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Characterizing and Predicting Canadian Adolescents' Internalizing Symptoms in the First Year of the COVID-19 Pandemic

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To date, most longitudinal studies of adolescents' internalizing symptoms during the COVID-19 pandemic include few time points, limiting knowledge about the long-term course of adolescents' mental health during the pandemic. Moreover, examining intraindividual variability in symptoms, which may have important implications for adolescents' adjustment beyond mean or "typical" symptoms, requires multiple time points. We examined the course of internalizing symptoms in 271 Ontario adolescents (mean $n = 193$ across time points) during the first year of the pandemic (March 2020–April 2021) via mixed-effect location scale models, drawing upon established internalizing symptom risk factors as predictors of mean trends and intraindividual variability. Adolescents' internalizing symptoms were relatively stable and generally low over the first year of the pandemic, with severity peaking in February and April 2021. Girls showed more symptoms on average and greater intraindividual variability in symptoms. Parents' depressive symptoms predicted intraindividual variability in adolescents' anxious and depressive symptoms. Adolescents' symptoms were stable and generally below clinical cutoffs. However, female adolescents and those whose parents experienced more depressive symptoms were most vulnerable to the stress of the pandemic. Implications for intervention and prevention efforts are discussed.

Public Significance Statement
This study investigated adolescents' symptoms of depression and anxiety over the first year of the COVID-19 pandemic. Although most had low, stable symptoms, girls, on average, had greater symptoms than boys and also showed more variability in their symptoms. Adolescents' whose parents had more depressive symptoms also showed more variability in their symptoms.

Keywords: internalizing symptoms, COVID-19, intraindividual variability, adolescent

Supplemental materials: https://doi.org/10.1037/cbs0000381.supp

Background

Disruption from COVID-19-related public health measures has fueled speculation about the pandemic's impact on adolescent mental health (Courtney et al., 2020) for several reasons. First, longitudinal work has found increases both in adolescents' internalizing (De France et al., 2022; Magson et al., 2021) and externalizing symptoms (Cerniglia & Cimino, 2022; Mansfield et al., 2022) during the pandemic. As adolescence is a particularly high-risk time for increases in internalizing (i.e., depressive and anxious) symptoms (Costello et al., 2011; Rapee et al., 2009), the present study focuses on predicting adolescents' internalizing symptoms during the pandemic. In particular, the increased emphasis on peer relationships during adolescence (Orben et al., 2020), the reduction in social contacts, increased strain in relationships with friends (Ravens-Sieberer et al., 2021), and increased conflict with parents (Kapetanovic et al., 2021; Magson et al., 2021) experienced by youth during the pandemic may increase vulnerability for depression and anxiety. Early cross-sectional studies supported speculation about negative associations between the pandemic and adolescent internalizing symptoms. In two studies, almost half of the Chinese adolescents met cutoffs for depression (Qi et al., 2020) and anxiety (Zhou et al., 2020) in March 2020. Similarly, up to half of adolescents in samples from North America, Europe, and South America reported clinically significant internalizing symptoms in

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March–May 2020 (Craig et al., 2022; Ellis et al., 2020; Hawes et al., 2021; Rios-González & Palacios, 2020).

While these cross-sectional findings show elevated adolescent internalizing symptoms early in the pandemic, longitudinal studies are needed to determine the pandemic's longer term impact on mental health. To date, short-term longitudinal studies that collected pre- and peripandemic data from approximately Spring–Fall 2020 have reported increases in internalizing symptoms. For example, a study combining samples of adolescents from the United States, the Netherlands, and Peru who were assessed between 2015 and 2019 and again between March and August 2020 found increases in depressive, but not anxious, symptoms (Barendse et al., 2022). Icelandic adolescents first assessed in 2016 or 2018 showed increases in depressive symptoms in October 2020, with girls reporting particularly strong increases relative to boys (Thorisdottir et al., 2021). Another 2-time-point study of Australian 13- to 16-year-olds assessed throughout 2019 and again in May 2020 also found increases in anxiety and depression (Magson et al., 2021). Finally, in a 5-time-point Canadian study, adolescents' internalizing symptoms were higher during the pandemic than predicted based on prepandemic symptom trajectories (De France et al., 2022). Compared to studies examining changes in adolescents' internalizing symptoms from prepandemic to during the pandemic, fewer studies to date have examined changes in adolescents' internalizing symptoms over the course of the pandemic. However, one study of German 7- to 17-year-olds assessed from May 2020 to October 2021 found internalizing symptom increases between May–June 2020 and December 2020–January 2021, with slight declines between the latter time point and September–October 2021 (Ravens-Sieberer et al., 2022). A U.S. study assessing adolescents in March 2020 and again in May 2020 also found increased anxious symptoms in boys and girls and increased depressive symptoms in girls (Hawes et al., 2021). Taken together, these studies suggest that the pandemic has contributed to increases in adolescent internalizing symptoms.

