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# Depressive symptoms in youth before and during the COVID-19 pandemic: longitudinal investigation of patterns dependent on age, sex, and family history of mental illness

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## Original Article

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## Abstract

**Background.** Cross-sectional studies report high levels of depressive symptoms during the COVID-19 pandemic, especially in youth and females. However, longitudinal research comparing depressive symptoms before and during the pandemic is lacking. Little is known about how the pandemic affected individuals with familial history of mental illness. The present study examines the impact of the pandemic on youth depressive symptoms, including offspring of parents with major mood and psychotic disorders.

**Methods.** Between March 2018 and February 2020, we measured depressive symptoms in 412 youth aged 5–25 years. We measured depressive symptoms again in 371 (90%) of these youth between April 2020 and May 2022. Two thirds (249) participants had a biological parent with a major mood or psychotic disorder. We tested the effect of the pandemic by comparing depression symptoms before and after March 2020. We examined age, sex, and family history as potential moderators.

**Results.** We found an overall small increase in youth depressive symptoms ($b = 0.07$, 95% CI −0.01 to 0.15, $p = 0.062$). This was driven by an increase in female youth without familial history of mental illness ($b = 0.35$, 95% CI 0.14 to 0.56, $p = 0.001$). There was no change in depressive symptoms among offspring of parents with mental illness or males.

**Conclusions.** Our results provide reassurance about the wellbeing of children of parents with mental illness during a period of restricted access to resources outside the family. Rather than increasing symptoms in established risk groups, the pandemic led to a redistribution of depression burden towards segments of the youth population that were previously considered to be low-risk.

## Introduction

With the global lasting effects of the COVID-19 pandemic, there is growing concern about how the pandemic is impacting mental health, especially among youth. Cross-sectional studies have indicated dramatically increased rates of mental illness including depression in the general population during the pandemic (Hawke et al., 2020; Xiong et al., 2020). This is concerning as depression is a leading cause of disability across the life course (Malhi & Mann, 2018; Walker, McGee, & Druss, 2015). In Canada, large increases in depression have been reported in adults and adolescents (Ellis, Dumas, & Forbes, 2020; Salmon, Taillieu, Fortier, Stewart-Tufescu, & Afifi, 2022), including more than doubling of significant depressive symptoms at the start of the pandemic which persisted even after restrictions lessened (Mental Health Research Canada, 2020a, 2020b). The largest increases in depressive symptoms were reported in the province of Nova Scotia, which maintained low infection rates (Mental Health Research Canada, 2020a). The reported increases in depression were based on surveys targeted at the general population that enrolled new participants each time with low or unknown response rates. It is unclear if these high rates of depressive symptoms reflect true changes in the Canadian population or if they are impacted by selection bias. There is need for longitudinal research comparing depressive symptoms in the same individuals before and during the pandemic, especially in those who may already be at increased risk of developing mental illness. Globally, longitudinal research shows more modest changes in depression (Daly, Sutin, & Robinson, 2020; Ertanir, Kassis, & Garrote, 2021; Kwong et al., 2021; von Soest et al., 2022).

The impact of the COVID-19 pandemic and associated restrictions on youth mental health and development has been portrayed as potentially serious and long lasting (Hafstad & Augusti, 2021). Preliminary longitudinal surveys completed with adolescents and young adults

have shown increased depressive symptoms, especially among adolescent females (Ertanir et al., 2021; Hawes, Szenczy, Klein, Hajcak, & Nelson, 2021; Liu, Davis, Palma, Sandman, & Glynn, 2022; Thorisdottir et al., 2021). However, data on youth at-risk are lacking. Offspring of parents with major mood and psychotic disorders are at high risk of developing mental illness including depression (Rasic, Hajek, Alda, & Uher, 2014). Interactions between genetic risk and environmental factors throughout early life influence the development of transdiagnostic mental illness (Uher, 2014). Living with a parent experiencing mental illness may be associated with increased psychopathology and difficulties in social functioning (Brockington et al., 2011; Ranning, Munk Laursen, Thorup, Hjorthøj, & Nordentoft, 2016). During the pandemic, access to external resources such as schools and leisure activities was restricted and young people depended more exclusively on household members, especially parents. Consequently, there is concern that living in lockdown with a parent with mental illness may further increase this risk (Zhou et al., 2021). Therefore, we explored the relationship between depressive symptoms before and during the COVID-19 pandemic in a cohort of offspring of parents with and without a major mood or psychotic disorder. We hypothesized an increase in youth depressive symptoms across our cohort with offspring of parents with major mood and psychotic disorders and female youth showing the largest increases.

