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Heterogeneous Child and Youth Mental Health Responses to Pandemic Reopening Phases: Evidence from a Population-Based Longitudinal Study

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Abstract

Prior evidence indicates that child and youth mental health was affected during the COVID-19 pandemic; however, individual responses to transitions between lockdown and reopening phases remain poorly understood. This study examined longitudinal mental health responses in a population-based cohort of children and youth aged 4–17 years (N=1,261; 51% male; 82% White) across pandemic recovery phases in Ontario, Canada. Mental health responses were estimated using structured residuals capturing within-person deviations from latent growth trajectories of parent-reported internalizing, oppositional-defiant, and inattention/hyperactivity symptoms across five waves collected between January 2021 and December 2022. Mental health responses varied over time, particularly following periods of re-lockdowns. Higher-than-expected symptoms were generally associated with parent distress and diagnosed health conditions, although patterns differed across symptom domains and timepoints. Four latent profiles emerged: a large group showing expected symptom responses (83%; n=1,049), a group showing higher-than-expected symptoms, particularly internalizing symptoms following renewed restrictions (7%; n=88), a group showing an inverse pattern of lower-than-expected symptoms at this transition (7%; n=89), and a small group showing lower-than-expected symptoms earlier in the reopening period (3%; n=35). The higher-response profile also showed greater functional interference and increasing mental health service use. These findings demonstrate substantial heterogeneity in child and youth mental

health responses to pandemic transitions and highlight the importance of identifying time-specific support needs during periods of societal change and recovery.

Keywords: longitudinal; children and youth; mental health; COVID-19 pandemic recovery

Introduction

Since the outbreak of the COVID-19 pandemic, considerable efforts have been dedicated to understanding the impact of pandemic lockdowns and school closures on the mental health of children and youth (Cortese et al., 2022; Dessain et al., 2024; Wang et al., 2020). In Canada, a province-wide investigation revealed that more than two-thirds of children and youth had perceived deterioration in mental health as reported by both caregivers and self-reports, which was associated with stress from social isolation (Cost et al., 2022). Despite the anticipated negative impacts, meta-analytic evidence suggests overall small effects of the pandemic on young people's mental health (i.e., symptom changes from pre-pandemic to during or after the pandemic) at the population level (Bussières e al., 2021; Ching et al., 2025; Newlove-Delgado et al., 2023). While most existing studies have focused on internalizing symptoms (Kauhanen et al., 2023; Madigan et al., 2023; Newlove-Delgado et al., 2023), some research has also identified externalizing problems and inattention—mental health domains highly relevant to children and youth—as having worsened during the pandemic (Hu & Qian, 2021; Ravens-Sieberer et al., 2022; Rogers & MacLean, 2023; Wendel et al., 2020), warranting more comprehensive investigations across multiple domains of mental health.

Further, the lack of long-term longitudinal evidence has limited the ability to draw conclusions about within-person changes over the extended course of the pandemic and in

identifying risk or protective factors contributing to this variability, which could be valuable for informing pandemic recovery and future preparedness efforts (Ching et al., 2025; Newlove-Delgado et al., 2023; Pierce et al., 2020). A recent longitudinal study on a large cohort of Canadian children, with three waves of follow-up from July 2020 to July 2023, identified overall curvilinear trajectories of child-reported mental health symptoms across various domains, showing an initial decline during the pandemic followed by a rising trend post-pandemic (Park et al., 2024). This rising trend highlights the need to understand changes in child and youth mental health symptoms beyond the peak of the pandemic to inform timely strategies that mitigate adverse outcomes in the current post-pandemic context (Bhutta et al., 2022; Manchia et al., 2022).

To date, research in this area has primarily focused on average changes in observed symptoms, with increases in symptoms typically interpreted as negative responses to the pandemic, and stable or decreasing trends viewed as positive responses. While useful for understanding population trends in the pandemic's impact on mental health, it is limited in capturing *time-specific reactivity or response to events* (e.g., pandemic lockdown or reopening). As an alternative, taking a residuals approach allows these responses to be quantified as deviations from expected outcomes, offering insight into individual differences in response to events (Burt & Obradović, 2013; Chen & Bonanno, 2020). In the context of the present study, we focus on children's and youth's *mental health responses*, defined as

individual deviations from expected trajectories, rather than absolute symptom levels, across pandemic phases with varying levels of restrictions. In Ontario, Canada, the reopening began with a gradual lifting of restrictions and schools returning to full-time, in-person learning with modifications in late 2021. This was followed by a brief period of increased restrictions due to new virus variants in early 2022, before the full reopening that continued through the remainder of 2022 and into 2023 (Dekker & Macdonald, 2022). Examining the time-varying impact of the pandemic on mental health in this context can be challenging using conventional trajectory modeling, which focuses on average change as indicated by the slope across multiple timepoints. In contrast, the residuals approach allows for time-specific estimation of individual deviations from expected trends, making it particularly well-suited to address unanswered questions about children's and youth's mental health responses at distinct timepoints during the pandemic reopening phases.

A key focus in understanding mental health response to the pandemic is identifying risk and protective factors associated with changes in mental health challenges across pandemic phases. Modifiable factors such as awareness of pandemic prevention and control measures, parenting self-efficacy, family engagement, and support in accessing schooling, have been found to be associated with more favorable mental health outcomes (Rogers et al., 2024; Yusuf et al., 2022; Zhou et al., 2020). These protective factors are often tied to timely access to services, though such access was frequently disrupted during lockdowns and may have

remained limited during periods of societal reopening (Patrick et al., 2020; Samji et al., 2022; Shidhaye, 2023; Stewart et al., 2022), in turn impacting children's mental health and broader functional outcomes (Masten & Motti-Stefanidi, 2020; Yusuf et al., 2022). Equally important, yet understudied, are the broader impacts associated with variability in children's and youths' mental health responses, including functional interference and service needs. Such understanding is essential for guiding targeted interventions and policies that strengthen interconnected support systems and promote long-term resilience beyond the immediate crisis (Hussong et al., 2021; Masten, 2021).