However, many studies to date have included only a few time points, limiting fine-grained examination of the course of adolescents' internalizing symptoms across longer time spans. A small number of time points also precludes investigators from examining intraindividual variability in internalizing symptoms (Hedeker et al., 2008; Shiffman et al., 2008), which may have implications for adjustment beyond mean symptoms (Maciejewski et al., 2014; Neumann et al., 2011). For example, intraindividual variability in depressive symptoms has predicted suicide risk in adolescents with parents with mood disorders (Melhem et al., 2019). Additionally, intraindividual variability in negative affect has been concurrently (Koval et al., 2013; Nelis & Bukowski, 2019) and prospectively (Maciejewski et al., 2014; Neumann et al., 2011) associated with adolescents' internalizing symptoms. Intraindividual variability in negative emotions, which include internalizing symptoms, such as sadness and fear, may reflect difficulties with emotion regulation (Kim-Spoon et al., 2013). Consistent with this idea, poor emotion regulation, defined as limited capacity to modulate one's emotional arousal to facilitate adaptive behaviour in stressful or emotionally arousing situations (Eisenberg et al., 2010), has been linked to greater variability in both negative affect and internalizing symptoms (Kim-Spoon et al., 2013; Silk et al., 2003). Accordingly, adolescents who are less adept at regulating their emotions when exposed to pandemic-related stress may experience greater intraindividual variability in their internalizing symptoms.

Predicting Individual Variation in Internalizing Symptoms During the COVID-19 Pandemic

Sex, socioeconominc status (SES), and parents' internalizing symptoms may all predict adolescent internalizing symptoms during the pandemic. Around puberty onset, girls become more vulnerable to developing depressive symptoms than boys (Costello et al., 2011), and childhood sex differences in anxiety (i.e., higher anxiety in girls) increase through early adolescence (Roza et al., 2003). Several contextual factors likely contribute to sex differences in internalizing symptoms. Compared to boys, girls are more likely to experience sexual assault and abuse (Finkelhor et al., 2014), experiences associated with internalizing symptoms (Dworkin, 2020). More broadly, links between internalizing symptoms and stressful interpersonal events (e.g., family conflict, romantic breakups) may be particularly strong for adolescent girls (Rudolph, 2002). Accordingly, stressful interpersonal events related to restricted peer contact and increased time with family during the pandemic may contribute to isolation and relationship strain, which may pose particular risk for internalizing symptoms in adolescent girls.

Low SES is another established predictor of adolescent internalizing symptoms (McNeilly et al., 2021), including during the pandemic. A large March 2020 study found that lower parental education predicted general mental health concerns in youth (Li et al., 2021), while another study found that youths with parents with less education reported greater anxiety symptoms and general mental health problems during the pandemic (Ravens-Sieberer et al., 2021). Finally, parental anxiety and depression are also well-established risk factors for internalizing disorders in offspring (Burstein et al., 2010; Rapee et al., 2009; Weissman et al., 2016), with vulnerability likely stemming from both heritable (Bolton et al., 2006) and environmental (Hicks et al., 2009) factors. While parental depression and anxiety are respectively associated with offspring depression and anxiety (McClure et al., 2001; Weissman et al., 2016), parental depression has also predicted offspring anxiety (Lieb et al., 2000), and parental anxiety has predicted offspring depression (Burstein et al., 2010). During the pandemic, parents' and adolescents' internalizing symptoms have been associated concurrently (Black et al., 2021; Khoury et al., 2021) and prospectively (Lorenzo et al., 2021).

The Present Study

To date, longitudinal studies indicate increases in adolescents' internalizing symptoms during the pandemic (Barendse et al., 2022; De France et al., 2022; Magson et al., 2021; Ravens-Sieberer et al., 2022; Thorisdottir et al., 2021). However, relatively few studies have examined internalizing symptoms at more than two time points, providing "snapshots" of adolescents' internalizing symptoms but not the "film" (Shiffman et al., 2008), limiting our understanding of long-term trajectories of adolescents' depressive and anxious symptoms during the pandemic. Moreover, longitudinal studies with few time points cannot examine intraindividual symptom variability. We addressed these gaps and provided novel information concerning Canadian adolescents' mental health over the first year of the pandemic by examining sex, SES, and parents' internalizing

symptoms as predictors of mean trends and intraindividual variability in adolescents' internalizing symptoms.

Canadian adolescents and parents completed biweekly internalizing symptom questionnaires online from March 2020 to April 2021, resulting in 21 time points. This detailed assessment strategy allowed us not only to describe adolescents' internalizing symptoms in the first year of the pandemic but also to use mixed-effect location scale models (MELSMs; Hedeker et al., 2008; McNeish, 2021; described below) to examine established risk factors as predictors of mean trends and intraindividual variability in adolescents' internalizing symptoms. We hypothesized that female adolescents and adolescents with lower SES would show greater mean symptoms. While far less is known about associations between these variables and intraindividual symptom variability, we tentatively hypothesized that sex and SES would predict intraindividual variability in adolescents' symptoms as well, given prior links between intraindividual variability in negative affect and internalizing symptoms (Kim-Spoon et al., 2013; Maciejewski et al., 2014; Nelis & Bukowski, 2019) and between symptom variability and suicidality (Melhem et al., 2019). Consistent with studies finding associations between parental depression and both anxiety and depression in offspring (Lieb et al., 2000; Weissman et al., 2016), along with associations between parental anxiety and offspring anxiety and depression (Burstein et al., 2010; McClure et al., 2001), we expected that parents' internalizing symptoms would predict mean trends in adolescents' symptoms. As previous work on intraindividual variability is limited, we did not formulate strong hypotheses regarding associations between parents' internalizing symptoms and intraindividual variability in adolescents' internalizing symptoms.

Materials and Method

Participants

Participants were community families originally recruited in 2008–2010 for a longitudinal study of children's emotional development. At baseline, eligible children were 3 years old (M_{age} = 3.43 years, SD = 0.30), lived with at least one biological parent available to participate, and had no medical or psychological conditions that would prevent them from completing study measures. The baseline sample included 409 children (201 boys) and caregivers (382 mothers, 27 fathers). At age 5 (M_{age} = 5.49 years, SD = 1.58), 379 families completed additional assessments, including a short SES measure (see below).