## Methods

### Study participants

We examined the impact of the COVID-19 pandemic in youth participants of an ongoing longitudinal study in Nova Scotia, Canada that is enriched for offspring of parents with a major mood or psychotic disorder (Uher et al., 2014). We included youth who were aged between 5 and 25 years on 13 March 2020 and who completed measures of depressive symptoms within the two years prior to the pandemic start. We excluded participants with intellectual disability incompatible with completing the assessments. Participants with capacity to make an informed decision provided written informed consent. For participants who could not provide informed consent, participants provided assent and a parent or guardian provided written informed consent.

### Offspring depressive symptoms

We measured offspring depressive symptoms using the short form of the Mood and Feelings Questionnaire (MFQ) (Costello & Angold, 1988). The short form MFQ is a validated measure containing 13 questions with responses options 'not true', 'sometimes', and 'true' to be completed by the youth and/or parent. Scores on the short form MFQ range from 0 to 26 with scores above 12 frequently used as a cut-off for clinically significant depressive symptoms (Angold, Costello, Messer, & Pickles, 1995). We used the parent report MFQ for participants ages 5–8 and the youth self-report MFQ for age 6+. When participants had both a youth and a parent report MFQ completed at the same timepoint, we averaged the responses. We collected MFQs in the two years prior to the COVID-19 pandemic and two years following the start of the pandemic. We defined two age groups to explore the impact of age defined as younger youth (age 5–14) and older youth and adolescents (age 15–24). We selected the start of the older group as age 15 which is the start of middle adolescence, a period of psychosocial development that typically includes increased independence, responsibilities, and changing peer and romantic relationships (Kipke, 1999). In Nova Scotia, this corresponds with Grade 10 education which is typically the start of high school which has a more independent educational model with more choice.

### Parental diagnosis

Parent diagnosis was determined through the Structured Clinical Interview for DSM-5 (SCID-5) (First, 2015). Family history of a major mood or psychotic disorder was defined as having a biological parent with a lifetime diagnosis of major depressive disorder, bipolar disorder, schizophrenia, schizoaffective disorder, or schizophreniform disorder. Diagnostic assessments were completed by research employees with undergraduate and graduate training is psychology, psychiatry, and associated disciplines trained and supervised by licensed psychiatrists and clinical psychologists. We confirmed parent diagnoses in consensus meetings with a psychiatrist or psychologist. High-risk youth refers to biological offspring of one or more parents who meet criteria for major depressive disorder, bipolar disorder, schizophrenia, schizoaffective disorder, or schizophreniform disorder. Low-risk offspring refers to youth who do not have a biological parent with a major mood or psychotic disorder.

### Statistical analysis

We examined offspring depressive symptoms using mixed effects linear regression with MFQ scores as the dependent variable, time (before vs during pandemic) as the fixed independent variable of interest and age and sex as fixed-effect covariates. We used the nested random effects of family and individual to model non-independence of multiple offspring within a family and repeated observations within an individual. We explored three potential moderators: age (5–14, 15–24 years), sex (female or male sex assigned at birth), and familial risk status (low-risk, high-risk). We described the effects of pandemic in analyses stratified by age, sex, and family history, and we tested the moderating relationships as statistical interactions. If more than one of these interactions was significant ($p < 0.05$), we explored the joint moderator effects as higher order interactions (including all lower order interactions in the mixed-effects regression equation). We conducted sensitivity analyses to ensure that our results were not unduly affected by socioeconomic status (SES), whether offspring were living with both biological parents, or MFQ reporter. We report the effect size as the standardized beta coefficients, their 95% confidence intervals, and $p$ values. We interpreted $p$ values below 0.05 as significant. We completed our analysis using the STATA 17.1 software.