To address these empirical gaps, the current study represents a novel effort to map mental health responses among children and youth during phases marked by varying levels of public health restriction loosening in Ontario, Canada. We employed a probability-based sampling approach and a longitudinal design spanning five waves of data collection from January 2021 to December 2022, incorporating a residuals approach within a latent growth curve modeling framework. The study aims to address the following research aims:

1) To estimate individual deviations from expected trajectories of mental health symptoms (i.e., mental health responses) at each of the three reopening phases, for each mental health symptom domain: internalizing, oppositional-defiant, and inattention/hyperactivity symptoms.
2) To examine time-varying correlates of mental health responses, including presence of

diagnosed physical, mental or neurodevelopmental health conditions, low-household-income, and parent distress.

3) To identify homogeneous subgroups based on mental health responses during the reopening phases across the three mental health domains.
4) To examine how these subgroups differ on baseline child, family, and pandemic characteristics, as well as the impact on functioning (hereafter referred to as functional interference) and service use during the reopening phases.

We hypothesize significant individual variability in mental health responses during each reopening phase, resulting in the identification of multiple subgroups distinguished by different levels and rates of change in mental health responses (e.g., increasing, decreasing, or stable deviations from expected trends), with varying patterns across mental health domains. Additionally, we hypothesize that the presence of diagnosed health conditions, low household income, and parent distress will be positively associated with children's and youth's mental health responses, although the magnitude of these associations is expected to vary across domains and reopening phases. We also anticipate that older youth and girls may show higher-than-expected symptoms, particularly for internalizing symptoms, given prior evidence of greater sensitivity to social stressors and elevated risk for psychopathology in these populations (Roberts & Lopez-Duran, 2019; Samji et al., 2022). Lastly, we hypothesize that subgroups characterized by increasing deviations above expected symptom levels will

show greater functional interference and higher rates of service use during reopening.

Methods

Study Design, Procedures, and Participants

The COVID-19 Ontario Provincial Assessment and Tracking of Child and Family Health Study (ONPATH) is a population-based longitudinal study examining changes in mental health symptoms and access to care among Ontario children and youth and their families during the COVID-19 pandemic. The ONPATH sampling frame was drawn from the Probit panel, a probabilistic survey research panel designed to reflect the demographic and socioeconomic characteristics of the Canadian population. The sampling frame included members with at least one child aged 4–17 years residing in their Ontario household as of January 10, 2021 (n = 4,242). A total of 1,261 eligible panel members participated at baseline (response rate = 29.7%), with data collected between January 13 and February 24, 2021. Table 1 presents the demographic characteristics of the 1,261 baseline participants, all of whom were included in the analytic sample.

Baseline participants were invited to complete follow-up surveys approximately every 4–6 months, with data collection also timed to capture changes in societal restrictions. Follow-up data were collected at Time 2 (May 7–June 15, 2021; 76.0% retention, n = 959), Time 3 (October 13–November 25, 2021; 66.1%, n = 833), Time 4 (February 18–March 23,

2022; 61.8%, n = 779), and Time 5 (October 20–December 6, 2022; 57.0%, n = 719). At Time 2, Ontario was under a province-wide lockdown, with uniform public health measures across Public Health Units (PHUs) and all publicly funded schools closed to in-person learning. Times 3 and 4 occurred during reopening phases, as restrictions eased and schools resumed full-time in-person learning with modifications. Between Times 3 and 4, the emergence of the Omicron variant led to a brief period of renewed restrictions and school closures. By Time 5, most restrictions had been lifted, and schools were fully open without modifications. Further details on the ONPATH study design and pandemic context across data-collection waves are provided in Georgiades et al. (2026).

Measures

Mental health symptoms (primary outcomes). The Ontario Child Health Study Emotional Behavioural Scales (OCHS-EBS; Duncan et al., 2019) is a 52-item measure assessing dimensional symptoms for seven DSM-5 disorders. Caregivers rate the frequency of symptoms in their children aged 4–17 years over the past six months on a scale from 0 (never or not true), 1 (sometimes or somewhat true), to 2 (often or very true). For the ONPATH study, a 21-item abbreviated version was used, with the recall period adapted to the past week and psychometrically validated using data from the Ontario Child Health Study (Georgiades et al., 2026). This abbreviated version includes three subscales demonstrating excellent structural validity: internalizing symptoms (8 items), oppositional-defiant

symptoms (6 items), and inattention/hyperactivity symptoms (7 items). Each subscale showed strong internal consistency (Cronbach's α = .94 to .97), good test-retest reliability (*r* = .74 to .81), and robust convergent and discriminant validity when assessed against the Mini International Neuropsychiatric Interview for Children and Adolescents (MINIKID; Georgiades et al., 2026; Sheehan et al., 2010). The current analysis used factor scores adjusted for measurement non-invariance for each subscale through moderated nonlinear factor analysis as the primary outcomes assessing mental health symptoms (see Georgiades et al., 2026 for details).

