission, etc.)?

Have you spread false rumours to destroy someone's reputation?

Have you been arrested and taken to a police station because you did something illegal?

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