### Ethics approval

The study protocol has been approved by the Nova Scotia Health Research Ethics Board (file number 100 266).

## Results

### Participant characteristics

Of the 412 youth who completed assessments in the two years prior to the pandemic, 371 (90%) youth from 208 families

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completed assessments with the same instrument between April 2020 and May 2022. Of the 371 offspring, 249 (67%) had a biological parent with a major mood or psychotic disorder. Our dataset includes 993 observations before the pandemic and 868 observations during the pandemic from our sample of 371. To assess if timing of the assessments between April 2020 and May 2022 were unbalanced between low-risk and high-risk groups, we divided the during COVID-19 time period into quarters (3-month periods). We then assessed for differences with a chi-squared test which showed no differences (see online Supplementary Table S1 for time quarters as well as restriction information per time quarter). Table 1 presents the demographic and clinical characteristics of the participants. We also explored participant characteristics of the 41 youth who did not complete the same instrument during the pandemic. We ran $\chi^2$ and $t$ tests to determine if these youth differed from our study cohort and found that this group had higher percentage of females and slightly higher MFQ scores (online Supplementary Table S2).

**Table 1.** Participant demographic and clinical characteristics

| | Youth familial risk group | |
|---|---|---|
| | Low risk ($n = 122$) | High risk ($n = 249$) |
| Families, *n* | 67 | 141 |
| Youth characteristics | | |
| Age, mean (s.d.)* | 12.40 (s.d. = 3.62) | 13.41 (s.d. = 4.47) |
| Age 5–15, *n* (%) | 96 (79%) | 164 (66%) |
| Age 15–25, *n* (%) | 26 (21%) | 85 (34%) |
| Sex, female, *n* (%) | 59 (48%) | 121 (49%) |
| Gender, transgender or non-binary, *n* (%) | 6 (5%) | 12 (5%) |
| Black, Indigenous, and/or Asian identity, *n* (%) | 10 (8%) | 21 (8%) |
| Rural, *n* (%) | 32 (26%) | 51 (20%) |
| Income less than $60 000, *n* (%)* | 19 (16%) | 84 (34%) |
| Living with both biological parents, *n* (%)* | 95 (78%) | 160 (64%) |
| Average number of siblings, mean (s.d.)* | 1.46 (1.13) | 1.07 (0.87) |
| MFQ before COVID-19, mean (s.d.)* | 3.11 (s.d. = 3.52) | 4.10 (s.d. = 4.64) |
| MFQ during COVID-19, mean (s.d.) | 4.45 (s.d. = 4.87) | 4.46 (s.d. = 4.23) |
| MFQ clinical threshold before COVID-19 (score ⩾ 12), *n* (%)[a] | 10 (8%) | 45 (18%) |
| MFQ clinical threshold during COVID-19 (score⩾12), *n* (%) | 16 (13%) | 31 (12%) |
| Parent diagnosis | | |
| Depression, *n* (%) | 0 | 145 (58%) |
| Bipolar disorder, *n* (%) | 0 | 72 (29%) |
| Schizophrenia, *n* (%) | 0 | 32 (13%) |

[a]The * denotes significant difference between groups at $p < 0.05$. We tested differences between groups using chi-square for categorical variables and $t$ test for continuous variables. We report analyses by biological sex, and not gender, because the number of transgender and non-binary participants was too small to support separate gender-based analysis.

### Impact of COVID-19 on offspring depressive symptoms

After accounting for age, sex, and family non-independence, we found a small increase in youth depressive symptoms across the entire cohort ($b = 0.07$, 95% CI −0.01 to 0.15, $p = 0.062$; Table 2). As this was a small effect size, we additionally completed a post-hoc power calculation which showed we had adequate power to identify a change of this size (observed power = 0.82).