Sociodemographic and COVID-related characteristics (baseline covariates). Sociodemographic information included child's age (in years), child's gender (0 = girl, 1 = boy; those identifying as other genders [n = 13] were excluded due to small sample size), caregiver gender (0 = woman, 1 = man; other genders [n = 2] were excluded), racialized identity (0 = Asian, Black, or Other/Mixed, 1 = White), and household income below the low-income measure (0 = not low income, 1 = low income; based on the 2019 before-tax cutoffs adjusting for inflation; Statistics Canada, 2021). Low household income status was coded at each timepoint as a time-varying variable, while baseline low-income status was used as a time-invariant covariate. COVID-19-related characteristics included whether participants resided in an area with control or lockdown measures at baseline, determined by linking participants' forward sortation number to their public health unit (Government of

Ontario, 2020) and coded as binary (0 = non-lockdown, 1 = lockdown).

Parent distress (time-varying covariate). The Kessler-6 (K-6; Kessler et al., 2002) was administered at each wave to assess caregiver distress over the past 30 days. The K-6 includes six items that assess how often caregivers experienced feelings of nervousness, hopelessness, restlessness, depression, feelings of effortlessness, or worthlessness, and demonstrated good internal consistency (Cronbach's α=.85; Kessler et al., 2002). Responses were rated on a scale from 0 (none of the time) to 4 (all of the time). These items were summed to create an overall distress score, with pro-rating applied when one item was missing. rent distress was treated as a time-varying covariate to account for variability in the mental health responses of children and youth at Times 3 to 5.

Presence of pre-existing diagnosed health conditions (time-varying covariate). The presence of diagnosed health conditions was determined using three caregiver-reported items assessing whether a health professional had ever diagnosed the child with 1) a physical health condition, 2) a learning or communication disorder, or 3) a mental health or developmental disorder, either previously or since the last survey. As a cumulative measure, at each wave, a "yes" response to any item at the current or any prior wave classified the child as having a diagnosed condition. In the current analysis, this variable was treated as time-varying to account for variability in mental health responses from Time 3 to Time 5.

Functional interference (time-varying correlate). At each wave, functional interference

was assessed based on three caregiver-reported items rating the impact of children's mental health symptoms on their functioning, including interactions with family, making or keeping friendships, and learning/schoolwork. Responses were rated on a scale from 0 (not at all), 1 (a little), to 2 (a lot). The three items were loaded onto a latent factor, with repeated measures estimated using a partial scalar longitudinal invariance model to derive factor scores for functional interference over time (see Table S1 for longitudinal invariance model results). In the current analysis, the derived scores at Times 3 to 5 were used to compare across subgroups with differing patterns of mental health responses.

Service use (time-varying correlate). Service use was assessed through questions about whether the child had received help for mental health concerns since the last survey, either in person or remotely, from a general healthcare or mental health professional (e.g., social worker, psychologist, or other counselor) in clinical, school, or community settings. At each wave, receiving help from any of these professionals was coded as 1 and not receiving help as 0. In the current analysis, the proportion of the sample indicating using mental health services at Times 3 to 5 was compared across subgroups with differing patterns of mental health responses.

Statistical Analysis

For the first aim, linear latent growth models were fitted for each of the three mental health outcome domains (i.e., internalizing, oppositional-defiant, and

inattention/hyperactivity symptoms) to provide a parsimonious estimate of expected trajectories given the limited number of timepoints. Structured residuals were estimated at the final timepoint in the three-, four-, and five-wave models, respectively. For instance, a linear latent growth model was fitted across Time 1 to Time 3, with the residual at Time 3 parameterized as a latent variable with freely estimated mean and variance. Similarly, the structured residual at Time 4 was derived from a model fitted across Time 1 to Time 4, and the same approach was applied to Time 5 (see Figure 1 for an example of the Time 5 model specification, with the corresponding Mplus syntax provided in Appendix I). Latent residuals near zero indicate symptom levels consistent with those expected from the latent trajectory based on prior timepoints; positive residuals (> 0) reflect higher-than-expected symptoms, whereas negative residuals (< 0) reflect lower-than-expected symptoms. In examining the second aim, residual estimates at Times 3, 4, and 5 were regressed in separate models on three concurrent, timepoint-specific predictors: the presence of any diagnosed health conditions, low household income, and parent distress. Child age and gender were included as time-invariant covariates of the latent residuals to account for baseline developmental and demographic differences.

To address the third aim, the latent residual estimates at each of the three timepoints for the three mental health symptom domains at Times 3, 4, and 5 (9 indicators in total) were included in latent profile models to identify person-centred subgroups (see Appendix II for

the Mplus syntax). The optimal profile solution was identified using several fit indices, including Bayesian information criterion (BIC), sample size-adjusted Bayesian information criterion (SABIC), and Lo-Mendell-Rubin likelihood ratio test (LMR-LRT) statistics. Modal class assignment was informed by both entropy and posterior probabilities, where entropy values ≥ 0.90 were considered to reflect excellent classification accuracy (Lubke & Muthén, 2007).

For the fourth aim, baseline child and family characteristics, including child's age, gender (binary: boy or girl), presence of any diagnosed health conditions (binary), baseline domain-level mental health symptoms (continuous), primary caregiver's racialized identity (binary: Racialized or non-racialized), low household income status (binary), and lockdown status (binary), were used as predictors of subgroup membership. Additionally, functional interference (continuous) and service use (binary) at Time 3 to Time 5 were used as correlates of subgroup membership. Both the predictors and time-varying correlates of subgroup membership were examined with three-step approaches to obtain regression and chi-square estimates adjusted for classification uncertainty (Asparouhouv & Muthén, 2013). All analyses were performed using Mplus 8.7 (Muthén & Muthén, 2017), with missing data handled with full information maximum likelihood estimation under the assumption of missing completely at random. Sampling weights were applied throughout the analyses to obtain weighted estimates for population inference.