At pandemic onset in March 2020, the 395 families remaining in the cohort were invited to complete biweekly self-report measures of internalizing symptoms online from March 2020 to April 2021, with pauses from July to September 2020 and November to January 2021 to minimize burden, for a total of 21 time points. These periods were selected because COVID-19 prevalence and public health restrictions were relatively stable from July to September 2020 (*Ontario COVID-19 Data Tool*, 2022) and to provide participants respite from data collection during the winter holidays from November 2020 to January 2021. A total of 285 adolescent–parent dyads participated during at least one time point. Adolescents were approximately 14 years old (M_{age} = 14.16, SD = .67; 132 boys) and primarily White (94%; 0.4% Black, 1.8% Asian, 2.1% Hispanic/Latino, and 2.1% identified their race as other). Families were largely middle-high income (2.5% < $20,000/year; 11.1% $20,000–$40,000/year; 19.3% $40,001–$70,000; 27.1% $70,001–$100,000; 40% > $100,000). On average, n = 193 adolescents (range = 56[1]–223) and n = 204 parents [range = 49 (see footnote 1)–236] participated per time point. Adolescents completed an average of 14 time points (SD = 6), and parents completed 15 (SD = 6) time points on average.

Adolescents who participated at any time point did not differ on sex, race, or SES from adolescents who did not participate (lowest p = .09); parents who participated at any time point did not differ on SES from parents who did not participate (p = .40). Number of time points completed was uncorrelated with race, sex, age, or SES for adolescents (lowest p = .24). SES was unrelated to parents' number of time points completed (p = .63). Before participating, parents provided informed consent, and adolescents provided assent. Participants were informed they could withdraw from the study at any time or choose not to complete individual items, questionnaires, or time points. Mental health resources were shared with all participants. This study was approved by the ethics review board of the first author's institution.

Measures

SES

When children were 5 years old, parents completed items querying family income and parental education. The family income item asked the primary caregiver to indicate their family's total income from: less than $20,000/year; $20,000–$40,000/year; $40,001–$70,000/year; $70,001–$100,000/year; and more than $100,000/year. The education items asked both parents to indicate their highest education level: less than eighth grade, some high school, high school graduate/General Education Development, some college or 2-year degree, bachelor's/4- to -5-year degree, master's degree, and doctoral degree. Family income, maternal education, and paternal education were transformed to z-scores and averaged to create an SES composite, consistent with other studies using SES as a predictor (Steenland et al., 2004).

Internalizing Symptoms During the COVID-19 Pandemic

Adolescents completed the Anxious/Depressed and Withdrawn/Depressed subscales of the Youth Self-Report (YSR-AD and YSR-WD, respectively; Achenbach & Rescorla, 2001). Parents completed the Patient Health Questionnaire–9 (PHQ-9; Kroenke et al., 2001) to assess depressive symptoms and the Generalized Anxiety Disorder Scale–7 (GAD-7; Spitzer et al., 2006) to assess anxious symptoms. Psychometric information for all symptom measures can be found in the supplemental materials (supplement B).

Data Analysis Plan

MELSMs

MELSMs model intraindividual variability ("scale") as a function of predictors as well as how mean values of the outcome ("location")

[1] One data collection time point (May 19, 2020, to May 31, 2020) had a very small sample size (n = 56 adolescents; 49 parents) due to a change in data collection procedures. Prior to late May 2020, participants were assigned individualized 2-week windows in which to complete questionnaires, based on the date they began the study. Beginning in late May 2020, all participants were assigned the same 2-week window to complete questionnaires.

change based on predictors (Hedeker et al., 2008). Location and scale are modelled as two dependent variables in the same model, with intraindividual variability modelled with a log-linear submodel. Via Bayesian Markov chain Monte Carlo modelling in Mplus 8.7 (Muthén & Muthén, 2017), MELSMs estimated mean trends and intraindividual variability in YSR-AD and -WD scores from adolescent sex, SES, and parents' internalizing symptoms during the pandemic (McNeish, 2021). Adolescents were Level 2 units, with symptoms nested within individuals. Parents' PHQ-9 and GAD-7 scores during the pandemic were individual-mean-centred, Level 1 variables. Sex and SES were Level 2 predictors. Mean parental PHQ-9 and GAD-7 scores for each individual adolescent–parent dyad were grand-mean-centred Level 2 predictors. Because location scale models require data from multiple time points, adolescents who participated at only one time point ($n = 13$) and one parent–adolescent dyad in which the adolescent did not complete any time points were excluded from analyses, for a total of $N = 271$ adolescents included in analyses. Adolescents who completed more than one time point did not differ from adolescents who were excluded from analyses in terms of age, sex, race, or SES (lowest $p = .32$).