### Moderators of change in depressive symptoms

We further probed the change in depressive symptoms by testing the interactions of age, biological sex, and familial risk status, with time (before and during COVID-19). The two-way interaction between age and time was not significant ($b = 0.12$, 95% CI −0.02 to 0.27, $p = 0.100$). There was a significant two-way interaction between biological sex and time ($b = 0.25$, 95% CI 0.11 to 0.40, $p = 0.001$), reflecting a greater increase in depressive symptoms in females relative to males during the pandemic. We also found a significant two-way interaction between familial risk and time ($b = -0.18$, 95% CI −0.33 to −0.03, $p = 0.023$), which reflected greater increase in depressive symptoms in low-risk relative to high-risk youth. Since the two-way interactions between sex and time, and familial risk status and time were both significant, we proceeded to test a three-way interaction between sex, familial risk, and time. This three-way interaction was significant ($b = -0.29$, 95% CI −0.56 to −0.01, $p = 0.041$), reflecting a relatively specific increase in depressive symptoms among females at low familial risk (Table 3, Fig. 1).

### Analyses stratified by age, sex, and familial risk

To quantify the impact of the pandemic for subgroups of youth defined by age, sex, and familial risk status, we completed a planned set of stratified analyses. We found an increase in depressive symptoms in younger youth, age 5–14 ($b = 0.12$, 95% CI 0.04 to 0.22, $p = 0.007$) and a slightly larger increase in depressive symptoms in older youth, age 15–25 ($b = 0.23$, 95% CI 0.05 to 0.41, $p = 0.012$). Females experienced a significant increase in depressive symptoms ($b = 0.13$, 95% CI 0.01 to 0.25, $p = 0.036$), while males did not ($b = 0.04$, 95% CI −0.05 to 0.13, $p = 0.356$). We found a significant increase in depressive symptoms in low-risk offspring ($b = 0.19$, 95% CI 0.06 to 0.31, $p = 0.005$). High-risk offspring showed no change in depressive symptoms ($b = 0.02$, 95% CI −0.07 to 0.12, $p = 0.651$). We found that of the low-risk offspring, low-risk female offspring had a greater increase in depressive symptoms ($b = 0.35$, 95% CI 0.14 to 0.56, $p = 0.001$) than low-risk male offspring who had a numerical increase that was not significant ($b = 0.07$, 95% CI −0.08 to

**Table 2.** Effect of COVID-19 on youth depressive symptoms

| | Beta value | 95% confidence interval | | *p* value |
|---|---|---|---|---|
| | | Lower | Upper | |
| Time (during *vs* pre-pandemic) | 0.07 | −0.01 | 0.15 | 0.062 |
| Age (years) | 0.02 | 0.01 | 0.04 | 0.003 |
| Sex | 0.36 | 0.23 | 0.49 | <0.001 |
| Constant | −0.55 | −0.77 | −0.33 | |

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**Table 3.** Effect of COVID-19 on youth depressive symptoms exploring the interaction of age, sex, familial risk status, and time

| | Beta value | 95% confidence interval | | *p* value |
|---|---|---|---|---|
| | | Lower | Upper | |
| Time | 0.12 | 0.04 | 0.21 | 0.005 |
| Age (years) | 0.02 | 0.01 | 0.04 | 0.025 |
| Sex | 0.27 | 0.13 | 0.41 | <0.001 |
| Familial risk | 0.17 | −0.01 | 0.34 | 0.060 |
| Interaction: age and time | 0.11 | −0.03 | 0.26 | 0.134 |
| Interaction: sex and time | 0.28 | 0.13 | 0.41 | <0.001 |
| Interaction: familial risk and time | −0.18 | −0.33 | −0.03 | 0.019 |
| Interaction: sex, familial risk, and time | −0.29 | −0.56 | −0.01 | 0.041 |
| Constant | −0.55 | −0.81 | −0.31 | |

0.21, $p = 0.365$). When examining the combinations of familial risk, sex, and age, we found that older female youth at low familial risk of major mood and psychotic disorders had the greatest increase in depressive symptoms in our cohort ($b = 0.59$, 95% CI 0.10 to 1.08, $p = 0.019$; Fig. 2 and online Supplementary Tables S3–S14).

### *Sensitivity analysis for main result and familial risk results*

We performed a range of sensitivity analyses to probe whether socioeconomic status (SES), living with both biological parents, and restricting analyses to only self-report MFQs impacted both the overall result and the familial risk stratified results. Across all nine sensitivity analyses, the results were within one standard error of the original estimate (please refer to online Supplementary Tables S15–S23 in our Supplementary Materials).