Results

Aim 1: To estimate mental health responses during the reopening phases (i.e., Time 3 to Time 5)

As shown in Table S2, the latent mean residuals for oppositional-defiant and inattention/hyperactivity symptoms were significantly below zero at Time 3 (M = –.30 and –.39, SE = .07, both *ps* < .001), indicating lower-than-expected symptoms, but significantly above zero at Time 5 (M = .09 and .13, SE = .04 and .05, both *ps* < .05), indicating higher-than-expected symptoms. The latent mean residuals for all symptom domains at Time 4 did not significantly differ from zero, indicating that, on average, mental health symptoms aligned with expected levels based on prior trajectories. Except for inattention/hyperactivity symptoms at Time 3, the variance parameters of latent residuals across all domains and timepoints were significantly different from zero (all *ps* < .001), indicating substantial variability in individual responses.

Aim 2: To examine time-varying covariates of mental health responses during the reopening phases

As reported in Table 2, higher parent distress was consistently associated with higher latent residual estimates (i.e., child's higher-than-expected mental health symptoms at a given timepoint) across domains and timepoints (β = .20 to .35, SE = .05 to .14, all *ps* < .05), except

for oppositional-defiant symptoms at Time 5. Child's presence of any health conditions was associated with higher responses in internalizing and oppositional-defiant symptoms at Time 3 (β = .20 & .11, SE = .07 & .05, both *ps* < .05) and inattention/hyperactivity symptoms at Time 4 (β = .16, SE = .06, *p* = .007). Low household income was not significantly associated with mental health responses across domains and timepoints.

Girls tended to show higher internalizing responses at Times 4 and 5 (β = -.14 & -.21, both SE = .06, *p* < .05). Older children showed higher internalizing responses at Time 3 (β = .14, SE = .06, *p* = .02), while younger children showed higher responses in inattention/hyperactivity symptoms at Time 4 (β = -.12, SE = .06, *p* = .04).

Aim 3: To identify person-centred subgroups based on mental health responses across the three domains during the reopening phases

The model fit statistics for both unweighted and weighted models are presented in Table S3. The BIC and SABIC values decreased with an increasing number of profiles, indicating improved model fit. For the LMR-LRT, we relied on results from the unweighted models to identify subgroups within the sample, as the weighted LMR-LRT tends to favor a single-profile solution that reflects the overall population trend (Asparouhov, 2005; Nylund et al., 2007). The results suggested that adding additional profiles improved model fit up to a 4-profile solution. The entropy values ranged from .91 to .94, indicating excellent modal class assignment across models. Upon balancing model fit statistics with the clinical relevance of

the identified profiles, a four-profile solution was selected. The four profiles estimated with weighted sampling are depicted below and visualized in Figure 2.

- Profile 1 (7%, n = 88): This profile is characterized by higher-than-expected mental health symptoms across domains, particularly internalizing symptoms, at Time 4 following a re-lockdown.
- Profile 2 (83%, n = 1049): This profile represents the majority of the sample, with expected mental health responses across timepoints.
- Profile 3 (7%, n = 89): This profile shows a pattern inverse to Profile 1, with lower-than-expected mental health symptoms across domains observed at Time 4.
- Profile 4 (3%, n = 35): This profile was characterized by lower-than-expected symptoms at Time 3, followed by expected responses at Times 4 and 5.

Aim 4: To examine the baseline predictors of subgroup membership and time-varying correlates (functional interference and service use) during the reopening phases

The results of the multinomial logistic regression examining baseline predictors of subgroup membership are presented in Table 3. Boys were more likely to be classified into Profile 4 (74.2%) than Profile 1 (49.4%) ($\beta = 1.37$, SE = .65, $p = .036$). Children in Profile 1 were more likely to have male caregivers as survey respondents (71.5%) compared to those in Profile 2 (56.9%) ($\beta = .91$, SE = .40, $p = .023$). Children in Profile 4 were less likely to have diagnosed health conditions (11.3%) compared to all other subgroups (34.7 to 47.3%) (β

= 2.10 to 2.92, SE = .91 to .97, all *ps* < .05). Children in Profiles 3 and 4 showed higher baseline internalizing symptoms compared to the other two groups (β = .53 to .80, SE = .19 to .34, all *ps* < .05), with Profile 4 also exhibiting higher baseline inattention/hyperactivity symptoms than Profile 3 (β = .99, SE = 0.44, $p = .024$). Child's age, caregiver racialized identity, low household income, initial lockdown status, and child's baseline oppositional-defiant symptoms were not significant predictors of subgroup membership.

Further, the subgroups differed significantly in the extent of functional interference and service use during the reopening period. As shown in Figure 3 (with estimate details reported in Table S5), the subgroup patterns of functional interference over time generally aligned with those of mental health response, with the group difference most prominent at Time 4 ($\chi^2 = 24.18$, $p < .001$) compared to Time 3 ($\chi^2 = 12.10$, $p = .007$) and Time 5 ($\chi^2 = 10.09$, $p = .018$). Overall, children in Profile 1 showed the highest average levels of functional interference across timepoints, while those in Profile 4 showed consistently low functional interference. As for service use, the subgroups showed the greatest difference at Time 5 ($\chi^2 = 12.10$, $p = .007$) compared to Time 3 ($\chi^2 = 10.82$, $p = .013$) and Time 4 ($\chi^2 = 7.28$, $p = .064$). Children in Profile 1 showed an increasing trend in service use on average, while the other groups generally maintained consistent or decreasing rates as the reopening progressed.