Results

Descriptive Statistics

Adolescents' internalizing symptoms were generally stable from March 2020 to April 2021, with peaks on the YSR-AD subscale in September 2020 and January 2021 for girls[2] (Figure 1). Similarly, YSR-WD scores showed a peak in January 2021 for girls. These peaks coincided with the start of the first full academic year during the pandemic in September 2020 and the beginning of Ontario's second stay-at-home order in January 2021. From March 2020 to April 2021, most adolescents scored below clinical thresholds (75%–90% below threshold on the YSR-AD subscale and 77%–90% below threshold on the YSR-WD subscale). Excluding the May 4, 2020, time point at which a very small sample of adolescents participated ($n = 56$), the time points during which the most adolescents scored in the clinical range on the YSR-WD subscale were the time points beginning February 15, 2021, and March 29, 2021 (12% at both). The highest percentage of adolescents scored in the clinical range on the YSR-AD subscale during the time point beginning on February 15, 2021 (13%). Severity peaks in February 2021 may be related to Ontario's second stay-at-home order, which was extended in mid-February 2021. Similarly, spring vacation from school was postponed during the time point beginning on March 29. Finally, peak symptom severity was calculated by examining the frequencies of each adolescent's highest symptom severity across all 21 time points. During at least one time point, 22% of adolescents scored in the clinical range on the YSR-AD subscale, while 19% scored in the clinical range on the YSR-WD subscale at least once. Percentages of adolescents meeting clinical cutoffs at all 21 time points are presented in supplemental Table 1.

Table 1 presents mean correlations between adolescent and parent symptoms and demographic variables, aggregated across all 21 time points. Adolescent age in March 2020 was modestly positively correlated with adolescents' anxious (mean $r = .17$, mean $p = .03$, range = .13–.23) and depressive symptoms (mean $r = .18$, $p = .03$, range = .10–.24). Girls reported more anxious (mean $r = .31$, mean $p = .01$, range = .23–.37) and depressive symptoms (mean $r = .22$, mean $p = .05$, range = .04–.29; sex was coded male = 0, female = 1).

MELSMs

Adolescent sex, SES, parents' PHQ-9 scores, and parents' GAD-7 scores were simultaneously added as predictors in separate models predicting adolescents' YSR-AD and -WD scores. Predictors that predicted either intraindividual variability or mean trends were retained in final versions of each model. SES did not predict mean trends or intraindividual variability in adolescents' internalizing symptoms, likely due to restricted range (see discussion). It was therefore dropped from final models.

MELSMs—Adolescents' Anxious Symptoms

In the final model predicting adolescents' anxious symptoms (Table 2), girls showed higher "typical" anxiety than boys ($\gamma_{01} = 3.42$, 95% CI [2.32, 4.53]), as well as greater intraindividual variability in anxious symptoms ($\omega_1 = 1.25$, 95% CI [0.77, 1.74]). As parents' individual mean depressive symptoms increased, intraindividual variability in adolescents' anxious symptoms increased ($\omega_2 = 0.10$, 95% CI [0.05, 0.16]). In contrast to hypotheses, parents' depressive and anxious symptoms did not predict mean trends in adolescents' anxious symptoms ($\gamma_{03} = 0.02$, 95% CI [−0.26, 0.28] for PHQ-9; $\gamma_{04} = 0.23$, 95% CI [−0.06, 0.53] for GAD-7), and parents' anxious symptoms did not predict intraindividual variability in adolescents' anxious symptoms ($\omega_3 = -0.11$, 95% CI [−0.26, 0.03]).

MELSMs—Adolescents' Depressive Symptoms

In the final model predicting adolescents' depressive symptoms (Table 3), girls had greater depressive symptoms, on average, than boys ($\gamma_{01} = 1.67$, 95% CI [0.92, 2.42]). Girls also showed higher intraindividual variability in symptoms ($\omega_1 = 0.67$, 95% CI [0.21, 1.16]). Parents' internalizing symptoms did not predict mean trends in adolescents' depressive symptoms ($\gamma_{03} = 0.11$, 95% CI [−0.07, 0.27] for PHQ-9; $\gamma_{04} = 0.07$, 95% CI [−0.11, 0.27] for GAD-7). As parents' individual mean depressive symptoms increased, intraindividual variability in adolescents' depressive symptoms increased ($\omega_2 = 0.21$, 95% CI [0.11, 0.31]). Contrary to expectations, as parents' individual mean anxious symptoms increased, intraindividual variability in adolescents' depressive symptoms decreased ($\omega_3 = -0.22$, 95% CI [−0.33, −0.11]).