## Interpretation

In a longitudinal study with a high retention rate, we found a small overall increase in youth depressive symptoms during the COVID-19 pandemic that was unevenly distributed across groups defined by sex and familial risk status. Female youth, as predicted, showed a larger increase in depressive symptoms in comparison to male youth. However, contrary to our hypothesis, the increase in depressive symptoms was concentrated in youth at low familial risk and no increase occurred among high-risk youth. Furthermore, we found that low-risk female youth, who do not have parents with a major mental disorder experienced a notably larger increase in depressive symptoms than high-risk female youth who had a parent with a major mental disorder. Our results remained unchanged when accounting for socioeconomic differences between groups.

Our findings should be interpreted within the context of the pandemic in Atlantic Canada. Nova Scotia experienced relatively low rates of COVID-19 infection but imposed restrictions on gatherings, internal travel, and day care and school closures that were among the stricter in the Canadian provinces and territories (Habli, 2022). Similarly tight public health measures have been associated with worsened mental health in Norway (von Soest et al., 2022). In populations with greater COVID-19 infection rates, there are questions about the directionality of COVID-19 infection and depression (Taquet, Luciano, Geddes, & Harrison, 2021). Our cohort provides an opportunity to explore how the pandemic and associated restrictions impacted youth depressive symptoms with minimal potential of COVID-19 infection confounding results.

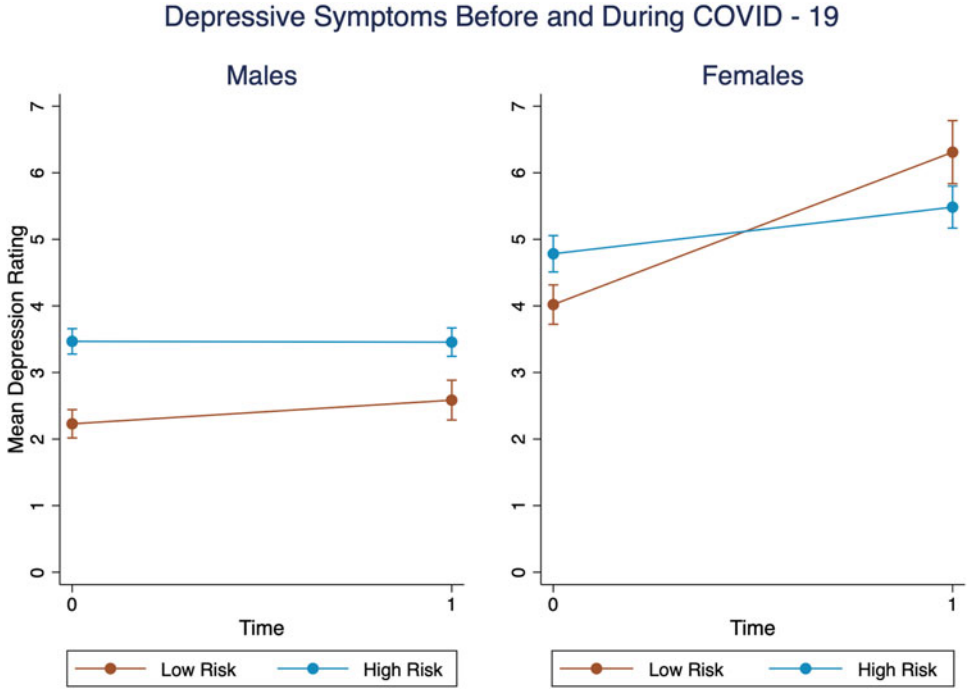


**Figure 1.** Youth depressive symptoms before and during COVID-19 in males and females stratified by familial risk status.