Discussion

This study represents a novel effort to examine mental health responses to varying

pandemic restrictions using a latent residual approach within a population-based sample of children and youth from Ontario, Canada, following the peak of the COVID-19 pandemic. The residuals-based approach allows us to measure mental health responses as deviations from individual and population-level trends, providing insights into psychological adaptation or maladaptation. Notably, the current five-wave study was designed to span an extended reopening period. Our analyses revealed substantial variability in mental health responses, with trends differing across mental health domains and the three reopening phases at Time 3 (late 2021, reopening from major lockdowns), Time 4 (early 2022, reopening after a brief re-lockdown), and Time 5 (late 2022, full reopening).

On average, children and youth showed lower-than-expected symptoms in oppositional-defiant and inattention/hyperactivity domains at Time 3, whereas higher-than-expected symptoms in these domains emerged by Time 5. In contrast, internalizing symptom responses remained within the expected range throughout the period. These patterns align with findings from a recent Canadian study, which reported a rebound in symptoms between the re-lockdown and full reopening phases—roughly corresponding to our Time 3 and Time 4 (Park et al., 2024). Our results suggest that oppositional-defiant and inattention/hyperactivity symptoms may be more responsive to short-term changes in public health restrictions, while internalizing symptoms appear more stable or persistent. Despite symptom levels generally decreasing over time across all domains, as suggested by our prior analyses (Georgiades et

al., 2026), the current residuals-based approach reveals domain-specific differences in mental health responses to varying levels of pandemic restrictions. These findings have important implications for the planning and delivery of mental health services aligned with specific patterns of need. Internalizing symptoms may require sustained, long-term support, whereas oppositional-defiant and inattention/hyperactivity difficulties may be more effectively addressed through timely, context-sensitive interventions responsive to environmental changes.

It is important to note, however, that substantial individual variability was observed in children's and youth's mental health responses, indicating that certain individuals may exhibit higher or lower symptoms apart from the general trends. Specifically, the presence of any diagnosed health condition and parent distress emerged as significant time-specific factors contributing to the observed variability. Higher parent distress was associated with their child's higher mental health responses across domains and timepoints (except for the non-significant correlation with oppositional-defiant symptoms at Time 5). While causal links cannot be established with the current data, our findings align with a growing body of evidence demonstrating robust associations between parent distress and internalizing symptoms in children and youth during the pandemic (Manchia et al., 2022; Shoychet et al., 2023). Our results also suggest that the presence of diagnosed health conditions may serve as a risk factor for higher-than-expected mental health symptoms during specific reopening

phases, with effects varying by symptom domain. This finding aligns with prior evidence showing that elevated pre-existing symptoms and health conditions are associated with worsened mental health outcomes during and beyond the pandemic (Buneviciene et al., 2022; Hampshire et al., 2022; Park et al., 2024; Robinson et al., 2022; Sonuga-Barke & Fearon, 2021).

Our study extends the prior evidence by demonstrating time-varying associations between health conditions (including newly diagnosed ones) and elevated mental health responses, particularly during the early reopening phases (Times 3 or 4). Compared to internalizing and oppositional-defiant symptoms, the effect of health conditions on inattention/hyperactivity symptoms emerged later at Time 4, coinciding with a brief period of school re-closure during the remission phase, after which reopening resumed. This delay may reflect challenges in adapting to changes in the learning environment and repeated transitions between online and in-person instruction during this period, with greater impact on children with pre-existing inattention/hyperactivity difficulties (e.g., ADHD) (Dessain et al., 2024; Rosenthal et al., 2022). On the other hand, the associations observed at Time 3 for internalizing and oppositional-defiant symptoms may reflect challenges associated with reopening and the re-emergence of academic and social stressors (e.g., peer interactions, performance demands, bullying), particularly among children with diagnosed health conditions. These findings highlight the need for tiered mental health support tailored to

varying levels of societal restriction, with adaptive strategies during transitions between lockdown and reopening phases, particularly for vulnerable children and their families.

To parse the observed variability in mental health responses across the reopening phases, we employed latent profile analysis, a mixture modeling approach, and identified four distinct subgroups. The majority of participants (83%) were classified to Profile 2, characterized by as-expected mental health responses that aligned with their prior trajectories and reflected the overall population trend. The most clinically relevant subgroup, Profile 1, comprised 7% of children and youth who showed higher-than-expected symptoms, particularly internalizing symptoms, at Time 4, coinciding with the re-lockdown period. More girls and those with diagnosed health conditions, and those with male caregivers as survey respondents were more likely to be classified into this profile, despite this subgroup's average symptom levels at baseline being relatively lower than those of the other subgroups. Girls have often been found to experience poorer mental health outcomes during the pandemic, particularly in the domain of internalizing symptoms (Magson et al., 2021; Racine et al. 2021; Zhou et al., 2020). Prior research has also linked pre-existing mental health symptoms and health conditions to greater vulnerability during the pandemic (Buneviciene et al., 2022; Hampshire et al., 2022; Robinson et al., 2022). Our findings further support that girls and those with diagnosed health conditions may be less resilient in adapting to transitions between pandemic phases—not limited to the peak period—as their internalizing symptoms tended to persist despite the

easing of restrictions compared to boys.

Unexpectedly, caregiver gender was the only time-invariant family factor associated with subgroup membership in mental health responses. Children of male caregiver respondents were more likely to be in the subgroup characterized by higher-than-expected mental health symptoms, despite caregiver gender being included as a factor in the invariance analyses. This association may reflect differences in how male and female caregivers report changes in a child's behavior, potentially due to varying opportunities for observation and gender-related expectations (De Los Reyes & Kazdin, 2005). Future research should consider potential informant discrepancies when assessing changes in child and youth mental health and incorporate perspectives from multiple informants. It should also be noted that the effects of child and parent gender on subgroup membership were modest and did not remain significant after applying stricter thresholds to control for Type I error, and thus this finding should be interpreted with caution.