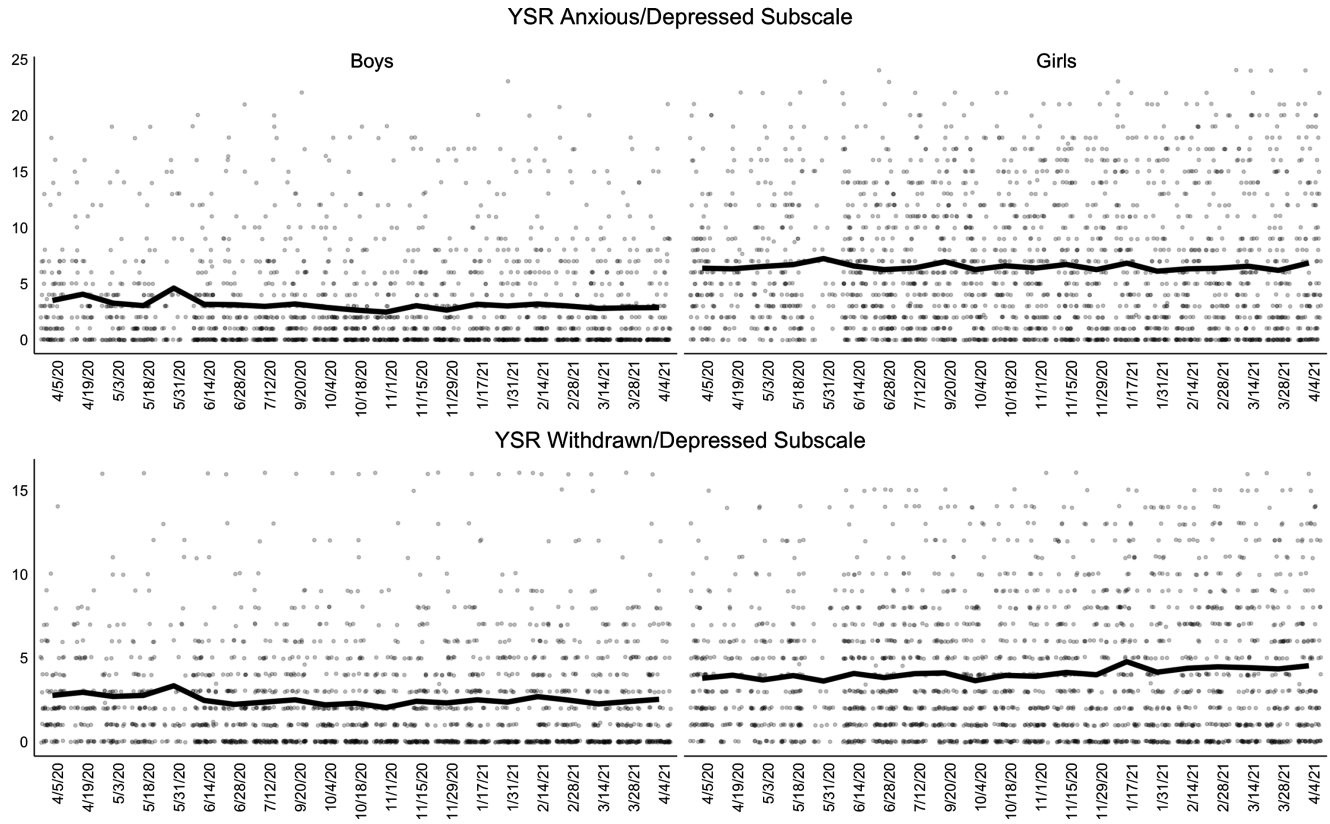
Discussion

Although extant longitudinal studies of adolescent mental health during the pandemic suggest that adolescents' internalizing symptoms increased early in the pandemic (Barendse et al., 2022; De France et al., 2022; Hawes et al., 2021), relatively few studies have included more than two time points of data collected during the pandemic

[2] For boys' scores on both YSR subscales and girls' YSR-AD scores, Figure 1 shows a peak during the May 19, 2020, to May 31, 2020, time point. Given the small sample size at this time point ($n = 56$), it is likely that these data are not representative of the full sample or Ontario adolescents generally. There were no drastic changes in COVID-19 rates (Ontario COVID-19 Data Tool, 2022) or public health restrictions at this time point, suggesting that a more general, steep increase in youth maladjustment was unlikely at that time. Accordingly, we speculate that the small sample size may have yielded a spuriously high estimate.

Figure 1

Raw Adolescent YSR-AD and YSR-WD Scores From March 2020 to April 2021



Note. These scatterplots present raw YSR scores, with lines representing mean symptoms. For boys' scores on both subscales and girls' YSR-AD scores, peaks appear during the May 19, 2020, to May 31, 2020, time point. Given the small sample size at this time point ($n = 56$), it is likely that these data are not representative of the full sample or Ontario adolescents generally. There were no drastic changes in COVID-19 rates (Ontario COVID-19 Data Tool, 2022) or public health restrictions at this time point, suggesting that a more general, steep increase in youth maladjustment was unlikely at that time. Accordingly, we speculate that the small sample size may have yielded a spuriously high estimate. YSR-AD = Youth Self-Report–Anxious/Depressed subscale; YSR-WD = Youth Self-Report–Withdrawn/Depressed subscale.

(with Ravens-Sieberer et al., 2022 as a notable exception), limiting conclusions about long-term trajectories of adolescents' mental health during the COVID-19 pandemic. Additionally, longitudinal studies with few time points are not well equipped to examine intraindividual symptom variability. We addressed these gaps by examining sex, SES, and parents' internalizing symptoms as predictors of mean trends and intraindividual variability in adolescents' internalizing symptoms over the first year of the pandemic.

From March 2020 to April 2021, most adolescents (75%–90%) scored below clinical thresholds on measures of internalizing symptoms. These stable, low-level symptoms are consistent with some studies finding no change in adolescents' symptoms during the pandemic (van der Laan et al., 2021) but contrast with speculation about the pandemic's significant negative mental health impact (Courtney et al., 2020; Golberstein et al., 2020). Although local case counts compared to the settings of other studies may have contributed to generally lower symptom severity (*Ontario COVID-19 Data Tool*, 2022), social isolation and relationship strain have been proposed to drive increasing adolescent internalizing symptoms (De France et al., 2022; Golberstein et al., 2020). Although it is important to note that the pandemic is still unfolding and adolescents' internalizing symptoms likely showed further change after April 2021, our results do not suggest pervasive increases in internalizing symptoms over the first year of the pandemic. Instead, our results are consistent with the notion that most adolescents' internalizing symptoms were low and stable during exposure to restrictive public health measures and other aspects of the pandemic, but some adolescents were more vulnerable to developing internalizing symptoms in the context of specific risk factors (i.e., female sex and parents' depressive symptoms).