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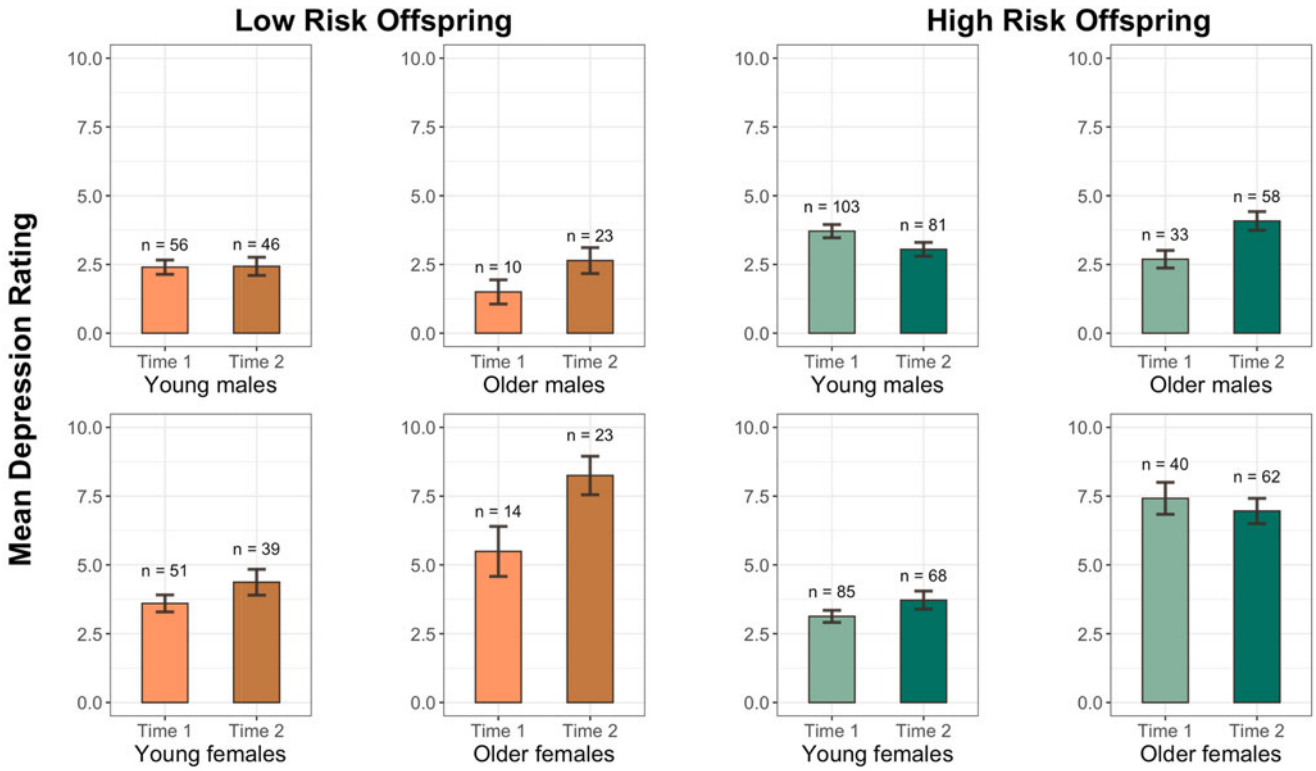


**Figure 2.** Mean youth depressive symptoms stratified by familial risk status, sex, and age group (young refers to participants between the ages of 5–14 and older refers to participants between the ages of 15–25). **n* represents the number of individuals in each bar; many individuals have multiple measurements at different points before and during COVID-19.

Previous studies exploring the relationship between youth depressive symptoms and the pandemic also found greater increases among female youth compared to male youth (Ertanir et al., 2021; Hawes et al., 2021; Liu et al., 2022; Thorisdottir et al., 2021). In our results, it is notable that older male youth had fewer depressive symptoms both at baseline and at follow-up compared to older female youth, consistent with established sex-differences in internalizing symptoms (Nolen-Hoeksema, 2012). Females may be more likely to experience depressive symptoms in response to stressful situations whereas males may experience different forms of mental health impact such as externalizing symptoms (Nolen-Hoeksema, 2012). There is also evidence that throughout the pandemic female adolescents experienced more deterioration in their social relationships in comparison to males (von Soest et al., 2022). Thus, it is possible that the restrictions on activities and limited means for socialization impacted females differently than males.