Aside from the baseline associated factors, children and youth in Profile 1 showed the highest average level of functional interference over time, along with an increasing pattern of service use (from 21% at Time 3 to 36% at Time 5). Thus, this subgroup may represent those with heightened mental health support needs across phases of varying societal restrictions. One possible explanation is that lockdowns reduced day-to-day stressors related to school, whereas the return to "normal life" and its associated demands posed challenges for this

subgroup. Previous research has found that school reopening was associated with greater emotional and behavioral difficulties in children and youth compared to those involved in home-schooling, as well as an increase in psychiatric visits (Davico et al., 2024; Wang et al., 2021).

In contrast, children and youth in Profile 3 (7%) showed an inverse pattern to Profile 1, with lower-than-expected mental health symptoms at Time 4. Although this subgroup demonstrated functional interference comparable to or lower than Profile 2 (the largest subgroup), service use remained elevated (28%) at Time 5. This may reflect their higher baseline levels of internalizing and oppositional-defiant symptoms, suggesting that lower-than-expected symptoms at Time 4 do not necessarily indicate reduced need for services. These findings underscore the importance of continuous monitoring and a tiered approach to service provision (Chen & Bonanno, 2020; Kearney & Childs, 2021; Rider et al., 2021). The remaining 3% of participants were classified into Profile 4, characterized by lower-than-expected symptoms at Time 3. Boys and those without diagnosed health conditions were more likely to belong to this group, despite exhibiting higher baseline levels of inattention/hyperactivity symptoms relative to other subgroups. While symptom levels were relatively elevated during lockdown, children and youth in this subgroup appeared to respond positively to reopening, as reflected in consistently low functional interference and service use (<15%). The elevated baseline inattention/hyperactivity symptoms may reflect challenges

associated with lockdown conditions and remote schooling, which appeared to attenuate as schools reopened.

Overall, the identification of distinct patterns of mental health responses underscores the importance of adopting a person-centered, longitudinal approach to understanding the impact of public health restrictions and transitions on children and youth. While reopening was associated with symptom reductions for some, others did not experience similar improvements. For some children and youth, adapting to changing environmental demands may be challenging, highlighting the need for additional supports to manage stressors associated with school reopening and the easing of restrictions. Our findings reinforce the importance of a stepwise model of mental health care (Rider et al., 2021), with universal supports as a foundation for all, alongside tiered interventions for those at risk or with emerging needs during the pandemic and reopening phases. For children and youth with persistently elevated symptoms, targeted clinical interventions are essential to address heightened needs. To inform future pandemic preparedness and response efforts, further research is needed to examine longer-term impacts and evaluate the implementation of targeted, tiered models of care.

The current study findings should be interpreted in light of several limitations. First, mental health symptoms were assessed solely through caregiver reports, which may not fully capture the perspectives of children and youth themselves. This approach may partly explain

the differing results observed between internalizing and oppositional-defiant symptoms, as the latter are typically more observable to caregivers (Bajeux et al., 2018). Additionally, although each data collection window was selected to occur within one month across participants, the predetermined timing may not have aligned precisely with key contextual events (e.g., specific dates of lockdowns or reopenings) and should therefore be interpreted as approximate. Additionally, some subgroups identified through latent profile analysis were relatively small compared to the most prevalent subgroup (i.e., Profile 2). Finally, the generalizability of these findings beyond Ontario may be limited, despite the global nature of pandemic-related challenges. This underscores the need for multisite, longitudinal studies with probability sampling to examine regional variation and inform globally relevant mental health strategies for children and youth in the post-pandemic era.

Conclusions

This study contributes to understanding heterogeneity in child and youth mental health responses across pandemic reopening phases. Using longitudinal data from a population-based sample, we extended beyond population-average trends by examining within-person deviations from expected mental health trajectories and identifying subgroups with distinct response patterns. Our findings highlight both between- and within-person variability in mental health responses, as well as time-varying associations with child and family characteristics, functional interference, and service use. Notably, while most children and

youth showed responses consistent with their underlying trajectories, a small subgroup (~7%) exhibited higher-than-expected symptoms, particularly internalizing symptoms, alongside greater functional interference and service use. These findings demonstrate that population-average trends may obscure clinically meaningful, time-specific mental health needs and underscore the importance of responsive, tiered approaches to supporting children and youth during periods of societal change and recovery.

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Table 1. Baseline characteristics of ONPATH participants (N=1261)

Child Gender, N (%)	
Boy	627 (50.9)
Girl	611 (48.1)
Other gender	13 (1.0)
Child Age, Mean (SD)	11.19 (5.39)
Schooling Modality, N (%)	
Full-time in-person	408 (35.9)
Blended	249 (17.5)
Full-time online	553 (46.7)
Public Health Unit Lockdown Status at Baseline, N (%)	
Lockdown	1007 (80.5)
Not lockdown	230 (19.6)
Presence of Diagnosed Physical, Mental or Neurodevelopmental Condition, N (%)	469 (35.3)
Parent Distress, Mean (SD)	4.95 (6.01)
Parent-Reported Child and Youth Mental Health Symptoms (Total Raw Score), Mean (SD)	
Internalizing symptoms	3.83 (4.95)
Oppositional defiant symptoms	3.65 (3.66)
Inattention/hyperactivity symptoms	4.72 (4.74)
Parent-Reported Child and Youth Mental Health Symptoms (Moderated Non-Linear Factor Analysis Score), Mean (SD)	
Internalizing symptoms	-0.14 (1.07)
Oppositional defiant symptoms	0.17 (.98)
Inattention/hyperactivity symptoms	0.24 (1.03)
Parent Gender, N (%)	
Man	704 (57.7)
Woman	551 (42.1)
Other gender	2 (0.2)
Parent Age, Mean (SD)	47.26 (10.38)
Parent Racialized Identity, N (%)	
White	1015 (81.6)
Asian [South Asian, East Asian, Southeast Asian, West Asian or Arab]	92 (7.6)
Black [Black African, Black Caribbean, Black Canadian or American]	48 (4.9)
Other/Mixed [Other, Latin American, Central	86 (5.9)