In line with hypotheses, girls had greater internalizing symptoms and greater intraindividual variability in internalizing symptoms than boys. This finding is consistent with sex differences in internalizing disorder prevalence in adolescence (Costello et al., 2011) but also provides novel information regarding sex differences in intraindividual variability in symptoms. Past work suggests that even in the absence of elevated symptoms, comparatively high intraindividual symptom variability nevertheless indicates risk for maladaptive outcomes, such as suicidality (Koval et al., 2013; Melhem et al., 2019). While far less is known about associations between intraindividual symptom variability and long-term outcomes, interpersonal stressors likely to be experienced by adolescents during the pandemic (e.g., reduced social contacts and interpersonal

Table 1
Descriptive Statistics and Correlations Among Study Variables

Variable	*M* (*SD*)/%	1	2	3	4	5	6	7
1. Adolescent age (March 2020)	14.16 (.67)	—						
2. Sex (% male)	46%	.14*	—					
3. Race (% White)	94%	.13*	.10	—				
4. SES	.11 (2.43)	−.01	.02	−.01	—			
5. YSR-AD	4.90 (5.51)	.17* (.13, .23*)	.31* (.23, .37**)	.05 (−.11, .16)	−.09 (−.18, −.01)	—		
6. YSR-WD	3.35 (3.65)	.18* (.10, .24**)	.22† (.04, .29**)	.02 (−.16, .13)	−.13 (−.21*, −.02)	.80** (.67**, .87**)	—	
7. PHQ-9	3.51 (4.43)	.02 (−.08, .10)	−.02 (−.11, .08)	.04 (−.09, .12)	−.21* (−.47**, −.08)	.12 (−.01, .28)	.18 (.09, .24**)	—
8. GAD-7	3.52 (4.05)	.02 (−.11, .14*)	−.01 (−.13, .18)	.08 (−.03, .16*)	−.16 (−.50**, −.02)	.14 (.01, .30†)	.16 (.06, .28**)	.78** (.63**, .86**)

Note. For symptom measures collected across the first year of the COVID-19 pandemic (March 2020–April 2021), mean correlations are presented, with ranges in parentheses. Sex was coded 0 = male, 1 = female. Because the sample is 94% White, race was coded 0 = White, 1 = non-White. The SES variable was created by transforming variables reflecting maternal and paternal education and family income to *z*-scores, then averaging. Higher values indicate higher SES. SES = socioeconomic status; YSR-AD = Youth Self-Report–Anxious/Depressed; YSR-WD = Youth Self-Report–Withdrawn/Depressed; PHQ-9 = Patient Health Questionnaire–9; GAD-7 = Generalized Anxiety Disorder Scale–7.
* $p < .05$. ** $p < .01$. † $p = .05$.

relationship strain; Kapetanovic et al., 2021; Magson et al., 2021) may render adolescent girls particularly vulnerable to experiencing intraindividual variability in internalizing symptoms (Hammen & Brennan, 2003; Rudolph, 2002). Prospective associations between interpersonal stress measured more directly and internalizing symptom variability will be important for future research to consider.

Contrary to established links between SES and internalizing symptoms (McNeilly et al., 2021), SES did not predict mean trends or intraindividual variability in adolescents' internalizing symptoms. Because our sample is largely middle-high income, it is likely that this restriction of range partially contributed to the lack of association between SES and internalizing symptoms. Additionally, compared to lower SES families, middle-high-income families like those in the current sample are also less likely to experience pandemic-related financial stress (Li et al., 2021), which likely increases vulnerability for internalizing symptoms (Wadsworth et al., 2005). Although the present study did not assess financial strain, the likely low financial strain experienced by most families in our sample probably also contributed to the lack of associations between SES and adolescents' internalizing symptoms.

As parents' depressive symptoms increased, intraindividual variability in adolescents' anxious and depressive symptoms increased. Given links between intraindividual variability in internalizing symptoms and negative emotions (Koval et al., 2013; Nelis & Bukowski, 2019), this finding suggests that adolescents with parents with elevated depressive symptoms may have comparatively poor emotion regulation capabilities (Kim-Spoon et al., 2013; Naragon-Gainey et al., 2018) and were at particular risk for fluctuations in internalizing symptoms over the first year of the COVID-19 pandemic. Links between adolescent internalizing symptom variability and parents' depressive symptoms are likely attributable to both heritable (Ford et al., 2014) and psychosocial factors (Cui et al., 2014; Kim et al., 2014). Interventions targeted to youth with parental histories of depression may be improved by addressing emotion regulation (Kennedy et al., 2019), as use of emotion regulation strategies has been linked to less strong associations between maternal depression and youth internalizing problems (Monti & Rudolph, 2017; Silk et al., 2006).

Contrary to hypotheses, parents' anxious symptoms did not predict intraindividual variability in adolescents' anxious symptoms. In contrast, as parents' anxious symptoms increased, intraindividual variability in adolescents' depressive symptoms decreased. While far less is known about the predictors of internalizing symptom variability compared to predictors of mean symptoms, both of these findings were somewhat unexpected. With a mean of $n = 144$ parents reporting anxious symptoms below clinical thresholds across time points, it is possible that parents with subthreshold anxious symptoms were more likely to exert control over the home environment through enforcing adolescents' adherence to structured daily routines and activities, which could stabilize adolescents' depressive symptoms (Cohodes et al., 2021). However, if this is the case, it is unclear why this association was not observed between parents' anxious symptoms and adolescents' intraindividual variability in anxious symptoms. Future work should attempt to replicate these findings to determine if these associations are spurious or potentially point to a unique link between parents' anxious symptoms and intraindividual variability in adolescents' depressive symptoms.