There is limited evidence on the impact of the pandemic on individuals with major mood and psychotic disorders and we found no published studies exploring the longitudinal impact of the pandemic on offspring of parents with major mood or psychotic disorders. We expected that the pandemic would increase stress for all youth, but that youth who already had an increased familial risk of mental illness would be particularly vulnerable to negative mental health outcomes in response to this stressor. Among individuals with mental illness, there is evidence of worsened mental health as well as evidence of improved or stable mental health throughout the pandemic (Joensen, Danielsen, Andersen, Groot, & Strandberg-Larsen, 2022; Kwong et al., 2021). At baseline, high-risk youth experienced more depressive symptoms than low-risk youth. The level of depressive symptoms in low-risk males remained lower than that of high-risk males during the pandemic. However, in addition to low-risk females experiencing a larger increase in depressive symptoms than high-risk females, older low-risk female adolescents surpassed the level of depressive symptoms high-risk females experienced. A potential explanation for this finding is that the pandemic may have provided high-risk youth and youth already experiencing depressive symptoms a calmer and less challenging environment (Joensen et al., 2022; McKinlay, May, Dawes, Fancourt, & Burton, 2022). Our longitudinal results did not show the predicted deterioration of the mental health of youth living with parents with mental illness throughout the pandemic (Zhou et al., 2021). The lack of increase among youth at high familial risk is not simply a ceiling effects as the range of MFQ scores reaches far above those reported by our participants. This result is reassuring for the mental health of youth living with parents with major mood and psychotic disorders throughout the pandemic. For low-risk female youth, it is possible that they may have experienced increased depressive symptoms in the context of a fear response when exposed to the stress of the pandemic or due to the loss experience of missed social, educational and career opportunities (Joensen et al., 2022).

The present study benefits from the well-characterized FORBOW cohort (Uher et al., 2014). This has allowed for a longitudinal comparison of depressive symptoms using the same measure across the same individuals before and during the pandemic. Our sample benefits from a high follow-up rate as we collected data during the pandemic from 90% of participants who completed assessments in the two years prior to the COVID-19

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pandemic. Even with such a high retention rate, when we explored differences between those with follow-ups and those without, we did note that those without during COVID-19 data were more likely to be female and with slightly higher MFQ scores. This further reinforces the need for high follow-up rates in longitudinal cohorts and highlights the importance of considering who may choose to participate in cross-sectional research and how they may differ from those who do not. Our sample benefits from the inclusion of offspring of parents with depression, bipolar disorder, and schizophrenia. However, our results must be interpreted in the context of two important limitations. First, our sample included fewer participants in the 15–25 age range, which has limited the statistical power of testing interactions between age and time. Stratified analyses did show the largest increase in depressive symptoms in older low-risk females. In the context of unbalanced distribution of participants across age groups, the negative test of age-by-time interaction should be interpreted with caution and may benefit from a re-examination in a larger longitudinal sample with greater number of older youth. Second, most youth at high familial risk were offspring of parents with major depressive or bipolar disorders. Due to a smaller number of offspring of parents with schizophrenia, the extension of the present result to offspring of parents with schizophrenia should also be interpreted with caution. Outside of mood, there are other symptoms including other internalizing and externalizing symptoms, which may be of interest during COVID-19. Current understanding of the impact of COVID-19 would benefit from future research focusing on other psychopathology in addition to depressive symptoms.

The present study found that the pandemic has significantly impacted the mental health of some Canadian youth, while other youth may have experienced stable or improved mental health. The pandemic appears to have disproportionately increased depressive symptoms among female youth. Notably, low-risk female youth experienced the greatest increase in depressive symptoms. Further follow-up of these youth will be instrumental in determining whether this effect will decrease or persist over time. It may be particularly important to further research and consider the social impacts of pandemic restrictions, especially for female youth, if more lockdowns occur in the future. To limit the lingering effects of pandemics and related long-term stressors on mental health, support and interventions should not be limited to established risk groups and must be available to female youth.

**Supplementary material.** The supplementary material for this article can be found at https://doi.org/10.1017/S003329172300257X

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**Competing interests.** The authors have no conflicts of interest to declare.

**Ethical standards.** The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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