American, South American, First Nations, Métis, Inuk]	
Low Income Household, N (%)	125 (16.6)
Number of Biological Parents in Family, N (%)	
Two biological parents	992 (78.1)
One or no biological Parents	263 (21.9)
Parent Education, N (%)	
High school or less	92 (29.7)
Post-secondary diploma or certificate less than Bachelor's degree	344 (33.4)
University Degree, Bachelor's or above	820 (36.9)
Urban-rural Residency, N (%)	
Large urban centre	891 (69.2)
Small-medium centre	182 (15.1)
Rural area	159 (15.7)

Note. Numbers represent unweighted counts, whereas percentages are weighted.

Table 2. Standardized coefficients and standard errors for effects of time-varying covariates on latent residuals of mental health symptoms (mental health response)

	Internalizing			**Oppositional Defiant**			**Inattention/Hyperactivity**		
	Time 3	Time 4	Time 5	Time 3	Time 4	Time 5	Time 3	Time 4	Time 5
Any Diagnosed	**.20**	-.01	.11	**.11**	.00	.14	.10	**.16**	.06
Health Condition	**(.07)****	(.05)	(.06)	**(.05)***	(.06)	(.07)	(.10)	**(.06)****	(.07)
Low Household	.09	-.04	.05	.07	-.01	-.02	.07	-.04	.05
Income	(.06)	(.08)	(.06)	(.07)	(.09)	(.08)	(.10)	(.06)	(.09)
Parent Distress	**.23**	**.35**	**.30**	**.20**	**.26**	.14	**.29**	**.35**	**.26**
	(.08) **	**(.07)*****	**(.08)*****	**(.07)****	**(.07)****	(.10)	**(.14)***	**(.05)*****	**(.09)****
Child's Age	**.14**	.03	.02	-.03	-.11	-.02	-.17	**-.12**	-.04
	(.06) *	(.06)	(.06)	(.06)	(.06)	(.08)	(.11)	**(.06)***	(.09)
Child's Gender	-.12	**-.14**	**-.21**	-.04	.03	-.13	-.10	.08	-.05
	(.06)	**(.06)***	**(.06)****	(.05)	(.07)	(.07)	(.09)	(.06)	(.08)

Note. $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$.

Table 3. Baseline predictors of subgroup membership of mental health responses during reopening phases (subgroup means and proportions with standard errors)

	Profile 1 (n=88)	**Profile 2 (n=1049)**	**Profile 3 (n=89)**	**Profile 4 (n=35)**	**Multinomial Logistic Regression Effects (Adjusted)**
Child's Age	11.1 (.5)	11.0 (.2)	11.7 (.5)	10.0 (1.1)	No significant effect
Child's Gender (Boy), %	49.4 (7.2)	50.2 (2.4)	56.2 (6.9)	74.2 (9.9)	4>1 (β=1.37, SE=.65, *p*=.036)
Caregiver's Gender (Man), %	71.5 (5.7)	56.9 (2.3)	60.6 (6.9)	40.0 (13.2)	1>2 (β=.91, SE=.40, *p*=.023)
Caregiver's Racialized Identity (Non-racialized), %	81.6 (5.9)	80.9 (1.9)	84.5 (4.3)	93.1 (5.3)	No significant effect
Low Household Income Status, %	23.8 (6.7)	24.7 (2.1)	14.8 (5.0)	19.9 (9.0)	No significant effect
Lockdown Status, %	80.9 (6.0)	80.2 (1.9)	81.8 (5.4)	82.2 (8.2)	No significant effect
Diagnosed Health Conditions, %	47.3 (7.1)	34.7 (2.2)	39.5 (7.1)	11.3 (6.0)	**1>4 (β=2.92, SE=.97, *p*=.003)** 2>4 (β=2.30, SE=.91, *p*=.011) 3>4 (β=2.10, SE=.97, *p*=.029)
Internalizing Symptoms	-.27 (.14)	-.26 (.05)	.23 (.23)	-.05 (.15)	**3>1 (β=.67, SE=.24, *p*=.005)** **3>2 (β=.53, SE=.19, *p*=.005)** 4>1 (β=.80, SE=.34, *p*=.019) 4>2 (β=.66, SE=.31, *p*=.033)
Oppositional-Defiant Symptoms	.22 (.15)	.16 (.05)	.48 (.18)	.05 (.22)	No significant effect
Inattention/Hyperactivity Symptoms	.39 (.14)	.29 (.05)	.45 (.12)	.70 (.23)	4>3 (β=.99, SE=.44, *p*=.024)

Note. The reported *p* values are not adjusted for multiple comparisons; with a family-wise alpha of .05, the Bonferroni-corrected cutoff is .0083, and *p* values meeting this criterion are bolded.