Additionally, parents' individual mean internalizing symptoms did not predict mean trends in adolescents' anxious or depressive

Table 2

Sex, SES, and Parents' Internalizing Symptoms Predicting Mean Trends and Intraindividual Variability in Adolescents' Anxious Symptoms From March 2020 to April 2021

Parameters	Full model	Retained in final model?	Final model
Location fixed effects			
Intercept	3.19 [2.35, 4.01]		3.18 [2.41, 3.99]
Sex	3.43 [2.30, 4.61]	✓	3.42 [2.32, 4.53]
SES	−0.15 [−0.37, 0.08]		
Parent PHQ-9 (individual means)	0.02 [−0.26, 0.28]		
Parent GAD-7 (individual means)	0.23 [−0.06, 0.53]		
Location random effect covariance structure			
Intercept	20.89 [17.49, 24.95]		21.66 [18.01, 26.11]
Parent PHQ-9	0.01 [0.01, 0.03]		0.02 [0.01, 0.04]
Parent GAD-7	0.01 [0.002, 0.02]		
Corr (intercept, PHQ-9)	−0.40 [−0.65, −0.13]		−0.41 [−0.61, −0.18]
Corr (intercept, GAD-7)	−0.21 [−0.52, 0.09]		
Scale fixed effects			
Intercept	−0.15 [−0.50, 0.20]		−0.12 [−0.46, 0.25]
Sex	1.27 [0.77, 1.75]	✓	1.25 [0.77, 1.74]
SES	−0.03 [−0.13, 0.07]		
Parent PHQ-9 (individual means)	0.23 [0.11, 0.35]	✓	0.10 [0.05, 0.16]
Parent GAD-7 (individual means)	−0.11 [−0.26, 0.03]		
Scale random effect covariance structure			
Intraindividual variance	3.80 [3.20, 4.55]		3.79 [3.17, 4.59]
Corr (intercept, scale variance)	0.49 [0.38, 0.59]		0.48 [0.37, 0.57]
Corr (PHQ-9, scale variance)	−0.14 [−0.34, 0.06]		−0.07 [−0.25, 0.11]
Corr (GAD-7, scale variance)	0.02 [−0.20, 0.26]		
Model summary			
R^2 (mean trends in YSR-AD)	0.09 [0.05, 0.17]		0.06 [0.03, 0.11]
R^2 (intraindividual variability in YSR-AD)	0.15 [0.07, 0.28]		0.07 [0.03, 0.11]

Note. Posterior median estimates are presented for each parameter. 95% credible intervals are included in brackets. To interpret loglinear, multiplicative scale effects, estimates can be exponentiated and multiplied by the exponentiated scale intercept; for example, the scale intercept = −0.12; exp (−0.12) = 0.89; posterior median of the effect of sex on intraindividual variability = 1.25; exp (1.25) = 3.49; 3.49 × 0.89 = 3.11. GAD-7 = Generalized Anxiety Disorder Scale–7; PHQ-9 = Patient Health Questionnaire–9; SES = socioeconomic status; YSR-AD = Youth Self-Report–Anxious/Depressed.

symptoms. Because both outcomes were estimated in the same model, stronger relations between parents' individual mean symptoms and adolescent intraindividual variability, compared to mean trends in adolescents' symptoms, may have rendered associations with adolescents' mean symptoms nonsignificant. Consistent with this notion, supplemental analyses predicting adolescents' symptoms using a "buildup" approach, with predictors added one at a time and nonsignificant predictors dropped, found that parents' symptoms were sometimes related to mean trends in adolescents' symptoms, but not after other predictors were added. While current findings suggest stronger associations between parents' symptoms and adolescent symptom variability, future work should compare model-building approaches to elucidate reliable predictors of mean trends and intraindividual variability in adolescents' internalizing symptoms.

Associations between parents' symptoms and adolescents' intraindividual symptom variability suggest meaningful links between parents' and adolescents' symptoms. Although the focus of the present study was on predicting adolescents' symptoms, supplementary analyses found that as adolescents' individual mean depressive symptoms increased, parents' depressive symptoms increased ($\gamma_{03} = 0.29$, 95% CI [0.05, 0.53]). These findings suggest reciprocal associations between family members' symptoms and that family-level factors may contribute to both parents' and adolescents' symptoms (Epkins & Harper, 2016; Nomura et al., 2002). Interventions targeting adolescents' symptoms may be bolstered by addressing family processes, consistent with research demonstrating the efficacy of family-based interventions (Compas et al., 2015; Perrino et al., 2016).

This study is among the first to examine adolescent internalizing symptoms over the first year of the pandemic; additionally, the 21 repeated measures in this study allowed us to examine predictors of both mean trends and intraindividual variability in internalizing symptoms, which results suggest may be equally relevant to understanding the mental health impact of the pandemic. However, this study also has limitations. We were unable to examine race as a predictor due to the low diversity of the sample (94% White), an important limitation given the pandemic's disproportionate impact on people of colour (Abedi et al., 2021). Similarly, our sample does not represent the full range of SES, and we did not examine financial strain during the pandemic, which likely contributed to internalizing symptoms. Moreover, the generalizability of the current findings to other regions with varying public health restrictions and case counts is unclear. Future studies should examine long-term trajectories of internalizing symptoms in more diverse samples. Additionally, although the internalizing symptoms observed in this study may be partly attributable to the stress of the pandemic, it is not possible to test this claim without assessing COVID-19-related stress or prepandemic symptoms. Relatedly, we did not assess other experiences that could have contributed to adolescents' internalizing symptoms, including experiences of sexual assault and abuse, which are more prevalent in adolescent girls (Finkelhor et al., 2014) and could have

Table 3
Sex, SES, and Parents' Internalizing Symptoms Predicting Mean Changes and Intraindividual Variability in Adolescents' Depressive Symptoms From March 2020 to April 2021

Parameters	Full model	Retained in final model?	Final model
Location fixed effects			
Intercept	2.49 [1.97, 3.02]		2.51 [1.94, 3.07]
Sex	1.70 [0.93, 2.48]	✓	1.67 [0.92, 2.42]
SES	−0.11 [−0.26, 0.05]		
Parent PHQ-9 (individual means)	0.11 [−0.07, 0.27]		
Parent GAD-7 (individual means)	0.07 [−0.11, 0.27]		
Location random effect covariance structure			
Intercept	9.03 [7.56, 10.76]		9.62 [8.09, 11.54]
Parent PHQ-9	0.01 [0.004, 0.01]		0.01 [0.004, 0.01]
Parent GAD-7	0.002 [0.001, 0.004]		0.001 [0.001, 0.003]
Corr (intercept, PHQ-9)	−0.26 [−0.51, −0.05]		−0.30 [−0.52, −0.05]
Corr (intercept, GAD-7)	−0.16 [−0.59, 0.24]		−0.002 [−0.45, 0.45]
Scale fixed effects			
Intercept	−0.38 [−0.72, −0.06]		−0.37 [−0.73, −0.04]
Sex	0.70 [0.22, 1.18]	✓	0.67 [0.21, 1.16]
SES	−0.06 [−0.16, 0.03]		
Parent PHQ-9 (individual means)	0.25 [0.14, 0.37]	✓	0.21 [0.11, 0.31]
Parent GAD-7 (individual means)	−0.21 [−0.35, −0.08]	✓	−0.22 [−0.33, −0.11]
Scale random effect covariance structure			
Intraindividual variance	3.50 [2.95, 4.18]		3.61 [3.00, 4.32]
Corr (intercept, scale variance)	0.52 [0.41, 0.61]		0.53 [0.44, 0.63]
Corr (PHQ-9, scale variance)	−0.004 [−0.23, 0.18]		−0.03 [−0.22, 0.16]
Corr (GAD-7, scale variance)	−0.08 [−0.35, 0.19]		0.01 [−0.28, 0.28]
Model summary			
R^2 (mean trends in YSR-AD)	0.07 [0.03, 0.13]		0.04 [0.01, 0.07]
R^2 (intraindividual variability in YSR-AD)	0.19 [0.07, 0.33]		0.15 [0.06, 0.27]

Note. Posterior median estimates are presented for each parameter, with exponentiated estimates for scale effects are included in parentheses. 95% credible intervals are included in brackets. To interpret loglinear, multiplicative scale effects, estimates can be exponentiated and multiplied by the exponentiated scale intercept; for example, the scale intercept = −0.37; exp (−0.37) = 0.69; posterior median of the effect of sex on intraindividual variability = 0.67; exp (0.67) = 1.95; 1.95 × 0.69 = 1.35. GAD-7 = Generalized Anxiety Disorder Scale–7; PHQ-9 = Patient Health Questionnaire–9; SES = socioeconomic status; YSR-AD = Youth Self-Report–Anxious/Depressed.

influenced associations between female sex and greater average and intraindividual variability in symptoms. Given that individual differences in emotion regulation likely influence symptom variation (Kim-Spoon et al., 2013), future studies should integrate measures of adolescent self-regulation. Finally, the pandemic is ongoing, and future studies should continue examining the pandemic's long-term impact on adolescent mental health. Some adolescents—particularly adolescent girls and those with parents with depressive symptoms—may be at particular risk and benefit most from intervention. Future work should identify protective factors to improve intervention and prevention efforts.

Résumé

À ce jour, la plupart des études longitudinales sur les symptômes d'intériorisation des adolescents pendant la pandémie de COVID-19 comprennent peu de points dans le temps, ce qui limite les connaissances sur l'évolution à long terme de la santé mentale des adolescents pendant la pandémie. De plus, l'examen de la variabilité intra-individuelle des symptômes, qui peut avoir des implications importantes pour l'adaptation des adolescents au-delà des symptômes moyens ou « typiques », nécessite plusieurs points dans le temps. Nous avons examiné l'évolution des symptômes d'intériorisation chez 271 adolescents de l'Ontario (n = 193 en moyenne sur l'ensemble des points temporels) au cours de la première année de la pandémie (mars 2020 à avril 2021) à l'aide de modèles d'échelle de localisation à effets mixtes, en nous appuyant sur des facteurs de risque de symptômes d'intériorisation établis comme prédicteurs des tendances moyennes et de la variabilité intra-individuelle. Les symptômes d'intériorisation des adolescents ont été relativement stables et généralement faibles au cours de la première année de la pandémie, avec un sommet de gravité en février et avril 2021. Les filles présentaient en moyenne plus de symptômes et une plus grande variabilité intra-individuelle des symptômes. Les symptômes dépressifs des parents ont permis de prédire la variabilité intra-individuelle des symptômes anxieux et dépressifs chez leurs adolescents. Les symptômes des adolescents étaient stables et généralement inférieurs aux seuils cliniques. Cependant, les adolescentes et celles dont les parents présentaient davantage de symptômes dépressifs étaient les plus vulnérables au stress de la pandémie. Les implications en termes d'efforts d'intervention et de prévention sont discutées.

Mots-clés : symptômes intériorisés, COVID-19, variabilité intra-individuelle, adolescent

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