Figure 1. Linear latent growth model with Time 5 latent residual parameter and covariates

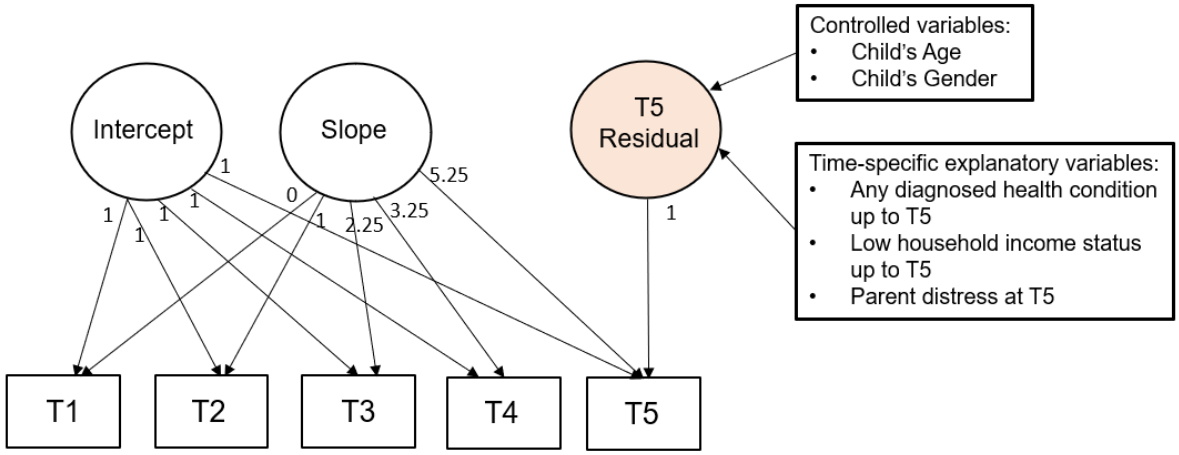
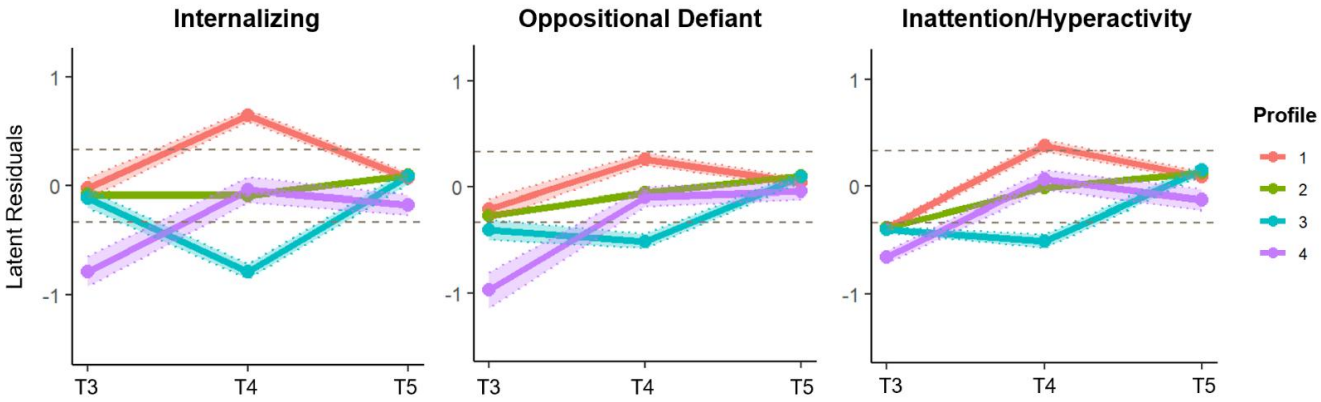
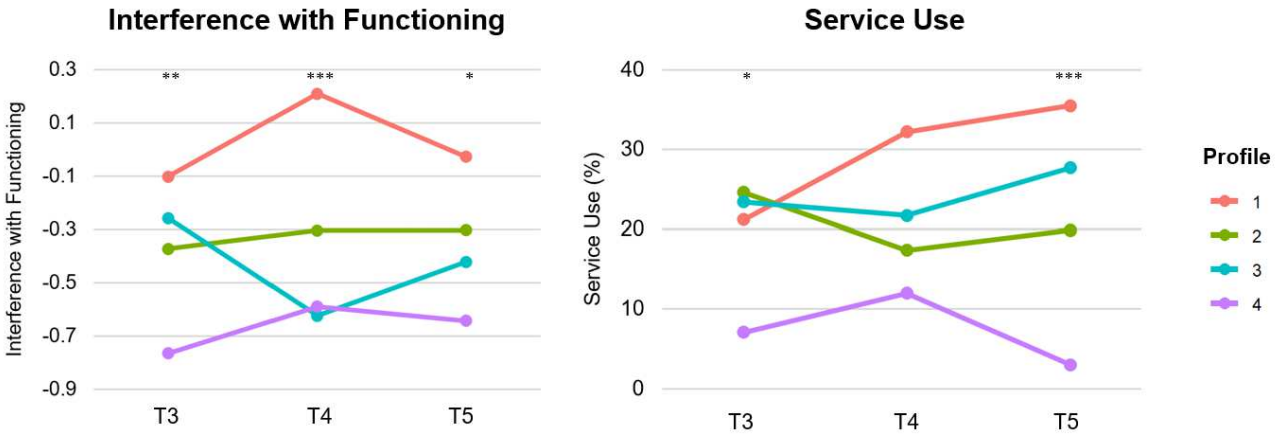


Figure 2. Latent profiles of mental health responses across domains and reopening phases (unweighted total N=1261)



Note. Indicator mean estimates are presented in Table S4. Dashed lines represent the range of median standard errors for the residual estimates; average values falling outside this range indicate significantly higher-than-expected or lower-than-expected symptoms.

Figure 3. Mean level of interference on functioning and rate of service use during reopening phases by subgroup



Note. Mean estimates by subgroup are presented in Table S5. Tests of group differences: $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryMaterialsONPATHMHResponse.docx